INTERNATIONAL ECOLOGICAL CLASSIFICATION STANDARD:

TERRESTRIAL ECOLOGICAL CLASSIFICATIONS

Alliances and Groups of the Wyoming Basin Ecoregion

Appendix Accompanying Report and Field Keys for the Wyoming Basin Ecoregion:
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by

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This subset of the International Ecological Classification Standard covers vegetation alliances and groups of the Wyoming Basin Ecoregion. This classification has been developed in consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications. Comments and suggestions regarding the contents of this subset should be directed to Mary J. Russo, Central Ecology Data Manager, NC <mary_russo@natureserve.org> and Marion Reid, Senior Regional Ecologist, Boulder, CO <marion_reid@natureserve.org>.

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[1] NatureServe is an international organization including NatureServe regional offices, a NatureServe central office, U.S. State Natural Heritage Programs, and Conservation Data Centres (CDC) in Canada and Latin America and the Caribbean. Ecologists from the following organizations have contributed the development of the ecological systems classification:

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1. FOREST & WOODLAND

Tropical, temperate and boreal forests, woodlands and tree savannas characterized by broadly mesomorphic (including scleromorphic) tree growth forms (including *broad-leaved, needle-leaved, sclerophyllous, palm, bamboo trees*, and *tree ferns*), typically with at least 10% cover (but tropical tree savannas up to 40% cover, when trees <8 m tall), irregular horizontal spacing of vegetation structure, and spanning humid to seasonally dry tropical to boreal and subalpine climates and wet to dry substrate conditions. Includes native forests, as well as managed, and some plantation forests where human management is infrequent.

1.B. Temperate & Boreal Forest & Woodland

Temperate & Boreal Forest & Woodland is typically dominated by broad-leaved deciduous and needle-leaved trees, with some broad-leaved evergreens in warmer regions, and a climate that varies from warm-temperate with only rare frosts to very cold subarctic conditions. It is found across the globe in the mid-latitudes, typically between 25° and 60-70°N and S latitude, and includes boreal, cool-temperate, and warm-temperate/Mediterranean forests.

1.B.2. Cool Temperate Forest & Woodland

Cool Temperate Forest & Woodland includes temperate deciduous forest and woodland, temperate needle-leaved forest and woodland, and temperate rainforest, dominated by broad-leaved or needle-leaved tree growth forms.

1.B.2.Nb. Rocky Mountain Forest & Woodland

This division is composed of forests, woodlands and savannas of the lower montane to subalpine zones of the continental temperate climates of western North America characterized by the conifers *Abies concolor, Abies grandis, Abies lasiocarpa, Abies religiosa, Juniperus* spp. (*Juniperus osteosperma, Juniperus scopulorum*), *Larix lyallii, Larix occidentalis, Picea engelmannii, Picea engelmannii x glauca* hybrids, *Picea pungens, Pinus albicaulis, Pinus aristata, Pinus contorta var. latifolia, Pinus flexilis, Pinus hartwegii, Pinus longaeva, Pinus ponderosa* (*var. brachyptera, var. ponderosa, var. scopulorum*), *Pseudotsuga menziesii var. glauca, Thuja plicata*, and *Tsuga heterophylla*.

M022. Southern Rocky Mountain Lower Montane Forest

These are conifer and mixed deciduous- conifer lower montane forests, woodlands and savannas of the southern Rocky Mountains and west into the ranges of the Great Basin.

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
1.B.2.Nb.1.a. M022 Southern Rocky Mountain Lower Montane Forest

G229. Southern Rocky Mountain Ponderosa Pine Open Woodland

Type Concept Sentence: This group includes savanna-like woodlands with widely spaced (<25% tree canopy cover) *Pinus ponderosa* (primarily *var. scopulorum* and *var. brachyptera*) (>150 years old) as the predominant conifer. The understory vegetation is predominantly fire-resistant grasses and forbs that resprout following surface fires. These occur at the lower treeline/ecotone between grassland or shrubland and more mesic coniferous forests typically in warm, dry, exposed sites and are found predominantly in the Colorado Plateau region, west into scattered locations in the Great Basin, and north along the eastern front of the southern Rocky Mountains into southeastern Wyoming.

OVERVIEW

Scientific Name: *Pinus ponderosa / Festuca* spp. - *Muhlenbergia* spp. Southern Rocky Mountain Open Woodland Group
Common Name (Translated Scientific Name): Ponderosa Pine / Fescue species - Muhly species Southern Rocky Mountain Open Woodland Group
Colloquial Name: Southern Rocky Mountain Ponderosa Pine / Grass Open Woodland

Type Concept: This group is found predominantly in the Colorado Plateau region, west into scattered locations in the Great Basin, and north along the eastern front of the southern Rocky Mountains into southeastern Wyoming. These savannas occur at the lower treeline/ecotone between grassland or shrubland and more mesic coniferous forests typically in warm, dry, exposed sites. Elevations range from less than 1900 m in central and northern Wyoming to 2800 m in the New Mexico mountains to well over 2700 m on the

higher plateaus of the Southwest. It is found on rolling plains, plateaus, or dry slopes usually on more southerly aspects. This group is best described as a savanna that has widely spaced (<25% tree canopy cover) (>150 years old) *Pinus ponderosa* (primarily *var. scopulorum* and *var. brachyptera*) as the predominant conifer. It is maintained by a fire regime of frequent, low-intensity surface fires. A healthy occurrence often consists of open and parklike stands dominated by *Pinus ponderosa*. Understory vegetation in the true savanna occurrences is predominantly fire-resistant grasses and forbs that resprout following surface fires; shrubs, understory trees and downed logs are uncommon. Important species include *Festuca arizonica, Muhlenbergia straminea (= Muhlenbergia virescens), Pseudoroegneria spicata, Andropogon gerardii, Schizachyrium scoparium, Festuca idahoensis, Piptatheropsis micrantha (= Piptatherum micranthum)*, and *Bouteloua gracilis*. A century of anthropogenic disturbance and fire suppression has resulted in a higher density of *Pinus ponderosa* trees, altering the fire regime and species composition.

Classification Comments: The Pine Escarpment regions of northwestern and central Nebraska are not included within this group; they have been lumped into Black Hills-Northwestern Great Plains Ponderosa Pine Forest & Woodland Group (G216). This group was created to account for the new concept of ponderosa pine savannas in the southern Rocky Mountains. Presently, many stands contain understories of more shade-tolerant species, such as *Pseudotsuga menziesii* and/or *Abies* spp., as well as younger cohorts of *Pinus ponderosa*. Central Rocky Mountain Ponderosa Pine Open Woodland Group (G213) in the eastern Cascades, Okanogan, and Northern Rockies regions receives winter and spring rains, and thus has a greater spring "green-up" than the drier woodlands in the Central Rockies.

Similar NVC Types:
- G228 Southern Rocky Mountain Ponderosa Pine Forest & Woodland
- G216 Black Hills-Northwestern Great Plains Ponderosa Pine Forest & Woodland
- G213 Central Rocky Mountain Ponderosa Pine Open Woodland

Diagnostic Characteristics: This group is dominated by well-spaced *Pinus ponderosa*. The understory is predominantly fire-resistant grasses such as *Festuca arizonica, Muhlenbergia straminea, Pseudoroegneria spicata, Andropogon gerardii, Schizachyrium scoparium, Festuca idahoensis, Piptatheropsis micrantha*, and *Bouteloua gracilis*. This group will have floristic affinities to adjacent grasslands, especially when it occurs in the ecotone between foothill woodlands and grasslands.

VEGETATION

Physiognomy and Structure: This group is characterized by widely spaced conifers forming open savannas (<25% cover) and a parklike understory strongly dominated by fire-resistant graminoids. Shrubs are few or absent from communities within this group. There may be a mid-level canopy of shrubs, copses of oaks, or even an occasional oak tree, but these are minor vegetation components.

Floristics: This group is dominated by well-spaced *Pinus ponderosa* with other conifers such as *Pseudotsuga menziesii* and *Abies* spp. sometimes present as canopy associates. Small trees and shrubs are poorly represented but can include scattered *Juniperus* spp., *Quercus gambelii, Artemisia tridentata*, and *Chrysothamnus depressus*. The understory is predominantly graminoid-dominated with species including *Festuca arizonica, Muhlenbergia straminea (= Muhlenbergia virescens), Pseudoroegneria spicata, Andropogon gerardii, Carex rossii, Elymus elymoides, Koeleria macrantha, Poa fendleriana, Schizachyrium scoparium, Festuca idahoensis, Piptatheropsis micrantha (= Piptatherum micranthum)*, and *Bouteloua gracilis*.

ENVIRONMENT & DYNAMICS

Environmental Description: Elevations range from less than 1900 m in central Wyoming to 2800 m in the New Mexico mountains to well over 2700 m on the higher plateaus of the Southwest. It is found on a variety of landforms including rolling plains, plateaus, or cinder cones, bottomlands, mesas, and dry slopes usually on all aspects. *Climate:* Where precipitation is greater than about 480 mm, blue grama is absent or minor and ponderosa pine occurs with understory bunchgrass species, mainly *Festuca arizonica, Muhlenbergia montana*, and/or *Muhlenbergia straminea*. Fires, either lightning- or human-caused, are frequent in these dry forests.

Dynamics: Fire is a key factor in maintaining the open canopies characteristic of these savannas. Historically, surface fires and drought were influential in maintaining open-canopy conditions in these savannas. With settlement and subsequent fire suppression, stands have become more dense. Presently, many contain understories of more shade-tolerant species, such as *Pseudotsuga menziesii* and/or *Abies* spp., as well as younger cohorts of *Pinus ponderosa*. These altered stand structures have affected fuel loads and altered fire regimes. Presettlement fire regimes were primarily frequent (5- to 15-year return intervals), low-intensity surface fires triggered by lightning strikes or deliberately set by Native Americans. With fire suppression and increased fuel loads, fires are now less frequent and often become intense crown fires which can kill mature *Pinus ponderosa*. Establishment is erratic and believed to be linked to periods of adequate soil moisture and good seed crops, as well as fire frequencies which allow seedlings to reach sapling size. Longer fire intervals have resulted in many stands having dense subcanopies of overstocked and unhealthy young *Pinus ponderosa*. Savage and Swetnam (1990) suggest that continuity of understory fuels, especially the grass layer,

maintained high frequencies of low-intensity, surface fires along the entire gradient from ponderosa pine woodlands to spruce-fir forests. This hypothesis is supported by evidence that forests with grassy understories were once extensive and continuous over a large elevational range (Savage and Swetnam 1990, Moir et al. 1997). Descriptions of forests around the turn of the century noted open, large areas not confined to ponderosa pine forests. Most ecologists agree that hot, crown fires were not extensive in these open ponderosa pine savannas, although small thickets would have been destroyed by spot crown fires.

DISTRIBUTION

Geographic Range: This group is found predominantly in the Colorado Plateau region, west into scattered locations of the Great Basin, and north along the eastern front of the Rocky Mountains of Colorado and Wyoming.

Spatial Scale & Pattern [optional]: Large patch
Nations: US
States/Provinces: AZ, CO, NM, NV, UT, WY
TNC Ecoregions [optional]: 18:C, 19:C, 20:C, 21:C
USFS Ecoregions (2007): 315A:CC, 315B:CC, 315H:CP, 321A:PP, 331B:CC, 331G:C?, 331H:CC, 331I:CC, 331J:CP, 342F:CC, M313B:PP, M331B:CC, M331F:CC, M331G:CP, M331I:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **<** Interior Ponderosa Pine: 237 (Eyre 1980)

LOWER LEVEL UNITS

Alliances:
- A3419 *Pinus ponderosa* / Grass Understory Southern Rocky Mountain Open Woodland Alliance

AUTHORSHIP

Primary Concept Source: M.G. Harrington and S.S. Sackett (1992)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 03/17/2010
Classif Resp Region: West
Internal Author: MEH 3-10, mod. GK 12-15

REFERENCES

References: Eyre 1980, Faber-Langendoen et al. 2017a, Harrington and Sackett 1992, Johansen and Latta 2003, Mehl 1992, Moir and Dieterich 1988, Moir et al. 1997, Savage and Swetnam 1990

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G229. Southern Rocky Mountain Ponderosa Pine Open Woodland

A3419. Pinus ponderosa / Grass Understory Southern Rocky Mountain Open Woodland Alliance

Type Concept Sentence: These woodlands are characterized by widely spaced canopies dominated by *Pinus ponderosa* primarily occurring in the southern Rocky Mountains and extending into adjacent ecoregions.

OVERVIEW

Scientific Name: *Pinus ponderosa* / Grass Understory Southern Rocky Mountain Open Woodland Alliance
Common Name (Translated Scientific Name): Ponderosa Pine / Grass Understory Southern Rocky Mountain Open Woodland Alliance
Colloquial Name: Southern Rocky Mountain Ponderosa Pine / Grass Open Woodland

Type Concept: These woodlands are characterized by widely spaced canopies primarily dominated by *Pinus ponderosa* in association with other conifers, including *Juniperus* spp., *Pinus discolor, Pinus edulis*, and *Pseudotsuga menziesii*. The typically moderately dense herbaceous layer has greater cover than the shrub layer and is dominated by graminoids. The most common dominant graminoids include *Andropogon gerardii, Bouteloua gracilis, Festuca arizonica, Muhlenbergia montana, Muhlenbergia straminea (= Muhlenbergia virescens)*, and *Schizachyrium scoparium*. These woodlands occur from the central and southern Rocky Mountains, extending south to the mountains of western Texas, escarpments of the Great Plains and west to the Mogollon Rim and Colorado

Plateau. Stands occur on bottomlands, elevated plains, cinder cones, piedmont slopes, mesas, foothills, and mountains at elevations ranging from 1700-2900 m.

Classification Comments:

Internal Comments: DFL 1-16: Canada removed.
Other Comments:

Similar NVC Types: This alliance is similar to that listed above, but is distinguished by having understories where shrubs are poorly represented typically with <5% total cover.
- A3398 *Pinus ponderosa* Southern Rocky Mountain Forest & Woodland Alliance

Diagnostic Characteristics: This alliance is dominated by well-spaced *Pinus ponderosa*. The diagnostic feature of this alliance is the depauperate shrub layer with cover typically <5% and dense herbaceous understory predominantly dominated by fire-resistant grasses.

VEGETATION

Physiognomy and Structure: These are widely spaced woodland stands of needle-leaved evergreen trees 10-30 m in height. Associated trees are primarily needle-leaved evergreen species. The understory may consist of a depauperate shrub layer with cover typically <5%. and a dense herbaceous understory predominantly dominated by graminoids.

Floristics: This alliance includes woodlands dominated by *Pinus ponderosa*. Structurally, these are savannas with large, open growth-form *Pinus ponderosa* trees (generally) as the only canopy dominant. Average tree canopy cover ranges from 10-50%. Other conifers, including *Juniperus* spp., *Pinus discolor, Pinus edulis*, and *Pseudotsuga menziesii*, may be present at low cover. The diagnostic feature of this alliance is the depauperate shrub layer with cover typically <5% and moderate to dense herbaceous understory predominantly dominated by fire-resistant grasses. Shrubs which may occur at low cover include *Artemisia tridentata, Brickellia californica, Ceanothus fendleri, Ceanothus fendleri, Cercocarpus montanus, Chrysothamnus viscidiflorus, Ericameria nauseosa, Fallugia paradoxa, Mahonia* spp., *Purshia tridentata, Quercus gambelii, Quercus grisea, Rhus trilobata, Tetradymia canescens*, and *Yucca baccata*. The herbaceous layer is dense and composed of fire-resistant graminoids. Dominant species may include *Andropogon gerardii, Bouteloua gracilis, Festuca arizonica, Muhlenbergia montana, Muhlenbergia straminea (= Muhlenbergia virescens)*, and *Schizachyrium scoparium*. Other graminoid associates may include *Achnatherum lobatum (= Stipa lobata), Andropogon gerardii, Aristida* spp., *Bothriochloa barbinodis (= var. barbinodis), Bouteloua curtipendula, Bouteloua hirsuta, Carex geophila, Carex rossii, Elymus elymoides, Hesperostipa comata, Koeleria macrantha, Piptochaetium fimbriatum*, and *Piptochaetium pringlei*. An assortment of forbs may occur, but cover is low relative to graminoids. Common associates may include *Ageratina rothrockii (= Eupatorium rothrockii), Allium cernuum, Antennaria* spp., *Artemisia ludoviciana, Campanula rotundifolia, Chaetopappa ericoides, Chaetopappa ericoides, Erigeron* spp., *Lotus wrightii, Oxytropis lambertii, Packera neomexicana, Penstemon* spp., and *Silene laciniata*.

ENVIRONMENT & DYNAMICS

Environmental Description: These woodlands typically occur between grassland or shrubland and more mesic coniferous forests. The quantity and timing of precipitation vary greatly across the range of the alliance, ranging from 25-60 cm annually, with at least some seasonal drought. East of the Continental Divide and in the Southwest, summer precipitation predominates. Monsoonal summer rains can contribute a substantial proportion to the annual precipitation totals in the Southwest. Stands occur on bottomlands, elevated plains, cinder cones, piedmont slopes, mesas, foothills, and mountains at elevations ranging from 1700-2900 m. Fire is a key factor in maintaining the open canopies characteristic of these woodlands, but soil drought or infertility may be equally important in some areas. Soils are derived from igneous, metamorphic, and sedimentary materials and are characterized by good aeration and drainage, coarse textures, circumneutral to slightly acidic pH, an abundance of mineral material, and periods of drought during the growing season.

Dynamics: *Pinus ponderosa* is a drought-resistant, shade-intolerant conifer which usually occurs at lower treeline in the major ranges of the western United States. Historically, surface fires and drought were influential in maintaining open-canopy conditions in these woodlands. With settlement and subsequent fire suppression, stands have become more dense. Presently, many stands contain understories of more shade-tolerant species, such as *Pseudotsuga menziesii* and/or *Abies* spp., as well as younger cohorts of *Pinus ponderosa*. These altered stand structures have affected fuel loads and altered fire regimes. Presettlement fires were frequent (5- to 15-year return intervals) with low-intensity surface fires triggered by lightning strikes or deliberately set by Native Americans. With fire suppression and increased fuel loads, fires are now less frequent and often become intense crown fires which can kill mature *Pinus ponderosa*. Establishment is erratic and believed to be linked to periods of adequate soil moisture and good seed crops, as well as fire frequencies which allow seedlings to reach sapling size. Longer fire-return intervals have resulted in many stands having dense subcanopies of overstocked and unhealthy young *Pinus ponderosa*.

DISTRIBUTION

Geographic Range: This alliance is found predominantly in the central and southern Rocky Mountains, west into the Colorado Plateau and Mogollon Rim, east to Texas, the Great Plains and Black Hills.

Nations: MX, US
States/Provinces: AZ, CO, MT, NE, NM, OK, SD, TX, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Pinus ponderosa* woodland alliance (Hoagland 1998a)
- **><** Interior Ponderosa Pine: 237 (Eyre 1980)

LOWER LEVEL UNITS

Associations:
- CEGL000856 *Pinus ponderosa / Festuca arizonica* Woodland
- CEGL000863 *Pinus ponderosa / Muhlenbergia straminea* Woodland
- CEGL000864 *Pinus ponderosa / Muhlenbergia straminea - Festuca arizonica* Woodland
- CEGL000852 *Pinus ponderosa / Cercocarpus montanus / Andropogon gerardii* Open Woodland
- CEGL000848 *Pinus ponderosa / Bouteloua gracilis* Woodland
- CEGL000862 *Pinus ponderosa / Muhlenbergia montana* Woodland

AUTHORSHIP

Primary Concept Source: M.S. Reid and D. Sarr, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Diamond 1993, Eyre 1980, Faber-Langendoen et al. 2017b, Hoagland 1998a

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
1.B.2.Nb.1.b. M022 Southern Rocky Mountain Lower Montane Forest

G228. Southern Rocky Mountain Ponderosa Pine Forest & Woodland

Type Concept Sentence: This widespread woodland group is found throughout the cordillera of the Rocky Mountains at lower treeline typically in warm, dry, exposed sites where the dominant tree is *Pinus ponderosa* (primarily *var. scopulorum* and *var. brachyptera*) usually with a shrubby layer of species of *Artemisia, Arctostaphylos, Cercocarpus, Purshia, Symphoricarpos*, and *Quercus gambelii*, with *Pseudoroegneria spicata, Pascopyrum smithii*, and species of *Achnatherum, Bouteloua, Festuca, Hesperostipa*, and *Muhlenbergia* common grasses.

OVERVIEW

Scientific Name: *Pinus ponderosa* Southern Rocky Mountain Forest & Woodland Group
Common Name (Translated Scientific Name): Ponderosa Pine Southern Rocky Mountain Forest & Woodland Group
Colloquial Name: Southern Rocky Mountain Ponderosa Pine Forest & Woodland

Type Concept: This widespread group is most common throughout the cordillera of the Rocky Mountains, from the Greater Yellowstone region south. It is also found in the Colorado Plateau region, west into scattered locations of the Great Basin. Its easternmost extent in Wyoming is in the Bighorn Mountains. These woodlands occur at the lower treeline/ecotone between grassland or shrubland and more mesic coniferous forests typically in warm, dry, exposed sites. Elevations range from less than 1900 m in northern Wyoming to 2800 m in the New Mexico mountains. Occurrences are found on all slopes and aspects; however, moderately steep to very steep slopes or ridgetops are most common. This group generally occurs on soils derived from igneous, metamorphic, and sedimentary material, with characteristic features of good aeration and drainage, coarse textures, circumneutral to slightly acidic pH, an abundance of mineral material, rockiness, and periods of drought during the growing season. *Pinus ponderosa* (primarily *var. scopulorum* and *var. brachyptera*) is the predominant conifer; *Pseudotsuga menziesii, Pinus edulis, Pinus*

contorta, Populus tremuloides, and *Juniperus* spp. may also be present in the tree canopy. The understory is usually shrubby, with *Artemisia nova, Artemisia tridentata, Arctostaphylos patula, Arctostaphylos uva-ursi, Cercocarpus montanus, Purshia stansburiana, Purshia tridentata, Quercus gambelii, Symphoricarpos* spp., *Prunus virginiana, Amelanchier alnifolia*, and *Rosa* spp. common. *Pseudoroegneria spicata, Pascopyrum smithii*, and species of *Hesperostipa, Achnatherum, Festuca, Muhlenbergia*, and *Bouteloua* are some of the common grasses. Mixed fire regimes and surface fires of variable return intervals maintain these woodlands, depending on climate, degree of soil development, and understory density.

Classification Comments: Central Rocky Mountain Ponderosa Pine Open Woodland Group (G213) in the eastern Cascades, Okanogan and Northern Rockies regions receives winter and spring rains, and thus has a greater spring "green-up" than the drier woodlands in the Central Rockies. This group also intergrades with Southern Rocky Mountain Ponderosa Pine Open Woodland Group (G229). They are distinguished by the high-frequency surface-fire regime, less steep or rocky environmental setting, and more open grassy understory structure of the savanna group. Ponderosa pine woodlands, savannas, and "escarpments'" of central and eastern Montana, eastern Wyoming, the Black Hills region, western Dakotas, and Nebraska are now included in Black Hills-Northwestern Great Plains Ponderosa Pine Forest & Woodland Group (G216).

Similar NVC Types:
- G229 Southern Rocky Mountain Ponderosa Pine Open Woodland
- G210 Central Rocky Mountain Douglas-fir - Pine Forest
- G216 Black Hills-Northwestern Great Plains Ponderosa Pine Forest & Woodland
- G213 Central Rocky Mountain Ponderosa Pine Open Woodland

Diagnostic Characteristics: *Pinus ponderosa* (primarily *var. scopulorum* and *var. brachyptera*) is the predominant conifer; *Pseudotsuga menziesii, Pinus edulis, Pinus contorta, Populus tremuloides*, and *Juniperus* spp. may also be present in the tree canopy. The understory is usually shrubby, with *Artemisia nova, Artemisia tridentata, Arctostaphylos patula, Arctostaphylos uva-ursi, Cercocarpus montanus, Purshia stansburiana, Purshia tridentata, Quercus gambelii, Symphoricarpos* spp., *Prunus virginiana, Amelanchier alnifolia*, and *Rosa* spp. common. *Pseudoroegneria spicata, Pascopyrum smithii*, and species of *Hesperostipa, Achnatherum, Festuca, Muhlenbergia*, and *Bouteloua* are some of the common grasses.

VEGETATION

Physiognomy and Structure: Conifer-dominated open forests or woodlands. Shrubs tend to predominate in the understory. Graminoids are common, but not as abundant as seen in the graminoid-dominated savanna group.

Floristics: This group is dominated by *Pinus ponderosa* with *Pseudotsuga menziesii, Pinus edulis, Pinus contorta, Populus tremuloides*, and *Juniperus* spp. as common canopy associates. In the southern Rocky Mountains and the mountains of southern Arizona and New Mexico, associated trees include *Pseudotsuga menziesii, Abies concolor, Picea pungens, Pinus strobiformis, Pinus edulis, Pinus discolor, Pinus cembroides, Pinus flexilis, Juniperus scopulorum*, and *Populus tremuloides*. In far southern stands, *Juniperus deppeana* may also be common. Average tree canopy cover ranges from 20-70%. The understory may include dense stands of shrubs or be dominated by grasses, sedges, or herbaceous species, although many of the associations are named for shrub species. Existing stands usually have younger cohorts of *Pinus ponderosa* present and may be less open than in the past. Understory shrub species include *Artemisia nova, Artemisia tridentata, Arctostaphylos patula, Arctostaphylos uva-ursi, Cercocarpus montanus, Purshia stansburiana, Purshia tridentata, Quercus gambelii, Symphoricarpos* spp., *Fallugia paradoxa, Ribes* spp., *Robinia neomexicana, Alnus incana, Forestiera pubescens, Prunus virginiana, Amelanchier alnifolia*, and *Rosa* spp. The herbaceous layer tends to vary inversely with shrub cover, but is composed primarily of graminoids. Important species include *Bouteloua gracilis, Carex geyeri, Carex rossii, Carex pensylvanica, Koeleria macrantha, Leucopoa kingii (= Festuca kingii), Muhlenbergia straminea (= Muhlenbergia virescens), Muhlenbergia montana, Achnatherum hymenoides (= Oryzopsis hymenoides), Achnatherum occidentale (= Stipa occidentalis), Pseudoroegneria spicata, Poa secunda, Elymus elymoides, Festuca idahoensis, Festuca arizonica*, and *Hesperostipa comata (= Stipa comata)*. Important or diagnostic forb species include *Aspidotis densa, Wyethia mollis, Balsamorhiza sagittata, Achillea millefolium, Sedum stenopetalum, Maianthemum racemosum (= Smilacina racemosa), Vicia americana*, and species of many other genera, such as *Erigeron, Lupinus, Fragaria, Lathyrus, Heterotheca, Arenaria*, and *Antennaria*.

ENVIRONMENT & DYNAMICS

Environmental Description: This group within the region occurs at the lower treeline/ecotone between grassland or shrubland and more mesic coniferous forests typically in warm, dry, exposed sites at elevations ranging from 1980-2800 m (6500-9200 feet). It can occur on all slopes and aspects; however, it commonly occurs on moderately steep to very steep slopes or ridgetops. At higher elevations, it will typically occur on south- or west-facing slopes. This group generally occurs on soils derived from igneous, metamorphic, and sedimentary material, including basalt, basaltic, andesitic flows, intrusive granitoids and porphyrites, and tuffs (Youngblood and Mauk 1985). Characteristic soil features include good aeration and drainage, coarse textures, circumneutral to slightly acidic pH, an abundance of mineral material, and periods of drought during the growing season. Some occurrences may

occur as edaphic climax communities on very skeletal, infertile, and/or excessively drained soils, such as pumice, cinder or lava fields, and scree slopes. Surface textures are highly variable in this group, ranging from sand to loam and silt loam. Exposed rock and bare soil consistently occur to some degree in all the associations. *Pinus ponderosa / Arctostaphylos patula* represents the extreme, with typically a high percentage of rock and bare soil present.

Precipitation generally contributes 25-60 cm annually to this group, mostly through winter storms and some monsoonal summer rains. Typically a seasonal drought period occurs throughout this group as well. Fire plays an important role in maintaining the characteristics of these open-canopy woodlands. However, soil infertility and drought may contribute significantly in some areas as well.

Climate: The quantity and timing of precipitation vary across the range of the group, ranging from 25-60 cm annually, with at least some seasonal drought. East of the Continental Divide and in the Southwest, summer precipitation predominates, whereas western stands receive most of their precipitation from westerly winter storms. Monsoonal summer rains can contribute a substantial proportion to the annual precipitation totals in the Southwest. Elevations decrease with increasing latitude, from less than 1000 m in eastern Washington to over 2750 m in southern Arizona and New Mexico. *Soil/substrate/hydrology:* Fire is a key factor in maintaining the open canopies characteristic of these woodlands, but soil drought or infertility may be equally important in some areas. This group generally occurs on soils derived from igneous, metamorphic, and sedimentary material, including basalt, basaltic, andesitic flows, intrusive granitoids and porphyrites, and tuffs (Youngblood and Mauk 1985). Characteristic soil features include good aeration and drainage, coarse textures, circumneutral to slightly acidic pH, an abundance of mineral material, and periods of drought during the growing season. Some occurrences may occur as edaphic climax communities on very skeletal, infertile, and/or excessively drained soils, such as pumice, cinder or lava fields, and scree slopes. Surface textures are highly variable in this group, ranging from sand to loam and silt loam. Exposed rock and bare soil consistently occur to some degree in all the associations.

Dynamics: *Pinus ponderosa* is a drought-resistant, shade-intolerant conifer which usually occurs at lower treeline in the major ranges of the western United States. Historically, surface fires and drought were influential in maintaining open-canopy conditions in these woodlands. With settlement and subsequent fire suppression, occurrences have become denser. Presently, many occurrences contain understories of more shade-tolerant species, such as *Pseudotsuga menziesii* and/or *Abies* spp., as well as younger cohorts of *Pinus ponderosa*. These altered structures have affected fuel loads and fire regimes. Presettlement fire regimes were primarily frequent (5- to 15-year return intervals), low-intensity surface fires triggered by lightning strikes or deliberately set fires by Native Americans. With fire suppression and increased fuel loads, fire regimes are now less frequent and often become intense crownfires, which can kill mature *Pinus ponderosa* (Reid et al. 1999).

Establishment is erratic and believed to be linked to periods of adequate soil moisture and good seed crops, as well as fire frequencies, which allow seedlings to reach sapling size. Longer fire-return intervals have resulted in many occurrences having dense subcanopies of overstocked and unhealthy young *Pinus ponderosa* (Reid et al. 1999). Mehl (1992) states the following: "Where fire has been present, occurrences will be climax and contain groups of large, old trees with little understory vegetation or down woody material and few occurring dead trees. The age difference of the groups of trees would be large. Where fire is less frequent, there will also be smaller size trees in the understory giving the occurrence some structure with various canopy layers. Dead, down material will be present in varying amounts along with some occurring dead trees. In both cases the large old trees will have irregular open, large branched crowns. The bark will be lighter in color, almost yellow, thick and some will like have basal fire scars."

Grace's warbler, pygmy nuthatch, and flammulated owl are indicators of a healthy ponderosa pine woodland. All of these birds prefer mature trees in an open woodland setting (Winn 1998, Jones 1998d, Levad 1998 as cited in Rondeau 2001).

DISTRIBUTION

Geographic Range: This group is found throughout much of the Rocky Mountains cordillera, from northwestern Wyoming, south through the Rocky Mountains of Colorado and into New Mexico, and a few scattered stands in west Texas. In Arizona, it occurs on the Mogollon Rim north into the Colorado Plateau region and west into scattered locations of the Great Basin.

Spatial Scale & Pattern [optional]: Matrix
Nations: MX, US
States/Provinces: AZ, CO, ID?, NM, NV, UT, WY
TNC Ecoregions [optional]: 9:C, 10:C, 11:C, 18:C, 19:C, 20:C, 21:C, 22:P, 24:P
USFS Ecoregions (2007): 313A:CC, 313B:CC, 313C:CC, 313D:CC, 315A:CC, 315B:CC, 315H:CC, 321A:CC, 331B:CC, 331F:CP, 331G:CP, 331H:CC, 331I:CC, 331J:CC, 341A:CP, 341B:CC, 341F:CC, 342F:CC, 342G:CC, M313A:CC, M313B:CC, M331B:CC, M331D:CP, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M341A:CP, M341B:CC, M341C:CC, M341D:C?
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **<** Interior Ponderosa Pine: 237 (Eyre 1980)
- **>** Pine Series, *Pinus ponderosa-Quercus gambelii* Association - 122.321 (Brown et al. 1979)
- **>** Pine Series, *Pinus ponderosa* Association - 122.321 (Brown et al. 1979)
- **>** Pine Series, *Pinus ponderosa*-Mixed Conifer Association - 122.321 (Brown et al. 1979)
- **=** Ponderosa Pine Series (Mauk and Henderson 1984)
- **=** Ponderosa Pine Series (Muldavin et al. 1996)
- **=** Ponderosa Pine Series (Youngblood and Mauk 1985)
- **=** Ponderosa Pine Series (Komarkova et al. 1988b)
- **=** Ponderosa Pine Series (Hoffman and Alexander 1976)
- **=** Ponderosa Pine Series (DeVelice et al. 1986)
- **=** Ponderosa Pine Series (Hess and Alexander 1986)
- **=** Xeric *Pinus ponderosa* Forest (Peet 1981)

LOWER LEVEL UNITS

Alliances:

- A3398 *Pinus ponderosa* Southern Rocky Mountain Forest & Woodland Alliance

AUTHORSHIP

Primary Concept Source: F.H. Eyre (1980)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 03/17/2010
Classif Resp Region: West
Internal Author: MEH 2-10, mod. GK 12-15

REFERENCES

References: Brown 1982a, Brown et al. 1979, DeVelice et al. 1986, Eyre 1980, Faber-Langendoen et al. 2017a, Hess and Alexander 1986, Hoffman and Alexander 1976, Johansen and Latta 2003, Jones 1998d, Komarkova et al. 1988b, Mauk and Henderson 1984, Mehl 1992, Muldavin et al. 1987, Muldavin et al. 1996, Peet 1978a, Peet 1981, Peet 2000, Reid et al. 1999, Rondeau 2001, Winn 1998, Youngblood and Mauk 1985

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G228. Southern Rocky Mountain Ponderosa Pine Forest & Woodland

A3398. Pinus ponderosa Southern Rocky Mountain Forest & Woodland Alliance

Type Concept Sentence: This broad and variable alliance represents forest and woodlands of the southern Rocky Mountains with scattered occurrences in adjacent ecoregions dominated by *Pinus ponderosa* in association with other conifer species.

OVERVIEW

Scientific Name: *Pinus ponderosa* Southern Rocky Mountain Forest & Woodland Alliance
Common Name (Translated Scientific Name): Ponderosa Pine Southern Rocky Mountain Forest & Woodland Alliance
Colloquial Name: Southern Rocky Mountain Ponderosa Pine Forest & Woodland

Type Concept: This forest and woodland alliance is widespread in the southwestern mountains occurring primarily in the southern Rocky Mountains, but extending into adjacent ecoregions. It is composed of open to closed forests and woodlands primarily dominated by *Pinus ponderosa*. Other canopy associates may include *Abies concolor, Juniperus scopulorum, Pinus contorta, Pinus edulis, Pinus flexilis, Pinus strobiformis, Populus tremuloides*, and *Pseudotsuga menziesii*. The understory ranges from dense shrub or graminoid layers to barren rock. Common dominant shrubs may include *Arctostaphylos patula, Arctostaphylos pungens, Arctostaphylos uva-ursi, Artemisia nova, Artemisia tridentata ssp. vaseyana, Cercocarpus intricatus, Cercocarpus montanus, Ericameria nauseosa, Fallugia paradoxa, Purshia stansburiana, Quercus gambelii, Quercus x pauciloba, Ribes cereum, Ribes inerme, Robinia neomexicana*, and *Symphoricarpos oreophilus*. The most common herbaceous dominants may include *Achnatherum hymenoides, Andropogon hallii, Bromus inermis, Carex inops ssp. heliophila, Carex rossii, Carex siccata, Festuca thurberi, Leucopoa kingii, Leymus salinus, Poa fendleriana*, and *Pteridium aquilinum*. Within the Rocky Mountains, these forests and woodlands grow at elevations between 1800-2600 m (6000-8500 feet). In the Black Hills and northeastern Wyoming, it can be found from 1080-2100 m (3600-7000 feet). Sites are dry/dry-mesic to xeric, and soils are generally well-drained and coarse-textured. Occurrences can be found on slopes of a variety of aspects and pitches, but is most often on gentle to moderate, northeast- to northwest-facing slopes.

Classification Comments:

Internal Comments: DFL 1-16: Canada removed.MSR 11-14: split into a Colorado Plateau & Great Basin vs RM alliance?
Other Comments:

Similar NVC Types:
- A3419 *Pinus ponderosa* / Grass Understory Southern Rocky Mountain Open Woodland Alliance

Diagnostic Characteristics: *Pinus ponderosa* (primarily *var. scopulorum* and *var. brachyptera*) is the predominant conifer; *Pseudotsuga menziesii, Pinus edulis, Pinus contorta, Populus tremuloides*, and *Juniperus* spp. may also be present in the tree canopy. Understories are characterized by dense shrubs, graminoids or sparse, barren ground.

VEGETATION

Physiognomy and Structure: These are forest stands of needle-leaved evergreen trees 10-30 m in height. Associated trees are typically needle-leaved evergreen species, but cold-deciduous and broad-leaved evergreen trees may form a subcanopy. The understory is typically dominated by cespitose graminoids, sclerophyllous or cold-deciduous shrubs.

Floristics: This alliance includes forests and woodlands dominated by *Pinus ponderosa*. Structurally, these are open to closed with tree canopy cover ranging from 20-100%. The understory may include dense stands of shrubs or be dominated by grasses, sedges, or other herbaceous species. Stands usually have younger cohorts of *Pinus ponderosa* present and may be less open than in the past. Associated trees vary widely across the range of this alliance and may include *Abies concolor, Juniperus scopulorum, Pinus contorta, Pinus edulis, Pinus flexilis, Pinus strobiformis, Populus tremuloides*, and *Pseudotsuga menziesii*. A shrub layer may be prominent or nearly absent, depending on location and disturbance history. Common dominant shrubs may include *Arctostaphylos patula, Arctostaphylos pungens, Arctostaphylos uva-ursi, Artemisia nova, Artemisia tridentata ssp. vaseyana, Cercocarpus intricatus, Cercocarpus montanus, Ericameria nauseosa, Fallugia paradoxa, Purshia stansburiana, Quercus gambelii, Quercus x pauciloba, Ribes cereum, Ribes inerme, Robinia neomexicana*, and *Symphoricarpos oreophilus*. The herbaceous layer tends to vary inversely with shrub cover, but is composed primarily of graminoids. The most common herbaceous dominants may include *Achnatherum hymenoides, Andropogon hallii, Bromus inermis, Carex inops ssp. heliophila, Carex rossii, Carex siccata, Festuca thurberi, Leucopoa kingii, Leymus salinus, Poa fendleriana*, and *Pteridium aquilinum*.

ENVIRONMENT & DYNAMICS

Environmental Description: These forests and woodlands typically occur at the lowest elevations of the coniferous forest and woodland zone within their range. These are among the driest forested habitats in the western United States, but quantity and timing of precipitation vary greatly across the range of this vegetation. Generally, these woodlands occur in areas which receive 25-60 cm of precipitation annually, with at least some seasonal drought. Fire is a key factor in maintaining the relatively open canopies characteristic of these stands, but soil drought or infertility may be equally important in some areas. Within the Rocky Mountains, *Pinus ponderosa* grows at elevations between 1800 and 2600 m (6000-8500 feet) (Mehl 1992). In the Black Hills and northeastern Wyoming, it can be found from 1080-2100 m (3600-7000 feet). Soils are highly variable across the range of this type, and are derived from igneous, metamorphic, and sedimentary materials. The most characteristic soil features are good aeration and drainage, circumneutral to slightly acidic pH, an abundance of mineral material, and periods of drought during the growing season. It can be found on slopes of a variety of aspects and pitches, but is most often on gentle to moderate, northeast- to northwest-facing slopes. Some stands may occur as edaphic climax communities on very skeletal, infertile, and/or excessively drained soils, such as cinder or lava fields.

Dynamics: *Pinus ponderosa* is a drought-resistant, shade-intolerant conifer which usually occurs at lower treeline in the major ranges of the western United States. Historically, surface fires and drought were influential in maintaining open canopy conditions. With settlement and subsequent fire suppression, stands have become denser than they once were. Presettlement fire regimes were primarily frequent (5- to 15-year return intervals) including low-intensity surface fires triggered by lightning strikes or deliberately set by Native Americans. With fire suppression and increased fuel loads, fires are now less frequent and often become intense crown fires which can kill mature *Pinus ponderosa*. Presently, many stands contain understories of more shade-tolerant species, such as *Pseudotsuga menziesii* and/or *Abies* spp., which may be affecting fuel loads and may alter future fire regimes. Establishment is erratic and believed to be linked to periods of adequate soil moisture, good seed crops, and the availability of bare, unshaded mineral substrate. At drier sites, competition from adjacent grassland or shrubland vegetation can strongly affect seedling survival (Burns and Honkala 1990a).

DISTRIBUTION

Geographic Range: This alliance is found from northwestern Wyoming, the Black Hills of South Dakota, south through the Rocky Mountains of Colorado and into New Mexico, and a few scattered stands in western Texas. In Arizona, it occurs on the Mogollon Rim north into the Colorado Plateau region and west into scattered locations of the Great Basin.

Nations: MX, US
States/Provinces: AZ, CA?, CO, ID?, MT, MXCH, MXSO, ND, NE, NM, NV, SD, TX, UT, WY

TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **><** *Pinus ponderosa* (Ponderosa pine forest) Alliance (Sawyer et al. 2009) [87.010.00]
- **?** *Pinus ponderosa* Alliance (Ponderosa pine forest) (Buck-Diaz et al. 2012)
- **><** IA1b. Ponderosa Pine Forest (Allard 1990)
- **><** Interior Ponderosa Pine - Black Hills (Mehl 1992)
- **><** Interior Ponderosa Pine - Front Range (Mehl 1992)
- **><** Interior Ponderosa Pine: 237 (Eyre 1980)
- **><** Ponderosa Pine Series (Sawyer and Keeler-Wolf 1995)

LOWER LEVEL UNITS

Associations:

- CEGL002794 *Pinus ponderosa / Artemisia tridentata ssp. vaseyana* Woodland
- CEGL005645 *Pinus ponderosa var. scopulorum / Cercocarpus ledifolius* Southern Rocky Mountain Woodland
- CEGL000846 *Pinus ponderosa / Artemisia nova* Woodland
- CEGL002999 *Pinus ponderosa / Fallugia paradoxa* Woodland
- CEGL000870 *Pinus ponderosa / Quercus gambelii* Woodland
- CEGL000186 *Pinus ponderosa / Leucopoa kingii* Woodland
- CEGL000849 *Pinus ponderosa / Carex inops ssp. heliophila* Woodland
- CEGL000183 *Pinus ponderosa / Carex rossii* Forest
- CEGL002998 *Pinus ponderosa* / Cinder Woodland
- CEGL000199 *Pinus ponderosa / Ribes cereum* Forest
- CEGL005808 *Pinus ponderosa / Andropogon hallii* Woodland
- CEGL000874 *Pinus ponderosa / Quercus x pauciloba* Woodland
- CEGL007091 *Pinus ponderosa - Pinus strobiformis* Forest
- CEGL002944 *Pinus ponderosa / Pteridium aquilinum* Woodland
- CEGL000876 *Pinus ponderosa / Ribes inerme* Scree Woodland
- CEGL001490 *Pinus ponderosa / (Ericameria nauseosa) / Achnatherum hymenoides* Woodland
- CEGL000877 *Pinus ponderosa* / Rockland Woodland
- CEGL000842 *Pinus ponderosa / Arctostaphylos patula* Woodland
- CEGL000843 *Pinus ponderosa / Arctostaphylos pungens* Woodland
- CEGL000854 *Pinus ponderosa / Purshia stansburiana* Woodland
- CEGL000844 *Pinus ponderosa / Arctostaphylos uva-ursi* Woodland
- CEGL002943 *Pinus ponderosa / Bromus inermis* Ruderal Woodland
- CEGL000861 *Pinus ponderosa / Juniperus scopulorum* Woodland
- CEGL000851 *Pinus ponderosa / Cercocarpus montanus* Woodland
- CEGL002384 *Pinus ponderosa* / Sparse Understory Woodland
- CEGL005372 *Pinus ponderosa / Quercus gambelii / Carex inops ssp. heliophila* Woodland
- CEGL005373 *Pinus ponderosa / Festuca thurberi* Woodland
- CEGL005374 *Pinus ponderosa / Robinia neomexicana* Woodland
- CEGL005362 *Pinus ponderosa / Leymus salinus* Woodland
- CEGL005506 *Pinus ponderosa / Carex siccata* Woodland
- CEGL005507 *Pinus ponderosa / Poa fendleriana* Woodland
- CEGL005032 *Pinus ponderosa / Fallugia paradoxa - Ribes cereum* Woodland
- CEGL005441 *Pinus ponderosa - (Pinus longaeva) / Cercocarpus intricatus* Woodland
- CEGL005442 *Pinus ponderosa - Abies concolor / Symphoricarpos oreophilus* Woodland
- CEGL005647 *Pinus ponderosa var. scopulorum / Purshia tridentata* Southern Rocky Mountain Woodland
- CEGL000541 *Populus tremuloides - Pinus ponderosa* Rocky Mountain Forest

AUTHORSHIP

Primary Concept Source: M.S. Reid and D. Sarr, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:

Version Date: 2014/03/14

REFERENCES

References: Allard 1990, Buck-Diaz et al. 2012, Burns and Honkala 1990a, Diamond 1993, Eyre 1980, Faber-Langendoen et al. 2017b, Mehl 1992, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009

1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
1.B.2.Nb.1.c. M022 Southern Rocky Mountain Lower Montane Forest

G226. Southern Rocky Mountain White Fir - Douglas-fir Dry Forest

Type Concept Sentence: This group consists of dry mixed-conifer forests of mainly *Pseudotsuga menziesii* and *Abies concolor*, although as many as seven conifers can be found growing in the same occurrence, and there are a number of cold-deciduous shrub, forb and graminoid species common. It occurs throughout the southern Rocky Mountains and Great Basin and east into Texas, and has a mixed-severity fire regime.

OVERVIEW

Scientific Name: *Abies concolor - Pseudotsuga menziesii* Southern Rocky Mountain Dry Forest Group
Common Name (Translated Scientific Name): White Fir - Douglas-fir Southern Rocky Mountain Dry Forest Group
Colloquial Name: Dry White Fir Forest & Woodland

Type Concept: This is a group of the southern Rocky Mountains and Great Basin. It occurs from Nevada extending east into the Trans-Pecos plateaus of Texas, south to the Chihuahuan Desert, and throughout the Four Corners region. These are mixed-conifer forests occurring on all aspects at elevations ranging from 1200 to 3300 m. The composition and structure of the overstory are dependent upon the temperature and moisture relationships of the site and the successional status of the occurrence. *Pseudotsuga menziesii* and *Abies concolor* are most frequent, but *Pinus ponderosa* may be present to codominant. *Pinus flexilis* is common in Nevada. *Pseudotsuga menziesii* forests occupy drier sites, and *Pinus ponderosa* is a common codominant. *Abies concolor*-dominated forests occupy cooler sites, such as upper slopes at higher elevations, canyon sideslopes, ridgetops, and north- and east-facing slopes which burn somewhat infrequently. *Picea pungens* is uncommon in this group but does occur in cool, moist locations, often as smaller patches within a matrix of other associations. As many as seven conifers can be found growing in the same occurrence, and there are a number of cold-deciduous shrub, forb and graminoid species common, including *Juniperus communis, Cercocarpus ledifolius, Artemisia tridentata, Arctostaphylos uva-ursi, Mahonia repens, Paxistima myrsinites, Symphoricarpos oreophilus, Jamesia americana, Quercus gambelii, Galium triflorum, Muhlenbergia straminea (= Muhlenbergia virescens)*, and *Festuca arizonica*. Forests in this group were undoubtedly characterized by a mixed-severity fire regime under "natural conditions," characterized by a high degree of variability in lethality and return interval.

Classification Comments: The transition between this group and Middle Rocky Mountain Montane Douglas-fir Forest & Woodland Group (G215) in Wyoming needs to be further clarified, both in terms of floristics and distribution details. For now, it is assumed that this group does not occur in the Bighorn Range or in the Yellowstone region, but its occurrence in isolated ranges of central and western Wyoming is possible.

Similar NVC Types:
- G202 Madrean Upper Montane Conifer - Oak Forest & Woodland
- G225 Rocky Mountain Douglas-fir - White Fir - Blue Spruce Mesic Forest
- G215 Middle Rocky Mountain Montane Douglas-fir Forest & Woodland

Diagnostic Characteristics: The tree canopy is often dominated by the widespread *Pseudotsuga menziesii*, whereas *Abies concolor* is an indicator species that may be present to dominant in stands in the southern half of Colorado and northern New Mexico west into Arizona, Utah and Nevada. Diagnostic understory species are dry-mesic site indicators such as *Arctostaphylos patula, Arctostaphylos uva-ursi, Arnica cordifolia, Carex rossii, Cercocarpus ledifolius, Cercocarpus montanus, Danthonia parryi, Festuca arizonica, Juniperus communis, Mahonia repens, Poa fendleriana, Physocarpus monogynus, Pseudoroegneria spicata, Quercus gambelii, Quercus x pauciloba*, and *Vaccinium myrtillus*.

VEGETATION

Physiognomy and Structure: Mixed conifer-dominated woodlands and forests with shrub, grass or sparse understories. Occasionally broad-leaved deciduous trees are intermixed with the conifers in mesic environments.

Floristics: This highly variable ecological group comprises mixed-conifer forests at montane elevations throughout the Intermountain West region. *Abies concolor* dominates at higher, colder locations; *Picea pungens* represents mesic conditions; and *Pseudotsuga menziesii* dominates intermediate zones. As many as seven conifers can be found growing in the same occurrence, with the successful reproduction of the diagnostic species determining the association type. Common conifers include *Pinus ponderosa, Pinus flexilis, Abies lasiocarpa var. lasiocarpa, Abies lasiocarpa var. arizonica, Juniperus scopulorum*, and *Picea engelmannii*. *Populus tremuloides* is often present as intermingled individuals in remnant aspen clones or in adjacent patches. The composition and structure of the overstory are dependent upon the temperature and moisture relationships of the site and the successional status of the occurrence (DeVelice et al. 1986, Muldavin et al. 1996).

A number of cold-deciduous shrub and graminoid species are found in many occurrences (e.g., *Arctostaphylos uva-ursi, Mahonia repens, Paxistima myrsinites, Symphoricarpos oreophilus, Jamesia americana, Quercus gambelii*, and *Festuca arizonica*). Other important species include *Amelanchier alnifolia, Arctostaphylos patula, Holodiscus dumosus, Jamesia americana, Juniperus communis, Physocarpus monogynus, Quercus x pauciloba, Robinia neomexicana, Rubus parviflorus*, and *Vaccinium myrtillus*. Where soil moisture is favorable, the herbaceous layer may be quite diverse, including graminoids *Bromus ciliatus (= Bromus canadensis), Calamagrostis rubescens, Carex geyeri, Carex rossii, Carex siccata (= Carex foenea), Festuca occidentalis, Koeleria macrantha, Muhlenbergia montana, Muhlenbergia straminea (= Muhlenbergia virescens), Poa fendleriana, Pseudoroegneria spicata*, and forbs *Achillea millefolium, Arnica cordifolia, Erigeron eximius, Fragaria virginiana, Linnaea borealis, Luzula parviflora, Osmorhiza berteroi, Packera cardamine (= Senecio cardamine), Thalictrum occidentale, Thalictrum fendleri, Thermopsis rhombifolia, Viola adunca*, and species of many other genera, including *Lathyrus, Penstemon, Lupinus, Vicia, Arenaria, Galium*, and others.

ENVIRONMENT & DYNAMICS

Environmental Description: This group is widespread throughout the southern Rocky Mountains, occurring mostly on northerly and cooler aspects and less commonly westerly and southerly aspects at elevations ranging from 1200-3300 m. Landforms are variable and can include canyons, plateaus, draws, benches, hills, mesas, ravines, shoulder, sideslopes and toeslopes. Slopes can be gentle to extremely steep. *Climate:* Rainfall averages less than 75 cm per year (40-60 cm), with summer "monsoons" during the growing season contributing substantial moisture. *Soil/substrate/hydrology:* Geologic substrates include volcanic andesite, rhyolite, rhyolitic tuffs, colluvium, shale gneiss, granite, sandstone and limestone. Soils are variable from cobbles, clay loam, silt loam, sandy loam, sand, and gravel.

Dynamics: Forests in this group represent the gamut of fire tolerance. Formerly, *Abies concolor* in the Utah High Plateaus were restricted to rather moist or less fire-prone areas by frequent surface fires. These areas experienced mixed fire severities, with patches of crowning in which all trees were killed, intermingled with patches of underburn in which larger *Abies concolor* survived (Mauk and Henderson 1984, Zouhar 2001). With fire suppression, *Abies concolor* has vigorously colonized many sites formerly occupied by open *Pinus ponderosa* woodlands. These invasions have dramatically changed the fuel load and potential behavior of fire in these forests. In particular, the potential for high-intensity crownfires on drier sites now codominated by *Pinus ponderosa* and *Abies concolor* has increased. Increased landscape connectivity, in terms of fuel loadings and crown closure, has also increased the potential size of crownfires.

Pseudotsuga menziesii forests are the only true "fire-tolerant" occurrences in this group. *Pseudotsuga menziesii* forests were probably subject to a moderate-severity fire regime in presettlement times, with fire-return intervals of 30-100 years. Many of the important tree species in these forests are fire-adapted (*Populus tremuloides, Pinus ponderosa, Pinus contorta*) (Pfister et al. 1977), and fire-induced reproduction of *Pinus ponderosa* can result in its continued codominance in *Pseudotsuga menziesii* forests (Steele et al. 1981). Seeds of the shrub *Ceanothus velutinus* can remain dormant in forest occurrences for 200 years (Steele et al. 1981) and germinate abundantly after fire, competitively suppressing conifer seedlings. Successional relationships in this group are complex. *Pseudotsuga menziesii* is less shade-tolerant than many northern or montane trees such as *Tsuga heterophylla, Abies concolor, Picea engelmannii*, and seedlings compete poorly in deep shade. At drier locales, seedlings may be favored by moderate shading, such as by a canopy of *Pinus ponderosa*, which helps to minimize drought stress. In some locations, much of these forests have been logged or burned during European settlement, and present-day occurrences are second-growth forests dating from fire, logging, or other occurrence-replacing disturbances (Mauk and Henderson 1984, Chappell et al. 1997).

Picea pungens is a slow-growing, long-lived tree which regenerates from seed (Burns and Honkala 1990a). Seedlings are shallow-rooted and require perennially moist soils for establishment and optimal growth. *Picea pungens* is intermediate in shade tolerance, being somewhat more tolerant than *Pinus ponderosa* or *Pseudotsuga menziesii*, and less tolerant than *Abies lasiocarpa* or *Picea engelmannii*. It forms late-seral occurrences in the subhumid regions of the Utah High Plateaus. It is common for these forests to be heavily disturbed by grazing or fire.

In general, fire suppression has lead to the encroachment of more shade-tolerant, less fire-tolerant species (e.g., climax) into occurrences and an attendant increase in landscape homogeneity and connectivity (from a fuels perspective). This has increased the lethality and potential size of fires.

DISTRIBUTION

Geographic Range: This widespread group occurs throughout the southern Rocky Mountains, but extends west into the Great Basin in Nevada and east into the Trans-Pecos plateaus of Texas.

Spatial Scale & Pattern [optional]: Matrix
Nations: US
States/Provinces: AZ, CO, NM, NV, TX, UT, WY
TNC Ecoregions [optional]: 6:?, 9:C, 10:?, 11:C, 18:C, 19:C, 20:C, 21:C, 26:?
USFS Ecoregions (2007): 313A:CC, 313B:CC, 313C:CC, 313D:CP, 315A:C?, 315H:CC, 321A:??, 322A:CC, 331B:CC, 331G:C?, 331H:CC, 331I:CC, 331J:CC, 341A:CC, 341B:CC, 341C:CP, 341D:C?, 341E:CC, 341F:CC, 341G:CP, 342A:C?, 342B:C?, 342C:C?, 342D:C?, 342E:CC, 342F:CC, 342G:CC, 342J:C?, M313A:CC, M313B:CC, M331B:C?, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:C?, M341A:CC, M341B:CC, M341C:CC, M341D:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate. USNVC Confidence from peer reviewer, not AE.

SYNONYMY

- **><** *Abies concolor* Series (DeVelice et al. 1986)
- **><** *Abies concolor* Series (Moir and Ludwig 1979)
- **><** *Pseudotsuga menziesii* Series (DeVelice et al. 1986)
- **><** *Pseudotsuga menziesii* Series (Moir and Ludwig 1979)
- **>** Blue Spruce: 216 (Eyre 1980)
- **><** Interior Douglas-fir: 210 (Eyre 1980)
- **><** White Fir: 211 (Eyre 1980)

LOWER LEVEL UNITS

Alliances:
- A3420 *Abies concolor* Dry Forest & Woodland Alliance
- A3453 *Picea pungens* Southern Rocky Mountain Forest & Woodland Alliance
- A3454 *Pseudotsuga menziesii* Southern Rocky Mountain Forest & Woodland Alliance

AUTHORSHIP

Primary Concept Source: W.H. Moir and J.A. Ludwig (1979)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 03/17/2010
Classif Resp Region: West
Internal Author: MEH 3-10, mod. GK 12-15

REFERENCES

References: Alexander et al. 1984b, Alexander et al. 1987, Boyce 1977, Bunin 1975c, Burns and Honkala 1990a, Chappell et al. 1997, DeVelice et al. 1986, Eyre 1980, Faber-Langendoen et al. 2017a, Fitzhugh et al. 1987, Giese 1975, Heinze et al. 1962, Hess 1981, Hess and Alexander 1986, Hess and Wasser 1982, Hoffman and Alexander 1980, Hoffman and Alexander 1983, Komarkova et al. 1988b, Mauk and Henderson 1984, Moir and Ludwig 1979, Muldavin et al. 1996, Pfister et al. 1977, Steele et al. 1981, Steele et al. 1983, Youngblood and Mauk 1985, Zouhar 2001a

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G226. Southern Rocky Mountain White Fir - Douglas-fir Dry Forest

A3420. Abies concolor Dry Forest & Woodland Alliance

Type Concept Sentence: Forests and woodlands of the southern Rocky Mountains characterized by canopies dominated by *Abies concolor* in association with other conifers.

OVERVIEW

Scientific Name: *Abies concolor* Dry Forest & Woodland Alliance
Common Name (Translated Scientific Name): White Fir Dry Forest & Woodland Alliance
Colloquial Name: Dry White Fir Forest & Woodland

Type Concept: Forests and woodlands of this alliance occur primarily in the southern Rocky Mountains and extend west into the intermountain ranges of the Great Basin. These mixed conifer forests and woodlands have an open to closed canopy with *Abies concolor* successfully reproducing and typically codominant in the tree canopy. The composition of other species in the tree canopy varies across the range of the alliance with *Pinus ponderosa* or *Pseudotsuga menziesii* being most consistent. *Populus tremuloides*

may codominate in early-seral stands. Other canopy associates that may be present include *Abies lasiocarpa, Picea engelmannii, Pinus flexilis*, and *Pinus strobiformis*. The density of the understory varies with the amount of tree canopy shading. Shrub and dwarf-shrub layers may be present and vary in structure and composition. Ericaceous or cold-deciduous shrubs are most common. Common shrub species include *Acer glabrum, Amelanchier alnifolia, Arctostaphylos patula, Arctostaphylos uva-ursi, Jamesia americana, Juniperus communis, Mahonia repens, Paxistima myrsinites, Purshia tridentata, Quercus gambelii, Ribes cereum, Rosa woodsii, Rubus parviflorus, Symphoricarpos oreophilus*, and *Vaccinium myrtillus*. The herbaceous layer may be dominated by shade-tolerant forbs, ferns or graminoids. The most common dominant herbaceous species include *Carex rossii, Carex siccata, Danthonia parryi, Festuca arizonica, Galium triflorum, Leymus triticoides*, and *Muhlenbergia straminea (= Muhlenbergia virescens)*. These forests occur at middle to high elevations (1200-3150 m) and occupy a variety of topo-edaphic positions, such as lower and middle slopes of ravines, upper slopes at higher elevations, along stream terraces, ridgetops, and north- and east-facing slopes that burn somewhat infrequently. Parent materials and soils are highly variable and nondefinitive for these forests. Temperature and moisture regimes appear to be the key factors in their distribution.

Classification Comments: The name of the alliance needs to include better diagnostic species, as this alliance has a name very similar to *Abies concolor* Southern Rocky Mountain Mesic Forest & Woodland Alliance (A3369) (G225). For now, a hydrologic modifier is used to distinguish it.

Internal Comments: mjr 12-14: CA added for MOJN.
Other Comments:

Similar NVC Types:
- A3674 *Abies concolor - Pseudotsuga menziesii* Coastal, Cascadian & Sierran Forest Alliance

Diagnostic Characteristics: Forests and woodlands of the southern Rocky Mountains where *Abies concolor* is the dominant canopy species and is successfully reproducing. It is distinguished from other *Abies concolor* forests and woodlands in having an understory composed of species that have affinities to drier conditions.

VEGETATION

Physiognomy and Structure: These are open to closed, medium-statured to tall (20-50 m in height), multi-storied forests and woodlands of needle-leaved evergreen trees. Occasionally, a subcanopy (10-20 m tall) of broad-leaved evergreen or cold-deciduous trees may be present. Many densely stocked stands may have a somewhat depauperate understory, but more open stands often have a well-developed ericaceous or cold-deciduous shrub layer. The herbaceous layer is usually dominated by shade-tolerant forbs or cespitose graminoids.

Floristics: The successful reproduction of *Abies concolor* is always diagnostic in these stands and often it is one of the codominant species in the canopy. Common conifer associates include *Abies lasiocarpa var. arizonica, Abies lasiocarpa var. lasiocarpa, Juniperus scopulorum, Picea engelmannii, Picea pungens, Pinus flexilis, Pinus ponderosa, Pinus strobiformis*, and *Pseudotsuga menziesii*. *Populus tremuloides* is occasionally codominant in early-seral stands. The composition and proportions of these species are dependent upon the temperature and moisture relationships of the site and the successional status of the stand (DeVelice et al. 1986, Muldavin et al. 1996). A tall-shrub or low-tree layer composed of cold-deciduous species may also be present, including *Acer glabrum, Acer grandidentatum, Quercus gambelii*, or *Robinia neomexicana*. Locally abundant low to mid-statured shrubs include *Arctostaphylos patula, Arctostaphylos uva-ursi, Holodiscus dumosus, Jamesia americana, Juniperus communis, Mahonia repens, Paxistima myrsinites, Ribes cereum, Rubus parviflorus, Symphoricarpos oreophilus*, and *Vaccinium myrtillus*. The herbaceous layer can either be graminoid- or forb-dominated. Important forbs include *Erigeron eximius, Geranium richardsonii, Lathyrus lanszwertii, Maianthemum* spp. (= *Smilacina* spp.), *Pseudocymopterus montanus, Pteridium aquilinum, Thalictrum fendleri, Thermopsis rhombifolia*, and *Valeriana arizonica*. Important graminoids include *Bromus ciliatus var. ciliatus (= Bromus canadensis), Carex rossii, Carex siccata (= Carex foenea), Festuca arizonica, Koeleria macrantha*, and *Poa fendleriana*.

ENVIRONMENT & DYNAMICS

Environmental Description: These forests and woodlands occur at middle to high elevations (1200-3150 m) of major mountain ranges of the southern Rocky Mountains where annual precipitation is 75 cm or less. Summer "monsoonal" rainfall contributes substantial moisture. These forests and woodlands occupy a variety of topo-edaphic positions, such as lower and middle slopes of ravines, upper slopes at higher elevations, canyon sideslopes, along stream terraces, ridgetops, and north- and east-facing slopes that burn somewhat infrequently. All slopes and aspects are represented within this alliance. Parent materials and soils are highly variable and nondefinitive for these forests. Temperature and moisture regimes appear to be the key factors in their distribution.

Dynamics: With fire suppression, *Abies concolor* tends to replace many of the important conifers at lower elevation sites (Chappell et al. 1997). At higher elevations, the stands are naturally more closed and burn less frequently. Forb, shrub, and wildlife diversity varies greatly with the substrate (Chappell et al. 1997). In the Southern Rockies, frequent surface fires restricted these forests to

rather moist or less fire-prone areas. With fire suppression, *Abies concolor* has vigorously colonized many sites which were formerly occupied by open *Pinus ponderosa* woodlands. These invasions have dramatically changed the fuel load and potential behavior of fire in these forests. In particular, the potential for high-intensity crown fires has increased.

DISTRIBUTION

Geographic Range: This alliance is known from western Arizona east to the Colorado Plateau and southern Rocky Mountains of Utah, Colorado, New Mexico and Wyoming.

Nations: US
States/Provinces: AZ, CA, CO, NM, UT, WY
TNC Ecoregions [optional]: 4:C, 5:C, 11:C, 12:C, 14:C, 16:C, 17:C
USFS Ecoregions (2007): 322Aj:CCC, 341Dl:CCC, M261A:CC, M261B:CC, M261D:CC, M261E:CC, M261Fe:CCC, M261G:CC, M262B:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Great Basin, Mojave)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **=** *Abies concolor* (White fir forest) Alliance (Sawyer et al. 2009) [88.500.00]
- **=** *Abies concolor* Forest & Woodland Alliance (Evens et al. 2014)
- **><** *Abies concolor* Series (Johnston 1987)
- **=** *Abies concolor* Forest Alliance (CNPS 2017) [88.500.00]
- **><** Desert Mountain White Fir Forest (#85330) (Holland 1986b)
- **><** Sierran White Fir Forest (#84240) (Holland 1986b)
- **><** Southern California White Fir Forest (#85320) (Holland 1986b)
- **><** Western Needleleaf Forests: 20: Spruce-Fir-Douglas fir Forest (*Picea-Abies-Pseudotsuga*) (Küchler 1964)
- **><** Western Needleleaf Forests: 5: Mixed Conifer Forest (*Abies-Pinus-Pseudotsuga*) (Küchler 1964)
- **><** White Fir: 211 (Eyre 1980) [Pacific coastal stands]

LOWER LEVEL UNITS

Associations:

- CEGL000887 *Abies concolor / Festuca arizonica* Woodland
- CEGL005357 *Abies concolor* / Mixed Grasses Forest
- CEGL002732 *Abies concolor - Pinus ponderosa / Cercocarpus ledifolius* Forest
- CEGL000888 *Abies concolor / Galium triflorum* Woodland
- CEGL000244 *Abies concolor - Pseudotsuga menziesii / Carex siccata* Forest
- CEGL000249 *Abies concolor / Juniperus communis* Forest
- CEGL000431 *Abies concolor - Pseudotsuga menziesii / Carex rossii* Forest
- CEGL000242 *Abies concolor / Arctostaphylos patula* Forest
- CEGL000251 *Abies concolor / Mahonia repens* Forest
- CEGL000886 *Abies concolor / Leymus triticoides* Woodland
- CEGL000261 *Abies concolor / Quercus gambelii* Forest
- CEGL000252 *Abies concolor / Muhlenbergia straminea* Forest
- CEGL000522 *Populus tremuloides - Abies concolor / Arctostaphylos patula* Forest
- CEGL000265 *Abies concolor - Pseudotsuga menziesii / Vaccinium myrtillus* Forest
- CEGL005350 *Abies concolor - Pseudotsuga menziesii / Festuca thurberi - Danthonia parryi* Woodland
- CEGL000885 *Abies concolor / Cercocarpus ledifolius* Woodland
- CEGL000243 *Abies concolor / Arctostaphylos uva-ursi* Forest
- CEGL005351 *Abies concolor - (Pseudotsuga menziesii) / Quercus gambelii / Carex rossii* Forest
- CEGL000891 *Abies concolor - Pseudotsuga menziesii / Robinia neomexicana* Woodland

AUTHORSHIP

Primary Concept Source: D. Sarr, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Barbour 1988, Barbour and Minnich 2000, CNPS 2017, Chappell et al. 1997, DeVelice et al. 1986, Evens and San 2006, Evens et al. 2014, Eyre 1980, Faber-Langendoen et al. 2017b, Fites-Kaufman et al. 2007, Franklin 1988, Gordon 1980, Hendrickson

and Prigge 1975, Holland 1986b, Imper 1988a, Jimerson 1993, Johnston 1987, Keeler-Wolf and Thomas 2000, Klein and Evens 2006, Küchler 1964, Laacke 1990a, Laacke and Fiske 1983, Minnich 1987, Minnich 2007b, Muldavin et al. 1996, Paysen et al. 1980, Rundel et al. 1977, Sawyer 2006, Sawyer 2007, Sawyer and Thornburgh 1977, Sawyer et al. 2009, Sugihara et al. 2006, Taylor and Randall 1977, Taylor and Teare 1979a, Taylor and Teare 1979b, Thomas et al. 2004, Thorne et al. 2007, Vasek 1985, Waddell 1982, Zouhar 2001a

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G226. Southern Rocky Mountain White Fir - Douglas-fir Dry Forest

A3453. Picea pungens Southern Rocky Mountain Forest & Woodland Alliance

Type Concept Sentence: This forest and woodland alliance occurs in the central and southern Rocky Mountains west to the Great Basin and is defined by canopies dominated by *Picea pungens*.

OVERVIEW

Scientific Name: *Picea pungens* Southern Rocky Mountain Forest & Woodland Alliance
Common Name (Translated Scientific Name): Blue Spruce Southern Rocky Mountain Forest & Woodland Alliance
Colloquial Name: Southern Rocky Mountain Blue Spruce Forest & Woodland

Type Concept: This forest and woodland alliance occurs in the central and southern Rocky Mountains west to the Great Basin and is characterized by the dominance of *Picea pungens* in the forest canopy. Other conifers are usually present to codominant in these stands and may include *Abies concolor, Abies lasiocarpa, Picea engelmannii, Pinus contorta, Pinus ponderosa, Pinus strobiformis*, and *Pseudotsuga menziesii*. *Populus tremuloides* is the only widespread hardwood associate. The shrub layer usually has only moderate cover and is dominated by ericaceous or cold-deciduous species, with the latter group increasing with soil moisture or proximity to watercourses. Common dominant species include *Acer glabrum, Amelanchier alnifolia, Arctostaphylos patula, Arctostaphylos uva-ursi, Juniperus communis, Mahonia repens, Quercus gambelii*, and *Rubus parviflorus*. Due to favorable soil moisture, the herbaceous layer is usually a diverse mixture of forbs and graminoids, including *Achillea millefolium, Arnica cordifolia, Carex siccata (= Carex foenea), Festuca arizonica, Fragaria virginiana, Linnaea borealis, Packera cardamine (= Senecio cardamine)*, and *Pseudoroegneria spicata*. Stands are usually found in moist, concave topographic positions. Soils are variable, but usually young and derived from glacial or alluvial materials. Stands often occupy sites that are protected from extreme sun and wind within *Pinus ponderosa* or *Pseudotsuga menziesii* montane forests. North aspects are most common.

Classification Comments: This alliance is the combination of the former *Picea pungens* Forest Alliance (A.165) and *Picea pungens* Woodland Alliance (A.557).

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Diagnostic of this alliance is the dominance of *Picea pungens* in the moderately closed to closed tree canopy on sites that are moist, but not flooded during the growing season.

VEGETATION

Physiognomy and Structure: These forests are of low to medium stature (10-25 m) and are dominated by needle-leaved evergreen trees. Cold-deciduous trees are often mixed in these stands, especially in recently disturbed areas. These communities often have sclerophyllous or cold-deciduous shrub layers of moderate cover (10-30%). The herbaceous layer is usually well-developed, and dominated by mesophytic forbs and graminoids less than 1 m in height.

Floristics: These forests are characterized by the dominance of *Picea pungens* in the forest canopy and usually represent a mesic phase of the mixed conifer forests of the southern Rocky Mountains and Colorado Plateau. Other conifers are usually present in these stands, depending upon geographic location, site moisture, and stand history. Common associates include *Abies concolor, Abies lasiocarpa, Picea engelmannii, Pinus contorta, Pinus ponderosa, Pinus strobiformis*, and *Pseudotsuga menziesii*. *Populus tremuloides* is the only widespread hardwood associate. The shrub layer usually has only moderate cover and is dominated by ericaceous or cold-deciduous species, with the latter group increasing with soil moisture or proximity to watercourses. Common species include *Acer glabrum, Amelanchier alnifolia, Arctostaphylos patula, Arctostaphylos uva-ursi, Artemisia tridentata ssp. vaseyana, Ceanothus velutinus, Chrysothamnus viscidiflorus, Juniperus communis, Mahonia repens, Paxistima myrsinites, Purshia tridentata, Quercus gambelii, Ribes cereum, Rosa woodsii, Rubus parviflorus, Shepherdia canadensis*, and *Symphoricarpos oreophilus*. Due to favorable soil moisture, the herbaceous layer is usually a diverse mixture of forbs and graminoids. Common and dominant graminoids may include *Achnatherum lettermanii, Carex siccata (= Carex foenea), Festuca arizonica, Hesperostipa comata, Poa*

fendleriana, and *Pseudoroegneria spicata*. Common forbs may include *Achillea millefolium, Arenaria congesta, Arenaria fendleri, Arnica cordifolia, Astragalus miser, Cirsium calcareum, Erigeron eximius, Fragaria virginiana ssp. glauca (= Fragaria ovalis), Galium boreale, Geranium* spp., *Linnaea borealis, Maianthemum stellatum, Mertensia ciliata, Packera cardamine (= Senecio cardamine)*, and *Thalictrum fendleri*.

ENVIRONMENT & DYNAMICS

Environmental Description: These forests occur at middle elevations (1800-3300 m) of the central and southern Rocky Mountains and west to the Great Basin, usually in moist, concave topographic positions. Precipitation averages 46-60 cm annually, with the majority falling as growing-season rainfall. The temperature regime is continental and winters are moderately severe. Soils are variable, but usually young and derived from glacial or alluvial materials. The pH is neutral to slightly alkaline. Youngblood and Mauk (1985) suggest a preference by these forests for non-igneous parent materials. These communities often occupy sites that are protected from extreme sun and wind, within *Pinus ponderosa* or *Pseudotsuga menziesii* montane forests. These forests are typically most common on north-facing slopes, which can be gentle to steep.

Dynamics: *Picea pungens* is a slow-growing, long-lived tree which regenerates from seed (Burns and Honkala 1990a). Seedlings are shallow-rooted and require perennially moist soils for establishment and optimal growth. *Picea pungens* is intermediate in shade tolerance, being somewhat more tolerant than *Pinus ponderosa* or *Pseudotsuga menziesii*, and less tolerant than *Abies lasiocarpa* or *Picea engelmannii*. It forms late-seral stands in the subhumid regions of the southern Rocky Mountains. It is common for these forests to be heavily disturbed by grazing or fire.

DISTRIBUTION

Geographic Range: This forest alliance is from the central and southern Rocky Mountains, east to the Wyoming Basins and west to the Great Basin.

Nations: US
States/Provinces: AZ, CO, NM, OR?, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** *Picea pungens* Series (Muldavin et al. 1996)
- **><** *Picea pungens* Series (Alexander et al. 1984b)
- **><** *Picea pungens* Series (DeVelice et al. 1986)
- **><** *Picea pungens* Series (Fitzhugh et al. 1987)
- **><** Blue Spruce: 216 (Eyre 1980)

LOWER LEVEL UNITS

Associations:
- CEGL000395 *Picea pungens / Mahonia repens* Forest
- CEGL000385 *Picea pungens / Arctostaphylos uva-ursi* Forest
- CEGL000392 *Picea pungens / Juniperus communis* Forest
- CEGL005364 *Picea pungens / Arctostaphylos patula* Forest
- CEGL000386 *Picea pungens / Arnica cordifolia* Forest
- CEGL000397 *Picea pungens / Pseudoroegneria spicata* Forest
- CEGL000895 *Picea pungens / Festuca arizonica* Woodland

AUTHORSHIP

Primary Concept Source: R.L. DeVelice et al. (1986)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Alexander et al. 1984b, Burns and Honkala 1990a, DeVelice et al. 1986, Eyre 1980, Faber-Langendoen et al. 2017b, Fitzhugh et al. 1987, Muldavin et al. 1996, Youngblood and Mauk 1985

1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G226. Southern Rocky Mountain White Fir - Douglas-fir Dry Forest

A3454. Pseudotsuga menziesii Southern Rocky Mountain Forest & Woodland Alliance

Type Concept Sentence: Forests and woodlands primarily of the southern Rocky Mountains with canopies dominated by *Pseudotsuga menziesii*.

OVERVIEW

Scientific Name: *Pseudotsuga menziesii* Southern Rocky Mountain Forest & Woodland Alliance
Common Name (Translated Scientific Name): Douglas-fir Southern Rocky Mountain Forest & Woodland Alliance
Colloquial Name: Southern Rocky Mountain Douglas-fir Forest & Woodland

Type Concept: These forests and woodlands are primarily distributed in the southern Rocky Mountains, and as far east as Texas. They include evergreen forests dominated by *Pseudotsuga menziesii*. Canopy associates vary widely depending on geographic location and may include *Abies lasiocarpa, Juniperus scopulorum, Pinus contorta, Pinus flexilis, Pinus ponderosa, Pinus strobiformis*, and *Populus tremuloides*. Understories are most often shrub-dominated, but in some associations a layer of graminoids takes prominence. Common dominant shrubs may include *Arctostaphylos patula, Arctostaphylos uva-ursi, Artemisia tridentata, Cercocarpus montanus, Holodiscus dumosus, Juniperus communis, Paxistima myrsinites, Physocarpus monogynus, Quercus gambelii*, and *Quercus x pauciloba*. Herbaceous dominants may include *Festuca arizonica, Jamesia americana, Muhlenbergia montana, Muhlenbergia straminea (= Muhlenbergia virescens)*, and *Poa fendleriana*. Elevations range from less than 1000 m in the northern Rocky Mountains to nearly 2900 m in the Southern Rockies and plateaus of the southwestern U.S. Lower elevation stands typically occupy protected northern exposures or mesic ravines and canyons, often on steep slopes. At higher elevations, these forests occur primarily on southerly aspects or ridgetops.

Classification Comments:

Internal Comments: DFL 8-17: AB & Canada added per AB NHP. DFL 1-16: Canada removed.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Canopies are dominated or codominated by *Pseudotsuga menziesii* in association with other conifer species. These forests and woodlands are distinguished from other *Pseudotsuga menziesii* alliances in having a species composition that is more associated with the southern Rocky Mountains.

VEGETATION

Physiognomy and Structure: These forests are characterized by a multi-tiered needle-leaved evergreen tree canopy up to 50 m high, with 20-100% cover. Cold-deciduous, broad-leaved species occasionally codominate. Downed wood may also be abundant in older stands. Shrub cover is dominated by ericaceous or cold-deciduous species and can be dense. The herbaceous understory is primarily composed of graminoids.

Floristics: These forests and woodlands are dominated by *Pseudotsuga menziesii* in the canopy and almost always in the tree regeneration layer. *Pinus ponderosa* is an important seral species occurring in many associations, either as older seral remnants or codominating in the canopy. Other trees that can be present to abundant (typically seral) include *Populus tremuloides* (in the southern Rockies and south into New Mexico and Arizona), *Pinus strobiformis* (in New Mexico and Arizona), and *Pinus contorta* (throughout much of the alliance's range). Species of *Abies* and *Picea* do not commonly occur in this alliance, but are present in some stands. Understories in *Pseudotsuga menziesii* forests are varied; many associations have well-developed shrub layers, varying in height from <2 m (typically) to up to 5 m. Dominant or diagnostic species may include *Acer grandidentatum, Amelanchier alnifolia, Arctostaphylos patula, Jamesia americana, Physocarpus monogynus, Quercus arizonica, Quercus gambelii, Quercus rugosa, Quercus X pauciloba*, and *Quercus hypoleucoides*. *Arctostaphylos uva-ursi* and *Mahonia repens* are present to important throughout the range. The herbaceous layer can be sparse or, if the shrub layer is not abundant, can be relatively species-rich, usually graminoid-dominated. Important or dominant species include the graminoids *Bromus ciliatus, Calamagrostis rubescens, Carex geyeri, Carex rossii, Festuca arizonica, Festuca occidentalis, Luzula parviflora, Muhlenbergia montana*, and *Muhlenbergia straminea (= Muhlenbergia virescens)*; and the forbs *Arnica cordifolia, Osmorhiza berteroi, Thalictrum occidentale, Viola adunca*, and species of many other genera, including *Arenaria, Erigeron, Fragaria, Galium, Lathyrus, Lupinus, Penstemon, Vicia*, and others.

ENVIRONMENT & DYNAMICS

Environmental Description: These *Pseudotsuga menziesii* forests and woodlands occur under a comparatively dry and continental climate regime. Elevations range from less than 1000 m in the northern Rocky Mountains to nearly 2900 m in the Southern Rockies

and plateaus of the southwestern U.S. Lower elevation stands typically occupy protected northern exposures or mesic ravines and canyons, often on steep slopes. At higher elevations, these forests occur primarily on southerly aspects or ridgetops. Annual precipitation ranges from 50-100 cm with moderate snowfall and a greater proportion falling during the growing season. Monsoonal summer rains contribute a significant proportion of the annual precipitation in Arizona, New Mexico, and Colorado. Soils are highly variable across the range of this alliance and are derived from diverse parent materials. *Pseudotsuga menziesii* forests are reported by most studies (Pfister et al. 1977, Steele et al. 1981, Mauk and Henderson 1984, Lillybridge et al. 1995) to show no particular affinities to geologic substrates. Rock types are typically sedimentary rocks in the Central and Southern Rockies and the Colorado Plateau. The soils are typically slightly acidic (pH 5.0-6.0), well-drained, and well-aerated. They can be derived from moderately deep colluvium or shallow-jointed bedrock, and are usually gravelly or rocky.

Dynamics: Successional relationships in this alliance are complex. *Pseudotsuga menziesii* seedlings compete poorly in deep shade. At drier locales, seedlings may be favored by moderate shading, such as by a canopy of *Pinus ponderosa*, which helps to minimize drought stress. In some locations, much of these forests has been logged or burned during European settlement, and present-day stands are second-growth forests dating from fire, logging, or other stand-replacing disturbances (Mauk and Henderson 1984, Chappell et al. 1997). *Pseudotsuga menziesii* forests were probably subject to a moderate-severity fire regime in presettlement times, with fire-return intervals of 30-100 years. Many of the important tree species in these forests are fire-adapted (*Populus tremuloides, Pinus ponderosa, Pinus contorta*) (Pfister et al. 1977), and fire-induced reproduction of *Pinus ponderosa* can result in its continued codominance in *Pseudotsuga menziesii* forests (Steele et al. 1981). Seeds of the shrub *Ceanothus velutinus* can remain dormant in forest stands for 200 years (Steele et al. 1981) and germinate abundantly after fire, competitively suppressing conifer seedlings. Some stands may have higher tree-stem density than historically, due largely to fire suppression. Fire suppression has also led to the succession of *Pinus ponderosa* woodlands or *Quercus* spp. woodlands to *Pseudotsuga menziesii* forests.

DISTRIBUTION

Geographic Range: This alliance primarily occurs in the southern Rocky Mountains, but extends west into the Great Basin, and east to Trans-Pecos Texas, and north into Alberta, Canada.

Nations: CA, US
States/Provinces: AB, AZ, CO, MT, NM, NV, TX, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **><** *Pinus ponderosa - Pseudotsuga menziesii* Woodlands (Chappell et al. 1997)
- **><** Aspen: 217 (Eyre 1980)
- **><** IA1a. Douglas Fir - Pine Forest (Allard 1990)
- **><** Interior Douglas-fir: 210 (Eyre 1980)

LOWER LEVEL UNITS

Associations:

- CEGL000911 *Pseudotsuga menziesii* Scree Woodland
- CEGL002808 *Pseudotsuga menziesii / Artemisia tridentata (ssp. vaseyana, ssp. wyomingensis)* Woodland
- CEGL000438 *Pseudotsuga menziesii / Jamesia americana* Forest
- CEGL000902 *Pseudotsuga menziesii / Holodiscus dumosus* Scree Woodland
- CEGL000446 *Pseudotsuga menziesii / Paxistima myrsinites* Forest
- CEGL000424 *Pseudotsuga menziesii / Arctostaphylos uva-ursi* Forest
- CEGL000452 *Pseudotsuga menziesii / Quercus gambelii* Forest
- CEGL000449 *Pseudotsuga menziesii / Physocarpus monogynus* Forest
- CEGL000433 *Pseudotsuga menziesii / Festuca arizonica* Forest
- CEGL000444 *Pseudotsuga menziesii / Muhlenbergia straminea* Forest
- CEGL000545 *Populus tremuloides - Pseudotsuga menziesii / Juniperus communis* Forest
- CEGL000423 *Pseudotsuga menziesii / Arctostaphylos patula* Woodland
- CEGL000443 *Pseudotsuga menziesii / Muhlenbergia montana* Forest
- CEGL002809 *Pseudotsuga menziesii / Poa fendleriana* Woodland
- CEGL000455 *Pseudotsuga menziesii / Quercus x pauciloba* Forest
- CEGL000898 *Pseudotsuga menziesii / Cercocarpus montanus* Woodland

AUTHORSHIP

Primary Concept Source: M.S. Reid and D. Sarr, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2017/08/14

REFERENCES

References: Allard 1990, Chappell et al. 1997, Diamond 1993, Eyre 1980, Faber-Langendoen et al. 2017b, Lillybridge et al. 1995, Mauk and Henderson 1984, Pfister et al. 1977, Steele et al. 1981

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
1.B.2.Nb.1.d. M022 Southern Rocky Mountain Lower Montane Forest

G225. Rocky Mountain Douglas-fir - White Fir - Blue Spruce Mesic Forest

Type Concept Sentence: This group includes mesic or cold-site conifer, mixed conifer, or deciduous montane forests of the Rocky Mountains west into the ranges of the Great Basin. *Pseudotsuga menziesii* and *Abies concolor* are the most common canopy dominants, but *Picea engelmannii, Picea pungens*, or *Pinus ponderosa* may be present, as well as stands of conifer mixed with *Populus tremuloides* or *Acer grandidentatum* . The relatively mesic understory is diagnostic of the type, and naturally occurring fires are mostly light, erratic, and infrequent.

OVERVIEW

Scientific Name: *Abies concolor - Picea pungens - Pseudotsuga menziesii* Mesic Southern Rocky Mountain Forest Group
Common Name (Translated Scientific Name): White Fir - Blue Spruce - Douglas-fir Mesic Southern Rocky Mountain Forest Group
Colloquial Name: Southern Rocky Mountain Mesic White Fir Forest & Woodland

Type Concept: This group includes conifer, mixed conifer, and some deciduous montane forests of the Rocky Mountains west into the ranges of the Great Basin. Stands occur predominantly in cool ravines and on north-facing slopes with elevations from 1200 to 3300 m. Occurrences of this group are found on cooler and more mesic sites than Southern Rocky Mountain White Fir - Douglas-fir Dry Forest Group (G226). Such sites include lower and middle slopes of ravines, along stream terraces, moist, concave topographic positions, and north- and east-facing slopes. *Pseudotsuga menziesii* and *Abies concolor* are the most common canopy dominants, but *Picea engelmannii, Picea pungens*, or *Pinus ponderosa* may be present. This group includes mixed conifer/*Populus tremuloides* and mixed conifer/*Acer grandidentatum* stands as well as *Acer grandidentatum*-dominated forests. The relatively mesic understory is diagnostic of stands in this group. Although sites are not considered wetlands or true riparian areas, generally occurring outside the riparian floodplains, scattered riparian species may be present. Cold-deciduous shrub species include *Acer glabrum, Acer grandidentatum, Jamesia americana, Physocarpus malvaceus, Robinia neomexicana, Quercus gambelii, Vaccinium membranaceum*, and *Vaccinium myrtillus*. Herbaceous species include *Bromus ciliatus, Carex geyeri, Carex rossii, Carex siccata, Muhlenbergia straminea (= Muhlenbergia virescens), Pseudoroegneria spicata, Erigeron eximius, Fragaria virginiana, Luzula parviflora, Osmorhiza berteroi, Packera cardamine, Thalictrum occidentale*, and *Thalictrum fendleri*. Naturally occurring fires are of variable return intervals and mostly light, erratic, and infrequent due to the cool, moist conditions.

Classification Comments: This group is similar to and often occurs adjacent to Southern Rocky Mountain White Fir - Douglas-fir Dry Forest Group (G226), which occurs on more upland and relatively xeric sites and exposures. The overstory species may be similar except for the absence or low cover of relatively mesic species such as *Abies concolor, Picea pungens, Populus tremuloides*, and *Acer grandidentatum*; however, it is the mesic understory species that are usually diagnostic of this group. This group is also similar to montane riparian woodlands but lacks an understory dominated by wetland species and is not closely associated with perennial streams.

Similar NVC Types:
- G226 Southern Rocky Mountain White Fir - Douglas-fir Dry Forest

Diagnostic Characteristics: The tree canopy is often dominated or codominated by conifers, especially *Pseudotsuga menziesii, Abies concolor*, and the less extensive *Picea pungens*. *Acer grandidentatum*-dominated stands are included in this group as are mixed conifer/deciduous stands codominated by *Populus tremuloides* and/or *Acer grandidentatum*. However, a mesic understory layer is usually diagnostic of this group with indicator species such as such as *Acer glabrum, Acer grandidentatum, Alnus incana, Betula occidentalis, Cornus sericea, Jamesia americana, Linnaea borealis, Lonicera involucrata, Packera cardamine, Physocarpus malvaceus, Robinia neomexicana, Symphoricarpos oreophilus, Vaccinium membranaceum*, and herbaceous species *Bromus ciliatus, Carex siccata, Muhlenbergia straminea, Pseudoroegneria spicata, Erigeron eximius, Fragaria virginiana, Luzula parviflora, Osmorhiza berteroi, Packera cardamine, Thalictrum occidentale*, and *Thalictrum fendleri*.

VEGETATION

Physiognomy and Structure: Conifer-dominated woodlands and forests with grassy or shrubby understories. Occasionally broad-leaved deciduous trees are intermixed with the conifers in mesic settings, or as seral components.

Floristics: This mesic forest group is characterized by a moderately dense to dense tree canopy typically dominated by *Pseudotsuga menziesii, Abies concolor*, and less frequently *Picea pungens*, but *Picea engelmannii* or *Pinus ponderosa* may be present. This group also includes mixed conifer/*Populus tremuloides* and mixed conifer/*Acer grandidentatum* stands as well as *Acer grandidentatum*-dominated forests. However, the more shade-tolerant conifers of this group form a subcanopy that will eventually overtake the *Populus tremuloides* in early-seral types, and *Acer grandidentatum*-dominated forests most likely represent the wettest portion of the environment supporting this group. A relatively mesic understory is diagnostic of stands in this group. Although sites are not considered wetlands or true riparian areas, occurring outside the riparian floodplains, scattered riparian and facultative wetland species may be present. Characteristic cold-deciduous shrub species include *Acer glabrum, Acer grandidentatum, Alnus incana, Betula occidentalis, Cornus sericea, Jamesia americana, Physocarpus malvaceus, Robinia neomexicana, Quercus gambelii, Vaccinium membranaceum*, and *Vaccinium myrtillus*. Common herbaceous species include *Bromus ciliatus, Carex geyeri, Carex rossii, Carex siccata, Muhlenbergia straminea (= Muhlenbergia virescens), Pseudoroegneria spicata, Erigeron eximius, Fragaria virginiana, Luzula parviflora, Osmorhiza berteroi, Packera cardamine, Thalictrum occidentale*, and *Thalictrum fendleri*.

ENVIRONMENT & DYNAMICS

Environmental Description: This group includes conifer, mixed conifer, and some deciduous montane forests of the southern Rocky Mountains west into the ranges of the Great Basin. Stands occur predominantly in cool ravines and on north-facing slopes with elevations from 1200 to 3300 m. Occurrences of this group are found on cooler and more mesic sites than Southern Rocky Mountain White Fir - Douglas-fir Dry Forest Group (G226). Such sites include lower and middle slopes of ravines, along stream terraces, moist, concave topographic positions, and north- and east-facing slopes. Naturally occurring fires are of variable return intervals and mostly light, erratic, and infrequent due to the cool, moist conditions.

Dynamics:

DISTRIBUTION

Geographic Range: This montane forest group is found in the southern Rocky Mountains of Arizona and New Mexico north and west into the ranges of the Great Basin, southern Wyoming and southeastern Idaho (but it is not common there), occurring predominantly in cool ravines and on north-facing slopes.

Spatial Scale & Pattern [optional]: Large patch
Nations: MX?, US
States/Provinces: AZ, CO, ID, NM, NV, UT, WY
TNC Ecoregions [optional]: 9:C, 10:?, 11:C, 18:C, 19:C, 20:C, 21:C
USFS Ecoregions (2007): 313A:CC, 313B:CC, 313C:CC, 313D:CP, 315A:C?, 315H:CC, 321A:??, 322A:CC, 331B:CC, 331G:C?, 331H:CP, 331I:CC, 331J:CC, 341A:CC, 341B:CC, 341C:CP, 341D:CC, 341F:CC, 342A:C?, 342B:C?, 342D:CP, 342E:CC, 342F:CP, 342G:CP, 342J:CP, M313A:CC, M313B:CC, M331B:CP, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M341A:CC, M341B:CC, M341C:CC, M341D:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: High.

SYNONYMY

- **><** *Abies concolor* Series (DeVelice et al. 1986)
- **><** *Abies concolor* Series (Moir and Ludwig 1979)
- **><** *Picea pungens* Series (Moir and Ludwig 1979)
- **><** *Picea pungens* Series (DeVelice et al. 1986)
- **><** *Pseudotsuga menziesii* Series (DeVelice et al. 1986)
- **><** *Pseudotsuga menziesii* Series (Moir and Ludwig 1979)
- **>** Blue Spruce: 216 (Eyre 1980)
- **><** Interior Douglas-fir: 210 (Eyre 1980)
- **><** White Fir: 211 (Eyre 1980)

LOWER LEVEL UNITS

Alliances:

- A0165 *Picea pungens* Southern Rocky Mountain Mesic Forest Alliance
- A3370 *Pseudotsuga menziesii* Southern Rocky Mountain Mesic Forest Alliance
- A3369 *Abies concolor* Southern Rocky Mountain Mesic Forest & Woodland Alliance

AUTHORSHIP

Primary Concept Source: W.H. Moir and J.A. Ludwig (1979)
Author of Description: K.A. Schulz and M.E. Hall
Acknowledgments:
Version Date: 05/30/2013
Classif Resp Region: West
Internal Author: KAS 3-10, mod. MEH 5-13, mod. GK 12-15

REFERENCES

References: Alexander et al. 1984a, Alexander et al. 1984b, Alexander et al. 1987, Boyce 1977, Bunin 1975c, DeVelice et al. 1986, Eyre 1980, Faber-Langendoen et al. 2017a, Fitzhugh et al. 1987, Heinze et al. 1962, Hess 1981, Hess and Alexander 1986, Hess and Wasser 1982, Hoffman and Alexander 1980, Hoffman and Alexander 1983, Komarkova et al. 1988b, Mauk and Henderson 1984, Moir and Ludwig 1979, Mueggler 1988, Parson and DeBenedetti 1979, Pfister 1972, Ream 1964, Youngblood and Mauk 1985

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G225. Rocky Mountain Douglas-fir - White Fir - Blue Spruce Mesic Forest

A3369. Abies concolor Southern Rocky Mountain Mesic Forest & Woodland Alliance

Type Concept Sentence: Forests and woodlands included in this alliance consist of stands dominated by *Abies concolor* or codominated by *Populus tremuloides* or *Pseudotsuga menziesii*. They occur in mountain environments from the southern and central Rocky Mountains and east to the Wyoming Basins.

OVERVIEW

Scientific Name: *Abies concolor* Southern Rocky Mountain Mesic Forest & Woodland Alliance
Common Name (Translated Scientific Name): White Fir Southern Rocky Mountain Mesic Forest & Woodland Alliance
Colloquial Name: Southern Rocky Mountain Mesic White Fir Forest & Woodland

Type Concept: Forests and woodlands included in this alliance consist of stands dominated by *Abies concolor* or codominated by *Populus tremuloides* or *Pseudotsuga menziesii*. They occur in mountain environments from the southern and central Rocky Mountains and east to the Wyoming basins. In general, these mixed conifer forests have a moderately dense to closed canopy (>60%) with *Abies concolor* successfully reproducing and typically codominant in the tree canopy. The most common codominant canopy species include *Populus tremuloides* or *Pseudotsuga menziesii*. Occasionally these stands occur as woodlands with as little as 10% total canopy cover. Other common canopy associates include *Picea pungens, Pinus flexilis, Pinus ponderosa*, and *Pinus strobiformis*. Understories may be shrub-, forb- or graminoid-dominated. The most common dominant shrubs include *Acer glabrum, Acer grandidentatum, Holodiscus dumosus, Jamesia americana, Juglans major, Physocarpus malvaceus, Quercus gambelii*, and *Symphoricarpos oreophilus*. Common herbaceous dominants include *Erigeron eximius, Lathyrus lanszwertii var. leucanthus, Osmorhiza berteroi, Poa pratensis*, and *Thalictrum fendleri*. These forests occupy a variety of topo-edaphic positions, such as lower and middle slopes of ravines, upper slopes at higher elevations, along stream terraces, ridgetops, and north- and east-facing slopes that burn somewhat infrequently. Parent materials and soils are highly variable and nondefinitive for these forests. Elevations range from 1800-3000 m.

Classification Comments: The former *Abies concolor* Woodland Alliance (A.553) has been included here. The name of the alliance needs to include better diagnostic species, as this alliance has a name very similar to A3420 (G226). For now, a geographic modifier is used to distinguish it.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Nearly sparse to dense forests and woodlands where *Abies concolor* is the primary dominant or codominant with *Populus tremuloides* or *Pseudotsuga menziesii*. Indicative of this alliance are understories where *Abies concolor* is always regenerating. It is distinguished from other *Abies concolor* alliances in having understories dominated by mesophytic species.

VEGETATION

Physiognomy and Structure: These are open to closed, medium-statured to tall (20-50 m in height), multi-storied forests of needle-leaved evergreen trees. Occasionally a subcanopy (10-20 m tall) of broad-leaved evergreen or cold-deciduous trees may be present. Many densely stocked stands may have a somewhat depauperate understory, but more open stands often have a well-developed ericaceous or cold-deciduous shrub layer. The herbaceous layer is usually dominated by shade-tolerant forbs, but sod-forming or cespitose graminoids may also be common.

Floristics: Forests and woodlands included in this alliance consist of open to closed, medium-statured to tall (20-50 m in height) stands dominated by *Abies concolor* or codominated by *Populus tremuloides* or *Pseudotsuga menziesii*. Occasionally these stands occur as woodlands with as little as 10% total canopy cover. Other common canopy associates include *Picea pungens, Pinus flexilis, Pinus ponderosa*, and *Pinus strobiformis*. Understories may be shrub-, forb- or graminoid-dominated. The most common dominant shrubs include *Acer glabrum, Acer grandidentatum, Holodiscus dumosus, Jamesia americana, Juglans major, Physocarpus malvaceus, Quercus gambelii*, and *Symphoricarpos oreophilus*. Other shrub associates may include *Alnus incana, Amelanchier utahensis, Cornus sericea (= Cornus stolonifera), Juniperus communis, Lonicera arizonica, Lonicera involucrata, Mahonia repens (= Berberis repens), Paxistima myrsinites, Rosa woodsii, Rubus idaeus*, and *Rubus parviflorus*. The herbaceous layer may be quite lush and diverse with shade-tolerant species. Common herbaceous dominants include *Erigeron eximius, Lathyrus lanszwertii var. leucanthus, Osmorhiza berteroi, Poa pratensis*, and *Thalictrum fendleri*. Other herbaceous associates may include *Aquilegia chrysantha, Artemisia franserioides, Bromus ciliatus var. ciliatus, Bromus ciliatus var. richardsonii (= Bromus richardsonii), Carex siccata (= Carex foenea), Fragaria* ssp., *Galium mexicanum ssp. asperrimum (= Galium asperrimum), Geranium richardsonii, Koeleria macrantha, Monarda fistulosa var. menthifolia, Oreochrysum parryi*, and *Osmorhiza depauperata*.

ENVIRONMENT & DYNAMICS

Environmental Description: These forests and woodlands occupy a variety of topo-edaphic positions, such as lower and middle slopes of ravines, upper slopes at higher elevations, canyon sideslopes, along stream terraces, ridgetops, scree slopes and north- and east-facing slopes that burn somewhat infrequently. Parent materials and soils are highly variable and nondefinitive for these forests. Annual precipitation averages 50-80 cm, with abundant snowfall, but summer rainfall due to convective storms is also important. Soils are generally slightly acidic, well-drained loams or sandy loams with substantial organic matter. Elevations range from 1800-3000 m.

Dynamics: With fire suppression, *Abies concolor* has vigorously colonized many sites which were formerly occupied by open *Pinus ponderosa* woodlands. These invasions have dramatically changed the fuel load and potential behavior of fire in these forests. In particular, the potential for high-intensity crown fires has increased. *Abies concolor* is much more shade-tolerant than *Populus tremuloides* and is the most important regenerating species under closed-canopy conditions. Most of these mixed stands are seral and will eventually be dominated by *Abies concolor*. This unique forest alliance is linked to gap-forming disturbances, such as fire or windthrow, which allow regeneration of *Populus tremuloides* and control abundances of *Abies concolor* (Mueggler and Campbell 1986, Mueggler 1988).

DISTRIBUTION

Geographic Range: This forest alliance occurs mainly in the southern and central Rocky Mountains, but extends west to the Utah Plateaus, south to the Apache Highlands and west into the Wyoming Basins.

Nations: MX?, US
States/Provinces: AZ, CA?, CO, NM, NV, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: NPS (Great Basin)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **><** *Abies concolor* Series (Johnston 1987)
- **><** Interior Douglas-fir: 210 (Eyre 1980) [southwestern stands]
- **><** Western Needleleaf Forests: 20: Spruce-Fir-Douglas fir Forest (*Picea-Abies-Pseudotsuga*) (Küchler 1964)
- **><** Western Needleleaf Forests: 5: Mixed Conifer Forest (*Abies-Pinus-Pseudotsuga*) (Küchler 1964)
- **><** White Fir: 211 (Eyre 1980)

LOWER LEVEL UNITS

Associations:

- CEGL000523 *Populus tremuloides - Abies concolor / Symphoricarpos oreophilus* Forest

- CEGL000263 *Abies concolor / Symphoricarpos oreophilus* Forest
- CEGL002947 *Populus tremuloides - Abies concolor / Poa pratensis* Ruderal Forest
- CEGL000890 *Abies concolor - (Pseudotsuga menziesii) / Jamesia americana - Holodiscus dumosus* Scree Woodland
- CEGL000247 *Abies concolor - Pseudotsuga menziesii / Erigeron eximius* Forest
- CEGL000253 *Abies concolor / Osmorhiza berteroi* Forest
- CEGL005353 *Abies concolor - (Pseudotsuga menziesii) / Thalictrum fendleri* Forest
- CEGL000248 *Abies concolor / Juglans major* Forest
- CEGL000255 *Abies concolor - Picea pungens - Populus angustifolia / Acer glabrum* Forest
- CEGL000240 *Abies concolor - Pseudotsuga menziesii / Acer glabrum* Forest
- CEGL000241 *Abies concolor / Acer grandidentatum* Forest
- CEGL000254 *Abies concolor / Physocarpus malvaceus* Forest
- CEGL005352 *Abies concolor - (Pseudotsuga menziesii) / Quercus gambelii / Thalictrum fendleri* Forest
- CEGL000250 *Abies concolor - Pseudotsuga menziesii / Lathyrus lanszwertii var. leucanthus* Forest

AUTHORSHIP

Primary Concept Source: M.E. Hall, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments: We have incorporated significant descriptive information previously compiled by D. Sarr.
Version Date: 2014/03/14

REFERENCES

References: Eyre 1980, Faber-Langendoen et al. 2017b, Johnston 1987, Küchler 1964, Mueggler 1988, Mueggler and Campbell 1986

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G225. Rocky Mountain Douglas-fir - White Fir - Blue Spruce Mesic Forest

A0165. Picea pungens Southern Rocky Mountain Mesic Forest Alliance

Type Concept Sentence: Forests included in this alliance are characterized by the dominance of *Picea pungens* in the forest canopy. *Populus tremuloides* may codominate on some sites. This forest alliance occurs at middle elevations (1800-3300 m) of the central and southern Rocky Mountains, usually in moist, concave topographic positions.

OVERVIEW

Scientific Name: *Picea pungens* Southern Rocky Mountain Mesic Forest Alliance
Common Name (Translated Scientific Name): Blue Spruce Southern Rocky Mountain Mesic Forest Alliance
Colloquial Name: Southern Rocky Mountain Mesic Blue Spruce Forest

Type Concept: Forests included in this alliance are characterized by the dominance of *Picea pungens* in the forest canopy. *Populus tremuloides* may codominate on some sites. Other conifers are usually present in these stands and may include *Abies concolor, Abies lasiocarpa, Picea engelmannii, Pinus contorta, Pinus ponderosa, Pinus strobiformis*, and *Pseudotsuga menziesii*. The shrub layer is usually of only moderate cover and dominated by ericaceous or cold-deciduous species, with the latter group increasing with soil moisture or proximity to watercourses. Common species include *Amelanchier alnifolia, Acer glabrum, Juniperus communis, Lonicera involucrata, Quercus gambelii*, and *Rubus parviflorus*. Due to favorable soil moisture, the herbaceous layer is usually a diverse mixture of forbs and graminoids that may include *Achillea millefolium, Arnica cordifolia, Carex siccata (= Carex foenea), Erigeron eximius, Festuca arizonica, Fragaria virginiana, Linnaea borealis, Packera cardamine (= Senecio cardamine)*, and *Pseudoroegneria spicata*. This forest alliance occurs at middle elevations (1800-3300 m) of the central and southern Rocky Mountains, usually in moist, concave topographic positions. Soils are variable, but usually young and derived from glacial or alluvially deposited materials. Stands often occupy sites that are protected from extreme sun and wind within *Pinus ponderosa* or *Pseudotsuga menziesii* montane forests. North aspects are most common.

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Diagnostic of this alliance is the dominance of *Picea pungens* in the moderately closed to closed tree canopy on sites that are not flooded during the growing season. Early-seral stands may be codominated by *Populus tremuloides*. Understory cover is moderate.

VEGETATION

Physiognomy and Structure: These forests are of low to medium stature (10-25 m) and are dominated by needle-leaved evergreen trees. Cold-deciduous trees are often mixed in these stands, especially in recently disturbed areas. These communities often have sclerophyllous or cold-deciduous shrub layers of moderate cover (10-30%). The herbaceous layer is usually well-developed, and dominated by mesophytic forbs and graminoids less than 1 m in height.

Floristics: These forests are characterized by the dominance of *Picea pungens* in the forest canopy and usually represent a mesic phase of the mixed conifer forests of the southern Rocky Mountains and Colorado Plateau. Early-seral stands may be codominated by *Populus tremuloides*. Other conifers are usually present in these stands, depending upon geographic location, site moisture, and stand history. Common associates include *Abies concolor, Abies lasiocarpa, Picea engelmannii, Pinus contorta, Pinus ponderosa, Pinus strobiformis*, and *Pseudotsuga menziesii*. The shrub layer is usually of only moderate cover and dominated by ericaceous or cold-deciduous species, with the latter group increasing with soil moisture or proximity to watercourses. Common species include *Acer glabrum, Amelanchier alnifolia, Arctostaphylos uva-ursi, Cornus sericea, Juniperus communis, Mahonia repens, Quercus gambelii, Ribes inerme, Rosa woodsii, Rubus parviflorus*, and *Symphoricarpos rotundifolius*. Due to favorable soil moisture, the herbaceous layer is usually a diverse mixture of forbs and graminoids and may include and *Achillea millefolium, Arnica cordifolia, Carex siccata (= Carex foenea), Erigeron eximius, Festuca arizonica, Fragaria virginiana, Linnaea borealis, Packera cardamine (= Senecio cardamine)*, and *Pseudoroegneria spicata*.

ENVIRONMENT & DYNAMICS

Environmental Description: These forests occur at middle elevations (1800-3300 m) of the central and southern Rocky Mountains, usually in moist, concave topographic positions. Precipitation averages 46-60 cm annually with the majority falling as growing-season rainfall. The temperature regime is continental and winters are moderately severe. Soils are variable, but usually young and derived from glacial or alluvially deposited materials. The pH is neutral to slightly alkaline. Youngblood and Mauk (1985) suggest a preference by these forests for non-igneous parent materials. These communities often occupy sites that are protected from extreme sun and wind within *Pinus ponderosa* or *Pseudotsuga menziesii* montane forests. These forests are typically most common on north-facing slopes, which can be gentle to steep.

Dynamics: *Picea pungens* is a slow-growing, long-lived tree which regenerates from seed (Burns and Honkala 1990a). Seedlings are shallow-rooted and require perennially moist soils for establishment and optimal growth. *Picea pungens* is intermediate in shade tolerance, being somewhat more tolerant than *Pinus ponderosa* or *Pseudotsuga menziesii*, and less tolerant than *Abies lasiocarpa* or *Picea engelmannii*. It forms late-seral stands in the subhumid regions of the southern Rocky Mountains. It is common for these forests to be heavily disturbed by grazing or fire. Stems of *Populus tremuloides* are thin-barked and readily killed by fire. It is a fire-adapted species that generally needs fire or some other stand-replacing disturbance to establish and maintain dominance in a forest. These mixed forests are seral and in the absence of stand-replacing disturbance such as fire will slowly convert to a *Picea pungens*-dominated climax forest (Mueggler 1988). Most of the stands sampled by Mueggler (1988) had a history of livestock grazing as evidenced by relative abundance of the exotic plants *Taraxacum officinale* and *Poa pratensis* and the scarcity of grazing-susceptible plants (Mueggler 1988).

DISTRIBUTION

Geographic Range: These forests have been reported from the central and southern Rocky Mountains and higher elevations of the Colorado Plateau in Arizona, Colorado, New Mexico, Utah and Wyoming.

Nations: US
States/Provinces: AZ, CO, NM, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** *Picea pungens* Series (Alexander et al. 1984b)
- **><** Aspen: 217 (Eyre 1980)
- **><** Blue Spruce: 216 (Eyre 1980)

LOWER LEVEL UNITS

Associations:
- CEGL000393 *Picea pungens / Linnaea borealis* Forest
- CEGL000535 *Populus tremuloides - Picea pungens* Forest

- CEGL000394 *Picea pungens / Lonicera involucrata* Forest
- CEGL000391 *Picea pungens / Fragaria virginiana ssp. virginiana* Forest
- CEGL000399 *Picea pungens / Packera cardamine* Forest
- CEGL000387 *Picea pungens / Carex siccata* Forest
- CEGL000390 *Picea pungens / Erigeron eximius* Forest

AUTHORSHIP

Primary Concept Source: D. Sarr and K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Alexander et al. 1984b, Burns and Honkala 1990a, Eyre 1980, Faber-Langendoen et al. 2017b, Mueggler 1988, Youngblood and Mauk 1985

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G225. Rocky Mountain Douglas-fir - White Fir - Blue Spruce Mesic Forest

A3370. Pseudotsuga menziesii Southern Rocky Mountain Mesic Forest Alliance

Type Concept Sentence: This alliance includes evergreen forests dominated by *Pseudotsuga menziesii* occurring on the Colorado Plateau and Rocky Mountains of Arizona, Colorado and New Mexico.

OVERVIEW

Scientific Name: *Pseudotsuga menziesii* Southern Rocky Mountain Mesic Forest Alliance
Common Name (Translated Scientific Name): Douglas-fir Southern Rocky Mountain Mesic Forest Alliance
Colloquial Name: Southern Rocky Mountain Mesic Douglas-fir Forest

Type Concept: This alliance includes evergreen forests dominated by *Pseudotsuga menziesii* occurring on the Colorado Plateau and Rocky Mountains of Arizona, Colorado and New Mexico. Canopy associates may include *Abies concolor, Abies lasiocarpa, Picea engelmannii, Pinus ponderosa, Pinus strobiformis*, and *Populus tremuloides*. Shrub cover ranges from sparse to abundant, the most common species being *Acer grandidentatum*. Other associated shrubs may include *Acer glabrum, Frangula betulifolia (= Rhamnus betulifolia), Holodiscus dumosus, Jamesia americana, Lonicera arizonica, Mahonia repens (= Berberis repens), Physocarpus monogynus, Quercus chrysolepis, Quercus gambelii, Quercus hypoleucoides, Quercus rugosa, Ribes pinetorum, Rubus neomexicanus*, and *Symphoricarpos oreophilus*. The herbaceous layer may be moderate to lush and most commonly dominated by graminoids. Common dominant species may include *Achillea millefolium var. occidentalis (= Achillea lanulosa), Brickellia grandiflora, Bromus ciliatus, Carex rossii, Cystopteris fragilis, Erigeron eximius, Galium asprellum, Maianthemum stellatum (= Smilacina stellata), Muhlenbergia montana, Oreochrysum parryi, Poa fendleriana, Thalictrum fendleri, Trisetum spicatum (= Trisetum montanum)*, and *Vicia americana*. These forests are known from ridges, upper slopes and stream terraces from 1500-3000 m in elevation.

Classification Comments: Associations attributed to this alliance are not well-sampled and little descriptive material is available. Therefore, this alliance is considered to be conceptually weak and the description incomplete.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: These forests are distinguished by canopies dominated by *Pseudotsuga menziesii* occurring in the Colorado Plateau in mesic conditions.

VEGETATION

Physiognomy and Structure: These forests are characterized by a multi-tiered needle-leaved evergreen tree canopy up to 50 m high, with between 60-100% cover. A sparse subcanopy of cold-deciduous or evergreen trees is often present, particularly in northwestern coastal stands. Downed wood may also be abundant in older stands. Shrub cover is dominated by ericaceous or cold-deciduous species and can be dense. The herbaceous understory is composed of either shade-tolerant forbs to xerophytic forbs and grasses in drier stands.

Floristics: Canopies are dominated by *Pseudotsuga menziesii*. Associates may include *Abies concolor, Abies lasiocarpa, Picea engelmannii, Pinus ponderosa, Pinus strobiformis*, and *Populus tremuloides*. Shrub cover ranges from scarce to abundant, the most

common species being *Acer grandidentatum*. Other associated shrubs may include *Acer glabrum, Frangula betulifolia (= Rhamnus betulifolia), Holodiscus dumosus, Jamesia americana, Lonicera arizonica, Mahonia repens (= Berberis repens), Physocarpus monogynus, Quercus chrysolepis, Quercus gambelii, Quercus hypoleucoides, Quercus rugosa, Ribes pinetorum, Rubus neomexicanus*, and *Symphoricarpos oreophilus*. The herbaceous layer may be moderate to lush and most commonly dominated by graminoids. Common dominant species may include *Achillea millefolium var. occidentalis (= Achillea lanulosa), Brickellia grandiflora, Bromus ciliatus, Carex rossii, Cystopteris fragilis, Erigeron eximius, Galium asprellum, Maianthemum stellatum (= Smilacina stellata), Muhlenbergia montana, Oreochrysum parryi, Poa fendleriana, Thalictrum fendleri, Trisetum spicatum (= Trisetum montanum)*, and *Vicia americana*.

ENVIRONMENT & DYNAMICS

Environmental Description: These forests are known from ridges, upper slopes and stream terraces from 1500-3000 m in elevation.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is described from the Colorado Plateau of Colorado, New Mexico and Arizona.

Nations: US
States/Provinces: AZ, CO, NM
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** IA1a. Douglas Fir - Pine Forest (Allard 1990)
- **><** Interior Douglas-fir: 210 (Eyre 1980)

LOWER LEVEL UNITS

Associations:
- CEGL000419 *Pseudotsuga menziesii / Acer grandidentatum* Forest
- CEGL000428 *Pseudotsuga menziesii / Bromus ciliatus* Forest

AUTHORSHIP

Primary Concept Source: D. Bassett, M. Larson, and W. Moir (1987)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Allard 1990, Bassett et al. 1987, Diamond 1993, Eyre 1980, Faber-Langendoen et al. 2017b

M501. Central Rocky Mountain Dry Lower Montane-Foothill Forest

Conifer forests, woodlands and savannas of *Pinus ponderosa* and *Pseudotsuga menziesii*, with *Pinus flexilis* and *Juniperus scopulorum*, found on dry settings of the lower montane to foothill zones of the interior Pacific Northwest, and extending east into the northwestern Great Plains regions.

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
1.B.2.Nb.2.c. M501 Central Rocky Mountain Dry Lower Montane-Foothill Forest

G215. Middle Rocky Mountain Montane Douglas-fir Forest & Woodland

Type Concept Sentence: This *Pseudotsuga menziesii*-dominated forest and woodland group occurs throughout the middle Rocky Mountains of central and southern Idaho, south and east into the Greater Yellowstone region, including the Bighorn, Gros Ventre and Wind River ranges of Wyoming, and north into Montana on the east side of the Continental Divide to about the McDonald Pass area and also along the Rocky Mountain Front region and central "sky island" ranges of Montana.

OVERVIEW

Scientific Name: *Pseudotsuga menziesii* Middle Rocky Mountain Montane Forest & Woodland Group

Common Name (Translated Scientific Name): Douglas-fir Middle Rocky Mountain Montane Forest & Woodland Group
Colloquial Name: Middle Rocky Mountain Douglas-fir Dry-Mesic Forest & Woodland

Type Concept: This group occurs throughout the middle Rocky Mountains of central and southern Idaho (Beaverhead, Lemhi, and Lost River ranges), south and east into the Greater Yellowstone region, and the Bighorn, Gros Ventre and Wind River ranges of Wyoming. It extends north into Montana on the east side of the Continental Divide, north to about the McDonald Pass area, and also into the Rocky Mountain Front region and central "sky island" ranges of Montana. This is a *Pseudotsuga menziesii*-dominated group without the maritime floristic composition; these are forests and woodlands occurring in the Central Rockies where the southern monsoon influence is less and maritime climate regime is not important. This group includes extensive *Pseudotsuga menziesii* forests, occasionally with *Pinus flexilis* on calcareous substrates, and *Pinus contorta* at higher elevations. True firs, such as *Abies concolor, Abies grandis*, and *Abies lasiocarpa*, are generally absent in these occurrences, but *Picea engelmannii* can occur in some stands. *Pinus ponderosa* is not common in this group. Understory components include shrubs such as *Juniperus communis, Mahonia repens, Physocarpus malvaceus*, and *Symphoricarpos oreophilus*, and graminoids such as *Calamagrostis rubescens, Carex rossii*, and *Leucopoa kingii*. The fire regime is of mixed severity with moderate frequency. This group often occurs at the lower treeline immediately above valley grasslands, or sagebrush steppe and shrublands. Sometimes there may be a "bath-tub ring" of *Pinus ponderosa* at lower elevations or *Pinus flexilis* between the valley non-forested and the solid *Pseudotsuga menziesii* forest. In the Wyoming Basins, this group occurs as isolated stands of *Pseudotsuga menziesii*, with *Artemisia tridentata, Carex rossii, Leucopoa kingii*, and *Pseudoroegneria spicata*.

Classification Comments: Need to re-assess the concept of this group in relation to Central Rocky Mountain Mesic Grand Fir - Douglas-fir Forest Group (G211), East Cascades Mesic Grand Fir - Douglas-fir Forest Group (G212), and Central Rocky Mountain Douglas-fir - Pine Forest Group (G210). Also, its transition in the south to Southern Rocky Mountain White Fir - Douglas-fir Dry Forest Group (G226) needs to be clarified. It seems this group would most appropriately contain Rocky Mountain associations wherein *Pseudotsuga menziesii* is the only conifer, hence forests and woodlands that are not mixed conifer. Certainly this group is outside the range of distribution of either *Abies concolor* or *Picea pungens*, which are major components of Southern Rocky Mountain forest groups. It also does not overlap with major interior Pacific Northwest forest types which are affiliated with a more maritime climate regime, where trees such as *Abies grandis, Larix occidentalis, Pinus monticola, Thuja plicata*, or *Tsuga heterophylla* occur. However, it does have some overlap with Central Rocky Mountain Douglas-fir - Pine Forest Group (G210), and there are *Pseudotsuga menziesii*-dominated forests extending south in the Rockies well into New Mexico, so the floristic "transition" from middle to southern Rocky Mountains is not yet clear.

Similar NVC Types:
- G226 Southern Rocky Mountain White Fir - Douglas-fir Dry Forest
- G210 Central Rocky Mountain Douglas-fir - Pine Forest
- G211 Central Rocky Mountain Mesic Grand Fir - Douglas-fir Forest

Diagnostic Characteristics: These are *Pseudotsuga menziesii*-dominated forests and woodlands without the maritime floristic composition. They tend to be drier than *Pseudotsuga menziesii*-dominated forests further north in the Rockies, where the maritime climate regime provides more moisture during the growing season.

VEGETATION

Physiognomy and Structure: Forests and woodlands of evergreen conifers, with understory components of broad-leaved deciduous shrubs, evergreen needle-leaved shrubs, and grasses or dryland sedges.

Floristics: This group includes extensive *Pseudotsuga menziesii* forests, occasionally with *Pinus flexilis* on calcareous substrates, *Pinus contorta* at higher elevations and *Juniperus osteosperma* or *Juniperus scopulorum*. True firs, such as *Abies concolor, Abies grandis*, and *Abies lasiocarpa*, are generally absent in these occurrences, but *Picea engelmannii* can occur in some stands. *Pinus ponderosa* is also not common in this group. Understory components include shrubs such as *Acer glabrum, Amelanchier alnifolia, Cercocarpus ledifolius, Linnaea borealis, Juniperus communis, Mahonia repens, Physocarpus malvaceus, Purshia tridentata, Spiraea betulifolia, Symphoricarpos albus*, and *Symphoricarpos oreophilus*. Common graminoids include *Calamagrostis rubescens, Carex rossii, Leucopoa kingii*, and *Piptatheropsis micrantha (= Piptatherum micranthum)*. Forbs are variable, but typical taxa include *Arnica cordifolia, Osmorhiza berteroi, Thalictrum occidentale, Viola adunca*, and species of many other genera, including *Arenaria, Erigeron, Lathyrus, Lupinus, Fragaria, Galium, Penstemon, Vicia*, and others. This group often occurs at the lower treeline immediately above valley grasslands, or sagebrush steppe and shrublands. Sometimes there may be a "bath-tub ring" of *Pinus ponderosa* at lower elevations or *Pinus flexilis* between the valley non-forested and the solid *Pseudotsuga menziesii* forest. In the Wyoming Basins, this group occurs as isolated stands of *Pseudotsuga menziesii*, with *Artemisia tridentata, Carex rossii, Leucopoa kingii*, and *Pseudoroegneria spicata*.

ENVIRONMENT & DYNAMICS

Environmental Description: These are forests and woodlands occurring in the Central Rockies where the southern monsoon influence is less and maritime climate regime is not important. In the middle Rocky Mountains, *Pseudotsuga menziesii* forests occur under a comparatively drier and more continental climate regime, and at higher elevations than in the Pacific Northwest. Elevations range from less than 1000 m in the central Rocky Mountains to over 2400 m in the Wyoming Rockies. Lower elevation stands typically occupy protected northern exposures or mesic ravines and canyons, often on steep slopes. At higher elevations, these forests occur primarily on southerly aspects or ridgetops and plateaus. Annual precipitation ranges from 50-100 cm with moderate snowfall and a greater proportion falling during the growing season. Monsoonal summer rains can contribute a significant proportion of the annual precipitation in the southern portion of the range. Soils are highly variable and derived from diverse parent materials. *Pseudotsuga menziesii* forests are reported by most studies (Pfister et al. 1977, Steele et al. 1981, Mauk and Henderson 1984, Lillybridge et al. 1995) to show no particular affinities to geologic substrates. Rock types can include extrusive volcanics in the Yellowstone region, and sedimentary rocks elsewhere in the Rockies. The soils are typically slightly acidic (pH 5.0-6.0), well-drained, and well-aerated. They can be derived from moderately deep colluvium or shallow-jointed bedrock, and are usually gravelly or rocky.

Dynamics: Successional relationships in this group are complex. *Pseudotsuga menziesii* is less shade-tolerant than many northern or montane trees such as *Tsuga heterophylla, Abies concolor, Picea engelmannii*, or *Thuja plicata*, and seedlings compete poorly in deep shade. At drier locales, seedlings may be favored by moderate shading, such as by a canopy of *Pinus ponderosa*, which helps to minimize drought stress. In some locations, much of these forests have been logged or burned during European settlement, and present-day stands are second-growth forests dating from fire, logging, or other stand-replacing disturbances (Mauk and Henderson 1984). *Pseudotsuga menziesii* forests were probably subject to a moderate-severity fire regime in presettlement times, with fire-return intervals of 30-100 years. Many of the important tree species in these forests are fire-adapted (*Populus tremuloides, Pinus ponderosa, Pinus contorta*) (Pfister et al. 1977), and fire-induced reproduction of *Pinus ponderosa* can result in its continued codominance in *Pseudotsuga menziesii* forests (Steele et al. 1981). Seeds of the shrub *Ceanothus velutinus* can remain dormant in forest stands for 200 years (Steele et al. 1981) and germinate abundantly after fire, competitively suppressing conifer seedlings. Some stands may have higher tree-stem density than historically, due largely to fire suppression.

DISTRIBUTION

Geographic Range: This group occurs throughout the middle Rocky Mountains of central and southern Idaho (Lemhi, Beaverhead and Lost River ranges), south and east into the Greater Yellowstone region, and south and east into the Wind River, Gros Ventre and Bighorn ranges of Wyoming. It extends north into Montana on the east side of the Continental Divide to the Rocky Mountain Front and east into the "sky island" ranges of central Montana. It may also occur in scattered patches in southeastern Oregon. Some associations placed in this group also occur in Colorado.

Spatial Scale & Pattern [optional]: Matrix
Nations: CA, US
States/Provinces: CO, ID, MT, OR?, UT, WY
TNC Ecoregions [optional]: 6:P, 7:?, 8:C, 9:C, 10:C, 20:C, 26:C
USFS Ecoregions (2007): 342A:CC, 342C:CP, 342D:CP, 342J:CP, M331A:CC, M331B:CC, M331D:CP, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CP
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **<** Interior Douglas-fir: 210 (Eyre 1980)

LOWER LEVEL UNITS

Alliances:
- A3462 *Pseudotsuga menziesii* Middle Rocky Mountain Dry-Mesic Forest & Woodland Alliance
- A3463 *Pseudotsuga menziesii* Middle Rocky Mountain Mesic-Wet Forest Alliance

AUTHORSHIP

Primary Concept Source: R. Steele, R.D. Pfister, R.A. Ryker, and J.A. Kittams (1981)
Author of Description: M.S. Reid and K.A. Schulz
Acknowledgments:
Version Date: 11/09/2015
Classif Resp Region: West
Internal Author: MSR 3-10, mod. KAS 11-15

REFERENCES

References: Cooper et al. 1987, Daubenmire and Daubenmire 1968, Eyre 1980, Faber-Langendoen et al. 2017a, Lillybridge et al. 1995, Mauk and Henderson 1984, Pfister et al. 1977, Steele and Geier-Hayes 1995, Steele et al. 1981

1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G215. Middle Rocky Mountain Montane Douglas-fir Forest & Woodland

A3462. Pseudotsuga menziesii Middle Rocky Mountain Dry-Mesic Forest & Woodland Alliance

Type Concept Sentence: This forest and woodland alliance is dominated by *Pseudotsuga menziesii* and occurs on relatively dry to mesic sites throughout the middle Rocky Mountains of central and southern Idaho, the Greater Yellowstone region, and the Wind River, Gros Ventre and Bighorn ranges of Wyoming and in Montana on the east side of the Continental Divide.

OVERVIEW

Scientific Name: *Pseudotsuga menziesii* Middle Rocky Mountain Dry-Mesic Forest & Woodland Alliance
Common Name (Translated Scientific Name): Douglas-fir Middle Rocky Mountain Dry-Mesic Forest & Woodland Alliance
Colloquial Name: Middle Rocky Mountain Douglas-fir Dry-Mesic Forest & Woodland

Type Concept: Stands of this alliance are *Pseudotsuga menziesii*-dominated forests and woodlands occasionally with *Juniperus osteosperma, Juniperus scopulorum, Pinus flexilis* (on calcareous substrates), *Populus tremuloides* (on disturbed sites), and *Pinus contorta* (at higher elevations). True firs, such as *Abies concolor, Abies grandis*, and *Abies lasiocarpa*, are absent, but occasional *Picea engelmannii* can occur in some stands. *Pinus ponderosa* is also not common in this group. Understory components include shrubs such as *Cercocarpus ledifolius, Juniperus communis, Mahonia repens, Purshia tridentata, Spiraea betulifolia, Symphoricarpos albus*, and *Symphoricarpos oreophilus*. Common graminoids include *Calamagrostis rubescens, Carex rossii, Leucopoa kingii*, and *Pseudoroegneria spicata*. Forbs are variable, but typical taxa include *Arnica cordifolia, Thalictrum occidentale, Viola adunca*, and species of many other genera, including *Antennaria, Arenaria, Erigeron, Eriogonum, Lathyrus, Lupinus, Penstemon*, and *Vicia*. This alliance occurs on relatively dry to mesic sites throughout the middle Rocky Mountains of central and southern Idaho, the Greater Yellowstone region, and the Wind River, Gros Ventre and Bighorn ranges of Wyoming. It extends north into Montana on the east side of the Continental Divide, to the McDonald Pass area, and also into the Rocky Mountain Front region and central "sky island" ranges of Montana. This alliance often occurs at the lower treeline immediately above valley grasslands, or sagebrush steppe and shrublands. Stands are found on all aspects in the Central Rockies where the southern monsoon influence is less and maritime climate regime is not important. Climate is drier and more continental than at higher elevations or in the Pacific Northwest. Annual precipitation ranges from 50-100 cm with moderate snowfall and a greater proportion falling during the growing season. Monsoonal summer rains can contribute a significant proportion of the annual precipitation in the southern portion of the range. Elevations range from less than 1000 m in the central Rocky Mountains to over 2400 m in the Wyoming Rockies. Lower elevation stands typically occupy cooler, less xeric northern exposures often on steep slopes. At higher elevations, these forests occur primarily on southerly aspects or ridgetops and plateaus. Soils are highly variable and derived from diverse parent materials, including extrusive volcanics in the Yellowstone region, and sedimentary rocks elsewhere in the Rockies. The soils are typically well-drained and well-aerated. They can be derived from moderately deep colluvium or shallow-jointed bedrock, and are usually gravelly or rocky.

Classification Comments: Several associations included in this alliance are broadly defined and may occur outside the central Rocky Mountains. More review of similar groups and the associations in this alliance is needed to clarify the classification.

Internal Comments:
Other Comments:

Similar NVC Types: There are other *Pseudotsuga menziesii* alliances in several other groups that may be similar, especially in Vancouverian Dry Coastal Beach Pine Forest & Woodland Group (G205), Central Rocky Mountain Douglas-fir - Pine Forest Group (G210), Middle Rocky Mountain Montane Douglas-fir Forest & Woodland Group (G215), Rocky Mountain Douglas-fir - White Fir - Blue Spruce Mesic Forest Group (G225), and Southern Rocky Mountain White Fir - Douglas-fir Dry Forest Group (G226).

- A3463 *Pseudotsuga menziesii* Middle Rocky Mountain Mesic-Wet Forest Alliance: is similar but restricted to mesic to wet sites and has diagnostic mesic to wet species in the understory.

Diagnostic Characteristics: Open to closed-canopy woodlands and forests dominated by *Pseudotsuga menziesii* with a variety of dry-mesic site indicator species in the understory such as the shrubs *Cercocarpus ledifolius, Juniperus communis, Mahonia repens, Purshia tridentata, Spiraea betulifolia, Symphoricarpos albus, Symphoricarpos oreophilus*, and several herbaceous species, including *Arnica cordifolia, Calamagrostis rubescens, Carex rossii*, and *Leucopoa kingii*.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance is characterized by open stands of evergreen needle-leaved trees 15-50 m tall. There may be sparse cover of broad-leaved and scale-leaved trees in the subcanopy (5-15 m tall). Shrubs are typically sparse, but may be moderately dense on some sites and are typically dominated by broad-leaved, cold-deciduous shrubs <2 m tall. The herbaceous layer is sparse under denser tree canopies and on rock substrates, but is typically a moderately dense layer that is usually dominated by perennial, medium-tall bunch grasses with forbs. Occasionally perennial forbs are dominant. Annual grasses and forbs are seasonally present.

Floristics: Stands are *Pseudotsuga menziesii*-dominated forests and woodlands occasionally with *Juniperus osteosperma, Juniperus scopulorum, Pinus flexilis* (on calcareous substrates), *Populus tremuloides* (on disturbed sites), and *Pinus contorta* (at higher elevations). True firs, such as *Abies concolor, Abies grandis*, and *Abies lasiocarpa*, are absent, but occasional *Picea engelmannii* can occur in some stands. *Pinus ponderosa* is also not common in this group. Understory components include shrubs such as *Cercocarpus ledifolius, Cercocarpus montanus, Holodiscus dumosus, Juniperus communis, Mahonia repens, Purshia tridentata, Spiraea betulifolia, Symphoricarpos albus*, and *Symphoricarpos oreophilus*. Common graminoids include *Calamagrostis rubescens, Carex rossii, Festuca idahoensis, Leucopoa kingii*, and *Pseudoroegneria spicata*. Forbs are variable, but typical taxa include *Arnica cordifolia, Thalictrum occidentale, Viola adunca*, and species of many other genera, including *Antennaria, Arenaria, Erigeron, Eriogonum, Lathyrus, Lupinus, Penstemon*, and *Vicia*. This alliance often occurs at the lower treeline immediately above valley grasslands, or sagebrush steppe and shrublands. Sometimes there may be a "bath-tub ring" of *Pinus ponderosa* at lower elevations or *Pinus flexilis* between the valley non-forested and then solid *Pseudotsuga menziesii* forest. In the Wyoming Basins, this alliance occurs as isolated stands of *Pseudotsuga menziesii* with *Artemisia tridentata, Carex rossii, Leucopoa kingii*, and *Pseudoroegneria spicata*. Annual grasses and forbs may be present, especially on disturbed sites.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs on relatively dry to mesic sites throughout the middle Rocky Mountains of central and southern Idaho, the Greater Yellowstone region, and the Wind River, Gros Ventre and Bighorn ranges of Wyoming. It extends north into Montana on the east side of the Continental Divide, to the McDonald Pass area, and also into the Rocky Mountain Front region and central "sky island" ranges of Montana. Stands are found on all aspects in the Central Rockies where the southern monsoon influence is less and maritime climate regime is not important. Climate is drier and more continental than at higher elevations or in the Pacific Northwest. Annual precipitation ranges from 50-100 cm with moderate snowfall and a greater proportion falling during the growing season. Monsoonal summer rains can contribute a significant proportion of the annual precipitation in the southern portion of the range. Elevations range from less than 1000 m in the central Rocky Mountains to over 2400 m in the Wyoming Rockies. Lower elevation stands typically occupy protected northern exposures and canyons, often on steep slopes. At higher elevations, these forests occur primarily on southerly aspects or ridgetops and plateaus. Substrates are typically shallow, lithic, course-textured soils derived from colluvium and residuum. Soil texture ranges from gravelly sand to loam. There is typically high surface cover of rock, as well as coarse fragments within the soil. Soil pH varies from acidic to alkaline depending on parent material. Parent materials are extremely varied and may include andesite, basalt, dolomite, gneiss, granite, lava, limestone, mudstone, rhyolite, sandstone and tuff. Extrusive volcanics are common in the Yellowstone region, and sedimentary rocks elsewhere in the Rockies. *Pseudotsuga menziesii* forests are reported by most studies (Pfister et al. 1977, Steele et al. 1981, Mauk and Henderson 1984) to show no particular affinities to geologic substrates. These rocky, shallow soils have so little moisture-holding capacity that these sites are effectively very dry for plant growth even where there is substantial precipitation. In some cases, these sites are exposed to high winds. Wind detracts from soil moisture status by blowing off snow, directly desiccating plants, and eroding soil.

Dynamics: Successional relationships in this alliance are complex. *Pseudotsuga menziesii* is less shade-tolerant than many northern or montane trees such as *Abies concolor, Picea engelmannii, Thuja plicata*, or *Tsuga heterophylla*, and seedlings compete poorly in deep shade. At drier locales, seedlings may be favored by moderate shading, such as by a canopy of *Pinus ponderosa*, which helps to minimize drought stress. In some locations, much of these forests have been logged or burned during European settlement, and present-day stands are second-growth forests dating from fire, logging, or other stand-replacing disturbances (Mauk and Henderson 1984). *Pseudotsuga menziesii* forests were probably subject to a moderate-severity fire regime in presettlement times, with fire-return intervals of 30-100 years.

DISTRIBUTION

Geographic Range: This alliance occurs on relatively dry to mesic sites throughout the middle Rocky Mountains of central and southern Idaho, the Greater Yellowstone region, and the Wind River, Gros Ventre and Bighorn ranges of Wyoming. It extends north into Montana on the east side of the Continental Divide, to the McDonald Pass area, and also into the Rocky Mountain Front region and central "sky island" ranges of Montana.

Nations: CA, US
States/Provinces: ID, MT, WY

TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **>** *Populus tremuloides - Pseudotsuga menziesii / Symphoricarpos oreophilus* Community Type (Mueggler 1988)
- **>** *Pseudotsuga menziesii - Pinus flexilis / Hesperochloa kingii* Association (Cooper 1975)
- **>** *Pseudotsuga menziesii / Arnica cordifolia* Habitat Type (Pfister et al. 1977)
- **>** *Pseudotsuga menziesii / Berberis repens* Habitat Type (Hoffman and Alexander 1976)
- **>** *Pseudotsuga menziesii / Cercocarpus ledifolius* Community Type (DeVelice 1992)
- **>** *Pseudotsuga menziesii / Juniperus communis* Habitat Type (Steele et al. 1983)
- **>** *Pseudotsuga menziesii / Spiraea betulifolia* Habitat Type (Cooper et al. 1987)
- **>** *Pseudotsuga menziesii / Symphoricarpos albus* Habitat Type (Steele et al. 1981)
- **>** *Pseudotsuga menziesii / Symphoricarpos oreophilus* Habitat Type (Steele et al. 1981)
- **<** Interior Douglas-fir: 210 (Eyre 1980)

LOWER LEVEL UNITS

Associations:

- CEGL000897 *Pseudotsuga menziesii / Cercocarpus ledifolius* Woodland
- CEGL000462 *Pseudotsuga menziesii / Symphoricarpos oreophilus* Forest
- CEGL000427 *Pseudotsuga menziesii / Arnica cordifolia* Forest
- CEGL000906 *Pseudotsuga menziesii - Pinus flexilis / Leucopoa kingii* Woodland
- CEGL000442 *Pseudotsuga menziesii / Mahonia repens* Forest
- CEGL000904 *Pseudotsuga menziesii / Leucopoa kingii* Woodland
- CEGL000546 *Populus tremuloides - Pseudotsuga menziesii / Symphoricarpos oreophilus* Forest
- CEGL000440 *Pseudotsuga menziesii / Juniperus osteosperma* Forest
- CEGL000457 *Pseudotsuga menziesii / Spiraea betulifolia* Forest
- CEGL000903 *Pseudotsuga menziesii / Juniperus scopulorum* Woodland
- CEGL000909 *Pseudotsuga menziesii / Purshia tridentata* Woodland
- CEGL000439 *Pseudotsuga menziesii / Juniperus communis* Forest
- CEGL000459 *Pseudotsuga menziesii / Symphoricarpos albus* Forest

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz and M.S. Reid
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Cooper 1975, Cooper et al. 1987, Cooper et al. 1995, DeByle and Winokur 1985, DeVelice 1992, DeVelice and Lesica 1993, DeVelice et al. 1991, DeVelice et al. 1995, Eyre 1980, Faber-Langendoen et al. 2017b, Fischer and Clayton 1983, Hoffman and Alexander 1976, Horton 1971, Mauk and Henderson 1984, Mueggler 1988, Oswald 1966, Pfister et al. 1977, Reed 1976, Roberts 1980, Roberts et al. 1979a, Steele and Geier-Hayes 1995, Steele et al. 1981, Steele et al. 1983, Youngblood and Mueggler 1981

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G215. Middle Rocky Mountain Montane Douglas-fir Forest & Woodland

A3463. Pseudotsuga menziesii Middle Rocky Mountain Mesic-Wet Forest Alliance

Type Concept Sentence: This forest and woodland alliance is dominated by *Pseudotsuga menziesii* without the maritime floristic composition. It occurs on relatively moist, cool to warm sites throughout the middle Rocky Mountains of central and southern Idaho, the Greater Yellowstone region, and the Wind River, Gros Ventre and Bighorn ranges of Wyoming and in Montana on the east side of the Continental Divide.

OVERVIEW

Scientific Name: *Pseudotsuga menziesii* Middle Rocky Mountain Mesic-Wet Forest Alliance
Common Name (Translated Scientific Name): Douglas-fir Middle Rocky Mountain Mesic-Wet Forest Alliance
Colloquial Name: Middle Rocky Mountain Douglas-fir Mesic-Wet Forest

Type Concept: Stands are *Pseudotsuga menziesii*-dominated forests and woodlands; occasionally *Populus tremuloides* may codominate on disturbed sites ,and *Pinus contorta* may be present at higher elevations. True firs, such as *Abies concolor, Abies grandis*, and *Abies lasiocarpa*, are absent, but occasional *Picea engelmannii* can occur in some stands. *Pinus ponderosa* is also not common in this group. Understory components include relatively mesic species such as the shrubs *Acer glabrum, Amelanchier alnifolia, Linnaea borealis*, and *Physocarpus malvaceus*, and herbs and grasses such as *Achillea millefolium, Bromus carinatus, Eucephalus engelmannii (= Aster engelmannii), Fragaria vesca, Geranium viscosissimum, Lathyrus* spp., *Osmorhiza berteroi*, and *Piptatheropsis micrantha (= Piptatherum micranthum)*. This alliance is restricted to mesic to wet sites in the middle Rocky Mountains of central and southern Idaho, the Greater Yellowstone region, and the Wind River, Gros Ventre and Bighorn ranges of Wyoming. It extends north into Montana on the east side of the Continental Divide, to the McDonald Pass area, and also into the Rocky Mountain Front region and central "sky island" ranges of Montana. This alliance occurs in the Central Rockies where the southern monsoon influence is less and maritime climate regime is not important. Climate is drier and more continental than at higher elevations or in the Pacific Northwest. Annual precipitation ranges from 50-100 cm with moderate snowfall and a greater proportion falling during the growing season. Monsoonal summer rains can contribute a significant proportion of the annual precipitation in the southern portion of the range. Elevations range from less than 1000 m in the central Rocky Mountains to over 2400 m in the Wyoming Rockies. Stands typically occupy cooler northern exposures in relatively moist sites such as lower slopes, benches and valley bottoms. Lower elevation stands occupy mesic ravines and canyons on northerly aspects. Soils are highly variable and derived from diverse parent materials, including extrusive volcanics in the Yellowstone region, and sedimentary rocks elsewhere in the Rockies. The soils can be derived from moderately deep colluvium or shallow-jointed bedrock, and are usually gravelly or rocky.

Classification Comments: Several associations included in this alliance are broadly defined and may occur outside the central Rocky Mountains. More review of similar groups and the associations in this alliance is needed to clarify the classification.

Internal Comments:
Other Comments:

Similar NVC Types: There are other *Pseudotsuga menziesii* alliances in several other groups that may be similar, especially in Vancouverian Dry Coastal Beach Pine Forest & Woodland Group (G205), Central Rocky Mountain Douglas-fir - Pine Forest Group (G210), Middle Rocky Mountain Montane Douglas-fir Forest & Woodland Group (G215), Rocky Mountain Douglas-fir - White Fir - Blue Spruce Mesic Forest Group (G225), and Southern Rocky Mountain White Fir - Douglas-fir Dry Forest Group (G226).

- A3462 *Pseudotsuga menziesii* Middle Rocky Mountain Dry-Mesic Forest & Woodland Alliance: is similar but occurs more widely on drier sites and lacks the mesic to wet understory species diagnostic of A3463.

Diagnostic Characteristics: Open to closed-canopy woodlands and forests dominated by *Pseudotsuga menziesii* with mesic-wet site indicator species in the understory such as *Acer glabrum, Amelanchier alnifolia, Linnaea borealis, Osmorhiza berteroi, Physocarpus malvaceus*, and *Piptatheropsis micrantha*.

VEGETATION

Physiognomy and Structure: These forests and woodlands are characterized by a multi-tiered needle-leaved evergreen tree canopy up to 50 m high, with between 25-100% cover. A sparse subcanopy of cold-deciduous or evergreen trees is often present, particularly in northwestern coastal stands. Downed wood may also be abundant in older stands. Shrub cover is dominated by cold-deciduous species and can be dense. A sparse to dense perennial herbaceous layer is usually present and composed of either shade-tolerant forbs and ferns in the Central Rockies or mesophytic forbs and grasses.

Floristics: Stands of this alliance are *Pseudotsuga menziesii*-dominated forests and woodlands. Occasionally *Populus tremuloides* may codominate on disturbed sites, and *Pinus contorta* may be present at higher elevations. True firs, such as *Abies concolor, Abies grandis*, and *Abies lasiocarpa*, are absent, but occasional *Picea engelmannii* can occur in some stands. *Pinus ponderosa* is also not common in this group. Understory components include relatively mesic species such as the shrubs *Acer glabrum, Amelanchier alnifolia, Holodiscus dumosus, Linnaea borealis, Paxistima myrsinites, Physocarpus malvaceus, Rosa woodsii*, and *Salix scouleriana*, and herbs and grasses such as *Achillea millefolium, Bromus carinatus, Eucephalus engelmannii (= Aster engelmannii), Fragaria vesca, Galium boreale, Geranium viscosissimum, Lathyrus* spp., *Osmorhiza berteroi*, and *Piptatheropsis micrantha (= Piptatherum micranthum)*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance is restricted to mesic to wet sites in the middle Rocky Mountains of central and southern Idaho, the Greater Yellowstone region, and the Wind River, Gros Ventre and Bighorn ranges of Wyoming. It extends north into Montana on the east side of the Continental Divide, to the McDonald Pass area, and also into the Rocky Mountain Front region and central "sky island" ranges of Montana. This alliance occurs in the Central Rockies where the southern monsoon influence is less and maritime climate regime is not important. Climate is drier and more continental than at higher elevations or in the Pacific

Northwest. Annual precipitation ranges from 50-100 cm with moderate snowfall and a greater proportion falling during the growing season. Monsoonal summer rains can contribute a significant proportion of the annual precipitation in the southern portion of the range. Elevations range from less than 1000 m in the central Rocky Mountains to over 2400 m in the Wyoming Rockies. Stands typically occupy cooler northern exposures in relatively moist sites such as lower slopes, benches and valley bottoms. Lower elevation stands occupy mesic ravines and canyons on northerly aspects. Soils are highly variable and derived from diverse parent materials, including extrusive volcanics in the Yellowstone region, and sedimentary rocks elsewhere in the Rockies. The soils can be derived from moderately deep colluvium or shallow-jointed bedrock, and are usually gravelly or rocky.

Dynamics: Successional relationships in this alliance are complex. *Pseudotsuga menziesii* is less shade-tolerant than many northern or montane trees such as *Abies concolor, Picea engelmannii, Thuja plicata*, or *Tsuga heterophylla*, and seedlings compete poorly in deep shade. At drier locales, seedlings may be favored by moderate shading, such as by a canopy of *Pinus ponderosa*, which helps to minimize drought stress. In some locations, much of these forests have been logged or burned during European settlement, and present-day stands are second-growth forests dating from fire, logging, or other stand-replacing disturbances (Mauk and Henderson 1984). *Pseudotsuga menziesii* forests were probably subject to a moderate severity fire regime in presettlement times, with fire-return intervals of 30-100 years.

DISTRIBUTION

Geographic Range: This alliance occurs on relatively moist, cool to warm sites throughout the middle Rocky Mountains of central and southern Idaho, the Greater Yellowstone region, and the Wind River, Gros Ventre and Bighorn ranges of Wyoming. It extends north into Montana on the east side of the Continental Divide, to the McDonald Pass area, and also into the Rocky Mountain Front region and central "sky island" ranges of Montana

Nations: CA, US
States/Provinces: ID, MT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** *Populus tremuloides - Pseudotsuga menziesii / Amelanchier alnifolia* Community Type (Mueggler 1988)
- **>** *Pseudotsuga menziesii / Acer glabrum* Habitat Type (Steele et al. 1981)
- **>** *Pseudotsuga menziesii / Acer glabrum* Habitat Type, *Pachistima myrsinites* Phase (Steele et al. 1983)
- **>** *Pseudotsuga menziesii / Amelanchier alnifolia* Habitat Type (Roberts 1980)
- **>** *Pseudotsuga menziesii / Osmorhiza chilensis* Habitat Type (Steele et al. 1983)
- **>** *Pseudotsuga menziesii / Physocarpus malvaceus* Habitat Type (Cooper et al. 1987)
- **><** Interior Douglas-fir: 210 (Eyre 1980)

LOWER LEVEL UNITS

Associations:

- CEGL000905 *Pseudotsuga menziesii / Piptatheropsis micrantha* Woodland
- CEGL000445 *Pseudotsuga menziesii / Osmorhiza berteroi* Forest
- CEGL000543 *Populus tremuloides - Pseudotsuga menziesii / Amelanchier alnifolia* Forest
- CEGL000447 *Pseudotsuga menziesii / Physocarpus malvaceus* Forest
- CEGL000418 *Pseudotsuga menziesii / Acer glabrum* Forest
- CEGL000420 *Pseudotsuga menziesii / Amelanchier alnifolia* Forest
- CEGL000441 *Pseudotsuga menziesii / Linnaea borealis* Forest

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz and M.S. Reid
Acknowledgments: We have incorporated significant descriptive information previously compiled by Marion Reid.
Version Date: 2014/01/08

REFERENCES

References: Cooper 1975, Cooper et al. 1987, Cooper et al. 1995, DeByle and Winokur 1985, DeVelice 1992, DeVelice and Lesica 1993, DeVelice et al. 1991, DeVelice et al. 1995, Eyre 1980, Faber-Langendoen et al. 2017b, Fischer and Clayton 1983, Hoffman and

Alexander 1976, Horton 1971, Mauk and Henderson 1984, Mueggler 1988, Oswald 1966, Pfister et al. 1977, Reed 1976, Roberts 1980, Roberts et al. 1979a, Steele and Geier-Hayes 1995, Steele et al. 1981, Steele et al. 1983, Youngblood and Mueggler 1981

1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
1.B.2.Nb.2.d. M501 Central Rocky Mountain Dry Lower Montane-Foothill Forest

G209. Rocky Mountain Foothill-Rock Outcrop Limber Pine - Juniper Woodland

Type Concept Sentence: This foothill woodland group is found on rocky sites in the Rocky Mountains from southern Alberta to central Colorado, including escarpments and low hills across Wyoming and the western Great Plains, and is characterized by an open-tree canopy or patchy woodland that is dominated by either *Pinus flexilis, Juniperus osteosperma*, or *Juniperus scopulorum*.

OVERVIEW

Scientific Name: *Pinus flexilis - Juniperus scopulorum* Rocky Mountain Foothill Woodland Group
Common Name (Translated Scientific Name): Limber Pine - Rocky Mountain Juniper Rocky Mountain Foothill Woodland Group
Colloquial Name: Central Rocky Mountain Juniper / Grass Woodland

Type Concept: This group occurs in foothills and may extend into lower montane zones in the Rocky Mountains from southern Alberta and northern Montana south to central Colorado and on escarpments across Wyoming extending out into the western Great Plains. Elevation ranges from 1000-2400 m. These are rock outcrop, escarpment and patchy woodlands, occurring generally below continuous forests of *Pseudotsuga menziesii* or *Pinus ponderosa*. Climatologically, the region is semi-arid and has a continental regime of hot summers and cold winters. Precipitation patterns are variable, but snow is common in winter, and spring rains are an important contributor. These woodlands are restricted to shallow soils and fractured bedrock derived from a variety of parent material, including limestone, sandstone, dolomite, granite, and colluvium. An unusual plant association in Idaho occurs on relatively unweathered mafic lava flows, where it occurs in mesic pockets within the fractured lava. In all cases, soils have a high rock component (typically over 50% cover) and are coarse- to fine-textured, often gravelly and calcareous. Slopes are typically moderately steep to steep. At higher elevations, it is limited to the most xeric aspects on rock outcrops, and at lower elevations to the relatively mesic north aspects. Fire is infrequent and spotty because the rocky substrates prevent development of a continuous vegetation canopy needed to spread. Vegetation is characterized by an open-tree canopy or patchy woodland that is dominated by either *Pinus flexilis, Juniperus osteosperma*, or *Juniperus scopulorum*. This group generally occurs outside of the range of *Pinus edulis*, which is not present. A sparse to moderately dense short-shrub layer, if present, may include a variety of shrubs, such as *Artemisia nova, Artemisia tridentata, Cercocarpus ledifolius, Cercocarpus montanus, Ericameria nauseosa, Juniperus horizontalis, Purshia tridentata*, or *Rhus trilobata*. Herbaceous layers are generally sparse, but range to moderately dense, and are typically dominated by perennial graminoids such as *Bouteloua gracilis, Hesperostipa comata, Koeleria macrantha, Piptatheropsis micrantha (= Piptatherum micranthum), Poa secunda*, or *Pseudoroegneria spicata*. Within this group, there may be small patches of grassland or shrubland composed of some of the above species.

Classification Comments: How to treat *Pinus flexilis* in the Rocky Mountains is still somewhat uncertain. For now, we have kept three groups which have limber pine as a component. The group described here is composed predominantly of limber pine or juniper that is elevationally below the zone of continuous lower montane forests found in the main Rocky Mountain cordillera. The associations placed in this group are restricted to foothill settings on rock outcrops, or to escarpments in the Great Plains. Associations extending from the foothill zone into the subalpine, such as *Pinus flexilis / Arctostaphylos uva-ursi* Woodland (CEGL000802), are included in Rocky Mountain Subalpine-Montane Limber Pine - Bristlecone Pine Woodland Group (G221). Additionally, there are *Juniperus osteosperma*-dominated stands included in this group from the Pryor, Big Horn, and Laramie mountain ranges because these stands are significantly disjunct from the main distribution of *Juniperus osteosperma* in the Colorado Plateau and Great Basin regions and have floristic similarities to the Great Plains. Finally, this foothill woodland group is relatively fine scale and closely related to Black Hills-Northwestern Great Plains Ponderosa Pine Forest & Woodland Group (G216). These two groups could be combined into a single group and this original concept could be treated as an alliance of this larger Great Plains woodland group.

Similar NVC Types:
- G221 Rocky Mountain Subalpine-Montane Limber Pine - Bristlecone Pine Woodland
- G216 Black Hills-Northwestern Great Plains Ponderosa Pine Forest & Woodland
- G224 Intermountain Basins Subalpine Limber Pine - Bristlecone Pine Woodland

Diagnostic Characteristics: Patchy woodlands found on rock outcrops and escarpments at foothill elevations along the eastern Rocky Mountains Front out into the western Great Plains. Dominant and characteristic species are *Pinus flexilis, Juniperus osteosperma*, or *Juniperus scopulorum*. Understory diagnostic species include both widespread Interior West species such as *Artemisia nova,*

Artemisia tridentata, Cercocarpus ledifolius, Cercocarpus montanus, Ericameria nauseosa, Purshia tridentata, or *Pseudoroegneria spicata* and primarily Great Plains species such as *Bouteloua gracilis, Koeleria macrantha*, or *Schizachyrium scoparium*. Floristically these are more related to the Great Plains than to the main Rocky Mountains. High winds, cold winters, and fractured rock substrates are limiting ecological factors influencing the species composition. This group is somewhat analogous to pinyon-juniper woodlands, but pinyon pines are not present this far north, and limber pine is more tolerant of the high winds generally found east of the Continental Divide out in the northwestern Great Plains.

VEGETATION

Physiognomy and Structure: Patchy woodlands dominated by relatively short conifers (scrub woodlands). Undergrowth can be shrubby with typically broad-leaved deciduous shrubs, but sometimes microphyllous evergreen *Artemisia* or *Purshia*. Grasses are common, typically cool-season bunch grasses. Sometimes there is little to no undergrowth.

Floristics: This group is dominated by *Pinus flexilis, Juniperus osteosperma*, or *Juniperus scopulorum*. *Pinus edulis* is not present. A sparse to moderately dense short-shrub layer, if present, may include a variety of shrubs, such as *Artemisia nova, Artemisia tridentata, Cercocarpus ledifolius, Cercocarpus montanus, Ericameria nauseosa, Juniperus horizontalis, Purshia tridentata, Rhus trilobata*, or *Rosa woodsii*. Herbaceous layers are generally sparse, but range to moderately dense, and are typically dominated by perennial graminoids such as *Bouteloua gracilis, Hesperostipa comata, Koeleria macrantha, Leymus innovatus* (in Alberta), *Piptatheropsis micrantha (= Piptatherum micranthum), Poa secunda, Pseudoroegneria spicata*, or *Schizachyrium scoparium*.

ENVIRONMENT & DYNAMICS

Environmental Description: This group occurs in foothill and lower montane zones in the Rocky Mountains from southern Alberta and northern Montana south to central Colorado and on escarpments across Wyoming extending out into the western Great Plains. Elevation ranges from 1000-2400 m. It occurs generally below continuous forests of *Pseudotsuga menziesii* or *Pinus ponderosa*. Climatologically, the region is semi-arid and has a continental regime of hot summers and cold winters. High winds are a common feature found to the east of the Continental Divide and out in the Great Plains; limber pine is adapted to these winds with highly flexible branches which prevent breakage. Precipitation patterns are variable, but snow is common in winter, and spring rains are an important contributor. These woodlands are restricted to shallow soils and fractured bedrock derived from a variety of parent material, including limestone, sandstone, dolomite, granite, and colluvium. An unusual plant association in Idaho occurs on relatively unweathered mafic lava flows, where it occurs in mesic pockets within the fractured lava. In all cases, soils have a high rock component (typically over 50% cover) and are coarse- to fine-textured, often gravelly and calcareous. Slopes are typically moderately steep to steep.

Climate: Climatologically, the region is semi-arid and has a continental regime of hot summers and cold winters. High winds are a common feature found to the east of the Continental Divide and out in the Great Plains; limber pine is adapted to these winds with highly flexible branches which prevent breakage. Precipitation patterns are variable, but snow is common in winter, and spring rains are an important contributor.

Soil/substrate/hydrology: These woodlands are restricted to shallow soils and fractured bedrock derived from a variety of parent material, including limestone, sandstone, dolomite, granite, and colluvium. An unusual plant association in Idaho occurs on relatively unweathered mafic lava flows, where it occurs in mesic pockets within the fractured lava. In all cases, soils have a high rock component (typically over 50% cover) and are coarse- to fine-textured, often gravelly and calcareous. Slopes are typically moderately steep to steep.

Dynamics: Fire is infrequent and spotty because the rocky substrates prevent development of a continuous vegetation canopy needed to spread.

DISTRIBUTION

Geographic Range: This group occurs in foothill and lower montane zones in the Rocky Mountains from southern Alberta and northern Montana south to central Colorado and on escarpments across Wyoming extending out into the western Great Plains. This group also occurs in southeastern Idaho, though it would not be common there.

Spatial Scale & Pattern [optional]: Large patch
Nations: CA?, US
States/Provinces: AB, CO, ID, MT, ND, SD, WY
TNC Ecoregions [optional]: 6:C, 7:P, 8:C, 9:C, 10:C, 20:C, 25:P, 26:C, 27:C, 67:P
USFS Ecoregions (2007): 331D:CC, 331F:CC, 331G:CC, 331H:CC, 331K:CP, 331N:CC, 332C:CC, 342A:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, M242D:PP, M331A:C?, M331B:CC, M331D:C?, M331E:CC, M331I:CC, M331J:CC, M332B:CP, M332D:CC, M333C:PP, M334A:??
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate. This may prove to be too fine of a split for a group concept.

SYNONYMY

- **><** Limber Pine: 219 (Eyre 1980)
- **><** Rocky Mountain Juniper: 220 (Eyre 1980)

LOWER LEVEL UNITS

Alliances:

- A3427 *Juniperus osteosperma - Juniperus scopulorum* / Grass Understory Central Rocky Mountain Woodland Alliance
- A3426 *Juniperus osteosperma - Juniperus scopulorum* / Shrub Understory Central Rocky Mountain Woodland Alliance
- A3425 *Pinus flexilis* / Grass Understory Central Rocky Mountain Woodland Alliance
- A3424 *Pinus flexilis* / Shrub Understory Central Rocky Mountain Woodland Alliance

AUTHORSHIP

Primary Concept Source: D.H. Knight (1994)
Author of Description: M.S. Reid and K.A. Schulz
Acknowledgments:
Version Date: 05/30/2013
Classif Resp Region: West
Internal Author: MSR 3-10, mod. KAS 5-13, 11-15

REFERENCES

References: Anderson 1999b, DeVelice and Lesica 1993, Eyre 1980, Faber-Langendoen et al. 2017a, Hansen and Hoffman 1988, Knight 1994, Knight et al. 1987, Steele et al. 1983, Thilenius et al. 1995

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G209. Rocky Mountain Foothill-Rock Outcrop Limber Pine - Juniper Woodland

A3427. Juniperus osteosperma - Juniperus scopulorum / Grass Understory Central Rocky Mountain Woodland Alliance

Type Concept Sentence: This foothill and outcrop alliance primarily occurs along the eastern slope of the central Rocky Mountains and adjacent Great Plains, but extends from Colorado to Alberta. Stands have an open canopy dominated by *Juniperus scopulorum* or, less commonly, *Juniperus osteosperma* with understory characterized by a moderately dense to low perennial grass layer. If shrubs are present, then cover is low (<10%) and perennial grass cover exceeds shrub cover.

OVERVIEW

Scientific Name: *Juniperus osteosperma - Juniperus scopulorum* / Grass Understory Central Rocky Mountain Woodland Alliance
Common Name (Translated Scientific Name): Rocky Mountain Juniper - Utah Juniper / Grass Understory Central Rocky Mountain Woodland Alliance
Colloquial Name: Central Rocky Mountain Juniper / Grass Woodland

Type Concept: This woodland alliance occurs in foothill and lower montane zones in the Rocky Mountains from southern Alberta and northern Montana south to central Colorado and on escarpments across Wyoming extending out into the western Great Plains. The vegetation is characterized by an open-tree canopy or patchy woodland that is dominated by either *Juniperus scopulorum* or, less commonly, *Juniperus osteosperma* with a grassy understory. *Pinus flexilis* is absent or has low cover. The herbaceous layer ranges from low to moderately dense, and is typically dominated by perennial graminoids such as *Bouteloua gracilis, Hesperostipa comata, Koeleria macrantha, Piptatheropsis micrantha (= Piptatherum micranthum), Poa secunda*, or *Pseudoroegneria spicata*. If shrubs are present, then cover is low (<10%) and perennial grass cover exceeds shrub cover. These are rock outcrop, escarpment and patchy woodlands, occurring generally below continuous forests of *Pseudotsuga menziesii* or *Pinus ponderosa*. Elevation ranges from 1000-2400 m. Climatologically, the region is semi-arid and has a continental regime of hot summers and cold winters. Precipitation patterns are variable, but snow is common in winter, and spring rains are an important contributor. At higher elevations, it is limited to the most xeric aspects on rock outcrops, and at lower elevations to the relatively mesic north aspects. Slopes range from gentle to steep. Soils are typically thin, stony, clay or clay loam, commonly with exposed bedrock. The soil parent material varies with community association, but may be limestone, gneiss, sandstone, scoria, or shale. Stands are best developed on calcareous soils.

Classification Comments: *Juniperus scopulorum* is a wide-ranging species in the Rocky Mountains and may dominate stands in other groups. *Juniperus osteosperma*-dominated stands from the Pryor, Big Horn, and Laramie mountain ranges are included in this alliance because these stands are significantly disjunct from the main distribution of *Juniperus osteosperma* in the Colorado Plateau

and Great Basin regions and may have floristic similarities to the Great Plains. At their upper elevational limit, *Juniperus scopulorum* communities may merge with woodlands and forests dominated by *Pinus* species. The dominance of *Juniperus scopulorum* and low cover of other tree species in the tree layer are diagnostic features that can usually be used to separate communities within this alliance from other wooded communities with grassy understories. At the lower elevation edges of this alliance it may be difficult to distinguish where open stands of this alliance transition to grassland with scattered trees (<10% cover).

Internal Comments: KAS 12-13: We need to review widespread *Juniperus* spp. associations and possibly split some of them in two if they occur in multiple groups. There are currently only two associations attributed to this alliance, but there is likely more community diversity in the field.
Other Comments:

Similar NVC Types:

- A3426 *Juniperus osteosperma - Juniperus scopulorum* / Shrub Understory Central Rocky Mountain Woodland Alliance: occurs in the same group and the overstory is very similar, but understory is dominated by shrubs instead if grasses.
- A3496 *Juniperus osteosperma* / Shrub Understory Woodland Alliance: is also dominated by *Juniperus osteosperma*, but with a shrub-dominated understory and occurs in a different group.

Diagnostic Characteristics: The alliance includes stand of patchy woodlands found on rock outcrops and escarpments at foothill elevations along the eastern Rocky Mountains Front Range out into the western Great Plains. Dominant and characteristic species are *Juniperus scopulorum* and *Juniperus osteosperma*. Perennial grass characterizes the understory with moderate to dense cover. Scattered shrubs may be present at lower cover than herbaceous layer. Diagnostic herbaceous species in the understory include *Pseudoroegneria spicata* and other species more typical of the Great Plains such as *Bouteloua gracilis, Koeleria macrantha*, or *Schizachyrium scoparium*. Shrubs are absent or have low cover (<10%) and perennial grass cover exceeds shrub cover.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has an open to moderately dense tree canopy that is typically 2-5 m tall. Stands are solely dominated by evergreen scale-leaved trees. Scattered evergreen needle-leaved or deciduous broad-leaved trees may be present, but they never codominate. An open to moderately dense herbaceous layer dominated by perennial graminoids is present. Perennial forbs may be scattered. Annual forbs and grasses may be seasonally present.

Floristics: This alliance occurs in foothill and lower montane zones in the Rocky Mountains and extends out into the western Great Plains on escarpments. The vegetation is characterized by a patchy or open to moderately dense tree canopy 2-8 m tall that is dominated by either *Juniperus scopulorum* or, less commonly, *Juniperus osteosperma*. Scattered individuals of *Pinus ponderosa* or *Pseudotsuga menziesii* may be present in the tree canopy, but have low cover (<5%) and are never codominant. In the plains stands the deciduous broad-leaved tree *Fraxinus pennsylvanica* may be present. Herbaceous layers range from low to moderately dense, and are typically dominated by perennial graminoids such as *Bouteloua gracilis, Hesperostipa comata, Koeleria macrantha, Piptatheropsis micrantha (= Piptatherum micranthum), Poa secunda*, or *Pseudoroegneria spicata*. Other graminoids include *Achnatherum hymenoides (= Oryzopsis hymenoides), Carex rossii, Festuca idahoensis, Leucopoa kingii (= Festuca kingii), Leymus ambiguus*, and *Muhlenbergia montana*. Perennial forbs are sparse but may be fairly diverse. The most common forbs are *Achillea millefolium, Artemisia ludoviciana, Campanula rotundifolia, Eriogonum umbellatum, Galium boreale, Helianthus pumilus, Heterotheca villosa, Heuchera bracteata, Maianthemum stellatum, Penstemon virens, Potentilla fissa*, and *Senecio integerrimus*. The cactus *Opuntia polyacantha* is often present. In some stands mosses and lichens provide significant ground cover. Annual grasses and forbs are seasonally present. If shrubs are present, then cover is low (<10%) and perennial grass cover exceeds shrub cover.

ENVIRONMENT & DYNAMICS

Environmental Description: This foothill and outcrop alliance occurs in foothill and lower montane zones in the Rocky Mountains from southern Alberta and northern Montana south to central Colorado and on escarpments across Wyoming extending out into the western Great Plains. These are rock outcrop, escarpment and patchy woodlands, generally below continuous montane forests of *Pseudotsuga menziesii* or *Pinus ponderosa*. Elevation ranges from 1000-2400 m. Climatologically, the region is semi-arid and has a continental regime of hot summers and cold winters. Precipitation patterns are variable, but snow is common in winter, and spring rains are an important contributor. Annual precipitation is 40-60 cm. These woodlands are restricted to shallow soils and fractured bedrock derived from a variety of parent material, including limestone, sandstone, dolomite, granite, lava, shale and colluvium. Soils have a high rock component (typically over 50% cover) and are coarse- to fine-textured, often gravelly and are best developed calcareous soils. Slopes are typically moderately steep to steep. At higher elevations, it is limited to the most xeric aspects on rock outcrops, and at lower elevations to the relatively mesic north aspects.

Dynamics: Woodlands in this alliance are considered to be edaphic or topographic climax communities (Hansen et al. 1984, Tiedemann et al. 1987). *Juniperus scopulorum* is a long-lived species. Hansen and Hoffman (1988) found most trees in stands they sampled to be over 120 years, with some individuals older than 360 years. Fire can be used to control *Juniperus scopulorum* stands

on rangeland because the species will not resprout after being burned (Wright et al. 1979, Fischer and Bradley 1987). Young individuals are most vulnerable to fire (Wright et al. 1979, Fischer and Bradley 1987). The effect of fire on a stand is largely dependent on the tree height and density, fine fuel load on the ground, weather conditions, and season (Wright et al. 1979). Trees are more vulnerable in open stands where fires frequently occur in the spring, the humidity is low, wind speeds are over 10-20 mph, and there are adequate fine fuels to carry fire (Wright et al. 1979, Fischer and Bradley 1987). Under other conditions, burns tend to be spotty with low tree mortality. Large trees are generally not killed unless fine fuels, such as tumbleweeds, have accumulated beneath the tree to provide fuel ladders for the fire to reach the crown. Closed-canopy stands rarely burn because they typically do not have enough understory or wind to carry a fire. Altered fire regimes, cutting trees for fencing, and improper grazing by livestock have significant impacts on the quality of sites. Grazing by livestock can modify the fire regime by removing the fine fuels that carry fire. Fire, livestock grazing, and trampling by hikers and vehicles disturb cryptogamic soil crusts that help maintain soil structure, reduce soil erosion, provide habitat for plants and preserve biological diversity. More study is needed to understand and manage these woodlands.

DISTRIBUTION

Geographic Range: This alliance occurs in foothill and lower montane zones in the Rocky Mountains from southern Alberta and northern Montana south to central Colorado and on escarpments across Wyoming extending out into the western Great Plains and the Black Hills. This alliance generally occurs outside of the range of *Pinus edulis*, which is not present.

Nations: CA, US
States/Provinces: AB, CO, MT, SD, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** *Juniperus scopulorum / Agropyron spicatum* Community (Jones 1992b)
- **>** *Juniperus scopulorum / Agropyron spicatum* Habitat Type (Hansen and Hoffman 1988)
- **>** *Juniperus scopulorum / Agropyron spicatum* Habitat Type (Francis 1983)
- **>** *Juniperus scopulorum / Agropyron spicatum* Habitat Type (Tiedemann et al. 1987)
- **>** *Juniperus scopulorum / Agropyron spicatum* Plant Association (DeVelice et al. 1995)
- **>** *Juniperus scopulorum / Agropyron spicatum* Plant Association (DeVelice et al. 1999)
- **>** *Juniperus scopulorum / Agropyron spicatum* Plant Association (Johnston 1987)
- **<** *Juniperus scopulorum* Series (Johnston 1987)
- **<** *Juniperus scopulorum* Series (Hess 1981)
- **>** *Juniperus scopulorum* Vegetation Type (Thilenius et al. 1995)
- **<** Rocky Mountain Juniper: 220 (Eyre 1980)

LOWER LEVEL UNITS

Associations:

- CEGL000750 *Juniperus scopulorum / Schizachyrium scoparium* Woodland
- CEGL005601 *Juniperus scopulorum / Poa secunda - Penstemon deustus* Woodland
- CEGL000748 *Juniperus scopulorum / Pseudoroegneria spicata* Woodland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Badaracco 1971, Bighorn Coal Mine n.d., Brown 1971, Cooper et al. 1995, DeVelice 1992, DeVelice and Lesica 1993, DeVelice et al. 1995, DeVelice et al. 1999, Eyre 1980, Faber-Langendoen et al. 2017b, Fischer and Bradley 1987, Francis 1983, Hansen 1985, Hansen and Hoffman 1988, Hansen et al. 1984, Hess 1981, Hess and Alexander 1986, Johnston 1987, Jones 1992b, Lesica and DeVelice 1992, Moran 1981a, Steele et al. 1983, Terwilliger et al. 1979a, Thilenius et al. 1995, Tiedemann et al. 1987, Wasser and Hess 1982, Wells 1965, Wells 1970a, Wells 1970b, Wright et al. 1979

1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G209. Rocky Mountain Foothill-Rock Outcrop Limber Pine - Juniper Woodland

A3426. Juniperus osteosperma - Juniperus scopulorum / Shrub Understory Central Rocky Mountain Woodland Alliance

Type Concept Sentence: This foothill and outcrop alliance primarily occurs along the eastern slope of the central Rocky Mountains and adjacent Great Plains, but extends from central Colorado to Alberta. Stands have an open to moderately dense tree canopy dominated by *Juniperus scopulorum* or, less commonly, dominated by *Juniperus osteosperma* with understory characterized by an open to moderately dense shrub cover. Shrub cover is typically >10%, but if less, then shrub cover exceeds herbaceous layer.

OVERVIEW

Scientific Name: *Juniperus osteosperma - Juniperus scopulorum* / Shrub Understory Central Rocky Mountain Woodland Alliance
Common Name (Translated Scientific Name): Rocky Mountain Juniper - Utah Juniper / Shrub Understory Central Rocky Mountain Woodland Alliance
Colloquial Name: Central Rocky Mountain Juniper / Shrub Woodland

Type Concept: This woodland alliance occurs in foothill and lower montane zones in the Rocky Mountains from southern Alberta and northern Montana south to central Colorado and on escarpments across Wyoming extending out into the western Great Plains. The vegetation is characterized by an open-tree canopy or patchy woodland that is dominated by either *Juniperus scopulorum* or, less commonly, *Juniperus osteosperma*. *Pinus flexilis* is absent or has low cover. The understory is characterized by open to moderately dense shrub cover (>10%) composed of *Artemisia nova, Artemisia tridentata, Cercocarpus ledifolius, Cercocarpus montanus*, or *Purshia tridentata*. Total shrub cover is typically >10%, but if less, then shrub cover exceeds herbaceous layer. These are rock outcrop, escarpment and patchy woodlands, occurring generally below continuous forests of *Pseudotsuga menziesii* or *Pinus ponderosa*. Elevation ranges from 1000-2400 m. Climatologically, the region is semi-arid and has a continental regime of hot summers and cold winters. Precipitation patterns are variable, but snow is common in winter, and spring rains are an important contributor. At higher elevations, it is limited to the most xeric aspects on rock outcrops, and at lower elevations to the relatively mesic north aspects. Slopes range from gentle to steep. Soils are typically thin, stony, clay or clay loam, commonly with exposed bedrock. The soil parent material varies with community association, but may be limestone, gneiss, sandstone, scoria, or shale. Stands area best developed on calcareous soils.

Classification Comments: *Juniperus scopulorum* is a wide-ranging species in the Rocky Mountains and may dominate stands in other groups. *Juniperus osteosperma*-dominated stands from the Pryor, Big Horn, and Laramie mountain ranges are included in this alliance because these stands are significantly disjunct from the main distribution of *Juniperus osteosperma* in the Colorado Plateau and Great Basin regions and have floristic similarities to the Great Plains. Tree canopy is typically 10-35% cover or more, but includes stands with 5-9% tree cover when trees characterize the stand on rocky outcrops, i.e., shrub cover is sparse and is less than tree cover.

Internal Comments: KAS 12-13: We need to review widespread *Juniperus* spp. associations and possibly split them in two if they occur in multiple groups
Other Comments:

Similar NVC Types:
- A3427 *Juniperus osteosperma - Juniperus scopulorum* / Grass Understory Central Rocky Mountain Woodland Alliance: occurs in the same group and the overstory is very similar, but understory is dominated by grasses instead if shrubs.
- A3497 *Juniperus osteosperma* / Herbaceous Understory Open Woodland Alliance: is also dominated by *Juniperus osteosperma* with a grass understory, but occurs in a different group.

Diagnostic Characteristics: The alliance includes stands of patchy woodlands found on rock outcrops and escarpments at foothill elevations along the eastern Rocky Mountains Front Range out into the western Great Plains. Dominant and characteristic species are *Juniperus scopulorum* and *Juniperus osteosperma*. Shrubs characterize the understory with low to moderately dense cover. This alliance includes stands with a sparse understory of scattered shrubs. Herbaceous cover is sparse to moderately dense, but has less cover than shrubs. Diagnostic understory species include widespread Interior West species such as *Artemisia nova, Artemisia tridentata, Cercocarpus ledifolius, Cercocarpus montanus, Ericameria nauseosa*, or *Purshia tridentata*.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has an open to moderately dense tree canopy that is typically 2-5 m tall. Stands are solely dominated by evergreen scale-leaved trees. Scattered evergreen needle-leaved or deciduous broad-leaved trees may be present, but they never codominate. A sparse to moderately dense shrub layer may be present as a mixture of

broadleaf and microphyllous, deciduous or evergreen shrubs that are usually less than 2 m tall. A sparse to moderately dense herbaceous layer dominated by perennial graminoids is usually present. Perennial forbs may be scattered. Annual forbs and grasses may be seasonally present.

Floristics: This woodland alliance occurs in foothill and lower montane zones in the Rocky Mountains from southern Alberta and northern Montana south to central Colorado and on escarpments across Wyoming extending out into the western Great Plains. The vegetation is characterized by an open to closed tree canopy (typically 10-35% cover) or patchy woodland usually 2-8 m tall that is dominated by either *Juniperus scopulorum* or, less commonly, *Juniperus osteosperma*. *Pinus flexilis* is absent or has low cover. In the plains stands the deciduous broad-leaved tree *Fraxinus pennsylvanica* may be present. Higher elevations stands may have scattered individuals of *Pinus ponderosa*, or *Pseudotsuga menziesii* may be present with low cover (<5% cover). Although cover of trees is typically >10% in this alliance, stands with 5-9% tree cover are included when trees characterize the stand and cover of trees exceeds cover of understory layers. The understory is characterized by open to moderately dense short-shrub cover (usually 10-35%) but includes denser stands. The dominant shrub species are *Artemisia nova, Artemisia tridentata, Cercocarpus ledifolius, Cercocarpus montanus, Prunus virginiana*, and *Purshia tridentata*. Common, but less abundant shrubs include *Ericameria nauseosa (= Chrysothamnus nauseosus), Physocarpus monogynus, Purshia tridentata, Rhus trilobata, Ribes* spp., *Rubus deliciosus*, and *Symphoricarpos* spp. Scattered dwarf-shrubs such as *Artemisia frigida* or *Linanthus pungens (= Leptodactylon pungens)* are frequently present. Total shrub cover is typically >10%, but if less, then shrub cover exceeds herbaceous layer. The herbaceous layer is dominated by graminoids typical of dry habitats. These species include *Achnatherum hymenoides (= Oryzopsis hymenoides), Bouteloua gracilis, Carex rossii, Festuca idahoensis, Leucopoa kingii (= Festuca kingii), Hesperostipa comata (= Stipa comata), Leymus ambiguus, Muhlenbergia montana, Piptatheropsis micrantha (= Oryzopsis micrantha), Poa secunda, Pseudoroegneria spicata*, and *Schizachyrium scoparium*. Perennial forbs are sparse but may be fairly diverse. The most common forbs are *Achillea millefolium, Artemisia ludoviciana, Campanula rotundifolia, Eriogonum umbellatum, Galium boreale, Helianthus pumilus, Heterotheca villosa, Heuchera bracteata, Maianthemum stellatum, Penstemon virens, Potentilla fissa*, and *Senecio integerrimus*. The fern *Cystopteris fragilis* and the cactus *Opuntia polyacantha* are often present. In some stands mosses and lichens cover up to 72% of the ground surface. Annual grasses and forbs are seasonally present. Some stands in rocky terrain may lack an understory.

ENVIRONMENT & DYNAMICS

Environmental Description: These are rock outcrop, escarpment and patchy woodlands, occurring generally below continuous forests of *Pseudotsuga menziesii* or *Pinus ponderosa* from the lower montane zone in the Rocky Mountains and Black Hills to breaks in the Great Plains. Elevation ranges from 1000-2400 m. Climatologically, the region is semi-arid and has a continental regime of hot summers and cold winters. Precipitation patterns are variable, but snow is common in winter, and spring rains are an important contributor. At higher elevations, it is limited to the most xeric aspects on rock outcrops, and at lower elevations to the relatively mesic north aspects. Slopes range from gentle to steep. Soils are typically thin, stony, clay or clay loam, commonly with exposed bedrock. The soil parent material varies with community association, but may be limestone, gneiss, granite, sandstone, scoria, or shale. Stands are best developed on calcareous soils. Exposed bedrock is common and many stands have over 50% bare soil. Soil pH ranges from slightly acidic to alkaline.

Adjacent vegetation at higher elevations is woodland and forest dominated by *Pinus ponderosa, Pinus flexilis*, or *Pseudotsuga menziesii*. Adjacent vegetation at lower elevations includes shrubland dominated by *Artemisia* spp., *Cercocarpus* spp., or *Purshia tridentata*, riparian woodland dominated by *Pseudotsuga menziesii*, or dry prairie. The transition can be abrupt or an extended ecotone where the woodland grades into a savanna.

Dynamics: Woodlands in this alliance are considered to be edaphic or topographic climax communities (Hansen et al. 1984, Tiedemann et al. 1987). *Juniperus scopulorum* is a long-lived species. Hansen and Hoffman (1988) found most trees in stands they sampled to be over 120 years, with some individuals older than 360 years. Fire can be used to control *Juniperus scopulorum* stands on rangeland because the species will not resprout after being burned (Wright et al. 1979, Fischer and Bradley 1987). Young individuals are most vulnerable to fire (Wright et al. 1979, Fischer and Bradley 1987). The effect of fire on a stand is largely dependent on the tree height and density, fine fuel load on the ground, weather conditions, and season (Wright et al. 1979). Trees are more vulnerable in open stands where fires frequently occur in the spring when the humidity is low, wind speeds are over 10-20 mph, and there is adequate fine fuels to carry fire (Wright et al. 1979, Fischer and Bradley 1987). Under other conditions, burns tend to be spotty with low tree mortality. Large trees are generally not killed unless fine fuels, such as tumbleweeds, have accumulated beneath the tree to provide fuel ladders for the fire to reach the crown. Closed-canopy stands rarely burn because they typically do not have enough understory or wind to carry a fire. Altered fire regimes, cutting trees for fencing, and improper grazing by livestock have significant impacts on the quality of sites. Grazing by livestock can modify the fire regime by removing the fine fuels that carry fire. Fire, livestock grazing, and trampling by hikers and vehicles disturb biological soil crusts that help maintain soil structure, reduce soil erosion, provide habitat for plants and preserve biological diversity. More study is needed to understand and manage these woodlands.

DISTRIBUTION

Geographic Range: This alliance occurs in foothill and lower montane zones in the Rocky Mountains from southern Alberta and northern Montana south to central Colorado and on escarpments across Wyoming extending out into the western Great Plains.

Nations: CA, US
States/Provinces: AB, CO, MT, SD, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** *Juniperus osteosperma / Cercocarpus ledifolius* Community Type (DeVelice and Lesica 1993)
- **>** *Juniperus scopulorum - Artemisia tridentata - Bouteloua gracilis* Vegetation Type (Jennings 1979)
- **>** *Juniperus scopulorum - Cercocarpus ledifolius* Community Type (DeVelice 1992)
- **>** *Juniperus scopulorum - Cercocarpus ledifolius* Community Type (Cooper et al. 1995)
- **>** *Juniperus scopulorum / Agropyron spicatum* Plant Association (DeVelice et al. 1995)
- **>** *Juniperus scopulorum / Artemisia nova* Community Type (DeVelice and Lesica 1993)
- **>** *Juniperus scopulorum / Artemisia nova* Community Type (Lesica and DeVelice 1992)
- **>** *Juniperus scopulorum / Artemisia tridentata* Community Type (Cooper et al. 1995)
- **>** *Juniperus scopulorum / Artemisia tridentata* Community Type (DeVelice 1992)
- **>** *Juniperus scopulorum / Artemisia tridentata* Habitat Type (Wasser and Hess 1982)
- **>** *Juniperus scopulorum / Artemisia tridentata* Habitat Type (Hess and Alexander 1986)
- **>** *Juniperus scopulorum / Artemisia tridentata* Habitat Type (Hess 1981)
- **>** *Juniperus scopulorum / Cercocarpus montanus* Habitat Type (Hess and Alexander 1986)
- **>** *Juniperus scopulorum / Cercocarpus montanus* Habitat Type (Hess 1981)
- **>** *Juniperus scopulorum / Cercocarpus montanus* Habitat Type (Wasser and Hess 1982)
- **>** *Juniperus scopulorum / Cercocarpus montanus* Plant Association (Baker 1984a)
- **>** *Juniperus scopulorum / Purshia tridentata* Habitat Type (Hess and Alexander 1986)
- **>** *Juniperus scopulorum / Purshia tridentata* Habitat Type (Hess 1981)
- **>** *Juniperus scopulorum / Purshia tridentata* Habitat Type (Wasser and Hess 1982)
- **>** *Juniperus scopulorum/Artemisia tridentata* (Bourgeron and Engelking 1994)
- **>** *Juniperus scopulorum/Cercocarpus ledifolius* (Bourgeron and Engelking 1994)
- **<** *Juniperus scopulorum* Series (Johnston 1987)
- **<** *Juniperus scopulorum* Series (Hess 1981)
- **>** *Juniperus* / mountain mahogany woodland (Knight et al. 1987)
- **>** Utah Juniper - Curlleaf Mountain Mahogany Stand (Marriott and Jones 1989)

LOWER LEVEL UNITS

Associations:

- CEGL000743 *Juniperus scopulorum / Artemisia tridentata* Woodland
- CEGL000744 *Juniperus scopulorum - Cercocarpus ledifolius* Woodland
- CEGL000749 *Juniperus scopulorum / Purshia tridentata* Woodland
- CEGL005620 *Juniperus scopulorum / Artemisia tridentata ssp. wyomingensis* Woodland
- CEGL000734 *Juniperus osteosperma / Cercocarpus ledifolius* Woodland
- CEGL000745 *Juniperus scopulorum / Cercocarpus montanus* Woodland
- CEGL000742 *Juniperus scopulorum / Artemisia nova* Woodland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Badaracco 1971, Baker 1984a, Baker and Kennedy 1985, Bighorn Coal Mine n.d., Bourgeron and Engelking 1994, Brown 1971, Burns and Honkala 1990a, Caicco and Wellner 1983c, Cooper et al. 1995, DeVelice 1992, DeVelice and Lesica 1993, DeVelice et al. 1995, Despain 1973a, Faber-Langendoen et al. 2017b, Fischer and Bradley 1987, Hansen 1985, Hansen and Hoffman 1988,

Hansen et al. 1984, Hess 1981, Hess and Alexander 1986, Jennings 1978, Jennings 1979, Johnson and Pfister 1982, Johnston 1987, Jones 1989b, Kline 1973, Knight et al. 1987, Komarkova et al. 1988a, Lesica and DeVelice 1992, Marriott and Jones 1989, Moran 1981a, Ramaley 1909, Rust 1999, Steele et al. 1983, Strong 1980, Terwilliger et al. 1979a, Tiedemann et al. 1987, Warren n.d., Wasser and Hess 1982, Wells 1965, Wells 1970a, Wells 1970b, Wight 1965, Wight and Fisser 1968, Wright et al. 1979

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G209. Rocky Mountain Foothill-Rock Outcrop Limber Pine - Juniper Woodland

A3425. Pinus flexilis / Grass Understory Central Rocky Mountain Woodland Alliance

Type Concept Sentence: This foothill and outcrop woodland alliance occurs along the eastern slope of the central Rocky Mountains and adjacent Great Plains and is dominated by *Pinus flexilis* and may be codominated by *Juniperus scopulorum* or less commonly *Juniperus osteosperma* with an understory characterized by a moderately dense to low herbaceous cover, typically perennial grass.

OVERVIEW

Scientific Name: *Pinus flexilis* / Grass Understory Central Rocky Mountain Woodland Alliance
Common Name (Translated Scientific Name): Limber Pine / Grass Understory Central Rocky Mountain Woodland Alliance
Colloquial Name: Central Rocky Mountain Limber Pine / Grass Woodland

Type Concept: This foothill and outcrop woodland alliance occurs along the eastern slope of the central and northern Rocky Mountains and on escarpments in the northwestern Great Plains. Stands have an open canopy dominated by *Pinus flexilis* and may be codominated by *Juniperus scopulorum* or, less commonly, *Juniperus osteosperma*. The understory is characterized by moderately dense to low herbaceous cover, typically perennial grasses. If shrubs are present, then cover is low (<10%) and perennial grass cover exceeds shrub cover. The most common species are graminoids such as *Achnatherum hymenoides (= Oryzopsis hymenoides), Bouteloua gracilis, Calamagrostis purpurascens, Carex rossii, Festuca campestris, Festuca idahoensis, Koeleria macrantha, Leucopoa kingii (= Festuca kingii)*, and *Pseudoroegneria spicata*. Scattered forbs are typically present. Stands range from lower montane and foothill zones down to geographic breaks in the plains. Elevations range from 850-2400 m. Sites are typically xeric on exposed, windswept rocky slopes and ridges from montane to foothills and prairie breaks. These open woodlands occur on all aspects, but are most common on dry south- and west-facing slopes. Soils are typically shallow, skeletal and coarse-textured, such as gravelly, sandy loams or loams, but may include alkaline clays. The parent material is commonly limestone or sandstone. Exposed bedrock is common and many stands have over 50% bare soil. Although sites may be rocky, they usually have some soil development that supports moderate grass cover.

Classification Comments: *Pinus flexilis* is a widespread species and may be dominant in bristlecone pine groups such as Rocky Mountain Subalpine-Montane Limber Pine - Bristlecone Pine Woodland Group (G221) and Intermountain Basins Subalpine Limber Pine - Bristlecone Pine Woodland Group (G224), and may be present in many dry-mesic mixed montane forest and woodland groups.

Internal Comments: KAS 12-13: We need to review widespread limber pine associations and possibly split some of them in two if they occur in multiple groups. There is currently only one association attributed to this alliance, but there is likely more community diversity.
Other Comments:

Similar NVC Types:
- A0540 *Pinus flexilis* Rocky Mountain Woodland Alliance: is also dominated by *Pinus flexilis* with some associations with a grassy understory, but occurs in a different group at higher elevation]
- A3424 *Pinus flexilis* / Shrub Understory Central Rocky Mountain Woodland Alliance: occurs in the same group and the overstory is very similar, but understory is dominated by shrubs instead of grasses.

Diagnostic Characteristics: The alliance includes stands of patchy woodlands found on rock outcrops and escarpments at foothill elevations along the eastern Rocky Mountains Front Range out into the western Great Plains. Dominant and characteristic species are *Pinus flexilis, Juniperus osteosperma*, or *Juniperus scopulorum*. Perennial grasses characterize the understory with moderate to dense cover. Scattered shrubs may be present at lower cover than herbaceous layer. Diagnostic herbaceous understory species include *Pseudoroegneria spicata* and species more typical of the Great Plains species such as *Bouteloua gracilis, Koeleria macrantha*, or *Schizachyrium scoparium*.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has an open tree canopy that is typically to 3-10 m tall. The canopy is dominated by evergreen needle-leaved trees. A sparse to moderately dense herbaceous layer dominated by perennial graminoids

is present. Perennial forbs have sparse cover. Annual forbs and grasses may be seasonally present. If shrubs are present, then cover is low <10% and perennial grass cover exceeds shrub cover.

Floristics: This foothill and outcrop alliance occurs along the eastern slope of the central Rocky Mountains and adjacent Great Plains. Stands have an open canopy solely dominated or codominated by the evergreen needle-leaved tree *Pinus flexilis*, typically 3-10 m tall. Other trees species that may be present to codominant vary by geography and elevational zone throughout the woodland's range and include *Pinus ponderosa* or *Pseudotsuga menziesii* in the montane zone, and *Juniperus osteosperma* or *Juniperus scopulorum* in the lower montane transition to foothill zones and extends out on escarpments in the plains. *Pinus albicaulis, Pinus aristata, Pinus balfouriana*, and *Pinus longaeva* are not present. The understory is characterized by moderately dense to low herbaceous cover, typically perennial grasses. If shrubs are present, then cover is low (<10%) and perennial grass cover exceeds shrub cover. The most common species are graminoids such as *Achnatherum hymenoides (= Oryzopsis hymenoides), Bouteloua gracilis, Calamagrostis purpurascens, Carex rossii, Festuca campestris, Festuca idahoensis, Koeleria macrantha, Leucopoa kingii (= Festuca kingii)*, and *Pseudoroegneria spicata*. Scattered forbs may include species of *Achillea, Antennaria, Arenaria, Arnica, Astragalus, Erigeron, Eriogonum, Hymenopappus, Hymenoxys, Liatris, Sedum, Solidago*, and *Thermopsis*.

ENVIRONMENT & DYNAMICS

Environmental Description: Woodlands included in this alliance occur intermittently from lower montane and foothill zones throughout much of the Rocky Mountains, on escarpments and other geographic breaks in the northwestern Great Plains, and basins and plains in Wyoming. Elevations range from 850-2400 m. Sites are typically xeric on exposed, windswept rocky slopes and ridges from montane to foothills and prairie breaks. Some stands are on eroded substrates and resemble "badlands" while others may occur on lavaflows. These open woodlands occur on all aspects, but are most common on dry south- and west-facing slopes. Soils are typically shallow, skeletal and coarse-textured, such as gravelly, sandy loams or loams, but may include alkaline clays. The parent material is commonly limestone or sandstone. Exposed bedrock is common and many stands have over 50% bare soil. Although sites may be rocky, they usually have some soil development that supports moderate grass cover.

Adjacent montane stands are dominated by *Pinus ponderosa, Pinus contorta*, or *Pseudotsuga menziesii*. At lower elevations adjacent vegetation may include *Juniperus*-dominated woodlands and savannas; shrublands dominated by species of *Artemisia, Cercocarpus*, or *Purshia tridentata*; dry prairie; or riparian woodland dominated by *Pseudotsuga menziesii*. The transition can be abrupt or an extended ecotone where the woodlands grade into a savanna.

Dynamics: Although some of the conifers that are typically codominant in *Pinus flexilis* stands are late-successional species, they are not likely to displace *Pinus flexilis*. This is because most of these stands occur on harsh sites where *Pinus flexilis* is more competitive than most other conifer species. These stands are generally considered to be topographic or edaphic "climax'" stands (Cooper 1975, Eyre 1980). Even in stands at lower elevations, such as prairie breaks, it is unlikely that other coniferous species will become dominant (Eyre 1980). Because *Pinus flexilis* occurs over a broad range of elevations, it can also be important as a post-fire seral species on drier sites in the Rocky Mountains (Cooper 1975, Peet 1988). Peet (1978a) reported apparent competitive displacement with *Pinus flexilis* in Colorado. He noted that *Pinus flexilis* may dominate xeric sites from low to high elevations, except where *Pinus aristata* or *Pinus albicaulis* occur. There, *Pinus flexilis* is largely restricted to lower elevation, rocky sites. Peet (1978a) also reported that *Pinus flexilis* occurs in the less xeric *Pinus contorta* and *Pinus ponderosa* habitats.

DISTRIBUTION

Geographic Range: This alliance occurs in foothill and lower montane zones in the Rocky Mountains from southern Alberta and northern Montana south to northern Colorado and on escarpments across Wyoming extending out into the western Great Plains.

Nations: CA, US
States/Provinces: AB, CO, MT, SD, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** *Pinus flexilis / Agropyron spicatum* Habitat Type (Alexander 1985)
- **>** *Pinus flexilis / Agropyron spicatum* Habitat Type (Girard et al. 1989)
- **>** *Pinus flexilis / Agropyron spicatum* Habitat Type (Pfister et al. 1977)
- **>** *Pinus flexilis / Leucopoa kingii* Community (Jones 1992b)
- **>** *Pinus flexilis* Habitat Type (USFS 1992)
- **?** *Pinus flexilis* Habitat Type (Steele et al. 1983)

- **<** *Pinus flexilis* Series (Johnston 1987)
- **<** *Pinus flexilis* Series (Girard et al. 1989)

LOWER LEVEL UNITS

Associations:
- CEGL000813 *Pinus flexilis / Pseudoroegneria spicata* Woodland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Alexander 1985, Alexander 1986, Burns and Honkala 1990a, Cooper 1975, DeVelice 1992, DeVelice and Lesica 1993, DeVelice et al. 1986, Eyre 1980, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Girard et al. 1989, Hess 1981, Hess and Alexander 1986, Hoffman and Alexander 1980, Johnston 1987, Jones 1989b, Jones 1992b, Lanner and Vander Wall 1980, Lesica and DeVelice 1992, MTNHP unpubl. data, Mauk and Henderson 1984, Peet 1978a, Peet 1981, Peet 1988, Pfister et al. 1977, Steele et al. 1981, Steele et al. 1983, Terwilliger et al. 1979a, USFS 1992, Wasser and Hess 1982

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G209. Rocky Mountain Foothill-Rock Outcrop Limber Pine - Juniper Woodland

A3424. Pinus flexilis / Shrub Understory Central Rocky Mountain Woodland Alliance

Type Concept Sentence: This foothill and outcrop woodland alliance occurs along the eastern slope of the central Rocky Mountains and adjacent Great Plains. It is dominated by *Pinus flexilis* and may be codominated by *Juniperus scopulorum* or, less commonly, *Juniperus osteosperma* with an understory characterized by an open to moderately dense shrub layer. Herbaceous cover is typically low with less than cover than the shrubs.

OVERVIEW

Scientific Name: *Pinus flexilis* / Shrub Understory Central Rocky Mountain Woodland Alliance
Common Name (Translated Scientific Name): Limber Pine / Shrub Understory Central Rocky Mountain Woodland Alliance
Colloquial Name: Central Rocky Mountain Limber Pine / Shrub Woodland

Type Concept: This foothill and outcrop woodland alliance occurs along the eastern slope of the central and northern Rocky Mountains and on escarpments in the northwestern Great Plains. Stands have an open canopy dominated by *Pinus flexilis* and may be codominated by *Juniperus scopulorum* or, less commonly, *Juniperus osteosperma*. The understory typically has an open to moderately dense shrub layer (10-40% cover). Shrubs such as *Amelanchier utahensis, Artemisia tridentata, Cercocarpus montanus, Purshia tridentata*, and *Rhus trilobata* are common. Total shrub cover is typically >10%, but if less, then shrub cover exceeds herbaceous layer. The herbaceous layer is sparse to moderately dense and is composed primarily of graminoids such as *Achnatherum hymenoides (= Oryzopsis hymenoides), Bouteloua gracilis, Festuca campestris, Leucopoa kingii (= Festuca kingii), Koeleria macrantha*, and *Pseudoroegneria spicata*. Scattered forbs may be present. Stands occur intermittently from lower montane and foothill zones in the central and northern Rocky Mountains, and on geographic breaks in the northwestern Great Plains. Elevations range from 850-2400 m. Sites are typically xeric on exposed, windswept rocky slopes and ridges. Some stands are on eroded substrates and resemble "badlands" while others may occur on lavaflows. These open woodlands occur on all aspects, but are most common on dry south- and west-facing slopes. Soils are typically shallow, skeletal and coarse-textured, such as gravelly, sandy loams or loams, but may include alkaline clays. Exposed bedrock is common and many stands have over 50% bare soil.

Classification Comments: *Pinus flexilis* is a widespread species and may also be dominant in bristlecone pine-dominated groups such as Rocky Mountain Subalpine-Montane Limber Pine - Bristlecone Pine Woodland Group (G221) and Intermountain Basins Subalpine Limber Pine - Bristlecone Pine Woodland Group (G224), and is present in many mixed montane forest and woodland groups.

Internal Comments: KAS 12-13: We need to review widespread limber pine associations and possibly split some of them in two if they occur in multiple groups. There are currently four associations attributed to this alliance.
Other Comments:

Similar NVC Types:
- A0540 *Pinus flexilis* Rocky Mountain Woodland Alliance: is also dominated by *Pinus flexilis* with some associations with a shrub understory, but occurs in a different group at higher elevation.

- A3425 *Pinus flexilis* / Grass Understory Central Rocky Mountain Woodland Alliance: occurs in the same group and the overstory is very similar, but understory is dominated by grasses instead of shrubs.

Diagnostic Characteristics: The alliance includes stands of patchy woodlands found on rock outcrops and escarpments at foothill elevations along the eastern Rocky Mountains Front Range out into the western Great Plains. Dominant and characteristic species are *Pinus flexilis, Juniperus osteosperma*, or *Juniperus scopulorum*. Shrubs characterize the understory with low to moderately dense cover. This alliance includes stands with a sparse understory of scattered shrubs. Herbaceous cover is sparse to moderately dense, but has less cover than shrubs. Diagnostic species include widespread Interior West species such as *Artemisia tridentata, Cercocarpus ledifolius, Cercocarpus montanus, Ericameria nauseosa*, or *Purshia tridentata*.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has an open tree canopy that is typically to 3-10 m tall. The canopy is dominated by evergreen needle-leaved trees. A sparse to moderately dense short-shrub and/or dwarf-shrub layer is present. If present, both shrub layers may be dominated by broad-leaved or microphyllous deciduous shrubs. A sparse to moderately dense herbaceous layer dominated by perennial graminoids is often present. Perennial forbs have low cover. Annual forbs and grasses may be seasonally present.

Floristics: Stands have an open canopy dominated by *Pinus flexilis* typically 3-10 m tall and may be codominated by *Juniperus scopulorum* or, less commonly, *Juniperus osteosperma*. The understory typically has an open to moderately dense shrub layer (10-40% cover). Shrubs such as *Amelanchier utahensis, Artemisia tridentata, Cercocarpus montanus, Purshia tridentata*, and *Rhus trilobata* are common. Total shrub cover is typically >10%, but if less, then shrub cover exceeds herbaceous layer cover. The herbaceous layer is sparse to moderately dense and is composed primarily of graminoids such as *Achnatherum hymenoides (= Oryzopsis hymenoides), Bouteloua gracilis, Festuca campestris, Leucopoa kingii (= Festuca kingii), Koeleria macrantha*, and *Pseudoroegneria spicata*. Scattered forbs may include species of *Achillea, Antennaria, Arenaria, Arnica, Astragalus, Erigeron, Eriogonum, Hymenopappus, Hymenoxys, Liatris, Sedum, Solidago*, and *Thermopsis*. In six plots in the Little Missouri National Grassland in western North Dakota, the average cover for each of the strata was trees 38%, shrubs 21%, graminoids 20%, and forbs 9% (USFS 1992).

ENVIRONMENT & DYNAMICS

Environmental Description: Woodlands included in this alliance occur intermittently from lower montane and foothill zones in central and northern Rocky Mountains, and on geographic breaks in the northwestern Great Plains. Elevations range from 850-2400 m. Sites are typically xeric on exposed, windswept rocky slopes and ridges. Some stands are on eroded substrates and resemble "badlands" while others may occur on lavaflows. These open woodlands occur on all aspects, but are most common on dry south- and west-facing slopes. Soils are typically shallow, skeletal and coarse-textured, such as gravelly, sandy loams or loams, but may include alkaline clays. Exposed bedrock is common and many stands have over 50% bare soil.

Adjacent vegetation at high elevations includes lower montane stands that are dominated by *Pinus ponderosa* or *Pseudotsuga menziesii*. At lower elevations adjacent vegetation may include *Juniperus*-dominated woodlands and savannas; shrublands dominated by species of *Artemisia, Cercocarpus*, or *Purshia tridentata*; or dry prairie. The transition can be abrupt or an extended ecotone where patchy or open woodlands grade into a savanna and then prairie with scattered trees.

Dynamics: Although some of the conifers that are typically codominant in *Pinus flexilis* stands are late-successional species, they are not likely to displace *Pinus flexilis*. This is because most of these stands occur on harsh sites where *Pinus flexilis* is more competitive than most other conifer species. These stands are generally considered to be topographic or edaphic "climax" stands (Cooper 1975, Eyre 1980). Even in stands at lower elevations, such as prairie breaks, it is unlikely that other coniferous species will become dominant (Eyre 1980). Because *Pinus flexilis* occurs over a broad range of elevations, it can also be important as a post-fire seral species on drier sites in the Rocky Mountains (Cooper 1975, Peet 1988). Peet (1978a) reported apparent competitive displacement with *Pinus flexilis* in Colorado. He noted that *Pinus flexilis* may dominate xeric sites from low to high elevations, except where *Pinus aristata* or *Pinus albicaulis* occur. There, *Pinus flexilis* is largely restricted to lower elevation, rocky sites. Peet (1978a) also reported that *Pinus flexilis* occurs in the less xeric *Pinus contorta* and *Pinus ponderosa* habitats.

Birds and small mammals often eat and cache the large, wingless pine seeds. Most important is the Clark's nutcracker, which can transport the seeds long distances and cache them on exposed windswept sites (Lanner and Vander Wall 1980). This results in the regeneration of pines in clumps from forgotten caches (Eyre 1980, Steele et al. 1983).

DISTRIBUTION

Geographic Range: This alliance occurs in foothill and lower montane zones in the Rocky Mountains from southern Alberta and northern Montana south to northern Colorado and on escarpments across Wyoming extending out into the western Great Plains.

Nations: CA, US
States/Provinces: AB, CO, MT, SD, WY
TNC Ecoregions [optional]:

USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **>** *Pinus flexilis / Juniperus osteosperma* Community Type (DeVelice and Lesica 1993)
- **>** *Pinus flexilis / Juniperus scopulorum* Community Type (Lesica and DeVelice 1992)
- **>** *Pinus flexilis / Juniperus scopulorum* Community Type (DeVelice and Lesica 1993)
- **?** *Pinus flexilis* Habitat Type (Steele et al. 1983)
- **?** *Pinus flexilis* Habitat Type (USFS 1992)
- **?** *Pinus flexilis* Series (Johnston 1987)
- **?** *Pinus flexilis* Series (Girard et al. 1989)
- **>** Limber Pine / Antelope Bitterbrush (High Density Limber Pine) Vegetation Type (Day 1985)
- **>** Limber Pine / Antelope Bitterbrush (High Total Cover) Vegetation Type (Day 1985)
- **>** Limber Pine / Antelope Bitterbrush (Low Total Cover) Vegetation Type (Day 1985)

LOWER LEVEL UNITS

Associations:

- CEGL000809 *Pinus flexilis / Juniperus scopulorum* Woodland
- CEGL000814 *Pinus flexilis / Purshia tridentata* Woodland
- CEGL005320 *Pinus flexilis / Cercocarpus montanus - Amelanchier utahensis* Woodland
- CEGL005603 *Pinus flexilis / Chamaebatiaria millefolium / Poa secunda* Open Woodland
- CEGL000808 *Pinus flexilis / Juniperus osteosperma* Woodland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Alexander 1985, Alexander 1986, Burns and Honkala 1990a, Cooper 1975, Day 1985, DeVelice 1992, DeVelice and Lesica 1993, Eyre 1980, Faber-Langendoen et al. 2017b, Girard et al. 1989, Hess 1981, Hess and Alexander 1986, Hoffman and Alexander 1980, Holland 1986b, Johnston 1987, Jones 1989b, Lanner and Vander Wall 1980, Lesica and DeVelice 1992, MTNHP unpubl. data, Mauk and Henderson 1984, Peet 1978a, Peet 1981, Peet 1988, Pfister et al. 1977, Steele et al. 1981, Steele et al. 1983, Terwilliger et al. 1979a, USFS 1992, Wasser and Hess 1982

M020. Rocky Mountain Subalpine-High Montane Conifer Forest

This is a diverse macrogroup of high montane and subalpine forests and woodland found throughout the mountainous regions of the western U.S. and southwestern Canada.

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
1.B.2.Nb.5.a. M020 Rocky Mountain Subalpine-High Montane Conifer Forest

G220. Rocky Mountain Lodgepole Pine Forest & Woodland

Type Concept Sentence: This group occupies upper montane and subalpine elevations of the Rocky Mountains, and is dominated by *Pinus contorta* with shrub, grass, or barren understories, typically on well-drained, gravelly, coarse-textured, and acidic parent materials.

OVERVIEW

Scientific Name: *Pinus contorta* Rocky Mountain Forest & Woodland Group
Common Name (Translated Scientific Name): Lodgepole Pine Rocky Mountain Forest & Woodland Group
Colloquial Name: Rocky Mountain Lodgepole Pine - Aspen Forest

Type Concept: This group occupies upper montane to subalpine elevations of the Rocky Mountains, north into the Canadian Rockies and east into mountain "islands" of north-central Montana. Parent materials are typically well-drained, gravelly, coarse-textured, acidic, and are rarely formed from calcareous parent materials. Other stands occur over excessively well-drained pumice deposits,

glacial till and alluvium on valley floors where there is cold-air accumulation, warm and droughty shallow soils over fractured quartzite bedrock, and shallow moisture-deficient soils with a significant component of volcanic ash. In these conditions where other conifers cannot become established, stands of *Pinus contorta* may persist for longer periods. These forests are dominated by *Pinus contorta* with shrub, grass, or barren understories. Sometimes there are intermingled mixed conifer/*Populus tremuloides* stands, with the latter occurring with inclusions of deeper, typically fine-textured soils. The shrub stratum may be conspicuous to absent; common species include *Arctostaphylos uva-ursi, Artemisia tridentata, Juniperus communis, Ceanothus velutinus, Linnaea borealis, Mahonia repens, Purshia tridentata, Spiraea betulifolia, Spiraea douglasii, Shepherdia canadensis, Vaccinium scoparium, Vaccinium cespitosum, Vaccinium membranaceum, Symphoricarpos albus*, and *Ribes* spp. Common herbaceous species include *Festuca idahoensis, Elymus elymoides, Calamagrostis rubescens, Carex geyeri, Carex pensylvanica*, and *Carex rossii*.

Classification Comments: The higher elevation *Pinus contorta* forests of the southern Cascades in Oregon are included in Sierra-Cascade Cold-Dry Subalpine Woodland Group (G243), corresponding to the distribution of *Pinus contorta var. murrayana*. In the mountains of British Columbia and western Alberta, this group transitions to a yet-to-be described boreal lodgepole group, as well as to a boreal mesic mixed conifer-hardwood group, where lodgepole mixes with boreal species such as *Picea glauca* and *Picea mariana*.

Similar NVC Types:
- G218 Rocky Mountain Subalpine Moist Spruce - Fir Forest & Woodland
- G219 Rocky Mountain Subalpine Dry-Mesic Spruce - Fir Forest & Woodland
- G243 Sierra-Cascade Cold-Dry Subalpine Woodland

Diagnostic Characteristics: This group is characterized by needle-leaved evergreen trees, strongly dominated by *Pinus contorta* and may include smaller inclusions of *Populus tremuloides*. Understory growth forms may be conspicuous to absent, shrub- or graminoid-dominated.

VEGETATION

Physiognomy and Structure: These forests and woodlands occur most frequently as dense, even-aged, early- to mid-successional stands, or less often as uneven-aged, later-successional stands where other conifers cannot become established. The understory varies from a conspicuous or sparse layer of shrubs or grasses to nearly barren substrate.

Floristics: *Pinus contorta* is the overwhelming canopy dominant often forming dense stands. Other conifers such as spruce and fir may become established. *Populus tremuloides* can occur as a seral component or in mixed stands with the lodgepole. The understory varies and may be conspicuous to absent and dominated by shrubs or graminoids. Common shrubs include *Arctostaphylos uva-ursi, Arctostaphylos nevadensis, Artemisia tridentata, Juniperus communis, Ceanothus velutinus, Linnaea borealis, Mahonia repens, Purshia tridentata, Spiraea betulifolia, Spiraea douglasii, Shepherdia canadensis, Vaccinium scoparium, Vaccinium cespitosum, Vaccinium membranaceum, Menziesia ferruginea, Symphoricarpos albus*, and *Ribes* spp. Common herbaceous species include *Osmorhiza berteroi, Thalictrum occidentale, Thalictrum fendleri, Xerophyllum tenax, Clintonia uniflora, Carex inops ssp. inops, Arnica cordifolia, Festuca idahoensis, Elymus elymoides, Calamagrostis rubescens, Carex geyeri, Carex pensylvanica*, and *Carex rossii*.

ENVIRONMENT & DYNAMICS

Environmental Description: This group occupies upper montane to subalpine elevations of the Rocky Mountains, north into the Canadian Rockies and east into mountain "islands" of north-central Montana. Elevations range from just over 900 m in the northeastern Cascades to well over 3100 m in the Uinta Mountains in Utah and the southern Colorado Rockies.

Climate: Temperature regimes are extreme throughout this region and frequent growing season frosts occur. Annual precipitation in these montane and subalpine habitats ranges from less than 40 cm to over 150 cm, usually with the majority falling as snow. Late-melting snowpacks provide the majority of growing season moisture.

Soil/substrate/hydrology: Stands typically occur over well-drained, gravelly, coarse-textured, acidic, and rarely formed from calcareous parent materials occasionally with inclusions of deeper, typically fine-textured soils. Other stands occur over excessively well-drained pumice deposits, glacial till and alluvium on valley floors where there is cold-air accumulation, warm and droughty shallow soils over fractured quartzite bedrock, and shallow moisture-deficient soils with a significant component of volcanic ash.

Dynamics: *Pinus contorta* is an aggressively colonizing, shade-intolerant conifer which usually occurs in lower subalpine forests in the major ranges of the western United States. Establishment is episodic and linked to stand-replacing disturbances, primarily fire. The incidence of serotinous cones varies within and between varieties of *Pinus contorta*, being most prevalent in Rocky Mountain populations. Closed, serotinous cones appear to be strongly favored by fire, and allow rapid colonization of fire-cleared substrates (Burns and Honkala 1990a). Hoffman and Alexander (1980, 1983) report that in stands where *Pinus contorta* exhibits a multi-aged population structure, with regeneration occurring, there is typically a higher proportion of trees bearing nonserotinous cones. The

dominance of *Pinus contorta* in associations in this group is related to fire history and topo-edaphic conditions (Pfister et al. 1977, Hoffman and Alexander 1980, Steele et al. 1981, Mauk and Henderson 1984). Following stand-replacing fires, *Pinus contorta* will rapidly colonize and develop into dense stands of even-aged trees. These stands, while frequently persistent for more than 100 years, may succeed to spruce-fir forests or woodlands. Most (but not all) forests in this group are early- to mid-successional forests which developed following fires.

Some *Pinus contorta* forest associations occur, and will persist, on sites that are too extreme for other conifers to establish. These include excessively well-drained pumice deposits (Volland 1976), glacial till and alluvium on valley floors where there is cold-air accumulation (Steele et al. 1981), warm and droughty shallow soils over fractured quartzite bedrock (Mauk and Henderson 1984), well-drained to xeric stabilized sand dunes (Jenny et al. 1969, Kumler 1969), and shallow moisture-deficient soils with a significant component of volcanic ash (Cooper et al. 1987). Some *Pinus contorta* forests can be persistent for hundreds of years, a result of a lack of seed source or the competitive exclusion of other conifer species (Moir 1969a, Pfister et al. 1977, Despain 1973b, Hoffman and Alexander 1983, Cooper et al. 1987), or the frost tolerance of *Pinus contorta* seedlings and mature trees, which allows the development of monotypic stands in frost-prone areas (Steele et al. 1981, Burns and Honkala 1990a).

DISTRIBUTION

Geographic Range: This group occurs at upper montane to subalpine elevations of the Rocky Mountains, from Colorado north into the Canadian Rockies, west across Idaho into the eastern Cascades in Washington, the Blue Mountains in Oregon, and east onto mountain "islands" of north-central Montana.

Spatial Scale & Pattern [optional]: Matrix, Large patch
Nations: CA, US
States/Provinces: AB, BC, CA?, CO, ID, MT, NV, OR, UT, WA, WY
TNC Ecoregions [optional]: 3:C, 7:C, 8:C, 9:C, 18:C, 20:C, 26:C, 68:C
USFS Ecoregions (2007): 331A:CC, 331G:CC, 331J:CC, 331K:C?, 342A:CC, 342B:C?, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:CC, 342J:CC, M242C:CC, M242D:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CP, M331G:CP, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M341B:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low. USNVC Confidence from peer reviewer, not AE.

SYNONYMY

- **<** LP Lodgepole pine, Interior Cedar Hemlock and Interior Douglas-fir zones (Ecosystems Working Group 1998)
- **<** Lodgepole Pine: 218 (Eyre 1980)
- **<** Montane Seral Forests (Peet 2000)
- **><** Pl - Huckleberry - Cladonia (ESSFwc2/02) (Lloyd et al. 1990)
- **><** Pl - Huckleberry - Knight's plume (SBSmw/11) (Steen and Coupé 1997)
- **><** Pl - Huckleberry - Velvet-leaved blueberry (SBSmw/03) (Steen and Coupé 1997)
- **><** Pl - Juniper - Dwarf blueberry (SBSmc3/02) (DeLong et al. 1993)
- **><** Pl - Juniper - Dwarf blueberry (SBSmc3/02) (Steen and Coupé 1997)
- **><** Pl - Juniper - Ricegrass (SBSdk/02) (DeLong et al. 1993)
- **><** Pl - Juniper - Ricegrass (SBSdk/02) (Steen and Coupé 1997)
- **><** Pl - Juniper - Ricegrass (SBSdk/02) (Banner et al. 1993)
- **><** Pl - Velvet-leaved blueberry - Cladonia (SBSdh1/02) (DeLong 1996)
- **><** PlBl - Soopolallie - Kinnikinnick (MSdc2/04) (Steen and Coupé 1997)

LOWER LEVEL UNITS

Alliances:

- A0424 *Pinus contorta - Populus tremuloides* Rocky Mountain Forest Alliance
- A4079 *Pinus contorta* Rocky Mountain Woodland Alliance
- A3366 *Pinus contorta* Rocky Mountain Forest Alliance

AUTHORSHIP

Primary Concept Source: D.G. Despain (1973b)
Author of Description: M.E. Hall
Acknowledgments: D. Tart
Version Date: 05/30/2013
Classif Resp Region: West
Internal Author: MEH 2-10, 5-13, mod. GK 12-15

REFERENCES

References: Alexander 1986, Arno et al. 1985, Banner et al. 1993, Burns and Honkala 1990a, Cooper et al. 1987, DeLong 1996, DeLong et al. 1993, Despain 1973a, Despain 1973b, Ecosystems Working Group 1998, Eyre 1980, Faber-Langendoen et al. 2017a, Hess and Alexander 1986, Hess and Wasser 1982, Hoffman and Alexander 1976, Hoffman and Alexander 1980, Hoffman and Alexander 1983, Jenny et al. 1969, Johnson and Clausnitzer 1992, Johnston 1997, Kumler 1969, Lloyd et al. 1990, Mauk and Henderson 1984, Mehl 1992, Meidinger and Pojar 1991, Moir 1969a, Peet 2000, Pfister et al. 1977, Steele et al. 1981, Steen and Coupé 1997, Volland 1976, Whipple 1975, Williams and Smith 1990

1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G220. Rocky Mountain Lodgepole Pine Forest & Woodland

A0424. Pinus contorta - Populus tremuloides Rocky Mountain Forest Alliance

Type Concept Sentence: This mixed evergreen-deciduous forest alliance is codominated by *Pinus contorta* and *Populus tremuloides* and has been described on mountain slopes and plateaus in Utah, Idaho, Colorado and Wyoming.

OVERVIEW

Scientific Name: *Pinus contorta - Populus tremuloides* Rocky Mountain Forest Alliance
Common Name (Translated Scientific Name): Lodgepole Pine - Quaking Aspen Rocky Mountain Forest Alliance
Colloquial Name: Rocky Mountain Lodgepole Pine - Aspen Forest

Type Concept: This mixed evergreen-deciduous forest alliance has been described on mountain slopes and plateaus in Utah, Colorado and Wyoming. Seral forests included in this alliance are characterized by an open to moderately closed, mixed evergreen-deciduous tree canopy that is codominated by *Populus tremuloides* and *Pinus contorta*. Several other species of conifers may be scattered within the stands, including *Abies lasiocarpa, Picea engelmannii, Picea pungens, Pinus flexilis*, and Pseudotsuga menziesii. Younger stands typically have dense *Populus tremuloides* with *Pinus contorta* mixed in. As stands age, *Populus tremuloides* cover is slowly reduced until *Pinus contorta* becomes dominant. The understory is moderately dense to sparse and becomes sparser as *Pinus contorta* becomes more dominant. The short-shrub layer is often dominated by *Juniperus communis* or *Symphoricarpos oreophilus*. Other shrubs may include *Arctostaphylos uva-ursi, Artemisia tridentata, Mahonia repens, Paxistima myrsinites, Rosa woodsii, Shepherdia canadensis*, and *Symphoricarpos albus*. Scattered tall shrubs *Amelanchier alnifolia* and *Prunus virginiana* may be present. The relatively sparse herbaceous layer is a mixture of graminoids and forbs and is often dominated by *Calamagrostis rubescens, Carex geyeri, Lathyrus lanszwertii*, or *Thalictrum fendleri*. Other common graminoids include *Achnatherum occidentale (= Stipa occidentalis), Bromus carinatus, Carex rossii, Elymus glaucus*, and *Elymus trachycaulus*. Forbs, such as *Achillea millefolium, Arnica cordifolia, Balsamorhiza* spp., *Fragaria vesca, Geranium* spp., *Lupinus argenteus, Osmorhiza berteroi (= Osmorhiza chilensis)*, and *Potentilla* spp., may be present. The exotic species *Poa pratensis* and *Taraxacum officinale* are common in livestock-impacted stands. Sites occur on gentle to steep slopes on all aspects. Soils are derived from alluvium and colluvium.

Classification Comments: This alliance is included in this group because disturbed stands may have significant cover of *Populus tremuloides*. However, conifers are always dominant.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Mixed deciduous-evergreen seral forests ultimately dominated by *Pinus contorta*, but in younger stands codominated by *Populus tremuloides*.

VEGETATION

Physiognomy and Structure: Vegetation included in this minor alliance has a moderately dense to dense upper canopy of mixed deciduous broad-leaved and evergreen needle-leaved trees (5-20 m tall). The understory has a moderate to sparse short-shrub layer, typically dominated by an evergreen, scale-leaved or deciduous broad-leaved shrub species. A sparse tall-shrub layer dominated by deciduous broad-leaved shrubs may be present. A moderate to sparse herbaceous layer may also be present, dominated by perennial forbs or graminoids.

Floristics: The open to moderately closed, mixed evergreen needle-leaved and deciduous broad-leaved tree canopy is composed of short to moderately tall trees, and is codominated by *Pinus contorta* and *Populus tremuloides*. Several other species of conifers may be scattered within the stands, including *Abies lasiocarpa, Pinus flexilis, Picea engelmannii, Picea pungens*, and *Pseudotsuga menziesii*. Younger stands typically have dense *Populus tremuloides* with *Pinus contorta* mixed in. As the stands age, *Populus tremuloides* cover is slowly reduced until *Pinus contorta* becomes dominant (Mueggler 1988). The understory is typically moderately

dense to sparse and becomes sparser as *Pinus contorta* becomes more dominant. The short-shrub layer is often dominated by *Juniperus communis* or *Symphoricarpos oreophilus*. Other shrubs may include *Arctostaphylos uva-ursi, Artemisia tridentata, Mahonia repens, Paxistima myrsinites, Rosa woodsii, Shepherdia canadensis*, and *Symphoricarpos albus*. The tall-shrub layer consists of scattered *Amelanchier alnifolia* and *Prunus virginiana*. The relatively sparse herbaceous layer is a mixture of graminoids and forbs and is often dominated by *Calamagrostis rubescens, Carex geyeri, Lathyrus lanszwertii*, or *Thalictrum fendleri*. Other common graminoids include Achnatherum occidentale (= Stipa occidentalis), Bromus carinatus, Carex rossii, Elymus glaucus, and *Elymus trachycaulus*. Forbs include *Achillea millefolium, Arnica cordifolia, Balsamorhiza* spp., *Fragaria vesca, Geranium* spp., *Lupinus argenteus, Osmorhiza berteroi (= Osmorhiza chilensis)*, and *Potentilla* spp. The exotic species *Poa pratensis* and *Taraxacum officinale* are common in livestock-impacted stands (Mueggler 1988). Annuals are typically uncommon.

ENVIRONMENT & DYNAMICS

Environmental Description: Elevations range above 1700-3000 m. Climate is temperate with cold winters. Mean annual precipitation is greater than 38 cm and typically greater than 50 cm. Sites occur on gentle to steep slopes on all aspects. Soils are derived from alluvium and colluvium from sedimentary, metamorphic and igneous parent materials. However, stands are found mainly on sandstone and quartzite.

Dynamics: Both *Pinus contorta* and *Populus tremuloides* are thin-barked and readily killed by fire, and both are fire-adapted species that generally need disturbance to establish and maintain dominance in a forest. These mixed forests are seral and, in the absence of stand-replacing disturbance such as fire, will slowly convert to a *Pinus contorta*-dominated forest and then eventually to a *Picea engelmannii - Abies lasiocarpa*-dominated forest if subalpine or a *Pseudotsuga menziesii*-dominated forest if montane (Mueggler 1988). Most of the stands sampled by Mueggler (1988) had a history of livestock grazing as evidenced by relative abundance of the exotic plants *Taraxacum officinale* and *Poa pratensis* and the scarcity of grazing-susceptible plants (Mueggler 1988).

DISTRIBUTION

Geographic Range: Forests included in this alliance are scattered in the mountains and plateaus of Utah, Wyoming, and Idaho, and may occur elsewhere in the western United States where both *Populus tremuloides* and *Pinus contorta* are common.

Nations: US
States/Provinces: CO, ID, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **><** Aspen: 217 (Eyre 1980)
- **><** Lodgepole Pine: 218 (Eyre 1980)

LOWER LEVEL UNITS

Associations:
- CEGL000537 *Populus tremuloides - Pinus contorta / Juniperus communis* Forest
- CEGL000536 *Populus tremuloides - Pinus contorta / Carex geyeri - Calamagrostis rubescens* Forest
- CEGL000538 *Populus tremuloides - Pinus contorta / Symphoricarpos oreophilus* Forest
- CEGL000539 *Populus tremuloides - Pinus contorta / Thalictrum fendleri* Forest

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Eyre 1980, Faber-Langendoen et al. 2017b, Mueggler 1988

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G220. Rocky Mountain Lodgepole Pine Forest & Woodland

A3366. Pinus contorta Rocky Mountain Forest Alliance

Type Concept Sentence: This alliance is characterized by forests dominated by *Pinus contorta* and occurs in the upper montane and subalpine zones of the Rocky Mountains and the eastern Cascade Range.

OVERVIEW

Scientific Name: *Pinus contorta* Rocky Mountain Forest Alliance
Common Name (Translated Scientific Name): Lodgepole Pine Rocky Mountain Forest Alliance
Colloquial Name: Rocky Mountain-East Cascadian Lodgepole Pine Forest

Type Concept: This alliance is found in the upper montane and subalpine zones of southern Rocky Mountains, north to the Canadian Rocky Mountains and west into the Cascade Range. Forests included in this alliance are characterized by a closed to open tree canopy that is dominated by the conifer *Pinus contorta*. Stands may be even-aged or multi-aged depending on geographic location, edaphic characteristics, and how the stands were established following wildfire. Shrub and herbaceous layers may be present or absent depending on tree canopy. Other tree species such as *Abies lasiocarpa, Picea engelmannii, Pinus albicaulis, Pinus flexilis, Populus tremuloides, Pseudotsuga menziesii, Tsuga heterophylla*, or *Tsuga mertensiana* may be present to abundant as seedlings and saplings. On warmer sites, *Abies grandis, Thuja plicata*, and *Tsuga heterophylla* may be also present. Associated shrub and herbaceous species vary across the range of this alliance. Common subalpine and montane shrub species include *Arctostaphylos nevadensis, Arctostaphylos patula, Arctostaphylos uva-ursi, Ceanothus velutinus, Linnaea borealis, Mahonia repens, Purshia tridentata, Ribes* spp., *Spiraea betulifolia, Spiraea douglasii, Shepherdia canadensis, Symphoricarpos albus, Vaccinium cespitosum, Vaccinium membranaceum*, and *Vaccinium scoparium*. Herbaceous cover is very sparse. The cover of the herbaceous stratum can be dominated by either graminoids or perennial forbs and tends to vary inversely with shrub cover. Important graminoids include *Achnatherum occidentale (= Stipa occidentalis), Carex pensylvanica, Carex geyeri, Carex rossii, Calamagrostis rubescens, Danthonia californica*, and *Elymus glaucus*. Important forbs are *Arnica cordifolia, Chimaphila umbellata, Orthilia secunda, Osmorhiza berteroi (= Osmorhiza chilensis), Pedicularis racemosa, Thalictrum* spp., and *Xerophyllum tenax*. Elevations range from just over 900 m in the eastern Cascades to well over 3100 m in the Rocky Mountains. This alliance occurs in a broad array of habitats.

Classification Comments: This alliance is derived from a series concept, in which associations are distinguished by the dominance of *Pinus contorta* in the tree canopy and the near total lack of regeneration of other conifers. In the habitat-typing classification system, stands dominated by *Pinus contorta* but with significant regeneration of other conifers, such as *Abies grandis, Abies lasiocarpa, Picea engelmannii, Pseudotsuga menziesii, Thuja plicata*, or *Tsuga heterophylla*, have typically been placed into series named for those conifers. There are undoubtedly several to many associations which should be placed in this alliance, but which have been classified as belonging to other series because of the lack of regeneration of *Pinus contorta*. Future work will need to review this issue and identify additional associations belonging to this alliance.

Internal Comments:
Other Comments:

Similar NVC Types:
- A4079 *Pinus contorta* Rocky Mountain Woodland Alliance: has more open canopies (<60% total cover).

Diagnostic Characteristics: Forests of the Rocky Mountains and eastern Cascades with canopies primarily dominated by *Pinus contorta*. Canopy cover is typically dense, and understories are variable depending on substrate and density of the canopy. Diagnostic of this upland forest alliance is the dominance of *Pinus contorta* in the tree canopy without significant regeneration of *Abies lasiocarpa* or similar shade-tolerant species.

VEGETATION

Physiognomy and Structure: These are closed-canopy (>60% cover), densely stocked stands of needle-leaved evergreen trees from 10-30 m in height. Stands can be so dense that little light penetrates the tree canopy, and understory vegetation is sparse or absent. In younger stands, the tree canopy often has a structure of same-size and even-aged classes. In older stands, there may be a taller, older, larger size class, with a relatively dense shorter tree layer composed of saplings and pole-sized conifers, often of different species than the older trees. Where densities are lower, or where canopy gaps occur, ericaceous or cold-deciduous shrubs may be locally abundant. The herbaceous layer is typically sparse and can be dominated by either shade-tolerant forbs, grasses or sedges.

Floristics: *Pinus contorta* is almost always the only mature tree in stands of this alliance, but other conifers are occasionally present. In some stands, species such as *Abies grandis, Abies lasiocarpa, Picea engelmannii, Pseudotsuga menziesii*, or Tsuga mertensiana may be present to abundant as seedlings and saplings. On warmer sites *Abies grandis, Thuja plicata*, and *Tsuga heterophylla* may be also present. In the eastern Cascades, northern Utah, and Rocky Mountains, *Pinus contorta* forests occupy large areas in the upper montane to lower subalpine elevation zones. Stand structure can vary from dense "dog-hair" stands established following wildfire, to a more multi-aged structure with widely spaced large older trees and a subcanopy of younger *Pinus contorta*. The dominance of

Pinus contorta may be maintained in some of these stands by recurring surface fires that kill seedlings and saplings of other shade-tolerant conifers but allow reproduction of *Pinus contorta* (Pfister et al. 1977, Chappell et al. 1997). The shrub stratum may be conspicuous to absent depending upon canopy closure and soil moisture, but where shrubs are present, common species include *Arctostaphylos nevadensis, Arctostaphylos patula, Arctostaphylos uva-ursi, Ceanothus velutinus, Linnaea borealis, Mahonia repens, Purshia tridentata, Ribes* spp., *Spiraea betulifolia, Spiraea douglasii, Shepherdia canadensis, Symphoricarpos albus, Vaccinium cespitosum, Vaccinium membranaceum*, and *Vaccinium scoparium*. The cover of the herbaceous stratum tends to vary inversely with shrub cover. Where there is a significant herbaceous layer, it can be dominated by either graminoids or perennial forbs. Important graminoids include *Achnatherum occidentale (= Stipa occidentalis), Calamagrostis rubescens, Carex geyeri, Carex pensylvanica, Carex rossii, Danthonia californica*, or *Elymus glaucus*. Important forbs are *Arnica cordifolia, Chimaphila umbellata, Orthilia secunda, Osmorhiza berteroi (= Osmorhiza chilensis), Pedicularis racemosa, Thalictrum* spp., and *Xerophyllum tenax*.

ENVIRONMENT & DYNAMICS

Environmental Description: *Pinus contorta* occupies the broadest array of habitats of any coniferous species in the western United States, and forests dominated by this species occur in widely varying ecological settings. This includes upland plant associations found in the montane and subalpine zone of the Rocky Mountains and eastern Cascades. Elevations range from just over 900 m in the Cascades to well over 3100 m in the Rockies. Temperature regimes are extreme throughout this region and frequent growing-season frosts occur. Annual precipitation in these montane and subalpine habitats ranges from less than 40 cm to over 150 cm, usually with the majority falling as snow. Late-melting snowpacks provide the majority of growing-season moisture, particularly in the Cascades. The dominance of *Pinus contorta* in associations in this alliance is related to fire history and topo-edaphic conditions (Pfister et al. 1977, Hoffman and Alexander 1980, Steele et al. 1981, Mauk and Henderson 1984). Following stand-replacing fires, *Pinus contorta* will rapidly colonize and develop into dense stands of even-aged trees. Over time, many of these stands can succeed to dominance by other more shade-tolerant conifer species. Most forests in this alliance are early- to mid-successional forests which developed following fires.

Some *Pinus contorta* forest associations occur, and will persist, on sites that are too extreme for other conifers to establish. These include excessively well-drained pumice deposits (Volland 1976), glacial till and alluvium on valley floors where there is cold air accumulation (Steele et al. 1981), warm and droughty shallow soils over fractured quartzite bedrock (Mauk and Henderson 1984), well-drained to xeric stabilized sand dunes (Jenny et al. 1969, Kumler 1969), and shallow moisture-deficient soils with a significant component of volcanic ash (Cooper et al. 1987). Some *Pinus contorta* forests can be persistent for hundreds of years, a result of a lack of seed source or the competitive exclusion of other conifer species (Moir 1969a, Pfister et al. 1977, Despain 1983, Hoffman and Alexander 1983, Cooper et al. 1987), or the frost tolerance of *Pinus contorta* seedlings and mature trees, which allows the development of monotypic stands in frost-prone areas (Steele et al. 1981, Burns and Honkala 1990a). Soils supporting these forests are typically well-drained, gravelly, and have textures ranging from silty to sands and gravels. They are acidic and rarely are formed from calcareous parent materials.

Dynamics: *Pinus contorta* is aggressively colonizing and shade-intolerant. Establishment is episodic and linked to stand-replacing disturbances, primarily fire. The incidence of serotinous cones varies within and among varieties of *Pinus contorta*, being most prevalent in Rocky Mountain populations. Closed, serotinous cones appear to be strongly favored by fire and allow rapid colonization of fire-cleared substrates (Burns and Honkala 1990a). Hoffman and Alexander (1980, 1983) report that in stands where *Pinus contorta* exhibits a multi-aged population structure, with regeneration occurring, there is typically a higher proportion of trees bearing nonserotinous cones. Chappell et al. (1997) report that where these forests are found on pumice, *Pinus contorta* dominance is maintained by periodic disturbance from both fires and insect infestations. Without fires and insects, stands will become dense forests and quite barren. Unlike most *Pinus contorta* forests, most of these stands are not seral to another tree species (Chappell et al. 1997). Fire is infrequent in coastal stands, but shifting sand substrates and wind-borne salt spray act to discourage competition and provide suitable conditions for perpetuation of *Pinus contorta* (Jenny et al. 1969, Kumler 1969, Chappell et al. 1997).

DISTRIBUTION

Geographic Range: These forests occur from the southern Rocky Mountains north to the Canadian Rocky Mountains, east to the Big Horn Mountains of Wyoming and west to the eastern Cascade Range of Washington and Oregon.

Nations: CA, US
States/Provinces: AB, BC, CA?, CO, ID, MT, NM, NV?, OR, UT, WA, WY, YT
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** Lodgepole Pine Series (Sawyer and Keeler-Wolf 1995)
- **><** Lodgepole Pine: 218 (Eyre 1980)

LOWER LEVEL UNITS

Associations:

- CEGL000143 *Pinus contorta / Carex pensylvanica* Forest
- CEGL000163 *Pinus contorta / Shepherdia canadensis* Forest
- CEGL000133 *Pinus contorta / Arctostaphylos nevadensis* Forest
- CEGL000135 *Pinus contorta / Arnica cordifolia* Forest
- CEGL000175 *Pinus contorta / Xerophyllum tenax* Forest
- CEGL000141 *Pinus contorta / Carex geyeri* Forest
- CEGL000172 *Pinus contorta / Vaccinium scoparium* Forest
- CEGL000154 *Pinus contorta / Mahonia repens* Forest
- CEGL000168 *Pinus contorta / Vaccinium cespitosum* Forest
- CEGL000144 *Pinus contorta / Carex rossii* Forest
- CEGL000153 *Pinus contorta / Linnaea borealis* Forest
- CEGL002604 *Pinus contorta / Spiraea douglasii* Forest
- CEGL000146 *Pinus contorta / Danthonia californica* Forest
- CEGL005933 *Pinus contorta / Jamesia americana* Forest
- CEGL005935 *Pinus contorta / Vaccinium myrtillus* Forest
- CEGL000156 *Pinus contorta / Pedicularis racemosa* Forest
- CEGL000164 *Pinus contorta / Spiraea betulifolia* Forest
- CEGL000145 *Pinus contorta / Ceanothus velutinus* Forest
- CEGL000139 *Pinus contorta / Calamagrostis rubescens* Forest
- CEGL000174 *Pinus contorta / Vaccinium scoparium / Calamagrostis rubescens* Forest
- CEGL000170 *Pinus contorta / Vaccinium membranaceum* Forest
- CEGL000159 *Pinus contorta / Purshia tridentata / Carex pensylvanica* Forest
- CEGL000166 *Pinus contorta / Symphoricarpos albus* Forest
- CEGL000169 *Pinus contorta / Vaccinium membranaceum* Rocky Mountain Forest
- CEGL000155 *Pinus contorta / Osmorhiza berteroi* Forest
- CEGL000173 *Pinus contorta var. latifolia / Vaccinium scoparium / Carex inops ssp. inops* Forest
- CEGL000134 *Pinus contorta / Arctostaphylos uva-ursi* Forest
- CEGL002731 *Pinus contorta - Picea mariana / Vaccinium vitis-idaea / Pleurozium schreberi* Forest
- CEGL002733 *Pinus contorta / Vaccinium vitis-idaea - Arctostaphylos uva-ursi / Pleurozium schreberi* - (*Cladina* spp.) Forest
- CEGL005928 *Pinus contorta / Menziesia ferruginea* Forest
- CEGL005913 *Pinus contorta / Vaccinium membranaceum / Xerophyllum tenax* Forest
- CEGL005923 *Pinus contorta / Vaccinium cespitosum / Clintonia uniflora* Forest
- CEGL005916 *Pinus contorta / Clintonia uniflora* Forest
- CEGL005924 *Pinus contorta / Vaccinium scoparium / Xerophyllum tenax* Forest
- CEGL005922 *Pinus contorta / Menziesia ferruginea / Clintonia uniflora* Forest
- CEGL000167 *Pinus contorta / Thalictrum occidentale* Forest

AUTHORSHIP

Primary Concept Source: F.H. Eyre (1980)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Barrows et al. 1977, Burns and Honkala 1990a, Chappell et al. 1997, Cooper et al. 1987, Despain 1973b, Despain 1983, Eyre 1980, Faber-Langendoen et al. 2017b, Harrington 1978, Hoffman and Alexander 1980, Hoffman and Alexander 1983, Jenny et al. 1969, Kumler 1969, Mauk and Henderson 1984, Moir 1969a, Pfister et al. 1977, Sawyer and Keeler-Wolf 1995, Steele et al. 1981, Volland 1976

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G220. Rocky Mountain Lodgepole Pine Forest & Woodland

A4079. Pinus contorta Rocky Mountain Woodland Alliance

Type Concept Sentence: This woodland alliance is characterized by open-canopy woodlands dominated by *Pinus contorta* and is found in mainly montane and subalpine zones of the northern Rocky Mountains and eastern Cascade Range, but extends into the southern Rocky Mountains.

OVERVIEW

Scientific Name: *Pinus contorta* Rocky Mountain Woodland Alliance
Common Name (Translated Scientific Name): Lodgepole Pine Rocky Mountain Woodland Alliance
Colloquial Name: Rocky Mountain Lodgepole Pine Woodland

Type Concept: This woodland alliance includes upland plant associations found mainly in the montane and subalpine zones of the northern Rocky Mountains and eastern Cascade Range, but some associations extend into the southern Rocky Mountains. *Pinus contorta* is usually the only mature tree in these woodlands, but occasionally other conifers will be present. A short-shrub layer is usually present, but is often patchy and rarely has substantial cover. Important shrubs and dwarf-shrubs include *Amelanchier alnifolia, Arctostaphylos patula, Arctostaphylos uva-ursi, Artemisia tridentata, Juniperus communis, Mahonia repens, Paxistima myrsinites, Purshia tridentata*, and *Ribes cereum*. The herbaceous layer is typically sparse and has low species richness. Cespitose graminoids or forbs tolerant of dry conditions are dominant. Diagnostic of this widespread woodland alliance is the dominance of *Pinus contorta* in a relatively open tree canopy (<60% cover) and the lack of significant *Abies lasiocarpa* regeneration. Sites include canyons, ridges, swales, plateaus, toeslopes, basins, flats, and benches. Slopes and aspects are not consistent. Soils are variable, but tend to be coarse-textured and well-drained. The open tree canopy is related to unusually dry or cold topo-edaphic situations such as excessively well-drained pumice deposits, shallow rocky soils with little water-holding capacity often on warm aspects, and well-drained to xeric stabilized sand dunes.

Classification Comments: This alliance is derived from a series concept, in which associations are distinguished by the dominance of *Pinus contorta* in the tree canopy and the lack of regeneration of other conifers. In the habitat-typing classification system, stands dominated by *Pinus contorta* but with significant regeneration of other conifers, such as *Abies grandis, Abies lasiocarpa, Picea engelmannii, Pseudotsuga menziesii, Thuja plicata*, or *Tsuga heterophylla*, have typically been placed into series named for those conifers.

Internal Comments:
Other Comments:

Similar NVC Types:
- A3366 *Pinus contorta* Rocky Mountain Forest Alliance: has more closed canopies (>60% total cover).

Diagnostic Characteristics: Diagnostic of this widespread woodland alliance is the dominance of *Pinus contorta* in a relatively open tree canopy (<60% cover) and the lack of significant *Abies lasiocarpa* regeneration.

VEGETATION

Physiognomy and Structure: These are typically open (<60% cover), sparsely-stocked stands of needle-leaved evergreen trees from 10-30 m in height. Scattered ericaceous shrubs dominate a sparse ground layer, which may include a sparse cover of cespitose graminoids.

Floristics: Although these are usually monotypic stands dominated by *Pinus contorta*, some other trees may occasionally be present, including *Abies grandis, Larix occidentalis, Picea engelmannii, Pinus flexilis, Pinus ponderosa, Populus tremuloides, Pseudotsuga menziesii*, and *Tsuga mertensiana*. A short-shrub layer is usually present, but is often patchy and rarely has substantial cover. *Purshia tridentata* is an important shrub in several associations, particularly on ash or volcanic sands (Volland 1976, Pfister et al. 1977). Other important to dominant shrubs include *Amelanchier alnifolia, Arctostaphylos patula, Arctostaphylos uva-ursi, Artemisia tridentata, Juniperus communis, Mahonia repens, Paxistima myrsinites*, and *Ribes cereum*. The herbaceous layer is typically somewhat sparse and dominated by cespitose graminoids or forbs tolerant of dry conditions. Important species include *Achnatherum occidentale (= Stipa occidentalis), Arnica cordifolia, Carex rossii, Chamerion angustifolium (= Epilobium angustifolium), Elymus elymoides, Eriogonum umbellatum, Festuca idahoensis, Potentilla fissa, Sedum stenopetalum*, and species of *Antennaria, Eriophyllum, Fragaria, Lupinus*, and *Penstemon*.

ENVIRONMENT & DYNAMICS

Environmental Description: *Pinus contorta* occupies the broadest array of habitats of any coniferous species in the western United States. This alliance occurs in the montane and subalpine zones of the Rocky Mountains and eastern Cascade Range with elevations ranging from just over 1200 m in the Cascades to over 3050 m in the Rockies. Temperature regimes are extreme throughout this region and frequent growing-season frosts occur. Annual precipitation in these montane and subalpine habitats ranges from less

than 40 cm to over 150 cm annually, usually with the majority falling as snow. Late-melting snowpacks provide the majority of growing-season moisture, particularly in the Cascades. The dominance of *Pinus contorta* in associations in this alliance is related to fire history and topo-edaphic conditions (Pfister et al. 1977, Steele et al. 1983, Mauk and Henderson 1984, Hess and Alexander 1986). Following stand-replacing fires, *Pinus contorta* will rapidly colonize and dominate sites. Most woodlands in this alliance are early- to mid-successional, having developed following fires. However, the persistence of these woodland associations is related to their occurrence on unusually dry or cold topo-edaphic situations. These include excessively well-drained pumice deposits in central Oregon (Volland 1976), obsidian-sand benchlands of alluvial origin in the Yellowstone area of Montana (Pfister et al. 1977), warm and droughty soils with gravelly loam textures (Mauk and Henderson 1984, Hess and Alexander 1986), and well-drained to xeric stabilized sand dunes (Alpert 1984). Slopes and aspects are variable, and can include moderately steep to very steep ridge and canyon slopes, gentle to moderate slopes, ridges and swales, plateaus, butte toeslopes, basins, flats, and benches.

Dynamics: In *Pinus contorta* forests, establishment is episodic and linked to stand-replacing disturbances. The reproductive and seral dynamics of *Pinus contorta* woodlands are less well-described. Chappell et al. (1997) report that *Pinus contorta* woodlands on very deep Mazama pumice deposits in central Oregon are maintained by periodic disturbances from wildfire and insect infestations. Without fires and insects, stands become more closed-canopy forests and quite barren. The incidence of serotinous cones varies within and among varieties of *Pinus contorta*, being most prevalent in Rocky Mountain populations. Closed, serotinous cones appear to be strongly favored by fire, and allow rapid colonization of fire-cleared substrates (Burns and Honkala 1990a).

DISTRIBUTION

Geographic Range: Associations of this alliance occur mainly in the montane and subalpine zones of the northern Rocky Mountains and eastern Cascade Range, although some associations extend into the southern Rocky Mountains.

Nations: CA, US
States/Provinces: AB, CO, ID, MT, NV?, OR, UT, WA?, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** Lodgepole Pine: 218 (Eyre 1980)

LOWER LEVEL UNITS

Associations:
- CEGL000165 *Pinus contorta / Achnatherum occidentale* Woodland
- CEGL000161 *Pinus contorta / Purshia tridentata - Ribes cereum* Woodland
- CEGL000162 *Pinus contorta var. latifolia / Purshia tridentata / Achnatherum occidentale ssp. occidentale* Woodland
- CEGL000765 *Pinus contorta / Purshia tridentata* Woodland
- CEGL000136 *Pinus contorta / Artemisia tridentata / Festuca idahoensis* Woodland
- CEGL000137 *Pinus contorta / Artemisia tridentata / Elymus elymoides* Woodland
- CEGL005921 *Pinus contorta / Clintonia uniflora - Xerophyllum tenax* Woodland
- CEGL005934 *Pinus contorta* / Rock Woodland
- CEGL000766 *Pinus contorta* Scree Woodland
- CEGL000149 *Pinus contorta / Festuca idahoensis* Woodland
- CEGL000160 *Pinus contorta var. latifolia / Purshia tridentata / Festuca idahoensis* Woodland
- CEGL005915 *Pinus contorta / Heracleum maximum* Woodland
- CEGL000764 *Pinus contorta / Juniperus communis* Woodland

AUTHORSHIP

Primary Concept Source: F.H. Eyre (1980)
Author of Description: M. E. Hall
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Alpert 1984, Burns and Honkala 1990a, Chappell et al. 1997, Eyre 1980, Faber-Langendoen et al. 2017b, Hess and Alexander 1986, Mauk and Henderson 1984, Pfister et al. 1977, Steele et al. 1983, Volland 1976

1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
1.B.2.Nb.5.b. M020 Rocky Mountain Subalpine-High Montane Conifer Forest

G219. Rocky Mountain Subalpine Dry-Mesic Spruce - Fir Forest & Woodland

Type Concept Sentence: This group consists of matrix forests of the drier sites within the subalpine zone of the Cascades and Rocky Mountains with *Picea engelmannii* and *Abies lasiocarpa* dominating either mixed or alone. These forests often represent the highest elevation forests in an area, and the relatively xeric understory species are diagnostic.

OVERVIEW

Scientific Name: *Picea engelmannii - Abies lasiocarpa - Pinus contorta* Dry-Mesic Forest & Woodland Group
Common Name (Translated Scientific Name): Engelmann Spruce - Subalpine Fir - Lodgepole Pine Dry-Mesic Forest & Woodland Group
Colloquial Name: Scree & Talus Dry-Mesic Subalpine Fir - Engelmann Spruce Woodland

Type Concept: Engelmann spruce and subalpine fir forests comprise a substantial part of the subalpine forests of the Cascades and Rocky Mountains from southern British Columbia east into Alberta, and south into New Mexico and the Intermountain West region. They also occur on mountain "islands" of north-central Montana. They are the matrix forests of the subalpine zone, with elevations ranging from 1275 m in its northern distribution to 3355 m in the south (4100-11,000 feet). Despite their wide distribution, the tree canopy characteristics are remarkably similar, with *Picea engelmannii* and *Abies lasiocarpa* dominating either mixed or alone. *Pseudotsuga menziesii* may persist in occurrences of this group for long periods without regeneration. *Pinus contorta* is common in many occurrences, and patches of pure *Pinus contorta* are not uncommon, as well as mixed conifer/*Populus tremuloides* stands. In some areas, such as Wyoming, *Picea engelmannii*-dominated forests are on limestone or dolomite, while nearby codominated spruce-fir forests are on granitic or volcanic rocks. Upper elevation examples may have more woodland physiognomy, and *Pinus albicaulis* or *Pinus flexilis* can be a seral component. Relatively xeric understory species are diagnostic of this group and may include *Amelanchier alnifolia, Juniperus communis, Mahonia repens, Physocarpus malvaceus, Shepherdia canadensis, Vaccinium myrtillus*, or *Vaccinium scoparium*. In the Bighorn Mountains, *Artemisia tridentata* is a common shrub. These forests often represent the highest elevation forests in an area. Sites within this group are cold year-round, and precipitation is predominantly in the form of snow, which may persist until late summer. Snowpacks are deep and late-lying, and summers are cool. Frost is possible almost all summer and may be common in restricted topographic basins and benches. Disturbance includes occasional blowdown, insect outbreaks and stand-replacing fire. Mean return interval for stand-replacing fire is 222 years as estimated in southeastern British Columbia.

Classification Comments: What have been called "ribbon forests" or "tree islands" by some authors [citations?] are included in this group; they can be found at upper treeline in many areas of the Rockies, including the central and northern ranges in Colorado and the Medicine Bow and Bighorn ranges of Wyoming. These are more typically islands or ribbons of trees within open-meadow areas. These patterns are controlled by deposition of windblown snow where deep drifts prevent trees from establishing. The relationship of G218 and G219 may be complicated, given that they are wide-ranging groups, and it could be very hard to cleanly place associations into each group, floristically and geographically.

Similar NVC Types:
- G220 Rocky Mountain Lodgepole Pine Forest & Woodland
- G218 Rocky Mountain Subalpine Moist Spruce - Fir Forest & Woodland

Diagnostic Characteristics: These subalpine forests and woodlands are characterized by diagnostic subalpine trees *Picea engelmannii, Abies lasiocarpa*, and sometimes with *Pinus contorta* with dry to mesic understory shrub species such as *Juniperus communis, Mahonia repens*, or *Vaccinium scoparium*. [expand list of diagnostic shrubs and herbs?]

VEGETATION

Physiognomy and Structure: This group is composed of needle-leaved evergreen forests and woodlands dominated by tall (>30 m) trees. Canopy is generally closed to moderately open.

Floristics: This forest and woodland group has a tree canopy typically dominated by *Picea engelmannii* and *Abies lasiocarpa*, either mixed or alone, with a xeric understory species. *Pseudotsuga menziesii* may persist in occurrences of this group for long periods without regeneration. *Pinus contorta* is common in many occurrences, and patches of pure *Pinus contorta* are not uncommon, as well as mixed conifer/*Populus tremuloides* stands. In some areas, such as Wyoming, *Picea engelmannii*-dominated forests are on limestone or dolomite, while nearby codominated spruce-fir forests are on granitic or volcanic rocks. Upper elevation examples may have more woodland physiognomy, and *Pinus albicaulis* or *Pinus flexilis* can be a seral component. Xeric understory species may include shrubs and dwarf-shrubs such as *Jamesia americana, Juniperus communis, Mahonia repens, Physocarpus malvaceus, Ribes*

inerme, Rubus parviflorus, Shepherdia canadensis, Vaccinium cespitosum, and *Vaccinium scoparium*. In the Bighorn Mountains, *Artemisia tridentata* is a common shrub. *Vaccinium myrtillus* occurs both on dry and mesic sites. More northern occurrences often have taller, more mesic shrub and herbaceous species such as *Empetrum nigrum*. Dry to mesic herbaceous species that are characteristic of this group include *Arnica cordifolia, Arnica latifolia, Calamagrostis rubescens, Carex geyeri, Carex rossii, Carex siccata, Leymus triticoides*, and near alpine elevation *Geum rossii* and *Trifolium dasyphyllum*. Mosses may also dominate the understory without significant cover of vascular plants.

ENVIRONMENT & DYNAMICS

Environmental Description: Engelmann spruce and subalpine fir forests comprise a substantial part of the subalpine forests of the Cascades and Rocky Mountains from southern British Columbia east into Alberta, and south into New Mexico and the Intermountain West region. They also occur on mountain "islands" of north-central Montana. They are the matrix forests of the subalpine zone, with elevations ranging from 1275 m in its northern distribution to 3355 m in the south (4100-11,000 feet). They often represent the highest elevation forests in an area. Sites within this group are cold year-round, and precipitation is predominantly in the form of snow, which may persist until late summer. Snowpacks are deep and late-lying, and summers are cool. Frost is possible almost all summer and may be common in restricted topographic basins and benches. In some areas, such as Wyoming, these forests are on limestone or dolomite, while nearby forests are on granitic or volcanic rocks. Stands found at upper treeline in many areas of the Rockies, including the central and northern ranges in Colorado and the Medicine Bow and Bighorn ranges of Wyoming, are more typically islands or ribbons of trees, sometimes with a krummholz form, with open-meadow areas in a mosaic. These patterns are controlled by snow deposition and wind-blown ice. *Climate:* Sites within this group are cold year-round, and precipitation is predominantly in the form of snow, which may persist until late summer. Snowpacks are deep and late-lying, and summers are cool. Frost is possible almost all summer and may be common in restricted topographic basins and benches.

Dynamics: *Picea engelmannii* can be very long-lived, reaching 500 years of age. *Abies lasiocarpa* decreases in importance relative to *Picea engelmannii* with increasing distance from the region of Montana and Idaho where maritime air masses influence the climate. Disturbance includes occasional blowdown, insect outbreaks and fire. Fire is an important disturbance factor, but fire regimes have a long return interval and so are often stand-replacing. Mean return interval for stand-replacing fire is 222 years as estimated in southeastern British Columbia. *Picea engelmannii* can rapidly recolonize and dominate burned sites, or can succeed other seral species such as *Pinus contorta* or *Populus tremuloides*. Due to great longevity, *Pseudotsuga menziesii* may persist in occurrences of this group for long periods without regeneration. Old-growth characteristics in *Picea engelmannii* forests will include treefall and windthrow gaps in the canopy, with large downed logs, rotting woody material, tree seedling establishment on logs or on mineral soils unearthed in root balls, and snags [citations?].

DISTRIBUTION

Geographic Range: This group is found in the eastern Cascades and throughout the Rocky Mountains from southern interior British Columbia east into Alberta, south into New Mexico and the Intermountain West region. This type tends to be very limited in the northern Oregon Cascades.

Spatial Scale & Pattern [optional]: Matrix
Nations: CA, US
States/Provinces: AB, AZ, BC, CO, ID, MT, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]: 4:C, 7:C, 8:C, 9:C, 11:C, 20:C, 21:C, 26:C, 68:C
USFS Ecoregions (2007): 313A:CC, 313B:CC, 315A:PP, 321A:CC, 331J:CC, 341A:CC, 341B:CC, 341D:CC, 341E:CP, 341F:CC, 341G:CC, 342A:CC, 342B:CP, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:CC, 342I:CP, 342J:CC, M242B:CC, M242C:CC, M242D:CC, M313A:CC, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M341A:CC, M341B:CC, M341C:CC, M341D:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **<** EF Engelmann Spruce - Sub-alpine Fir Dry Forested (Ecosystems Working Group 1998) [Dry Grouseberry/Crowberry sites, Azalea/Rhododendron sites in ESSFdv dv1 dv2 xc 3 xc4 xv1 xv2]
- **<** Engelmann Spruce - Subalpine Fir: 206 (Eyre 1980)

LOWER LEVEL UNITS

Alliances:

- A3645 *Abies lasiocarpa - Populus tremuloides* Rocky Mountain Dry-Mesic Forest Alliance
- A3643 *Abies lasiocarpa - Picea engelmannii* Rocky Mountain Dry-Mesic Forest Alliance

- A3644 *Abies lasiocarpa - Picea engelmannii* Dry-Mesic Scree & Talus Woodland Alliance
- A3641 *Abies lasiocarpa - Picea engelmannii* Southern Rocky Mountain Dry-Mesic Forest Alliance
- A3642 *Abies lasiocarpa - Picea engelmannii* Treeline Dry-Mesic Forest Alliance

AUTHORSHIP

Primary Concept Source: F.H. Eyre (1980)
Author of Description: K.A. Schulz
Acknowledgments: D. Tart
Version Date: 10/08/2013
Classif Resp Region: West
Internal Author: KAS 2-10, mod. DFL/MEH 10-13, mod. GK 12-15

REFERENCES

References: Alexander and Ronco 1987, Alexander et al. 1984a, Alexander et al. 1987, Clagg 1975, Cooper et al. 1987, Daubenmire and Daubenmire 1968, DeVelice et al. 1986, Ecosystems Working Group 1998, Eyre 1980, Faber-Langendoen et al. 2017a, Fitzhugh et al. 1987, Hess and Alexander 1986, Hess and Wasser 1982, Hoffman and Alexander 1976, Hoffman and Alexander 1980, Hoffman and Alexander 1983, Hopkins 1979a, Hopkins 1979b, Johnson and Clausnitzer 1992, Johnson and Simon 1987, Komarkova et al. 1988b, Lillybridge et al. 1995, Mauk and Henderson 1984, Mehl 1992, Meidinger and Pojar 1991, Muldavin et al. 1996, Peet 1978a, Peet 1981, Pfister 1972, Pfister et al. 1977, Romme 1982, Steele and Geier-Hayes 1995, Steele et al. 1981, Veblen 1986, Whipple and Dix 1979, Williams and Lillybridge 1983, Williams et al. 1995, Youngblood and Mauk 1985

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G219. Rocky Mountain Subalpine Dry-Mesic Spruce - Fir Forest & Woodland

A3644. Abies lasiocarpa - Picea engelmannii Dry-Mesic Scree & Talus Woodland Alliance

Type Concept Sentence: This forest and woodland alliance of the northern, central and southern Rocky Mountains occurs on talus and scree slopes dominated by *Abies lasiocarpa* or *Picea engelmannii*.

OVERVIEW

Scientific Name: *Abies lasiocarpa - Picea engelmannii* Dry-Mesic Scree & Talus Woodland Alliance
Common Name (Translated Scientific Name): Subalpine Fir - Engelmann Spruce Dry-Mesic Scree & Talus Woodland Alliance
Colloquial Name: Scree & Talus Dry-Mesic Subalpine Fir - Engelmann Spruce Woodland

Type Concept: This forest and woodland alliance of the northern, central and southern Rocky Mountains occurs on talus and scree slopes. Currently there is no floristic or environmental data available for *Abies lasiocarpa* Scree Woodland (CEGL000925), and therefore the description of this alliance is based on the other two associations attributed here. Canopy cover is open to moderately closed and dominated by *Abies lasiocarpa* or *Picea engelmannii*. Canopy associates may include *Pseudotsuga menziesii* and occasionally *Pinus strobiformis*. Understories are distinctly shrubby. Dominant shrubs may include *Acer glabrum, Holodiscus dumosus, Jamesia americana, Juniperus communis*, and *Symphoricarpos oreophilus*. The herbaceous layer is poorly represented and may have sparse to moderate cover. The most common species is *Leymus triticoides*. This alliance is restricted to upper elevations above 3020 m and occurs on steep slopes with cobbly soils derived from talus and scree.

Classification Comments: This alliance is provisional as two of the member associations occur in the far southern Rocky Mountains and one occurs in the north-central Rocky Mountains leaving a substantial geographic information gap. This alliance is based upon a series concept in which *Abies lasiocarpa* or *Picea engelmannii* may not be the dominant tree canopy species but is always present in the regeneration layer, and it is assumed would dominate the site should "climax" conditions be reached. These forests and woodlands have been poorly sampled and may prove with further data to be sparsely vegetated types that should be moved into the sparse vegetation class of the USNVC.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Moderately closed to nearly sparse needle-leaved evergreen forests and woodlands of the northern, central and southern Rocky Mountains occurring on scree and talus slopes dominated by *Abies lasiocarpa* or *Picea engelmannii*.

VEGETATION

Physiognomy and Structure: These are forests dominated by needle-leaved evergreen trees up to 45 m in height and moderately closed to nearly sparse (20-100%). Although cold-deciduous trees are relatively rare, they can be prominent in some regional

variants or seral stands. Stands may be so tightly stocked that little light reaches the forest floor and understory layers are depauperate. In stands with somewhat more open canopies, a moderately dense shrub layer may be present, dominated by ericaceous or cold-deciduous species. The herbaceous layer is dominated by perennial forbs or sod-forming graminoids, and herbaceous cover increases with increasing light availability and/or soil moisture. There is often significant cover of mosses and sometimes lichens on the forest floor and on downed woody material.

Floristics: Canopy cover is open to moderately closed and dominated by *Abies lasiocarpa* or *Picea engelmannii*. Canopy associates may include *Pseudotsuga menziesii* and occasionally *Pinus strobiformis*. Understories are distinctly shrubby. Dominant shrubs may include *Acer glabrum, Holodiscus dumosus, Jamesia americana, Juniperus communis*, and *Symphoricarpos oreophilus*. The herbaceous layer is poorly represented and may have sparse to moderate cover. The most common species is *Leymus triticoides*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance is restricted to upper elevations above 3020 m and occurs on steep slopes with cobbly soils derived from talus and scree.

Dynamics: *Picea engelmannii* is susceptible to infestations by the spruce beetle (*Dendroctonus rufipennis*) or the spruce budworm (*Choristoneura occidentalis)*, which can cause high mortality during outbreaks.

DISTRIBUTION

Geographic Range: Little is known about the full distribution of this alliance. Currently it is documented from the Arizona-New Mexico Mountains and the central and southern Rocky Mountains.

Nations: US
States/Provinces: AZ, MT, NM, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **><** *Abies lasiocarpa-Picea engelmannii* Series (Johnston 1987)
- **><** *Picea* series (Pfister et al. 1977)
- **><** Engelmann Spruce - Subalpine Fir: 206 (Eyre 1980)
- **><** Western Needleleaf Forests: 15: Western Spruce-Fir Forest (*Picea-Abies*) (Küchler 1964)
- **><** Western Needleleaf Forests: 21: Southwestern Spruce-Fir Forest (*Picea-Abies*) (Küchler 1964)

LOWER LEVEL UNITS

Associations:

- CEGL000925 *Abies lasiocarpa* Scree Woodland
- CEGL000918 *Abies lasiocarpa / Holodiscus dumosus* Scree Woodland
- CEGL000362 *Picea engelmannii / Leymus triticoides* Forest

AUTHORSHIP

Primary Concept Source: E. Muldavin, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Eyre 1980, Faber-Langendoen et al. 2017b, Johnston 1987, Küchler 1964, Pfister et al. 1977

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G219. Rocky Mountain Subalpine Dry-Mesic Spruce - Fir Forest & Woodland

A3643. Abies lasiocarpa - Picea engelmannii Rocky Mountain Dry-Mesic Forest Alliance

Type Concept Sentence: This alliance is characterized by forests and woodlands with broad distributions throughout the southern, central and northern Rocky Mountains and eastern Cascades dominated by *Abies lasiocarpa* and/or *Picea engelmannii*.

OVERVIEW

Scientific Name: *Abies lasiocarpa - Picea engelmannii* Rocky Mountain Dry-Mesic Forest Alliance
Common Name (Translated Scientific Name): Subalpine Fir - Engelmann Spruce Rocky Mountain Dry-Mesic Forest Alliance
Colloquial Name: Rocky Mountain Dry-Mesic Subalpine Fir - Engelmann Spruce Forest

Type Concept: This alliance is characterized by forests and woodlands with broad distributions in the upper montane or subalpine zone throughout the southern, central and northern Rocky Mountains and eastern Cascades dominated by *Abies lasiocarpa* and/or *Picea engelmannii*. Canopies may be open to closed. Common associated conifers can include *Abies concolor, Larix occidentalis, Picea pungens, Pinus albicaulis, Pinus aristata, Pinus contorta, Pinus flexilis, Pinus strobiformis*, and *Pseudotsuga menziesii*. Understories are highly variable across the range of this alliance and can be dominated by grasses, dry sedges, mesic forbs or shrubs. Common shrub species can include *Acer glabrum, Amelanchier alnifolia, Jamesia americana, Juniperus communis, Lonicera utahensis, Mahonia repens, Paxistima myrsinites, Physocarpus monogynus, Ribes montigenum, Ribes pinetorum, Rosa woodsii, Salix scouleriana, Shepherdia canadensis, Spiraea betulifolia, Symphoricarpos oreophilus, Vaccinium myrtillus*, and *Vaccinium scoparium*. Herbaceous layers may be forb-dominated as well. Species may include *Arnica cordifolia, Arnica latifolia, Astragalus miser, Chamerion angustifolium (= Epilobium angustifolium), Erigeron eximius, Eucephalus engelmannii (= Aster engelmannii), Frasera speciosa, Goodyera repens, Orthilia secunda, Pedicularis racemosa, Polemonium pulcherrimum*, and *Solidago multiradiata*. The most common graminoids include *Carex geyeri, Carex rossii, Luzula parviflora*, and *Poa nervosa*. This alliance occurs above the warmer and drier montane forests of the West, which are typically mixed-coniferous forests, but may extend down into the montane zone where there is cold-air drainage. Parent materials and soils are variable. Sites include gentle to very steep mountain slopes, ridgetops, plateaus, basins, alluvial terraces and benches. All aspects are represented, but northerly and easterly aspects predominate, and southerly aspects are found only at higher elevations. Soils are variable, but often gravelly or rocky, relatively shallow with thick duff layers and sometimes high moss or lichen cover.

Classification Comments: This alliance is based upon a series concept in which *Abies lasiocarpa* and/or *Picea engelmannii* may not be the dominant tree canopy species but are always present in the regeneration layer, and it is assumed would dominate the site should "climax" conditions be reached.

Internal Comments:
Other Comments:

Similar NVC Types: This alliance is distinguished in part from *Abies lasiocarpa - Picea engelmannii* Southern Rocky Mountain Dry-Mesic Forest Alliance (A3641) in having a much broader distribution throughout much of the Rocky Mountains.

- A3641 *Abies lasiocarpa - Picea engelmannii* Southern Rocky Mountain Dry-Mesic Forest Alliance: has a narrower distribution and species compositions more characteristic to the southern Rocky Mountains.

Diagnostic Characteristics: Needle-leaved evergreen forests and woodlands of the subalpine elevation zones of the Rocky Mountains with dry to mesic moisture regimes. Canopies are dominated by *Abies lasiocarpa* and/or *Picea engelmannii*. Understories are highly variable across the range of this alliance and can be dominated by grasses, dry sedges, mesic forbs or shrubs.

VEGETATION

Physiognomy and Structure: These are forests and woodlands dominated by needle-leaved evergreen trees up to 30 m in height and with open to closed canopy cover (20-100%). Although cold-deciduous trees are relatively rare, they can be prominent in some early-successional stands. Stands may have such high tree density that little light reaches the forest floor and understory layers are depauperate. In stands with somewhat more open canopies, a moderately dense shrub layer may be present, dominated by ericaceous or, less commonly, cold-deciduous species. The ground layer is dominated by perennial forbs or sod-forming graminoids, and herbaceous cover increases with increasing light availability and/or soil moisture. A nonvascular layer of predominantly mosses may be present. Old-growth stands will have hummocky topography, downed logs and snags, and lichens or fungi may cover rotting woody debris.

Floristics: These subalpine forests are characterized by a canopy typically dominated by *Abies lasiocarpa* and/or *Picea engelmannii*. In early- to mid-successional stands, other conifers can be dominant or codominant, but *Picea engelmannii* and *Abies lasiocarpa* are the most abundant seedlings and saplings. In the Northern Rockies and Cascades other important conifers can include *Larix occidentalis, Pinus contorta, Pinus flexilis*, and *Pseudotsuga menziesii*. On the east side of the Continental Divide, only *Pseudotsuga* and *Pinus contorta* are important, but in northwestern Wyoming and Utah, *Pinus flexilis* or *Pinus albicaulis* can codominate stands at higher elevations. In the southern stands of Colorado and Arizona, other important canopy species may include *Abies concolor, Abies lasiocarpa var. arizonica, Picea pungens, Pinus aristata, Pinus flexilis*, and *Pinus strobiformis*. The shrub layer is often sparse, but where canopies are more open can be dominated by ericaceous, cold-deciduous or evergreen species such as *Acer glabrum, Amelanchier alnifolia, Jamesia americana, Juniperus communis, Lonicera utahensis, Mahonia repens, Paxistima myrsinites, Physocarpus monogynus, Ribes montigenum, Ribes pinetorum, Rosa woodsii, Salix scouleriana, Shepherdia canadensis, Spiraea*

betulifolia, Symphoricarpos oreophilus, Vaccinium myrtillus, and *Vaccinium scoparium*. The herbaceous layer can be either depauperate or species-rich, and is most often dominated by perennial forbs. Important to dominant species include *Arnica cordifolia, Arnica latifolia, Astragalus miser, Chamerion angustifolium (= Epilobium angustifolium), Erigeron eximius, Eucephalus engelmannii (= Aster engelmannii), Frasera speciosa, Goodyera repens, Orthilia secunda, Pedicularis racemosa, Polemonium pulcherrimum*, and *Solidago multiradiata*. The most common graminoids include *Carex geyeri, Carex rossii, Luzula parviflora*, and *Poa nervosa*. One association has a depauperate understory, with only mosses having significant cover, such as *Hypnum revolutum*.

ENVIRONMENT & DYNAMICS

Environmental Description: These upper montane or subalpine forests occur in much of the Rocky Mountains and eastern Cascades where they are often the matrix forests and woodlands. They occur above the warmer and drier montane forests of the West, which are typically mixed-coniferous forests. In the Cascade Range, they occupy areas with pronounced rainshadow effects from mountains to the west, where precipitation is more limited than in the surrounding areas. Average temperatures are fairly uniform across the alliance's range, with mean July and January temperatures of 12° and -10°C, respectively (Burns and Honkala 1990a). Snowpacks can be deep, but often melt quickly, and summers are cool. Summer frosts are characteristic, especially on sites where cold air pools. Elevations of occurrence increase with decreasing latitude, ranging from less than 970-1800 m in the Cascades, from 900 m to well over 3200 m in the Northern Rockies of Montana, Idaho and Wyoming, and up to 3350 m in the Colorado Rockies. Sites where these forests and woodlands are found include gentle to very steep mountain slopes, high-elevation ridgetops and upper slopes, plateau-like surfaces, basins, alluvial terraces, and well-drained benches. In some locations where there is cold-air drainage, these forests may extend down in elevation into the montane zone, where they will occupy dry stream terraces, toeslopes, or mesic sites with cooler temperature regimes such as northern aspects. Parent materials and soils are variable across the distribution of the alliance. Parent materials include ash, tuff, lava, basalt, granitics, quartzite, dolomite, rhyolite, and other sedimentary rock types. Stands can also occur on colluvium or alluvium. Soils are typically not deep, poorly developed, and can have significant amounts of rock and gravel in the profile. Subalpine soils, such as found associated with these forests, often show evidence of podzolization processes, especially in the north, and poorly decomposed organic layers are common.

Dynamics: *Picea engelmannii* can be very long-lived, reaching 500 years of age. *Abies lasiocarpa* decreases in importance relative to *Picea engelmannii* with increasing distance from the region of Montana and Idaho where maritime air masses influence the climate. Fire is an important disturbance factor, but fire regimes have a long return interval and so are often stand-replacing. *Picea engelmannii* can rapidly recolonize and dominate burned sites, or can succeed to other species such as *Pinus contorta* or *Populus tremuloides*. Due to great longevity, *Pseudotsuga menziesii* may persist in stands of this alliance for long periods without regeneration. Old-growth characteristics in *Picea engelmannii* forests will include treefall and windthrow gaps in the canopy, with large downed logs, rotting woody material, tree seedling establishment on logs or on mineral soils unearthed in root balls, and snags. *Picea engelmannii* is susceptible to infestations by the spruce beetle (*Dendroctonus rufipennis*) or the spruce budworm (*Choristoneura occidentalis)*, which can cause high mortality during outbreaks. In the Southwest, *Arceuthobium microcarpum* is a common cause of mortality for the species. *Abies lasiocarpa* forests develop on sites with limited, short growing seasons and relatively deep winter snowpacks. Tree growth is very slow in these habitats, and forests are rapidly colonized by much more rapidly growing shade-intolerant species, such as *Pseudotsuga menziesii, Pinus contorta*, or *Populus tremuloides*, following fire, clearcut logging, or windthrow disturbance. *Abies lasiocarpa* is among the most shade-tolerant trees in the Rocky Mountains, but seedlings compete poorly in greater than 50% full sunlight (Burns and Honkala 1990a). In Oregon and Washington, many communities are bottomland, moist, upper montane forests that rarely burn. Fire is important in many of the more open sites, as well as those on steep slopes. Snow avalanches occur frequently at upper elevations, and can result in a mosaic of varying stand ages on sites affected by this disturbance type.

DISTRIBUTION

Geographic Range: This alliance occupies the subalpine elevation zones of the central, southern and northern Rocky Mountains, east to the Cascades and west to the Wyoming Basins.

Nations: US
States/Provinces: AZ, CO, ID, MT, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **><** *Abies lasiocarpa-Picea engelmannii* Series (Johnston 1987)
- **><** *Picea* series (Pfister et al. 1977)

- >< Engelmann Spruce - Subalpine Fir: 206 (Eyre 1980)
- >< Western Needleleaf Forests: 15: Western Spruce-Fir Forest (*Picea-Abies*) (Küchler 1964)
- >< Western Needleleaf Forests: 21: Southwestern Spruce-Fir Forest (*Picea-Abies*) (Küchler 1964)

LOWER LEVEL UNITS

Associations:

- CEGL000301 *Abies lasiocarpa - Picea engelmannii / Calamagrostis rubescens* Forest
- CEGL005638 *Abies lasiocarpa - (Pinus contorta) / Juniperus communis - Lomatium martindalei* Woodland
- CEGL000298 *Abies lasiocarpa - Picea engelmannii / Arnica cordifolia* Forest
- CEGL000323 *Abies lasiocarpa / Osmorhiza berteroi* Forest
- CEGL000326 *Abies lasiocarpa / Physocarpus malvaceus* Forest
- CEGL000318 *Abies lasiocarpa / Mahonia repens* Forest
- CEGL000344 *Abies lasiocarpa - Picea engelmannii / Vaccinium scoparium* Forest
- CEGL000368 *Picea engelmannii / Hypnum revolutum* Forest
- CEGL002676 *Picea engelmannii / Physocarpus malvaceus* Forest
- CEGL000305 *Abies lasiocarpa / Carex rossii* Forest
- CEGL000919 *Abies lasiocarpa - Picea engelmannii / Juniperus communis* Woodland
- CEGL000381 *Picea engelmannii / Vaccinium scoparium* Forest
- CEGL000304 *Abies lasiocarpa - Picea engelmannii / Carex geyeri* Forest
- CEGL000306 *Abies lasiocarpa / Clematis columbiana var. columbiana* Forest
- CEGL000324 *Abies lasiocarpa / Paxistima myrsinites* Woodland
- CEGL000299 *Abies lasiocarpa - Picea engelmannii / Arnica latifolia* Forest
- CEGL000355 *Picea engelmannii / Arnica cordifolia* Forest
- CEGL005925 *Picea engelmannii / Juniperus communis* Forest
- CEGL000379 *Picea engelmannii / Vaccinium myrtillus* Forest
- CEGL000343 *Abies lasiocarpa - Picea engelmannii / Vaccinium myrtillus* Forest
- CEGL000325 *Abies lasiocarpa / Pedicularis racemosa* Forest

AUTHORSHIP

Primary Concept Source: B.C. Johnston (1987)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Burns and Honkala 1990a, Eyre 1980, Faber-Langendoen et al. 2017b, Horton 1971, Johnson and Simon 1987, Johnston 1987, Küchler 1964, Pfister et al. 1977

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G219. Rocky Mountain Subalpine Dry-Mesic Spruce - Fir Forest & Woodland

A3641. Abies lasiocarpa - Picea engelmannii Southern Rocky Mountain Dry-Mesic Forest Alliance

Type Concept Sentence: This alliance is known from the Colorado Plateau, Arizona - New Mexico Mountains and southern Rocky Mountains and consists of forests dominated by *Abies lasiocarpa* and/or *Picea engelmannii*.

OVERVIEW

Scientific Name: *Abies lasiocarpa - Picea engelmannii* Southern Rocky Mountain Dry-Mesic Forest Alliance
Common Name (Translated Scientific Name): Subalpine Fir - Engelmann Spruce Southern Rocky Mountain Dry-Mesic Forest Alliance
Colloquial Name: Southern Rocky Mountain Dry-Mesic Subalpine Fir - Engelmann Spruce Forest & Woodland

Type Concept: These upper montane or subalpine conifer forests occur in many of the mountainous areas of the Colorado Plateau, Arizona - New Mexico Mountains and southern Rocky Mountains where they are often the matrix forests of the subalpine zone. *Abies lasiocarpa* and *Picea engelmannii* generally are dominant singly or in combination. *Picea engelmannii* will often be prominent on more moist sites or in more mature stands. Associates vary geographically. Common associated trees species, particularly in seral stands, may include *Pinus aristata, Pinus contorta, Pinus flexilis, Populus tremuloides*, and *Pseudotsuga menziesii*. Forest understories are highly variable across the range of this alliance and can be dominated by dry sedges, grasses, forbs or shrubs. Dominant shrubs may include *Acer glabrum, Jamesia americana, Juniperus communis, Lonicera utahensis, Paxistima myrsinites, Ribes pinetorum, Rubus idaeus, Salix scouleriana, Sambucus racemosa var. melanocarpa (= Sambucus melanocarpa), Symphoricarpos oreophilus, Vaccinium cespitosum, Vaccinium myrtillus*, and *Vaccinium scoparium*. Common and dominant graminoids may include *Bromus ciliatus var. richardsonii (= Bromus richardsonii), Carex siccata (= Carex foenea), Poa fendleriana*, and *Poa pratensis*. Forb

cover is relatively low to moderate and may consist of *Actaea rubra ssp. arguta (= Actaea arguta), Aquilegia* spp., *Campanula rotundifolia, Galium* spp., *Lathyrus lanszwertii var. leucanthus (= Lathyrus arizonicus), Ligusticum porteri, Mertensia franciscana, Oreochrysum parryi (= Solidago parryi), Orthilia secunda (= Ramischia secunda), Osmorhiza depauperata, Packera sanguisorboides (= Senecio sanguisorboides), Pteridium aquilinum, Senecio* spp., *Trisetum spicatum (= Trisetum montanum), Vicia americana, Vicia americana, Viola canadensis*, and *Woodsia* spp., These forests occur above the warmer and drier montane forests of the West, which are typically mixed-coniferous forests, but may extend down into the montane zone where there is cold-air drainage. Parent materials and soils are variable. Sites include gentle to very steep mountain slopes, ridgetops, plateaus, basins, alluvial terraces and benches. All aspects are represented, but northerly and easterly aspects predominate, and southerly aspects are found only at higher elevations. Typically, soils are not deep, poorly developed and rocky.

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types: This alliance is distinguished from *Abies lasiocarpa - Picea engelmannii* Rocky Mountain Dry-Mesic Forest Alliance (A3643) in being characterized by associations with species compositions more characteristic to the southern Rocky Mountains.

- A3643 *Abies lasiocarpa - Picea engelmannii* Rocky Mountain Dry-Mesic Forest Alliance: has a much broader distribution throughout much of the Rocky Mountains.

Diagnostic Characteristics: Needle-leaved evergreen forests and woodlands of the southern Rocky Mountains dominated by *Abies lasiocarpa* and/or *Picea engelmannii*. Diagnostic of forests in this alliance is that they are upland forests (non-flooded) with average tree canopy cover greater than 60%. Understories are distinguished from those of similar alliances in species compositions with distributions centered in the southern Rocky Mountains as opposed to the more ubiquitous species distributed more broadly to the north.

VEGETATION

Physiognomy and Structure: These are forests dominated by needle-leaved evergreen trees up to 45 m in height and of high cover (60-100%). Although cold-deciduous trees are relatively rare, they can be prominent in some regional variants or seral stands. Stands may be so tightly stocked that little light reaches the forest floor and understory layers are depauperate. In stands with somewhat more open canopies, a moderately dense shrub layer may be present, dominated by ericaceous or cold-deciduous species. The herbaceous layer is dominated by perennial forbs or sod-forming graminoids, and herbaceous cover increases with increasing light availability and/or soil moisture. There is often significant cover of mosses and sometimes lichens on the forest floor and on downed woody material.

Floristics: These subalpine forests are characterized by a canopy varying from 20-45 m in height dominated by *Picea engelmannii* and/or *Abies lasiocarpa*. In early- to mid-successional stands, other conifers can be dominant or codominant, but *Picea engelmannii* and *Abies lasiocarpa* are the most abundant seedlings and saplings. Important, but usually seral, tree species include *Pinus contorta, Pseudotsuga menziesii*, and *Populus tremuloides*. Other trees in these stands include *Picea pungens, Pinus aristata, Pinus flexilis*, and *Pinus strobiformis*. Forest understories are highly variable across the range of this alliance and can be dominated by dry sedges, grasses, forbs or shrubs. The shrub layer may be sparse to well-developed. Dominant shrubs may include *Acer glabrum, Jamesia americana, Juniperus communis, Lonicera utahensis, Paxistima myrsinites, Ribes pinetorum, Rubus idaeus, Salix scouleriana, Sambucus racemosa var. melanocarpa (= Sambucus melanocarpa), Symphoricarpos oreophilus, Vaccinium cespitosum, Vaccinium myrtillus*, and *Vaccinium scoparium*. Common and dominant graminoids may include *Bromus ciliatus var. richardsonii (= Bromus richardsonii)*, include *Carex siccata (= Carex foenea), Poa fendleriana*, and *Poa pratensis*. Forb cover is low to moderate and may consist of *Actaea rubra ssp. arguta (= Actaea arguta), Aquilegia* spp., *Campanula rotundifolia, Galium* spp., *Lathyrus lanszwertii var. leucanthus (= Lathyrus arizonicus), Ligusticum porteri, Mertensia franciscana, Oreochrysum parryi (= Solidago parryi), Orthilia secunda (= Ramischia secunda), Osmorhiza depauperata, Packera sanguisorboides (= Senecio sanguisorboides), Pteridium aquilinum, Senecio* spp., *Trisetum spicatum (= Trisetum montanum), Vicia americana, Vicia americana, Viola canadensis*, and *Woodsia* spp.

ENVIRONMENT & DYNAMICS

Environmental Description: These upper montane or subalpine forests occur in many of the mountainous areas of the Colorado Plateau, Arizona - New Mexico Mountains and southern Rocky Mountains, where they are often the matrix forests of the subalpine zone. They occur above the warmer and drier montane forests of the West, which are typically mixed-coniferous forests. Average temperatures are fairly uniform across the alliance's range, with mean July and January temperatures of 12° and -10°C, respectively (Burns and Honkala 1990a). Snowpacks can be deep, but often melt quickly, and summers are cool. Summer frosts are characteristic, especially on sites where cold air pools. Elevations range from 2600-3500 m. Sites include gentle to very steep mountain slopes, ridgetops, and plateaus. In some locations where there is cold-air drainage, these forests may extend down in elevation into the

montane zone, where they will occupy dry stream terraces, toeslopes, with cooler temperature regimes such as northern aspects. Parent materials and soils are variable across the distribution of the alliance. Parent materials include ash, tuff, lava, basalt, granitics, quartzite, dolomite, rhyolite, and other sedimentary rock types. Stands can also occur on colluvium or alluvium. Soils are typically not deep, poorly developed, and can have significant amounts of rock and gravel in the profile. Subalpine soils, such as those found associated with these forests, often show evidence of podzolization processes, especially in the north, and poorly decomposed organic layers are common.

Dynamics: *Abies lasiocarpa* and *Picea engelmannii* forests develop on sites with limited, short growing seasons and relatively deep winter snowpacks. Tree growth is very slow in these habitats, and forests are rapidly colonized by much more rapidly growing shade-intolerant species, such as *Pseudotsuga menziesii, Pinus contorta*, or *Populus tremuloides*, following fire, clearcut logging, or windthrow disturbance. *Abies lasiocarpa* is among the most shade-tolerant trees in the Rocky Mountains, but seedlings compete poorly in greater than 50% full sunlight (Burns and Honkala 1990a). Snow avalanches occur frequently at upper elevations, and can result in a mosaic of varying stand ages on sites affected by this disturbance type. *Picea engelmannii* is susceptible to infestations by the spruce beetle (*Dendroctonus rufipennis*) or the spruce budworm (*Choristoneura occidentalis*), which can cause high mortality during outbreaks. In the Southwest, *Arceuthobium microcarpum* is a common cause of mortality for the species.

DISTRIBUTION

Geographic Range: This alliance occurs in the Colorado Plateau, Arizona - New Mexico Mountains and southern Rocky Mountains of Arizona, Colorado, Nevada, Wyoming, New Mexico and possibly Utah.

Nations: US
States/Provinces: AZ, CO, NM, NV, UT?, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **><** *Abies lasiocarpa-Picea engelmannii* Series (Johnston 1987)
- **><** *Picea* series (Pfister et al. 1977)
- **><** Engelmann Spruce - Subalpine Fir: 206 (Eyre 1980)
- **><** Western Needleleaf Forests: 15: Western Spruce-Fir Forest (*Picea-Abies*) (Küchler 1964)
- **><** Western Needleleaf Forests: 21: Southwestern Spruce-Fir Forest (*Picea-Abies*) (Küchler 1964)

LOWER LEVEL UNITS

Associations:

- CEGL000333 *Abies lasiocarpa / Packera sanguisorboides* Forest
- CEGL000371 *Picea engelmannii* / Moss Forest
- CEGL000321 *Abies lasiocarpa - Picea engelmannii* / Moss Forest
- CEGL000303 *Abies lasiocarpa - Picea engelmannii / Carex siccata* Forest
- CEGL000313 *Abies lasiocarpa / Lathyrus lanszwertii var. leucanthus* Forest
- CEGL000312 *Abies lasiocarpa / Jamesia americana* Forest

AUTHORSHIP

Primary Concept Source: M.S. Reid and D. Sarr, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Burns and Honkala 1990a, Eyre 1980, Faber-Langendoen et al. 2017b, Johnston 1987, Küchler 1964, Pfister et al. 1977

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G219. Rocky Mountain Subalpine Dry-Mesic Spruce - Fir Forest & Woodland

A3642. Abies lasiocarpa - Picea engelmannii Treeline Dry-Mesic Forest Alliance

Type Concept Sentence: Forests occurring at or near treeline in the Front Range of the Rocky Mountains in Wyoming and Colorado and dominated by *Abies lasiocarpa* and/or *Picea engelmannii*.

OVERVIEW

Scientific Name: *Abies lasiocarpa - Picea engelmannii* Treeline Dry-Mesic Forest Alliance
Common Name (Translated Scientific Name): Subalpine Fir - Engelmann Spruce Treeline Dry-Mesic Forest Alliance
Colloquial Name: Treeline Dry-Mesic Subalpine Fir - Engelmann Spruce Forest

Type Concept: These forests occur at or near treeline in the Front Range of the Rocky Mountains. Canopies are dominated by *Abies lasiocarpa* and/or *Picea engelmannii* and stand structure may take on a ribbon or tree island form. *Abies lasiocarpa, Pinus flexilis*, and *Pinus aristata* are minor components in the canopy and very infrequent in the understory. The shrub layer is sparse and species-poor although *Ribes montigenum* and *Vaccinium scoparium* may be present. Herbaceous species may be absent or sparse and typically include the forbs *Geum rossii* and *Trifolium dasyphyllum*. These forests occur at 3300-3450 m (10,810-11,320 feet) elevation, just below krummholz timberline. Sites are gentle to moderately steep slopes that are relatively xeric, cold and exposed.

Classification Comments: This alliance is based upon four associations, for which only one has detailed floristic and environmental information. Furthermore, the composition of tree islands and ribbon forests has not been adequately sampled. Therefore, further information will be required to complete a more comprehensive description of this alliance.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Open- to closed-canopy needle-leaved evergreen forests occurring at or near treeline dominated by *Abies lasiocarpa* and/or *Picea engelmannii*. Diagnostic of this alliance in part are forests with ribbon or tree island structures.

VEGETATION

Physiognomy and Structure: These are forests dominated by needle-leaved evergreen with open to high cover (20-100%). Understory layers are typically depauperate.

Floristics: Canopies are dominated by *Abies lasiocarpa* and/or *Picea engelmannii* and stand structure may take on a ribbon or tree island form. *Abies lasiocarpa, Pinus flexilis*, and *Pinus aristata* are minor components in the canopy and very infrequent in the understory. The shrub layer is sparse and species-poor although *Ribes montigenum* and *Vaccinium scoparium* may be present. Herbaceous species may be absent or sparse and typically include the forbs *Geum rossii* and *Trifolium dasyphyllum*.

ENVIRONMENT & DYNAMICS

Environmental Description: These forests occur at 3300-3450 m (10,810-11,320 feet) elevation, just below krummholz timberline. Sites are gentle to moderately steep slopes that are relatively xeric, cold and exposed.

Dynamics: *Abies lasiocarpa* forests develop on sites with limited, short growing seasons and relatively deep winter snowpacks. Tree growth is very slow in these habitats, and forests are rapidly colonized by much more rapidly growing shade-intolerant species, such as *Pseudotsuga menziesii, Pinus contorta*, or *Populus tremuloides*, following fire, clearcut logging, or windthrow disturbance. *Abies lasiocarpa* is among the most shade-tolerant trees in the Rocky Mountains, but seedlings compete poorly in greater than 50% full sunlight (Burns and Honkala 1990a). Snow avalanches occur frequently at upper elevations, and can result in a mosaic of varying stand ages on sites affected by this disturbance type.

DISTRIBUTION

Geographic Range: This alliance is known from the central and southern Rocky Mountains of Wyoming and Colorado. Stands may also occur in Arizona and Utah.

Nations: US
States/Provinces: AZ?, CO, UT?, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** *Abies lasiocarpa-Picea engelmannii* Series (Johnston 1987)
- **><** *Picea* series (Pfister et al. 1977)

- >< Engelmann Spruce - Subalpine Fir: 206 (Eyre 1980)
- >< Western Needleleaf Forests: 15: Western Spruce-Fir Forest (*Picea-Abies*) (Küchler 1964)
- >< Western Needleleaf Forests: 21: Southwestern Spruce-Fir Forest (*Picea-Abies*) (Küchler 1964)

LOWER LEVEL UNITS

Associations:
- CEGL000328 *Abies lasiocarpa - Picea engelmannii* Ribbon Forest
- CEGL000366 *Picea engelmannii / Geum rossii* Forest
- CEGL000377 *Picea engelmannii / Trifolium dasyphyllum* Forest
- CEGL000329 *Abies lasiocarpa - Picea engelmannii* Tree Island Forest

AUTHORSHIP

Primary Concept Source: B.C. Johnston (1984)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Burns and Honkala 1990a, Eyre 1980, Faber-Langendoen et al. 2017b, Johnston 1984, Johnston 1987, Küchler 1964, Pfister et al. 1977

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G219. Rocky Mountain Subalpine Dry-Mesic Spruce - Fir Forest & Woodland

A3645. Abies lasiocarpa - Populus tremuloides Rocky Mountain Dry-Mesic Forest Alliance

Type Concept Sentence: This forest alliance of the southern and central Rocky Mountains and Intermountain West is composed of forests with mixed canopies dominated by *Abies lasiocarpa* and *Populus tremuloides*.

OVERVIEW

Scientific Name: *Abies lasiocarpa - Populus tremuloides* Rocky Mountain Dry-Mesic Forest Alliance
Common Name (Translated Scientific Name): Subalpine Fir - Quaking Aspen Rocky Mountain Dry-Mesic Forest Alliance
Colloquial Name: Rocky Mountain Dry-Mesic Subalpine Fir - Aspen Forest

Type Concept: Stands included in this mixed evergreen-deciduous forest alliance have been described from mountain slopes and plateaus in the central Rocky Mountains and Intermountain West. The mixed coniferous and deciduous tree canopy is open to moderately closed and dominated by *Populus tremuloides* and *Abies lasiocarpa* or *Picea engelmannii*. Several other species of conifers may be scattered within the stands, including *Abies concolor, Picea pungens, Pinus contorta, Pinus flexilis*, and *Pseudotsuga menziesii*. Younger stands typically have dense *Populus tremuloides*, with *Abies lasiocarpa* or *Picea engelmannii* mixed in. As the stands age in this typically seral forest alliance, *Populus tremuloides* is slowly reduced until conifers become dominant. Mixed stands must have at least 25% relative tree cover of both aspen (deciduous) and conifers. The understory is typically composed of a short-shrub layer often dominated by *Juniperus communis, Shepherdia canadensis*, or *Symphoricarpos oreophilus*. Other shrubs may include *Mahonia repens, Paxistima myrsinites, Physocarpus malvaceus*, and *Rosa woodsii*. If present, the tall-shrub layer often consists of scattered *Amelanchier alnifolia, Acer grandidentatum*, and *Prunus virginiana*. The relatively sparse herbaceous layer is a mixture of graminoids and forbs and is often dominated by *Bromus carinatus, Calamagrostis rubescens, Carex geyeri, Carex rossii, Pedicularis racemosa*, or *Thalictrum fendleri*. Stands occur on gentle to steep slopes on all aspects but are most common on cooler and more mesic, north and east aspects. Soils are derived from alluvium and colluvium from sedimentary, metamorphic and igneous parent materials.

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Diagnostic of these seral forests is the open to moderately closed, mixed coniferous and deciduous tree canopy codominated by *Populus tremuloides* and *Abies lasiocarpa* or *Picea engelmannii*. Stands must have at least 25% relative tree cover of both aspen (deciduous) and conifers.

VEGETATION

Physiognomy and Structure: Vegetation included in this minor alliance has a moderately dense to dense upper canopy of mixed deciduous broad-leaved and evergreen needle-leaved trees (5-20 m tall). The understory has a moderate to sparse short-shrub layer typically dominated by evergreen, scale-leaved or deciduous broad-leaved shrub species. A sparse tall-shrub layer, dominated by deciduous broad-leaved shrubs, may be present. A moderate to sparse herbaceous layer may also be present, dominated by perennial forbs or graminoids.

Floristics: Seral forests are included in this Rocky Mountain alliance. The open to moderately closed, mixed evergreen needle-leaved and deciduous broad-leaved tree canopy is composed of short to moderately tall trees and is codominated by *Populus tremuloides* and *Abies lasiocarpa* or *Picea engelmannii*. Several other species of conifers may be scattered within the stands, including *Abies concolor, Picea pungens, Pinus contorta, Pinus flexilis*, and *Pseudotsuga menziesii*. Younger stands typically have dense *Populus tremuloides*, with *Abies lasiocarpa* or *Picea engelmannii* mixed in. As the stands age in this typically seral forest alliance, *Populus tremuloides* is slowly reduced until conifers become dominant (Mueggler 1988). Mixed stands must have at least 25% relative tree cover of both aspen (deciduous) and conifers. The understory is typically moderately dense to sparse and becomes sparser as *Abies lasiocarpa* or *Picea engelmannii* become more dominant. The understory is typically dominated by a short-shrub layer, with sparse tall-shrub and herbaceous layers. The short-shrub layer is often dominated by *Juniperus communis* or *Shepherdia canadensis*. Other shrubs may include *Mahonia repens, Paxistima myrsinites, Physocarpus malvaceus*, and *Rosa woodsii*. If present, the tall-shrub layer often consists of scattered *Amelanchier alnifolia, Acer grandidentatum*, and *Prunus virginiana*. The relatively sparse herbaceous layer is a mixture of graminoids and forbs and is often dominated by *Bromus carinatus, Calamagrostis rubescens, Carex geyeri, Carex rossii, Pedicularis racemosa*, or *Thalictrum fendleri*. Other common graminoids include *Achnatherum occidentale (= Stipa occidentalis), Bromus ciliatus, Elymus glaucus*, and *Elymus trachycaulus*. Forbs such as *Achillea millefolium, Arnica cordifolia, Chamerion angustifolium (= Epilobium angustifolium), Eucephalus engelmannii (= Aster engelmannii), Fragaria vesca, Geranium* spp., *Lathyrus* spp., *Lupinus* spp., *Osmorhiza berteroi (= Osmorhiza chilensis), Senecio serra*, and *Pseudostellaria jamesiana (= Stellaria jamesiana)* are common. The exotic species *Poa pratensis* and *Taraxacum officinale* are common in livestock-impacted stands (Mueggler 1988). Annuals are typically uncommon.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands included in this mixed evergreen-deciduous forest alliance have been described from mountain slopes and plateaus in the central Rocky Mountains and parts of the Intermountain West. Elevations range from 1700 to 3000 m. Climate is temperate with cold winters. Mean annual precipitation is greater than 38 cm and typically greater than 50 cm. Sites occur on gentle to steep slopes on all aspects but are most common on north and east aspects. Soils are derived from alluvium and colluvium from sedimentary, metamorphic and igneous parent materials.

Dynamics: Stems of *Populus tremuloides* are thin-barked and readily killed by fire. It is a fire-adapted species that generally needs fire or some other stand-replacing disturbance to establish and maintain dominance in a forest. These mixed forests are seral and in the absence of disturbance will slowly convert to late-successional forests dominated by *Abies lasiocarpa* or *Picea engelmannii* (Mueggler 1988). Most of the stands sampled by Mueggler (1988) have had a history of livestock grazing as evidenced by relative abundance of the exotic plants *Taraxacum officinale* and *Poa pratensis* and the scarcity of grazing-susceptible plants (Mueggler 1988).

DISTRIBUTION

Geographic Range: Forests included in this alliance are scattered in the mountains and plateaus of Utah, Wyoming, Colorado, and Idaho

Nations: US
States/Provinces: CO, ID, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Abies lasiocarpa* Series (Mauk and Henderson 1984) [Early-seral stands in this habitat type may have significant *Populus tremuloides*.]
- **><** Aspen: 217 (Eyre 1980)
- **><** Engelmann Spruce - Subalpine Fir: 206 (Eyre 1980)

LOWER LEVEL UNITS

Associations:

- CEGL000525 *Populus tremuloides - Abies lasiocarpa / Carex geyeri - Calamagrostis rubescens* Forest
- CEGL000526 *Populus tremuloides - Abies lasiocarpa / Carex rossii* Forest
- CEGL000524 *Populus tremuloides - Abies lasiocarpa / Amelanchier alnifolia* Forest
- CEGL000528 *Populus tremuloides - Abies lasiocarpa / Pedicularis racemosa* Forest
- CEGL000527 *Populus tremuloides - Abies lasiocarpa / Juniperus communis* Forest
- CEGL000529 *Populus tremuloides - Abies lasiocarpa / Shepherdia canadensis* Forest

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Eyre 1980, Faber-Langendoen et al. 2017b, Mauk and Henderson 1984, Mueggler 1988, Mueggler and Campbell 1986

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
1.B.2.Nb.5.c. M020 Rocky Mountain Subalpine-High Montane Conifer Forest

G218. Rocky Mountain Subalpine Moist Spruce - Fir Forest & Woodland

Type Concept Sentence: This is a high-elevation forest group of mesic sites within the Rocky Mountains and eastern Cascades dominated by *Picea engelmannii* and *Abies lasiocarpa* where occurrences are typically found in locations with cold-air drainage or ponding, or where snowpacks linger late into the summer. Moisture-loving understory species are diagnostic of this group.

OVERVIEW

Scientific Name: *Picea engelmannii - Abies lasiocarpa - Tsuga mertensiana* Moist Forest & Woodland Group
Common Name (Translated Scientific Name): Engelmann Spruce - Subalpine Fir - Mountain Hemlock Moist Forest & Woodland Group
Colloquial Name: Rocky Mountain Subalpine Fir - Engelmann Spruce Moist Forest

Type Concept: This is a high-elevation group of the Rocky Mountains and eastern Cascades dominated by *Picea engelmannii* and *Abies lasiocarpa*. It extends westward into the northeastern side of Mount Rainier in Washington, and as far east as mountain "islands" of north-central Montana. *Picea engelmannii* is generally more important in southern forests than those in the Pacific Northwest. Occurrences are typically found in locations with cold-air drainage or ponding, or where snowpacks linger late into the summer, such as north-facing slopes and high-elevation ravines. They can extend down in elevation below the subalpine zone in places where cold-air ponding occurs; northerly and easterly aspects predominate. These forests are found on gentle to very steep mountain slopes, high-elevation ridgetops and upper slopes, plateaulike surfaces, basins, alluvial terraces, well-drained benches, and inactive stream terraces. In the northern Rocky Mountains of northern Idaho and Montana, *Tsuga mertensiana* occurs as small to large patches within the matrix of this mesic spruce-fir group and only in the most maritime of environments (the coldest and wettest of the more Continental subalpine fir forests). In parts of the northern Cascades, the climate is more maritime than typical for this group, but due to the lower snowfall in these rainshadow areas, summer drought may be more significant than snowpack in limiting tree regeneration in burned areas. *Picea engelmannii* is rare in these areas. *Populus tremuloides* is a common codominant tree in many disturbed stands. Moisture-loving understory species are diagnostic of this group and may include shrubs *Cornus canadensis, Ledum glandulosum* (rare), *Menziesia ferruginea, Phyllodoce empetriformis, Rhododendron albiflorum, Rubus parviflorus, Salix* spp. and *Vaccinium membranaceum*. The understory may also be dominated by mesic herbaceous species such as *Actaea rubra, Calamagrostis canadensis, Clintonia uniflora, Erigeron eximius, Gymnocarpium dryopteris, Luzula glabrata var. hitchcockii, Maianthemum stellatum, Rubus pedatus, Saxifraga bronchialis, Thalictrum* spp., *Tiarella* spp., and *Valeriana sitchensis*. Disturbances include occasional blowdown, insect outbreaks (30-50 years), mixed-severity fire, and stand-replacing fire (every 150-500 years). The more summer-dry climatic areas also have occasional high-severity fires.

Classification Comments: This group is similar to Rocky Mountain Subalpine Dry-Mesic Spruce - Fir Forest & Woodland Group (G219) but is distinguished by its occurrence on mesic to wet microsites within the matrix of the drier (and warmer) subalpine spruce-fir or lodgepole pine forests. The microsites include north-facing slopes, swales or ravines, toeslopes, cold pockets, and other locations where available soil moisture is higher or lasts longer into the growing season. This group is NOT confined to the northern Rocky Mountains or Pacific Northwest (it is not geographically defined, rather by topographic settings in the subalpine). In the Canadian

Rockies, this group transitions to a yet-to-be described Boreal mesic mixed-conifer group, where *Abies lasiocarpa* and *Picea engelmannii* occur with boreal taxa, such as *Picea mariana* or *Picea glauca*.

While the name of this group suggests a Rocky Mountain distribution, floristic affinities of Engelmann spruce-subalpine fir forests in the eastern Cascades of Washington and Oregon are such that the spruce-fir forests of those regions are included in this group. The subalpine fir and Engelmann spruce-dominated forests of the northeastern side of Mount Rainier are included here. They are more similar to subalpine fir forests on the eastern slopes of the Cascades than they are to mountain hemlock forests. Subalpine fir forests found on the Olympic Peninsula and west of the Cascade crest are typically mixed with *Tsuga mertensiana, Abies amabilis, Callitropsis nootkatensis*, and other species with "Vancouverian rainforest" affinities, and are not included in this group.

The following associations need further review to confirm their placement in this group: *Abies lasiocarpa / Cornus canadensis* Forest (CEGL000309) (swamp type?); *Abies lasiocarpa - Picea engelmannii / Ribes (montigenum, lacustre, inerme)* Forest (CEGL000331) (a hodge-podge of indicators); *Populus tremuloides - Abies lasiocarpa / Symphoricarpos oreophilus / Bromus carinatus* Forest (CEGL000530) (G219?); *Populus tremuloides - Abies lasiocarpa / Symphoricarpos oreophilus* / Tall Forbs Forest (CEGL000531) (G219?); and *Populus tremuloides - Abies lasiocarpa / Symphoricarpos oreophilus / Thalictrum fendleri* Forest (CEGL000532) (G219?).

Similar NVC Types:

- G220 Rocky Mountain Lodgepole Pine Forest & Woodland
- G223 Northern Rocky Mountain Whitebark Pine - Subalpine Larch Woodland: could also be considered as one or two alliances within the spruce-fir group.
- G219 Rocky Mountain Subalpine Dry-Mesic Spruce - Fir Forest & Woodland

Diagnostic Characteristics: These subalpine forest and woodlands are characterized by diagnostic subalpine trees *Picea engelmannii, Abies lasiocarpa*, and sometimes with *Tsuga mertensiana* with mesic to wet understory shrub species such as *Cornus canadensis, Ledum glandulosum*, *Menziesia ferruginea, Phyllodoce empetriformis, Rhododendron albiflorum, Rubus parviflorus, Salix* spp., and *Vaccinium membranaceum*, or mesic to wet herbaceous species such as *Actaea rubra, Calamagrostis canadensis, Clintonia uniflora, Erigeron eximius, Gymnocarpium dryopteris, Luzula glabrata var. hitchcockii, Maianthemum stellatum, Rubus pedatus, Saxifraga bronchialis, Thalictrum fendleri, Tiarella* spp., and *Valeriana sitchensis*.

VEGETATION

Physiognomy and Structure: This group is composed of needle-leaved evergreen forests and woodlands dominated by tall (>30 m) trees. Canopy is generally closed to moderately open.

Floristics: This is a high-elevation group of the Rocky Mountains and dry eastern Cascades typically dominated by *Picea engelmannii* and *Abies lasiocarpa*. In the northern Rocky Mountains of northern Idaho and Montana, *Tsuga mertensiana* occurs as small to large patches within the matrix of this mesic spruce-fir group and only in the most maritime of environments (the coldest and wettest of the more Continental subalpine fir forests). *Populus tremuloides* is a common codominant tree in many disturbed stands. Moisture-loving wet understory species are diagnostic of this group and may include shrubs *Cornus canadensis, Ledum glandulosum, Menziesia ferruginea, Phyllodoce empetriformis, Rhododendron albiflorum, Rubus parviflorus, Salix brachycarpa, Salix glauca, Spiraea betulifolia, Symphoricarpos albus*, and *Vaccinium membranaceum*. The understory may also be dominated by herbaceous species such as *Actaea rubra, Calamagrostis canadensis, Carex siccata, Clintonia uniflora, Erigeron eximius, Eucephalus engelmannii (= Aster engelmannii), Gymnocarpium dryopteris, Heracleum maximum, Luzula glabrata var. hitchcockii, Maianthemum stellatum, Osmorhiza berteroi, Osmorhiza occidentalis, Packera cardamine, Packera sanguisorboides, Pedicularis racemosa, Rubus pedatus, Rudbeckia occidentalis, Saxifraga bronchialis, Thalictrum fendleri, Tiarella* spp., *Valeriana occidentalis, Valeriana sitchensis*, and *Xerophyllum tenax*.

ENVIRONMENT & DYNAMICS

Environmental Description: Occurrences are typically found at high elevations in locations with cold-air drainage or ponding, or where snowpacks linger late into the summer, such as north-facing slopes and high-elevation ravines. They can extend down in elevation below the subalpine zone in places where cold-air ponding occurs; northerly and easterly aspects predominate. These forests are found on gentle to very steep mountain slopes, high-elevation ridgetops and upper slopes, plateaulike surfaces, basins, alluvial terraces, well-drained benches, and inactive stream terraces. *Climate:* Sites within this group are cold year-round, and precipitation is predominantly in the form of snow, which may persist until late summer. Snowpacks are deep and late-lying, and summers are cool. Frost is possible almost all summer and may be common in restricted topographic basins and benches. Occurrences are typically found in locations with ponding, or where snowpacks linger late into the summer, such as north-facing slopes and high-elevation ravines. They can extend down in elevation below the subalpine zone in places where cold-air ponding occurs; northerly and easterly aspects predominate.

Dynamics: Disturbances include occasional blowdown, insect outbreaks (30-50 years), mixed-severity fire, and stand-replacing fire (every 150-500 years). The more summer-dry climatic areas also have occasional high-severity fires.

DISTRIBUTION

Geographic Range: This group is found at high elevations of the Rocky Mountains, extending west into the northeastern side of Mount Rainier in Washington, and as far east as mountain "islands" of north-central Montana.

Spatial Scale & Pattern [optional]: Large patch
Nations: CA, US
States/Provinces: AB, AZ, BC, CA?, CO, ID, MT, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]: 4:C, 7:C, 8:C, 9:C, 11:C, 20:C, 21:C, 26:C, 68:C
USFS Ecoregions (2007): 242A:CC, 313A:CC, 313B:CC, 315A:??, 331J:CC, 341A:CC, 341B:CC, 341D:CC, 341E:CP, 341F:CC, 341G:CC, 342A:CC, 342B:CC, 342C:CP, 342D:CC, 342E:CC, 342H:CC, 342I:C?, 342J:CC, M242A:CC, M242B:CC, M242C:CC, M242D:CC, M313A:CC, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M341A:CC, M341B:CC, M341C:CC, M341D:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **<** Engelmann Spruce - Subalpine Fir: 206 (Eyre 1980)
- **><** Mountain Hemlock: 205 (Eyre 1980) [Mountain hemlock in the northern Rockies of MT, ID and northeast WA is included in this group.]

LOWER LEVEL UNITS

Alliances:

- A3617 *Tsuga mertensiana* Rocky Mountain Forest Alliance
- A0422 *Abies lasiocarpa - Populus tremuloides* Rocky Mountain Moist Forest Alliance
- A3614 *Abies lasiocarpa - Picea engelmannii* Rocky Mountain Moist Forest Alliance
- A3616 *Abies lasiocarpa - Picea engelmannii* Rocky Mountain Talus & Scree Woodland Alliance
- A3615 *Abies lasiocarpa - Picea engelmannii* Southern Rocky Mountain Moist Forest Alliance

AUTHORSHIP

Primary Concept Source: F.H. Eyre (1980)
Author of Description: K.A. Schulz
Acknowledgments: D. Tart
Version Date: 10/08/2013
Classif Resp Region: West
Internal Author: KAS 2-10, mod. DFL 10-13, mod. GK 12-15

REFERENCES

References: Alexander and Ronco 1987, Alexander et al. 1984a, Alexander et al. 1987, BCMF 2006, Banner et al. 1993, Clagg 1975, Cooper et al. 1987, Daubenmire and Daubenmire 1968, DeVelice et al. 1986, Ecosystems Working Group 1998, Eyre 1980, Faber-Langendoen et al. 2017a, Hess and Alexander 1986, Hess and Wasser 1982, Hoffman and Alexander 1976, Hoffman and Alexander 1980, Hoffman and Alexander 1983, Johnson and Clausnitzer 1992, Johnson and Simon 1987, Komarkova et al. 1988b, Lillybridge et al. 1995, MacKinnon et al. 1990, Mauk and Henderson 1984, Mehl 1992, Meidinger and Pojar 1991, Muldavin et al. 1996, Peet 1978a, Peet 1981, Pfister 1972, Pfister et al. 1977, Steele et al. 1981, Steen and Coupé 1997, Williams and Lillybridge 1983, Williams et al. 1995, Youngblood and Mauk 1985

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G218. Rocky Mountain Subalpine Moist Spruce - Fir Forest & Woodland

A3614. Abies lasiocarpa - Picea engelmannii Rocky Mountain Moist Forest Alliance

Type Concept Sentence: These upper montane and subalpine forests and woodlands of the northern Rocky Mountains are dominated by *Abies lasiocarpa* and/or *Picea engelmannii*.

OVERVIEW

Scientific Name: *Abies lasiocarpa - Picea engelmannii* Rocky Mountain Moist Forest Alliance
Common Name (Translated Scientific Name): Subalpine Fir - Engelmann Spruce Rocky Mountain Moist Forest Alliance
Colloquial Name: Rocky Mountain Subalpine Fir - Engelmann Spruce Moist Forest

Type Concept: This alliance consists of upper montane and subalpine conifer-dominated forests and woodlands of the Rocky Mountains. *Abies lasiocarpa* and *Picea engelmannii* dominate the canopy either singly or together. Some sites are codominated by *Populus tremuloides* depending on stand age. Associates vary geographically. Common associated conifers can include *Larix occidentalis, Picea pungens, Pinus albicaulis, Pinus contorta*, and *Pseudotsuga menziesii*. Understories are highly variable across the range of this alliance and can be dominated by grasses, dry sedges, ferns, mesic forbs or shrubs (typically ericaceous). Dominant shrubs may include *Menziesia ferruginea, Rhododendron albiflorum, Spiraea betulifolia, Symphoricarpos albus, Vaccinium cespitosum*, and *Vaccinium scoparium*. Important herbaceous species may include *Actaea rubra, Clintonia uniflora, Coptis occidentalis, Cornus canadensis, Galium triflorum, Gymnocarpium dryopteris, Linnaea borealis, Luzula glabrata var. hitchcockii, Maianthemum stellatum, Senecio triangularis, Streptopus amplexifolius, Thalictrum occidentale*, and *Xerophyllum tenax*. Elevations range from 970-3200 m. Sites where these forest and woodlands are found include gentle to very steep mountain slopes, high-elevation ridgetops and upper slopes, basins, alluvial terraces, well-drained benches, and inactive stream terraces.

Classification Comments: Many of the spruce-fir associations of this ecological group were formally grouped into one alliance, but are now split apart to reflect northern and southern distributions.

Internal Comments:
Other Comments:

Similar NVC Types:
- A3615 *Abies lasiocarpa - Picea engelmannii* Southern Rocky Mountain Moist Forest Alliance: has species with more southern distributions.

Diagnostic Characteristics: This alliance is characterized by open to closed canopies dominated by *Abies lasiocarpa* and/or *Picea engelmannii* singly or in combination with associated species of more northern affinities. Sites are montane to subalpine with relatively moist substrates.

VEGETATION

Physiognomy and Structure: These forests and woodlands are dominated by needle-leaved evergreen trees up to 30 m in height and of low to dense cover (20-100%). Although cold-deciduous trees are relatively rare, they can be prominent in some regional variants or seral stands. A moderately dense shrub layer is usually present, dominated by ericaceous or, less commonly, cold-deciduous species. The herbaceous layer is dominated by perennial forbs or sod-forming graminoids. In some regions, a nonvascular layer dominated by mosses covers the ground surface.

Floristics: *Abies lasiocarpa* and/or *Picea engelmannii* are dominant singly or together. *Picea engelmannii* will often be prominent on more moist sites or in more mature stands. *Populus tremuloides* may be codominant in younger stands. Total canopy cover ranges from 20-100%. Canopy associates vary geographically. Common associated conifers can include *Larix occidentalis, Picea pungens, Pinus albicaulis, Pinus contorta*, and *Pseudotsuga menziesii*. Understories are highly variable across the range of this alliance and can be dominated by grasses, dry sedges, ferns, mesic forbs or shrubs (typically ericaceous). The shrub layer is typically less than 2 m in height, and can be up to 80% in cover, although in some stands may be under 20% and a reflection of dry conditions. Dominant shrubs may include *Menziesia ferruginea, Rhododendron albiflorum, Spiraea betulifolia, Symphoricarpos albus, Vaccinium cespitosum*, and *Vaccinium scoparium*. Important herbaceous species may include *Actaea rubra, Clintonia uniflora, Coptis occidentalis, Cornus canadensis, Galium triflorum, Gymnocarpium dryopteris, Linnaea borealis, Luzula glabrata var. hitchcockii, Maianthemum stellatum, Senecio triangularis, Streptopus amplexifolius, Thalictrum occidentale*, and *Xerophyllum tenax*.

ENVIRONMENT & DYNAMICS

Environmental Description: These upper montane or subalpine forests and woodlands occur in many of the mountainous areas of the middle to northern Rocky Mountains where they are often the matrix forests of the subalpine zone. They occur above the warmer and drier montane forests of the West, which are typically mixed-coniferous forests. Average temperatures are fairly uniform across the alliance's range, with mean July and January temperatures of 12° and -10°C, respectively (Burns and Honkala 1990a). Snowpacks can be deep, but often melt quickly, and summers are cool. Summer frosts are characteristic, especially on sites where cold air pools. Elevations range from 1300-1950 m in the eastern Cascades, and increase with decreasing latitude from roughly 2200 m in central Idaho to over 3500 m in Colorado. Sites where these forests are found include gentle to very steep mountain slopes, high-elevation ridgetops and upper slopes, plateau-like surfaces, basins, alluvial terraces, well-drained benches, and inactive stream terraces. All aspects and slopes are represented, but northerly and easterly aspects predominate. Southerly aspects are found only at higher elevations than where these forests occur in a given region. In some locations where there is cold-air drainage, these forests may extend down in elevation into the montane zone, where they will occupy dry stream terraces, toeslopes, or mesic sites with cooler temperature regimes such as northern aspects. Parent materials and soils are variable across the distribution of the alliance. Parent materials include ash, tuff, lava, basalt, granitics, quartzite, dolomite, rhyolite, and other sedimentary rock types. Stands can also occur on colluvium or alluvium. Soils are typically not deep, poorly developed, and can have

significant amounts of rock and gravel in the profile. Subalpine soils, such as found associated with these forests, often show evidence of podzolization processes, especially in the north, and poorly decomposed organic layers are common.

Dynamics: *Abies lasiocarpa* forests develop on sites with limited, short growing seasons and relatively deep winter snowpacks. Tree growth is very slow in these habitats, and forests are rapidly colonized by faster growing shade-intolerant species, such as *Pseudotsuga menziesii, Pinus contorta*, or *Populus tremuloides* following fire, clearcut logging, or windthrow disturbance. *Abies lasiocarpa* is among the most shade-tolerant trees in the Rocky Mountains, but seedlings compete poorly in greater than 50% full sunlight (Burns and Honkala 1990a). In Oregon and Washington, many communities are bottomland, moist, upper montane forests that rarely burn. Fire is important in many of the more open sites, as well as those on steep slopes. Snow avalanches occur frequently at upper elevations, and can result in a mosaic of varying stand ages on sites affected by this disturbance type.

Picea engelmannii can be very long-lived, reaching 500 years of age. *Abies lasiocarpa* decreases in importance relative to *Picea engelmannii* with increasing distance from the region of Montana and Idaho where maritime air masses influence the climate. Fire is an important disturbance factor, but fire regimes have a long return interval and so are often stand-replacing. *Picea engelmannii* can rapidly recolonize and dominate burned sites, or can succeed to other species such as *Pinus contorta* or *Populus tremuloides*. Due to great longevity, *Pseudotsuga menziesii* may persist in stands of this alliance for long periods without regeneration. Old-growth characteristics in *Picea engelmannii* forests will include treefall and windthrow gaps in the canopy, with large downed logs, rotting woody material, tree seedling establishment on logs or on mineral soils unearthed in root balls, and snags.

DISTRIBUTION

Geographic Range: This alliance occurs in the subalpine zones of the central and northern Rocky Mountains and eastern Cascade Range.

Nations: CA, US
States/Provinces: CA?, CO, ID, MT, OR, UT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** Engelmann Spruce - Subalpine Fir: 206 (Eyre 1980)

LOWER LEVEL UNITS

Associations:
- CEGL002323 *Picea engelmannii x glauca / Spiraea douglasii var. douglasii* Woodland
- CEGL002327 *Abies lasiocarpa var. lasiocarpa / Vaccinium membranaceum / Brachythecium* spp. Woodland
- CEGL000335 *Abies lasiocarpa / Spiraea betulifolia* Forest
- CEGL000315 *Abies lasiocarpa - Picea engelmannii / Linnaea borealis* Forest
- CEGL000341 *Abies lasiocarpa - Picea engelmannii / Vaccinium membranaceum* Rocky Mountain Forest
- CEGL000340 *Abies lasiocarpa - Picea engelmannii / Vaccinium cespitosum* Forest
- CEGL000360 *Picea engelmannii / Clintonia uniflora* Forest
- CEGL000406 *Picea (engelmannii x glauca, engelmannii) / Clintonia uniflora* Forest
- CEGL000337 *Abies lasiocarpa - Picea engelmannii / Symphoricarpos albus* Forest
- CEGL000295 *Abies lasiocarpa - Picea engelmannii / Actaea rubra* Forest
- CEGL000319 *Abies lasiocarpa - Picea engelmannii / Menziesia ferruginea* Forest
- CEGL000346 *Abies lasiocarpa / Xerophyllum tenax* Forest
- CEGL000338 *Abies lasiocarpa - Picea engelmannii / Thalictrum occidentale* Forest
- CEGL002613 *Abies lasiocarpa / Rhododendron albiflorum / Senecio triangularis* Woodland
- CEGL002689 *Picea engelmannii / Linnaea borealis* Forest
- CEGL000311 *Abies lasiocarpa - Picea engelmannii / Galium triflorum* Forest
- CEGL000415 *Picea engelmannii / Maianthemum stellatum* Forest
- CEGL000309 *Abies lasiocarpa / Cornus canadensis* Forest
- CEGL005918 *Abies lasiocarpa - Picea engelmannii / Vaccinium cespitosum / Clintonia uniflora* Forest
- CEGL005917 *Abies lasiocarpa - Picea engelmannii / Vaccinium membranaceum / Xerophyllum tenax* Forest
- CEGL005919 *Abies lasiocarpa - Picea engelmannii / Vaccinium scoparium / Thalictrum occidentale* Forest
- CEGL005914 *Abies lasiocarpa - Picea engelmannii / Vaccinium scoparium / Xerophyllum tenax* Forest

- CEGL005920 *Abies lasiocarpa - Picea engelmannii / Streptopus amplexifolius - Luzula glabrata var. hitchcockii* Woodland
- CEGL000317 *Abies lasiocarpa - Picea engelmannii / Luzula glabrata var. hitchcockii* Woodland
- CEGL000342 *Abies lasiocarpa / Vaccinium membranaceum* Forest
- CEGL005908 *Populus tremuloides - Abies lasiocarpa - Picea engelmannii / Streptopus amplexifolius* Forest
- CEGL005892 *Abies lasiocarpa - Picea engelmannii / Clintonia uniflora - Xerophyllum tenax* Forest
- CEGL005893 *Abies lasiocarpa - Picea engelmannii / Menziesia ferruginea / Clintonia uniflora* Forest
- CEGL005894 *Abies lasiocarpa - Picea engelmannii / Menziesia ferruginea - Vaccinium scoparium* Forest
- CEGL005895 *Abies lasiocarpa - Picea engelmannii / Menziesia ferruginea / Xerophyllum tenax* Forest
- CEGL005912 *Abies lasiocarpa - Picea engelmannii / Clintonia uniflora* Forest
- CEGL005896 *Abies lasiocarpa - Picea engelmannii / Menziesia ferruginea / Luzula glabrata var. hitchcockii* Woodland
- CEGL005897 *Abies lasiocarpa - Picea engelmannii / Menziesia ferruginea / Streptopus amplexifolius* Woodland
- CEGL005898 *Abies lasiocarpa - Picea engelmannii / Xerophyllum tenax - Luzula glabrata var. hitchcockii* Woodland
- CEGL005926 *Picea engelmannii / Vaccinium cespitosum* Forest
- CEGL002174 *Picea engelmannii / Galium triflorum* Forest
- CEGL005637 *Abies lasiocarpa / Vaccinium membranaceum / Lupinus arcticus ssp. subalpinus* Woodland
- CEGL005635 *Abies lasiocarpa / Rhododendron albiflorum / Rubus lasiococcus* Forest
- CEGL002611 *Abies lasiocarpa / Gymnocarpium dryopteris* Forest
- CEGL000308 *Abies lasiocarpa / Coptis occidentalis* Forest

AUTHORSHIP

Primary Concept Source: F.H. Eyre (1980)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Burns and Honkala 1990a, Eyre 1980, Faber-Langendoen et al. 2017b

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G218. Rocky Mountain Subalpine Moist Spruce - Fir Forest & Woodland

A3616. Abies lasiocarpa - Picea engelmannii Rocky Mountain Talus & Scree Woodland Alliance

Type Concept Sentence: These woodlands of the subalpine Rocky Mountains are associated with talus and scree substrates and dominated by *Abies lasiocarpa* and/or *Picea engelmannii*.

OVERVIEW

Scientific Name: *Abies lasiocarpa - Picea engelmannii* Rocky Mountain Talus & Scree Woodland Alliance
Common Name (Translated Scientific Name): Subalpine Fir - Engelmann Spruce Rocky Mountain Talus & Scree Woodland Alliance
Colloquial Name: Rocky Mountain Subalpine Fir - Engelmann Spruce Talus & Scree Woodland

Type Concept: These upper montane or subalpine conifer woodlands are found scattered throughout the Rocky Mountains within cool and relatively dry climate regimes. In mature stands, the association is characterized by *Abies lasiocarpa* as the dominant tree species, often with *Picea engelmannii*. In seral stands, other conifers can be important or even dominant, but *Abies lasiocarpa* is always present in the regeneration layer. Other tree associates include *Callitropsis nootkatensis (= Chamaecyparis nootkatensis), Larix* spp., *Pinus albicaulis, Pinus contorta, Picea glauca, Pseudotsuga menziesii*, and *Tsuga* spp. Stands have sparse shrub layers, typically a reflection of dry conditions related to poorly developed soils, and may include species such as *Acer circinatum, Holodiscus dumosus, Juniperus communis, Ribes* spp., *Salix brachycarpa*, and *Salix glauca*. The herbaceous layer is generally sparse. Important forbs include species of *Arnica, Fragaria, Lupinus, Pedicularis*, and *Thalictrum*. Graminoids are rarely important in these woodlands. These woodlands are found on scree and talus slopes where marginal growing conditions produce an open tree canopy. Parent materials and soils are variable across the distribution of the alliance.

Classification Comments: This alliance is a subset of associations of a former larger woodland alliance (A.559), but is now considered environmentally unique in occupying scree and talus slopes. Associations in this alliance have been poorly sampled and may prove with further data to be sparsely vegetated types that should be moved into the sparse vegetation class of the USNVC.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: *Abies lasiocarpa* and/or *Picea engelmannii* form open canopies and occur on talus and scree habitats in upper montane and subalpine environments. Diagnostic of woodlands in this alliance is that they are upland (non-flooded) with average tree canopy of less than 60% cover that is either dominated by *Abies lasiocarpa* or has *Abies lasiocarpa* as the predominant conifer in the tree-regeneration layer.

VEGETATION

Physiognomy and Structure: These woodlands are dominated by needle-leaved evergreen trees up to 30 m in height and of low to moderate cover (20-60%). Although cold-deciduous trees are relatively rare, they can be prominent in some regional variants or seral stands. A sparse to moderately dense shrub layer may be present, dominated by ericaceous or, less commonly, cold-deciduous species. The herbaceous layer is variable and is typically dominated by perennial forbs. In some regions, a nonvascular layer dominated by mosses covers the ground surface.

Floristics: Older stands of these woodlands are characterized by *Abies lasiocarpa* as the dominant tree species in an open tree canopy, often with *Picea engelmannii*. Total canopy cover averages <60%, but some stands may have somewhat higher cover. In younger stands, other conifers can be important or even dominant, but *Abies lasiocarpa* is always present in the regeneration layer. Canopy associates may include *Pinus contorta, Populus tremuloides*, and *Pseudotsuga menziesii*. Associations in this alliance have poorly to well-developed shrub layers, with the herbaceous layer being relatively depauperate and sparse. The shrub layer is typically less than 2 m in height, and can be up to 80% in cover, although in some stands may be under 20% and a reflection of dry conditions and poorly developed soils. Important to dominant species include *Acer circinatum, Holodiscus dumosus, Juniperus communis, Ribes* spp., *Salix brachycarpa*, and *Salix glauca*. Important forbs include *Arnica cordifolia, Arnica latifolia, Chamerion angustifolium (= Epilobium angustifolium), Galium triflorum, Orthilia secunda, Polemonium pulcherrimum, Saxifraga bronchialis*, and species of *Fragaria, Lupinus, Pedicularis*, and *Thalictrum*. Graminoids are rarely important in these woodlands. Where these woodlands occur on sites with some soil development, there may be a nonvascular layer composed primarily of mosses on the ground surface (Steele et al. 1981, Henderson et al. 1989).

ENVIRONMENT & DYNAMICS

Environmental Description: These upper montane or subalpine woodlands are found scattered throughout the Rocky Mountains in cool and relatively dry climate regimes. These woodlands occur on droughty, well-drained substrates such as scree and talus slopes on southerly or westerly slopes and ridgetops. Snowpacks can be deep, and summers are cool. Summer frosts are characteristic, especially in sites where cold air pools. Elevations range from roughly 2200 m in central Idaho to over 3200 m in Utah, Colorado and New Mexico. In some locations where there is cold-air drainage, these woodlands extend down in elevation into the montane zone. Soils are typically shallow, poorly developed, with significant amounts of rock and gravel in the profile.

Dynamics:

DISTRIBUTION

Geographic Range: The distribution of this alliance is poorly documented. It has been documented primarily from the southern Rocky Mountains of Colorado, Wyoming and New Mexico with occurrences known also from the northern Rocky Mountains in Glacier-Waterton International Peace Park in Montana and Alberta, Canada.

Nations: CA, US
States/Provinces: AB, CO, MT, NM, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** *Abies lasiocarpa-Picea engelmannii* Series (Johnston 1987)
- **><** Engelmann Spruce - Subalpine Fir: 206 (Eyre 1980)
- **><** Western Needleleaf Forests: 15: Western Spruce-Fir Forest (*Picea-Abies*) (Küchler 1964)
- **><** Western Needleleaf Forests: 21: Southwestern Spruce-Fir Forest (*Picea-Abies*) (Küchler 1964)

LOWER LEVEL UNITS

Associations:

- CEGL000923 *Abies lasiocarpa / Salix glauca* Scree Woodland
- CEGL005823 *Abies lasiocarpa - Picea engelmannii / Valeriana sitchensis* Woodland

- CEGL000922 *Abies lasiocarpa / Salix brachycarpa* Scree Woodland
- CEGL000924 *Abies lasiocarpa / Saxifraga bronchialis* Scree Woodland

AUTHORSHIP

Primary Concept Source: M.S. Reid and D. Sarr, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Eyre 1980, Faber-Langendoen et al. 2017b, Henderson et al. 1989, Johnston 1987, Küchler 1964, Steele et al. 1981

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G218. Rocky Mountain Subalpine Moist Spruce - Fir Forest & Woodland

A3615. Abies lasiocarpa - Picea engelmannii Southern Rocky Mountain Moist Forest Alliance

Type Concept Sentence: These subalpine forests and woodlands of the Rocky Mountains with southern distributions are dominated by *Abies lasiocarpa* and/or *Picea engelmannii*.

OVERVIEW

Scientific Name: *Abies lasiocarpa - Picea engelmannii* Southern Rocky Mountain Moist Forest Alliance
Common Name (Translated Scientific Name): Subalpine Fir - Engelmann Spruce Southern Rocky Mountain Moist Forest Alliance
Colloquial Name: Southern Rocky Mountain Subalpine Fir - Engelmann Spruce Moist Forest

Type Concept: These conifer forests occur predominantly in the southern Rocky Mountains where they are often the matrix forests of the upper montane and subalpine zones. These are closed-canopy forests (60-100% cover) dominated by *Abies lasiocarpa* and/or *Picea engelmannii*. *Abies lasiocarpa* may not be present where sites are too dry or cold. Canopy associates are variable depending on location. Common associates include *Abies concolor, Picea pungens, Pinus strobiformis, Populus tremuloides*, and *Pseudotsuga menziesii*. Forest understories are highly variable across the range of this alliance and can be dominated by grasses, dry sedges, mesic forbs or shrubs. The shrub layer is sparse to moderately dense. Important shrubs may include *Acer glabrum, Lonicera utahensis, Mahonia repens, Paxistima myrsinites, Physocarpus malvaceus, Ribes* spp., *Rosa* spp., *Rubus parviflorus, Symphoricarpos* spp., and *Vaccinium* spp. Forb cover is often sparse, but diverse with species including *Arnica* spp., *Aquilegia* spp., *Caltha leptosepala, Cardamine cordifolia, Chamerion angustifolium, Erigeron eximius, Lupinus argenteus, Mertensia* spp., *Mitella pentandra, Orthilia secunda, Osmorhiza berteroi, Oxypolis fendleri, Packera* spp., *Pyrola* spp., and *Stellaria* spp. Graminoid cover is generally low but may include *Achnatherum lettermanii (= Stipa lettermanii), Bromus carinatus, Carex geyeri, Carex rossii, Festuca idahoensis, Luzula parviflora*, and *Trisetum spicatum*. Associations occur on cool, relatively mesic to moist sites with gentle to steep slopes on all aspects (especially northerly) and also on lower slopes of canyon drainages and riparian areas. Elevations range from 2200-3500 m.

Classification Comments: Many of the spruce - fir associations of this ecological group were formally grouped into one alliance, but split apart to reflect northern and southern distributions. There are some associations placed here, such as *Abies lasiocarpa - Picea engelmannii / Acer glabrum* Forest (CEGL000294), which have very broad northern and southern distributions and may require further review to be parsed into two different associations.

Internal Comments:
Other Comments:

Similar NVC Types:

- A3614 *Abies lasiocarpa - Picea engelmannii* Rocky Mountain Moist Forest Alliance: has species with more northern distributions.

Diagnostic Characteristics: This alliance is characterized by open to closed forest canopies dominated by *Abies lasiocarpa* and/or *Picea engelmannii* singly or in combination with associated species of more southern affinities. Canopy cover is typically 60-100%, but may be lower in some occurrences. Shrub and herbaceous composition is highly variable depending on location. This alliance represents the matrix forest vegetation of the upper montane and subalpine zones of the southern Rocky Mountains.

VEGETATION

Physiognomy and Structure: These forests are dominated by needle-leaved evergreen trees up to 45 m in height and of high cover (60-100%). Although cold-deciduous trees are relatively rare, they can be prominent in some regional variants or seral stands. Stands may be so tightly stocked that little light reaches the forest floor and understory layers are depauperate. In stands with somewhat more open canopies, a moderately dense shrub layer may be present and dominated by ericaceous or cold-deciduous species. The

herbaceous layer is dominated by perennial forbs or sod-forming graminoids, and herbaceous cover increases with increasing light availability and/or soil moisture. There is often significant cover of mosses and sometimes lichens on the forest floor and on downed woody material.

Floristics: Despite the wide distribution of these subalpine forests, their tree canopy characteristics are remarkably similar across their range of distribution. *Abies lasiocarpa* and/or *Picea engelmannii* are dominant singly or together. Both species are typically present in most stands. In some stands, *Picea engelmannii* may be absent altogether, or *Abies lasiocarpa* may only occur as seedlings and saplings. *Picea engelmannii* will often be prominent on more moist sites or in more mature stands. *Populus tremuloides* is a major seral species, and *Pinus contorta* occurs less frequently. Other common canopy associates may include *Abies concolor, Picea pungens*, and *Pseudotsuga menziesii*. The shrub and herbaceous layers of these forest associations are highly variable. Forest understories can be dominated by grasses or dry sedges in the more open forests, or by ericaceous shrubs or moist forbs in closed-canopy, moist sites. Shrub layers where they do occur are typically less than 1 m tall. Important to dominant shrubs include *Acer glabrum, Jamesia americana, Juniperus communis, Mahonia repens, Physocarpus monogynus, Ribes* spp., *Shepherdia canadensis, Vaccinium cespitosum, Vaccinium myrtillus*, and *Vaccinium scoparium*. Forb cover is often sparse, but diverse with species including *Arnica* spp., *Aquilegia* spp., *Caltha leptosepala, Cardamine cordifolia, Chamerion angustifolium, Erigeron eximius, Lupinus argenteus, Mertensia* spp., *Mitella pentandra, Orthilia secunda, Osmorhiza berteroi, Oxypolis fendleri, Packera* spp., *Pyrola* spp., and *Stellaria* spp. Graminoid cover is generally low but may include *Achnatherum lettermanii (= Stipa lettermanii), Bromus carinatus, Carex geyeri, Carex rossii, Festuca idahoensis, Luzula parviflora*, and *Trisetum spicatum*.

ENVIRONMENT & DYNAMICS

Environmental Description: These forests occur in the southern Rocky Mountains where they are often the matrix forests of the upper montane and subalpine zones. They occur above the warmer and drier montane forests. Average temperatures are fairly uniform across the alliance's range, with mean July and January temperatures of 12° and -10°C, respectively (Burns and Honkala 1990a). Snowpacks can be deep, but often melt quickly, and summers are cool. Summer frosts are characteristic, especially on sites where cold air pools. Elevations range from 2200-3500 m. Associations occur on cool, relatively mesic to moist sites with gentle to steep slopes on all aspects. In some locations where there is cold-air drainage, these forests may extend down in elevation into the montane zone, where they will occupy dry stream terraces, toeslopes, or mesic sites with cooler temperature regimes such as northern aspects. Parent materials and soils are variable across the distribution of the alliance. Parent materials include ash, tuff, lava, basalt, granitics, quartzite, dolomite, rhyolite, and other sedimentary rock types. Stands can also occur on colluvium or alluvium. Soils are typically not deep, poorly developed, and can have significant amounts of rock and gravel in the profile. Subalpine soils, such as found associated with these forests, often show evidence of podzolization processes and poorly decomposed organic layers are common.

Dynamics: *Picea engelmannii* can be very long-lived, reaching 500 years of age. *Abies lasiocarpa* decreases in importance relative to *Picea engelmannii* with increasing distance from the region of Montana and Idaho where maritime air masses influence the climate. Fire is an important disturbance factor, but fire regimes have a long return interval and so are often stand-replacing. *Picea engelmannii* can rapidly recolonize and dominate burned sites, or can succeed to other species such as *Pinus contorta* or *Populus tremuloides*. Due to great longevity, *Pseudotsuga menziesii* may persist in stands of this alliance for long periods without regeneration. Old-growth characteristics in *Picea engelmannii* forests will include treefall and windthrow gaps in the canopy, with large downed logs, rotting woody material, tree seedling establishment on logs or on mineral soils unearthed in root balls, and snags. *Picea engelmannii* is susceptible to infestations by spruce beetle (*Dendroctonus rufipennis*) or spruce budworm (*Choristoneura occidentalis*), which can cause high mortality during outbreaks. In the Southwest, dwarf mistletoe *Arceuthobium microcarpum* is a common cause of mortality for the species.

Abies lasiocarpa forests develop on sites with limited, short growing seasons and relatively deep winter snowpacks. Tree growth is very slow in these habitats, and forests are rapidly colonized by much more rapidly growing shade-intolerant species, such as *Pseudotsuga menziesii, Pinus contorta*, or *Populus tremuloides*, following fire, clearcut logging, or windthrow disturbance. *Abies lasiocarpa* is among the most shade-tolerant trees in the Rocky Mountains, but seedlings compete poorly in greater than 50% full sunlight (Burns and Honkala 1990a). Fire is important in many of the more open sites, as well as those on steep slopes. Snow avalanches occur frequently at upper elevations, and can result in a mosaic of varying stand ages on sites affected by this disturbance type.

DISTRIBUTION

Geographic Range: This alliance is occurs in the upper montane and subalpine zones of the central and southern Rocky Mountains, but extends west in the Utah High Plateaus, Great Basin, and Columbia Plateau and east into the Wyoming Basins.

Nations: US
States/Provinces: AZ, CO, ID, MT, NM, NV, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):

Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **><** *Abies lasiocarpa-Picea engelmannii* Series (Johnston 1987)
- **><** *Picea* series (Pfister et al. 1977)
- **><** Engelmann Spruce - Subalpine Fir: 206 (Eyre 1980)
- **><** Western Needleleaf Forests: 15: Western Spruce-Fir Forest (*Picea-Abies*) (Küchler 1964)
- **><** Western Needleleaf Forests: 21: Southwestern Spruce-Fir Forest (*Picea-Abies*) (Küchler 1964)

LOWER LEVEL UNITS

Associations:

- CEGL000375 *Picea engelmannii / Packera cardamine* Forest
- CEGL000354 *Picea engelmannii / Acer glabrum* Forest
- CEGL000374 *Picea engelmannii / Ribes montigenum* Forest
- CEGL000294 *Abies lasiocarpa - Picea engelmannii / Acer glabrum* Forest
- CEGL000373 *Abies lasiocarpa - Picea engelmannii / Polemonium pulcherrimum* Forest
- CEGL000310 *Abies lasiocarpa / Erigeron eximius* Forest
- CEGL000332 *Abies lasiocarpa / Rubus parviflorus* Forest
- CEGL000331 *Abies lasiocarpa - Picea engelmannii / Ribes (montigenum, lacustre, inerme)* Forest
- CEGL000364 *Picea engelmannii / Erigeron eximius* Forest

AUTHORSHIP

Primary Concept Source: F.H. Eyre (1980)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/01/07

REFERENCES

References: Burns and Honkala 1990a, Eyre 1980, Faber-Langendoen et al. 2017b, Johnston 1987, Küchler 1964, Pfister et al. 1977

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G218. Rocky Mountain Subalpine Moist Spruce - Fir Forest & Woodland

A0422. Abies lasiocarpa - Populus tremuloides Rocky Mountain Moist Forest Alliance

Type Concept Sentence: This mixed evergreen-deciduous forest alliance is codominated by *Populus tremuloides* and *Abies lasiocarpa* and has been described from mountain slopes and plateaus in the Rocky Mountains from Alberta, Canada, south to Montana, Wyoming, Colorado, and west into Utah.

OVERVIEW

Scientific Name: *Abies lasiocarpa - Populus tremuloides* Rocky Mountain Moist Forest Alliance
Common Name (Translated Scientific Name): Subalpine Fir - Quaking Aspen Rocky Mountain Moist Forest Alliance
Colloquial Name: Rocky Mountain Moist Subalpine Fir - Aspen Forest

Type Concept: The mixed coniferous and deciduous tree canopy is open to moderately closed and is dominated by *Populus tremuloides* and *Abies lasiocarpa*. Several other species of conifers may be scattered within the stands, including *Abies concolor, Picea engelmannii, Picea pungens, Pinus contorta, Pinus flexilis*, and *Pseudotsuga menziesii*. Younger stands typically have dense *Populus tremuloides*, with *Abies lasiocarpa* or other conifers mixed in. As the stands age in this typically seral forest association, *Populus tremuloides* is slowly reduced until conifers become dominant. Mixed stands must have at least 25% relative tree cover of both aspen (deciduous) and conifers. The understory is most often composed of a short-shrub layer often dominated by *Symphoricarpos oreophilus*. Other shrubs may include *Amelanchier alnifolia, Mahonia repens, Paxistima myrsinites, Physocarpus malvaceus*, and *Rosa woodsii*. The herbaceous layer is variable and may compete with shrub species for understory dominance or in some stands be dominant over shrubs. It is a mixture of graminoids and forbs. Characteristic herbaceous species may include *Delphinium x occidentale, Eucephalus engelmannii (= Aster engelmannii), Heracleum maximum, Osmorhiza occidentalis, Pedicularis racemosa, Rudbeckia occidentalis, Thalictrum fendleri*, and *Valeriana occidentalis*. Stands included in this mixed evergreen-deciduous forest alliance have been described from mountain slopes and plateaus in the Rocky Mountains from Alberta, Canada, south to Montana, Wyoming, Colorado and west into Utah. They occur on gentle to steep slopes on all aspects, but are most

common on cooler and more mesic, north and east aspects. Soils are derived from alluvium and colluvium from sedimentary, metamorphic and igneous parent materials.

Classification Comments: This alliance is composed of five associations for which only two have descriptive material. Further review of undescribed associations will be required to produce a more thorough description of this alliance.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Diagnostic of these seral forests is the open to moderately closed, mixed coniferous and deciduous tree canopy codominated by *Populus tremuloides* and *Abies lasiocarpa* that occupy the upper montane and subalpine zones of the Rocky Mountains.

VEGETATION

Physiognomy and Structure: Vegetation included in this minor alliance has a moderately dense to dense upper canopy of mixed deciduous broad-leaved and evergreen needle-leaved trees (5-20 m tall). The understory has a moderate to sparse short-shrub layer typically dominated by evergreen scale-leaved or deciduous broad-leaved shrub species. A sparse tall-shrub layer dominated by deciduous broad-leaved shrubs may be present. A moderate to sparse herbaceous layer may also be present, most often dominated by tall perennial forbs.

Floristics: Seral forests are included in this Rocky Mountain alliance. The open to moderately closed, mixed evergreen needle-leaved and deciduous broad-leaved tree canopy is composed of short to moderately tall trees and is codominated by *Populus tremuloides* and *Abies lasiocarpa*. Several other species of conifers may be scattered within the stands, including *Abies concolor, Picea engelmannii, Picea pungens, Pinus contorta, Pinus flexilis*, and *Pseudotsuga menziesii*. Younger stands typically have dense *Populus tremuloides*, with *Abies lasiocarpa* mixed in. As the stands age in this typically seral forest association, *Populus tremuloides* is slowly reduced until conifers become dominant (Mueggler 1988). Mixed stands must have at least 25% relative tree cover of both aspen (deciduous) and conifers. The understory is typically moderately dense to sparse and becomes sparser as *Abies lasiocarpa* becomes more dominant. The understory is most often dominated by a short-shrub layer dominated by *Symphoricarpos oreophilus*. Other shrubs may include *Mahonia repens, Paxistima myrsinites, Physocarpus malvaceus*, and *Rosa woodsii*. The herbaceous layer is variable and may compete with shrub species for understory dominance or in some stands be more prominent over shrubs. It is a mixture of graminoids and forbs. Characteristic herbaceous species may include *Delphinium x occidentale, Eucephalus engelmannii (= Aster engelmannii), Heracleum maximum, Osmorhiza occidentalis, Pedicularis racemosa, Rudbeckia occidentalis, Thalictrum fendleri*, and *Valeriana occidentalis*.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands included in this mixed evergreen-deciduous forest alliance have been described from mountain slopes and plateaus in the Rocky Mountains from Alberta, Canada, south to Montana, Wyoming and Colorado and west into Utah. Elevations range from 2200 to 3500 m. Climate is temperate with cold winters. Mean annual precipitation is typically greater than 50 cm. Sites occur on gentle to steep slopes on all aspects, but are most common on north and east aspects. Soils are derived from alluvium and colluvium from sedimentary, metamorphic and igneous parent materials.

Dynamics: Stems of *Populus tremuloides* are thin-barked and readily killed by fire. It is a fire-adapted species that generally needs fire or some other stand-replacing disturbance to establish and maintain dominance in a forest. These mixed forests are seral and in the absence of disturbance will slowly convert to late-successional forests dominated by *Abies lasiocarpa* or *Picea engelmannii* (Mueggler 1988).

DISTRIBUTION

Geographic Range: Forests included in this alliance are scattered in the Rocky Mountains of Alberta, Canada, Montana, Idaho, Wyoming, Colorado and Utah.

Nations: CA, US
States/Provinces: AB, CO, ID, MT, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Abies lasiocarpa* Series (Mauk and Henderson 1984) [Early seral stands in this habitat type may have significant *Populus tremuloides*.]
- **><** Aspen: 217 (Eyre 1980)
- **><** Engelmann Spruce - Subalpine Fir: 206 (Eyre 1980)

LOWER LEVEL UNITS

Associations:

- CEGL000533 *Populus tremuloides - Abies lasiocarpa* / Tall Forbs Forest
- CEGL000532 *Populus tremuloides - Abies lasiocarpa / Symphoricarpos oreophilus / Thalictrum fendleri* Forest
- CEGL005911 *Populus tremuloides* - Conifer / *Spiraea betulifolia - Symphoricarpos albus* Forest
- CEGL000534 *Populus tremuloides - Abies lasiocarpa / Thalictrum fendleri* Forest
- CEGL000531 *Populus tremuloides - Abies lasiocarpa / Symphoricarpos oreophilus* / Tall Forbs Forest
- CEGL000530 *Populus tremuloides - Abies lasiocarpa / Symphoricarpos oreophilus / Bromus carinatus* Forest

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Eyre 1980, Faber-Langendoen et al. 2017b, Mauk and Henderson 1984, Mueggler 1988, Mueggler and Campbell 1986

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G218. Rocky Mountain Subalpine Moist Spruce - Fir Forest & Woodland

A3617. Tsuga mertensiana Rocky Mountain Forest Alliance

Type Concept Sentence: The forests are known from the middle and northern Rocky Mountains and eastern Cascades and characterized by a canopy dominated by *Tsuga mertensiana*.

OVERVIEW

Scientific Name: *Tsuga mertensiana* Rocky Mountain Forest Alliance
Common Name (Translated Scientific Name): Mountain Hemlock Rocky Mountain Forest Alliance
Colloquial Name: Rocky Mountain Hemlock Forest

Type Concept: These forests are characterized by a canopy of *Tsuga mertensiana*, a needle-leaved evergreen tree which can approach 35 m in height. Other conifers that may be present include *Abies grandis, Abies lasiocarpa, Picea engelmannii*, and *Pinus monticola*. The understory is often sparse due to dense canopy shading. Characteristic understory shrubs may include *Lonicera utahensis, Menziesia ferruginea, Paxistima myrsinites, Rhododendron albiflorum, Taxus brevifolia*, and *Vaccinium membranaceum*. Herbaceous species include *Asarum caudatum, Athyrium filix-femina, Clintonia uniflora, Coptis occidentalis, Gymnocarpium dryopteris, Maianthemum stellatum (= Smilacina stellata), Prosartes hookeri (= Disporum hookeri), Tiarella trifoliata, Trillium ovatum, Viola orbiculata*, and *Xerophyllum tenax*. This forest alliance occurs in the middle and northern Rocky Mountains and eastern Cascade Range from Oregon, Idaho and Montana. It occurs in cold, snowy subalpine environments and is generally associated with areas of incursions of maritime air masses, which moderate temperatures and produce deep winter snowpacks. Although this alliance typically occurs in subalpine habitats, it may occur in montane forest environments, such as slope benches or canyon bottoms, which are prone to cold-air drainage. Most soils can be characterized as loose, coarse-textured, and well-drained.

Classification Comments: This alliance is now defined for mountain hemlock forests of the subalpine zones of the Rocky Mountains and was formerly included with associations found further north. Very little descriptive material exists for associations in this alliance and further review will be required to adequately describe its attributions.

Internal Comments: mjr 3-16: *Tsuga mertensiana* does not occur in WY (removed).
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Forests of the subalpine zones of the northern Rocky Mountains and eastern Cascades with canopies dominated by *Tsuga mertensiana* in association with other conifer species.

VEGETATION

Physiognomy and Structure: Associations in this alliance are characterized by a dense canopy of needle-leaved evergreen trees, resulting in low light intensities at the forest floor and low understory cover. Trees are often large and widely spaced, with an open understory of occasional shrubs. When present, the shrub layer is often composed of low ericaceous shrubs which are sparsely scattered. An herbaceous layer of graminoids is occasionally present.

Floristics: These forests are characterized by a canopy of *Tsuga mertensiana*, a needle-leaved evergreen tree which can approach 35 m in height. Other conifers that may be present include *Abies grandis, Abies lasiocarpa, Picea engelmannii*, and *Pinus monticola*. The understory is often sparse due to dense canopy shading. Understory shrubs are largely ericaceous, including *Lonicera utahensis, Menziesia ferruginea, Paxistima myrsinites, Rhododendron albiflorum, Taxus brevifolia*, and *Vaccinium membranaceum*. Herbaceous species include *Asarum caudatum, Athyrium filix-femina, Clintonia uniflora, Coptis occidentalis, Gymnocarpium dryopteris, Maianthemum stellatum (= Smilacina stellata), Prosartes hookeri (= Disporum hookeri), Tiarella trifoliata, Trillium ovatum, Viola orbiculata*, and *Xerophyllum tenax*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs in cold, snowy subalpine environments of the northern Rocky Mountains. It is generally associated with areas of incursions of maritime air masses, which moderate temperatures and produce deep winter snowpacks. Although this alliance typically occurs in subalpine habitats, it may occur in montane forest environments, such as slope benches or canyon bottoms, which are prone to cold-air drainage. Most soils can be characterized as loose, coarse-textured, and well-drained.

Dynamics: *Tsuga mertensiana* is a slow-growing, long-lived conifer, which can regenerate under its own canopy. Forests dominated by this species can be seral to forests dominated by other shade-tolerant conifers, such as *Tsuga heterophylla* or *Callitropsis nootkatensis* at the lower or northern edges of its range, respectively.

DISTRIBUTION

Geographic Range: This alliance occurs in the subalpine zones of the central and northern Rocky Mountains and eastern Cascade Range.

Nations: US
States/Provinces: ID, MT, OR, WA?
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** Mountain Hemlock: 205 (Eyre 1980)
- **><** Western Needleleaf Forests: 4: Fir-Hemlock Forest (*Abies-Tsuga*) (Küchler 1964)

LOWER LEVEL UNITS

Associations:
- CEGL000508 *Tsuga mertensiana / Rhododendron albiflorum* Forest
- CEGL000504 *Tsuga mertensiana / Clintonia uniflora* Forest
- CEGL007383 *Tsuga mertensiana / Luzula glabrata var. hitchcockii* Forest
- CEGL000516 *Tsuga mertensiana / Xerophyllum tenax* Forest
- CEGL000506 *Tsuga mertensiana / Menziesia ferruginea* Forest
- CEGL000514 *Tsuga mertensiana / Vaccinium membranaceum* Forest

AUTHORSHIP

Primary Concept Source: S.V. Cooper K. E. Neiman, R. Steele, and D. W. Roberts (1987)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Atzet and McCrimmon 1990, Atzet and Wheeler 1984, Cooper et al. 1987, Eyre 1980, Faber-Langendoen et al. 2017b, Küchler 1964

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
1.B.2.Nb.5.d. M020 Rocky Mountain Subalpine-High Montane Conifer Forest

G222. Rocky Mountain Subalpine-Montane Aspen Forest & Woodland

Type Concept Sentence: This group consists of upland forests dominated by *Populus tremuloides* without significant conifer cover and an understory structure of complex multiple shrub and herbaceous layers, or simply just an herbaceous layer. It is widespread in the southern and central Rocky Mountains but occurs in the montane and subalpine zones throughout much of the western U.S., south into northern Mexico and north into Canada.

OVERVIEW

Scientific Name: *Populus tremuloides* Rocky Mountain Forest & Woodland Group
Common Name (Translated Scientific Name): Quaking Aspen Rocky Mountain Forest & Woodland Group
Colloquial Name: Bigtooth Maple Montane Forest

Type Concept: This widespread group is more common in the southern and central Rocky Mountains but occurs in the montane and subalpine zones throughout much of the western U.S., south into northern Mexico and north into Canada. An eastern extension occurs along the Rocky Mountains foothill front, in mountain "islands" in Montana (Big Snowy and Highwood mountains), and the Black Hills of South Dakota. In California, this group is in the Sierra Nevada adjacent to the Great Basin. Large stands are found in the Inyo and White mountains, while small stands occur on the Modoc Plateau. Elevations generally range from 1525 to 3050 m (5000-10,000 feet), but occurrences can be found at lower elevations in some regions. Distribution of this group is primarily limited by adequate soil moisture required to meet its high evapotranspiration demand. Secondarily, it is limited by the length of the growing season or low temperatures. These are upland forests and woodlands dominated by *Populus tremuloides* without a significant conifer component (<25% relative tree cover). The understory structure may be complex with multiple shrub and herbaceous layers, or simple with just an herbaceous layer. The herbaceous layer may be dense or sparse, dominated by graminoids and/or forbs. Associated shrub species include *Symphoricarpos* spp. (*Symphoricarpos oreophilus* being the most widespread and *Symphoricarpos albus* and *Symphoricarpos mollis* having limited distribution), *Rubus parviflorus, Amelanchier alnifolia, Prunus virginiana*, and *Arctostaphylos uva-ursi*.

Classification Comments: This group differs from Northwestern Great Plains Aspen Woodland Group (G328), which is limited to plains environments. The scattered occurrences in the Trans-Pecos of Texas are of interest as they represent disjunct outliers of the type occurring under highly limited circumstances. In Alberta and interior British Columbia, these forests transition to Alaskan-Yukon Boreal Dry Aspen Forest Group (G349). Associations where aspen is mixed with one or more Rocky Mountain conifers in the canopy, or even in the undergrowth, are placed into their respective conifer forest groups (e.g., into a spruce-fir group, or a mixed montane conifer group). Typically, in those associations, the floristics and species richness are more similar to conifer forest groups, than to the aspen group.

Similar NVC Types:
- G328 Northwestern Great Plains Aspen Woodland

Diagnostic Characteristics: Open to dense canopies of broad-leaved deciduous trees dominated by *Populus tremuloides*. It has Rocky Mountain floristics associated with it, as opposed to boreal floristics. The herbaceous layer may be dense or sparse, dominated by graminoids or forbs. Common shrubs include *Acer glabrum, Amelanchier alnifolia, Artemisia tridentata, Juniperus communis, Prunus virginiana, Rosa woodsii, Rhamnus alnifolia, Lonicera utahensis, Shepherdia canadensis, Symphoricarpos oreophilus*, and the dwarf-shrubs *Mahonia repens* and *Vaccinium* spp. The herbaceous layers may be lush and diverse. Common graminoids may include *Bromus carinatus, Calamagrostis rubescens, Carex siccata, Carex geyeri, Carex rossii, Elymus glaucus, Elymus trachycaulus, Festuca thurberi*, and *Hesperostipa comata*. Associated forbs may include *Achillea millefolium, Eucephalus engelmannii, Delphinium* spp., *Aconitum columbianum, Geranium viscosissimum, Heracleum sphondylium, Ligusticum filicinum, Lupinus argenteus, Osmorhiza berteroi, Pteridium aquilinum, Rudbeckia occidentalis, Thalictrum fendleri, Valeriana occidentalis, Wyethia amplexicaulis*, and many others.

VEGETATION

Physiognomy and Structure: Occurrences typically have a somewhat closed canopy of trees 5-20 m tall that is dominated by the cold-deciduous, broad-leaved tree *Populus tremuloides*. Conifers my contribute up to 15% of the canopy cover. The open-spaced

stems of *Populus tremuloides* often give way to a lush understory consisting of complex multiple shrub and herbaceous layers, or just an herbaceous layer.

Floristics: Occurrences have a somewhat closed canopy of trees of 5-20 m tall that is dominated by the cold-deciduous, broad-leaved tree *Populus tremuloides*. Conifers that may be present but typically in minor amounts include *Abies concolor, Abies lasiocarpa, Picea engelmannii, Picea pungens, Pinus contorta, Pinus ponderosa*, and *Pseudotsuga menziesii*. Conifer species may contribute up to 15% of the tree canopy before the occurrence is reclassified as a mixed occurrence. Because of the open growth form of *Populus tremuloides*, enough light can penetrate for lush understory development. Depending on available soil moisture and other factors such as disturbance, the understory structure may be complex with multiple shrub and herbaceous layers, or simple with just an herbaceous layer. The herbaceous layer may be dense or sparse, dominated by graminoids or forbs. Common shrubs include *Acer glabrum, Amelanchier alnifolia, Artemisia tridentata, Juniperus communis, Prunus virginiana, Rosa woodsii, Rhamnus alnifolia, Lonicera utahensis, Shepherdia canadensis, Symphoricarpos oreophilus*, and the dwarf-shrubs *Mahonia repens* and *Vaccinium* spp. The herbaceous layers may be lush and diverse. Common graminoids may include *Bromus carinatus, Calamagrostis rubescens, Carex siccata (= Carex foenea), Carex geyeri, Carex rossii, Elymus glaucus, Elymus trachycaulus, Festuca thurberi*, and *Hesperostipa comata*. Associated forbs may include *Achillea millefolium, Eucephalus engelmannii (= Aster engelmannii), Delphinium* spp., *Aconitum columbianum, Geranium viscosissimum, Heracleum sphondylium, Ligusticum filicinum, Lupinus argenteus, Osmorhiza berteroi (= Osmorhiza chilensis), Pteridium aquilinum, Rudbeckia occidentalis, Thalictrum fendleri, Valeriana occidentalis, Wyethia amplexicaulis*, and many others. In California, *Symphyotrichum spathulatum (= Aster occidentalis)* is a common forb. Exotic grasses such as the perennials *Poa pratensis* and *Bromus inermis* and the annual *Bromus tectorum* are often common in occurrences due to grazing disturbance.

ENVIRONMENT & DYNAMICS

Environmental Description: Topography is variable; sites range from level to steep slopes. Aspect varies according to the limiting factors. Occurrences at high elevations are restricted by cold temperatures and are found on warmer southern aspects. At lower elevations, occurrences are restricted by lack of moisture and are found on cooler north aspects and mesic microsites.

Climate: Climate is temperate with a relatively long growing season, typically cold winters and deep snow. Mean annual precipitation is greater than 38 cm (15 inches) and typically greater than 51 cm (20 inches), except in semi-arid environments where occurrences are restricted to mesic microsites such as seeps or where large snow drifts develop. Distribution of this group is primarily limited by adequate soil moisture required to meet its high evapotranspiration demand (Mueggler 1988). Secondarily, its range is limited by the length of the growing season or low temperatures (Mueggler 1988).

Soil/substrate/hydrology: The soils are typically deep and well-developed with rock often absent from the soil. Soil texture ranges from sandy loam to clay loam. Parent materials are variable and may include sedimentary, metamorphic or igneous rocks, but it appears to grow best on limestone, basalt, and calcareous or neutral shales (Mueggler 1988).

Dynamics: Occurrences in this group often originate from, and are likely maintained by, stand-replacing disturbances such as avalanche, crownfire, disease and windthrow, or clearcutting by man or flooding by beaver. The stems of these thin-barked, clonal trees are easily killed by surface fires, but they can quickly and vigorously resprout in densities of up to 30,000 stems per hectare (Knight 1994). The stems are relatively short-lived (100-150 years), and the occurrences often succeed to longer-lived conifer forest if undisturbed. Occurrences are favored by fire in the conifer zone (Mueggler 1988). With adequate disturbance, a clone may live many centuries. Although *Populus tremuloides* produces abundant seeds, seedling survival is rare because the long moist conditions required to establish them are rare in the habitats where they occur. Superficial soil drying will kill seedlings (Knight 1994).

DISTRIBUTION

Geographic Range: This group is more common in the southern and central Rocky Mountains but occurs in the montane and subalpine zones throughout much of the western U.S., south into northern Mexico and north into Canada. An eastern extension occurs along the Rocky Mountains foothill front, in mountain "islands" in Montana (Big Snowy and Highwood mountains), and the Black Hills of South Dakota. In California, this group is in the Sierra Nevada adjacent to the Great Basin. Large stands are found in the Inyo and White mountains, while small stands occur on the Modoc Plateau. Very small occurrences may be found in a few scattered locations of the Trans-Pecos of Texas.

Spatial Scale & Pattern [optional]: Large patch
Nations: CA, MX, US
States/Provinces: AB, AZ, BC, CA, CO, ID, MT, NM, NV, OR, SD, TX, UT, WA, WY
TNC Ecoregions [optional]: 1:P, 3:C, 4:P, 5:P, 7:C, 8:C, 9:C, 11:C, 12:P, 18:C, 19:C, 20:C, 21:P, 25:C, 26:C, 81:P
USFS Ecoregions (2007): 313A:CC, 313B:CC, 313D:CC, 315H:PP, 321A:CC, 322A:CC, 331A:CC, 331F:CC, 331G:CC, 331I:C?, 331J:CC, 331K:CP, 331N:CP, 332F:??, 341A:CC, 341B:CC, 341C:CC, 341D:CC, 341E:CC, 341F:CC, 341G:CC, 342A:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:CC, 342I:CP, 342J:CC, M242B:CP, M242C:CC, M242D:CC, M261D:CC, M261E:CC, M261G:CC, M313A:CC, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC,

M332A:CC, M332B:CP, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CP, M333D:CC, M334A:CC, M341A:CC, M341B:CC, M341C:CC, M341D:CC

Omernik Ecoregions:

Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low. USNVC Confidence from peer reviewer, not AE.

SYNONYMY

- **<** Aspen Woodland (411) (Shiflet 1994)
- **<** Aspen: 217 (Eyre 1980)
- **>** Douglas-fir-White Fir (=Mixed Conifer) Series, *Populus tremuloides* subclimax Association - 122.314 (Brown et al. 1979)
- **>** Engelmann Spruce-Alpine Fir Series, *Populus tremuloides* subclimax Association - 121.316 (Brown et al. 1979)
- **>** Pine Series, *Populus tremuloides* subclimax Association - 122.326 (Brown et al. 1979)

LOWER LEVEL UNITS

Alliances:

- A3371 *Acer grandidentatum* Montane Forest Alliance
- A2036 *Populus tremuloides* Rocky Mountain Forest & Woodland Alliance
- A3367 *Betula papyrifera* Rocky Mountain Forest & Woodland Alliance
- A4078 *Populus tremuloides* Southern Rocky Mountain Woodland & Scrub Alliance

AUTHORSHIP

Primary Concept Source: F.H. Eyre (1980)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 06/05/2013
Classif Resp Region: West
Internal Author: MEH 2-10, 6-13, mod. GK 12-15

REFERENCES

References: Bartos 1979, Bartos and Campbell 1998, Bartos and Mueggler 1979, Brown 1982a, Brown et al. 1979, DeByle and Winokur 1985, DeVelice et al. 1986, Eyre 1980, Faber-Langendoen et al. 2017a, Henderson et al. 1977, Hess and Wasser 1982, Johnston and Hendzel 1985, Knight 1994, Mueggler 1988, Powell 1988a, Shepperd et al. 2006, Shiflet 1994, Swanson et al. 2010, Youngblood and Mauk 1985

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G222. Rocky Mountain Subalpine-Montane Aspen Forest & Woodland

A3371. Acer grandidentatum Montane Forest Alliance

Type Concept Sentence: This alliance includes mainly deciduous forests dominated by *Acer grandidentatum* occurring in relatively moist lower montane areas of the Utah-Wyoming Rocky Mountains and Columbia Plateau.

OVERVIEW

Scientific Name: *Acer grandidentatum* Montane Forest Alliance
Common Name (Translated Scientific Name): Bigtooth Maple Montane Forest Alliance
Colloquial Name: Bigtooth Maple Montane Forest

Type Concept: This alliance includes mainly deciduous forests dominated by *Acer grandidentatum* occurring in relatively moist lower montane areas of the Utah-Wyoming Rocky Mountains and Columbia Plateau. Forests in this alliance are dominated by a dense canopy of *Acer grandidentatum*, often occurring with *Quercus* spp. and *Juniperus* spp. Shrub and herb strata are relatively sparse throughout the range of the alliance and are composed of short shrubs and annual or perennial graminoids and forbs. Tree and shrub associates include *Amelanchier alnifolia, Artemisia tridentata, Paxistima myrsinites, Physocarpus malvaceus, Populus tremuloides, Prunus virginiana, Quercus gambelii*, and *Symphoricarpos* spp. The alliance can occur on all aspects but is best developed on north-facing valleys or canyons with moderate insolation and favorable soil moisture. In the southern part of the range, these communities are typically associated with protected topographic positions with relatively moist soils and lower fire frequencies than surrounding hillsides. Elevations range from 1200-2600 m.

Classification Comments: This alliance excludes associations of *Acer grandidentatum* found in Trans-Pecos Texas.

Internal Comments:

Other Comments:

Similar NVC Types:
- A3214 *Acer grandidentatum - Quercus muehlenbergii - Juglans major* Forest & Woodland Alliance
- A3109 *Acer grandidentatum - Quercus gravesii - Quercus muehlenbergii* Forest & Woodland Alliance

Diagnostic Characteristics: Forests in this alliance are dominated by a dense canopy of *Acer grandidentatum*, often occurring with *Quercus* spp. and *Juniperus* spp.

VEGETATION

Physiognomy and Structure: This alliance is characterized by a closed canopy of tall cold-deciduous or broad-leaved evergreen shrubs or short trees 6-8 m in height. Short evergreen shrubs may also be present. The herbaceous understory is typically sparse and composed of annual or perennial graminoids and forbs.

Floristics: These forests are dominated by a dense canopy of *Acer grandidentatum*, often occurring with *Quercus* spp. and *Juniperus* spp. In Rocky Mountain stands, tree and shrub associates include *Amelanchier alnifolia, Artemisia tridentata, Paxistima myrsinites, Physocarpus malvaceus, Populus tremuloides, Prunus virginiana, Quercus gambelii*, and *Symphoricarpos* spp. Shrub and herb strata are relatively sparse. Forests in this alliance grade to slightly less mesic mixed evergreen-deciduous forests, woodlands, or brushfields on adjacent hillsides.

ENVIRONMENT & DYNAMICS

Environmental Description: Vegetation within this alliance occurs in relatively moist lower montane areas of the southern and central Rocky Mountains. These forests occur from 1200-2600 m in elevation. Annual precipitation generally exceeds 40 cm with a large proportion falling during the growing season. The alliance can occur on all aspects but is best developed on north-facing valleys or canyons which have moderate insolation and favorable soil moisture.

Dynamics: In southern stands, these communities are typically associated with protected topographic positions with relatively moist soils and lower fire frequencies than surrounding hillsides.

DISTRIBUTION

Geographic Range: This alliance is known from the Utah-Wyoming Rocky Mountains, Utah High Plateaus, and Colorado Plateau.

Nations: US
States/Provinces: ID, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL000559 *Acer grandidentatum / Quercus gambelii* Forest
- CEGL000558 *Acer grandidentatum / Calamagrostis rubescens* Forest

AUTHORSHIP

Primary Concept Source: D. Sarr, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Diamond 1993, Faber-Langendoen et al. 2017b

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G222. Rocky Mountain Subalpine-Montane Aspen Forest & Woodland

A3367. Betula papyrifera Rocky Mountain Forest & Woodland Alliance

Type Concept Sentence: This forest and woodland alliance is found in Alberta, Montana, Washington, and Wyoming and dominated by the successional species *Betula papyrifera*.

OVERVIEW

Scientific Name: *Betula papyrifera* Rocky Mountain Forest & Woodland Alliance
Common Name (Translated Scientific Name): Paper Birch Rocky Mountain Forest & Woodland Alliance
Colloquial Name: Rocky Mountain Paper Birch Forest & Woodland

Type Concept: This forest and woodland alliance is found in Montana, Washington, and Wyoming. It is composed of early-successional forests and woodlands that occur on north-facing slopes and rocky, cut-over areas. This alliance is a provisional type, developed to account for *Betula papyrifera* stands in the Rockies that have not been adequately studied or classified.

Classification Comments: Although in the range of *Populus tremuloides*, this alliance is restricted to stands where *Betula papyrifera* comprises >90% of the deciduous canopy.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Small patch early-successional forests and woodlands of a wide geographic distribution dominated by *Betula papyrifera* with >90% of the total deciduous canopy cover.

VEGETATION

Physiognomy and Structure: This alliance has a cold-deciduous, tree-dominated canopy that is woodland or forest in structure. The dominant tree does not cast dense shade and thus there is usually a prominent subcanopy or shrub layer. The subcanopy, and most other tree reproduction, is composed largely of more shade-tolerant tree species, of a mix of either deciduous or evergreen species.

Floristics: The canopy is open to closed and in some stands the tree density can be high. The dominant tree *Betula papyrifera* does not cast dense shade and thus there is usually a prominent subcanopy or shrub layer.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs on north-facing slopes and rocky, cut-over areas of the northern Rocky Mountains.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is found in the Rocky Mountains of Alberta, Montana, Washington, and Wyoming.

Nations: CA, US
States/Provinces: AB, MT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL005844 *Betula papyrifera / Acer glabrum* Woodland
- CEGL000520 *Betula papyrifera* Forest

AUTHORSHIP

Primary Concept Source: M.E. Hall, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Faber-Langendoen et al. 2017b

1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G222. Rocky Mountain Subalpine-Montane Aspen Forest & Woodland

A2036. Populus tremuloides Rocky Mountain Forest & Woodland Alliance

Type Concept Sentence: This alliance is widespread in the southern, central and northern Rocky Mountains, west to the Sierra Nevada and east to the Black Hills and defined by a canopy dominated by *Populus tremuloides*.

OVERVIEW

Scientific Name: *Populus tremuloides* Rocky Mountain Forest & Woodland Alliance
Common Name (Translated Scientific Name): Quaking Aspen Rocky Mountain Forest & Woodland Alliance
Colloquial Name: Rocky Mountain Aspen Forest & Woodland

Type Concept: This alliance is widespread in the montane and subalpine zones Rocky Mountains and adjacent regions, including the Sierra Nevada and Black Hills. Stands are found on a variety of landscape positions, but are consistently in mesic habitats. Stands in this alliance often originate following disturbance. The dominant species of the canopy is *Populus tremuloides*. Scattered conifer trees such as *Pseudotsuga menziesii* and species of *Pinus, Picea*, and *Abies* may also be present. Common shrubs include *Acer glabrum, Amelanchier alnifolia, Artemisia tridentata, Juniperus communis, Prunus virginiana, Rosa woodsii, Shepherdia canadensis, Symphoricarpos oreophilus*, and the dwarf-shrubs *Mahonia repens* and *Vaccinium myrtillus*. The herbaceous layer may be lush and diverse. Common graminoids may include *Bromus carinatus, Calamagrostis rubescens, Carex siccata (= Carex foenea), Carex geyeri, Carex rossii, Elymus glaucus, Elymus trachycaulus, Festuca thurberi*, and *Hesperostipa comata (= Stipa comata)*. Associated forbs may include *Achillea millefolium, Eucephalus engelmannii (= Aster engelmannii), Delphinium x occidentale, Geranium viscosissimum, Heracleum sphondylium, Ligusticum filicinum, Lupinus argenteus, Osmorhiza berteroi (= Osmorhiza chilensis), Pteridium aquilinum, Rudbeckia occidentalis, Thalictrum fendleri, Valeriana occidentalis, Wyethia amplexicaulis*, and many others. Elevations generally range from 1525 to 3050 m (5000-10,000 feet), but occurrences can be found at lower elevations in some regions. Topographic positions are variable, but occurrences tend to occupy cooler, moist aspects.

Classification Comments: This alliance may eventually be split into two or more alliances based on floristics or regional characteristics.

Internal Comments: MEH 1-14: AB, AZ, BC, CA, CO, ID, MT, NM, OR, SD, TX?, UT, WA, WY added & MB, ON, SK removed.
Other Comments:

Similar NVC Types:
- A3209 *Betula papyrifera - Populus tremuloides - Quercus macrocarpa* Forest Alliance

Diagnostic Characteristics: Highly variable and widely distributed alliance is characterized by stands dominated by the broad-leaved deciduous tree *Populus tremuloides*. Coniferous species may be present but not codominant. Physiognomy varies from open woodlands to dense forests. Understories are dominated by a combination of broad-leaved deciduous shrubs, evergreen shrubs, grasses and occasionally forbs.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a moderately dense to dense tree canopy dominated by cold-deciduous broad-leaved trees (5-20 m tall). Evergreen needle-leaved trees may be present, but do not codominate the tree canopy. The understory is variable. Sparse to dense, tall- and short-shrub layers may be present and are typically dominated by deciduous broad-leaved species; however, a scale-leaved short shrub dominates the understory of some stands. Sparse to dense tall or short herbaceous layers may also be present and may be dominated by perennial forbs or graminoids.

Floristics: *Populus tremuloides* is typically the sole dominant canopy tree, and stands may have open to closed cover. Other canopy associates may include *Abies lasiocarpa, Picea engelmannii, Populus angustifolia, Populus balsamifera*, and *Pseudotsuga menziesii*. Common shrubs include *Acer glabrum, Amelanchier alnifolia, Artemisia tridentata, Juniperus communis, Mahonia repens, Prunus virginiana, Rosa woodsii, Shepherdia canadensis, Symphoricarpos oreophilus*, and *Vaccinium myrtillus*. The herbaceous layer may be lush and diverse. Common graminoids may include *Bromus carinatus, Calamagrostis rubescens, Carex siccata (= Carex foenea), Carex geyeri, Carex rossii, Elymus glaucus, Elymus trachycaulus, Festuca thurberi*, and *Hesperostipa comata (= Stipa comata)*. Associated forbs may include *Achillea millefolium, Eucephalus engelmannii (= Aster engelmannii), Delphinium x occidentale, Geranium viscosissimum, Heracleum sphondylium, Ligusticum filicinum, Lupinus argenteus, Osmorhiza berteroi (= Osmorhiza chilensis), Pteridium aquilinum, Rudbeckia occidentalis, Thalictrum fendleri, Valeriana occidentalis, Wyethia amplexicaulis*, and many others.

Exotic grasses, such as the perennial *Poa pratensis* and the annual *Bromus tectorum*, are often common in stands disturbed by grazing.

ENVIRONMENT & DYNAMICS

Environmental Description: Sites include variable topographic positions with slopes ranging from level to steep with variable aspects, with occurrences on warmer aspects at higher elevations and cooler aspects are lower elevations. The soils are typically deep and well-developed with rock often absent from the soil. Soil texture ranges from sandy loam to clay loam. Parent materials are variable and may include sedimentary, metamorphic or igneous rocks, but this vegetation appears to grow best on limestone, basalt, and calcareous or neutral shales (Mueggler 1988).

Dynamics: Stands in this alliance often originate and are likely maintained by stand-replacing disturbances such as crown fire, disease and windthrow, or cutting by man or beaver. The stems of these thin-barked, clonal trees are easily killed by surface fires, but they can quickly and vigorously resprout in densities of up to 30,000 stems per hectare (Knight 1993). The stems are relatively short-lived (100-150 years), and the stand will succeed to longer-lived conifer forest if undisturbed. Stands are favored by fire in the conifer zone (Mueggler 1988). With adequate disturbance a clone may live many centuries. Although *Populus tremuloides* produces abundant seeds, seedling survival is rare because of the long moist conditions required to establish are rare in the habitats that it occurs in. Superficial soil drying will kill seedlings (Knight 1994).

DISTRIBUTION

Geographic Range: This alliance is more common in the southern and central Rocky Mountains, but occurs in the montane and subalpine zones throughout much of the western U.S., south into northern Mexico and north into Canada. An eastern extension occurs along the Rocky Mountains foothill front, in mountain "islands" in Montana (Big Snowy and Highwood mountains), the Black Hills of South Dakota and also west to the Sierra Nevada.

Nations: CA, US
States/Provinces: AB, AZ, BC, CA, CO, ID, MT, NM, NV, OR, SD, TX?, UT, WA, WY
TNC Ecoregions [optional]: 11:C
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: NPS (Great Basin)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL002816 *Populus tremuloides / Amelanchier alnifolia - Symphoricarpos oreophilus* / Mixed Graminoid Forest
- CEGL000614 *Populus tremuloides / Symphoricarpos oreophilus / Festuca thurberi* Forest
- CEGL000575 *Populus tremuloides / Calamagrostis rubescens* Forest
- CEGL000611 *Populus tremuloides / Symphoricarpos oreophilus / Bromus carinatus* Forest
- CEGL000583 *Populus tremuloides / Corylus cornuta* Forest
- CEGL000619 *Populus tremuloides / Thalictrum fendleri* Forest
- CEGL000620 *Populus tremuloides / Vaccinium myrtillus* Forest
- CEGL000586 *Populus tremuloides / Heracleum sphondylium* Forest
- CEGL000568 *Populus tremuloides / Amelanchier alnifolia - Symphoricarpos oreophilus* / Tall Forbs Forest
- CEGL000585 *Populus tremuloides / Festuca thurberi* Forest
- CEGL000593 *Populus tremuloides / Lupinus argenteus* Forest
- CEGL000603 *Populus tremuloides / Rudbeckia occidentalis* Forest
- CEGL000613 *Populus tremuloides / Symphoricarpos oreophilus / Carex rossii* Forest
- CEGL000567 *Populus tremuloides / Amelanchier alnifolia - Symphoricarpos oreophilus / Calamagrostis rubescens* Forest
- CEGL003146 *Populus tremuloides / Artemisia tridentata / Monardella odoratissima - Kelloggia galioides* Forest
- CEGL000607 *Populus tremuloides / Spiraea betulifolia* Forest
- CEGL000597 *Populus tremuloides / Pteridium aquilinum* Forest
- CEGL000592 *Populus tremuloides / Lonicera involucrata* Forest
- CEGL000602 *Populus tremuloides / Rubus parviflorus* Forest
- CEGL000588 *Populus tremuloides / Juniperus communis / Carex geyeri* Forest
- CEGL000579 *Populus tremuloides / Carex geyeri* Forest
- CEGL000580 *Populus tremuloides / Carex rossii* Forest
- CEGL000578 *Populus tremuloides / Carex siccata* Forest

- CEGL000606 *Populus tremuloides / Shepherdia canadensis* Forest
- CEGL000572 *Populus tremuloides / Artemisia tridentata* Forest
- CEGL000610 *Populus tremuloides / Symphoricarpos oreophilus* Forest
- CEGL000564 *Populus tremuloides / Amelanchier alnifolia* Forest
- CEGL000565 *Populus tremuloides / Amelanchier alnifolia / Pteridium aquilinum* Forest
- CEGL000589 *Populus tremuloides / Juniperus communis / Lupinus argenteus* Forest
- CEGL005932 *Populus tremuloides / Physocarpus monogynus* Forest
- CEGL000581 *Populus tremuloides / Ceanothus velutinus* Forest
- CEGL000617 *Populus tremuloides / Symphoricarpos oreophilus / Wyethia amplexicaulis* Forest
- CEGL005624 *Populus tremuloides / Prunus virginiana* Central Rocky Mountain Forest
- CEGL000587 *Populus tremuloides / Juniperus communis* Forest
- CEGL000563 *Populus tremuloides / Acer glabrum* Forest
- CEGL000598 *Populus tremuloides / Quercus gambelii / Symphoricarpos oreophilus* Forest
- CEGL000608 *Populus tremuloides / Hesperostipa comata* Forest
- CEGL000566 *Populus tremuloides / Amelanchier alnifolia - Symphoricarpos oreophilus / Bromus carinatus* Forest
- CEGL000615 *Populus tremuloides / Symphoricarpos oreophilus* / Tall Forbs Forest
- CEGL000618 *Populus tremuloides* / Tall Forbs Forest
- CEGL000595 *Populus tremuloides / Heracleum maximum* Forest
- CEGL000605 *Populus tremuloides / Sambucus racemosa* Forest
- CEGL000571 *Populus tremuloides / Amelanchier alnifolia / Thalictrum fendleri* Forest
- CEGL000945 *Populus tremuloides / Physocarpus malvaceus - Amelanchier alnifolia* Scree Woodland
- CEGL000594 *Populus tremuloides / Mahonia repens* Forest
- CEGL000604 *Populus tremuloides / Salix scouleriana* Forest
- CEGL000946 *Populus tremuloides / Symphoricarpos albus / Elymus glaucus* Woodland
- CEGL000569 *Populus tremuloides / Amelanchier alnifolia - Symphoricarpos oreophilus / Thalictrum fendleri* Forest
- CEGL000570 *Populus tremuloides / Amelanchier alnifolia* / Tall Forbs Forest
- CEGL000612 *Populus tremuloides / Symphoricarpos oreophilus / Calamagrostis rubescens* Forest
- CEGL000616 *Populus tremuloides / Symphoricarpos oreophilus / Thalictrum fendleri* Forest
- CEGL000591 *Populus tremuloides / Ligusticum filicinum* Forest
- CEGL000622 *Populus tremuloides / Wyethia amplexicaulis* Forest
- CEGL000573 *Populus tremuloides / Bromus carinatus* Forest
- CEGL000609 *Populus tremuloides / Symphoricarpos albus* Forest
- CEGL005848 *Populus tremuloides / Symphoricarpos occidentalis* Forest
- CEGL005849 *Populus tremuloides / Urtica dioica* Forest
- CEGL003748 *Populus tremuloides* / Invasive Perennial Grasses Forest
- CEPS009589 *Populus tremuloides / Ribes* spp. Woodland [Park Special]
- CEGL003145 *Populus tremuloides / Monardella odoratissima* Forest

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Faber-Langendoen et al. 2017b, Knight 1994, Mueggler 1988

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G222. Rocky Mountain Subalpine-Montane Aspen Forest & Woodland

A4078. Populus tremuloides Southern Rocky Mountain Woodland & Scrub Alliance

Type Concept Sentence: This alliance is known only from Grand Canyon National Park and El Malpais National Monument and characterized by open woodland or regenerating stands of *Populus tremuloides*.

OVERVIEW

Scientific Name: *Populus tremuloides* Southern Rocky Mountain Woodland & Scrub Alliance
Common Name (Translated Scientific Name): Quaking Aspen Southern Rocky Mountain Woodland & Scrub Alliance
Colloquial Name: Southern Rocky Mountain Quaking Aspen Woodland & Scrub

Type Concept: Communities of this alliance are characterized by open woodlands or regenerating stands of *Populus tremuloides*. Conifers such as *Pinus ponderosa* and *Pseudotsuga menziesii* from the surrounding mixed conifer stands can be interspersed in the canopy. In the open canopy, shrub cover is often dense and may include *Ceanothus fendleri, Holodiscus dumosus, Rhus trilobata, Ribes leptanthum, Robinia neomexicana*, and *Symphoricarpos oreophilus*. The herbaceous layer ranges from sparse to dense and is typically graminoid-dominated. Species include *Carex rossii, Carex siccata, Piptatheropsis micrantha (= Piptatherum micranthum)*, and *Poa fendleriana*. This alliance is known only from Grand Canyon National Park and El Malpais National Monument on plateaus and gentle to steep slopes. Elevations range from to 2350-2690 m. Communities occur on all aspects and slopes may be gentle to steep.

Classification Comments: This alliance is provisional and represents stands of *Populus tremuloides* that occupy sites with conditions that prohibit the development of forest vegetation or burned areas.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Open woodland stands dominated by *Populus tremuloides* or post-burn shrubland vegetation where *Populus tremuloides* was the dominant. Shrub vegetation tends to be dense as a result of the open canopy. The herbaceous component is typically graminoid-dominated and may be open to dense. Forbs do not contribute substantial cover.

VEGETATION

Physiognomy and Structure: Communities in this alliance are variable in structure and may be short-statured woodlands with 40-60% cover not exceeding 5 m in height. Other stands are found in post-burn areas where *Populus tremuloides* was the dominant tree. Shrub cover is dense in these open stands and in post-burn areas shrubs form thickets and are the dominant vegetation.

Floristics: Communities of this alliance are characterized by open woodlands or regenerating stands of *Populus tremuloides*. Conifers such as *Pinus ponderosa* and *Pseudotsuga menziesii* from the surrounding mixed conifer stands can be interspersed in the canopy. Trees typically do not exceed 5 m in the height or 60% in cover. In the open canopy, shrub cover is often dense and may include *Ceanothus fendleri, Holodiscus dumosus, Rhus trilobata, Ribes leptanthum, Robinia neomexicana*, and *Symphoricarpos oreophilus*. The herbaceous layer ranges from sparse to dense and is typically graminoid-dominated. Species include *Carex rossii, Carex siccata, Piptatheropsis micrantha (= Piptatherum micranthum)*, and *Poa fendleriana*. Forbs are typically present but are not dominant. Associates may include *Achillea millefolium, Arabis fendleri (= Boechera fendleri), Arenaria lanuginosa, Artemisia campestris, Chamerion angustifolium, Chenopodium* sp., *Conyza canadensis, Erigeron divergens, Erigeron formosissimus, Fragaria vesca, Gayophytum diffusum, Lotus utahensis, Machaeranthera canescens, Packera neomexicana var. mutabilis, Pseudognaphalium macounii, Pseudostellaria jamesiana*, and *Solidago velutina*.

ENVIRONMENT & DYNAMICS

Environmental Description: Positions include plateaus and side slopes. Elevations range from to 2350-2690 m. Communities occur on all aspects, and slopes may be gentle to steep. Some sites include areas that have experienced high-intensity fires. Substrates include silty loams, sandy loams or cinder.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is known only from Grand Canyon National Park in Arizona and El Malpais National Monument in New Mexico.

Nations: US
States/Provinces: AZ, NM
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL005503 *Populus tremuloides / Robinia neomexicana* Woodland
- CEGL005034 *Populus tremuloides* / Mixed Shrubs / Cinder Woodland
- CEGL005504 *Populus tremuloides - Ceanothus fendleri / Carex* spp. Scrub

AUTHORSHIP

Primary Concept Source: Muldavin et al. (2013c); Kearsley et al. (2013)
Author of Description: M. E. Hall
Acknowledgments:
Version Date: 2014/01/07

REFERENCES

References: Faber-Langendoen et al. 2017b, Kearsley et al. 2015, Muldavin et al. 2013c

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
1.B.2.Nb.5.e. M020 Rocky Mountain Subalpine-High Montane Conifer Forest

G221. Rocky Mountain Subalpine-Montane Limber Pine - Bristlecone Pine Woodland

Type Concept Sentence: This group is composed of open, patchy woodlands dominated by *Pinus flexilis* and/or *Pinus aristata* usually on dry, rocky, wind-blasted, mostly west-facing slopes and exposed ridges near upper treeline and is known from throughout the Rocky Mountains and west into the southern Colorado Plateau.

OVERVIEW

Scientific Name: *Pinus flexilis - Pinus aristata* Rocky Mountain Subalpine-Montane Woodland Group
Common Name (Translated Scientific Name): Limber Pine - Bristlecone Pine Rocky Mountain Subalpine-Montane Woodland Group
Colloquial Name: Rocky Mountain Limber Pine Woodland

Type Concept: This group is found throughout the Rocky Mountains and extends west into the southern Colorado Plateau. Stands occur on dry, rocky ridges and slopes near upper treeline above the matrix spruce-fir forest and extend down to the lower montane zone. Sites are harsh, exposed to desiccating winds, with rocky substrates and a short growing season that limit plant growth. Higher elevation occurrences are found well into the subalpine-alpine transition on wind-blasted, mostly west-facing slopes and exposed ridges. Calcareous substrates are important for *Pinus flexilis*-dominated communities in the northern Rocky Mountains and probably elsewhere. The open tree canopy is often patchy and is strongly dominated by *Pinus flexilis* and/or *Pinus aristata* with the latter restricted to southern Colorado, northern New Mexico and the San Francisco Mountains in Arizona. Other trees such as *Juniperus scopulorum, Picea engelmannii, Pinus contorta, Pinus ponderosa*, or *Pseudotsuga menziesii* are occasionally present, but do not dominate. *Arctostaphylos uva-ursi, Cercocarpus ledifolius, Juniperus communis, Mahonia repens, Purshia tridentata, Ribes montigenum*, or *Vaccinium* spp. may form an open shrub layer in some stands. The herbaceous layer, if present, is generally sparse and composed of xeric graminoids, such as *Calamagrostis purpurascens, Festuca arizonica, Festuca idahoensis, Festuca thurberi*, or *Pseudoroegneria spicata*, or more alpine plants.

Classification Comments: This montane-subalpine group occurs on higher elevation mountains of the Rocky Mountains. It is distinguished from Rocky Mountain Foothill-Rock Outcrop Limber Pine - Juniper Woodland Group (G209) largely by life zone, which for the most part is restricted to isolated low mountains, hills, and escarpments of the western Great Plains where soil moisture is slightly higher than surrounding grasslands, and lower foothills in northern Colorado, Wyoming and Montana. The foothill stands are typically juniper-dominated and occur below the zone of continuous *Pinus ponderosa* or *Pseudotsuga menziesii* woodlands and forests.

~Rocky Mountain Subalpine-Montane Limber Pine - Bristlecone Pine Woodland Group (G221) is also similar to Intermountain Basins Subalpine Limber Pine - Bristlecone Pine Woodland Group (G224) because *Pinus flexilis* can dominate stands; however, the groups are geographically separate with Intermountain Basins Subalpine Limber Pine - Bristlecone Pine Woodland Group (G224) restricted to the eastern Sierra Nevada and ranges in the northern Mojave Desert and Great Basin extending east to the high plateaus of southwestern and central Utah, roughly following the range of distribution for *Pinus longaeva*.

Stands may occur adjacent to Rocky Mountain Subalpine Dry-Mesic Spruce - Fir Forest & Woodland Group (G219) and Southern Rocky Mountain White Fir - Douglas-fir Dry Forest Group (G226), but are distinguished by dominance of *Pinus flexilis* or *Pinus aristata*.

Similar NVC Types:

- G209 Rocky Mountain Foothill-Rock Outcrop Limber Pine - Juniper Woodland
- G224 Intermountain Basins Subalpine Limber Pine - Bristlecone Pine Woodland

Diagnostic Characteristics: *Pinus flexilis* and/or *Pinus aristata* are the dominant and diagnostic species of this woodland group. The understory is variable, but is characterized by xeric shrubs and grasses found in montane and subalpine zones in the Rocky Mountains.

VEGETATION

Physiognomy and Structure: Conifer-dominated woodlands with a typically open tree canopy that is often patchy. Shrub and herbaceous layers, if present, generally have low cover as substrates are characteristically rocky. Higher elevation stands often have cushion plants present.

Floristics: This woodland group is characterized by an open tree canopy that is often patchy and dominated by *Pinus flexilis* and/or *Pinus aristata* with the latter restricted to southern Colorado, northern New Mexico and the San Francisco Mountains in Arizona. Other trees such as *Juniperus scopulorum, Picea engelmannii, Pinus contorta, Pinus ponderosa*, or *Pseudotsuga menziesii* are occasionally present, but do not dominate. *Arctostaphylos uva-ursi, Cercocarpus ledifolius, Juniperus communis, Mahonia repens, Purshia tridentata, Ribes montigenum*, or *Vaccinium* spp. may form an open shrub layer in some stands. The herbaceous layer, if present, is generally sparse and composed of xeric graminoids, such as *Calamagrostis purpurascens, Festuca arizonica, Festuca idahoensis, Festuca thurberi, Leucopoa kingii, Muhlenbergia filiculmis, Muhlenbergia montana, Poa fendleriana*, and *Trisetum spicatum*. Highest elevation stands have a floristic component of typically subalpine and alpine plants, such as *Sedum lanceolatum, Trifolium dasyphyllum, Carex rupestris, Carex elynoides*, or *Phlox pulvinata*. Other scattered forbs may include species of *Achillea, Antennaria, Artemisia, Arenaria, Arnica, Astragalus, Campanula, Erigeron, Hymenoxys, Penstemon, Polemonium, Senecio*, and *Thalictrum*.

ENVIRONMENT & DYNAMICS

Environmental Description: This woodland group is found throughout the Rocky Mountains and extends west into the southern Colorado Plateau. Stands occur on dry, rocky ridges and slopes near upper treeline above the matrix spruce-fir forest and extends down to the lower montane zone. Sites are harsh, exposed to desiccating winds, with rocky substrates and a short growing season that limit plant growth. Higher elevation occurrences are found well into the subalpine-alpine transition on wind-blasted, mostly west-facing slopes and exposed ridges. Calcareous substrates are important for *Pinus flexilis*-dominated communities in the northern Rocky Mountains and possibly elsewhere.

Climate: Elevations range from 2400-3670 m. Climate is semi-arid, cold temperate with cool summers. Annual precipitation patterns and amounts vary with latitude, but locally the sites are typically xeric on exposed, windswept rocky slopes and ridges. *Soil/substrate/hydrology:* Soils are typically well-drained, shallow, skeletal and coarse-textured such as gravelly, sandy loams or loams. Stands occur most frequently on igneous, metamorphic and volcanic substrates such as andesite, granite, gneiss, breccia, tuff, and conglomerate, but also occur on sedimentary rocks like sandstone. Exposed bedrock is common. Soil pH is 4.5-6.9, acidic to slightly acidic. Calcareous substrates are important for *Pinus flexilis*-dominated communities in the northern Rocky Mountains and possibly elsewhere.

Dynamics: Natural regeneration of *Pinus flexilis* appears to be closely associated with caching of the large wingless seeds, primarily by Clark's nutcracker (*Nucifraga columbiana*) (Lanner and Vander Wall 1980). Germination of cached seeds often results in the multi-stemmed clumps characteristic of these sites, although the species may produce multiple stems from boles damaged near the ground. Germination and rooting will sometimes be restricted to crevices in rock. *Pinus longaeva* has smaller winged seeds and should be wind-disseminated. However, caching by nutcrackers does take place, especially when other *Pinus* species are also available (Dr. R. Lanner pers. comm.). Fires seldom destroy these woodlands due to the sparse nature of the canopy cover of trees and abundant bare ground. Peet (1978, 1981) notes that *Pinus aristata* is dominant at higher elevations in much of the southern Rocky Mountains, where *Pinus flexilis* is restricted to lower elevations. This is attributed to apparent competitive exclusion, because *Pinus flexilis* is dominant at high elevations in northern Colorado, Wyoming and Montana.

DISTRIBUTION

Geographic Range: This group is found throughout the Rocky Mountains, including the Uinta and northern Wasatch mountains, and the Jarbridge Mountains in northeastern Nevada, and extends west into the southern Colorado Plateau. It also occurs farther east, in the Bighorn Range of north-central Wyoming, although it is not common there. Montane limber pine communities probably occur in the mountains of Alberta as well.

Spatial Scale & Pattern [optional]: Large patch
Nations: CA, US
States/Provinces: AB, CO, ID, MT, NM, NV, OR, UT, WY
TNC Ecoregions [optional]: 6:C, 7:C, 8:C, 9:C, 10:?, 19:C, 20:C, 21:C, 26:C

USFS Ecoregions (2007): 313B:CC, 331J:CC, M313A:CC, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333C:CC, M341B:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **<** Bristlecone Pine: 209 (Eyre 1980)
- **><** Limber Pine: 219 (Eyre 1980)

LOWER LEVEL UNITS

Alliances:
- A0537 *Pinus aristata* Woodland Alliance
- A0540 *Pinus flexilis* Rocky Mountain Woodland Alliance

AUTHORSHIP

Primary Concept Source: F.H. Eyre (1980)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 03/17/2010
Classif Resp Region: West
Internal Author: KAS 3-10, mod. GK 12-15

REFERENCES

References: Baker 1992, Beasley and Klemmedson 1980, Brunstein and Yamaguchi 1992, Eyre 1980, Faber-Langendoen et al. 2017a, Knight 1994, Krebs 1972, Lanner and Vander Wall 1980, Peet 1978a, Peet 1981, Ranne 1995, Ranne et al. 1997, Steele et al. 1983

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G221. Rocky Mountain Subalpine-Montane Limber Pine - Bristlecone Pine Woodland

G345. Central Rocky Mountain Montane White Spruce Forest

Type Concept Sentence: This group consists of forests where *Picea glauca* is the characteristic conifer often with other trees such as *Betula papyrifera, Picea engelmannii x glauca* hybrids, *Pinus contorta, Pinus ponderosa, Populus tremuloides*, and *Pseudotsuga menziesii*. They are found in lower montane regions of western Montana, southwestern Alberta and southeastern British Columbia, with outliers in mountains of the northwestern Great Plains, especially the Black Hills of Wyoming and South Dakota.

OVERVIEW

Scientific Name: *Picea glauca - Pseudotsuga menziesii* Central Rocky Mountain Forest Group
Common Name (Translated Scientific Name): White Spruce - Douglas-fir Central Rocky Mountain Forest Group
Colloquial Name: Black Hills White Spruce Forest

Type Concept: This group is found in lower montane regions of western Montana, southwestern Alberta and southeastern British Columbia, with outliers in mountains of the northwestern Great Plains, especially the Black Hills of Wyoming and South Dakota. This forest group is limited to sideslopes and depressions, often adjoining cool, riparian zones, where snow persists well into the growing season. Soils vary widely from deep to quite shallow. *Picea glauca* is the characteristic conifer, but other trees can include *Pinus ponderosa, Pinus contorta, Picea engelmannii x glauca* hybrids, *Pseudotsuga menziesii, Populus tremuloides*, and *Betula papyrifera*. Undergrowth shrubs typically include *Arctostaphylos uva-ursi, Elaeagnus commutata, Juniperus communis, Linnaea borealis, Shepherdia canadensis, Symphoricarpos albus*, and *Vaccinium scoparium*. Common forbs and graminoids include *Fragaria virginiana, Oxytropis* spp., *Linnaea borealis, Leymus innovatus, Lathyrus ochroleucus, Hedysarum alpinum*, and Asteraceae spp. Disturbance regimes are not well-documented for this group, but likely include periodic windthrow as well as fire spreading from adjacent, drier forests and woodlands.

Classification Comments: Information on this group needs to be better integrated across Montana, British Columbia and Alberta. Further information on this group in British Columbia is found in Meidinger and Pojar (1991) and in Alberta, in Achuff and Corns (1982), Achuff and Dudynsky (1984), Achuff et al. (2002), and Natural Areas Committee (2006). No sources are currently known for Montana. Its full geographic extent and distinguishing / diagnostic features require further work. As of 2013, the association lists for the Alberta and British Columbia parts have not been integrated.

Similar NVC Types:

Diagnostic Characteristics: Forests and woodlands with *Picea glauca* dominating. Generally in lower montane and foothill settings in the Central Rocky Mountain region, with Rocky Mountain floristic components (as opposed to boreal floristics). Other trees present can include *Pinus ponderosa, Pinus contorta, Pseudotsuga menziesii, Abies lasiocarpa*, and *Populus tremuloides* or *Picea engelmannii x glauca* hybrids.

VEGETATION

Physiognomy and Structure: Open to closed canopies of conifers, with some deciduous hardwoods intermingled in some occurrences. Typically there is a well-developed shrub layer also of deciduous species, along with forbs, graminoids and often high cover of mosses. Some occurrences may lack the shrub layer.

Floristics: *Picea glauca* is the characteristic conifer, but other trees can include *Pinus ponderosa, Pinus contorta, Abies lasiocarpa, Picea engelmannii* (and *Picea glauca* x *Picea engelmannii* introgressive hybrids), *Pseudotsuga menziesii, Populus tremuloides*, and *Betula papyrifera*. Undergrowth shrubs typically include *Arctostaphylos uva-ursi, Elaeagnus commutata, Juniperus communis, Linnaea borealis, Shepherdia canadensis, Symphoricarpos albus*, and *Vaccinium scoparium*. Common forbs and graminoids include *Fragaria virginiana, Oxytropis* spp., *Linnaea borealis, Leymus innovatus, Lathyrus ochroleucus, Hedysarum alpinum*, and Asteraceae spp.

ENVIRONMENT & DYNAMICS

Environmental Description: In the main part of its range, this forest group is limited to sideslopes and depressions, likely adjoining riparian zones, where snow is well-retained. Soils vary widely from deep to shallow. In the Black Hills, these forests occur as small or large patches at cooler higher elevations, on level or gently sloping areas, from about 1740 to 2135 m (5700-7000 feet) elevation; at lower elevations, they are restricted to north-facing slopes within the ponderosa pine matrix.

Dynamics:

DISTRIBUTION

Geographic Range: This group is found in lower montane regions of western Montana, southwestern Alberta and southeastern British Columbia, with outliers in higher mountains of the northwestern Great Plains, especially the Black Hills of Wyoming and South Dakota, and possibly the Bighorn Mountains of Wyoming. In Albert and British Columbia, this group occurs north through Banff National Park to Jasper National Park, and in the British Columbia portion of the Rockies, these occur in the Columbia Trench north to at least Kootenay and Yoho national parks.

Spatial Scale & Pattern [optional]: Large patch
Nations: CA, US
States/Provinces: AB, BC, MT, SD, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: PC (Banff, Jasper, Kootenay, Yoho)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low. USNVC Confidence from peer reviewer, not AE.

SYNONYMY

- **=** *Picea glauca* series (Hoffman and Alexander 1987)
- **<** Montane Natural Subregion (Natural Regions Committee 2006) [The white spruce group is found within the mesic parts of this region, which can contain other types.]
- **<** Montane Spruce Zone (Meidinger and Pojar 1991) [The white spruce group is found within the mesic parts of this ecological zone, which can contain other types.]

LOWER LEVEL UNITS

Alliances:

- A3623 *Picea glauca* Black Hills Forest Alliance
- A3624 *Picea glauca - Pseudotsuga menziesii* Rocky Mountain Forest Alliance

AUTHORSHIP

Primary Concept Source: Hoffman and Alexander (1987); Meidinger and Pojar (1991); Natural Regions Committee (2006)
Author of Description: D. Faber-Langendoen
Acknowledgments: Lorna Allen, Peter Achuff, Del Meidinger

Version Date: 06/06/2013
Classif Resp Region: West
Internal Author: DFL/MSR 2-10, mod. DFL 6-13, mod. GK 12-15

REFERENCES

References: Achuff and Corns 1982, Achuff and Dudynsky 1984a, Achuff et al. 2002, Faber-Langendoen et al. 2017a, Hoffman and Alexander 1987, Meidinger and Pojar 1991, Natural Regions Committee 2006

1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G345. Central Rocky Mountain Montane White Spruce Forest

G223. Northern Rocky Mountain Whitebark Pine - Subalpine Larch Woodland

Type Concept Sentence: This group consists of woodlands dominated by *Pinus albicaulis* and *Abies lasiocarpa*, or *Larix lyallii*, that form stunted tree clumps, or open woodlands with herb- or dwarf-shrub-dominated openings with an undergrowth that is usually somewhat depauperate. It is found in the northern Rocky Mountains at high elevations of the treeline/alpine transition zone, an often harsh, windswept environment, where trees maybe flagged from damage by blowing snow and ice crystals.

OVERVIEW

Scientific Name: *Pinus albicaulis - Abies lasiocarpa - Larix lyallii* Northern Rocky Mountain Woodland Group
Common Name (Translated Scientific Name): Whitebark Pine - Subalpine Fir - Subalpine Larch Northern Rocky Mountain Woodland Group
Colloquial Name: Whitebark Pine Forest & Woodland

Type Concept: This group of the Northern Rockies is typically a high-elevation mosaic of stunted tree clumps, open woodlands, with herb- or dwarf-shrub-dominated openings, occurring above upper subalpine closed forest ecosystems and below alpine communities. The climate is typically very cold and snowy in winter and relatively dry and cool in summer. The upper and lower elevational limits, due to climatic variability and differing topography, vary considerably; in interior British Columbia, this group occurs between 1400 and 2200 m elevation, and in northwestern Montana, it occurs up to 2400 m. Landforms include ridgetops, mountain slopes, glacial trough walls and moraines, talus slopes, landslides and rockslides, cirque headwalls and basins. Some sites have little snow accumulation because of high winds and sublimation. In this harsh, often windswept environment, trees are typically stunted and flagged from damage associated with wind, blowing snow and ice crystals, especially at the upper elevations of the type. The stands or patches often originate when *Pinus albicaulis*, and in some communities *Picea engelmannii*, colonize a sheltered site such as the lee side of a rock. *Abies lasiocarpa* can then colonize in the shelter of either species. These high-elevation coniferous woodlands are dominated by *Pinus albicaulis* and *Abies lasiocarpa*, or *Larix lyallii*. The undergrowth is usually somewhat depauperate, but some stands support a near sward of heath plants, such as *Phyllodoce empetriformis, Vaccinium myrtillus*, and *Vaccinium scoparium*, that may be present to codominant. The herbaceous layer is sparse under dense shrub canopies or may be dense where the shrub canopy is open or absent. Common species include *Ligusticum grayi*(?), *Arnica latifolia, Xerophyllum tenax, Carex rossii, Carex geyeri*, and *Luzula glabrata var. hitchcockii*. Major disturbances are windthrow and snow avalanches. Fire is known to occur infrequently in this group, at least where woodlands are present; lightning damage to individual trees is common, but sparse canopies and rocky terrain limit the spread of fire.

Classification Comments: *Pinus albicaulis* and *Larix lyallii* associations are considered distinct enough to be placed in their own group. Alternatively, they could be merged into one of the Rocky Mountain spruce-fir groups, or with the limber pine group, as a "Rocky Mountain dry, cold, subalpine-montane pine" group. *Pinus albicaulis* woodlands in northeastern Oregon are included in this group. In the Sierra Nevada and Oregon Cascades, they are placed into Sierra-Cascade Cold-Dry Subalpine Woodland Group (G243).

Similar NVC Types:
- G218 Rocky Mountain Subalpine Moist Spruce - Fir Forest & Woodland
- G243 Sierra-Cascade Cold-Dry Subalpine Woodland

Diagnostic Characteristics: These coniferous woodlands are dominated by *Pinus albicaulis* and *Abies lasiocarpa* and locally *Larix lyallii* with occasional *Picea engelmannii*. The undergrowth is often composed of few species, but some stands support a near sward of heath plants, such as *Vaccinium myrtillus* and *Vaccinium scoparium*, that may be present to codominant. The herbaceous layer is sparse under dense shrub canopies or may be dense where the shrub canopy is open or absent. Common species include *Ligusticum grayi, Xerophyllum tenax, Festuca idahoensis, Carex rossii, Calamagrostis rubescens*, and *Luzula glabrata var. hitchcockii*.

VEGETATION

Physiognomy and Structure: This group is characterized by *Pinus albicaulis* or *Larix lyallii*, sometimes associated with other conifers, which form woodlands and occasionally forests. Trees are often stunted and flagged as a result of harsh cold and wind. The understory is variable depending on substrates ranging from sparse on rockier sites to dense on more mesic sites and typically characterized by heaths and graminoids.

Floristics: These woodlands are mostly dominated by *Pinus albicaulis* or *Larix lyallii* and occasionally codominated by *Abies lasiocarpa*. Understories range from sparse to dense and are occupied by heath species, including *Arctostaphylos uva-ursi, Vaccinium membranaceum, Vaccinium myrtillus, Menziesia ferruginea*, and *Vaccinium scoparium*. The herbaceous layer is sparse under dense shrub canopies or may be dense where the shrub canopy is open or absent. Common species include *Ligusticum grayi, Xerophyllum tenax, Festuca idahoensis, Carex rossii, Calamagrostis rubescens*, and *Luzula glabrata var. hitchcockii*.

ENVIRONMENT & DYNAMICS

Environmental Description: This subalpine group typically occurs at elevations of 1800-2700 m and occasionally up to 3000 m. Occurrences occupy warmer southern and western aspects on mid to upper slopes, shoulder slopes, ridges, and exposed high-elevation benches. These sites are often subject to desiccating winds, heavy snowpack, and extreme diurnal temperate fluctuations. Substrates include a variety of igneous, metamorphic, and sedimentary geologic formations. Soils are well- to excessively drained and can include coarse sand, silt and clay loams. *Climate:* The climate is typically very cold and snowy in winter and relatively dry in summer. Yearly snow accumulations are often over 3 m in the northern Cascades and 2-3 m in the Rockies. Some sites have little snow accumulation because of high winds and sublimation. In this harsh, often windswept environment, trees are often stunted and flagged from damage associated with wind and blowing snow and ice crystals, especially at the upper elevations of the type. *Soil/substrate/hydrology:* Where *Larix lyallii* is dominant, soils are poorly developed and almost exclusively of fractured granitic or quartzite rocks which have not been previously colonized by other vascular plants. The majority of sites where *Larix lyallii* occurs are in areas which experienced heavy alpine glaciation less than 12,000 years ago.

Dynamics: *Pinus albicaulis* is a slow-growing, long-lived conifer that is common at higher elevations in the upper subalpine zone. It typically occurs in a mosaic of tree islands and meadows where it often colonizes sites and creates habitat for less hardy tree species. In lower subalpine forests, it is a seral species, establishing after a large disturbance such as stand-replacing fire or avalanche, or it is restricted to dry, rocky ridges where it competes well with shade-tolerant tree species. Without disturbance, it will be overtopped in 100-120 years by faster growing, shade-tolerant species such as *Abies lasiocarpa, Picea engelmannii, Pseudotsuga menziesii*, and *Tsuga mertensiana*. Although crownfires and high-intensity surface fires kill *Pinus albicaulis*, it tolerates low-intensity surface fires that will kill the shade-tolerant understory. Fire intervals range from 30-300 years.

Birds and small mammals often eat and cache the large, wingless pine seeds and are responsible for the dispersal of this species. Most important is the Clark's nutcracker, which can transport the seeds long distances and cache them on exposed windswept and burned-over sites. This results in the regeneration of pines in clumps from forgotten caches (Eyre 1980, Steel et al. 1983, Burns and Honkala 1990a, Schmidt and McDonald 1990).

Pests include the mountain pine beetle (*Dendroctonus ponderosae*), which has killed many mature trees in the past, during epidemics where populations of the beetle build up in lower elevation *Pinus contorta* stands, then move up into the *Pinus albicaulis* (Steel et al. 1983, Burns and Honkala 1990a, Schmidt and McDonald 1990). The exotic pathogen white pine blister rust (*Cronartium ribicola*) is attacking and killing *Pinus albicaulis* trees in many parts of the interior northwestern U.S. It is especially destructive in more mesic habitats that favor infection of its alternate host *Ribes* spp. *Pinus albicaulis* is very susceptible to this disease, and the only real hope is propagating individuals that have high genetic resistance to blister rust (Steel et al. 1983, Burns and Honkala 1990a, Schmidt and McDonald 1990, Tomback et al. 2001).

Larix lyallii is a very slow-growing, long-lived tree, with individuals attaining up to 1000 years in age (Richards 1981). It is generally intolerant of shade from other trees, but extreme environmental conditions limit competition. Reproduction is typically by seed and is most favorable on moist mineral soil. Seedling growth is initially very slow and accelerates after an extensive root system is established. Major disturbances to stands of this group are windthrow and snow avalanches. Lightning damage to individual trees is common, but sparse canopies and rocky terrain serve to limit the spread of fire.

DISTRIBUTION

Geographic Range: This group occurs in the northern Rocky Mountains, west into the eastern Cascade Range and eastern Washington and Oregon, and east into the mountain "islands" of central Montana. It also occurs in the Canadian Rockies of Alberta and eastern British Columbia.

Spatial Scale & Pattern [optional]: Large patch
Nations: CA, US
States/Provinces: AB, BC, CA, ID, MT, NV, OR, WA, WY
TNC Ecoregions [optional]: 3:C, 4:C, 7:C, 8:C, 9:C, 68:C

USFS Ecoregions (2007): 342H:CC, 342I:CP, M242C:CC, M242D:CC, M331A:CC, M331B:CP, M331D:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate. USNVC Confidence from peer reviewer, not AE.

SYNONYMY

- **><** *Picea engelmannii - Abies lasiocarpa - Pinus albicaulis - Pinus contorta* forest (Achuff 1989)
- **><** *Pinus albicaulis-Abies lasiocarpa* Woodlands and Parklands (Chappell et al. 1997)
- **><** *Pinus albicaulis* Series (Steele et al. 1983)
- **><** *Pinus albicaulis* Series (Johnston 1987)
- **><** *Pinus albicaulis* Zone (Barrows et al. 1977)
- **<** FP Engelmann Spruce - Subalpine Fir Parkland (Ecosystems Working Group 1998)
- **<** WB Whitebark Pine Subalpine (Ecosystems Working Group 1998)
- **>** Whitebark Pine: 208 (Eyre 1980)

LOWER LEVEL UNITS

Alliances:

- A0631 *Larix lyallii* Woodland Alliance
- A3368 *Pinus albicaulis* Forest & Woodland Alliance

AUTHORSHIP

Primary Concept Source: F.H. Eyre (1980)
Author of Description: M.E. Hall and M.S. Reid
Acknowledgments:
Version Date: 06/10/2013
Classif Resp Region: West
Internal Author: MEH/MSR 2-10, 6-13, mod. GK 12-15

REFERENCES

References: Achuff 1989, Arno and Habeck 1972, Barrows et al. 1977, Burns and Honkala 1990a, Chappell et al. 1997, Cooper et al. 1999, Ecosystems Working Group 1998, Eyre 1980, Faber-Langendoen et al. 2017a, Franklin and Dyrness 1973, Johnston 1987, Lillybridge et al. 1995, Meidinger and Pojar 1991, Pfister et al. 1977, Richards 1981, Schmidt and McDonald 1990, Steele et al. 1983, Tomback et al. 2001, Williams and Lillybridge 1983, Williams and Smith 1990

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G223. Northern Rocky Mountain Whitebark Pine - Subalpine Larch Woodland

1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub

These pinyon pine- and juniper-dominated woodlands, scrub, and savannas generally occur just above semi-desert shrublands and grasslands or shortgrass prairies and below montane forest vegetation throughout the semi-arid Intermountain West and western Great Plains of North America.

M026. Intermountain Singleleaf Pinyon - Juniper Woodland

This broadly defined pinyon and juniper woodland, savanna and scrub macrogroup occurs in dry foothills in the interior western U.S. and is characterized by an open to closed tree canopy composed of *Juniperus occidentalis, Juniperus osteosperma, Pinus edulis, Pinus monophylla*, and/or *Cercocarpus ledifolius*.

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1. Forest & Woodland
1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub
1.B.2.Nc.1.a. M026 Intermountain Singleleaf Pinyon - Juniper Woodland

G246. Colorado Plateau-Great Basin Juniper Open Woodland

Type Concept Sentence: This widespread juniper woodland and savanna group occurs in the Colorado Plateau and Great Basin and is characterized by dominance of *Juniperus osteosperma* trees in an open tree canopy with high cover of perennial bunchgrasses and forbs (savannas) or an open to closed canopy often with a shrub understory (woodlands) and the lack of pinyon trees *Pinus edulis* and *Pinus monophylla*, which occur outside the ecological or geographic range of this type.

OVERVIEW

Scientific Name: *Juniperus osteosperma* Open Woodland Group
Common Name (Translated Scientific Name): Utah Juniper Open Woodland Group
Colloquial Name: Utah Juniper / Herb Open Woodland

Type Concept: This widespread juniper woodland and savanna group occupies dry foothills and sandsheets of the Colorado Plateau and eastern Great Basin from the western Colorado to Nevada and southern Idaho, and south to northwestern New Mexico and northern Arizona. The vegetation ranges from savanna, often with inclusions of denser patches of juniper, to open to dense woodland. The savanna stands are characterized by an open tree canopy of *Juniperus osteosperma* trees with high cover of perennial bunchgrasses and forbs, with *Achnatherum hymenoides, Bouteloua gracilis, Hesperostipa comata, Leymus salinus*, and *Pleuraphis jamesii* being most common. Woodland stands are generally open, but range from an open to closed canopy often with shrubs between trees depending on size of gaps. Characteristic shrubs include *Artemisia nova, Artemisia tridentata, Cercocarpus intricatus, Coleogyne ramosissima*, and *Ephedra* spp. Pinyon trees are typically not present because sites are outside the ecological or geographic range of *Pinus edulis* and *Pinus monophylla*. These juniper woodlands and wooded grasslands are generally found at lower elevations and on more xeric sites than Great Basin Pinyon - Juniper Woodland Group (G247) or Colorado Plateau Pinyon - Juniper Woodland Group (G250). Elevation ranges from 1500-2300 m. Stands occur on lower mountain slopes, hills, plateaus, basins and more recently on flats where juniper is expanding into semi-desert grasslands and steppe.

Classification Comments: *Juniperus californica* savannas in the Central Valley of California and around the fringes of the Mojave Desert are not part of this group. In many cases, they are the result of some disturbance removing an oak component from one of the several oak woodland and savanna systems of California. This group does not extend north into the Columbia Plateau where *Juniperus occidentalis* dominates the Columbia Plateau Western Juniper Open Woodland Group (G248). This Utah juniper savanna and woodland group does not include sparse juniper stands on rock outcrops or woodlands. It corresponds to both the *Juniperus osteosperma*-dominated portion of the *pinyon-juniper savanna* type (low to moderate cover of trees, well-developed graminoid understory, generally a minor shrub component, growing on deeper soils) and well as the *Juniperus osteosperma*-dominated portion of the *persistent pinyon-juniper woodland* type (occurs on rocky uplands with shallow, coarse-textured, and often skeletal soils that support relatively sparse herbaceous cover and rarely burn) described in Romme et al. (2009).

Similar NVC Types:
- G250 Colorado Plateau Pinyon - Juniper Woodland
- G247 Great Basin Pinyon - Juniper Woodland

Diagnostic Characteristics: These woodlands and savannas are characterized by the dominance of *Juniperus osteosperma* in the tree layer and absence of *Pinus monophylla* and *Pinus edulis*. If stand is a savanna, then there is a lush perennial grass layer with scattered *Juniperus osteosperma* trees. Characteristic grasses include *Achnatherum hymenoides, Hesperostipa comata, Leymus salinus*, and *Pleuraphis jamesii*. *Juniperus occidentalis* is absent (or accidental) as it is restricted to Columbia Plateau Western Juniper Woodland & Savanna Group (G248).

VEGETATION

Physiognomy and Structure: This group includes both open to closed woodlands dominated by the evergreen sclerophyllous tree *Juniperus osteosperma*, as well as savannas characterized by a lush perennial grass layer (20-90% cover) with tree layer dominated by *Juniperus osteosperma*. Woodland stands may have shrubs present to dense forming a layer.

Floristics: The vegetation is typically open savanna, although there may be inclusions of denser patches of juniper. This savanna is typically dominated by *Juniperus osteosperma* trees with high cover of perennial bunchgrasses and forbs, with *Bouteloua gracilis, Hesperostipa comata, Leymus salinus, Pleuraphis jamesii, Pleuraphis mutica*, and *Pseudoroegneria spicata* being most common. Pinyon trees are typically not present because sites are outside the ecological or geographic range of *Pinus edulis* and *Pinus monophylla*. Scattered shrubs may be present with low cover relative to the perennial herbaceous layer. Characteristic shrubs include *Artemisia arbuscula, Artemisia nova, Artemisia tridentata, Cercocarpus intricatus, Cercocarpus montanus, Coleogyne ramosissima, Ephedra* viridis, *Mahonia fremontii, Purshia tridentata*, and *Symphoricarpos oreophilus*. *Juniperus scopulorum* may codominate or replace *Juniperus osteosperma* in upper elevation stands, near washes, and in the cooler northern extent.

ENVIRONMENT & DYNAMICS

Environmental Description: This widespread juniper woodland and savanna group occupies dry foothills and sandsheets of the Colorado Plateau and eastern Great Basin. These wooded grasslands are generally found at lower elevations and on more xeric sites than Great Basin Pinyon - Juniper Woodland Group (G247) or Colorado Plateau Pinyon - Juniper Woodland Group (G250). Elevation ranges from 1500-2300 m. Stands occur on lower mountain slopes, hills, plateaus, basins and more recently on flats where juniper is expanding into semi-desert grasslands and steppe. Soils are generally calcareous and alkaline, and often shallow and rocky, but may be acidic.

Dynamics: Some researchers believe that at one time the juniper savanna was more common than juniper woodlands (West and Young 2000). These savanna communities depend on periodic fire (once every 10-30 years) to maintain the juniper savanna structure by thinning trees that invade the interspaces between larger fire-resistant trees and create woodlands (Wright et al. 1979, West and Young 2000). Juniper trees less than 1.2 m (4 feet) tall are readily killed by fires (Wright et al. 1979). Heavy grazing by livestock reduces the fine fuel layer (grasses), which decreases the fire frequency resulting in increased juniper density (Wright et al. 1979, West and Young 2000). Over the last century, a reduction in fire frequency has caused a conversion of some juniper savanna to juniper woodland as well as invasion of juniper trees from areas of naturally low fire frequency, e.g., rocky ridges into adjacent communities, especially sagebrush steppe (Wright et al. 1979, West and Young 2000).

DISTRIBUTION

Geographic Range: This *Juniperus osteosperma* woodland and savanna group occupies dry foothills and sandsheets of the Colorado Plateau and Great Basin from western Colorado to Nevada and southern Idaho, and south to northwestern New Mexico and northern Arizona. Where it occurs in California, it is found only in the far eastern edges of the state within or adjacent to the Great Basin.

Spatial Scale & Pattern [optional]: Large patch
Nations: US
States/Provinces: AZ, CA, CO, ID, NM, NV, UT
TNC Ecoregions [optional]: 9:C, 10:C, 11:C, 18:C, 19:C, 20:C, 21:C
USFS Ecoregions (2007): 313A:CC, 313B:CC, 313C:CC, 313D:CC, 315H:CC, 321A:CC, 322A:CC, 341A:C?, 341D:C?, 341E:C?, 341F:C?, 341G:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CP, 342G:CC, 342J:CC, M313A:CC, M331D:CC, M331E:C?, M331G:CP, M331H:CC, M331I:CP, M331J:CP, M332E:CC, M341A:CC, M341D:CP
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **=** Juniper steppe woodland (*Juniperus - Artemisia - Agropyron*) (Küchler 1964)
- **=** Utah Juniper Series (Dick-Peddie 1993)

LOWER LEVEL UNITS

Alliances:
- A3497 *Juniperus osteosperma* / Herbaceous Understory Open Woodland Alliance
- A3496 *Juniperus osteosperma* / Shrub Understory Woodland Alliance

AUTHORSHIP

Primary Concept Source: A.W. Kuchler (1964)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 11/09/2015
Classif Resp Region: West
Internal Author: KAS 1-10, 6-23, 11-15

REFERENCES

References: Bassett et al. 1987, Blackburn and Tueller 1970, Brown 1982a, Brown et al. 1979, Dick-Peddie 1993, Eyre 1980, Faber-Langendoen et al. 2017a, Fitzhugh et al. 1987, Francis 1986, Küchler 1964, Larson and Moir 1986, Larson and Moir 1987, Romme et al. 2009, Sawyer et al. 2009, Shiflet 1994, Tuhy et al. 2002, West 1999a, West 1999b, West and Young 2000, West et al. 1998, Wright et al. 1979

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1. Forest & Woodland
1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub

G246. Colorado Plateau-Great Basin Juniper Open Woodland

A3497. Juniperus osteosperma / Herbaceous Understory Open Woodland Alliance

Type Concept Sentence: This juniper woodland and savanna alliance is characterized by an open to moderately dense, short (<15 m) tree canopy strongly dominated by *Juniperus osteosperma* or *Juniperus scopulorum* (at higher elevations) with an understory dominated by an open to dense layer of perennial grasses and lacking significant cover of shrubs. It occurs in the Colorado Plateau, but it extends out into adjacent ecoregions primarily west into the Great Basin and north and east into the foothills of the central and southern Rocky Mountains.

OVERVIEW

Scientific Name: *Juniperus osteosperma* / Herbaceous Understory Open Woodland Alliance
Common Name (Translated Scientific Name): Utah Juniper / Herbaceous Understory Open Woodland Alliance
Colloquial Name: Utah Juniper / Herb Open Woodland

Type Concept: Stands have a typically open to moderately dense tree canopy with an understory characterized by herbaceous vegetation. Tree canopy is dominated by *Juniperus osteosperma* with *Juniperus scopulorum* becoming important at higher elevations and along drainages. *Pinus* species are absent or accidental. Perennial grasses typically dominate the herbaceous layer although forbs are present and can be diverse. Characteristic species include *Achnatherum hymenoides, Bouteloua gracilis, Hesperostipa comata, Hesperostipa neomexicana, Leymus salinus, Pleuraphis jamesii, Pleuraphis mutica*, and *Pseudoroegneria spicata*. The non-native, invasive annual grass *Bromus tectorum* may be abundant in disturbed stands and dominate the herbaceous layer of highly disturbed stands. The core distribution of this juniper alliance is the Colorado Plateau, but it extends out into adjacent ecoregions primarily west into the Great Basin and north and east into the foothills of the central and southern Rocky Mountains. Stands occur on level to moderately steep alluvial fans and terraces, colluvial slopes, benches, hills, and badlands. Elevation of most stands ranges from 1423 to 1880 m (4670-6165 feet) but may occur as high as 2200 m (7215 feet) on warmer southwest-facing slopes. Sites may be oriented to any aspect. Stands have been observed on north-facing steep slopes along bluffs of the Snake River in southeastern Idaho. Soils are well-drained sands, sandy clays, or clay loams derived from shales, sandstones, or a mix of the two. Less frequently substrates are derived from eolian sands.

Classification Comments: This alliance may include stands with *Juniperus monosperma* present to codominant in northeastern Arizona. There is a transition zone between the ranges of the two species of *Juniperus* in the southern Colorado Plateau.

Internal Comments: mjr 12-14: CA added for MOJN. KAS-1-14: *Juniperus osteosperma / Pleuraphis mutica* Woodland (CEGL000736) is included in this alliance because it is reported in the Southern Colorado Plateau north of the Mogollon Rim, but needs further review as it has presence of warm desert indicator species.
Other Comments:

Similar NVC Types: This alliance has similarities to other pinyon-juniper and juniper woodland and savanna alliances in several other groups, such as G200, G247, G248, G250, G252, G253, and G487.

- A3134 *Juniperus coahuilensis - Juniperus deppeana - Juniperus monosperma* / Grass Understory Open Woodland Alliance: is similar in that it is a juniper savanna, but Madrean and warm desert floristic species overlap very little with Intermountain West floristics.
- A3426 *Juniperus osteosperma - Juniperus scopulorum* / Shrub Understory Central Rocky Mountain Woodland Alliance
- A3572 *Pinus edulis - Juniperus osteosperma* / Herbaceous Understory Open Woodland Alliance: is similar except overstory is characterized by *Pinus edulis* with 5% or more cover.
- A3575 *Juniperus monosperma* / Herbaceous Understory Open Woodland Alliance: is similar except overstory is dominated by *Juniperus monosperma*.
- A3500 *Juniperus occidentalis* / Herbaceous Understory Open Woodland Alliance: is similar except overstory is dominated by *Juniperus occidentalis*.
- A3496 *Juniperus osteosperma* / Shrub Understory Woodland Alliance: is similar but understory has a shrub layer (>10% cover) or, if less, shrub cover exceeds herbaceous cover.
- A2109 *Pinus monophylla - Juniperus osteosperma* / Herbaceous Understory Open Woodland Alliance: is similar except overstory is characterized by *Pinus monophylla* with 5% or more cover.

Diagnostic Characteristics: Stands have an open to moderately dense tree canopy dominated by *Juniperus osteosperma* with *Juniperus scopulorum* present to dominant at higher elevations. Understory is characterized by dominant and diagnostic perennial grass species *Bouteloua gracilis, Hesperostipa comata, Hesperostipa neomexicana, Leymus ambiguus, Leymus salinus, Pleuraphis jamesii, Pleuraphis mutica, Poa fendleriana, Poa secunda*, and *Pseudoroegneria spicata*. Shrub cover is sparse and does not form a layer. Forbs are present generally with low cover. This alliance also includes disturbed stands with the understory dominated by introduced annual grass *Bromus tectorum*.

VEGETATION

Physiognomy and Structure: These are sparsely to moderate dense (5-30% cover) wooded communities dominated by scale-leaved evergreen trees of low stature (<15 m). Evergreen or cold-deciduous shrubs occupy the interstices between trees, interspersed with cespitose graminoids. In total, the herbaceous layer is usually of moderate cover (25-50%), but may also be low (5% cover) when it exceeds shrub cover. Occasionally shrubs may be present, but do not form a layer (<10% cover).

Floristics: Stands have a short (<15 m tall), typically open to moderately dense tree canopy with an understory characterized by herbaceous vegetation. Tree canopy is dominated by *Juniperus osteosperma* with *Juniperus scopulorum* becoming important at higher elevations and along drainages. *Pinus* species, such as *Pinus monophylla, Pinus edulis, Pinus flexilis, Pinus ponderosa*, or *Pseudotsuga menziesii* are absent or accidental. The open to dense herbaceous layer is typically dominated by perennial grasses. Characteristic species include *Achnatherum hymenoides, Bouteloua gracilis, Hesperostipa comata, Hesperostipa neomexicana, Leymus ambiguus, Leymus salinus, Pleuraphis jamesii, Pleuraphis mutica, Poa fendleriana, Poa secunda*, and *Pseudoroegneria spicata*. Forbs are present in the herbaceous layer and can be diverse but contribute little cover, including *Arenaria hookeri, Arenaria fendleri, Calochortus gunnisonii, Chaetopappa ericoides, Cymopterus bulbosus, Cymopterus purpureus, Eriogonum umbellatum, Hymenoxys richardsonii, Linanthus pungens (= Leptodactylon pungens), Lepidium montanum, Machaeranthera grindelioides, Mirabilis multiflora, Oenothera pallida, Petradoria pumila, Phlox austromontana, Phlox hoodii, Sphaeralcea coccinea, Streptanthella longirostris, Stenotus acaulis, Tetraneuris acaulis (= Hymenoxys acaulis)*, and *Xylorhiza venusta*. The non-native, invasive annual grass *Bromus tectorum* may be abundant in disturbed stands and dominate the herbaceous layer of highly disturbed stands. Scattered shrubs such as *Artemisia tridentata, Artemisia nova, Atriplex* spp., *Chrysothamnus* spp., *Cercocarpus* spp. (on thin soils near rock outcrops), *Gutierrezia sarothrae, Krascheninnikovia lanata*, and *Opuntia* spp. by be present but do not form a layer or exceed the herbaceous cover.

ENVIRONMENT & DYNAMICS

Environmental Description: This savanna and open woodland alliance is distributed across the Intermountain West from the foothills of the eastern Sierra Nevada to the foothills of the central and southern Rocky Mountains. Climate is temperate with freezing temperatures during winter. Distribution of the alliance is often correlated with "thermal belts" which occur above the areas of cold-air drainage in high intermountain basins. Average annual precipitation is between 25 and 50 cm; however, seasonal distribution is variable across the range of the alliance. Stands occur on alluvial fans and terraces, colluvial slopes, benches, hills, and badlands. Sites are on level to moderately steep (3-46% slope) terrain that may be oriented to any aspect. Elevation of most stands ranges from 1423 to 1880 m (4670-6165 feet) but may occur as high as 2200 m (7215 feet). Sites tend to occur on cooler north and east aspects at lower elevations and warmer/drier south and west aspects at higher elevations. Soils are well-drained sands, sandy clays, or clay loams derived from shales, sandstones, or a mix of the two. Less frequently substrates are derived from eolian sands. Parent materials include Mesozoic marine shales of the Morrison Formation, Chinle Formation or Mancos shale, Kayenta Formation and Cedar Mesa sandstone. Colluvium from sandstone cliffs or outcrops upslope is common on the ground surface.

Dynamics: Within the distribution of *Pinus edulis*, this alliance typically occurs at lower elevation and on more xeric sites than *Pinus edulis* - (*Juniperus* spp.) woodlands. There is elevational overlap between this alliance and *Pinus monophylla* woodlands as this pinyon can occur on more xeric sites than *Pinus edulis*. *Juniperus osteosperma* also occurs on sites outside the ranges of *Pinus edulis* and *Pinus monophylla*. There has been significant expansion of this alliance over the last century into sagebrush-dominated shrublands. An altered fire regime (such as fire suppression, thus longer return intervals) is considered a primary cause of this expansion.

DISTRIBUTION

Geographic Range: The core distribution of this juniper alliance is the Colorado Plateau, but it extends out into adjacent ecoregions primarily west into the Great Basin and north and east into the foothills of the central and southern Rocky Mountains.

Nations: US
States/Provinces: AZ, CA, CO, ID, MT, NM, NV, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** *Juniperus osteosperma* (Utah juniper woodland) Alliance (Sawyer et al. 2009) [89.300.00]
- **><** Utah Juniper Series (Sawyer and Keeler-Wolf 1995)

LOWER LEVEL UNITS

Associations:

- CEGL002815 *Juniperus osteosperma / Hesperostipa comata* Open Woodland
- CEGL002817 *Juniperus osteosperma / Bromus tectorum* Ruderal Woodland
- CEGL000740 *Juniperus osteosperma / Hesperostipa neomexicana* Open Woodland
- CEGL000736 *Juniperus osteosperma / Pleuraphis mutica* Open Woodland
- CEGL000738 *Juniperus osteosperma / Pseudoroegneria spicata* Open Woodland
- CEGL005618 *Juniperus osteosperma / Festuca idahoensis* Open Woodland
- CEGL001488 *Juniperus osteosperma / Leymus salinus ssp. salmonis* Wooded Grassland
- CEGL002361 *Juniperus osteosperma / Bouteloua gracilis* Open Woodland
- CEGL003109 *Juniperus osteosperma / Leymus salinus* Open Woodland
- CEGL002362 *Juniperus osteosperma / Pleuraphis jamesii* Open Woodland
- CEGL001489 *Juniperus osteosperma / Hesperostipa comata* Wooded Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by M. Jennings, M.S. Reid, and D. Sarr.
Version Date: 2014/03/14

REFERENCES

References: Baker 1983b, Baker 1984a, Baker and Kennedy 1985, Barney and Frischknecht 1974, Blackburn 1967, Blackburn et al. 1968a, Blackburn et al. 1968c, Blackburn et al. 1969a, Blackburn et al. 1969e, Blackburn et al. 1971, Brotherson and Evenson 1983, Bunting 1987, Caicco and Wellner 1983c, Dastrup 1963, Despain 1973a, Donart et al. 1978b, Everett 1986, Faber-Langendoen et al. 2017b, Isaacson 1967, Jameson et al. 1962, Johnsen 1962, Johnston 1987, Jones 1989b, Kline 1973, Knight et al. 1987, Komarkova et al. 1988b, Koniak 1985, Larson and Moir 1986, Larson and Moir 1987, Lesica and DeVelice 1992, Marriott and Jones 1989, Moir and Carleton 1987, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, USFS 1983a, USFS 1985c, West et al. 1978, Wight 1965, Wight and Fisser 1968, Wright et al. 1979

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1. Forest & Woodland
1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub
G246. Colorado Plateau-Great Basin Juniper Open Woodland

A3496. Juniperus osteosperma / Shrub Understory Woodland Alliance

Type Concept Sentence: This juniper woodland alliance is characterized by an open to moderately dense, short (<15 m) tree canopy that is strongly dominated by *Juniperus osteosperma* or *Juniperus scopulorum* (at higher elevations) with an understory characterized by an open dense layer of shrubs (<10% cover). If understory is sparse then shrubs exceed herbaceous cover. It occurs in the Colorado Plateau, but it extends out into adjacent ecoregions primarily west into the Great Basin and north and east into the foothills of the central and southern Rocky Mountains.

OVERVIEW

Scientific Name: *Juniperus osteosperma* / Shrub Understory Woodland Alliance
Common Name (Translated Scientific Name): Utah Juniper / Shrub Understory Woodland Alliance
Colloquial Name: Utah Juniper / Shrub Woodland

Type Concept: Stands have a short, typically open to moderately dense tree canopy with an understory characterized by shrubs. Tree canopy is dominated by *Juniperus osteosperma* with *Juniperus scopulorum* becoming important and sometimes dominant at higher elevations and on relatively mesic sites such as along drainages. *Pinus* species are absent or accidental with very low cover. Shrubs typically dominate the understory and form an open to moderately dense layer. Scattered shrubs frequently characterize the sparse and rocky understory. Characteristic shrubs are many, including *Artemisia arbuscula, Artemisia nova, Artemisia tridentata, Cercocarpus intricatus, Cercocarpus montanus, Coleogyne ramosissima, Mahonia fremontii, Quercus gambelii*, and *Symphoricarpos oreophilus*. The herbaceous layer is sparse to moderate and composed of grasses and often diverse forbs. Common species may include *Achnatherum hymenoides, Bouteloua gracilis, Hesperostipa comata, Hesperostipa neomexicana, Leymus salinus, Pleuraphis jamesii*, and *Pseudoroegneria spicata*. The non-native, invasive annual grass *Bromus tectorum* may be abundant and dominate the herbaceous layer of highly disturbed stands. This alliance also includes sparse understory stands often with scattered shrubs and grasses. The core distribution of this juniper alliance is semi-arid canyons, foothills, plateaus and low mountains in the Colorado Plateau, but it extends out into adjacent ecoregions primarily west into the Great Basin and north and east into the foothills of the central and southern Rocky Mountains. Stands have been observed on north-facing steep slopes along bluffs of the Snake River in southeastern Idaho. Stands occur on a variety of sites, including alluvial fans and stream terraces, colluvial slopes, benches, ledges,

hills, ridges, mesas, and badlands. Sites range from level to steep terrain that may be oriented to any aspect. Elevation of most stands ranges from 1220 to 2260 m (4000-7400 feet). Soils are often calcareous, shallow, poorly developed, rapidly to well-drained sands, sandy clays, or clay loams derived from shales, sandstones, or a mix of the two.

Classification Comments: This alliance may include stands with *Juniperus monosperma* present to codominant in northeastern Arizona. There is a transition zone between the ranges of the two species of *Juniperus* in the southern Colorado Plateau. Scattered shrubs frequently characterize the sparse and rocky understory of stands and so are included in this alliance.

Internal Comments:
Other Comments:

Similar NVC Types: This alliance has similarities to other pinyon-juniper and juniper woodland and savanna alliances in several other groups, such as G200, G247, G248, G250, G252, G253, and G487.

- A3133 *Juniperus coahuilensis - Juniperus deppeana - Juniperus monosperma* / Shrub Understory Open Woodland Alliance: is similar in that it is a juniper woodland, but Madrean and warm desert floristic species overlap very little with southern Rocky Mountain and western Great Plains floristics.
- A3427 *Juniperus osteosperma - Juniperus scopulorum* / Grass Understory Central Rocky Mountain Woodland Alliance
- A2109 *Pinus monophylla - Juniperus osteosperma* / Herbaceous Understory Open Woodland Alliance
- A2108 *Pinus monophylla - Juniperus osteosperma* / Shrub Understory Woodland Alliance: is similar except overstory is characterized by *Pinus monophylla* with 5% or more cover.
- A3497 *Juniperus osteosperma* / Herbaceous Understory Open Woodland Alliance: is similar but understory lacks a shrub layer and is dominated by an herbaceous layer (>10% cover) or, if less, grass cover exceeds shrub cover.
- A3571 *Pinus edulis - Juniperus osteosperma* / Shrub Understory Foothill & Lower Montane Dry-Mesic Woodland Alliance: is similar except overstory is characterized by *Pinus* edulis with 5% or more cover.

Diagnostic Characteristics: Stands have an open to moderately dense tree canopy dominated by *Juniperus osteosperma* with *Juniperus scopulorum* present to dominant at higher elevations. Understory is characterized by dominant and diagnostic shrub species such as *Artemisia arbuscula, Artemisia bigelovii, Artemisia nova, Artemisia tridentata, Atriplex confertifolia, Atriplex confertifolia, Cercocarpus intricatus, Cercocarpus montanus, Chrysothamnus viscidiflorus, Coleogyne ramosissima, Ephedra nevadensis, Ephedra viridis, Ericameria teretifolia, Eriogonum fasciculatum, Fendlera rupicola, Fraxinus anomala, Grayia spinosa, Gutierrezia sarothrae, Mahonia fremontii, Purshia glandulosa, Purshia tridentata, Quercus gambelii, Rhus trilobata, Salvia dorrii, Symphoricarpos oreophilus, Tetradymia axillaris*, and *Yucca* spp.

VEGETATION

Physiognomy and Structure: These are sparsely to densely (5-80% cover) wooded communities dominated by scale-leaved evergreen trees of low stature (<15 m). Evergreen or cold-deciduous shrubs occupy the interstices between trees, interspersed with cespitose graminoids. In total, the shrub layer is usually open to moderate (10-50% cover), but may also be sparse (<10% cover) or when shrubs exceeds herbaceous cover.

Floristics: Stands have a short (<15 m tall), open to moderately dense tree canopy with an understory characterized by shrubs. Tree canopy is dominated by *Juniperus osteosperma* with *Juniperus scopulorum* becoming important and sometimes dominant at higher elevations and on relatively mesic sites such as along drainages. *Pinus* species, such as *Pinus monophylla, Pinus edulis, Pinus flexilis, Pinus ponderosa*, or *Pseudotsuga menziesii* are absent or accidental. Shrubs typically dominate the understory and form an open to moderately dense layer. Characteristic shrubs are many, including *Artemisia arbuscula, Artemisia bigelovii, Artemisia nova, Artemisia tridentata, Atriplex confertifolia, Atriplex confertifolia, Cercocarpus intricatus, Cercocarpus montanus, Chrysothamnus viscidiflorus, Coleogyne ramosissima, Ephedra nevadensis, Ephedra viridis, Ericameria teretifolia, Eriogonum fasciculatum, Fendlera rupicola, Fraxinus anomala, Grayia spinosa, Gutierrezia sarothrae, Mahonia fremontii, Purshia glandulosa, Purshia tridentata, Quercus gambelii, Rhus trilobata, Salvia dorrii, Symphoricarpos oreophilus, Tetradymia axillaris*, and *Yucca* spp. The herbaceous layer is typically sparse to low in terms of cover but high in species diversity. Common graminoids provide sparse to moderate cover and include *Achnatherum hymenoides, Aristida purpurea, Bouteloua gracilis, Bouteloua curtipendula, Bromus tectorum, Elymus elymoides, Hesperostipa comata, Hesperostipa neomexicana, Leymus salinus, Pleuraphis jamesii, Poa fendleriana, Poa secunda*, and *Pseudoroegneria spicata*. Associated forbs may include *Chamaesyce fendleri, Cryptantha* spp., *Eriogonum inflatum, Eriogonum alatum, Gayophytum racemosum, Hymenoxys richardsonii, Hymenopappus filifolius, Lepidium montanum, Linanthus pungens (= Leptodactylon pungens), Machaeranthera canescens, Mirabilis multiflora, Packera multilobata (= Senecio multilobatus), Phlox hoodii, Plantago patagonica, Stenotus acaulis (= Haplopappus acaulis)*, and *Tetraneuris acaulis (= Hymenoxys acaulis)*. The non-native, invasive annual grass *Bromus tectorum* may be abundant and dominate the herbaceous layer of highly disturbed stands. This alliance also includes sparse understory stands often with scattered shrubs and grasses. The lack of understory can be caused by harsh substrate (rockland, shale badland) or dense tree canopy resulting from lack of fire that shades out understory.

ENVIRONMENT & DYNAMICS

Environmental Description: This open to dense woodland alliance occurs in semi-arid canyons, foothills, plateaus and low mountains across the Intermountain West from the eastern Sierra Nevada to the central and southern Rocky Mountains. Climate is temperate with freezing temperatures during winter. Distribution of the alliance is often correlated with "thermal belts" which occur above the areas of cold-air drainage in high intermountain basins. Average annual precipitation is between 25 and 50 cm; however, seasonal distribution is variable across the range of the alliance. Stands occur on a variety of sites, including alluvial fans and stream terraces, colluvial slopes, benches, ledges, hills, ridges, mesas, and badlands. Sites range from level to steep terrain that may be oriented to any aspect, and most sites are on cooler north and east aspects at lower elevations and warmer/drier south and west aspects at higher elevations. Elevation of most stands ranges from 1220 to 2260 m (4000-7400 feet). Soils are often calcareous, shallow, poorly developed, rapidly to well-drained sands, sandy clays, or clay loams derived from shales, sandstones, or a mix of the two. Less frequently substrates are derived sandy loams from eolian sands. Parent materials are sandstones, shale, and Precambrian gneiss. The unvegetated ground surface often has a high percentage of rock, exposed bedrock or bare ground, but in undisturbed stands, the cover of cryptobiotic crusts may be high.

Dynamics: Within the distribution of *Pinus edulis*, this alliance typically occurs at lower elevation and on more xeric sites than *Pinus edulis* - (*Juniperus* spp.) woodlands. There is elevational overlap between this alliance and *Pinus monophylla* woodlands as this pinyon can occur on more xeric sites than *Pinus edulis*. *Juniperus osteosperma* also occurs on sites outside the ranges of *Pinus edulis* and *Pinus monophylla*. There has been significant expansion of this alliance over the last century into sagebrush-dominated shrublands. An altered fire regime (such as fire suppression, thus longer return intervals) is considered a primary cause of this expansion.

Fires in this alliance are thought to be infrequent because *Juniperus osteosperma* and many shrubs such as *Artemisia tridentata* are easily killed by burns and do not resprout (Barney and Frischknecht 1974, Everett 1986). In addition, many stands have an open canopy with insufficient understory to carry fire. Shrubs will often re-establish relatively quickly (about 10-20 years) if a seed source is nearby (Barney and Frischknecht 1974, Bunting 1987). However, *Juniperus osteosperma* is relatively slow to recover following fire, and shrubs such as sagebrush may dominate the sites for decades (Jameson et al. 1962). Fire, drought and competition with grasses are thought to have kept *Juniperus* spp. communities restricted to rocky areas that do not burn frequently (Wright et al. 1979).

DISTRIBUTION

Geographic Range: The core distribution of this juniper alliance is the Colorado Plateau, but it extends out into adjacent ecoregions primarily west into the Great Basin and north and east into the foothills of the central and southern Rocky Mountains. Stands have been observed on north-facing steep slopes along bluffs of the Snake River in southeastern Idaho.

Nations: US
States/Provinces: AZ, CA, CO, ID, MT, NM, NV, UT, WY
TNC Ecoregions [optional]: 11:C, 17:C
USFS Ecoregions (2007): 322Aj:CCC, 322Al:CCC, 341Ff:CCC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Mojave); USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** *Juniperus osteosperma* (Utah juniper woodland) Alliance (Sawyer et al. 2009) [89.300.00]
- **=** *Juniperus osteosperma* Woodland Alliance (Evens et al. 2014)

LOWER LEVEL UNITS

Associations:

- CEGL000735 *Juniperus osteosperma / Cercocarpus montanus* Woodland
- CEGL005754 *Juniperus osteosperma / Eriogonum fasciculatum - Yucca baccata* Woodland
- CEGL002967 *Juniperus scopulorum - Quercus gambelii* Woodland
- CEGL005616 *Juniperus osteosperma / Artemisia tridentata ssp. tridentata / Pseudoroegneria spicata* Woodland
- CEGL002964 *Juniperus osteosperma* Wooded Shrubland [Placeholder]
- CEGL000741 *Juniperus osteosperma / Symphoricarpos oreophilus* Woodland
- CEGL000733 *Juniperus osteosperma / Cercocarpus intricatus* Woodland
- CEGL000729 *Juniperus osteosperma / Artemisia nova* / Rock Woodland
- CEGL005598 *Juniperus (osteosperma, scopulorum) / Artemisia tridentata ssp. wyomingensis - Chamaebatiaria millefolium* Woodland
- CEGL005599 *Juniperus (scopulorum, osteosperma) / Ericameria nana* Wooded Grassland

- CEGL000728 *Juniperus osteosperma / Artemisia nova* Woodland
- CEGL000730 *Juniperus osteosperma / Artemisia tridentata* Woodland
- CEGL000737 *Juniperus osteosperma - Juniperus monosperma* / Sparse Understory Woodland
- CEGL000731 *Juniperus osteosperma / Artemisia tridentata / Achnatherum hymenoides* Woodland
- CEGL005617 *Juniperus osteosperma / Artemisia tridentata ssp. wyomingensis* Woodland
- CEGL005619 *Juniperus osteosperma / Purshia tridentata / Poa secunda* Woodland
- CEGL002909 *Juniperus osteosperma / Coleogyne ramosissima* Woodland
- CEGL000732 *Juniperus osteosperma* / Sparse Understory Woodland
- CEGL000727 *Juniperus osteosperma* Woodland
- CEGL002266 *Juniperus osteosperma* / Mixed Shrubs Talus Woodland
- CEGL002360 *Juniperus osteosperma / Artemisia tridentata ssp. tridentata* Woodland
- CEGL003965 *Juniperus osteosperma / Mahonia fremontii* Woodland
- CEGL003774 *Juniperus osteosperma - (Pinus edulis) / Coleogyne ramosissima - Purshia stansburiana - Quercus havardii var. tuckeri* Wooded Shrubland
- CEGL005600 *Juniperus osteosperma / Artemisia tridentata ssp. wyomingensis / Hesperostipa comata* Wooded Shrubland
- CEPP005694 *Juniperus osteosperma / Quercus havardii - Artemisia filifolia - Ephedra cutleri* Sandsheet Scrub
- CEPP005696 *Juniperus osteosperma / Quercus gambelii* Woodland
- CEPP006716 *Juniperus osteosperma / Gutierrezia microcephala* Woodland
- CEGL002757 *Juniperus osteosperma / Artemisia arbuscula* Woodland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by M. Jennings and M.S. Reid.
Version Date: 2016/09/29

REFERENCES

References: Evens et al. 2014, Faber-Langendoen et al. 2017b, Keeler-Wolf and Thomas 2000, Sawyer et al. 2009

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1. Forest & Woodland
1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub
1.B.2.Nc.1.b. M026 Intermountain Singleleaf Pinyon - Juniper Woodland

G248. Columbia Plateau Western Juniper Open Woodland

Type Concept Sentence: This woodland and savanna group is centered on the Columbia Plateau and extends from the eastern foothills of the Cascades and the Modoc Plateau across the northern margin of the Great Basin and is characterized by an open to closed canopy of *Juniperus occidentalis* that is sometime codominated by *Cercocarpus ledifolius* and typically has a shrubby understory dominated by *Artemisia tridentata*.

OVERVIEW

Scientific Name: *Juniperus occidentalis* Open Woodland Group
Common Name (Translated Scientific Name): Western Juniper Open Woodland Group
Colloquial Name: Western Juniper / Shrub Woodland

Type Concept: This woodland group is found on the Columbia Plateau and extends to the northern and western margins of the Great Basin, from southwestern Idaho, along the eastern foothills of the Cascades, south to the Modoc Plateau of northeastern California. *Juniperus occidentalis* is typically the only tree species with *Pinus monophylla* absent. *Pinus ponderosa* or *Pinus jeffreyi* may be present in higher elevation stands. The tree form of *Cercocarpus ledifolius* may occasionally codominate. In the understory, *Artemisia tridentata* is the most common shrub; others are *Cercocarpus ledifolius* (shrub form), *Chrysothamnus viscidiflorus, Ericameria nauseosa, Purshia tridentata, Ribes cereum*, and *Tetradymia* spp. Graminoids commonly include *Carex filifolia, Festuca idahoensis, Poa secunda*, and *Pseudoroegneria spicata*. This group occurs over a wide elevation range from under 200 m along the Columbia River in central Washington to over 1500 m in the Blue Mountains. In the middle of its distribution in central Oregon, stands occur on all aspects and slope positions. Older woodlands are generally found in rocky areas where fire frequency is low. Generally soils are medium-textured, with abundant coarse fragments, and derived from volcanic parent materials. Throughout much of its range, fire exclusion and removal of fine fuels by grazing livestock have reduced fire frequency and allowed *Juniperus occidentalis* seedlings to colonize adjacent alluvial soils and expand into the shrub-steppe and grasslands. *Juniperus occidentalis* savanna may occur on the drier edges of woodlands where trees are intermingling with or invading the surrounding grasslands and where local edaphic or climatic conditions favor grasslands over shrublands. Where this group grades into relatively mesic forest or grassland habitats, these woodlands become restricted to rock outcrops or escarpments with excessively drained soils.

Classification Comments: This woodland group includes two very different ecological types. There are old-growth *Juniperus occidentalis* woodlands with trees and stands often over 1000 years old, with large, fairly well-spaced trees with rounded crowns. There are also large areas where juniper has expanded into sagebrush steppe and bunchgrass-dominated areas, with young, pointed-crowned trees growing closely together. Currently, these two very different types are about equally distributed across the landscape, with *Juniperus occidentalis* continuing to expand, either from the combination of fire exclusion, past grazing or climate change. *Juniperus occidentalis* has also expanded into *Pinus ponderosa* and *Pinus ponderosa - Pinus contorta* stands in central Oregon. These two types correspond to the *Juniperus occidentalis*-dominated portion of the *persistent pinyon-juniper woodlands* (open to denser of tree canopy occurring on shallow rocky soils) and *wooded shrublands* (open tree canopy with well-developed shrub stratum and variable grass-forb cover) described by Romme et al. (2009).

Woodland stands dominated by *Juniperus grandis (= Juniperus occidentalis var. australis)* occur in the subalpine Sierra Nevada and forested uplands of the northern Coast Ranges of California, southward to San Bernardino, San Gabriel and various desert mountain ranges and westward into Nevada are included in Sierra-Cascade Cold-Dry Subalpine Woodland Group (G243).

Similar NVC Types:

- G243 Sierra-Cascade Cold-Dry Subalpine Woodland

Diagnostic Characteristics: *Juniperus occidentalis* is the diagnostic and typically dominant species of this woodland and savanna group. This juniper species is largely restricted to the Columbia Plateau ecoregion. *Cercocarpus ledifolius* may codominate some stands. *Pinus monophylla* is not present in this region. The understory of stands included in this group is variable and ranges from perennial grass-dominated tree savannas and open woodlands to open and moderately dense woodlands with a shrub-dominated understory to wooded shrublands with a sparse *Juniperus occidentalis* tree layer (5-10% cover).

VEGETATION

Physiognomy and Structure: This woodland and savanna group has an open to dense canopy that includes two very different tree canopy structures: (1) an old-growth *Juniperus occidentalis* woodland with large, fairly well-spaced trees with rounded crowns, and (2) relatively young, often dense junipers trees with pointed crowns. The structure of the understory ranges from perennial grass-dominated tree savannas and open woodlands to shrublands with a very open tree canopy (wooded shrublands) and open to moderately dense woodlands with a shrub-dominated understory. Cover of understory species sharply declines when tree canopy cover exceeds 40% (Young et al. 1982). Many of the tree savannas have a sparse shrub layer present.

Floristics: Stands have a typically open tree canopy that is dominated by *Juniperus occidentalis* trees, although *Pinus ponderosa* or *Pinus jeffreyi* may be present in some stands. *Pinus monophylla* is not present in this region. The tree form of *Cercocarpus ledifolius* may occasionally codominate. In the understory, *Artemisia tridentata* is the most common shrub; others are *Purshia tridentata, Ericameria nauseosa, Cercocarpus ledifolius* (shrub form), *Chrysothamnus viscidiflorus, Ribes cereum*, and *Tetradymia* spp. Graminoids commonly include *Carex filifolia, Festuca idahoensis, Poa secunda*, and *Pseudoroegneria spicata*.

ENVIRONMENT & DYNAMICS

Environmental Description: This woodland group is found on the Columbia Plateau and extends to the northern and western margins of the Great Basin. Elevations range from under 200 m along the Columbia River in central Washington to over 1500 m. In central Oregon, the center of distribution, all aspects and slope positions occur. Old-growth stands are largely restricted to rocky outcrops, upper slopes and ridges, and rims of mesa and canyon that are fire-safe. Younger seral stands have invaded adjacent shrublands and grasslands and now occur on lower slopes, valleys and plains. Soils are generally medium-textured, with abundant coarse fragments, and derived from volcanic parent materials. Where this group grades into relatively mesic forest or grassland habitats, these woodlands become restricted to dry sites such as rock outcrops or escarpments with excessively drained soils. *Soil/substrate/hydrology:* Soils are generally medium-textured, with abundant coarse fragments, and derived from volcanic parent materials. In central Oregon, the center of distribution, all aspects and slope positions occur. Where this group grades into relatively mesic forest or grassland habitats, these woodlands become restricted to dry sites such as rock outcrops or escarpments with excessively drained soils.

Dynamics: *Juniperus occidentalis* is a long-lived tree that can exceed 3000 years in age in rocky, fire-protected areas such as along rimrock (Waigchler et al. 2001, Thorne et al. 2007). These fire-sensitive trees do not sprout following fire and are typically killed by moderate to severe fires (Tirmenstein 1999h, Sawyer et al. 2009). Young junipers have thin bark and are readily killed by surface fires (Martin et al. 1978), whereas mature trees with thicker bark are described as "moderately resistant" (Fowells 1965). Reproductive age begins at about 20 years, peaks after 50 years and continues for many years (Miller and Rose 1995, Tirmenstein 1999h). Following stand-replacing fire, recovery time is relatively slow and depends on stand maturity, the size and season of burn, fire severity and juniper mortality, the persistence of the seeds in the seed bank, location of seed source, the presence of animal dispersers such as Clark's nutcrackers, competition from herbaceous species and shrubs, and the amount of post-fire precipitation

(Burkhardt and Tisdale 1976, Tirmenstein 1999h). Large burns and long distances from seed sources slow recovery rates because seed dispersal is dependent on water and animals (Tirmenstein 1999h).

DISTRIBUTION

Geographic Range: This woodland and savanna group is found along the northern and western margins of the Great Basin, from southwestern Idaho, along the eastern foothills of the Cascades, south to the Modoc Plateau of northeastern California. It also occurs in scattered localities of northern Nevada and south-central Washington.

Spatial Scale & Pattern [optional]: Large patch
Nations: US
States/Provinces: CA, ID, NV, OR, WA
TNC Ecoregions [optional]: 4:C, 6:C, 8:C
USFS Ecoregions (2007): 341G:CC, 342B:CC, 342C:CC, 342D:CP, 342H:CC, 342I:CC, 342J:CC, M242C:CC, M261A:C?, M261D:CC, M261E:CP, M261G:CC, M332G:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- = *Juniperus occidentalis* Zone (Franklin and Dyrness 1973)
- = Northern Juniper Woodlands (Holland and Keil 1995)
- = Western Juniper: 238 (Eyre 1980)

LOWER LEVEL UNITS

Alliances:
- A3500 *Juniperus occidentalis* / Herbaceous Understory Open Woodland Alliance
- A3499 *Juniperus occidentalis* / Shrub Understory Woodland Alliance

AUTHORSHIP

Primary Concept Source: J.F. Franklin and C.T. Dyrness (1973)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 11/09/2015
Classif Resp Region: West
Internal Author: KAS 1-10, 5-13, 11-15

REFERENCES

References: Barbour and Major 1988, Burkhardt and Tisdale 1976, Eyre 1980, Faber-Langendoen et al. 2017a, Fowells 1965, Franklin and Dyrness 1973, Holland and Keil 1995, Johnson and Clausnitzer 1992, Martin et al. 1978, Miller and Rose 1995, Romme et al. 2009, Sawyer et al. 2009, Shiflet 1994, Thorne et al. 2007, Tirmenstein 1999h, Volland 1976, Waigchler et al. 2001, Young et al. 1982

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1. Forest & Woodland
1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub
G248. Columbia Plateau Western Juniper Open Woodland

G247. Great Basin Pinyon - Juniper Woodland

Type Concept Sentence: This woodland group occurs on dry mountain ranges of the Great Basin region and eastern foothills of the Sierra Nevada and is characterized by an open to moderately dense tree canopy typically composed of a mix of *Pinus monophylla* and *Juniperus osteosperma*, but either tree species may dominate as long as there is significant presence of *Pinus monophylla* (not accidental) to characterize the stand as a pinyon-juniper stand and not the more xeric, typically lower-elevation *Juniperus osteosperma* woodland and savanna.

OVERVIEW

Scientific Name: *Pinus monophylla - Juniperus osteosperma* Woodland Group
Common Name (Translated Scientific Name): Singleleaf Pinyon - Utah Juniper Woodland Group
Colloquial Name: Great Basin Singleleaf Pinyon - Utah Juniper / Herb Open Woodland

Type Concept: This woodland group occurs on dry mountain ranges of the Great Basin region and eastern foothills of the Sierra Nevada, and south in scattered locations throughout southern California. The vegetation is characterized by an open to moderately dense tree canopy typically composed of a mix of *Pinus monophylla* and *Juniperus osteosperma*, but either tree species may

dominate as long as there is significant presence of *Pinus monophylla* (not accidental) to characterize the stand as a pinyon-juniper stand and not the more xeric, typically lower-elevation *Juniperus osteosperma* woodland and savanna. In some regions of southern California, *Juniperus osteosperma* is replaced by *Juniperus californica*. *Cercocarpus ledifolius* is a common associate and may occur in tree or shrub form. On the east slope of the Sierra Nevada in California, *Pinus jeffreyi* and *Juniperus grandis (= Juniperus occidentalis var. australis)* may be minor components of higher elevation stands in these woodlands. The understory layers are variable, but shrubs such as *Artemisia tridentata* frequently form a moderately dense short-shrub layer. Other associated shrubs include *Arctostaphylos patula, Artemisia arbuscula, Artemisia nova, Cercocarpus ledifolius, Cercocarpus intricatus, Coleogyne ramosissima, Juniperus californica, Quercus chrysolepis, Quercus gambelii, Quercus john-tuckeri, Quercus turbinella*, and *Yucca brevifolia*. Bunchgrasses such as *Bouteloua gracilis, Festuca idahoensis, Hesperostipa comata, Leymus cinereus (= Elymus cinereus), Poa fendleriana, Poa secunda*, and *Pseudoroegneria spicata* are commonly present and may form an herbaceous layer. These woodlands are typically found at lower elevations, but range from 1500-2600 m. Stands occur on warm, dry sites on mountain slopes, mesas, plateaus and ridges. Severe climatic events occurring during the growing season, such as frosts and drought, are thought to limit the distribution of pinyon-juniper woodlands to relatively narrow altitudinal belts on mountainsides. These woodlands occur at lower elevation than Colorado Plateau Pinyon - Juniper Woodland Group (G250) where sympatric.

Classification Comments: This group corresponds to the *Pinus monophylla*-dominated portion of the *persistent pinyon-juniper woodland* type from Romme et al. (2009) that occurs on rocky uplands with shallow, coarse-textured, and often skeletal soils that support relatively sparse herbaceous cover and rarely burn.

Similar NVC Types:
- G250 Colorado Plateau Pinyon - Juniper Woodland
- G246 Colorado Plateau-Great Basin Juniper Open Woodland

Diagnostic Characteristics: These woodlands are characterized by diagnostic tree species *Pinus monophylla* that forms an open to dense tree layer often with the wider ranging *Juniperus osteosperma* or, less frequently, *Juniperus californica* in southern California. *Juniperus osteosperma* also may dominate woodland stands within the range of *Pinus monophylla* as long as there is significant presence of *Pinus monophylla* (not accidental) to characterize the stand as a pinyon-juniper stand and not the more xeric, typically lower-elevation *Juniperus osteosperma* woodland and savanna. Understory diagnostic species are characteristic of the Great Basin, such as *Arctostaphylos patula, Artemisia nova, Artemisia tridentata, Cercocarpus intricatus, Cercocarpus ledifolius, Coleogyne ramosissima, Purshia stansburiana, Purshia tridentata, Pleuraphis jamesii, Pseudoroegneria spicata, Poa secunda*, or *Poa fendleriana*.

VEGETATION

Physiognomy and Structure: This vegetation group is characterized by an open to moderately dense, short (2-10 m tall) evergreen needle-leaved or scale-leaved tree canopy. Open to dense shrub and herbaceous layers may be present or absent. Herbaceous layers are usually sparse.

Floristics: These woodlands are characterized by an open to moderately dense tree canopy typically composed of a mix of *Pinus monophylla* and *Juniperus osteosperma*, but either tree species may dominate as long as there is significant presence of *Pinus monophylla* (not accidental) to characterize the stand as a pinyon-juniper stand and not the more xeric, typically lower-elevation *Juniperus osteosperma* woodland and savanna. In some regions of southern California, *Juniperus osteosperma* is replaced by *Juniperus californica*. *Cercocarpus ledifolius* is a common associate and may occur in tree or shrub form. On the east slope of the Sierra Nevada in California, *Pinus jeffreyi* and *Juniperus grandis (= Juniperus occidentalis var. australis)* may be minor components of these woodlands. Understory layers are variable, but shrubs such as *Artemisia tridentata* frequently form a moderately dense short-shrub layer. Other associated shrubs include *Amelanchier utahensis, Arctostaphylos patula, Arctostaphylos pungens, Artemisia arbuscula, Artemisia nova, Ceanothus greggii, Cercocarpus intricatus, Coleogyne ramosissima, Glossopetalon spinescens, Peraphyllum ramosissimum, Prunus virginiana, Purshia stansburiana, Purshia tridentata, Quercus chrysolepis, Quercus gambelii, Quercus john-tuckeri, Quercus turbinella, Shepherdia rotundifolia*, and *Yucca brevifolia*. Bunchgrasses such as *Bouteloua gracilis, Festuca idahoensis, Hesperostipa comata, Leymus cinereus (= Elymus cinereus), Poa fendleriana, Poa secunda*, and *Pseudoroegneria spicata* are commonly present and may form an herbaceous layer.

ENVIRONMENT & DYNAMICS

Environmental Description: This woodland group occurs on dry mountain ranges of the Great Basin region and eastern foothills of the Sierra Nevada, and south in scattered locations throughout southern California. It is typically found at lower elevations but ranges from 1500-2600 m. These woodlands occur on warm, dry sites on mountain slopes, mesas, plateaus and ridges. Substrates are variable but are often rocky with shallow soil. Severe climatic events occurring during the growing season, such as frosts and drought, are thought to limit the distribution of pinyon-juniper woodlands to relatively narrow altitudinal belts on mountainsides.

Dynamics: *Pinus monophylla, Juniperus osteosperma*, and *Juniperus scopulorum* are slow-growing, long-lived trees (about 650 years for *Juniperus osteosperma*, 300 years for *Juniperus scopulorum*, and 800 years for *Pinus monophylla* although older individuals are known) (Burns and Honkala 1990a, Zlatnik 1999e, Zouhar 2001b, Scher 2002, Sawyer et al. 2009). These trees are killed by severe fire because of thin bark and lack of self-pruning; however, mature trees can survive low-intensity fires (Zouhar 2001b, Sawyer et al. 2009). Although there is variation in fire frequency because of the diversity of site characteristics, stand-replacing fire was uncommon in this ecological system historically, with an average fire-return interval (FRI) of 100-1000 years occurring primarily during extreme fire behavior conditions and during long droughts (Zouhar 2001b) (Landfire 2007a, BpS model 1210190). Mixed-severity fire (average FRI of 100-500 years) was characterized as a mosaic of replacement and surface fires distributed through stands in patches at a fine scale (<0.1 acre) (LF BpS model 1210190).

DISTRIBUTION

Geographic Range: This woodland group occurs on dry mountain ranges of the Great Basin region and eastern foothills of the Sierra Nevada. It extends southwest in California to the northern Transverse Ranges (Ventura County) and San Jacinto Mountains (Riverside County). Stands do not occur in Mexico.

Spatial Scale & Pattern [optional]: Matrix
Nations: US
States/Provinces: CA, ID, NV, UT
TNC Ecoregions [optional]: 6:C, 11:C, 12:C, 18:C
USFS Ecoregions (2007): 313A:CC, 322A:CC, 322B:CC, 341A:CC, 341D:CC, 341E:CC, 341F:CC, 341G:CC, 342B:CC, 342C:CC, 342D:CC, 342J:CC, M242C:??, M261D:C?, M261E:CC, M261G:CC, M331D:CC, M341A:CC, M341C:CC, M341D:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- = PIMO Series (West et al. 1998)

LOWER LEVEL UNITS

Alliances:
- A2109 *Pinus monophylla - Juniperus osteosperma* / Herbaceous Understory Open Woodland Alliance
- A2108 *Pinus monophylla - Juniperus osteosperma* / Shrub Understory Woodland Alliance

AUTHORSHIP

Primary Concept Source: N.E. West, R.J. Tausch, and P.T. Tueller (1998)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 11/09/2015
Classif Resp Region: West
Internal Author: KAS 1-10, 5-13, 11-15

REFERENCES

References: Barbour and Major 1977, Brown 1982a, Brown et al. 1979, Burns and Honkala 1990a, Eyre 1980, Faber-Langendoen et al. 2017a, Holland and Keil 1995, Küchler 1964, Landfire 2007a, Romme et al. 2009, Sawyer et al. 2009, Scher 2002, Shiflet 1994, Thorne et al. 2007, West 1999a, West et al. 1998, Zlatnik 1999e, Zouhar 2001b

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1. Forest & Woodland
1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub
G247. Great Basin Pinyon - Juniper Woodland

G249. Intermountain Basins Curl-leaf Mountain-mahogany Woodland & Scrub

Type Concept Sentence: This *Cercocarpus ledifolius*-dominated woodland and shrubland group occurs in hills and mountain ranges of the intermountain western U.S. from the eastern foothills of the Sierra Nevada northeast to the foothills of the Bighorn Mountains and includes both tree and shrub forms of *Cercocarpus ledifolius* with *Artemisia tridentata ssp. vaseyana, Purshia tridentata*, and species of *Arctostaphylos, Ribes*, or *Symphoricarpos* often present to codominant in the shrub layer.

OVERVIEW

Scientific Name: *Cercocarpus ledifolius* Woodland & Scrub Group
Common Name (Translated Scientific Name): Curl-leaf Mountain-mahogany Woodland & Scrub Group
Colloquial Name: Curl-leaf Mountain-mahogany / Herb Woodland

Type Concept: This woodland and shrubland group includes stands dominated by either the tree or shrub form of *Cercocarpus ledifolius*. Scattered junipers or pines may also occur. *Artemisia tridentata ssp. vaseyana, Purshia tridentata*, along with species of *Arctostaphylos, Ribes*, or *Symphoricarpos* are often present to codominate in the shrub layer. Herbaceous undergrowth is often sparse and dominated by bunchgrasses, usually *Pseudoroegneria spicata* and *Festuca idahoensis*. Stands occur in hills and mountain ranges of the Intermountain West basins from the eastern foothills of the Sierra Nevada northeast to the foothills of the Bighorn Mountains. It typically occurs from 600 m to over 2650 m in elevation on rocky outcrops or escarpments and forms small- to large-patch stands in forested areas. Most stands occur as shrublands on ridges and steep rimrock slopes, but they may be composed of small trees in steppe areas. The tree form of *Cercocarpus ledifolius* is more common in the western range extent. *Cercocarpus ledifolius* is a slow-growing, drought-tolerant species that generally does not resprout after burning and needs the protection from fire that rocky sites provide.

Classification Comments: Within this group, the *Cercocarpus ledifolius* woodland and shrubland alliances are poorly distinguished in the literature, as most authors describe the species as having either a tall-shrub or small-tree growth form within a single association. Some associations may have shrub-dominated stands in one area and also have a woodland physiognomy in another. The woodland physiognomy appears to be more typical, based on available literature. Near the northern edge of its range in Montana and Idaho, *Cercocarpus ledifolius* is described as occurring primarily in the shrub form (Mueggler and Stewart 1980, Tisdale 1986). These northern variants are the only described stands which appear to be clearly distinct from the woodland alliance. The woodland alliance may have a different subspecies (or variety) as a dominant than the shrubland. Woodland stands tend to occur in the more western portion of the species range and are largely attributed to *Cercocarpus ledifolius var. intercedens (= Cercocarpus ledifolius var. intermontanus)*, whereas *Cercocarpus ledifolius var. ledifolius* is found in the eastern and northern portions of the range and typically occurs as a shrubland.

Similar NVC Types:

Diagnostic Characteristics: *Cercocarpus ledifolius* is the diagnostic and dominant species of this woodland and shrubland group. Scattered pinyon or juniper trees may be present with low cover in woodland stands. If pinyon and juniper trees are codominant, then the stand is pinyon-juniper woodland. In shrubland stands, other shrubs, especially *Artemisia tridentata ssp. vaseyana, Purshia tridentata*, or *Symphoricarpos* spp., may be present to codominant.

VEGETATION

Physiognomy and Structure: Structure in this group is variable as *Cercocarpus ledifolius* stands may form an open to dense short-tree canopy (3-5 m tall), a tall-shrub layer (3-4 m tall), or a short-shrub layer (1-2 m tall). Herbaceous layers are variable depending on density of woody canopy and type of substrate.

Floristics: This group includes both woodlands and shrublands dominated by *Cercocarpus ledifolius*. *Artemisia tridentata ssp. vaseyana, Purshia tridentata*, along with *Arctostaphylos patula, Holodiscus dumosus, Mahonia repens*, and species of *Ribes* or *Symphoricarpos* are often present. Undergrowth is often sparse and dominated by bunchgrasses, usually *Pseudoroegneria spicata* with *Calamagrostis rubescens, Festuca idahoensis, Leymus salinus*, or *Poa secunda*. Scattered junipers or pines may also occur.

ENVIRONMENT & DYNAMICS

Environmental Description: This woodland and shrubland group occurs in hills and mountain ranges of the Intermountain West basins from the eastern foothills of the Sierra Nevada northeast to the foothills of the Bighorn Mountains. It typically occurs from 600 m to over 2650 m in elevation on rocky outcrops or escarpments and forms small- to large-patch stands in forested areas. Most stands occur as shrublands on ridges and steep rimrock slopes, but they may be composed of small trees in steppe areas.

Dynamics: *Cercocarpus ledifolius* is a slow-growing, drought-tolerant species that can inhabit very poor sites, such as cliffs and outcrops. Stands are often small and clumped near ridgetops. These sites may also afford the species some protection from fire. The species is highly susceptible to fire damage and generally does not resprout. *Cercocarpus ledifolius* is highly favored by native ungulates for winter range, and many individual shrubs show evidence of highlining by deer or elk.

DISTRIBUTION

Geographic Range: This woodland and shrubland group occurs in hills and mountain ranges of the Intermountain West basins from the eastern foothills of the Sierra Nevada northeast to the foothills of the Bighorn Mountains.

Spatial Scale & Pattern [optional]: Large patch
Nations: US
States/Provinces: CA, CO, ID, MT, NV, OR, UT, WY
TNC Ecoregions [optional]: 6:P, 9:C, 10:P, 11:C, 12:C

USFS Ecoregions (2007): 313A:CC, 331A:CC, 331G:CC, 341A:CC, 341B:CP, 341D:CC, 341E:CC, 341F:CC, 341G:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342F:CP, 342G:CC, 342H:CC, 342I:CP, 342J:CC, M242C:CC, M261E:CC, M261G:CC, M331A:C?, M331B:CC, M331D:CC, M331E:CC, M331J:C?, M332A:CC, M332B:C?, M332D:C?, M332E:CC, M332F:CC, M332G:CC, M333D:PP, M341A:CC, M341B:CC, M341C:CC, M341D:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** Curlleaf Mountain-Mahogany (415) (Shiflet 1994)
- **>** Curlleaf Mountain-Mahogany - Bluebunch Wheatgrass (322) (Shiflet 1994)

LOWER LEVEL UNITS

Alliances:
- A3570 *Cercocarpus ledifolius* / Herbaceous Understory Woodland Alliance
- A0586 *Cercocarpus ledifolius* / Shrub Understory Woodland Alliance
- A0828 *Cercocarpus ledifolius* Scrub Alliance

AUTHORSHIP

Primary Concept Source: T.N. Shiflet (1994)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 11/09/2015
Classif Resp Region: West
Internal Author: KAS 1-10, 11-15

REFERENCES

References: Dealy 1975, Dealy 1978, Eyre 1980, Faber-Langendoen et al. 2017a, Holland and Keil 1995, Knight 1994, Knight et al. 1987, Lewis 1975b, Mueggler and Stewart 1980, Sawyer et al. 2009, Shiflet 1994

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1. Forest & Woodland
1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub
G249. Intermountain Basins Curl-leaf Mountain-mahogany Woodland & Scrub

A3570. Cercocarpus ledifolius / Herbaceous Understory Woodland Alliance

Type Concept Sentence: This woodland alliance is characterized by an open tree canopy of *Cercocarpus ledifolius* with the understory characterized by an open to moderate herbaceous layer typically dominated by bunchgrasses. It occurs in semi-arid steppe and temperate mountainous habitats of the interior western United States.

OVERVIEW

Scientific Name: *Cercocarpus ledifolius* / Herbaceous Understory Woodland Alliance
Common Name (Translated Scientific Name): Curl-leaf Mountain-mahogany / Herbaceous Understory Woodland Alliance
Colloquial Name: Curl-leaf Mountain-mahogany / Herb Woodland

Type Concept: The vegetation in this alliance is characterized by an open canopy of *Cercocarpus ledifolius*. Steppe woodlands typically have only *Cercocarpus ledifolius* in the overstory canopy, but *Juniperus occidentalis, Juniperus osteosperma, Juniperus scopulorum, Pinus edulis*, or *Pinus monophylla* occur in local areas. The understory is characterized by an open to moderate herbaceous layer typically dominated by bunchgrasses. Characteristic species include *Achnatherum* spp., *Calamagrostis rubescens, Elymus elymoides, Festuca idahoensis, Leymus ambiguus, Leymus salinus*, and *Pseudoroegneria spicata*. Diverse forbs may be present, usually with low cover. Scattered short shrubs may be present, but they do not form a layer (<10% cover) and have less total cover than the herbaceous layer. Plant associations in this alliance occur in semi-arid steppe and cool temperate mountainous habitats of the interior western United States. These woodlands often form small patchy stands in forested areas or may form the only tree cover in steppe regions. Elevation ranges from1730-2745 m (5675-9000 feet). Lower elevation stands in steppe regions have rolling topography, whereas mountain stands occur on moderate to very steep slopes and ridges. Aspect is variable depending on elevation. Annual precipitation is variable in amount (18-56 cm) and season depending on location with mostly snow in mountains and spring convective showers in steppe region. Soils are moderately shallow, rocky, well-drained gravelly loams over cracked bedrock or colluvium.

Classification Comments: The *Cercocarpus ledifolius* woodland and shrubland alliances are poorly distinguished in the literature, as most authors describe the species as having either a tall-shrub or small-tree growth form within a single association. Some

associations may have shrub-dominated stands in one area and also have a woodland physiognomy in another. The woodland physiognomy appears to be more typical, based on available literature. Near the northern edge of its range in Montana and Idaho, *Cercocarpus ledifolius* is described as occurring primarily in the shrub-form (Mueggler and Stewart 1980, Tisdale 1986). These northern variants are the only described stands which appear to be clearly distinct from the woodland alliance.

The woodland stands may have a different subspecies (or variety) as a dominant than the shrubland. In Wyoming, the heritage program is proposing to recognize two *Cercocarpus ledifolius* alliances, based upon varieties of *Cercocarpus ledifolius*. The most widespread proposed alliance there is dominated by *Cercocarpus ledifolius var. ledifolius*, which grows up to about 1.5 m tall. The other proposed alliance, dominated by *Cercocarpus ledifolius var. intercedens*, is found only along the western border of the state, and the growth form is as small trees 4-5 m tall. The two taxa are obviously different in Wyoming, in stature and leaf characteristics, and are easily separated. Further review of the two current *Cercocarpus ledifolius* alliances may warrant treatment as proposed for Wyoming.

Internal Comments:
Other Comments:

Similar NVC Types: This alliance has similarities to several montane conifer woodland alliances that have *Cercocarpus ledifolius* codominant in the subcanopy in several other groups, such as G209, G213, G215, G224, G226, G243, and G344.

- A0828 *Cercocarpus ledifolius* Scrub Alliance: is similar except overstory is composed of shrub-form rather than tree-form *Cercocarpus ledifolius*.
- A0586 *Cercocarpus ledifolius* / Shrub Understory Woodland Alliance: is similar but understory has a shrub layer (>10% cover) or, if less, shrub cover exceeds herbaceous cover.

Diagnostic Characteristics: The vegetation in this woodland alliance is characterized by an open tree canopy dominated by *Cercocarpus ledifolius*, sometimes with low cover of *Juniperus occidentalis, Juniperus osteosperma, Juniperus scopulorum, Pinus edulis*, or *Pinus monophylla*. The understory is characterized by an open to dense herbaceous layer. Diagnostic species include *Achnatherum* spp., *Calamagrostis rubescens, Elymus elymoides, Festuca idahoensis, Leymus ambiguus, Leymus salinus*, and *Pseudoroegneria spicata*. If shrubs are present, then cover is low (<10%) and the herbaceous layer significantly exceeds shrub cover forming a layer.

VEGETATION

Physiognomy and Structure: Plant associations in this alliance are woodlands dominated by a spreading broad-leaved evergreen small tree (5-15 m tall) of open cover (10-30%). Scattered evergreen or cold-deciduous shrubs may be present with low cover (<10%). A ground layer of cespitose or rhizomatous perennial graminoids is present and characterizes the understory.

Floristics: The vegetation in this alliance is characterized by an open canopy of *Cercocarpus ledifolius*. Steppe woodlands typically have only *Cercocarpus ledifolius* in the overstory canopy, but *Juniperus occidentalis, Juniperus osteosperma, Juniperus scopulorum, Pinus edulis*, or *Pinus monophylla* occur in local areas. The understory is characterized by an open to moderate herbaceous layer typically dominated by bunchgrasses. Characteristic species include *Achnatherum* spp., *Calamagrostis rubescens, Elymus elymoides, Festuca idahoensis, Leymus ambiguus, Leymus salinus*, and *Pseudoroegneria spicata*. Diverse forbs may be present, usually with low cover, and include such perennials as *Geum triflorum, Hieracium cynoglossoides, Senecio integerrimus*, and *Viola nuttallii*; the annual *Agoseris heterophylla* is often present. Other abundant and constant species include *Achnatherum lemmonii, Hesperostipa comata, Poa fendleriana*, and *Poa secunda*, and the perennial sedge *Carex rossii*. Scattered short shrubs may be present, including *Amelanchier alnifolia, Artemisia tridentata ssp. vaseyana, Ericameria nauseosa (= Chrysothamnus nauseosus), Holodiscus dumosus, Purshia tridentata, Prunus virginiana*, Ribes spp., and *Symphoricarpos* spp., but they do not form a layer (<10% cover) and have less total cover than the herbaceous layer.

ENVIRONMENT & DYNAMICS

Environmental Description: Plant associations in this woodland alliance occur in semi-arid steppe and foothills, and cool temperate mountainous habitats of the interior western United States. These woodlands often form small patchy stands in forested areas or may form the only tree cover in steppe regions. Elevations range from 1730 m to over 2745 m (5675-9000 feet). Climate ranges from semi-arid at lower elevations in southern Idaho to cool temperate in mountains of Montana. Precipitation is variable in amount and season depending on locations, with annual precipitation ranging from 18-56 cm with much of the precipitation falling during the winter months as snow in mountains or as convective showers in May and June in steppe and foothills. Lower elevation sites in steppe regions have rolling topography with low relief. Stands found in foothills and mountains occur on moderate to very steep slopes and ridges. Aspect is variable depending on elevation, with cooler east to north slopes more typical of lower elevation sites. Soils are moderately shallow (30-48 cm deep), rocky, well-drained gravelly loams over cracked bedrock or colluvium. Stones make up 30-60% of the soil volume. *Cercocarpus* roots extend into cracks within the bedrock. Parent materials include andesite, granite, rhyolite, tuffs and metamorphic (schist).

Dynamics: *Cercocarpus ledifolius* is a slow-growing, drought-tolerant species that can inhabit very poor sites, such as cliffs and outcrops. Stands are often small and clumped near ridgetops. These sites may also afford the species some protection from fire. The species is highly susceptible to fire damage and generally does not resprout. *Cercocarpus ledifolius* is highly favored by native ungulates for winter range, and many individual shrubs show evidence of highlining by deer or elk.

DISTRIBUTION

Geographic Range: This alliance occurs in the Great Basin extending west into the foothills of the Sierra Nevada and north into the Columbia Plateau, from northeastern California north across Nevada, into southeastern Oregon, southern Idaho, western Utah and western Montana.

Nations: US
States/Provinces: CA, ID, MT, NV, OR, UT
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** *Cercocarpus ledifolius* (Curl leaf mountain mahogany scrub) Alliance (Sawyer et al. 2009) [76.200.00]

LOWER LEVEL UNITS

Associations:
- CEGL000961 *Cercocarpus ledifolius / Calamagrostis rubescens* Woodland
- CEGL000962 *Cercocarpus ledifolius / Festuca idahoensis* Woodland
- CEGL000964 *Cercocarpus ledifolius / Leymus salinus ssp. salmonis* Woodland
- CEGL000968 *Cercocarpus ledifolius / Pseudoroegneria spicata - Festuca idahoensis* Woodland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by M.S. Reid and D. Sarr.
Version Date: 2014/03/14

REFERENCES

References: Beatley 1976, Blackburn et al. 1969d, Cooper et al. 1995, DeVelice 1992, Dealy 1975, Faber-Langendoen et al. 2017b, Gruell et al. 1985, Hall 1973, Heinze et al. 1962, Moseley 1987b, Mozingo 1987, Mueggler and Stewart 1980, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Tisdale 1986

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1. Forest & Woodland
1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub
G249. Intermountain Basins Curl-leaf Mountain-mahogany Woodland & Scrub

A0586. Cercocarpus ledifolius / Shrub Understory Woodland Alliance

Type Concept Sentence: This woodland is characterized by an open to moderately dense tree canopy of *Cercocarpus ledifolius* with the understory characterized by an open to moderate shrub layer (>10% cover) or, if less, then shrub cover exceeds herbaceous cover. It occurs in semi-arid steppe and temperate mountainous habitats of the interior western United States.

OVERVIEW

Scientific Name: *Cercocarpus ledifolius* / Shrub Understory Woodland Alliance
Common Name (Translated Scientific Name): Curl-leaf Mountain-mahogany / Shrub Understory Woodland Alliance
Colloquial Name: Curl-leaf Mountain-mahogany / Shrub Woodland

Type Concept: The vegetation in this alliance is characterized by an open to moderately dense canopy of *Cercocarpus ledifolius*. These woodlands may occur as scattered communities in arid steppe or on rocky outcrops or steep escarpments within forests. Steppe woodlands typically have only *Cercocarpus ledifolius* in the overstory canopy, but *Juniperus occidentalis, Juniperus osteosperma, Juniperus scopulorum, Pinus edulis*, or *Pinus monophylla* occur locally. The understory is characterized by an open to dense short-shrub layer. Shrub cover is over 10% or, if less, exceeds herbaceous cover. Characteristic shrub species include *Amelanchier alnifolia, Arctostaphylos patula, Artemisia tridentata, Ericameria nauseosa (= Chrysothamnus nauseosus), Holodiscus dumosus, Prunus virginiana, Purshia tridentata, Quercus gambelii, Ribes* spp., *Symphoricarpos oreophilus*, and *Symphoricarpos*

rotundifolius. Stands with sparse understories are included in this alliance because these stands usually have similar scattered shrubs present. A sparse to moderately dense herbaceous layer may be present and is typically dominated by bunchgrasses, including *Achnatherum* spp., *Calamagrostis rubescens, Elymus elymoides, Festuca idahoensis, Leymus ambiguus*, and *Pseudoroegneria spicata*. Diverse forbs may be present but usually with low cover. Plant associations in this alliance occur in semi-arid steppe and cool temperate mountainous habitats of the interior western United States. These woodlands often form small patchy stands on rocky outcrops or escarpments in forested areas, or may form the only tree cover in steppe regions. Elevations range from 1600 to 2835 m (5250-9300 feet). Annual precipitation averages 25-45 cm, with a significant proportion falling as winter snow. Soils are typically rocky and immature, and of coarser texture than soils of adjacent coniferous woodlands or forests.

Classification Comments: The *Cercocarpus ledifolius* woodland and shrubland alliances are poorly distinguished in the literature, as most authors describe the species as having either a tall-shrub or small-tree growth form within a single association. Some associations may have shrub-dominated stands in one area and also have a woodland physiognomy in another. The woodland physiognomy appears to be more typical, based on available literature. Near the northern edge of its range in Montana and Idaho, *Cercocarpus ledifolius* is described as occurring primarily in the shrub-form (Mueggler and Stewart 1980, Tisdale 1986). These northern variants are the only described stands which appear to be clearly distinct from the woodland alliance.

The woodland stands may have a different subspecies (or variety) as a dominant than the shrubland. In Wyoming, the heritage program is proposing to recognize two *Cercocarpus ledifolius* alliances, based upon varieties of *Cercocarpus ledifolius*. The most widespread proposed alliance there is dominated by *Cercocarpus ledifolius var. ledifolius*, which grows up to about 1.5 m tall. The other proposed alliance, dominated by *Cercocarpus ledifolius var. intercedens*, is found only along the western border of the state, and the growth form is as small trees 4-5 m tall. The two taxa are obviously different in Wyoming, in stature and leaf characteristics, and are easily separated. Further review of the two current *Cercocarpus ledifolius* alliances may warrant treatment as proposed for Wyoming.

Internal Comments:
Other Comments:

Similar NVC Types: This alliance has similarities to several montane conifer woodland alliances have *Cercocarpus ledifolius* codominant in subcanopy in several other groups, such as G209, G213, G215, G224, G226, G243, and G344.

- A0828 *Cercocarpus ledifolius* Scrub Alliance: is similar except overstory is composed of shrub-form rather than tree-form *Cercocarpus ledifolius*.
- A3570 *Cercocarpus ledifolius* / Herbaceous Understory Woodland Alliance: is similar but understory lacks a shrub layer and is dominated by an herbaceous layer (>10% cover) or, if less, grass cover exceeds shrub cover.

Diagnostic Characteristics: The vegetation in this woodland alliance is characterized by a tree canopy dominated by *Cercocarpus ledifolius*, sometimes with low cover of *Juniperus occidentalis, Juniperus osteosperma, Juniperus scopulorum, Pinus edulis*, or *Pinus monophylla*. The understory is characterized by an open to dense shrub layer dominated by species such as *Amelanchier alnifolia, Arctostaphylos patula, Artemisia tridentata, Ericameria nauseosa, Holodiscus dumosus, Quercus gambelii, Prunus virginiana, Purshia tridentata, Ribes* spp., *Symphoricarpos oreophilus*, or *Symphoricarpos rotundifolius*. An herbaceous layer may be present and is typically dominated by bunchgrasses sometimes with low cover of diverse forbs. If shrub cover is low (<10%), then it exceeds herbaceous cover.

VEGETATION

Physiognomy and Structure: Plant associations in this alliance are woodlands dominated by a spreading broad-leaved evergreen small tree (5-15 m tall) with open to moderate cover (10-60%). Smaller evergreen or cold-deciduous shrubs may be present and are typically of low to medium cover. A ground layer of cespitose or rhizomatous graminoids is usually present, but cover is highly variable.

Floristics: The vegetation in this alliance is characterized by an open to moderately dense canopy of *Cercocarpus ledifolius*. Steppe woodlands typically have only *Cercocarpus ledifolius* in the overstory canopy, but *Juniperus occidentalis, Juniperus osteosperma, Juniperus scopulorum, Pinus edulis*, or *Pinus monophylla* occur locally. Montane stands may have scattered emergent conifer trees present, including *Pinus jeffreyi, Pinus ponderosa*, and *Pseudotsuga menziesii*. The understory is characterized by an open to dense short-shrub layer. Shrub cover is over 10% or, if less, exceeds herbaceous cover. Characteristic shrub species include *Amelanchier alnifolia, Arctostaphylos patula, Artemisia tridentata, Ericameria nauseosa (= Chrysothamnus nauseosus), Holodiscus dumosus, Prunus virginiana, Purshia tridentata, Quercus gambelii, Ribes* spp., *Symphoricarpos oreophilus, Symphoricarpos rotundifolius*, and *Tetradymia canescens*. Stands with sparse understories are included in this alliance because these stands usually have similar scattered shrubs present. A sparse to moderately dense herbaceous layer may be present and is typically dominated by bunchgrasses, including *Achnatherum* spp., *Calamagrostis rubescens, Elymus elymoides, Festuca idahoensis, Leymus ambiguus*, and *Pseudoroegneria spicata*. Diverse forbs may be present but usually with low cover. Common forbs include *Arenaria* spp.,

Balsamorhiza sagittata, Chaetopappa ericoides, Comandra umbellata, Hackelia patens, Lappula occidentalis, Packera multilobata (= Senecio multilobatus), and *Senecio integerrimus*.

ENVIRONMENT & DYNAMICS

Environmental Description: Plant associations in this woodland alliance occur in semi-arid steppe and foothills, and cool temperate mountainous habitats of the interior western United States. These woodlands often form small patchy stands in arid steppe or on rocky outcrops or steep escarpments in forested areas or may form the only tree cover in steppe regions. Elevations range from 1600 to 2835 m (5250-9300 feet). Climate ranges from semi-arid at lower elevations in the Colorado Plateau, Columbia Plateau, and Owyhee Uplands to cool temperate in foothills and mountains of the western Sierra Nevada, northern Great Basin, and western slope of the Rocky Mountains. Precipitation is variable in amount and season depending on locations, with annual precipitation ranging from 25-45 cm with much of the precipitation falling during the winter months as snow in mountains or as convective showers in May and June in steppe and foothills. Lower elevation sites in steppe regions have rolling topography with low relief. Stands found in foothills and mountains occur on moderate to very steep slopes and ridges. Aspect is variable depending on elevation with cooler east to north slopes more typical of lower elevation sites. Soils are mostly shallow, rocky, well-drained sandy or gravelly loams derived from colluvium, bedrock, or less frequently alluvium. Parent materials are variable and include andesite, basalt, granite, rhyolite, tuff and metamorphic (schist) rocks, and sandstones. Stones make up 30-60% of the soil volume. *Cercocarpus* roots extend into cracks within the bedrock.

Dynamics: *Cercocarpus ledifolius* is a slow-growing, drought-tolerant species that can inhabit very poor sites, such as cliffs and outcrops. Stands are often small and clumped near ridgetops. These sites may also afford the species some protection from fire. The species is highly susceptible to fire damage and generally does not resprout. *Cercocarpus ledifolius* is highly favored by native ungulates for winter range, and many individual shrubs show evidence of highlining by deer or elk.

DISTRIBUTION

Geographic Range: This alliance occurs in the Great Basin extending west into the foothills of the Sierra Nevada and north into the Columbia Plateau, from northeastern California north across Nevada, into southeastern Oregon, southern Idaho, western Utah and southwestern Montana.

Nations: US
States/Provinces: CA, CO?, ID, MT, NV, OR, UT, WY?
TNC Ecoregions [optional]: 4:C, 6:C, 8:C, 9:C, 11:C, 12:C, 17:C, 18:C, 19:C
USFS Ecoregions (2007): 341Fb:CCC, 341Ff:CCC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Bryce Canyon, Capitol Reef, Cedar Breaks, Death Valley, Dinosaur, Grand Canyon, Great Basin, John Day Fossil Beds, Yosemite)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **><** *Cercocarpus ledifolius* (Curl leaf mountain mahogany scrub) Alliance (Sawyer et al. 2009) [76.200.00]
- **=** *Cercocarpus ledifolius* Shrubland Alliance (Evens et al. 2014)

LOWER LEVEL UNITS

Associations:

- CEGL000960 *Cercocarpus ledifolius / Artemisia tridentata* Woodland
- CEGL001022 *Cercocarpus ledifolius / Artemisia tridentata ssp. vaseyana* Woodland
- CEGL000963 *Cercocarpus ledifolius / Holodiscus dumosus* Woodland
- CEGL005359 *Cercocarpus ledifolius / Quercus gambelii* Woodland
- CEGL008637 *Cercocarpus ledifolius / Symphoricarpos rotundifolius* Woodland
- CEGL005355 *Cercocarpus ledifolius / Arctostaphylos patula* Woodland
- CEGL000970 *Cercocarpus ledifolius / Symphoricarpos oreophilus* Woodland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by M.S. Reid and D. Sarr.
Version Date: 2014/03/14

REFERENCES

References: Blackburn et al. 1969d, Cooper et al. 1995, DeVelice 1992, Dealy 1975, Evens et al. 2014, Faber-Langendoen et al. 2017b, Gruell et al. 1985, Hall 1973, Keeler-Wolf and Thomas 2000, Moseley 1987b, Mozingo 1987, Mueggler and Stewart 1980, Reid et al. 1999, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Tisdale 1986, VegCAMP and AIS 2013

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1. Forest & Woodland
1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub
G249. Intermountain Basins Curl-leaf Mountain-mahogany Woodland & Scrub

A0828. Cercocarpus ledifolius Scrub Alliance

Type Concept Sentence: This shrubland is characterized by an open to moderately dense shrub layer dominated or codominated by *Cercocarpus ledifolius* with a sparse to moderately dense herbaceous layer. It occurs in semi-arid, mountainous habitats of the interior western United States.

OVERVIEW

Scientific Name: *Cercocarpus ledifolius* Scrub Alliance
Common Name (Translated Scientific Name): Curl-leaf Mountain-mahogany Scrub Alliance
Colloquial Name: Curl-leaf Mountain-mahogany Scrub

Type Concept: The vegetation in this alliance is characterized by an open shrub canopy of *Cercocarpus ledifolius*. The vegetation may occur as scattered small- and large-patch communities in arid steppe or on rocky outcrops or steep escarpments within forests. Other shrubs often occur in the stands and include *Amelanchier alnifolia, Artemisia arbuscula, Artemisia frigida, Artemisia nova, Artemisia tridentata, Ericameria nauseosa (= Chrysothamnus nauseosus), Mahonia repens, Prunus virginiana, Ribes* spp., and *Symphoricarpos* spp. The herbaceous layer is usually composed of xeric graminoids, including *Achnatherum hymenoides (= Oryzopsis hymenoides), Achnatherum occidentale (= Stipa occidentalis), Calamagrostis rubescens, Elymus glaucus, Festuca idahoensis, Hesperostipa comata, Koeleria macrantha, Poa fendleriana, Poa secunda*, and *Pseudoroegneria spicata*. Diverse forbs may be present, usually with low cover. Outcrop communities usually include many of the species above, but may also include occasional forest trees, such as *Juniperus occidentalis, Juniperus osteosperma, Juniperus scopulorum, Pinus flexilis, Pinus jeffreyi, Pinus ponderosa*, or *Pseudotsuga menziesii*. The plant associations in this alliance occur in semi-arid, mountainous habitats of the interior western United States. These shrublands are often located on rocky outcrops or escarpments in forested areas. Most stands occur on steep rimrock slopes, usually in areas of shallow soils or protected slopes. Soils are typically rocky and immature, and are always rockier than found in surrounding sites. In Wyoming, stands of this alliance primarily grow on carbonate sediments (limestone or dolomite) or on sandstones rich in calcium carbonate. Other rock types include quartz, gneiss, and basalt.

Classification Comments: The *Cercocarpus ledifolius* woodland and shrubland alliances are poorly distinguished in the literature, as most authors describe the species as having either a tall-shrub or small-tree growth form within a single association. Some associations may have shrub-dominated stands in one area and also have a woodland physiognomy in another. The woodland physiognomy appears to be more typical, based on available literature. Near the northern edge of its range in Montana and Idaho, *Cercocarpus ledifolius* is described as occurring primarily in the shrub-form (Mueggler and Stewart 1980, Tisdale 1986). These northern variants are the only described stands which appear to be clearly distinct from the woodland alliance. The woodland alliance may have a different subspecies (or variety) as a dominant than the shrubland. In Wyoming, the heritage program is proposing to recognize two *Cercocarpus ledifolius* alliances, based upon varieties of *Cercocarpus ledifolius*. The most widespread proposed alliance there is dominated by *Cercocarpus ledifolius var. ledifolius*, which grows up to ca. 1.5 m tall. The other proposed alliance, dominated by *Cercocarpus ledifolius var. intercedens*, is found only along the western border of the state, and the growth form is small trees 4-5 m tall. The two taxa are obviously different in Wyoming, in stature and leaf characteristics, and are easily separated. Further review of the two current *Cercocarpus ledifolius* alliances may warrant treatment as proposed for Wyoming.

Internal Comments:
Other Comments:

Similar NVC Types: This alliance has similarities to several montane conifer woodland alliances have *Cercocarpus ledifolius* codominant in subcanopy in several other groups, such as G209, G213, G215, G224, G226, G243, and G344.

- A0586 *Cercocarpus ledifolius* / Shrub Understory Woodland Alliance: is similar except overstory is composed of tree-form rather than shrub-form *Cercocarpus ledifolius* and has a short-shrub layer.
- A3570 *Cercocarpus ledifolius* / Herbaceous Understory Woodland Alliance: is similar except overstory is composed of tree-form rather than shrub-form *Cercocarpus ledifolius* and has an herbaceous layer.

Diagnostic Characteristics: This alliance is composed of shrub-form *Cercocarpus ledifolius* dominating or codominating the shrub layer with other shrubs and dwarf-shrubs such as *Amelanchier alnifolia, Artemisia arbuscula, Artemisia frigida, Artemisia nova,*

Artemisia tridentata, Ericameria nauseosa, Mahonia repens, Prunus virginiana, Ribes spp., and *Symphoricarpos* spp. An open to moderately dense herbaceous layer is usually present and composed of xeric graminoids, including *Achnatherum hymenoides, Achnatherum occidentale, Calamagrostis rubescens, Elymus glaucus, Festuca idahoensis, Hesperostipa comata, Koeleria macrantha, Poa secunda*, and *Pseudoroegneria spicata*.

VEGETATION

Physiognomy and Structure: The vegetation in this alliance is dominated by a spreading broad-leaved evergreen shrub layer of open to moderate cover. If present, the herbaceous layer is composed of open to moderate cover of perennial bunch grasses.

Floristics: The vegetation in this alliance is characterized by an open shrub canopy of *Cercocarpus ledifolius*. The vegetation may occur as scattered small- and large-patch communities in arid steppe or on rocky outcrops or steep escarpments within forests. Other shrubs often occur in the stands and include *Amelanchier alnifolia, Artemisia arbuscula, Artemisia frigida, Artemisia nova, Artemisia tridentata, Ericameria nauseosa (= Chrysothamnus nauseosus), Mahonia repens, Prunus virginiana, Ribes* spp., and *Symphoricarpos* spp. The herbaceous layer is usually composed of xeric graminoids, including *Achnatherum hymenoides (= Oryzopsis hymenoides), Achnatherum occidentale (= Stipa occidentalis), Calamagrostis rubescens, Elymus glaucus, Festuca idahoensis, Hesperostipa comata, Koeleria macrantha, Poa fendleriana, Poa secunda*, and *Pseudoroegneria spicata*. Diverse forbs may be present, usually with low cover. Outcrop communities usually include many of the species above, but may also include occasional forest trees, such as *Juniperus occidentalis, Juniperus osteosperma, Juniperus scopulorum, Pinus flexilis, Pinus jeffreyi, Pinus ponderosa*, or *Pseudotsuga menziesii*. These shrublands are often located on rocky outcrops or escarpments in forested areas.

ENVIRONMENT & DYNAMICS

Environmental Description: The plant associations in this alliance occur in semi-arid, mountainous habitats of the interior west. Annual precipitation averages 25-45 cm, with a significant proportion falling as winter snow. These shrublands are often located on rocky outcrops or escarpments in forested areas. Most stands occur on steep rimrock slopes, usually in areas of shallow soils or protected slopes. In Wyoming, stands of this alliance primarily grow on carbonate sediments (limestone or dolomite) or on sandstones rich in calcium carbonate. Other rock types include quartz, gneiss, and basalt. Soils are typically rocky and immature, and are always rockier than found in surrounding sites. Adjacent vegetation is usually *Pinus ponderosa* or *Pseudotsuga menziesii* forests or woodlands, pinyon and/or juniper woodlands, or *Artemisia* shrubland.

Dynamics: *Cercocarpus ledifolius* is a slow-growing, drought-tolerant species which can inhabit very poor sites, such as cliffs, stony slopes, and outcrops. Stands are often small and clumped near ridgetops. These sites may also afford the species some protection from fire. The species is highly susceptible to fire damage and generally does not resprout. *Cercocarpus ledifolius* is highly favored by native ungulates for winter range and many individual shrubs show evidence of highlining by deer and elk.

DISTRIBUTION

Geographic Range: This alliance occurs in mountain ranges throughout the Great Basin and into the northern Mojave Desert, from eastern California and Oregon to Colorado and north to Wyoming and western Montana.

Nations: US
States/Provinces: CA, CO, MT, NM, NV, OR, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** *Cercocarpus ledifolius* (Curl leaf mountain mahogany scrub) Alliance (Sawyer et al. 2009) [76.200.00]
- **=** *Cercocarpus ledifolius* Shrubland Alliance (Bourgeron and Engelking 1994)
- **><** Curlleaf Mountain-Mahogany Series (Sawyer and Keeler-Wolf 1995)

LOWER LEVEL UNITS

Associations:

- CEGL000967 *Cercocarpus ledifolius / Pseudoroegneria spicata* Scrub
- CEGL005589 *Cercocarpus ledifolius - Purshia tridentata / Poa secunda* Scrub
- CEGL000965 *Cercocarpus ledifolius / Mahonia repens* Scrub
- CEGL001487 *Artemisia arbuscula - Cercocarpus ledifolius / Pseudoroegneria spicata - Poa secunda* Scrub
- CEGL000969 *Cercocarpus ledifolius / Symphoricarpos longiflorus* Scrub
- CEGL000966 *Cercocarpus ledifolius / Prunus virginiana* Scrub

AUTHORSHIP

Primary Concept Source: P.S. Bourgeron and L.D. Engelking (1994)
Author of Description: K.A. Schulz and D. Sarr
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Baker 1983c, Baker and Kennedy 1985, Bourgeron and Engelking 1994, Cooper et al. 1995, Dealy 1975, Faber-Langendoen et al. 2017b, Heinze et al. 1962, Johnson and Simon 1985, Knight et al. 1987, Lewis 1975a, Miller 1964, Mueggler and Stewart 1980, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Schlatterer 1972, Tisdale 1986

M027. Southern Rocky Mountain-Colorado Plateau Two-needle Pinyon - Juniper Woodland

This southern Rocky Mountain and Colorado Plateau pinyon and juniper savanna and woodland macrogroup is characterized by an open to closed evergreen, conifer tree canopy composed of diagnostic species *Juniperus monosperma* and/or *Pinus edulis* with an understory dominated by shrubs or grasses that lacks Madrean understory species. It occurs in dry mountains and foothills in southern Colorado south into northern and central New Mexico, and extends west across the Colorado Plateau and east to the plains on breaks in the southwestern Great Plains.

1. Forest & Woodland
1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub
1.B.2.Nc.2.a. M027 Southern Rocky Mountain-Colorado Plateau Two-needle Pinyon - Juniper Woodland

G250. Colorado Plateau Pinyon - Juniper Woodland

Type Concept Sentence: This woodland group is centered in the Colorado Plateau region and is composed of *Pinus edulis* often with *Juniperus osteosperma* or *Juniperus scopulorum* codominant in the tree canopy and a variable understory.

OVERVIEW

Scientific Name: *Pinus edulis - Juniperus osteosperma* Woodland Group
Common Name (Translated Scientific Name): Two-needle Pinyon - Utah Juniper Woodland Group
Colloquial Name: Two-needle Pinyon - Utah Juniper / Herb Open Woodland

Type Concept: This woodland group occurs in dry mountains and foothills of the Colorado Plateau region, including the Western Slope of Colorado and the Wasatch Range, south to the Mogollon Rim, and east into the northwestern corner of New Mexico. These woodlands are typically composed of a mix of *Pinus edulis* and *Juniperus osteosperma* in the tree canopy. Either tree may dominate as long as there is significant presence of *Pinus edulis* (not accidental) to characterize the stand as a pinyon-juniper stand and not the typically more xeric lower-elevation *Juniperus osteosperma* woodland and savanna. *Juniperus scopulorum* may replace *Juniperus osteosperma* and codominate at higher-elevation/less xeric sites.

In the southern portion of the Colorado Plateau in northern Arizona and northwestern New Mexico, hybrids of *Juniperus monosperma* and *Juniperus osteosperma* or both juniper species may dominate or codominate the tree canopy. Understory layers are variable and may be dominated by shrubs, graminoids, or be absent. Associated species include *Arctostaphylos patula, Artemisia tridentata, Cercocarpus intricatus, Cercocarpus montanus, Coleogyne ramosissima, Purshia stansburiana, Purshia tridentata, Quercus gambelii, Bouteloua gracilis, Pleuraphis jamesii, Pseudoroegneria spicata, Poa secunda*, or *Poa fendleriana*. This group occurs at higher elevations than Great Basin Pinyon - Juniper Woodland Group (G247) where sympatric on the Colorado Plateau.

Stands are typically found at lower elevations but ranges from 1500-2440 m. These woodlands occur on warm, dry sites on mountain slopes, mesas, plateaus, and ridges. Severe climatic events occurring during the growing season, such as frosts and drought, are thought to limit the distribution of pinyon-juniper woodlands to relatively narrow altitudinal belts on mountainsides. Soils supporting this group vary in texture, ranging from stony, cobbly, gravelly, or sandy loams to clay loam or clay.

Classification Comments: This group corresponds to the *Pinus edulis*-dominated portion of the *persistent pinyon-juniper woodland* type from Romme et al. (2009) that occurs in the Colorado Plateau on rocky uplands with shallow, coarse-textured, and often skeletal soils that support relatively sparse herbaceous cover and rarely burn. The similar Great Basin Pinyon - Juniper Woodland Group (G247) is dominated or codominated by *Pinus monophylla*, not *Pinus edulis*. Hybrid pinyon stands are evaluated by overall floristics and environment with *Juniperus monosperma* more prevalent on more xeric, lower-elevation sites. Another similar group, Southern Rocky Mountain Pinyon - Juniper Woodland Group (G253), that is defined by the range of *Juniperus monosperma* and *Pinus edulis* in the southern Rocky Mountains, transitions into this group in the northwestern corner of New Mexico.

Similar NVC Types:
- G253 Southern Rocky Mountain Pinyon - Juniper Woodland
- G247 Great Basin Pinyon - Juniper Woodland

- G246 Colorado Plateau-Great Basin Juniper Open Woodland

Diagnostic Characteristics: *Pinus edulis* and *Juniperus osteosperma* typically codominate the tree canopy in this group. However, either tree may dominate as long as there is significant presence of *Pinus edulis* (not accidental) to characterize the stand as a pinyon-juniper stand and not the typically more xeric lower-elevation *Juniperus osteosperma* woodland and savanna. This group is restricted to where the ranges of *Pinus edulis* and *Juniperus osteosperma* overlap and includes areas where hybrids between *Juniperus monosperma* and *Juniperus osteosperma* or mixed stands occur in northern Arizona and northwestern New Mexico. Understory diagnostic species are more characteristic of the Great Basin than Rocky Mountains, such as *Arctostaphylos patula, Artemisia nova, Artemisia tridentata, Cercocarpus intricatus, Coleogyne ramosissima, Purshia stansburiana, Purshia tridentata, Pleuraphis jamesii, Pseudoroegneria spicata, Poa secunda*, or *Poa fendleriana*.

VEGETATION

Physiognomy and Structure: These woodlands are characterized by diagnostic tree species *Pinus edulis* and *Juniperus osteosperma* that form an open to dense tree layer 3-10 m tall. Shrub and herbaceous layers are variable and may be sparse to dense or absent. On extremely xeric sites, diagnostic trees species may only attain 2 m in height and have more of shrub form.

Floristics: This woodland group is dominated by *Pinus edulis* and/or *Juniperus osteosperma* in the tree canopy. *Juniperus scopulorum* may codominate at higher elevations. In the southern portion of the Colorado Plateau in northern Arizona and northwestern New Mexico, hybrids between *Juniperus monosperma* and of *Juniperus osteosperma* or both may dominate or codominate the tree canopy. *Juniperus scopulorum* may codominate with *Juniperus osteosperma* at higher elevations. Understory layers are variable and may be dominated by shrubs, graminoids, or be absent. Associated species include *Arctostaphylos patula, Artemisia tridentata, Cercocarpus intricatus, Cercocarpus montanus, Coleogyne ramosissima, Purshia stansburiana, Purshia tridentata, Quercus gambelii, Bouteloua gracilis, Pleuraphis jamesii, Pseudoroegneria spicata, Poa secunda*, or *Poa fendleriana*.

ENVIRONMENT & DYNAMICS

Environmental Description: This woodland group occurs in dry mountains and foothills of the Colorado Plateau region and is typically found at lower elevations but ranges from 1500-2440 m. These woodlands occur on warm, dry sites on mountain slopes, mesas, plateaus, and ridges. Severe climatic events occurring during the growing season, such as frosts and drought, are thought to limit the distribution of pinyon-juniper woodlands to relatively narrow altitudinal belts on mountainsides. Soils supporting this group vary in texture, ranging from stony, cobbly, gravelly, or sandy loams to clay loam or clay.

Dynamics: Key ecological processes are drought, fire, herbivory, and insect/disease outbreaks. Both *Pinus edulis* and *Juniperus osteosperma* are relatively short (generally <15 m tall), shade-intolerant, drought-tolerant, slow-growing, long-lived trees (especially *Juniperus osteosperma* can reach 650 years old) (Meeuwig and Bassett 1983, Little 1987, Zlatnik 1999e, Romme et al. 2003). Both tree species are also non-sprouting and may be killed by fire (Wright et al. 1979). The effect of a fire on these stands is largely dependent on the tree height and density, fine fuel load on the ground, weather conditions and season (Wright et al. 1979). Large trees generally survive unless the fire gets into the crown due to heavy fuel loads in the understory. In this system fire acts to open stands, increase diversity and productivity in understory species, and create a mosaic of stands of different sizes and ages across the landscape while maintaining the boundary between woodlands and adjacent shrublands or grasslands (Bradley et al. 1992).

DISTRIBUTION

Geographic Range: This group occurs on dry mountains and foothills of the Colorado Plateau region from the Western Slope of Colorado to the Wasatch Range, south to the Mogollon Rim, and east into the northwestern corner of New Mexico.

Spatial Scale & Pattern [optional]: Matrix
Nations: US
States/Provinces: AZ, CO, NM, UT, WY?
TNC Ecoregions [optional]: 18:C, 19:C, 20:?
USFS Ecoregions (2007): 313A:CC, 313B:CC, 313C:CC, 313D:CC, 315H:CC, 321A:CC, 322A:CC, 341A:CC, 341B:CC, 341C:CC, 341F:CP, 342E:CP, 342G:CC, M313A:CC, M313B:CC, M331D:CC, M331E:CC, M331G:CC, M331H:CC, M331I:CC, M341B:CC, M341C:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Arches)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- = Colorado Pinyon-Utah Juniper Series (Dick-Peddie 1993)

LOWER LEVEL UNITS

Alliances:

- A3573 *Pinus edulis - Juniperus osteosperma* / Shrub Understory Colorado Plateau Woodland & Scrub Alliance
- A3571 *Pinus edulis - Juniperus osteosperma* / Shrub Understory Foothill & Lower Montane Dry-Mesic Woodland Alliance
- A3572 *Pinus edulis - Juniperus osteosperma* / Herbaceous Understory Open Woodland Alliance

AUTHORSHIP

Primary Concept Source: D.E. Brown, C.H. Lowe and C.P. Pase (1979)
Author of Description: K.A. Schulz
Acknowledgments: E. Muldavin
Version Date: 11/09/2015
Classif Resp Region: West
Internal Author: KAS 1-10, 5-13, 11-15

REFERENCES

References: AOU 1983, Baker and Kennedy 1985, Bradley et al. 1992, Brown 1982a, Brown et al. 1979, Degenhardt et al. 1996, Dick-Peddie 1993, Ernst and Ernst 2003, Eyre 1980, FNA Editorial Committee 2003, Faber-Langendoen et al. 2017a, Küchler 1964, Little 1987, Meeuwig and Bassett 1983, Peterson 1983, Romme et al. 2003, Romme et al. 2009, Shiflet 1994, Spackman et al. 1997, Stebbins 2003, Stuever and Hayden 1997a, Tanner 1983, Tuhy et al. 2002, Weber and Wittmann 1996b, Welsh et al. 1993, West et al. 1998, Wright et al. 1979, Zlatnik 1999e

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1. Forest & Woodland
1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub
G250. Colorado Plateau Pinyon - Juniper Woodland

A3572. Pinus edulis - Juniperus osteosperma / Herbaceous Understory Open Woodland Alliance

Type Concept Sentence: This open woodland and savanna alliance is characterized by diagnostic tree species *Pinus edulis* that forms a very open to moderately dense tree layer often with *Juniperus osteosperma* and an understory dominated by an open to dense layer of perennial grasses, lacking significant cover of shrubs. It occurs on dry mountain slopes, foothills, plateaus in the Colorado Plateau extending east into the west slope of the southern Rocky Mountains.

OVERVIEW

Scientific Name: *Pinus edulis - Juniperus osteosperma* / Herbaceous Understory Open Woodland Alliance
Common Name (Translated Scientific Name): Two-needle Pinyon - Utah Juniper / Herbaceous Understory Open Woodland Alliance
Colloquial Name: Two-needle Pinyon - Utah Juniper / Herb Open Woodland

Type Concept: This woodland alliance is characterized by diagnostic tree species *Pinus edulis* that forms a very open to moderately dense tree layer often with *Juniperus osteosperma* or, less frequently, *Juniperus monosperma* within the range of *Juniperus osteosperma* in northern Arizona. *Juniperus osteosperma* may also dominate stands as long as there is significant presence of *Pinus edulis* (not accidental) to characterize the stand as a pinyon-juniper stand and not the more xeric, typically lower elevation *Juniperus osteosperma* woodland and savanna. At higher elevations and relatively mesic sites, such as along drainages, *Juniperus scopulorum* may be present and sometimes dominant. Other conifers are absent or accidental with very low cover. The understory is characterized by an open to dense herbaceous layer. Scattered shrubs may be present but do not form a layer and do not exceed cover of the herbaceous layer. Perennial grasses typically dominate the herbaceous layer, although diverse forbs species are often present, but with low cover. Characteristic species include *Achnatherum hymenoides, Bouteloua gracilis, Elymus elymoides, Hesperostipa comata, Hesperostipa neomexicana, Leymus salinus, Muhlenbergia pungens, Poa fendleriana, Poa secunda, Pleuraphis jamesii*, and *Pseudoroegneria spicata*. The non-native, invasive annual grass *Bromus tectorum* becomes abundant in disturbed stands and may dominate the understory of highly disturbed stands. Some stands included in this alliance have been seeded with non-native perennial grasses such as *Psathyrostachys juncea* or *Agropyron cristatum* to control soil erosion or increase forage production and now have a semi-natural understory. This alliance occurs on warm, dry sites on mountain slopes, foothills, and plateaus in the Colorado Plateau extending east into the west slope of the southern Rocky Mountains. The climate of the region is semi-arid with drought not uncommon. Stands typically occur on nearly level to moderately steep, rocky slopes on hillsides and mesatops. Aspect does not seem important except in elevational extremes for a given latitude where low-elevation stands are restricted to the more mesic north slopes; canyons and high-elevation stands occur on south aspects. Sites are typically dry with shallow, rocky, calcareous and alkaline soils. Other sites include eroded "badlands," lava flows, scree slopes, and deep sands.

Classification Comments: In northwestern New Mexico outside the distributional range of *Juniperus osteosperma*, this alliance transitions into the southern Rocky Mountain pinyon-juniper woodland alliances. The following associations in this alliance need further review and classification action and possibly rename *Juniperus* spp. to (*Juniperus osteosperma*) as they are not known outside the *Juniperus osteosperma* range or distribution: *Pinus edulis - Juniperus* spp. / *Leymus salinus* Woodland (CEGL002340);

Pinus edulis - Juniperus spp. / *Poa fendleriana* Woodland (CEGL000787); and *Pinus edulis - Juniperus* spp. / *Pseudoroegneria spicata* Woodland (CEGL000788).

Internal Comments: KAS-1-14: More classification work is needed here. There are a variety of environments that exist within this alliance of grass understory Colorado Plateau P-J woodlands and savanna, such as sandy plains and mesas (sand deposits), shale badlands, rocky mesatops, and higher elevation less xeric, foothill and lower montane sites. These environments could be used to create additional alliances.
Other Comments:

Similar NVC Types: This alliance has similarities to other pinyon-juniper woodland and juniper woodland alliances in several other groups, such as G200, G246, G247, G248, G252, G253, and G487.

- A3571 *Pinus edulis - Juniperus osteosperma* / Shrub Understory Foothill & Lower Montane Dry-Mesic Woodland Alliance: is similar but understory is a shrub layer (>10% cover) or, if less, shrub cover exceeds grass cover.
- A3497 *Juniperus osteosperma* / Herbaceous Understory Open Woodland Alliance
- A3573 *Pinus edulis - Juniperus osteosperma* / Shrub Understory Colorado Plateau Woodland & Scrub Alliance: is similar but understory is a shrub layer (>10% cover) or, if less, shrub cover exceeds grass cover.

Diagnostic Characteristics: This woodland alliance occurs in the Colorado Plateau and extends east into the west slope of the southern Rocky Mountains within the distributional range of *Juniperus osteosperma*. The diagnostic tree species are *Pinus edulis* and *Juniperus osteosperma*, either of which may dominate woodland stands as long as there is significant presence of *Pinus edulis* (not accidental). The understory is characterized by an open to dense herbaceous layer. Characteristic species that may dominate include *Achnatherum hymenoides, Bouteloua gracilis, Elymus elymoides, Hesperostipa comata, Hesperostipa neomexicana, Leymus salinus, Muhlenbergia pungens, Poa fendleriana, Poa secunda, Pleuraphis jamesii*, and *Pseudoroegneria spicata*. The non-native, invasive annual grass *Bromus tectorum* and non-native perennial grasses such as *Psathyrostachys juncea* or *Agropyron cristatum* may become abundant in disturbed stands.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has an open to moderately dense tree canopy that is typically 3-10 m tall. Stands are either solely dominated by evergreen needle-leaved trees or may be codominated by scale-leaved evergreen trees. An open to moderate ground layer dominated by perennial graminoids is usually present. Perennial forbs and cacti are often scattered throughout the stands. Annual forbs and grasses may be seasonally present. Scattered shrubs may be present, but do not form a layer (<10% cover).

Floristics: This alliance is characterized by a very open to moderately dense tree canopy typically 3-12 m tall. The diagnostic tree species is *Pinus edulis* often with *Juniperus osteosperma* or, less frequently, *Juniperus monosperma* within the range of *Juniperus osteosperma* in northern Arizona. *Juniperus osteosperma* may also dominate stands as long as there is significant presence (>5% cover) of *Pinus edulis* to characterize the stand as a pinyon-juniper stand and not the more xeric, typically lower elevation *Juniperus osteosperma* woodland and savanna. At higher elevations and relatively mesic sites, such as along drainages, *Juniperus scopulorum* may be present and sometimes dominant. Other conifers are absent or accidental with very low cover. The understory is characterized by an open to dense herbaceous layer. Scattered shrubs may be present, such as *Artemisia* spp., *Cercocarpus montanus, Ephedra viridis, Ericameria nauseosa, Fraxinus anomala, Gutierrezia sarothrae, Opuntia polyacantha*, and *Rhus aromatica*, but do not form a layer and do not exceed cover of the herbaceous layer. Perennial grasses typically dominate the herbaceous layer, although diverse forbs species are often present, but with low cover. Characteristic species include *Achnatherum hymenoides, Bouteloua gracilis, Elymus elymoides, Hesperostipa comata, Hesperostipa neomexicana, Leymus salinus, Muhlenbergia pungens, Poa fendleriana, Poa secunda, Pleuraphis jamesii*, and *Pseudoroegneria spicata*. Commonly present forbs include species of *Arenaria, Artemisia, Eriogonum, Heterotheca, Hymenoxys, Mirabilis, Oxytropis, Penstemon, Phlox, Senecio, Stenotus*, and *Zinnia*. Annual grasses and forbs are seasonally present. The non-native, invasive annual grass *Bromus tectorum* becomes abundant in disturbed stands and may dominate the understory of highly disturbed stands. Some stands included in this alliance have been seeded with non-native perennial grasses such as *Psathyrostachys juncea* or *Agropyron cristatum* to control soil erosion or increase forage production and now have a semi-natural understory.

ENVIRONMENT & DYNAMICS

Environmental Description: This woodland alliance occurs on warm, dry sites on canyon and mountain slopes, mesatops, foothills, and plateaus in the Colorado Plateau extending east into the west slope of the southern Rocky Mountains. Climate is semi-arid and droughts are not uncommon. Summers are generally hot, and winters are cold with occasional snows and extended periods of freezing temperatures. The seasonality of precipitation varies from east to west with summer rain more common in the southern and eastern portion of the alliance's range and winter precipitation more common in the western portion of the range. Mean annual precipitation ranges from 30-46 cm. Elevations normally range from 1500-2465 m (4921-8087 feet). Stands occur on the lower and middle slopes of ridges, on benches, terraces and dunes. These sites range from moderately to steeply sloping (47% to more than

100% slopes), although a minority of stands occur on gentle slopes with gradients not exceeding 10%. Aspect does not seem important except in elevational extremes for a given latitude where low-elevation stands are restricted to the more mesic north slopes; canyons and high-elevation stands occur on south aspects. Soils are shallow to moderately deep, well-drained, often calcareous and alkaline with textures ranging from sand to clay depending on the underlying geology. Parent materials vary from shale, limestone and sandstone to metamorphic, and granitic rocks, eolian deposits, and basalt alluvium or colluvium overlying Moenkopi siltstone. Rocks and bare ground are often common and occupy most of the unvegetated surface, up to 90% in some stands and averaging 60%.

Dynamics: *Pinus edulis* is extremely drought-tolerant and slow-growing (Little 1987, Powell 1988b, Muldavin et al. 1998c). It is also non-sprouting and may be killed by fire (Wright et al. 1979). The effect of fire on a stand is largely dependent on the tree height and density, fine-fuel load on the ground, weather conditions, and season (Dwyer and Pieper 1967, Wright et al. 1979). Trees are more vulnerable in open stands where fires frequently occur in the spring, when the relative humidity is low, wind speeds are over 10-20 mph, and there are adequate fine fuels to carry fire (Wright et al. 1979). Under other conditions, burns tend to be spotty with low tree mortality. Large trees are generally not killed unless fine fuels, such as tumbleweeds, have accumulated beneath the tree to provide ladder fuels for the fire to reach the crown (Jameson 1962). Closed-canopy stands rarely burn because they typically do not have enough understory or wind to carry a fire (Wright et al. 1979).

Although *Pinus edulis* is drought-tolerant, prolonged droughts will weaken trees and promote mortality by secondary agents. Periodic die-offs of pinyon pine caused by insects, such as the pinyon Ips beetle (*Ips confusus*), or fungal agents, such as blackstain root-rot (*Leptographium wageneri*), tend to be correlated with droughts (Anhold 2005). These mortality events may be localized or widespread but can result in 50 to 90% mortality of *Pinus edulis* (Harrington and Cobb 1988).

Climatic and other factors have resulted in denser and expanded pinyon-juniper stands throughout the Colorado Plateau and Great Basin. Denser stands are more susceptible to attack by insects and disease (Anhold 2005). In addition, altered fire regimes, cutting trees for fencing or firewood, and improper grazing by livestock have significant impacts on the quality of sites. Grazing by livestock can modify the fire regime by removing the fine fuels that carry fire. Fire, livestock grazing, and trampling by recreationalists and vehicles disturb cryptogamic soil crusts that help maintain soil structure, reduce soil erosion, provide habitat for plants and preserve biological diversity (Ladyman and Muldavin 1996). More study is needed to understand and manage these woodlands ecologically.

DISTRIBUTION

Geographic Range: The core distribution of this woodland and savanna alliance is the Colorado Plateau extending east into the west slope of the southern Rocky Mountains.

Nations: US
States/Provinces: AZ, CO, NM, UT
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** *Pinus edulis* Series (Francis 1986)
- **>** Colorado Pinyon-Utah Juniper Series (Dick-Peddie 1993)

LOWER LEVEL UNITS

Associations:

- CEGL002819 *Pinus edulis - Juniperus osteosperma / Pseudoroegneria spicata* - Cushion Plant Woodland
- CEGL000778 *Pinus edulis - (Juniperus osteosperma) / Bouteloua gracilis* Woodland
- CEGL000788 *Pinus edulis - Juniperus* spp. / *Pseudoroegneria spicata* Woodland
- CEGL000787 *Pinus edulis - Juniperus* spp. / *Poa fendleriana* Woodland
- CEGL002364 *Pinus edulis - Juniperus osteosperma / Achnatherum hymenoides* Woodland
- CEGL005652 *Pinus edulis - Juniperus osteosperma / Hesperostipa comata* Open Woodland
- CEGL002373 *Pinus edulis - Juniperus osteosperma / Muhlenbergia pungens* Woodland
- CEGL002379 *Pinus edulis - Juniperus osteosperma / Pleuraphis jamesii* Woodland
- CEGL002368 *Pinus edulis - Juniperus osteosperma / Psathyrostachys juncea* Ruderal Woodland
- CEGL002371 *Pinus edulis - Juniperus osteosperma / Hesperostipa neomexicana* Woodland
- CEGL002367 *Pinus edulis - Juniperus osteosperma / Bromus tectorum* Ruderal Woodland
- CEGL002340 *Pinus edulis - Juniperus* spp. / *Leymus salinus* Woodland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by J. Coles.
Version Date: 2014/03/14

REFERENCES

References: Anhold 2005, Baker 1982b, Baker 1983b, Baker 1983c, Baker 1984a, Baker and Kennedy 1985, Barnes 1987, Brown 1982a, Burns and Honkala 1990a, Dick-Peddie 1993, Donart et al. 1978a, Dwyer and Pieper 1967, Erdman 1962, Erdman 1969, Erdman 1970, Erdman et al. 1969, Everett 1986, Eyre 1980, Faber-Langendoen et al. 2017b, Francis 1986, Harrington and Cobb 1988, Hess and Wasser 1982, Isaacson 1967, Jameson 1962, Jameson and Reid 1965, Jameson et al. 1962, Johnston 1984, Johnston 1987, Kennedy 1983a, Ladyman and Muldavin 1996, Larson and Moir 1986, Larson and Moir 1987, Little 1987, Marr et al. 1973b, Marr et al. 1979, Mason et al. 1967, Moir 1963, Moir and Carleton 1987, Muldavin et al. 1998c, Northcutt 1978, Powell 1988b, Tiedemann 1978, USFS 1981a, Vories 1974, Warren et al. 1982, Wright et al. 1973, Wright et al. 1979

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1. Forest & Woodland
1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub
G250. Colorado Plateau Pinyon - Juniper Woodland

A3573. Pinus edulis - Juniperus osteosperma / Shrub Understory Colorado Plateau Woodland & Scrub Alliance

Type Concept Sentence: This open woodland and scrub alliance is characteristic of exposed rocky mesatops and canyon slopes and rims in the Colorado Plateau and is characterized by diagnostic tree species *Pinus edulis* that forms a very open to moderately dense, short tree layer often with *Juniperus osteosperma* and an understory lacking or dominated by an open to moderately dense layer of shrubs (>10% cover) or, if less, then exceeding cover of grasses.

OVERVIEW

Scientific Name: *Pinus edulis - Juniperus osteosperma* / Shrub Understory Colorado Plateau Woodland & Scrub Alliance
Common Name (Translated Scientific Name): Two-needle Pinyon - Utah Juniper / Shrub Understory Colorado Plateau Woodland & Scrub Alliance
Colloquial Name: Colorado Plateau Two-needle Pinyon - Utah Juniper Woodland & Scrub

Type Concept: This open woodland and scrub alliance is characteristic of exposed rocky mesatops and canyon slopes and rims on the Colorado Plateau, but extends upslope into foothills and on xeric sites. The vegetation is sparse to moderately dense (10-80% total vegetation cover) and is dominated by dwarfed (usually <3 m tall) *Pinus edulis* and/or *Juniperus osteosperma* trees that form extensive tall shrublands or scrublands in the canyon country of the Colorado Plateau region. Both tree species are present with 3-25% cover. The understory is lacking or characterized by an open to moderately dense layer of shrubs (>10% cover) or, if less, then exceeding cover of grasses. Shrubs, if present, often include *Artemisia bigelovii, Atriplex canescens, Cercocarpus intricatus, Cercocarpus montanus, Chrysothamnus viscidiflorus, Coleogyne ramosissima, Ephedra torreyana, Ephedra viridis, Fendlera rupicola, Glossopetalon spinescens var. aridum (= Glossopetalon nevadense), Petradoria pumila, Purshia stansburiana, Quercus havardii var. tuckeri*, or *Quercus turbinella*. Herbaceous layers are typically sparse and composed of xeric grasses and forbs. *Opuntia fragilis* or cushion plants such as *Arenaria eastwoodiae* and *Paronychia sessiliflora* may characterize the understory and exceed shrub cover. Sites are variable but generally xeric. Stands occur on dry canyon rims, ridges, hills, benches, hogbacks, mesas, elevated plains and occasionally in intermittent drainages. Elevations generally range from 1400 to 2165 m (4600-7100 feet), but may extend up to 2480 m (8135 feet). Stands typically occur on gentle to moderately steep slopes on all aspects, but range from flat to steep slopes (0-30%). The soils are variable but generally shallow, poorly developed and skeletal, ranging from well-drained clay loam or sandy clay to rapidly drain loamy sand. The unvegetated ground surface is typically composed of litter, bedrock, and bare soil. Because this is a relatively xeric woodland, bare soil and rocks may cover up to 70% of the unvegetated surface, although biological soil crusts provide up to 40% cover.

Classification Comments: This alliance is similar to *Pinus edulis - Juniperus osteosperma* / Shrub Understory Foothill & Lower Montane Dry-Mesic Woodland Alliance (A3571), but trees are sometime stunted by harsh, xeric environments and have a sparse to open woody canopy, and lack some of the upper foothill, lower montane floristic species such as *Quercus gambelii*, when compared to higher elevation foothill pinyon-juniper woodland stands. Additional review is needed to verify association placement in these alliances. Scattered shrubs frequently characterize sparse and rocky understory stands and so are included in this alliance.

Internal Comments: KAS-1-14: Many of the associations included in this alliance range from sparse scrub woodlands to woodlands and it is not possible to separate based on canopy stature or floristic composition of understory at the alliance level, e.g., a canyonlands P-J scrub. I have broaden the concept of this new alliance to include most Colorado Plateau P-J woodland or scrub

associations with shrub or sparse understory into *Pinus edulis - (Juniperus osteosperma)* / Shrub Understory Woodland & Scrub Alliance (see name change). The less xeric associations, generally higher elevation stands with Gambel oak, mountain big sagebrush, etc., would be classified in the *Pinus edulis - (Juniperus osteosperma)* / Shrub Understory Foothill & Lower Montane Dry-Mesic Woodland Alliance (A3571), which I narrowed the concept to just include the relatively mesic P-J associations with shrubby understories.

Other Comments:

Similar NVC Types: This alliance has similarities to other pinyon-juniper woodland and juniper woodland alliances in several other groups, such as G200, G246, G247, G248, G252, G253, and G487.

- A3571 *Pinus edulis - Juniperus osteosperma* / Shrub Understory Foothill & Lower Montane Dry-Mesic Woodland Alliance: is similar but understory is dominated by an herbaceous layer (>10% cover) or, if less, grass cover exceeds shrub cover.
- A3572 *Pinus edulis - Juniperus osteosperma* / Herbaceous Understory Open Woodland Alliance: is similar but understory lacks a shrub layer and is dominated by an herbaceous layer (>10% cover) or, if less, grass cover exceeds shrub cover.

Diagnostic Characteristics: This is the common pinyon-juniper woodland and scrub found throughout much of the Colorado Plateau. The tree canopy is characterized by a sparse to open tree canopy that is relatively short (usually <3 m tall) but may extend up to 10 m. The diagnostic tree species are *Pinus edulis* and *Juniperus osteosperma*, either of which may dominate woodland stands as long as there is significant presence of *Pinus edulis* (not accidental) to characterize as a pinyon-juniper type. The sparse to moderately dense understory is an open shrub layer. The herbaceous layer is typically sparse and composed of grasses and often diverse forbs, especially cushion plants.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a sparse to moderately dense tree canopy that is typically <3 m tall, but may extent to 10 m on favorable sites. Stands are either solely dominated by evergreen needle-leaved trees or may be codominated by scale-leaved evergreen trees. A sparse to moderately dense shrub layer (0.5-3 m tall) may be present. If present, the shrub layer ranges from a single species to a diverse mix of broad-leaved and microphyllous deciduous or evergreen shrubs that are usually less than 3 m tall. A sparse to moderate ground layer dominated by perennial graminoids is usually present. Perennial forbs and cacti are often scattered throughout the stands. Annual forbs and grasses may be seasonally present.

Floristics: This vegetation of this open woodland and scrub alliance is sparse to moderately dense (10-80% total vegetation cover) and is dominated by dwarfed (usually <3 m tall) *Pinus edulis* and/or *Juniperus osteosperma* trees that form extensive tall shrublands or scrublands in the canyon country of the Colorado Plateau region. Both tree species are present with 3-25% cover. The understory may be lacking or be characterized by an open to moderately dense layer of shrubs (>10% cover) or, if less, then exceeding cover of grasses. Shrubs, if present, often include *Artemisia bigelovii, Atriplex canescens, Cercocarpus intricatus, Cercocarpus montanus, Chrysothamnus viscidiflorus, Coleogyne ramosissima, Ephedra torreyana, Ephedra viridis, Fendlera rupicola, Glossopetalon spinescens var. aridum (= Glossopetalon nevadense), Petradoria pumila, Purshia stansburiana, Quercus havardii var. tuckeri*, or *Quercus turbinella*. Shrub mixes often occur on steeper talus slopes. Herbaceous layers are typically sparse and composed of xeric grasses and diverse forbs, especially cushion plants. *Opuntia fragilis* or cushion plants, such as *Arenaria eastwoodiae, Enceliopsis nudicaulis, Erigeron compactus, Erigeron pumilus, Eriogonum alatum, Frasera albomarginata, Heterotheca villosa, Hymenopappus filifolius, Paronychia sessiliflora, Polygala subspinosa, Stenotus armerioides, Tetraneuris acaulis, Tetraneuris torreyana (= Tetraneuris depressa), Townsendia aprica*, and *Townsendia incana*, may characterize the understory and exceed shrub cover. Common perennial grasses include *Achnatherum hymenoides, Aristida purpurea, Bouteloua gracilis, Pleuraphis jamesii*, and *Poa fendleriana*. Other common forbs, such as *Arenaria fendleri, Artemisia ludoviciana, Descurainia pinnata, Eriogonum ovalifolium, Heterotheca villosa, Lappula occidentalis, Machaeranthera grindelioides, Oenothera pallida, Penstemon linarioides*, and *Streptanthus cordatus*, may be present with low cover. Stands of this community sampled at higher elevation have northern aspects and more dense vegetation cover. Biological soil crusts may have significant cover in sites derived from loess.

ENVIRONMENT & DYNAMICS

Environmental Description: This open woodland and scrub alliance is characteristic of exposed rocky mesatops and canyon slopes and rims on the Colorado Plateau, but extends upslope into foothills and on xeric sites. Climate is semi-arid. Summers are hot, and winters are cold with occasional snows and extended periods of freezing temperatures. The seasonality of precipitation varies from east to west with summer rain more common in the southern and eastern portion of the alliance's range and winter precipitation more common in the western portion of the range. Mean annual precipitation ranges from 20-35 cm. Sites are variable but generally xeric. Stands occur on dry canyon rims, ridges, hills, benches, Hogbacks, mesas, elevated plains and occasionally in intermittent drainages. Elevations generally range from 1400 to 2165 m (4600-7100 feet), but may extend up to 2480 m (8135 feet). Stands typically occur on gentle to moderately steep slopes on all aspects, but range from flat to steep slopes (0-30%). The soils are variable but generally shallow, poorly developed and skeletal, ranging from well-drained clay loam or sandy clay to rapidly drain loamy sand. Exposed sandstone or limestone bedrock and bare soil have high cover, and woody plants are generally rooted in cracks and joints in bedrock. Some stands may also occur on shale slopes covered by sandstone colluvium. Parent materials are variable and frequently

include sandstones and shales of the Cedar Mesa, Chinle, and Dakota Formation sandstones, Kayenta Formation, Curtis Formation, Moenkopi Formation, Morrison Formation, Organ Rock shales and eolian silt deposits, and Wingate and Navajo sandstones eroded and redeposited as eolian sands. The unvegetated ground surface is typically composed of litter, bedrock, and bare soil. Because this is a relatively xeric woodland, bare soil and rocks may cover up to 70% of the unvegetated surface, although biological soil crusts provide up to 40% cover.

Dynamics: *Pinus edulis* is extremely drought-tolerant and slow-growing (Little 1987, Powell 1988b, Muldavin et al. 1998c). It is also non-sprouting and may be killed by fire (Wright et al. 1979). Many xeric stands in this alliance are too sparse to burn. However, the effect of fire on a stand is largely dependent on the tree height and density, fine-fuel load on the ground, weather conditions, and season (Dwyer and Pieper 1967, Wright et al. 1979). Trees are more vulnerable in open stands where fires frequently occur in the spring, when the relative humidity is low, wind speeds are over 10-20 mph, and there are adequate fine fuels to carry fire (Wright et al. 1979). Under other conditions, burns tend to be spotty with low tree mortality. Large trees are generally not killed unless fine fuels, such as tumbleweeds, have accumulated beneath the tree to provide ladder fuels for the fire to reach the crown (Jameson 1962). Closed-canopy stands rarely burn because they typically do not have enough understory or wind to carry a fire (Wright et al. 1979).

Although *Pinus edulis* is drought-tolerant, prolonged droughts will weaken trees and promote mortality by secondary agents. Periodic die-offs of pinyon pine caused by insects, such as the pinyon Ips beetle (*Ips confusus*), or fungal agents, such as blackstain root-rot (*Leptographium wageneri*), tend to be correlated with droughts (Anhold 2005). These mortality events may be localized or widespread but can result in 50 to 90% mortality of *Pinus edulis* (Harrington and Cobb 1988).

Climatic and other factors have resulted in denser and expanded pinyon-juniper stands throughout the Colorado Plateau and Great Basin. Denser stands are more susceptible to attack by insects and disease (Anhold 2005). In addition, altered fire regimes, cutting trees for fencing or firewood, and improper grazing by livestock have significant impacts on the quality of sites. Grazing by livestock can modify the fire regime by removing the fine fuels that carry fire. Fire, livestock grazing, and trampling by recreationalists and vehicles disturb cryptogamic soil crusts that help maintain soil structure, reduce soil erosion, provide habitat for plants and preserve biological diversity (Ladyman and Muldavin 1996). More study is needed to understand and manage these woodlands ecologically.

DISTRIBUTION

Geographic Range: The core distribution of this open woodland alliance is the canyon country of the Colorado Plateau.

Nations: US
States/Provinces: AZ, CO, NV?, UT
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **<** *Pinus edulis* Series (Francis 1986)
- **<** Colorado Pinyon-Utah Juniper Series (Dick-Peddie 1993)

LOWER LEVEL UNITS

Associations:

- CEGL002365 *Pinus edulis - Juniperus osteosperma / Artemisia pygmaea* Woodland
- CEGL005657 *Pinus edulis - Juniperus osteosperma / Cercocarpus montanus* - Mixed Shrubs Woodland
- CEGL000782 *Pinus edulis - Juniperus osteosperma / Purshia stansburiana* Woodland
- CEGL000781 *Pinus edulis - Juniperus osteosperma / Coleogyne ramosissima* Woodland
- CEGL002328 *Pinus edulis - Juniperus osteosperma* / Mixed Shrubs Talus Woodland
- CEGL002331 *Pinus edulis - Juniperus osteosperma / Artemisia nova* Woodland
- CEGL002332 *Pinus edulis - Juniperus osteosperma / Petradoria pumila* Woodland
- CEGL002334 *Pinus edulis - Juniperus osteosperma / (Shepherdia rotundifolia, Amelanchier utahensis)* Wooded Shrubland
- CEGL002118 *Pinus edulis - Juniperus osteosperma / Artemisia bigelovii* Woodland
- CEGL002148 *Pinus edulis - Juniperus osteosperma* / Sparse Understory Woodland
- CEGL002335 *Pinus edulis - Juniperus osteosperma / Shepherdia rotundifolia* Woodland
- CEGL002497 *Pinus edulis - Juniperus osteosperma / Quercus havardii var. tuckeri* Woodland
- CEGL002366 *Pinus edulis - Juniperus osteosperma / Atriplex* spp. Woodland
- CEGL002370 *Pinus edulis - Juniperus osteosperma / Ephedra viridis - Gutierrezia sarothrae* Woodland

- CEGL004007 *Pinus edulis - Juniperus osteosperma / Quercus turbinella* Woodland
- CEGL002375 *Pinus edulis - Juniperus osteosperma* / Cushion Plant Woodland
- CEGL002374 *Pinus edulis - Juniperus osteosperma / Opuntia fragilis* Woodland
- CEGL002369 *Pinus edulis - Juniperus osteosperma / Ephedra torreyana - Artemisia bigelovii* Woodland
- CEGL004005 *Pinus edulis - Juniperus osteosperma / Fendlera rupicola* Woodland
- CEPP009635 *Pinus edulis - Juniperus osteosperma / Symphoricarpos longiflorus* Woodland
- CEGL000779 *Pinus edulis - Juniperus osteosperma / Cercocarpus intricatus* Woodland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by J. Coles.
Version Date: 2014/03/14

REFERENCES

References: Anhold 2005, Baker 1982b, Baker 1983b, Baker 1983c, Baker 1984a, Baker and Kennedy 1985, Bassett et al. 1987, Brown 1982a, Burns and Honkala 1990a, Dick-Peddie 1993, Donart et al. 1978a, Dwyer and Pieper 1967, Erdman 1962, Erdman 1969, Erdman 1970, Erdman et al. 1969, Everett 1986, Faber-Langendoen et al. 2017b, Francis 1986, Harrington and Cobb 1988, Hess and Wasser 1982, Holm 1927, Isaacson 1967, Jameson 1962, Jameson and Reid 1965, Jameson et al. 1962, Johnston 1984, Johnston 1987, Kennedy 1983a, Ladyman and Muldavin 1996, Larson and Moir 1986, Larson and Moir 1987, Little 1987, Moir 1963, Moir and Carleton 1987, Muldavin et al. 1998c, Pieper 1968, Powell 1988b, Soil Conservation Service 1978, Tiedemann 1978, Vories 1974, Warren et al. 1982, Wright et al. 1973, Wright et al. 1979, Zimmerman 1978

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1. Forest & Woodland
1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub
G250. Colorado Plateau Pinyon - Juniper Woodland

A3571. Pinus edulis - Juniperus osteosperma / Shrub Understory Foothill & Lower Montane Dry-Mesic Woodland Alliance

Type Concept Sentence: This woodland alliance is characterized by diagnostic tree species *Pinus edulis* that forms a very open to moderately dense tree layer often with *Juniperus osteosperma* (sometimes with *Juniperus monosperma* or *Juniperus scopulorum*) and an understory dominated by an open to dense layer of relatively mesic shrubs or shrubs exceed cover of grasses. It occurs on dry-mesic mountain slopes, foothills, and plateaus in the Colorado Plateau extending east into the west slope of the southern Rocky Mountains.

OVERVIEW

Scientific Name: *Pinus edulis - Juniperus osteosperma* / Shrub Understory Foothill & Lower Montane Dry-Mesic Woodland Alliance
Common Name (Translated Scientific Name): Two-needle Pinyon - Utah Juniper / Shrub Understory Foothill & Lower Montane Dry-Mesic Woodland Alliance
Colloquial Name: Foothill & Lower Montane Pinyon - Juniper / Shrub Dry-Mesic Woodland

Type Concept: This woodland alliance is characterized by diagnostic tree species *Pinus edulis* that forms an open to dense tree layer often with *Juniperus osteosperma* or, less frequently, *Juniperus monosperma* within the range of *Juniperus osteosperma* in northern Arizona. *Juniperus osteosperma* may also dominate stands as long as there is significant presence of *Pinus edulis* (not accidental) to characterize the stand as a pinyon-juniper stand and not the more xeric, typically lower elevation *Juniperus osteosperma* woodland. At higher elevations and relatively mesic sites, such as along drainages, *Juniperus scopulorum* may be present and sometimes dominant. Other conifers are absent or accidental with very low cover. The understory is characterized by relatively mesic shrubs that typically form an open to moderately dense layer. Diagnostic shrubs include *Amelanchier utahensis, Arctostaphylos patula, Arctostaphylos pungens, Artemisia tridentata ssp. tridentata, Artemisia tridentata ssp. vaseyana, Artemisia tridentata ssp. wyomingensis, Cercocarpus ledifolius, Quercus gambelii*, and *Symphoricarpos oreophilus*. The herbaceous layer is sparse to moderate and composed of grasses often with diverse, but low cover of forbs. Common species may include *Achnatherum hymenoides, Bouteloua gracilis, Hesperostipa comata, Hesperostipa neomexicana, Poa fendleriana, Poa secunda, Pleuraphis jamesii*, and *Pseudoroegneria spicata*. The non-native, invasive annual grass *Bromus tectorum* may become abundant in disturbed stands and dominate the herbaceous layer of highly disturbed stands. These woodlands occur on warm, dry-mesic sites on mountain slopes and foothills and in the higher plateaus and mountains in the Colorado Plateau and the west slope of the southern Rocky Mountains. Stands occur on flat to moderate slopes along drainages, on mesatops, and on moderate to steep, sometimes rocky slopes of foothills, mountains and canyons, especially in draws where soil moisture is concentrated, or on northern aspects or where shaded by upper canyon walls. Aspects are variable and elevations range from 1500-2770 m (4920-9090 feet). The soils are variable but tend to be shallow, gravelly and rapidly drained, ranging from sandy loams to silt clay loams. Litter from shrubs may be extensive (over

50% cover). Parent materials include alluvial, colluvial or eolian deposits derived from sandstone, shale, limestone, granite quartzite and rhyolite.

Classification Comments: In northwestern New Mexico outside the distributional range of *Juniperus osteosperma*, this alliance transitions into the southern Rocky Mountain pinyon-juniper woodland alliances. Stands with sparse or rock understory are included in this alliance because scattered similar shrub species are frequently present and characterize the stand at lower cover. Additional review is needed to verify alliance placement between this alliance and *Pinus edulis - Juniperus osteosperma* / Shrub Understory Colorado Plateau Woodland & Scrub Alliance (A3573).

~*Pinus edulis - Juniperus* spp. / *Artemisia arbuscula* Woodland (CEGL004008) needs further review and classification action - possibly archive because of lack of information. Also review lower elevation stands dominated by *Artemisia tridentata ssp. wyomingensis* and possibly create a new association and place in *Pinus edulis - Juniperus osteosperma* / Shrub Understory Colorado Plateau Woodland & Scrub Alliance (A3573) to split from higher elevation stands dominated by *Artemisia tridentata ssp. vaseyana* placed in this alliance (A3571).

Internal Comments: mjr 12-14: CA added for MOJN.
Other Comments:

Similar NVC Types: This alliance has similarities to other pinyon-juniper woodland and juniper woodland alliances in several other groups, such as G200, G246, G247, G248, G252, G253, and G487.

- A3572 *Pinus edulis - Juniperus osteosperma* / Herbaceous Understory Open Woodland Alliance: is similar but understory lacks a shrub layer and is dominated by an herbaceous layer (>10% cover) or, if less, grass cover exceeds shrub cover.
- A3574 *Juniperus monosperma* / Shrub Understory Woodland Alliance
- A3496 *Juniperus osteosperma* / Shrub Understory Woodland Alliance
- A3573 *Pinus edulis - Juniperus osteosperma* / Shrub Understory Colorado Plateau Woodland & Scrub Alliance: is similar but overstory trees are often short and scrubby occurring on to rocky outcrops and canyonlands with understory composed of xeric shrub species and relatively mesic shrubs such as *Quercus gambelii* absent or at low cover.

Diagnostic Characteristics: This woodland alliance occurs in the Colorado Plateau and extends east into the west slope of the southern Rocky Mountains within the distributional range of *Juniperus osteosperma*. The diagnostic tree species are *Pinus edulis* and *Juniperus osteosperma*, either of which may dominate woodland stands as long as there is significant presence of *Pinus edulis* (not accidental) to characterize as a pinyon-juniper type. The understory is characterized by relatively mesic shrubs. Diagnostic shrubs include *Amelanchier utahensis, Arctostaphylos patula, Arctostaphylos pungens, Artemisia tridentata ssp. tridentata, Artemisia tridentata ssp. vaseyana, Artemisia tridentata ssp. wyomingensis, Cercocarpus ledifolius, Quercus gambelii*, and *Symphoricarpos oreophilus*. The herbaceous layer is sparse to moderate and composed of grasses often with diverse, but low cover of forbs.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a moderately sparse to moderately dense tree canopy that is typically 3-10 m tall. Stands are either solely dominated by evergreen needle-leaved trees or may be codominated by broad-leaved or scale-leaved evergreen trees. A sparse to moderately dense shrub layer (0.5-3 m tall) is present. If present, the shrub layer ranges from a single species to a diverse mixture of broad-leaved and microphyllous deciduous or evergreen shrubs that are usually less than 3 m tall. A sparse to moderate ground layer dominated by perennial graminoids may be present. Perennial forbs and cacti are often scattered throughout the stands. Annual forbs and grasses may be seasonally present.

Floristics: This woodland alliance is characterized by diagnostic tree species *Pinus edulis* that forms an open to dense tree layer often with *Juniperus osteosperma* or, less frequently, *Juniperus monosperma* within the range of *Juniperus osteosperma* in northern Arizona. *Juniperus osteosperma* may also dominate stands as long as there is significant presence of *Pinus edulis* (not accidental) to characterize the stand as a pinyon-juniper stand and not the more xeric, typically lower elevation *Juniperus osteosperma* woodland. At higher elevations and relatively mesic sites, such as along drainages, *Juniperus scopulorum* may be present and sometimes dominant. Other conifers are absent or accidental with very low cover. The understory is characterized by relatively mesic shrubs that typically form an open to moderately dense layer. Diagnostic shrubs include *Amelanchier utahensis, Arctostaphylos patula, Arctostaphylos pungens, Artemisia tridentata ssp. tridentata, Artemisia tridentata ssp. vaseyana, Artemisia tridentata ssp. wyomingensis, Cercocarpus ledifolius, Quercus gambelii*, and *Symphoricarpos oreophilus*. Many other shrubs may be present, including *Ericameria* spp., *Gutierrezia sarothrae, Holodiscus dumosus, Opuntia* spp., *Peraphyllum ramosissimum, Purshia stansburiana*, and *Shepherdia rotundifolia*. The herbaceous layer is sparse to moderate and composed of grasses often with diverse, but low cover of forbs. Common species may include *Achnatherum hymenoides, Bouteloua gracilis, Hesperostipa comata, Hesperostipa neomexicana, Poa fendleriana, Poa secunda, Pleuraphis jamesii*, and *Pseudoroegneria spicata*. Commonly present forbs include species of *Arenaria, Artemisia, Balsamorhiza, Chenopodium, Cryptantha, Eriogonum, Heterotheca, Geranium, Machaeranthera, Mirabilis, Packera, Penstemon, Phlox, Senecio, Stenotus, Tetraneuris, Thalictrum, Vicia*, and *Zinnia*. Annual grasses

and forbs are seasonally present. Seedling *Pinus edulis* and *Juniperus* spp. are often present. The non-native, invasive annual grass *Bromus tectorum* may become abundant in disturbed stands and dominate the herbaceous layer of highly disturbed stands.

ENVIRONMENT & DYNAMICS

Environmental Description: This woodland alliance occurs on warm, dry-mesic sites on mountain slopes and foothills and in the higher plateaus and mountains in the Colorado Plateau and the western slope of the southern Rocky Mountains. Climate is semi-arid. Summers are generally hot, and winters are cold with occasional snows and extended periods of freezing temperatures. The seasonality of precipitation varies from east to west with summer rain more common in the southern and eastern portion of the alliance's range and winter precipitation more common in the western portion of the range. Mean annual precipitation ranges from 30-46 cm. Sites are variable but generally are relatively mesic. Stands occur on flat to moderate slopes along drainages and on mesatops, and on moderate to steep, sometimes rocky slopes of foothills, mountains and canyons, especially in draws where soil moisture is concentrated, or on northern aspects or where shaded by upper canyon walls. Aspects are variable and elevations range from 1500-2770 m (4920-9090 feet). Stands in the northern part of the range and at higher elevations (>2400 m) tend to occupy southerly aspects; whereas in the southern part of the range and at lower elevations (<2000 m), stands on northerly aspects are common unless they are located in a moisture-concentrating gully. The soils are variable but tend to be shallow and rapidly drained, ranging from sandy loam, to sandy clay loam, silt loam, and silt clay loam soil textures. They are often gravelly or rocky. Litter from *Quercus gambelii* and other shrubs may be extensive (over 50% cover). Parent materials include alluvial, colluvial or eolian deposits derived from sandstone, shale, limestone, granite quartzite and rhyolite.

Dynamics: *Pinus edulis* is extremely drought-tolerant and slow-growing (Little 1987, Powell 1988b, Muldavin et al. 1998c). It is also non-sprouting and may be killed by fire (Wright et al. 1979). The effect of fire on a stand is largely dependent on the tree height and density, fine-fuel load on the ground, weather conditions, and season (Dwyer and Pieper 1967, Wright et al. 1979). Trees are more vulnerable in open stands where fires frequently occur in the spring, when the relative humidity is low, wind speeds are over 10-20 mph, and there are adequate fine fuels to carry fire (Wright et al. 1979). Under other conditions, burns tend to be spotty with low tree mortality. Large trees are generally not killed unless fine fuels, such as tumbleweeds, have accumulated beneath the tree to provide ladder fuels for the fire to reach the crown (Jameson 1962). Closed-canopy stands rarely burn because they typically do not have enough understory or wind to carry a fire (Wright et al. 1979).

Although *Pinus edulis* is drought-tolerant, prolonged droughts will weaken trees and promote mortality by secondary agents. Periodic die-offs of pinyon pine caused by insects, such as the pinyon Ips beetle (*Ips confusus*), or fungal agents, such as blackstain root-rot (*Leptographium wageneri*), tend to be correlated with droughts (Anhold 2005). These mortality events may be localized or widespread but can result in 50 to 90% mortality of *Pinus edulis* (Harrington and Cobb 1988).

Climatic and other factors have resulted in denser and expanded pinyon-juniper stands throughout the Colorado Plateau and Great Basin. Denser stands are more susceptible to attack by insects and disease (Anhold 2005). In addition, altered fire regimes, cutting trees for fencing or firewood, and improper grazing by livestock have significant impacts on the quality of sites. Grazing by livestock can modify the fire regime by removing the fine fuels that carry fire. Fire, livestock grazing, and trampling by recreationalists and vehicles disturb cryptogamic soil crusts that help maintain soil structure, reduce soil erosion, provide habitat for plants and preserve biological diversity (Ladyman and Muldavin 1996). More study is needed to understand and manage these woodlands ecologically.

DISTRIBUTION

Geographic Range: The core distribution of this woodland alliance is in high plateaus and mountains in the Colorado Plateau extending east into the western slope of the southern Rocky Mountains.

Nations: US
States/Provinces: AZ, CA, CO, NM, UT
TNC Ecoregions [optional]: 17:C
USFS Ecoregions (2007): 322AI:CCC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Mojave)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Pinus edulis* (Two-needle pinyon stands) Special Stands (Sawyer et al. 2009) [87.050.00]
- **<** *Pinus edulis* Series (Francis 1986)
- **><** *Pinus edulis* Woodland Alliance (Evens et al. 2014)
- **<** Colorado Pinyon-Utah Juniper Series (Dick-Peddie 1993)

LOWER LEVEL UNITS

Associations:

- CEGL000775 *Pinus edulis - Juniperus osteosperma / Arctostaphylos pungens* Woodland
- CEGL002939 *Pinus edulis - Juniperus osteosperma / Arctostaphylos patula* Woodland
- CEGL002940 *Pinus edulis - Juniperus osteosperma / Cercocarpus ledifolius* Woodland
- CEGL000789 *Pinus edulis - Juniperus osteosperma / Purshia tridentata* Woodland
- CEGL005659 *Pinus edulis - Juniperus osteosperma / Quercus gambelii* Woodland
- CEGL004008 *Pinus edulis - Juniperus* spp. / *Artemisia arbuscula* Woodland
- CEGL005651 *Pinus edulis - Juniperus (monosperma, deppeana) / Quercus gambelii* Woodland
- CEGL005658 *Pinus edulis - Juniperus osteosperma / Artemisia tridentata (ssp. wyomingensis, ssp. vaseyana)* Woodland
- CEGL002329 *Pinus edulis - Juniperus osteosperma / Amelanchier utahensis* Woodland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by J.J. Coles.
Version Date: 2014/03/14

REFERENCES

References: Anhold 2005, Baker 1982b, Baker 1983b, Baker 1983c, Baker 1984a, Baker and Kennedy 1985, Bassett et al. 1987, Brown 1982a, DeLeuw, Cather & Company 1977, Dick-Peddie 1993, Donart et al. 1978a, Dwyer and Pieper 1967, Erdman 1962, Erdman 1969, Erdman 1970, Erdman et al. 1969, Evens 2000, Evens et al. 2014, Everett 1986, Faber-Langendoen et al. 2017b, Francis 1986, Harrington and Cobb 1988, Hess and Wasser 1982, Isaacson 1967, Jameson 1962, Jameson and Reid 1965, Jameson et al. 1962, Johnston 1984, Johnston 1987, Kennedy 1983a, Ladyman and Muldavin 1996, Larson and Moir 1986, Larson and Moir 1987, Little 1987, Marr et al. 1973b, Marr et al. 1979, Moir 1963, Moir and Carleton 1987, Muldavin et al. 1998c, Northcutt 1978, Pieper 1968, Powell 1988b, Sawyer et al. 2009, Soil Conservation Service 1978, Steinhoff 1978, Thomas et al. 2004, Tiedemann 1978, Vories 1974, Warren et al. 1982, Wright et al. 1973, Wright et al. 1979, Zimmerman 1978

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1. Forest & Woodland
1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub
1.B.2.Nc.2.b. M027 Southern Rocky Mountain-Colorado Plateau Two-needle Pinyon - Juniper Woodland

G252. Southern Rocky Mountain Juniper Open Woodland

Type Concept Sentence: This savanna and woodland group occurs along the east and south foothill slopes of the southern Rocky Mountains and into the southeastern Great Plains and includes both open woodland and savanna stands that are dominated by *Juniperus monosperma* in the tree layer with *Pinus edulis* typically absent and a grassy understory dominated by *Bouteloua gracilis, Bouteloua curtipendula, Bouteloua hirsuta, Bouteloua eriopoda, Hesperostipa neomexicana*, and *Pleuraphis jamesii*.

OVERVIEW

Scientific Name: *Juniperus monosperma* Open Woodland Group
Common Name (Translated Scientific Name): One-seed Juniper Open Woodland Group
Colloquial Name: One-seed Juniper / Shrub Woodland

Type Concept: This savanna and woodland group occurs along the east and south foothill slopes of the southern Rocky Mountains and into the plains of southeastern Colorado and northern and central New Mexico, south to the east side of the Sacramento Mountains and the Tularosa Basin, and east into the panhandles of Oklahoma and Texas. This group includes both open woodland and savanna stands that are dominated by *Juniperus monosperma* in the tree layer. Savanna stands typically have widely spaced, mature (>150 years old) juniper trees with lush perennial grasses in between trees, but may have inclusions (patches) of denser juniper woodlands. *Juniperus monosperma* is the dominant tree (2-10 m tall) with an occasional *Pinus edulis* tree (usually growing within the canopy of *Juniperus monosperma*). *Juniperus scopulorum* may dominate or codominate at higher elevations. Grass species are similar to those found in shortgrass prairie of the western Great Plains with *Bouteloua gracilis, Bouteloua curtipendula, Bouteloua hirsuta, Bouteloua eriopoda, Hesperostipa neomexicana*, and *Pleuraphis jamesii* common. Shrubs are typically scattered and sparse, but may include *Quercus x pauciloba* and *Gutierrezia sarothrae*. In addition, succulents such as *Yucca glauca, Yucca baccata, Opuntia phaeacantha*, and *Opuntia polyacantha* are typically present. Woodland stands may have a more developed shrub layer characterized by *Atriplex confertifolia, Artemisia bigelovii, Artemisia tridentata, Cercocarpus montanus, Ericameria nauseosa, Fallugia paradoxa, Forestiera pubescens, Krascheninnikovia lanata, Ribes cereum*, or *Quercus turbinella*. Stands occur on all aspects of lower hillslopes, alluvial terraces and plains. This woodland phase is often found on steeper, colluvial slopes of escarpments, and occasionally on lower toeslopes and valley bottoms. Soils range from deep loams to shallow, gravelly to rocky sites. This group has expanded into adjacent grasslands and become denser during the last century. It is best represented just below the lower elevational range of Southern Rocky Mountain Pinyon - Juniper Woodland Group (G253) and often intermingles with grasslands and shrublands.

Classification Comments: This group corresponds to the *Juniperus monosperma*-dominated portion of the *pinyon-juniper savanna* type described by Romme et al. (2009) with low to moderate cover of trees, well-developed graminoid understory, generally a minor shrub component, growing on deeper soils most abundantly in areas with a large proportion of growing season precipitation. Denser woodland areas are the result of infilling of juniper trees and small-patch inclusions of the denser juniper occurring on shallow rocky soils that resemble the *persistent pinyon-juniper woodland* type from Romme et al. (2009).

The similar Southern Rocky Mountain Pinyon - Juniper Woodland Group (G253) usually occurs at higher elevations and has *Pinus edulis* present and either dominant or codominant. This group transitions into Madrean Pinyon - Juniper Woodland Group (G200) and Madrean Juniper Open Woodland Group (G487) to the south. These groups are distinguished by the presence of other Madrean tree species, such as *Juniperus coahuilensis, Juniperus deppeana, Juniperus pinchotii, Pinus cembroides, Pinus discolor*, or evergreen oaks such as *Quercus grisea* or *Quercus mohriana* along with Madrean grasses and forbs.

Similar NVC Types:
- G487 Madrean Juniper Open Woodland
- G200 Madrean Pinyon - Juniper Woodland
- G253 Southern Rocky Mountain Pinyon - Juniper Woodland

Diagnostic Characteristics: *Juniperus monosperma* dominates the sparse to moderately dense tree layer in this woodland and savanna group. Dominant and diagnostic understory species are similar to those found in shortgrass prairie with *Bouteloua gracilis, Bouteloua curtipendula, Bouteloua hirsuta, Bouteloua eriopoda, Hesperostipa neomexicana*, and *Pleuraphis jamesii* common. Shrubs are typically scattered and sparse, but may include *Quercus x pauciloba, Yucca glauca*, and *Gutierrezia sarothrae*. Woodland stands may have a more developed shrub layer characterized by *Atriplex confertifolia, Artemisia tridentata, Cercocarpus montanus, Ericameria nauseosa, Fallugia paradoxa, Forestiera pubescens, Krascheninnikovia lanata, Ribes cereum*, or *Quercus turbinella*.

VEGETATION

Physiognomy and Structure: This group encompasses savanna that has widely spaced, short (2-10 m tall), mature (>150 years old) juniper trees and occasionally a *Pinus edulis* tree. The open to dense herbaceous layer typically dominates the vegetation and is composed of perennial grasses. These savannas have inclusions of denser juniper stands, especially near rock outcrops, that are somewhat fire-protected, and have greatly expanded into adjacent plains during the last century. Older established stands have widely species large, mature, rounded-crown trees, whereas more recent invasive juniper savanna stands are characterized by younger, shorter (<3 m tall, pointed-crown juniper trees.

Floristics: This group is best described as a savanna that has widely spaced, mature (>150 years old) juniper trees with lush perennial grasses in between trees, but may have inclusions (patches) of denser juniper woodlands. *Juniperus monosperma* is the dominant tree (2-10 m tall) with an occasional *Pinus edulis* tree. *Juniperus scopulorum* may dominate or codominate at higher elevations. Grass species are similar to those found in Shortgrass Prairie in the western Great Plains. *Bouteloua gracilis, Bouteloua curtipendula*, and *Pleuraphis jamesii* are most common, with *Hesperostipa comata, Koeleria macrantha, Lycurus phleoides* and *Muhlenbergia torreyi* often present. *Bouteloua eriopoda* is a more common grass in the southern extent, and *Andropogon hallii* and *Muhlenbergia pungens* are characteristic of deep sandy sites. Shrubs are poorly represented or absent; the ruderal subshrub *Gutierrezia sarothrae* and succulents such as *Cylindropuntia imbricata, Opuntia phaeacantha, Opuntia polyacantha, Rhus trilobata, Yucca baccata*, and *Yucca glauca* are the most frequent. Forbs such as *Astragalus* spp., *Cryptantha cinerea var. jamesii (= Cryptantha jamesii), Eriogonum jamesii, Erigeron divergens, Hymenopappus filifolius, Ipomopsis multiflora, Mentzelia* spp., and *Penstemon* spp. are also common.

ENVIRONMENT & DYNAMICS

Environmental Description: This woodland and savanna group occupies the lower and warmest elevations, growing from 1370 to 2300 m in a semi-arid climate, primarily along the east and south slopes of the southern Rocky Mountains extending south and east into the western Great Plains. Stands occur on all aspects of lower hillslopes, alluvial terraces and plains. This woodland phase is often found on steeper, colluvial slopes of escarpments, dipslopes of moderate slope, and occasionally on lower toeslopes and valley bottoms. Soils range from deep loams to shallow, gravelly to rocky sites. Slope sites tend to be rocky and gravelly, while terraces and plains sites less so, sometimes occurring on deeper loamy soils.

Dynamics: *Juniperus monosperma* is a long-lived, slow-growing, drought-tolerant small tree (3-12 m in height) that also occurs as a tall shrub (Johnson 2002). It is more drought-tolerant than *Pinus edulis* and often occurs without pinyon on more xeric, lower elevation sites (Johnson 2002). It is also non-sprouting and may be killed by fire (Wright et al. 1979). Juniper stands at cooler, higher elevation sites typically occur on xeric microsites that are too arid for pinyon or on post-disturbance sites such as where extended drought or ips beetle (*Ips confusus*) epidemics have eliminated pinyon from mixed pinyon-juniper stands. In this situation junipers

and shrubs may act as nurse plants providing shade for pinyon germination and re-establishment, converting a juniper woodland to pinyon-juniper woodland.

Within a given region, the density of trees, both historically and currently, is strongly related to topo-edaphic gradients. Less steep sites, especially those with finer-textured soils, are where savannas, grasslands, and shrub-steppes have occurred in the past. Juniper stands on these gentler slopes may have been larger but more savanna-like, with very open upper canopy and high grass production. Expansion of juniper into previously non-wooded areas occurred prior to European settlement on some sites, although this expansion may have been more extensive in the 20th century versus the previous. However, loss of juniper from marginal sites also occurred historically and recently in some areas (Romme et al. 2009). Especially in areas in which trees were historically rare or absent, there have been type conversions such that the historical condition is unidentifiable/replaced today. An important result of expansion into formerly non-wooded areas in many regions is that formerly heterogeneous mosaics of small patches of woodland, shrubland, and grassland are becoming more homogeneous as trees become established in the shrubland and grassland patches (Romme et al. 2009).

DISTRIBUTION

Geographic Range: This savanna and woodland group occurs along the east and south foothill slopes of the southern Rocky Mountains and into the plains in southeastern Colorado and northern and central New Mexico, south to the east side of the Sacramento Mountains and the Tularosa Basin, and extending east into the panhandles of Oklahoma and Texas.

Spatial Scale & Pattern [optional]: Large patch
Nations: US
States/Provinces: CO, NM, OK, TX
TNC Ecoregions [optional]: 20:C, 21:C, 27:C
USFS Ecoregions (2007): 315A:CC, 315B:CC, 315H:CC, 321A:PP, 331B:CC, 331C:C?, 331I:CC, 331J:CC, M313B:CC, M331F:CC, M331G:CC
Omernik Ecoregions:
Federal Lands [optional]: DOD (White Sands Missile Range); NPS (Bandelier, Salinas Pueblo Missions)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **=** One-seed Juniper Series (Dick-Peddie 1993)
- **=** One-seed Juniper-Rocky Mountain Juniper Series (Dick-Peddie 1993)

LOWER LEVEL UNITS

Alliances:
- A3575 *Juniperus monosperma* / Herbaceous Understory Open Woodland Alliance
- A3574 *Juniperus monosperma* / Shrub Understory Woodland Alliance

AUTHORSHIP

Primary Concept Source: W.A. Dick-Peddie (1993)
Author of Description: K.A. Schulz and E. Muldavin
Acknowledgments: E. Muldavin
Version Date: 11/09/2015
Classif Resp Region: West
Internal Author: KAS 1-10, 6-13, 11-15

REFERENCES

References: Barnes 1987, Dick-Peddie 1993, Dwyer and Pieper 1967, Eager 1999, Eyre 1980, Faber-Langendoen et al. 2017a, Francis 1986, Gehlbach 1967, Johnson 2002, Larson and Moir 1986, Larson and Moir 1987, Muldavin et al. 2011b, Muldavin et al. 2011d, Muldavin et al. 2012a, Muldavin et al. 2012b, Neely et al. 2001, Rogers 1950, Romme et al. 2009, Shaw et al. 1989, Shiflet 1994, Stuever and Hayden 1997a, West 1999b, West and Young 2000, Wright and Bailey 1982a, Wright et al. 1979

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1. Forest & Woodland
1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub
G252. Southern Rocky Mountain Juniper Open Woodland

G253. Southern Rocky Mountain Pinyon - Juniper Woodland

Type Concept Sentence: This pinyon - juniper woodland group occurs in the southern Rocky Mountains on dry mountains and foothills in southern Colorado east of the Continental Divide and is characterized by *Pinus edulis* that dominates or codominates the tree canopy with *Juniperus monosperma*.

OVERVIEW

Scientific Name: *Pinus edulis - Juniperus monosperma - Juniperus scopulorum* Woodland Group
Common Name (Translated Scientific Name): Two-needle Pinyon - One-seed Juniper - Rocky Mountain Juniper Woodland Group
Colloquial Name: Two-needle Pinyon - One-seed Juniper / Shrub Woodland

Type Concept: This southern Rocky Mountain woodland group occurs on dry mountains and foothills in southern Colorado east of the Continental Divide, in mountains and plateaus of northern and central New Mexico, and extends east on breaks in the southeastern Great Plains. The vegetation is characterized by *Pinus edulis* that dominates or codominates the tree canopy with *Juniperus monosperma*. *Juniperus monosperma* may dominate stands provided *Pinus edulis* is present with significant cover. *Juniperus scopulorum* may codominate or replace *Juniperus monosperma* at higher elevations. Stands with mixed *Juniperus osteosperma* are representative of the Colorado Plateau and are not included in this group. In southern transitional areas with Madrean Pinyon - Juniper Woodland Group (G200) in central New Mexico, *Juniperus deppeana* may be present but not codominant. Understory layers are variable and may be dominated by shrubs, graminoids, or be absent. Associated species are generally more typical of the southern Rocky Mountains than the Colorado Plateau. Common species include *Artemisia bigelovii, Cercocarpus montanus, Fallugia paradoxa, Quercus gambelii, Quercus x pauciloba*, and grasses such as *Achnatherum nelsonii, Achnatherum scribneri, Bouteloua gracilis, Festuca arizonica*, or *Pleuraphis jamesii*. Stands in this group are found on mountain slopes, mesas, plateaus, and ridges. Severe climatic events occurring during the growing season, such as frosts and drought, are thought to limit the distribution of pinyon-juniper woodlands to relatively narrow altitudinal belts on mountainsides. Elevationally, stands typically occur above the *Juniperus monosperma* only-dominated woodlands and savannas. Stands range from near 1500 to 2900 m with high-elevation stands restricted to relatively warm, dry ridges and south and west aspects. Soils vary in texture, ranging from stony, cobbly, gravelly sandy loams to clay loam or clay.

Classification Comments: This group corresponds to the *Pinus edulis*-dominated or -codominated portion of the *persistent pinyon-juniper woodland* type from Romme et al. (2009) that occurs in the southern Rocky Mountains east of the Continental Divide on rocky uplands with shallow, coarse-textured, and often skeletal soils that support relatively sparse herbaceous cover and rarely burn. The similar Southern Rocky Mountain Juniper Open Woodland Group (G252) occurs at lower elevations and typically has a strong perennial grass-dominated understory and *Pinus edulis* is absent or accidental. This group transitions into Madrean Pinyon - Juniper Woodland Group (G200) and is distinguished by Madrean tree species *Juniperus coahuilensis, Juniperus deppeana, Juniperus pinchotii, Pinus cembroides, Pinus discolor*, or evergreen oaks such as *Quercus grisea* or *Quercus mohriana*.

Another similar group, Colorado Plateau Pinyon - Juniper Woodland Group (G250), that is defined by the intersection of the ranges of *Juniperus osteosperma* and *Pinus edulis* on the Colorado Plateau, transitions into the Southern Rocky Mountain type in the northwestern corner of New Mexico and southwestern Colorado. Stands in northern Arizona with both *Juniperus monosperma* and *Juniperus osteosperma* are included in the Colorado Plateau group.

Similar NVC Types:
- G200 Madrean Pinyon - Juniper Woodland
- G252 Southern Rocky Mountain Juniper Open Woodland
- G250 Colorado Plateau Pinyon - Juniper Woodland

Diagnostic Characteristics: *Pinus edulis* dominates or codominates the tree canopy with *Juniperus monosperma* in this group. *Juniperus monosperma* may dominate stand as long as *Pinus edulis* is present with significant cover. It is restricted to where the ranges of *Pinus edulis* and *Juniperus monosperma* overlap.

VEGETATION

Physiognomy and Structure: These woodlands are characterized by diagnostic tree species *Pinus edulis* and *Juniperus monosperma* that form an open to dense tree layer 3-10 m tall. Shrub and herbaceous layers are variable and may be sparse to dense or absent.

Floristics: This southern Rocky Mountain woodland group is characterized by a relatively short (3-10 m tall), open to moderately dense tree canopy dominated by *Pinus edulis* and/or *Juniperus monosperma*. *Juniperus scopulorum* may codominate or replace *Juniperus monosperma* at higher elevations. *Juniperus monosperma* may dominate stands as long as *Pinus edulis* is present with significant cover. Stands with *Juniperus osteosperma* are representative of the Colorado Plateau and are not included in this group. In southern transitional areas with Madrean Pinyon - Juniper Woodland Group (G200) in central New Mexico, *Juniperus deppeana* may be present but not dominant. Understory layers are variable and may be dominated by shrubs, graminoids, or be absent. Associated species are generally more typical of the southern Rocky Mountains or Great Plains than the Colorado Plateau. Common species include *Artemisia bigelovii, Atriplex canescens, Cercocarpus montanus, Ericameria nauseosa, Fallugia paradoxa, Quercus gambelii, Quercus x pauciloba, Quercus turbinella, Ribes cereum*, and grasses such as *Achnatherum nelsonii, Achnatherum scribneri, Andropogon hallii, Bouteloua gracilis, Festuca arizonica, Hesperostipa comata, Hesperostipa neomexicana*, or *Pleuraphis jamesii*. Many different foothill and lower montane forbs may be present, but generally with low cover.

ENVIRONMENT & DYNAMICS

Environmental Description: This southern Rocky Mountain woodland group occurs on dry mountains and foothills in southern Colorado east of the Continental Divide, in mountains and plateaus of northern New Mexico, and extends east into the southeastern Great Plains on limestone and shale breaks, escarpments and hills. Stands are found on warm, dry sites on mountain slopes, mesas, plateaus, and ridges. Elevations range from near 1500 to 2900 m with high-elevation stands restricted to relatively warm, dry ridges and south and west aspects. Lower-elevation stands are often restricted to cooler north- and east-facing slopes. Severe climatic events occurring during the growing season, such as frosts and drought, are thought to limit the distribution of pinyon-juniper woodlands to relatively narrow altitudinal belts on a given mountainside. Soils vary in texture ranging from stony, cobbly, gravelly or sandy loams to clay loam or clay.

Dynamics: Both *Pinus edulis* and *Juniperus monosperma* are relatively short (generally <15 m tall), shade-intolerant, drought-tolerant, slow-growing, long-lived trees (Meeuwig and Bassett 1983, Little 1987, Anderson 2002, Johnson 2002, Romme et al. 2003). Both tree species are also non-sprouting and may be killed by fire (Wright et al. 1979).

Pinyon-juniper woodlands are influenced by drought, fires, grazing, and insect-pathogen outbreaks (West 1999b). Stands vary considerably in appearance and composition, both elevationally and geographically. Juniper tends to be more abundant at the warmer/drier lower elevations, pinyon tends to be more abundant at the higher elevations, and the two species share dominance within a broad middle-elevation zone (Woodin and Lindsey 1954).

The effect of a fire on a stand is largely dependent on the tree height and density, fine fuel load on the ground, weather conditions, and season (Dwyer and Pieper 1967, Wright et al. 1979). Some large trees may survive unless the fire gets into the crown due to heavy fuel loads in the understory or extreme fire conditions.

There are many insects, pathogens, and plant parasites that attack pinyon and juniper trees (Meeuwig and Bassett 1983, Gottfried et al. 1995, Rogers 1995, Weber et al. 1999). For pinyon and juniper, there are at least seven insects, plus blackstain root-rot (*Leptographium wageneri*) and mistletoes *Phoradendron juniperinum* and *Arceuthobium divaricatum*. Both mistletoes reduce vigor and cause occasional dieback but rarely cause mortality (Meeuwig and Bassett 1983). The insects are normally present in these woodland stands, and during drought-induced water stress periods, outbreaks may cause local to regional mortality (Wilson and Tkacz 1992, Gottfried et al. 1995, Rogers 1995). Most insect-related pinyon mortality in the West is caused by pinyon ips beetle (*Ips confusus*) (Rogers 1993). Pinyons cannot repel pinyon ips beetles when weakened by drought and many are killed.

DISTRIBUTION

Geographic Range: This southern Rocky Mountain woodland group occurs on dry mountains and foothills in southern Colorado east of the Continental Divide, in mountains and plateaus of northern and central New Mexico, and extends east to breaks in the southeastern Great Plains. It extends south to the Sacramento Mountains, especially the eastern side. The western side has Madrean elements (*Quercus grisea*) and may be classified as Madrean woodland.

Spatial Scale & Pattern [optional]: Matrix
Nations: US
States/Provinces: CO, NM, OK
TNC Ecoregions [optional]: 20:C, 21:C, 22:P, 27:C, 28:C
USFS Ecoregions (2007): 313B:CC, 315A:CC, 315B:CC, 315H:CC, 321A:CC, 322B:CC, 331B:CC, 331H:CP, 331I:CC, 331J:CC, M313B:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC
Omernik Ecoregions:
Federal Lands [optional]: DOD (Pinon Canyon, White Sands Missile Range); NPS (Bandelier, Great Sand Dunes, Salinas Pueblo Missions); USFS (Lincoln)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **>** *Juniperus monosperma/Oryzopsis micrantha* Plant Community (Shaw et al. 1989) [*Pinus edulis* present to codominant.]
- **>** Colorado Pinyon-One-seed Juniper Series (Dick-Peddie 1993)
- **>** Colorado Pinyon-Rocky Mountain Juniper Series (Dick-Peddie 1993)
- **<** Juniper - Pinyon Pine Woodland (504) (Shiflet 1994)
- **<** Pinyon - Juniper: 239 (Eyre 1980)

LOWER LEVEL UNITS

Alliances:
- A3577 *Pinus edulis - Juniperus monosperma* / Herbaceous Understory Open Woodland Alliance
- A3576 *Pinus edulis - Juniperus monosperma* / Shrub Understory Woodland Alliance

AUTHORSHIP

Primary Concept Source: W.A. Dick-Peddie (1993)

Author of Description: K.A. Schulz
Acknowledgments: E. Muldavin
Version Date: 11/09/2015
Classif Resp Region: West
Internal Author: KAS 1-10, 6-13, 11-15

REFERENCES

References: Anderson 2002, Dick-Peddie 1993, Dwyer and Pieper 1967, Eager 1999, Eyre 1980, Faber-Langendoen et al. 2017a, Gottfried et al. 1995, Johnson 2002, Little 1987, Meeuwig and Bassett 1983, Muldavin et al. 2011b, Muldavin et al. 2011d, Muldavin et al. 2012a, Muldavin et al. 2012e, Neely et al. 2001, Rogers 1993, Rogers 1995, Romme et al. 2003, Romme et al. 2009, Salas et al. 2010b, Shaw et al. 1989, Shiflet 1994, Stuever and Hayden 1997a, Weber et al. 1999, West 1999a, West 1999b, Wilson and Tkacz 1992, Woodin and Lindsey 1954, Wright et al. 1979

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1. Forest & Woodland
1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub
G253. Southern Rocky Mountain Pinyon - Juniper Woodland

1.B.3. Temperate Flooded & Swamp Forest

Temperate Flooded & Swamp Forest is a tree-dominated wetland influenced by minerotrophic groundwater, either on mineral or organic (peat) soil, found in mid-latitudes of the globe.

1.B.3.Nc. Rocky Mountain-Great Basin Montane Flooded & Swamp Forest

Forested riparian and depressional wetlands dominated by broad-leaved deciduous trees or conifers (or both) that occur at mid to high elevations of the Rocky Mountains, ranges of the Intermountain West and the Colorado Plateau, and in the Sierra Nevada and eastern Cascades.

M034. Rocky Mountain-Great Basin Montane Riparian & Swamp Forest

This macrogroup consists of montane riparian and swamp forests and woodlands dominated by cottonwood trees, conifer trees, or a mix with such species as *Acer negundo, Alnus rhombifolia, Picea engelmannii, Picea pungens, Pinus contorta, Pinus ponderosa, Populus angustifolia*, and *Populus balsamifera*. It occurs throughout the Great Basin and Rocky Mountains.

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1. Forest & Woodland
1.B.3.Nc. Rocky Mountain-Great Basin Montane Flooded & Swamp Forest
1.B.3.Nc.1.a. M034 Rocky Mountain-Great Basin Montane Riparian & Swamp Forest

G506. Rocky Mountain-Great Basin Montane Riparian & Swamp Forest

Type Concept Sentence: This riparian forest group includes seasonally flooded conifer-dominated forests found at montane to subalpine elevations of the Rocky Mountain cordillera, from southern New Mexico north into Montana, and west into the Intermountain West region and the Colorado Plateau. *Picea engelmannii, Picea pungens*, and/or *Populus angustifolia* dominate, and the understory is often dominated by forbs or graminoids with only a few shrubs. Soils are mineral and very well-oxygenated.

OVERVIEW

Scientific Name: *Picea engelmannii - Picea pungens - Populus angustifolia* Riparian & Swamp Forest Group
Common Name (Translated Scientific Name): Engelmann Spruce - Blue Spruce - Narrowleaf Cottonwood Riparian & Swamp Forest Group
Colloquial Name: Rocky Mountain Grand Fir Riparian Forest

Type Concept: This group contains woodlands dominated by cottonwood, conifer and aspen that line montane streams. Dominant tree species usually include *Abies lasiocarpa, Picea engelmannii, Pinus ponderosa, Juniperus scopulorum*, and/or *Populus angustifolia*; other important species include *Pseudotsuga menziesii, Picea pungens, Picea engelmannii x glauca*, and *Populus tremuloides*. Other trees possibly present but not usually dominant include *Alnus incana, Abies concolor, Abies grandis, Pinus contorta*, and *Juniperus osteosperma*. Shrub cover tends to be limited but may include *Alnus incana, Betula occidentalis, Cornus sericea, Crataegus rivularis, Forestiera pubescens var. pubescens, Ribes* spp., *Rosa woodsii, Salix* spp., and others. The herbaceous undergrowth can be lush to depauperate. Herbaceous species include *Calamagrostis canadensis, Carex aquatilis var. aquatilis, Carex obnupta, Carex pellita, Equisetum arvense, Heracleum maximum, Ranunculus alismifolius, Senecio bigelovii var. bigelovii, Streptopus amplexifolius*, and *Veratrum californicum*. This riparian group includes seasonally flooded forests found at montane to subalpine elevations of the Rocky Mountain cordillera, from southern New Mexico north into Montana, and west into the Intermountain West

region and the Colorado Plateau. It occurs throughout the interior of British Columbia and the eastern slopes of the Cascade Range. These are communities tolerant of periodic flooding and high water tables. Snowmelt moisture may create shallow water tables or seeps for a portion of the growing season. Stands typically occur at elevations between 1500 and 3300 m (4920-10,830 feet); farther north, elevation ranges between 900 and 2000 m. This is confined to specific riparian environments occurring on floodplains or terraces of rivers and streams, in V-shaped, narrow valleys and canyons (where there is cold-air drainage). Less frequently, occurrences are found in moderately wide valley bottoms on large floodplains along broad, meandering rivers, and on pond or lake margins.

Classification Comments: This group is restricted to montane riparian areas and avalanche chutes between lower and upper treeline.

Similar NVC Types:
- G505 Rocky Mountain-Great Basin Swamp Forest: occurs on saturated, extremely poorly drained soil.
- G507 North Pacific Montane Riparian Woodland

Diagnostic Characteristics: This group contains the conifer and aspen woodlands that line montane streams. These are communities tolerant of periodic flooding and high water tables.

VEGETATION

Physiognomy and Structure: Open to closed woodlands of tall conifer or deciduous trees with or without an understory of deciduous shrubs, generally forming linear bands following streams. These can blend into the surrounding upland forest, and often only the understory herbaceous species indicate the wet nature of the soils.

Floristics: Dominant tree species usually include *Abies lasiocarpa, Abies grandis, Picea engelmannii, Picea pungens, Populus angustifolia, Pinus ponderosa, Pinus contorta*, and/or *Juniperus scopulorum*; other important species include *Pseudotsuga menziesii, Picea engelmannii x glauca*, and *Populus tremuloides*. Other trees possibly present and dominant or codominant include *Abies concolor, Abies grandis, Pinus contorta*, and *Juniperus osteosperma*. Shrub cover tends to be limited but may include *Alnus incana, Betula occidentalis, Cornus sericea, Crataegus rivularis, Forestiera pubescens var. pubescens, Ribes* spp., *Rosa woodsii, Salix* spp., and others. The herbaceous undergrowth can be lush to depauperate. Herbaceous species include *Calamagrostis canadensis, Carex aquatilis var. aquatilis, Carex obnupta, Carex pellita, Equisetum arvense, Heracleum maximum, Ranunculus alismifolius, Senecio bigelovii var. bigelovii, Streptopus amplexifolius*, and *Veratrum californicum*. Floristic information is compiled from several sources for eastern Washington and Oregon (Kovalchik 1987, 1993, Crowe and Clausnitzer 1997), Nevada (Manning and Padgett 1995), Colorado (Kittel et al. 1999b), Montana (Butler 1979, 1985, Malanson and Butler 1984, Hansen et al. 1989), British Columbia (MacKenzie and Moran 2004), Utah (Padgett et al. 1989, Tuhy et al. 2002), New Mexico and Arizona (Szaro 1989, Muldavin et al. 2000a), and Wyoming (Walford 1996, Walford et al. 2001).

ENVIRONMENT & DYNAMICS

Environmental Description: *Climate*: Temperate cold. *Soil/substrate/hydrology:* Stands typically occur at elevations between 1500 and 3300 m (4920-10,830 feet); farther north, elevation ranges between 900 and 2000 m. This group is confined to specific riparian environments occurring on floodplains or terraces of rivers and streams, in V-shaped, narrow valleys and canyons (where there is cold-air drainage). Less frequently, occurrences are found in moderately wide valley bottoms on large floodplains along broad, meandering rivers, on pond or lake margins, and seeps on gentle slopes. Environmental information is compiled from several sources: for eastern Washington and Oregon (Kovalchik 1987, 1992, 2001, Crowe and Clausnitzer 1997); for Nevada (Manning and Padgett 1995); for Colorado (Baker 1988, 1989a, 1989b, 1990, Kittel et al. 1994, 1995, 1999a, 1999b); for Montana (Butler 1979, 1985, Malanson and Butler 1984, Hansen et al. 1989); for British Columbia (MacKenzie and Moran 2004); for Utah (Padgett et al. 1989, Tuhy et al. 2002); for New Mexico and Arizona (Szaro 1989, Muldavin et al. 2000a); and for Wyoming (Walford 1996, Walford et al. 2001).

Dynamics:

DISTRIBUTION

Geographic Range: This group is found at montane to subalpine elevations of the Rocky Mountain cordillera, from southern New Mexico north into Montana, Alberta and British Columbia, and west into the Intermountain West region and the Colorado Plateau.

Spatial Scale & Pattern [optional]: Linear
Nations: CA, US
States/Provinces: AB, AZ, BC, CA, CO, ID, MT, NM, NV, OR, SD, UT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):

Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **=** Blue Spruce: 216 (Eyre 1980) [Blue spruce commonly occurs in riparian zones]
- **=** ER Engelmann Spruce Riparian (Ecosystems Working Group 1998)
- **<** Engelmann Spruce - Subalpine Fir: 206 (Eyre 1980) [Engelmann spruce occurs as a dominant in riparian zones.]
- **<** Riparian (422) (Shiflet 1994)

LOWER LEVEL UNITS

Alliances:

- A3761 *Picea pungens* Riparian Forest Alliance
- A4154 *Acer negundo - Alnus incana ssp. tenuifolia - Cornus sericea* Riparian Woodland Alliance
- A3759 *Populus angustifolia* Riparian Forest Alliance
- A3797 *Pinus ponderosa - Juniperus scopulorum - Abies concolor* Riparian Woodland Alliance
- A3760 *Populus tremuloides* Riparian Forest Alliance
- A3762 *Abies grandis* Rocky Mountain Riparian Forest Alliance
- A3758 *Pinus contorta var. murrayana - Pinus contorta var. latifolia* Swamp Forest Alliance
- A3757 *Abies lasiocarpa - Picea engelmannii* Swamp Forest Alliance

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2011)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 05/11/2015
Classif Resp Region: West
Internal Author: GK 10-10, 9-13, 5-15, 12-15

REFERENCES

References: Baker 1988, Baker 1989a, Baker 1989b, Baker 1990, Butler 1979, Butler 1985, Crowe and Clausnitzer 1997, Ecosystems Working Group 1998, Eyre 1980, Faber-Langendoen et al. 2017a, Hansen et al. 1989, Kittel 1993, Kittel et al. 1994, Kittel et al. 1995, Kittel et al. 1999a, Kittel et al. 1999b, Kovalchik 1987, Kovalchik 1993, Kovalchik 2001, MacKenzie and Moran 2004, Malanson and Butler 1984, Manning and Padgett 1995, Muldavin et al. 2000a, Nachlinger et al. 2001, Padgett et al. 1988b, Padgett et al. 1989, Shiflet 1994, Szaro 1989, Tuhy et al. 2002, Walford 1996, Walford et al. 2001

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1. Forest & Woodland
1.B.3.Nc. Rocky Mountain-Great Basin Montane Flooded & Swamp Forest
G506. Rocky Mountain-Great Basin Montane Riparian & Swamp Forest

A3762. Abies grandis Rocky Mountain Riparian Forest Alliance

Type Concept Sentence: This alliance consists of riparian areas dominated by *Abies grandis*, usually with other conifers. *Abies lasiocarpa, Larix occidentalis, Pinus monticola*, and *Pseudotsuga menziesii* may be present to codominant. *Betula papyrifera* or *Populus balsamifera ssp. trichocarpa* sometimes form a scattered subcanopy. It occupies sites on benches, toeslopes or valley bottoms along mountain streams. The alliance occurs in the Rocky Mountains of western Montana, Idaho and eastern Washington and eastern Oregon, possibly extending into British Columbia Elevations range from 790-1410 m.

OVERVIEW

Scientific Name: *Abies grandis* Rocky Mountain Riparian Forest Alliance
Common Name (Translated Scientific Name): Grand Fir Rocky Mountain Riparian Forest Alliance
Colloquial Name: Rocky Mountain Grand Fir Riparian Forest

Type Concept: This is an alliance of riparian woodlands dominated by *Abies grandis*, usually with other conifers. *Abies lasiocarpa, Larix occidentalis, Pinus monticola*, and *Pseudotsuga menziesii* may be present to codominant. *Betula papyrifera* or *Populus balsamifera ssp. trichocarpa* sometimes forms a scattered subcanopy. There is usually a rich and well-developed shrub layer. Common shrubs include *Acer glabrum, Linnaea borealis, Rosa gymnocarpa, Rubus parviflorus*, and *Symphoricarpos albus*. The herbaceous layer is characterized by a diverse assemblage of moist-site forbs and ferns, including *Aralia nudicaulis, Athyrium filix-femina, Galium triflorum, Goodyera oblongifolia, Maianthemum stellatum, Orthilia secunda, Osmorhiza berteroi (= Osmorhiza chilensis), Senecio triangularis*, and *Tiarella trifoliata*. This alliance occurs in the Rocky Mountains of western Montana, Idaho and eastern Washington and eastern Oregon, possibly extending into British Columbia. It occupies sites on benches, toeslopes or valley

bottoms along mountain streams. Elevations where the alliance occurs range from 790-1410 m. Soils are typically very cobbly silt loams or sandy loam. Water tables are generally within 1 m of the soil surface in the spring, but the soils are well-drained.

Classification Comments: This alliance does not include *Abies grandis* riparian and wetland locations west of the Cascade Crest. These sites are outside the range of *Thuja plicata*, which dominates similar sites throughout the wetter parts of the Pacific Northwest.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Stands on riparian seasonally wet soils dominated by *Abies grandis* or other conifer species.

VEGETATION

Physiognomy and Structure: Upper canopy of evergreen needle-leaved tall coniferous trees. A sparse subcanopy is occasionally present, composed of broad-leaved winter-deciduous trees. A shrub layer of broad-leaved cold-deciduous shrubs is usually present in moist sites. Herbaceous cover is a species-diverse layer of shade-tolerant forbs and ferns.

Floristics: Vegetation within this alliance is distributed on low- to mid-elevation mountain slopes and bottomlands of the northern Rocky Mountains. *Picea engelmannii* is often a codominant with *Abies grandis* in stands of this alliance. *Pseudotsuga menziesii* or *Larix occidentalis* may be present at the drier margins, and *Abies lasiocarpa* may occur in higher elevation or frost pocket locations. *Betula papyrifera* or *Populus balsamifera ssp. trichocarpa* sometimes form a scattered subcanopy. There is usually a rich and well-developed shrub layer. Common shrubs include *Acer glabrum, Linnaea borealis, Rosa gymnocarpa, Rubus parviflorus*, and *Symphoricarpos albus*. The herbaceous layer is characterized by a diverse assemblage of moist-site forbs and ferns, including *Aralia nudicaulis, Athyrium filix-femina, Galium triflorum, Goodyera oblongifolia, Maianthemum stellatum, Orthilia secunda, Osmorhiza berteroi (= Osmorhiza chilensis), Senecio triangularis*, and *Tiarella trifoliata*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance generally occupies sites on benches, toeslopes or valley bottoms along mountain streams. Elevations where the alliance occurs range from 790-1410 m. Soils are typically very cobbly silt loams or sandy loam (Hansen et al. 1995). Water tables are generally within 1 m of the soil surface in the spring, but the soils are well-drained. Vegetation occurs within the maritime-influenced region of the northern Rocky Mountains.

Dynamics: The nominal species of this alliance is a long-lived, shade-tolerant conifer which can regenerate under a dense forest canopy. This type is often adjacent to drier *Pseudotsuga menziesii* or drier *Abies grandis* forests. Although *Abies grandis* is regarded as a climax species at such sites, repeated fire or disturbance can allow early-seral, but long-lived species, such as *Picea engelmannii* to codominate for many years. In mature, wet stands of this alliance, regeneration may be limited to rotting logs or stumps which allow germination above the wet forest floor.

DISTRIBUTION

Geographic Range: This alliance occurs in the Rocky Mountains of western Montana, Idaho and eastern Washington and eastern Oregon, possibly extending into British Columbia.

Nations: CA?, US
States/Provinces: BC?, ID, MT, OR, WA
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **><** *Abies grandis* Series (Cooper et al. 1987)

LOWER LEVEL UNITS

Associations:
- CEGL000280 *Abies grandis / Senecio triangularis* Riparian Forest
- CEGL000270 *Abies grandis / Athyrium filix-femina* Riparian Forest

- CEGL003441 *Pinus monticola / Deschampsia cespitosa* Riparian Forest

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Burns and Honkala 1990a, Cooper et al. 1987, Faber-Langendoen et al. 2017b, Hansen et al. 1991, Hansen et al. 1995

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1. Forest & Woodland
1.B.3.Nc. Rocky Mountain-Great Basin Montane Flooded & Swamp Forest
G506. Rocky Mountain-Great Basin Montane Riparian & Swamp Forest

A3757. Abies lasiocarpa - Picea engelmannii Swamp Forest Alliance

Type Concept Sentence: This alliance includes subalpine riparian or seep slope conifer forests characterized by the codominance of the conifers *Abies lasiocarpa* and *Picea engelmannii*. Other conifer species that may be present to codominant include *Picea engelmannii x glauca, Picea glauca, Pinus contorta*, and *Tsuga mertensiana* in the upper montane and subalpine areas of the Rocky Mountains. These forests occur in landscape positions where snowmelt moisture creates shallow water tables, seeps, or streamside flooding during much of the growing season.

OVERVIEW

Scientific Name: *Abies lasiocarpa - Picea engelmannii* Swamp Forest Alliance
Common Name (Translated Scientific Name): Subalpine Fir - Engelmann Spruce Swamp Forest Alliance
Colloquial Name: Subalpine Fir - Engelmann Spruce Swamp Forest

Type Concept: This alliance includes subalpine riparian or seep slope conifer forests characterized by the codominance of the conifers *Abies lasiocarpa* and *Picea engelmannii*. Other conifer species that may be present to codominant include *Picea engelmannii x glauca, Picea glauca, Pinus contorta*, and *Tsuga mertensiana*. Additional conifers may also be present in small amounts. The shrub layer is often well-developed, occurring as a dense ribbon along streams or where there is a break in the forest canopy. Important shrubs include *Alnus incana, Alnus viridis ssp. sinuata, Ledum glandulosum, Lonicera* spp., *Oplopanax horridus, Ribes lacustre, Salix* spp., *Vaccinium* spp., and *Xerophyllum tenax*. The herbaceous layer is typically lush and dominated by a mixture of mesophytic mostly forbs and some graminoids, including *Arnica cordifolia, Calamagrostis* spp., *Caltha leptosepala, Cardamine cordifolia, Carex* spp., *Deschampsia cespitosa, Dodecatheon jeffreyi, Equisetum* spp., *Ligusticum porteri, Ligusticum* spp., *Linnaea borealis, Mertensia ciliata, Mitella pentandra, Orthilia secunda, Oxypolis fendleri, Senecio triangularis, Senecio triangularis*, and *Streptopus amplexifolius*. These forests occur in the upper montane and subalpine areas of the Rocky Mountains in landscape positions where snowmelt moisture creates shallow water tables, seeps, or streamside flooding during much of the growing season. Sites include moist toeslopes, subirrigated stream terraces, alluvial benches, pond margins, wet meadows, or slopes and hillsides that are wet in spring and early summer. Soils often show evidence of podzolization processes and gleying due to seasonally saturated conditions, and tend to be acidic. They often have high organic matter content throughout the profile, but can vary from shallow to deep, and coarse to fine-textured.

Classification Comments: This alliance covers both closed-canopy and open-canopy woodlands and forests along riparian areas. One *Pinus flexilis* community type documented from Idaho and Wyoming is included in this alliance but there is no floristic or environmental information about it. We assume that it occurs at similar elevations as the other associations listed here.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Diagnostic characteristics of these forests are that the tree canopy is dominated by *Abies lasiocarpa* and/or *Picea engelmannii* as the predominant conifer in the tree regeneration layer, and they occur on sites saturated until late summer by snowmelt, occurring below seeps on lower hillslopes or in riparian habitats.

VEGETATION

Physiognomy and Structure: These are forests dominated by needle-leaved evergreen trees up to 30 m in height and of high cover (60-100%). A moderately dense shrub layer is usually present, dominated by ericaceous or, less commonly, cold-deciduous species. The herbaceous layer is dominated by perennial forbs, and herbaceous cover increases with increasing light availability and/or soil moisture.

Floristics: These forests are characterized by the codominance of *Abies lasiocarpa* and *Picea engelmannii* in the tree canopy, but *Pinus contorta* can be dominant on some sites. Other conifers can occur, typically as individuals of *Picea pungens, Larix occidentalis*, or *Pseudotsuga menziesii*. In the Northern Rockies, there is a well-developed shrub layer in these forests, although sometimes it can be patchy. *Alnus viridis ssp. sinuata* is the dominant shrub, averaging 35% cover, with lesser amounts of *Vaccinium membranaceum, Vaccinium scoparium*, or *Xerophyllum tenax*. The herbaceous layer in these Northern Rockies stands is not lush, and the most constant species are *Orthilia secunda* and *Arnica cordifolia*. In the Southern Rockies of Colorado and New Mexico, these forests do not have a significant layer of shrubs, but at high elevations *Vaccinium myrtillus* occasionally is present with 0-50% cover. *Salix drummondiana, Lonicera involucrata*, and *Ribes* species can be present, but with less than 10% cover. The herbaceous layer is a diverse mixture of mesophytic forbs and is often well over 80% in cover. Important species include *Cardamine cordifolia, Caltha leptosepala, Ligusticum porteri, Mertensia ciliata, Mitella pentandra, Oxypolis fendleri, Senecio triangularis*, and *Saxifraga odontoloma (= Micranthes odontoloma)*.

ENVIRONMENT & DYNAMICS

Environmental Description: These are semi-riparian or seep slope forests in upper montane and subalpine areas of the northern and central Rocky Mountains. Annual precipitation generally exceeds 75 cm in these forests in the Northern Rockies, snowpacks are typically deep and late-lying, and summers are cool. Summer frosts are characteristic in these habitats, due to cold-air drainage. Elevations range from 1525-2290 m in the northern Rocky Mountains, and from 2500-3480 m in Colorado and New Mexico. These forests occur in landscape positions where snowmelt moisture creates shallow water tables or seeps for a portion of the growing season. Sites include lower and middle slopes, stream terraces, benches, narrow valleys, or seep slopes. Slope aspects vary, but are often northerly, and can be flat to moderately steep (up to 55%). When these forests occur along streams, they are usually within 5 m of the stream channel and within 2 m of channel bankfull height (Kittel et al. 1999a). Soils often show evidence of podzolization processes and gleying due to seasonally saturated conditions. They often have high organic matter content throughout the profile. These forests are a specialized type within the *Abies - Picea* matrix type in subalpine areas of the Rocky Mountains, but may extend into montane habitats due to cold-air drainage and cool, moist microhabitats. Adjacent upland forests include *Picea engelmannii* or *Abies lasiocarpa* forests at the upper elevation boundary and *Pseudotsuga menziesii, Abies grandis*, or *Tsuga heterophylla - Thuja plicata* forests at lower elevations. Wetter sites often support herbaceous, cold-deciduous, or ericaceous riparian plant communities, or *Abies lasiocarpa* seasonally flooded forest communities.

Dynamics: *Abies lasiocarpa* temporarily flooded forests develop at sites with cool summer temperatures and wet soils. Tree growth is very slow in these habitats, and forests are rapidly colonized by much more rapidly growing shade-intolerant species, such as *Pinus contorta, Populus tremuloides*, or *Alnus viridis ssp. sinuata*, following fire, clearcut logging, or windthrow disturbance. Extensive windthrow is not common due to the relatively sheltered topographic positions. Removal of the tree layer at these sites can lead to rising water tables and expansion of anaerobic wetland soils, precluding recolonization by trees.

DISTRIBUTION

Geographic Range: This alliance is found throughout the Rocky Mountains from eastern Oregon and Washington, southern British Columbia and Alberta, Montana, Wyoming, Colorado, Utah, New Mexico, the Sky Islands of Arizona, as well as mountain ranges in Nevada.

Nations: CA, US
States/Provinces: AB, AZ, BC, CO, ID, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** *Abies lasiocarpa - Picea engelmannii* Series (Johnston 1987)
- **><** *Abies lasiocarpa-Picea engelmannii* Series (Johnston 1987)
- **><** Engelmann Spruce - Subalpine Fir: 206 (Eyre 1980)
- **><** Western Needleleaf Forests: 15: Western Spruce-Fir Forest (*Picea-Abies*) (Küchler 1964)
- **><** Western Needleleaf Forests: 21: Southwestern Spruce-Fir Forest (*Picea-Abies*) (Küchler 1964)

LOWER LEVEL UNITS

Associations:
- CEGL002677 *Picea engelmannii / Cornus sericea* Swamp Woodland
- CEGL000327 *Abies lasiocarpa - Picea engelmannii / Salix drummondiana* Swamp Forest

- CEGL000297 *Abies lasiocarpa - Picea engelmannii / Alnus viridis ssp. sinuata* Swamp Forest
- CEGL000361 *Picea engelmannii / Eleocharis quinqueflora* Swamp Woodland
- CEGL002663 *Abies lasiocarpa - Picea engelmannii / Mertensia ciliata* Swamp Forest
- CEGL000376 *Picea engelmannii / Senecio triangularis* Swamp Forest
- CEGL000357 *Picea engelmannii / Caltha leptosepala* Swamp Forest
- CEGL000339 *Abies lasiocarpa / Trautvetteria caroliniensis* Swamp Forest
- CEGL000359 *Picea engelmannii / Carex angustata* Swamp Forest
- CEGL000302 *Abies lasiocarpa / Caltha leptosepala ssp. howellii* Swamp Forest
- CEGL000336 *Abies lasiocarpa - Picea engelmannii / Streptopus amplexifolius* Swamp Forest
- CEGL000511 *Tsuga mertensiana / Streptopus amplexifolius* Swamp Forest
- CEGL000322 *Abies lasiocarpa - Picea engelmannii / Oplopanax horridus* Swamp Forest
- CEGL002630 *Picea engelmannii / Carex scopulorum var. prionophylla* Swamp Woodland
- CEGL000314 *Abies lasiocarpa / Ledum glandulosum* Swamp Forest
- CEGL002636 *Abies lasiocarpa / Carex aquatilis* Swamp Forest
- CEGL000367 *Picea engelmannii - Populus angustifolia / Heracleum maximum* Swamp Forest
- CEGL000296 *Abies lasiocarpa - Picea engelmannii / Alnus incana* Swamp Forest
- CEGL000812 *Pinus flexilis / Dasiphora fruticosa ssp. floribunda / Distichlis spicata* Swamp Woodland
- CEGL002678 *Picea engelmannii / Calamagrostis canadensis* Swamp Forest
- CEGL005927 *Picea engelmannii / Equisetum arvense* Swamp Forest
- CEGL005843 *Picea engelmannii / Salix drummondiana* Swamp Woodland
- CEGL005446 *Picea engelmannii / Carex scopulorum* Swamp Woodland
- CEGL000414 *Picea (engelmannii x glauca, engelmannii) / Packera streptanthifolia* Swamp Forest
- CEGL000300 *Abies lasiocarpa - Picea engelmannii / Calamagrostis canadensis* Swamp Forest

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Alexander 1981, Baker 1986a, Baker 1989b, Clausnitzer and Zamora 1987, Cooper and Cottrell 1990, Cooper et al. 1987, DeVelice and Ludwig 1983a, DeVelice et al. 1986, Eyre 1980, Faber-Langendoen et al. 2017b, Hansen et al. 1991, Hansen et al. 1995, Hess 1981, Hess and Alexander 1986, Johnson and Clausnitzer 1992, Johnson and Simon 1987, Johnston 1987, Kettler and McMullen 1996, Kittel and Lederer 1993, Kittel et al. 1996, Kittel et al. 1999a, Komarkova et al. 1988a, Komarkova et al. 1988b, Kovalchik 1993, Küchler 1964, Mauk and Henderson 1984, Padgett et al. 1988b, Peet 1975, Peet 1981, Pfister et al. 1977, Richard et al. 1996, Steele et al. 1981, Steele et al. 1983, Steen and Dix 1974, Terwilliger et al. 1979a, Wasser and Hess 1982, Whipple 1975, Williams and Smith 1990, Williams et al. 1990b, Youngblood and Mauk 1985

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1. Forest & Woodland
1.B.3.Nc. Rocky Mountain-Great Basin Montane Flooded & Swamp Forest
G506. Rocky Mountain-Great Basin Montane Riparian & Swamp Forest

A4154. Acer negundo - Alnus incana ssp. tenuifolia - Cornus sericea Riparian Woodland Alliance

Type Concept Sentence:

OVERVIEW

Scientific Name: *Acer negundo - Alnus incana ssp. tenuifolia - Cornus sericea* Riparian Woodland Alliance
Common Name (Translated Scientific Name): Box-elder - Thinleaf Alder - Red-osier Dogwood Riparian Woodland Alliance
Colloquial Name: Box-elder - Thinleaf Alder - Red-osier Dogwood Riparian Woodland

Type Concept:

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics:

VEGETATION

Physiognomy and Structure:

Floristics:

ENVIRONMENT & DYNAMICS

Environmental Description:

Dynamics:

DISTRIBUTION

Geographic Range:

Nations: CA, US
States/Provinces: AB, AZ, CO, ID, MT, NM, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL000627 *Acer negundo - Populus angustifolia / Cornus sericea* Riparian Forest
- CEGL000936 *Acer negundo / Betula occidentalis* Riparian Woodland
- CEGL002342 *Acer negundo - Ostrya knowltonii* Riparian Woodland
- CEGL000626 *Acer negundo / Equisetum arvense* Riparian Forest
- CEGL005383 *Acer negundo - Alnus oblongifolia* Riparian Forest
- CEGL005940 *Acer negundo - Alnus incana ssp. tenuifolia* Riparian Forest
- CEGL002750 *Acer negundo / Rhus trilobata* Riparian Woodland
- CEGL002797 *Acer negundo / Quercus gambelii* Riparian Woodland
- CEGL003971 *Ostrya knowltonii* Riparian Woodland
- CEGL000625 *Acer negundo / Cornus sericea* Riparian Forest

AUTHORSHIP

Primary Concept Source: G. Kittel
Author of Description:
Acknowledgments:

REFERENCES

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1. Forest & Woodland
1.B.3.Nc. Rocky Mountain-Great Basin Montane Flooded & Swamp Forest
G506. Rocky Mountain-Great Basin Montane Riparian & Swamp Forest

A3761. Picea pungens Riparian Forest Alliance

Type Concept Sentence: This alliance is characterized by the dominance of *Picea pungens* in the tree canopy. Common associates include *Abies concolor, Abies lasiocarpa, Picea engelmannii, Pinus contorta, Pinus ponderosa*, and *Pseudotsuga menziesii* (which may replace *Picea pungens*). *Populus angustifolia* is the most common deciduous tree species, although *Populus tremuloides* may persist as a seral species on well-drained sites. This riparian woodland alliance is found at middle elevations (from 1900-2900 m) of the central and southern Rocky Mountains and the Colorado Plateau. Stands typically occur in narrow or V-shaped valleys and canyons subject to cold-air drainage and limited sunlight. They occupy streambanks, terraces, narrow floodplains or benches, and subirrigated toeslopes; stream gradients are often steep. These sites can be subject to spring flooding, and usually water tables are within 1 m of the soil surface even late in the growing season.

OVERVIEW

Scientific Name: *Picea pungens* Riparian Forest Alliance

Common Name (Translated Scientific Name): Blue Spruce Riparian Forest Alliance
Colloquial Name: Blue Spruce Riparian Forest

Type Concept: This alliance is characterized by the dominance of *Picea pungens* in the tree canopy. Other conifers are usually present in these stands, depending upon geographic location, site moisture, and stand history. Common associates include *Abies concolor, Abies lasiocarpa, Picea engelmannii, Pinus contorta, Pinus ponderosa*, and *Pseudotsuga menziesii* (which may replace *Picea pungens*). *Populus angustifolia* is the most commonly present deciduous tree species, although *Populus tremuloides* may persist as a seral species on well-drained sites of this alliance. A shrub layer is often present but many stands lack a shrub layer. Common shrub species include *Alnus incana, Betula occidentalis, Cornus sericea, Rosa woodsii*, and several species of *Salix*. Other shrubs that may be present include *Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda), Lonicera involucrata*, and *Acer glabrum*. Because of favorable soil moisture, the herbaceous layer is usually a luxuriant mixture of forbs and graminoids, including *Calamagrostis canadensis, Carex siccata (= Carex foenea), Conioselinum scopulorum, Equisetum arvense, Fragaria virginiana, Heracleum sphondylium, Maianthemum stellatum, Mertensia ciliata*, and *Rudbeckia laciniata*. The herbaceous layer can have very high cover in some stands, but also may be very sparse. This riparian woodland alliance is found at middle elevations (from 1900-2900 m) of the central and southern Rocky Mountains and the Colorado Plateau region. Stands typically occur in narrow, or V-shaped, valleys and canyons subject to cold-air drainage and limited sunlight. They occupy streambanks, terraces, narrow floodplains or benches, and subirrigated toeslopes; stream gradients are often steep. These sites can be subject to spring flooding, and usually water tables are within 1 m of the soil surface even late in the growing season. The soils are somewhat variable, often with signs of mottling.

Classification Comments: This alliance is for conifer-dominated stands that occur in riparian zones on seasonally, intermittently or temporarily flooded/saturated soils.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Diagnostic of this woodland alliance is the dominance of *Picea pungens* or *Pseudotsuga menziesii* with 50% relative cover occurring on sites that have surface water for brief periods during the growing season.

VEGETATION

Physiognomy and Structure: These woodlands are of low to medium stature (10-25 m) and dominated by needle-leaved evergreen trees. Cold-deciduous trees are sometimes mixed in these stands. These communities often have cold-deciduous shrub layers of moderate to dense cover (20-60%). The herbaceous layer is usually well-developed and dominated by mesophytic forbs and graminoids less than 1 m in height.

Floristics: These riparian woodlands are characterized by the dominance of *Picea pungens* and/or *Pseudotsuga menziesii* with occasional *Pinus ponderosa* or *Pinus contorta* trees in the canopy. Other conifers are usually present in these stands, depending upon geographic location, site moisture, and stand history. Common associates include *Abies concolor, Abies lasiocarpa, Picea engelmannii, Pinus contorta, Pinus ponderosa*, and *Pseudotsuga menziesii*. The presence of these conifers is usually associated with raised microsites created by root-crown hummocks and windthrow mounds. *Populus angustifolia* is the most commonly present deciduous tree species, although *Populus tremuloides* may persist as a seral species on well-drained sites of this alliance. There is often an abundant tall-shrub layer, with cover ranging from 20-60%, dominated by one or several cold-deciduous species. The most common species include *Alnus incana, Betula occidentalis, Cornus sericea, Rosa woodsii*, and willow species, including *Salix exigua, Salix drummondiana, Salix monticola*, and *Salix bebbiana*. Other shrubs that may be present include *Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda), Lonicera involucrata*, and *Acer glabrum*. Due to favorable soil moisture, the herbaceous layer is usually a luxuriant mixture of forbs and graminoids, including *Calamagrostis canadensis, Carex siccata (= Carex foenea), Conioselinum scopulorum, Equisetum arvense, Fragaria virginiana, Heracleum sphondylium, Maianthemum stellatum, Mertensia ciliata*, and *Rudbeckia laciniata*. The herbaceous layer can have very high cover in some stands.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance is found at middle elevations (from 1900-2900 m) of the central and southern Rocky Mountains and the Colorado Plateau region. Precipitation averages 46-60 cm annually, with the majority falling as growing-season rainfall. The temperature regime is continental and winters are moderately severe. Stands of this alliance typically occur in narrow, or V-shaped, valleys and canyons subject to cold-air drainage and limited sunlight. They occupy streambanks, terraces, narrow floodplains or benches, and subirrigated toeslopes; stream gradients are often steep. These sites can be subject to spring flooding, and usually water tables are within 1 m of the soil surface even late in the growing season. The soils are somewhat variable, but are primarily derived from glacial or alluvially deposited materials. They range from shallow silty loams over cobbles and gravel, to deep

dark-colored clay loams with signs of mottling. The percentage of coarse fragments increases with soil depth, and most sites are well-drained. The pH is neutral to slightly alkaline.

Stands of these riparian woodlands are found within *Pinus ponderosa* or *Pseudotsuga menziesii* montane upland forests. Adjacent vegetation is usually *Pinus ponderosa - Pseudotsuga menziesii* forests at the upslope margin and herbaceous or other woody riparian communities where this vegetation grades into wetter streamside sites.

Dynamics: *Picea pungens* is a slow-growing, long-lived tree which regenerates from seed (Burns and Honkala 1990a). Seedlings are shallow-rooted and require perennially moist soils for establishment and optimal growth. *Picea pungens* is intermediate in shade tolerance, being somewhat more tolerant than *Pinus ponderosa* or *Pseudotsuga menziesii*, and less tolerant than *Abies lasiocarpa* or *Picea engelmannii*. It forms climax stands in the subhumid stands of the southern Rocky Mountains, but may occupy a seral position in more mesic northern stands (Burns and Honkala 1990a). In deep, narrow canyons with swift-moving streams and narrow floodplains and benches, *Picea pungens* appears to be a climax riparian species, and will remain on these sites until removed or damaged by a catastrophic flood (Kittel et al. 1999a). It is common for these forests to be heavily disturbed by grazing or fire, as well as recreational uses, such as campgrounds, fishing access, home building, and other activities.

DISTRIBUTION

Geographic Range: This alliance is found in the Rocky Mountains in Colorado, Wyoming, Utah, Idaho, and New Mexico and the highlands of Arizona.

Nations: US
States/Provinces: AZ, CO, ID, NM, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **><** *Picea pungens* Series (Moir and Ludwig 1979)
- **><** *Picea pungens* Series (Youngblood and Mauk 1985)
- **><** *Picea pungens* Series (DeVelice et al. 1986)
- **><** *Picea pungens* Series (Alexander et al. 1987)
- **><** *Picea pungens* Series (Fitzhugh et al. 1987)
- **><** *Picea pungens* Series (Larson and Moir 1987)
- **><** *Pseudotsuga menziesii/Cornus sericea* Habitat Type (Hansen et al. 1995)
- **><** Blue Spruce: 216 (Eyre 1980)

LOWER LEVEL UNITS

Associations:
- CEGL000396 *Picea pungens / Dasiphora fruticosa ssp. floribunda* Riparian Woodland
- CEGL000894 *Picea pungens / Alnus incana* Riparian Woodland
- CEGL000389 *Picea pungens / Equisetum arvense* Riparian Woodland
- CEGL002637 *Picea pungens / Betula occidentalis* Riparian Woodland
- CEGL000899 *Pseudotsuga menziesii / Cornus sericea* Riparian Woodland
- CEGL002639 *Pseudotsuga menziesii / Betula occidentalis* Riparian Woodland
- CEGL000388 *Picea pungens / Cornus sericea* Riparian Woodland

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Alexander et al. 1987, Baker 1986a, Baker 1989b, Burns and Honkala 1990a, Cooper and Cottrell 1990, DeVelice and Ludwig 1983a, DeVelice et al. 1986, Eyre 1980, Faber-Langendoen et al. 2017b, Fitzhugh et al. 1987, Hansen et al. 1990, Hansen et al. 1991, Hansen et al. 1995, Hess and Wasser 1982, Johnston 1984, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1995, Kittel et al. 1996, Kittel et al. 1997a, Kittel et al. 1999a, Komarkova et al. 1988a, Larson and Moir 1987, Moir and Ludwig 1979, Padgett et al. 1988b, Padgett et al. 1989, Richard et al. 1996, Youngblood and Mauk 1985

1. Forest & Woodland
1.B.3.Nc. Rocky Mountain-Great Basin Montane Flooded & Swamp Forest
G506. Rocky Mountain-Great Basin Montane Riparian & Swamp Forest

A3758. Pinus contorta var. murrayana - Pinus contorta var. latifolia Swamp Forest Alliance

Type Concept Sentence: This riparian woodland alliance is characterized by *Pinus contorta*. Other conifers sometimes present may include *Abies grandis, Abies lasiocarpa, Abies magnifica var. shastensis, Picea engelmannii, Pinus flexilis*, or *Tsuga mertensiana*. This forest alliance occurs in upper montane riparian or wetland areas in the Rocky Mountains and Sierra Nevada. Sites are flat, wet, relatively cold floodplain and basin landforms. Stands occur in forested margins of meadows, lake or forest basins, and along valley bottoms. In all cases, the sites are flat to gently sloping.

OVERVIEW

Scientific Name: *Pinus contorta var. murrayana - Pinus contorta var. latifolia* Swamp Forest Alliance
Common Name (Translated Scientific Name): Sierra Lodgepole Pine - Tall Lodgepole Pine Swamp Forest Alliance
Colloquial Name: Sierra Lodgepole Pine - Tall Lodgepole Pine Swamp Forest

Type Concept: This riparian woodland alliance is characterized by *Pinus contorta*. Other conifers sometimes present may include *Abies grandis, Abies lasiocarpa, Abies magnifica var. shastensis, Picea engelmannii, Pinus flexilis*, or *Tsuga mertensiana*. The short-shrub layer may be present with *Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda), Ledum glandulosum, Lonicera caerulea, Spiraea douglasii, Vaccinium cespitosum*, and/or *Vaccinium uliginosum*. Herbaceous species are not abundant in shrubby stands. Associate species often present can include *Carex angustata, Fragaria* spp., *Geum macrophyllum, Ligusticum grayi, Maianthemum stellatum, Thalictrum occidentale*, and *Trifolium longipes*. Some stands have a lush herbaceous layer is dominated by tall graminoids such as *Calamagrostis canadensis*. This forest alliance occurs in upper montane riparian or wetland areas in the Rocky Mountains and Sierra Nevada. Sites are flat, wet, relatively cold floodplain and basin landforms. Stands occur in forested margins of meadows, lake or forest basins, and along valley bottoms. In all cases, the sites are flat to gently sloping.

Classification Comments: *Pinus contorta* is a poor competitor and occupies both extremes on the moisture gradient. This alliance covers the non-bog, swamp forests types dominated by *Pinus contorta*.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: The dominance of *Pinus contorta* in the moderately dense to dense tree canopy without significant regeneration of other tree species, and the extended flooding and high water tables during the growing season.

VEGETATION

Physiognomy and Structure: The overstory tree canopy is dominated by evergreen needle-leaved trees. A short-shrub layer or an herbaceous layer may be present.

Floristics: *Pinus contorta* is the only tree present in the reported stands, and is the only species represented in the regeneration layer. Other conifers sometimes present may include *Abies grandis, Abies lasiocarpa, Abies magnifica var. shastensis, Picea engelmannii, Pinus flexilis*, or *Tsuga mertensiana*. The shrub layer may include *Arctostaphylos uva-ursi, Ribes* spp., *Rosa woodsii, Spiraea douglasii, Vaccinium boreale*, and several species of *Salix*, including *Salix boothii, Salix geyeriana*, and *Salix lemmonii*. The herbaceous layer can be forb- or graminoid-dominated. Graminoids include *Calamagrostis canadensis, Carex angustata, Carex angustata, Carex aquatilis, Danthonia californica, Deschampsia cespitosa, Elymus glaucus, Juncus balticus*, and *Koeleria macrantha*. Forb species include *Achillea millefolium, Antennaria* spp., *Dodecatheon jeffreyi, Fragaria virginiana, Galium boreale, Geum macrophyllum, Maianthemum stellatum, Mimulus primuloides, Packera pseudaurea (= Senecio pseudaureus), Potentilla* spp., *Symphyotrichum spathulatum (= Aster occidentalis), Thalictrum occidentale*, and *Trifolium longipes*.

ENVIRONMENT & DYNAMICS

Environmental Description: Sites include edges of meadows, streamside terraces, lakeshores, and flat to slightly concave drainages and basins. Valleys where it occurs are broad, low-gradient, and usually flat-bottomed. Soils are silts, sandy loams and silty clay loams. Wetter stands will have a significant organic component, sometime with a peat layer (Kovalchik 1987). The soil surface will often be slightly flooded at snowmelt, but by late summer the water table will drop to >1 m depth (Kovalchik 1987).

Dynamics:

DISTRIBUTION

Geographic Range: This alliance occurs in the Sierra Nevada of California and Nevada, and the Rocky Mountains of eastern Oregon, Idaho, Alberta, Montana, Wyoming, Colorado, and Utah.

Nations: CA, US
States/Provinces: AB, CA, CO, ID, MT, NV, OR, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** *Picea engelmannii* Forested Wetlands (Chappell et al. 1997)
- **><** Aspen: 217 (Eyre 1980)
- **><** Lodgepole Pine: 218 (Eyre 1980)

LOWER LEVEL UNITS

Associations:
- CEGL000157 *Pinus contorta var. murrayana - Populus tremuloides / Spiraea douglasii* Swamp Forest
- CEGL000147 *Pinus contorta / Deschampsia cespitosa* Swamp Forest
- CEGL005929 *Pinus contorta / Cornus sericea* Swamp Woodland
- CEGL000138 *Pinus contorta / Calamagrostis canadensis* Swamp Forest
- CEGL000140 *Pinus contorta / Carex (aquatilis, angustata)* Swamp Woodland

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Chappell et al. 1997, Crowe and Clausnitzer 1997, Eyre 1980, Faber-Langendoen et al. 2017b, Hopkins 1979a, Kovalchik 1987, Volland 1976

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1. Forest & Woodland
1.B.3.Nc. Rocky Mountain-Great Basin Montane Flooded & Swamp Forest
G506. Rocky Mountain-Great Basin Montane Riparian & Swamp Forest

A3797. Pinus ponderosa - Juniperus scopulorum - Abies concolor Riparian Woodland Alliance

Type Concept Sentence: This alliance consists of conifer-dominated canopies of low-elevation riparian areas characterized by an open canopy of the conifers *Pinus ponderosa, Juniperus scopulorum*, and/or *Abies concolor*. These woodlands can occur as broad, extensive stands on wider floodplain terraces or as narrow, long ribbons. They are found throughout the Rocky Mountains, south into Arizona and New Mexico, and west into eastern mountain valleys of Washington and Oregon.

OVERVIEW

Scientific Name: *Pinus ponderosa - Juniperus scopulorum - Abies concolor* Riparian Woodland Alliance
Common Name (Translated Scientific Name): Ponderosa Pine - Rocky Mountain Juniper - White Fir Riparian Woodland Alliance
Colloquial Name: Ponderosa Pine - Rocky Mountain Juniper - White Fir Riparian Woodland

Type Concept: Vegetation included in this riparian alliance is characterized by an open canopy of conifers. Dominant species include *Pinus ponderosa, Juniperus scopulorum*, and/or *Abies concolor*. Other conifer or deciduous trees may be present but the stand remains characterized by conifer dominance. Typically a tall-shrub layer is present, with species such as *Alnus* spp., *Betula occidentalis, Cornus sericea, Crataegus douglasii, Juglans major, Prunus virginiana, Quercus garryana*, or *Salix* spp. The herbaceous layer can be dominated by either graminoids or forbs. This alliance occurs on low-elevation streams in valleys that vary from V-shaped to trough-shaped or broad and flat, and stream gradients are typically moderate. These woodlands can occur as broad, extensive stands on wider floodplain terraces or as narrow, long ribbons. Sites include mountain valleys, foothill ravines, terraces and alluvial benches of major streams and rivers. In southern Arizona, stands occur along smaller perennial streams and washes. Soils are cobbly, coarse-textured and derived from alluvium. This alliance is found throughout the Rocky Mountains, south into Arizona and New Mexico, and west into the Columbia Basin of Washington and Oregon.

Classification Comments: Conifer-dominated riparian woodlands tend to be in areas of lower elevation than is typical for the conifer species, or in wide valley bottoms.

Internal Comments: GMK 8-14: This alliance may be too broad geographically and floristically. It may make sense to split north and south along floristic lines. However, there are few conifer only-dominated riparian areas at low elevations, so it may simply be a convenience to have them in one alliance, especially if many of the associations share broader distributed species such as *Pinus ponderosa*.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Diagnostic of this semi-riparian alliance are woodland stands dominated by *Pinus ponderosa, Juniperus scopulorum*, or *Abies concolor* with brief seasonal flooding during the growing season.

VEGETATION

Physiognomy and Structure: The tree canopy is dominated by a 5- to 10-m tall coniferous layer. The canopy is relatively open with an understory of widely scattered to dense shrubs. The tall-shrub stratum is moderately dense with 10-25% cover.

Floristics: These are riparian woodlands dominated by conifer trees. Dominant tree species include *Pinus ponderosa, Juniperus scopulorum*, and/or *Abies concolor*. Other trees present may include *Acer negundo, Juniperus deppeana, Pinus discolor, Pinus edulis, Populus angustifolia, Populus balsamifera ssp. trichocarpa, Pseudotsuga menziesii*, and *Quercus* spp. Some stands contain no shrub layers, others have luxurious growth of shrubs including *Alnus incana, Alnus rhombifolia, Amelanchier alnifolia, Betula occidentalis, Cornus sericea, Crataegus douglasii, Frangula betulifolia (= Rhamnus betulifolia), Holodiscus discolor, Juglans major, Physocarpus malvaceus, Prunus virginiana, Quercus garryana, Rhus aromatica, Ribes* spp., *Rosa woodsii, Salix* spp., *Solanum dulcamara, Symphoricarpos albus, Symphoricarpos occidentalis, Toxicodendron rydbergii* and/or *Vitis arizonica*. Herbaceous undergrowth can be absent or, if present, may occur both beneath the tree canopy or on exposed point bars. Native graminoids include *Bromus ciliatus var. richardsonii (= Bromus richardsonii), Panicum bulbosum, Panicum virgatum, Pascopyrum smithii*, and *Piptatheropsis micrantha (= Oryzopsis micrantha)*. Forbs can include *Achillea millefolium, Apocynum androsaemifolium, Galium boreale, Galium mexicanum ssp. asperrimum (= Galium asperrimum), Geranium caespitosum, Glycyrrhiza lepidota, Maianthemum stellatum, Potentilla* spp., Pteridium aquilinum, Thalictrum fendleri, and the fern ally *Equisetum arvense*.

ENVIRONMENT & DYNAMICS

Environmental Description: These are riparian streamside stands that occur on both wide floodplains and narrow valleys with little floodplain development. It can form extensive stands on older alluvial terraces of floodplains of major streams or rivers and others are narrow bands in V-shaped canyons. These woodlands are intolerant of frequent and prolonged flooding; however, they are tolerant of periodic flooding and high water tables. Typically, the soils are shallow, derived from coarse alluvial substrates. Soil textures are sandy clay loams to sandy loams with a high percentage of coarse fragments.

Dynamics: Flooding events that create bare mineral seedbeds on newly created alluvial terraces may be necessary for reproduction of conifers in these riparian sites (Muldavin et al. 1996), as grasses and forbs may compete with conifer seedlings for space and water. Conifer species grow within the flood zone of desert stream reaches, where they are able to germinate and grow on fresh, moist alluvium in the absence of competing grasses (Muldavin et al. 1996).

DISTRIBUTION

Geographic Range: This alliance is found on lower foothills and canyon bottoms of Arizona, New Mexico, Utah, Colorado, Idaho, eastern Washington, eastern Oregon, Wyoming and Montana.

Nations: US
States/Provinces: AZ, CO, ID, MT, NM, OR, UT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **><** *Pinus ponderosa* Series (Muldavin et al. 1996)
- **><** Ponderosa Pine Series (Crowe and Clausnitzer 1997)

LOWER LEVEL UNITS

Associations:

- CEGL000853 *Pinus ponderosa / Cornus sericea* Riparian Woodland
- CEGL002766 *Pinus ponderosa* Riparian Woodland
- CEGL002638 *Pinus ponderosa / Alnus incana* Riparian Woodland
- CEGL002777 *Juniperus scopulorum* Riparian Woodland [Placeholder]
- CEGL002754 *Pseudotsuga menziesii / Acer negundo* Riparian Woodland
- CEGL005367 *Abies concolor - Acer negundo / Alnus incana ssp. tenuifolia* Riparian Forest
- CEGL005384 *Pinus ponderosa / Forestiera pubescens* Riparian Woodland
- CEGL000866 *Pinus ponderosa / Symphoricarpos albus* Riparian Woodland
- CEGL000855 *Pinus ponderosa / Crataegus douglasii* Riparian Woodland
- CEGL000746 *Juniperus scopulorum / Cornus sericea* Riparian Woodland

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Bassett et al. 1987, Billings 1954, Cronquist et al. 1972, Crowe and Clausnitzer 1997, Evans 1989a, Faber-Langendoen et al. 2017b, Hansen et al. 1991, Hansen et al. 1995, Kauffman et al. 1985, Kittel et al. 1994, Kittel et al. 1996, Kittel et al. 1997a, Kittel et al. 1999a, Mack 1988, Maxey and Eakin 1949, Muldavin et al. 1996, ORNHP unpubl. data, Reid et al. 1994, Simpson 1876, Welsh et al. 1987

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1. Forest & Woodland
1.B.3.Nc. Rocky Mountain-Great Basin Montane Flooded & Swamp Forest
G506. Rocky Mountain-Great Basin Montane Riparian & Swamp Forest

A3759. Populus angustifolia Riparian Forest Alliance

Type Concept Sentence: This alliance consists of riparian woodlands dominated by *Populus angustifolia* alone or codominated with other deciduous or coniferous trees. It occurs on narrow stream terraces and large floodplains in the Rocky Mountains of Montana, Idaho, Wyoming, Utah, Colorado and New Mexico. It is also found in the mountains of eastern Oregon, Nevada, California's Sierra Nevada, and the highlands of Arizona. Elevations range from 1200-2750 m (4000-9000 feet).

OVERVIEW

Scientific Name: *Populus angustifolia* Riparian Forest Alliance
Common Name (Translated Scientific Name): Narrowleaf Cottonwood Riparian Forest Alliance
Colloquial Name: Narrowleaf Cottonwood Riparian Forest

Type Concept: This alliance consists of riparian forests and woodlands dominated by *Populus angustifolia* alone or codominated with other deciduous or coniferous trees. Due to the broad north to south geographic scope of this alliance, as well as its elevational range from foothill to subalpine, many other tree species may be present within stands. These include *Abies lasiocarpa, Acer grandidentatum, Acer negundo, Juniperus scopulorum, Picea engelmannii, Picea pungens, Pinus ponderosa, Populus balsamifera, Populus deltoides, Pseudotsuga menziesii*, and *Salix amygdaloides*. The shrub layer is dominated by *Acer glabrum, Alnus incana, Alnus oblongifolia, Amelanchier alnifolia, Amelanchier utahensis, Artemisia tridentata, Brickellia californica, Cornus sericea, Crataegus rivularis, Juniperus deppeana, Lonicera involucrata, Quercus gambelii, Rosa woodsii, Salix* spp., and/or *Symphoricarpos occidentalis*. Woody vines may be present, such as *Clematis ligusticifolia, Humulus lupulus var. lupuloides (= Humulus americanus), Parthenocissus quinquefolia (= Parthenocissus inserta)*, and *Vitis arizonica*. The herbaceous undergrowth is often dominated by non-native hay grasses and little forb cover. Common forbs that can be abundant include *Achillea millefolium, Heracleum maximum (= Heracleum lanatum), Maianthemum stellatum, Osmorhiza depauperata*, and/or *Thalictrum fendleri*. This alliance occurs in the Rocky Mountains of Montana, Idaho, Wyoming, Utah, Colorado and New Mexico. It is also found in the mountains of eastern Oregon, Nevada, California's Sierra Nevada, and the highlands of Arizona. Stands occur on narrow stream terraces and large floodplains. Elevations range from 1200-2750 m (4000-9000 feet). Microtopography is often smooth to gently undulating with slopes between 2 and 5%. Stands generally occur within 1 m vertical distance of flooding high water mark, but can also occur on higher terraces, up to 3 m above the channel. Water tables fluctuate seasonally, subirrigating soils in spring, but often dropping and drying soils by late August. Soils are typically well-drained with large amounts of coarse fragments in the subsurface horizons. The soil textures are fine sandy loams, clay loams, silty clay loams, and silty clay, sometimes with buried thin organic layers. Stands have also been documented on pure sand, where streams bisected sand dunes.

Classification Comments: While the geographic scope is large for this alliance, the constancy of canopy *Populus angustifolia* and the riparian/ streamside/ alluvial environment maintain a surprisingly consistent set of species composition throughout, even though there are regional expressions, these are variations on a theme. One reviewer suggested geographic separation for these regional expressions. Gwen Kittel developed these 4 alliance groupings, attempting geographic separation: Suballiance 1. *Populus angustifolia - Pinus pungens - Salix irrorata* Woodland Suballiance (Central - NV, UT, CO, OR); Suballiance 2. *Populus angustifolia - Alnus oblongifolia - Acer grandidentatum* Woodland Suballiance (Northern - Canada, MT, WY, ID); Suballiance 3. *Populus angustifolia - Juniperus deppeana - Forestiera pubescens* Woodland Suballiance (Southern - NM, AZ, CA, TX); and Suballiance 4. *Populus angustifolia - Pinus ponderosa - Cornus sericea* Woodland Suballiance (Throughout).

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Diagnostic of this alliance is the dominance of *Populus angustifolia* in the tree canopy.

VEGETATION

Physiognomy and Structure: The tree canopy is dominated by broad-leaved deciduous (10-15 m tall) trees. The canopy consists of overlapping crowns generally forming 25-100% cover. The tree subcanopy is minor, dominated by 5- to 10-m tall trees with 10-25% cover. The tall- and short-shrub layers range from sparse to moderate cover (10-70%). The herbaceous layer typically is dominated by perennial forbs.

Floristics: Associations within this alliance are defined as cold-deciduous, temporarily flooded woodlands. The tree canopy is typically open and dominated by *Populus angustifolia* with 20-70% cover. Other trees can include *Acer negundo, Juniperus scopulorum, Picea pungens, Pinus ponderosa, Picea engelmannii*, and *Salix amygdaloides* at lower elevation sites within the Rocky Mountains and *Populus balsamifera, Populus deltoides*, or *Acer grandidentatum* in the northern areas. The shrub layer is can be very dense and diverse with 10-80% cover of *Acer glabrum, Alnus incana, Amelanchier utahensis, Cornus sericea, Crataegus rivularis, Lonicera involucrata, Quercus gambelii, Rosa woodsii, Salix* spp., or *Symphoricarpos occidentalis*. The shrub layer in Arizona and New Mexico stands also consists of *Juniperus deppeana, Brickellia californica*, and *Alnus oblongifolia*. The forb layer includes 0-50% cover of *Achillea millefolium, Heracleum maximum (= Heracleum lanatum), Maianthemum stellatum*, and *Osmorhiza depauperata*. Graminoid cover is insignificant. In New Mexico and Arizona, a significant vine component is present, with cover of 25-60%, consisting mainly of *Clematis ligusticifolia, Humulus lupulus var. lupuloides (= Humulus americanus), Parthenocissus quinquefolia (= Parthenocissus inserta)*, and *Vitis arizonica*.

ENVIRONMENT & DYNAMICS

Environmental Description: Vegetation types in this alliance occur on terraces and floodplains immediately adjacent to streams. Elevations range from 1350 m in the southwest to 2400 m in Colorado. Microtopography is often smooth to gently undulating with slopes between 2 and 5%. Stands generally occur within 1 m of the high water mark, but can also occur on higher terraces, up to 3 m above the channel. Water tables are rarely within 50 cm of the soil surface, and stands are as much as 3-4 m above the stream level (Hansen et al. 1995). Soil pH levels range from slightly acidic to moderately alkaline (pH 6.2-8.4). Soils are typically well-drained with large amounts of coarse fragments in the subsurface horizons. The soil textures are fine sandy loams, clay loams, silty clay loams, and silty clay. Soils are frequently reworked by floods and beavers. Peat deposits, if present, are thin.

Dynamics: Cottonwood forests grow within an alluvial environment that is continually changing due to the ebb and flow of the river. Riparian vegetation is constantly being "re-set" by flooding disturbance. Cottonwood communities are early-, mid- or late-seral, depending on the age class of the trees and the associated species of the stand. Mature cottonwood stands do not regenerate in place, but regenerate by "moving" up and down a river reach. Over time, a healthy riparian area supports all stages of cottonwood communities. The process of cottonwood regeneration is well-documented. Periodic flooding events can leave sandbars of bare, mineral substrate. Cottonwood seedlings germinate and become established on newly-deposited, moist sandbars. In the absence of large floods in subsequent years, seedlings begin to trap sediment. In time, the sediment accumulates and the sandbar rises. The young forest community is then above the annual flood zone of the river channel.

In this newly elevated position, with an absence of excessive browsing, fire, and agricultural conversion, this cottonwood community can grow into a mature riparian forest. At the same time, the river channel continually erodes streambanks and creates fresh, new surfaces for cottonwood establishment. This results in a dynamic patchwork of different age classes, plant associations and habitats.

As cottonwoods mature, other tree species may become established. If the land surface is subject to reworking by the river, successional processes will start over with erosion and subsequent flooding deposition. If the land surface is not subject to alluvial processes, on for example a high terrace, the cottonwoods will be replaced by upland shrub or tree species from adjacent areas.

DISTRIBUTION

Geographic Range: This alliance occurs in the Rocky Mountains and broad river plains of mountain valleys of Alberta, Montana, Idaho, Wyoming, Utah, Colorado and New Mexico. It is also found in the mountains of eastern Oregon, Nevada, California's Sierra Nevada, and the highlands of Arizona.

Nations: CA, US
States/Provinces: AB, AZ, CA, CO, ID, MT, NM, NV, OR, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: NPS (Great Basin); USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **><** Cottonwood - Willow: 235 (Eyre 1980)
- **><** Deciduous Forest Series (Johnston 1987)
- **><** Montane Riparian Wetlands (Brown 1982a)

LOWER LEVEL UNITS

Associations:
- CEGL000646 *Populus angustifolia / Acer grandidentatum* Riparian Forest
- CEGL005962 *Populus angustifolia / Forestiera pubescens var. pubescens* Riparian Woodland
- CEGL002646 *Populus angustifolia / Salix drummondiana - Acer glabrum* Riparian Woodland
- CEGL000933 *Populus angustifolia - Juniperus deppeana / Brickellia californica* Riparian Woodland
- CEGL002643 *Populus angustifolia* Sand Dune Riparian Forest
- CEGL000656 *Populus angustifolia - Populus deltoides - Salix amygdaloides* Riparian Forest
- CEGL000653 *Populus angustifolia / Rosa woodsii* Riparian Forest
- CEGL000934 *Populus angustifolia - Picea pungens / Alnus incana* Riparian Woodland
- CEGL002644 *Populus angustifolia / Crataegus rivularis* Riparian Woodland
- CEGL002664 *Populus angustifolia / Cornus sericea* Riparian Woodland
- CEGL000650 *Populus angustifolia / Lonicera involucrata* Riparian Forest
- CEGL002648 *Populus angustifolia / Symphoricarpos (albus, occidentalis, oreophilus)* Riparian Woodland
- CEGL002645 *Populus angustifolia / Salix (monticola, drummondiana, lucida)* Riparian Woodland
- CEGL000648 *Populus angustifolia / Betula occidentalis* Riparian Woodland
- CEGL000935 *Populus angustifolia - Pinus ponderosa* Riparian Woodland
- CEGL002641 *Populus angustifolia - Pseudotsuga menziesii* Riparian Woodland
- CEGL000938 *Populus angustifolia / Alnus oblongifolia* Riparian Woodland
- CEGL002647 *Populus angustifolia / Salix irrorata* Riparian Woodland
- CEGL000652 *Populus angustifolia / Rhus trilobata* Riparian Woodland
- CEGL002642 *Populus angustifolia / Alnus incana* Riparian Woodland
- CEGL002640 *Populus angustifolia - Juniperus scopulorum* Riparian Woodland
- CEGL000651 *Populus angustifolia / Prunus virginiana* Riparian Woodland
- CEGL000654 *Populus angustifolia / Salix exigua* Riparian Woodland
- CEGL005992 *Populus angustifolia - Acer negundo* Riparian Woodland
- CEGL002537 *Populus angustifolia / Artemisia tridentata ssp. vaseyana / Eriogonum umbellatum* Dry Outwash Riparian Woodland
- CEGL002804 *Populus angustifolia / Quercus gambelii* Riparian Woodland
- CEGL000655 *Populus angustifolia / Salix ligulifolia - Shepherdia argentea* Riparian Woodland

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2016/09/29

REFERENCES

References: Baker 1984a, Baker 1986a, Baker 1989b, Bassett et al. 1987, Beidleman 1954, Boles and Dick-Peddie 1983, Brown 1982a, Cancalossi 1979, Cooper and Cottrell 1990, DeLeuw, Cather & Company 1977, Dick-Peddie 1993, Durkin et al. 1994b, Durkin et al. 1995a, Eyre 1980, Faber-Langendoen et al. 2017b, Freeman and Dick-Peddie 1970, Girard et al. 1997, Gom and Rood 1999, Hansen et al. 1991, Hansen et al. 1995, Hess 1981, Hess and Alexander 1986, Hess and Wasser 1982, Johnston 1987, Keammerer

1974a, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1995, Kittel et al. 1996, Kittel et al. 1997a, Kittel et al. 1999a, Klish 1977, Komarkova 1986, Laurenzi et al. 1983, Marriott and Jones 1989, Muldavin et al. 1993a, Muldavin et al. 1993b, Olson and Gerhart 1982, Padgett and Manning 1988, Padgett et al. 1988b, Padgett et al. 1989, Ramaley 1942, Richard et al. 1996, Smith 1994b, Thompson and Hansen 2002, Trammell and Trammell 1977, Woodbury et al. 1961, Youngblood et al. 1985a, Youngblood et al. 1985b

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1. Forest & Woodland
1.B.3.Nc. Rocky Mountain-Great Basin Montane Flooded & Swamp Forest
G506. Rocky Mountain-Great Basin Montane Riparian & Swamp Forest

A3760. Populus tremuloides Riparian Forest Alliance

Type Concept Sentence: This alliance includes only those stands of *Populus tremuloides* that are truly wetlands and riparian in their setting. Most stands of this alliance are found in riparian zones. Some may be near lakes where the ground is flooded or saturated for a short time in the spring. The moderate to closed tree canopy is dominated by *Populus tremuloides*; sometimes other tress are codominant, such as *Populus angustifolia, Abies concolor, Pinus ponderosa*, and *Picea pungens*. More open stands have a prominent shrub layer containing species such as *Alnus incana, Cornus sericea*, and *Salix* spp. This alliance is found in the Rocky Mountains of Alberta, Montana, Idaho, Wyoming, Colorado, Utah, eastern Oregon and Washington, and Great Basin mountain ranges of Nevada, possibly extending into the Sierra Nevada of California. It addition it occurs on high plateaus and canyons of New Mexico.

OVERVIEW

Scientific Name: *Populus tremuloides* Riparian Forest Alliance
Common Name (Translated Scientific Name): Quaking Aspen Riparian Forest Alliance
Colloquial Name: Quaking Aspen Riparian Forest

Type Concept: This alliance includes only those stands of *Populus tremuloides* that are truly wetlands and riparian in their setting. Most stands of this alliance are found in riparian zones. Some may be near lakes where the ground is flooded or saturated for a short time in the spring. The moderate to closed tree canopy is dominated by *Populus tremuloides*; sometimes other tress are codominant, such as *Populus angustifolia, Abies concolor, Pinus ponderosa*, and *Picea pungens*. More open stands have a prominent shrub layer containing species such as *Alnus incana, Cornus sericea*, and *Salix* spp. This alliance is found in the Rocky Mountains of Alberta, Montana, Idaho, Wyoming, Colorado, Utah, eastern Oregon and Washington, and Great Basin mountain ranges of Nevada, possibly extending into the Sierra Nevada of California. It addition it occurs on high plateaus and canyons of New Mexico.

Classification Comments: *Populus tremuloides* is a widespread species that occurs in generally mesic slopes. This alliance is limited to those stands on wetland soils and riparian alluvial areas and draws where water collects.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Riparian and other wetland areas dominated in the upper canopy by *Populus tremuloides*.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a moderately dense to dense tree canopy dominated by cold-deciduous broad-leaved trees (5-20 m tall). Evergreen needle-leaved trees may be present to codominant in the tree canopy. The understory is variable. Sparse to dense, tall- and short-shrub layers may be present and are typically dominated by deciduous broad-leaved species; however, a scale-leaved short shrub dominates the understory of some stands. Sparse to dense, tall or short herbaceous layers may also be present and may be dominated by perennial forbs or graminoids.

Floristics: This alliance is dominated by *Populus tremuloides*. Common tree associates include *Abies concolor, Abies lasiocarpa, Betula papyrifera, Picea engelmannii, Picea glauca, Pinus contorta, Populus balsamifera ssp. trichocarpa*, and *Pseudotsuga menziesii*, depending on the elevation. A shrub layer may be dominated by *Alnus incana, Amelanchier alnifolia, Arctostaphylos uva-ursi, Betula nana, Betula occidentalis, Cornus sericea, Prunus americana, Prunus pensylvanica, Prunus virginiana, Quercus gambelii, Ribes montigenum, Rosa woodsii, Rubus idaeus, Salix bebbiana, Salix drummondiana, Salix monticola*, other *Salix* spp., *Sorbus scopulina, Symphoricarpos albus, Symphoricarpos oreophilus*, and/or *Vaccinium scoparium*. The dwarf-shrubs *Mahonia repens* and *Vaccinium myrtillus* are common. The herbaceous layer may be lush and diverse, dominated by graminoids or tall forbs. Common graminoids may include *Bromus ciliatus, Bromus carinatus, Calamagrostis canadensis, Carex siccata (= Carex foenea), Carex hoodii, Elymus glaucus, Elymus trachycaulus*, and *Festuca thurberi*. Forbs may include *Achillea millefolium, Delphinium x occidentale, Equisetum arvense, Eucephalus engelmannii (= Aster engelmannii), Fragaria virginiana, Geranium richardsonii, Ligusticum porteri, Maianthemum stellatum, Mertensia arizonica, Osmorhiza occidentalis, Senecio bigelovii var. bigelovii, Thalictrum occidentale,*

Veratrum californicum, and many others. Exotic grasses such as the perennial *Poa pratensis* and the annual *Bromus tectorum* are often common in stands disturbed by grazing.

ENVIRONMENT & DYNAMICS

Environmental Description: Forests included in this alliance occur in seasonally flooded areas in the Rocky Mountain region. Elevations range from 850-3170 m. Climate is temperate with a relatively long growing season, typically cold winters and often deep snow. Mean annual precipitation is greater than 38 cm and typically greater than 50 cm. The distribution of *Populus tremuloides* forests is primarily limited by adequate soil moisture required to meet its high evapotranspiration demand (Mueggler 1988). Secondarily, its range is limited by the length of the growing season or low temperatures (Mueggler 1988). Habitats vary in aspect according to elevation and latitude in respect to the most limiting factor. Stands in this alliance are restricted to sites saturated by seepage from springs and streams from snowmelt. They occur below seeps on gentle slopes, wet draws and flats, and in depressions along streambank terraces. Aspects are variable. In Colorado they are typically on cool, moist north and northeast aspects, whereas in northwestern Wyoming, aspects often are on warmer eastern or western slopes. Soils are often fine-textured, poorly drained, consisting of silts and clays, often forming an organic muck (Youngblood and Mueggler 1981). However, some the alluvial soils are coarse-textured and permit rapid groundwater movement (Hansen et al. 1995). The water table is typically at or near the soil surface in the spring but may drop more than 1 m by midsummer (Hansen et al. 1995). Parent materials are variable and may include sedimentary, metamorphic or igneous rocks, but it appears to grow best on limestone, basalt, and calcareous or neutral shales (Mueggler 1988).

Dynamics: Stands in this alliance often originate, and likely are maintained by, stand-replacing disturbances such as crown fire, disease and windthrow, or clearcutting by man and beaver. The stems of these thin-barked, clonal trees are easily killed by surface fires. They can quickly and vigorously resprout in densities of up to 30,000 stems per hectare (Knight 1994). Stands are favored by fire in the conifer zone (Mueggler 1988). The stems are relatively short-lived (100-150 years) and individual stands will succeed to longer-lived conifer forest if undisturbed. With adequate disturbance, a clone may live many centuries. Although *Populus tremuloides* produces abundant seeds, seedling survival is rare because the long warm, moist conditions required to establish are rare in the habitats where it occurs.

DISTRIBUTION

Geographic Range: This alliance is found in the Rocky Mountains of Alberta, Montana, Idaho, Wyoming, Colorado, Utah, eastern Oregon and Washington, and Great Basin mountain ranges of Nevada, possibly extending into the Sierra Nevada of California. It addition it occurs on high plateaus and canyons of New Mexico.

Nations: CA, US
States/Provinces: AB, CA?, CO, ID, MT, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: NPS (Great Basin)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Pinus ponderosa* Riparian Woodlands (Chappell et al. 1997) [includes Oregon's *Pinus ponderosa - Populus tremuloides / Carex* spp. - (*Poa* spp.) Forest. This type may have a flood regime.]
- **><** *Populus tremuloides* (Aspen groves) Alliance (Sawyer et al. 2009) [61.111.00]
- **?** *Populus tremuloides* Riparian/Wetland Forests and Woodlands (Chappell et al. 1997)
- **><** Aspen Forest (#81B00) (Holland 1986b)
- **><** Aspen Series (Sawyer and Keeler-Wolf 1995)
- **><** Aspen: 217 (Eyre 1980)

LOWER LEVEL UNITS

Associations:

- CEGL000621 *Populus tremuloides / Veratrum californicum* Riparian Forest
- CEGL001082 *Populus tremuloides / Alnus incana - Salix* spp. Riparian Forest
- CEGL000576 *Populus tremuloides* Canyon Formation Riparian Forest
- CEGL000599 *Populus tremuloides / Ranunculus alismifolius* Riparian Forest
- CEGL000574 *Populus tremuloides / Calamagrostis canadensis* Riparian Forest
- CEGL000577 *Populus tremuloides / Carex pellita* Riparian Forest
- CEGL001149 *Populus tremuloides / Alnus incana / Betula nana - Ribes* spp. Riparian Forest
- CEGL001150 *Populus tremuloides / Alnus incana* Riparian Forest

- CEGL003149 *Populus tremuloides / Rosa woodsii* Riparian Forest
- CEGL002902 *Populus tremuloides / Salix drummondiana* Riparian Forest
- CEGL000590 *Populus tremuloides / Senecio bigelovii var. bigelovii* Riparian Forest
- CEGL000600 *Populus tremuloides / Ribes montigenum* Riparian Forest
- CEGL002650 *Populus tremuloides / Betula occidentalis* Riparian Forest
- CEGL003442 *Populus tremuloides / Carex aquatilis var. aquatilis* Riparian Forest
- CEGL003147 *Populus tremuloides - Pinus jeffreyi* Riparian Forest
- CEGL000584 *Populus tremuloides / Equisetum arvense* Riparian Forest
- CEGL000191 *Pinus ponderosa - Populus tremuloides / Carex* spp. - (*Poa* spp.) Riparian Forest
- CEGL005418 *Abies concolor - (Populus tremuloides) / Salix boothii / Carex scopulorum* Riparian Forest
- CEGL005419 *Abies concolor - Populus tremuloides / Carex scopulorum* Riparian Forest
- CEGL000582 *Populus tremuloides / Cornus sericea* Riparian Forest
- CEGL003371 *Populus tremuloides / Carex obnupta* Riparian Forest

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Bock and Bock 1984, Boggs et al. 1990, Chappell et al. 1997, Cooper and Heidel 1997, Cooper and Pfister 1981, DeByle 1985, Evans 1989a, Evenden 1990, Eyre 1980, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Freeman and Dick-Peddie 1970, Hall 1967, Hansen et al. 1990, Hansen et al. 1991, Hansen et al. 1995, Hayward 1928, Hoffman and Alexander 1980, Holland 1986b, Hopkins 1979a, Johnston and Hendzel 1985, Kagan 1985, Kettler and McMullen 1996, Kittel et al. 1994, Kittel et al. 1995, Kittel et al. 1997a, Kittel et al. 1999b, Klimas 1988a, Knight 1994, Kovalchik 1987, Manning and Padgett 1991, Manning and Padgett 1995, Mueggler 1988, Mueggler and Campbell 1986, Mutel 1973, Padgett 1982, Padgett et al. 1988b, Padgett et al. 1989, Powell 1988a, Richard et al. 1996, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Smith 1994b, Van Auken and Bush 1988, WNHP unpubl. data, Watson 1912, Youngblood and Mueggler 1981

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1. Forest & Woodland
1.B.3.Nc. Rocky Mountain-Great Basin Montane Flooded & Swamp Forest
1.B.3.Nc.1.b. M034 Rocky Mountain-Great Basin Montane Riparian & Swamp Forest

G505. Rocky Mountain-Great Basin Swamp Forest

Type Concept Sentence: This group is dominated by conifers such as *Thuja plicata* and/or *Picea engelmannii* with an obligate wetland herbaceous understory such as *Lysichiton americanus*, that generally occurs only on very poorly drained soils that are saturated year-round or may have seasonal flooding in the spring. It occurs in the northern Rocky Mountains from northwestern Wyoming north into the Canadian Rockies and west into eastern Oregon and Washington.

OVERVIEW

Scientific Name: *Thuja plicata - Picea engelmannii / Lysichiton americanus* Swamp Forest Group
Common Name (Translated Scientific Name): Western Red-cedar - Engelmann Spruce / American Skunk-cabbage Swamp Forest Group
Colloquial Name: Engelmann Spruce Swamp Forest

Type Concept: This forested wetland/swamp group occurs in the northern Rocky Mountains from northwestern Wyoming north into the Canadian Rockies and west into eastern Oregon and Washington. It is dominated by conifers with diagnostic hydric undergrowth vegetation. Dominant conifers include *Abies grandis, Abies lasiocarpa, Picea engelmannii, Picea glauca* (and their hybrid), *Pinus contorta, Pseudotsuga menziesii, Thuja plicata*, and/or *Tsuga heterophylla*. Aquatic obligate herbs include *Alopecurus aequalis, Calamagrostis canadensis, Carex disperma, Carex vesicaria, Dryopteris* spp., *Eleocharis palustris, Lysichiton americanus, Mitella breweri, Mitella pentandra, Phalaris arundinacea, Senecio triangularis*, and/or *Streptopus amplexifolius*. Typical wetland shrubs such as *Alnus incana, Cornus sericea (= Cornus stolonifera), Rhamnus alnifolia*, and *Salix* spp. may also be present. These occur on poorly drained soils that are saturated year-round or may have seasonal flooding in the spring. These are primarily on flat to gently sloping lowlands, but also occur up to near the lower limits of continuous forest (below the subalpine parkland), and can occur on steeper slopes where soils are shallow over unfractured bedrock (aka on seeps). This group is indicative of poorly drained, mucky areas, and areas are often bathed in a mosaic of moving and stagnant water. It can also occur around vernal ponds (usually <1 m but can be as much as 2 m deep) that usually fill with water over the fall, winter and early spring, but then at least partially dry up towards the end of the growing season. Trees that ring these ponds shade the water and influence the hydrology of the ponds themselves. Soils can

be woody peat, muck or mineral but tend toward mineral. Stands generally occupy sites on benches, toeslopes or valley bottoms along mountain streams. Stands are usually dominated by conifers, but can have hardwoods mixed or dominant. These wetland types are generally distinguishable from other upland forests and woodlands by shallow water tables.

Classification Comments: This is named and described as a conifer-dominated wetland, but it is noted that deciduous trees can be present and may solely dominate some stands. However, to date, there is no documentation or verification of deciduous-dominated swamps.

Similar NVC Types:
- G506 Rocky Mountain-Great Basin Montane Riparian & Swamp Forest: is found in aerated, better drained areas.
- G256 North Pacific Maritime Swamp Forest: is very similar but limited to the coastal maritime climates and lacks *Picea engelmannii*.
- G610 North Pacific Maritime Wooded Bog & Poor Fen: is a very similar group that occurs farther west and has Pacific Northwest Coastal indicator species.

Diagnostic Characteristics: This group is dominated by conifers with obligate wetland herbaceous understory on poorly drained soils that are saturated year-round or may have seasonal flooding in the spring.

VEGETATION

Physiognomy and Structure: Wetlands dominated by tall conifer trees, tall deciduous hardwood trees or both, often surrounding a perennial or ephemeral water body. Herbaceous undergrowth is often very dense and ranges from 0.1-1.5 m in height.

Floristics: Abundant conifer tree species include *Abies grandis, Abies lasiocarpa, Picea engelmannii, Picea glauca, Pinus contorta, Pseudotsuga menziesii, Thuja plicata*, and or *Tsuga heterophylla*. Deciduous broadleaf trees may also be present or dominant (but swamps dominated by deciduous trees have not yet been documented) such as *Betula papyrifera, Fraxinus latifolia, Larix occidentalis, Populus balsamifera ssp. trichocarpa (= Populus trichocarpa)*, and/or *Populus tremuloides*. These wetland types are generally distinguishable from other upland forests and woodlands by shallow water table indicator, mesic or hydric undergrowth vegetation; some of the most typical herbaceous species include *Alopecurus aequalis, Athyrium filix-femina, Calamagrostis canadensis, Callitriche heterophylla, Carex disperma, Carex vesicaria, Dryopteris* spp., *Eleocharis palustris, Equisetum arvense, Lysichiton americanus, Mitella breweri, Mitella pentandra, Phalaris arundinacea, Senecio triangularis*, and *Streptopus amplexifolius*. Common shrubs include *Alnus incana, Cornus sericea (= Cornus stolonifera), Rhamnus alnifolia*, and *Salix* spp. Floristic descriptions are compiled from Crowe and Clausnitzer (1997), Canadian Rockies Ecoregional Plan (2002), MacKenzie and Moran (2004), and Mincemoyer (2005).

ENVIRONMENT & DYNAMICS

Environmental Description: *Climate:* Temperate cool. *Soil/substrate/hydrology:* This group is dominated by conifers on poorly drained soils that are saturated year-round or may have seasonal flooding in the spring. These are primarily on flat to gently sloping lowlands, but also occur up to near the lower limits of continuous forest (below the subalpine parkland). It can occur on steeper slopes where soils are shallow over unfractured bedrock. This group is indicative of poorly drained, mucky areas, and areas are often a mosaic of moving and stagnant water. These wetland types are generally distinguishable from other upland forests and woodlands by shallow water tables and mesic or hydric undergrowth vegetation. It can also occur around vernal ponds (usually <1 m but can be as much as 2 m deep) that usually fill with water over the fall, winter and early spring, but then at least partially dry up towards the end of the growing season. Trees that ring these ponds shade the water and influence the hydrology of the ponds themselves. Soils can be woody peat, muck or mineral but tend toward mineral. Stands generally occupy sites on benches, toeslopes or valley bottoms along mountain streams. Environmental descriptions are compiled from Crowe and Clausnitzer (1997), NCC (2002), MacKenzie and Moran (2004), and Mincemoyer (2005).

Dynamics: These forests have permanently saturated soils that rarely dry out.

DISTRIBUTION

Geographic Range: This group occurs in the northern Rocky Mountains from northwestern Wyoming and central Montana, north into the Canadian Rockies of Alberta and British Columbia and west into Idaho, eastern Oregon and Washington.

Spatial Scale & Pattern [optional]: Large patch, Small patch
Nations: CA, US
States/Provinces: AB, BC, ID, MT, OR, WA, WY
TNC Ecoregions [optional]: 7:C, 8:C, 9:P, 26:C, 68:C
USFS Ecoregions (2007):
Omernik Ecoregions:

Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Alliances:
- A3775 *Picea engelmannii* Swamp Forest Alliance
- A3776 *Thuja plicata - Tsuga heterophylla* Rocky Mountain Swamp Forest Alliance

AUTHORSHIP

Primary Concept Source: S. Shaw and C.G. Fredine (1971)
Author of Description: G. Kittel and M.S. Reid
Acknowledgments:
Version Date: 12/02/2015
Classif Resp Region: West
Internal Author: GK 10-10, 9-13, 12-15

REFERENCES

References: Crowe and Clausnitzer 1997, Eyre 1980, Faber-Langendoen et al. 2017a, MacKenzie and Moran 2004, Mincemoyer 2005, NCC 2002, National Wetlands Working Group 1988, Shaw and Fredine 1971, Warner and Rubec 1997

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1. Forest & Woodland
1.B.3.Nc. Rocky Mountain-Great Basin Montane Flooded & Swamp Forest
G505. Rocky Mountain-Great Basin Swamp Forest

A3775. Picea engelmannii Swamp Forest Alliance

Type Concept Sentence: This alliance consists of riparian wetlands dominated by *Picea engelmannii, Picea glauca*, and their hybrids. *Betula papyrifera* is occasionally present. It can be found in in riparian areas of Montana, Wyoming and Idaho where the climate has a maritime influence with moist air masses from the Pacific Ocean that release large amounts of snow and rain.

OVERVIEW

Scientific Name: *Picea engelmannii* Swamp Forest Alliance
Common Name (Translated Scientific Name): Engelmann Spruce Swamp Forest Alliance
Colloquial Name: Engelmann Spruce Swamp Forest

Type Concept: This alliance contains coniferous-dominated swampy riparian areas with *Picea engelmannii, Picea glauca*, and their hybrids. *Betula papyrifera* is occasionally present. Shrub layer includes *Alnus incana, Betula occidentalis*, and/or *Cornus sericea*. The herbaceous layer is dominated by the forb *Lysichiton americanus* or *Carex disperma, Cinna latifolia*, and/or *Athyrium filix-femina*. This alliance can be found on level sites that have a high water table such as adjacent to meandering streams and ponds; the water table is usually within 50 cm of the soil surface throughout the year. Standing water may be present in depressions. Soils are poorly drained and have a high organic matter content in the upper horizon. Stands are located in low-elevation (880-900 m) valleys. The vegetation in this alliance occurs in riparian areas in Montana, Wyoming and Idaho.

Classification Comments: This alliance covers stands with saturated soils throughout the growing season.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Wooded wetlands dominated by *Picea engelmannii, Picea glauca*, and their hybrids.

VEGETATION

Physiognomy and Structure: This alliance is characterized by a moderately open canopy of needle-leaved evergreen trees. The shrub layer has a moderately open canopy of deciduous species. Forbs dominate the herbaceous canopy.

Floristics: This alliance contains coniferous-dominated swampy riparian areas with *Picea engelmannii* and hybrid swarms of *Picea* (a result of its hybridization with *Picea glauca*, a common lower elevation condition). A moderately open canopy of *Picea* spp. dominates the tree canopy. *Betula papyrifera* is occasionally present. A number of shrub species occur in the understory; the most

common species are *Alnus incana, Betula occidentalis*, and *Cornus sericea*. The herbaceous layer is dominated by the forb *Lysichiton americanus*. *Cinna latifolia* and *Athyrium filix-femina* are common associates, but occur in low abundances.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands are located in low-elevation (880-900 m) valleys adjacent to meandering streams and ponds. They are found on level sites that have a high water table; the water table is usually within 50 cm of the soil surface throughout the year. Standing water may be present in depressions. Soils are poorly drained and have a high organic matter content in the upper horizon.

Dynamics: The driving variable of greatest importance is permanent soil saturation (spring flooding common).

DISTRIBUTION

Geographic Range: This alliance is found in Idaho, Wyoming, Montana, and may occur in Colorado.

Nations: US
States/Provinces: CO?, ID, MT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL000412 *Picea (engelmannii x glauca, engelmannii) / Lysichiton americanus* Swamp Forest
- CEGL000405 *Picea (engelmannii x glauca, engelmannii) / Carex disperma* Swamp Forest

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Cooper 1975, Cooper 1986a, Cooper and Cottrell 1990, Faber-Langendoen et al. 2017b, Hansen et al. 1991, Hansen et al. 1995, Jensen 1990, Johnston 1987, Kettler and McMullen 1996, Kittel et al. 1999a, Moseley et al. 1991, Padgett et al. 1989, Peet 1975, Pfister et al. 1977, Steele et al. 1981, Steele et al. 1983, Williams and Smith 1990, Youngblood and Mueggler 1981

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1. Forest & Woodland
1.B.3.Nc. Rocky Mountain-Great Basin Montane Flooded & Swamp Forest
G505. Rocky Mountain-Great Basin Swamp Forest

A3776. Thuja plicata - Tsuga heterophylla Rocky Mountain Swamp Forest Alliance

Type Concept Sentence: These are seasonally flooded forests are dominated by conifer species such as *Thuja plicata* and/or *Tsuga heterophylla*. Other tree species that may be present include *Pseudotsuga menziesii, Abies grandis*, and *Abies lasiocarpa*. They occur in riparian areas and toeslopes that remain saturated throughout the growing season. These stands occur in the marine-influenced interior mountains of northeastern Washington, northern Idaho, southeastern British Columbia and northwestern Montana east of the Continental Divide.

OVERVIEW

Scientific Name: *Thuja plicata - Tsuga heterophylla* Rocky Mountain Swamp Forest Alliance
Common Name (Translated Scientific Name): Western Red-cedar - Western Hemlock Rocky Mountain Swamp Forest Alliance
Colloquial Name: Rocky Mountain Western Red-cedar - Western Hemlock Swamp Forest

Type Concept: These seasonally flooded forests are characterized by a dense to somewhat open coniferous canopy dominated by *Thuja plicata*. *Tsuga heterophylla* is a typical associate in these stands. *Pseudotsuga menziesii, Abies grandis*, and *Abies lasiocarpa* may also share the upper tree canopy. The herbaceous layer is diverse and dominated by wetland and moist forest species, including *Lysichiton americanus, Athyrium filix-femina, Achlys triphylla*, and *Senecio triangularis*. Mosses and lichens are common on trees, downed logs, and the forest floor. The alliance occurs in the marine-influenced coastal and interior mountains of northeastern

Washington, northern Idaho, southeastern British Columbia and northwestern Montana east of the Continental Divide. This alliance is found from sea level in coastal areas to over 1800 m in the northern Rocky Mountains of Idaho and western Montana. Annual precipitation ranges from less than 100 cm in the Northern Rockies to 300 cm or more in the coastal ranges of Oregon and Washington. These forests occur on riparian, toeslope, or valley bottom sites that are flooded for a substantial portion of the growing season. The seasonal flooding originates mostly from precipitation and snowmelt collecting in basins, with a small amount of streamside flooding. The soils are organic and saturated for part of the growing season. These forests are often transitional to non-forested wetlands.

Classification Comments: Maritime influence of interior Rocky Mountains creates pockets where *Thuja plicata* and *Tsuga heterophylla* thrive.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Saturated soil wetlands dominated by *Thuja plicata* and/or *Tsuga heterophylla*.

VEGETATION

Physiognomy and Structure: Stands of this alliance typically contain a dense canopy of tall conifers approaching 50 m or more in height. There is often a sparse to dense layer of cold-deciduous or evergreen shrubs. The herbaceous layer is usually a dense layer of shade-tolerant forbs and ferns, but in some cases can be sparse.

Floristics: Stands are dominated or codominated by *Thuja plicata*. *Tsuga heterophylla* is a typical associate that may be confined to higher microsites such as buttress roots, stumps and nurse logs. Other important and occasionally codominant conifers may include *Abies grandis, Abies lasiocarpa, Larix occidentalis, Pseudotsuga menziesii*, or *Taxus brevifolia*. Broad-leaved cold-deciduous trees, including *Alnus rubra, Acer macrophyllum, Betula papyrifera*, and *Populus balsamifera ssp. trichocarpa*, may form a subcanopy. Understory shrubs include *Acer glabrum, Alnus incana, Linnaea borealis, Paxistima myrsinites, Rubus parviflorus*, and/or *Vaccinium membranaceum*. The herbaceous layer may have *Adiantum pedatum, Aralia nudicaulis, Asarum caudatum, Athyrium filix-femina, Clintonia uniflora, Coptis occidentalis, Cornus canadensis, Geum macrophyllum, Gymnocarpium dryopteris, Lysichiton americanus, Tiarella trifoliata*, and/or *Trillium ovatum* . Mosses and lichens are common on trees, downed logs, and the forest floor.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands of the alliance generally occur on all slopes and aspects, but grow best on sites with high soil moisture, such as toeslopes and bottomlands (Cooper et al. 1987). These forests generally occur at moist, non-flooded or upland sites that are not saturated yearlong, such as riparian, toeslope, or valley bottom sites that are flooded for a substantial portion of the growing season. The seasonal flooding originates mostly from precipitation and snowmelt collecting in basins, with a small amount of streamside flooding. The soils are organic and saturated for part of the growing season.

Dynamics: Following disturbance, a variety of other conifer species can become established and dominate sites previously supporting stands of this forest alliance. *Pseudotsuga menziesii*, in particular, can become established and dominate sites for many years following disturbance. In the northern Rocky Mountains, stand-replacing disturbance can result in conversion to communities dominated by either *Larix occidentalis* or *Pinus monticola*. Typically, stand-replacement fire-return intervals are 150-500 years with moderate-severity fire intervals of 50-100 years. Specific fire influences vary with site characteristics. Generally, wetter sites burn less frequently and support older stands with more *Tsuga heterophylla* and *Thuja plicata*.

DISTRIBUTION

Geographic Range: This alliance occurs in the marine-influenced coastal and interior mountains of northeastern Washington, northern Idaho, southeastern British Columbia and northwestern Montana east of the Continental Divide.

Nations: CA?, US
States/Provinces: BC?, ID, MT, OR, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- >< Eastside Tsuga heterophylla-Thuja plicata Forests (Chappell et al. 1997)
- >< Tsuga heterophylla-Thuja plicata Coniferous Wetlands (Chappell et al. 1997)
- >< Western Needleleaf Forests: 2: Cedar-Hemlock-Douglas Fir Forest (*Thuja-Tsuga-Pseudotsuga*) (Küchler 1964)
- >< Western Redcedar - Western Hemlock: 227 (Eyre 1980)
- >< Western Redcedar: 228 (Eyre 1980)
- >< Westside Pseudotsuga menziesii-Tsuga heterophylla Forests (Chappell et al. 1997)

LOWER LEVEL UNITS

Associations:

- CEGL000479 *Thuja plicata - Tsuga heterophylla / Oplopanax horridus* Rocky Mountain Swamp Forest
- CEGL005931 *Thuja plicata / Carex disperma* Swamp Forest

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Atzet and McCrimmon 1990, Atzet et al. 1996, Burns and Honkala 1990a, Chappell et al. 1997, Clausnitzer and Zamora 1987, Cooper et al. 1987, Daubenmire 1952, Daubenmire and Daubenmire 1968, Douglas 1971, Eyre 1980, Faber-Langendoen et al. 2017b, Franklin 1966, Franklin and Dyrness 1973, Glad et al. 1987, Green and Klinka 1994, Hansen et al. 1991, Hansen et al. 1995, Henderson et al. 1986, Kojima and Krajina 1975, Kovalchik 1993, Kunze 1994, Küchler 1964, Lillybridge et al. 1995, Pfister et al. 1977, Scow et al. 1987, Topik et al. 1986, WNHP unpubl. data, Williams and Lillybridge 1985, Williams et al. 1990b, Zamora 1983

1.B.3.Nd. Western North American Interior Flooded Forest

This lowland riparian forest and woodland type is dominated by broad-leaved deciduous trees (cottonwoods, sycamores, and hackberries) and palms that occur along perennial and intermittent rivers, springs and oases of the California Central Valley, Southwest U.S. deserts, and the Tamaulipan region of south Texas and adjacent Mexico.

M036. Interior Warm & Cool Desert Riparian Forest

This macrogroup covers warm and cold climate riparian and wetland forested vegetation of the southwestern deserts and western interior U.S., including the Tamaulipan area of southern Texas. Some of the dominant trees species of this highly diverse macrogroup include *Vachellia farnesiana, Celtis laevigata, Ebenopsis ebano, Juglans major, Platanus racemosa, Platanus wrightii, Populus deltoides ssp. wislizeni, Populus deltoides ssp. monilifera, Populus fremontii, Prosopis glandulosa, Salix laevigata*, and *Salix gooddingii*. This macrogroup also includes oases dominated by evergreen palms *Washingtonia filifera* or *Sabal mexicana*.

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1. Forest & Woodland
1.B.3.Nd. Western North American Interior Flooded Forest
1.B.3.Nd.2.b. M036 Interior Warm & Cool Desert Riparian Forest

G797. Western Interior Riparian Forest & Woodland

Type Concept Sentence: This group consists of riparian woodlands dominated by trees and tall arborescent shrubs, with species such as *Acer negundo, Celtis laevigata var. reticulata, Cephalanthus occidentalis, Fraxinus velutina, Juglans major, Platanus wrightii, Populus deltoides, Populus fremontii, Platanus racemosa, Quercus lobata, Salix gooddingii, Salix laevigata, Sapindus saponaria*, and *Washingtonia filifera*. It is found throughout lowlands of the Interior West, including southwestern warm and cool deserts and Mediterranean California.

OVERVIEW

Scientific Name: Western Interior Riparian Forest & Woodland Group
Common Name (Translated Scientific Name): Western Interior Riparian Forest & Woodland Group
Colloquial Name: Box-elder - Singleleaf Ash - Netleaf Hackberry Riparian Woodland

Type Concept: This group consists of riparian woody vegetation. Dominant trees may include *Acer negundo, Celtis laevigata var. reticulata, Cephalanthus occidentalis, Fraxinus velutina, Juglans major, Platanus wrightii, Populus deltoides ssp. wislizeni, Populus deltoides ssp. monilifera, Populus fremontii, Platanus racemosa, Quercus lobata, Salix amygdaloides, Salix gooddingii, Salix laevigata, Sapindus saponaria*, and *Washingtonia filifera*. Dominant shrubs include *Alnus oblongifolia, Baccharis salicifolia, Prunus* spp., *Salix exigua, Salix lasiolepis, Shepherdia argentea*, and *Vitis californica*. Other dominants on serpentine substrates include *Aquilegia*

eximia, Carex serratodens, Cirsium fontinale, Hesperocyparis sargentii (= Cupressus sargentii), Frangula californica ssp. tomentella (= Rhamnus tomentella), Mimulus glaucescens, Mimulus guttatus, Packera clevelandii (= Senecio clevelandii), Salix breweri, Solidago spp., *Stachys albens*, and *Umbellularia californica*. The variety of plant associations within this group reflects elevation, stream gradient, floodplain width, and flooding events. It also includes springs, seeps, and perennial and intermittent streams and riparian areas found on serpentine substrates. These are disturbance-driven systems that require flooding, scour and deposition for germination and maintenance. Periodic flooding and associated sediment scour are necessary to maintain growth and reproduction of vegetation. Flooding regimes have been significantly altered in all but a few tributaries that support this group. This group occurs throughout lowlands of the interior west, including southwest warm and cool deserts and Mediterranean California, generally below about 1800 m (6000 feet) elevation. Known occurrences include the following rivers and their tributaries: Colorado, Gila, Pecos, Rio Grande, Sacramento, San Joaquin, Santa Cruz, Salt, San Pedro, Truckee, Snake and others.

Classification Comments: This group combines warm southwestern deserts with cool interior lower elevation rivers, and occurs from sea level, but does not include montane elevations.

Similar NVC Types:
- G510 Interior West Ruderal Riparian Forest & Scrub
- G533 North American Warm Desert Riparian Low Bosque & Shrubland
- G541 Warm Semi-Desert Shrub & Herb Dry Wash & Colluvial Slope

Diagnostic Characteristics: This group is wide-ranging in the western U.S. and occurs in the warm desert regions (Sonoran and Mojave) of the southwestern U.S. and adjacent Mexico, Mediterranean California, and the cool desert interior in riparian corridors along perennial and seasonally intermittent streams and spring-fed depressions. Diagnostic tree species trees include *Juglans major, Platanus racemosa, Platanus wrightii, Populus deltoides ssp. monilifera, Populus deltoides ssp. wislizeni, Populus fremontii, Salix amygdaloides, Salix laevigata*, and *Washingtonia filifera*. Shrubs are rich and varied. Stands are always adjacent to streams or their floodplains and have been observed to follow narrow tributaries. Seasonal flooding and soil saturation by a rising water table are necessary to maintain growth and reproduction of vegetation.

VEGETATION

Physiognomy and Structure: Open to closed woodlands of tall cold-deciduous trees and shrubs, forming linear bands following stream and river courses and alluvial floodplains. Herbaceous undergrowth is variable depending on the amount of shading in the overstory.

Floristics: The vegetation is a mix of riparian woodlands dominated by trees and tall arborescent shrubs. Dominant trees include *Acer macrophyllum, Acer negundo, Alnus rhombifolia, Alnus rubra, Celtis laevigata var. reticulata, Cephalanthus occidentalis, Fraxinus velutina, Juglans major, Platanus racemosa, Platanus wrightii, Populus deltoides ssp. wislizeni, Populus deltoides ssp. monilifera, Populus fremontii, Pseudotsuga menziesii, Quercus agrifolia, Quercus lobata, Salix amygdaloides, Salix gooddingii, Salix laevigata, Salix lasiolepis, Sapindus saponaria*, and *Washingtonia filifera*. Shrub dominants include *Alnus oblongifolia, Baccharis salicifolia, Prunus* spp., *Salix exigua, Salix geyeriana, Salix lasiolepis*, and *Vitis californica*. Other dominants on serpentine substrates include *Aquilegia eximia, Carex serratodens, Cirsium fontinale, Hesperocyparis sargentii (= Cupressus sargentii), Frangula californica ssp. tomentella (= Rhamnus tomentella), Mimulus glaucescens, Mimulus guttatus, Packera clevelandii (= Senecio clevelandii), Salix breweri, Solidago* spp., *Stachys albens*, and *Umbellularia californica*. These are disturbance-driven systems that require flooding, scour and deposition for germination and maintenance. Exotic species that may be present include *Ailanthus altissima, Eucalyptus* spp., and *Tamarix* spp., and herbs such as *Arundo donax*.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands occur on streambanks and floodplains. The variety of plant associations within this group reflects elevation, stream gradient, floodplain width, and flooding events. It also includes springs, seeps, and perennial and intermittent streams on serpentine substrates.

Dynamics: Vegetation is dependent upon annual or periodic flooding and associated sediment scour and/or annual rise in the water table for growth and reproduction. Permanent subsurface water is required to maintain *Washingtonia filifera*. Salinity is low in the root zone, but increases near the surface where evaporation leaves salt accumulations. Reproduction of *Washingtonia filifera* is limited by water supply, surface salinity, rainfall, and fire. Fan palms are fire-tolerant, while the understory species are not, and fires open up the understory allowing palm seedlings to establish. Removal of the understory also decreases competition for water. There are currently 24 known occurrences of *Washingtonia filifera* in Arizona, Nevada, and California (Sawyer et al. 2009).

DISTRIBUTION

Geographic Range: The group occurs throughout Mediterranean California, California's Central Valley, the southern Coast Ranges of Oregon, the lower valleys of Nevada and southern Idaho and the Colorado Plateau south into the canyons and desert valleys of the

Sonoran and Mojave deserts of southwestern United States and adjacent Mexico. Specifically, it is known in California, southern Oregon, Nevada, Utah, Colorado, southern Arizona, New Mexico, adjacent Mexico (Baja California, Baja California del Sur, Chihuahua), and western Texas. Elevation ranges from sea level up to 1800 m.

Spatial Scale & Pattern [optional]:
Nations: MX, US
States/Provinces: AZ, CA, CO, ID, MXBC?, MXBS, MXCH, MXSO, NM, NV, OR, UT
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **><** *Quercus lobata* (Valley oak woodland) Alliance (Sawyer et al. 2009) [71.040.00]
- **><** Arizona Cypress: 240 (Eyre 1980)
- **><** Cottonwood - Willow: 235 (Eyre 1980)
- **><** Port Orford-Cedar: 231 (Eyre 1980)
- **<** Riparian Woodland (203) (Shiflet 1994) [Serpentine substrates are not specifically mentioned in Shiflet (1994).]

LOWER LEVEL UNITS

Alliances:

- A0953 *Alnus oblongifolia* Riparian Forest Alliance
- A3801 *Platanus wrightii* Riparian Forest Alliance
- A0957 *Juglans major - Juglans microcarpa* Riparian Forest Alliance
- A3796 *Acer negundo - Fraxinus anomala - Celtis laevigata var. reticulata* Riparian Woodland Alliance
- A0485 *Washingtonia filifera* Wet Woodland Alliance
- A3750 *Platanus racemosa - Quercus agrifolia - Juglans californica* Riparian Woodland Alliance
- A3803 *Populus fremontii - Fraxinus velutina - Salix gooddingii* Riparian Forest & Woodland Alliance
- A3752 *Salix gooddingii - Salix laevigata* Riparian Forest Alliance
- A0644 *Populus fremontii* Great Basin Riparian Forest Alliance
- A0945 *Juglans microcarpa* Riparian Scrub Alliance
- A3798 *Populus deltoides ssp. wislizeni - Populus deltoides ssp. monilifera - Salix amygdaloides* Riparian Woodland Alliance
- A3802 *Populus deltoides ssp. wislizeni - Populus deltoides ssp. monilifera* Riparian Forest Alliance
- A0618 *Quercus lobata* Riparian Forest Alliance

AUTHORSHIP

Primary Concept Source: G. Kittel, P. Comer and T. Keeler-Wolf in Faber-Langendoen et al. (2015)
Author of Description: G. Kittel
Acknowledgments: Julie Evens, Todd Keeler-Wolf
Version Date: 09/29/2016
Classif Resp Region: West
Internal Author: MSR 11-14; GK 5-15, 12-15, 9-16

REFERENCES

References: Barbour and Major 1988, Brown 1982a, Dick-Peddie 1993, Eyre 1980, Faber-Langendoen et al. 2017a, Holland and Keil 1995, MacMahon 1988, Muldavin et al. 2000a, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Shiflet 1994, Stout et al. 2013, Szaro 1989, Thomas et al. 2004, Vogl and McHargue 1966

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1. Forest & Woodland
1.B.3.Nd. Western North American Interior Flooded Forest
G797. Western Interior Riparian Forest & Woodland

A3796. Acer negundo - Fraxinus anomala - Celtis laevigata var. reticulata Riparian Woodland Alliance

Type Concept Sentence: This alliance consists of riparian woodlands dominated by *Acer negundo, Fraxinus anomala*, and/or *Celtis laevigata var. reticulata*. Common associates include *Alnus incana, Betula occidentalis, Brickellia grandiflora, Brickellia longifolia, Cornus sericea, Quercus gambelii, Rhus trilobata*, and others. It is found on intermittently dry streams and/or in slickrock canyons, and occurs on the Colorado Plateau and south into Arizona and New Mexico.

OVERVIEW

Scientific Name: *Acer negundo - Fraxinus anomala - Celtis laevigata var. reticulata* Riparian Woodland Alliance
Common Name (Translated Scientific Name): Box-elder - Singleleaf Ash - Netleaf Hackberry Riparian Woodland Alliance
Colloquial Name: Box-elder - Singleleaf Ash - Netleaf Hackberry Riparian Woodland

Type Concept: This alliance consists of riparian woodlands dominated by *Acer negundo, Fraxinus anomala*, and/or *Celtis laevigata var. reticulata*. Common associates include *Alnus incana, Betula occidentalis, Brickellia grandiflora, Brickellia longifolia, Cornus sericea, Quercus gambelii, Rhus trilobata*, and others. Cottonwoods and willows are usually not present and, if present, are in very low abundance. It is found adjacent to streams and rivers, seeps and springs, near the base of colluvial slopes, and on alluvial terraces or in slickrock canyons, and occurs on the Colorado Plateau and south into Arizona and New Mexico.

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics:

VEGETATION

Physiognomy and Structure: These are broad-leaved deciduous woodlands typically with the canopy 10-20 m tall, with a sparse shrub layer and dense to sparse herbaceous layer.

Floristics: Stands are dominated by *Fraxinus anomala, Acer negundo*, and/or *Celtis laevigata var. reticulata*, usually in monotypic stands but occasionally can be seen together. Other trees present may include *Juniperus osteosperma, Pinus edulis*, or *Pseudotsuga menziesii*. Associated tall shrubs include *Amelanchier alnifolia, Betula occidentalis, Forestiera pubescens, Quercus gambelii, Rhus trilobata*, and *Salix exigua*. Short shrubs contribute low cover and include *Ephedra viridis, Ericameria nauseosa, Holodiscus dumosus, Rhus trilobata, Symphoricarpos rotundifolius*, and the vines *Clematis ligusticifolia* and *Vitis arizonica*. The herbaceous layer may have *Elymus glaucus, Equisetum arvense, Equisetum hyemale, Maianthemum stellatum, Mentha arvensis*, and *Phalaris arundinacea*. Exotic graminoids such as *Poa pratensis* or *Agrostis stolonifera* can be abundant.

ENVIRONMENT & DYNAMICS

Environmental Description: This vegetation is restricted to mesic sites, such as near seeps, springs and ephemeral stream channels, on immediate riverbanks, within 2 m of the active channel, or streambanks immediately below perennial or seasonal springs or on lower colluvial slopes where additional soil moisture is available. Sites are flat to gently sloping and may have any aspect. Substrates are nearly always derived from colluvium but often have been transported or redistributed by water to form alluvial deposits. Soils are shallow to deep and well-drained to rapidly drained. Soil texture varies widely and can be coarse-loamy to fine-loamy and generally has large amounts of gravel and cobble. The water table is seasonally within 1 m of the surface.

Dynamics: With scouring floods, *Acer negundo* may survive only if it grows on upper colluvial slopes. This may provide a seed source for regeneration after flooding and deposition. Female trees of the dioecious *Acer negundo* are better adapted to growing along the channel edge and are recommended over male trees for restoration of disturbed streambanks. *Acer negundo* is not rhizomatous, but has strong roots that provide streambank stability.

DISTRIBUTION

Geographic Range: This alliance ranges from Idaho to Montana south through Nevada, Utah, Colorado, Arizona and New Mexico.

Nations: CA, US
States/Provinces: AZ, CO, ID, MT, NM, NV, UT
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL002692 *Acer negundo / Brickellia (grandiflora, longifolia)* Riparian Woodland
- CEGL002752 *Fraxinus anomala* Riparian Woodland
- CEGL005953 *Celtis laevigata var. reticulata / Brickellia californica* Riparian Woodland
- CEPS009676 *Acer negundo / Quercus turbinella* Woodland [Park Special]
- CEGL005941 *Acer negundo - Fraxinus velutina* Riparian Woodland
- CEGL002599 *Acer negundo - Celtis laevigata var. reticulata* Riparian Woodland
- CEGL005942 *Acer negundo / Salix exigua* Riparian Woodland

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Faber-Langendoen et al. 2017b, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1999a, Padgett et al. 1989, Welsh et al. 1987

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1. Forest & Woodland
1.B.3.Nd. Western North American Interior Flooded Forest
G797. Western Interior Riparian Forest & Woodland

A0957. Juglans major - Juglans microcarpa Riparian Forest Alliance

Type Concept Sentence: This is a riparian wooded alliance where *Juglans major* or *Juglans microcarpa* dominates the upper canopy. Several other woody species, such as *Acer negundo, Brickellia laciniata, Celtis laevigata var. reticulata, Chilopsis linearis*, and *Fallugia paradoxa*, may be present. It occurs on perennial and intermittent streambanks and beds in the Southwest, typically gentle gradient but none-the-less very rocky reaches found in southern Arizona and New Mexico and it may also occur in adjacent areas in Mexico and southwestern Texas.

OVERVIEW

Scientific Name: *Juglans major - Juglans microcarpa* Riparian Forest Alliance
Common Name (Translated Scientific Name): Arizona Walnut - Little Walnut Riparian Forest Alliance
Colloquial Name: Arizona Walnut - Little Walnut Riparian Forest

Type Concept: This is a riparian wooded alliance where *Juglans major* or *Juglans microcarpa* dominates the upper canopy. Any of the following codominant trees or tall shrubs may also occur: *Acer negundo, Brickellia laciniata, Pinus edulis, Platanus occidentalis, Platanus wrightii, Quercus* spp., *Salix gooddingii*, or *Sapindus saponaria*. Other important shrubs and vines include *Celtis laevigata var. reticulata, Fallugia paradoxa, Frangula californica (= Rhamnus californica), Rhus glabra, Rhus trilobata, Ungnadia speciosa*, and *Vitis arizonica*. Common graminoid species are *Bouteloua curtipendula, Bouteloua gracilis*, and *Carex* spp. Forb cover has been reported to be sparse and typically weedy. This alliance occurs in and adjacent to streambeds in Arizona and New Mexico. It is typically found along rubble-bottomed perennial, intermittent and temporary streams, dry rocky ravines, arroyos, and streambeds from approximately 700-2300 m elevation.

Classification Comments: This alliance contains both short scrubby trees and taller forest-forming trees. *Juglans major* can have growth forms of tall shrubs or short trees.

Internal Comments: GK 9-14: Might this occur in SW Texas as well?
Other Comments:

Similar NVC Types:

Diagnostic Characteristics:

VEGETATION

Physiognomy and Structure: The woody canopy is dominated by broad-leaved deciduous tall shrubs or short trees, with an understory of shorter shrubs (1-2 m) and vines. A graminoid stratum is often present.

Floristics: This alliance is composed of structurally and compositionally variable riparian shrublands, with *Juglans major* or *Juglans microcarpa* being the most abundant and characteristic woody species. Other woody shrubs and small trees that can be present can include *Acer negundo, Brickellia laciniata, Celtis laevigata var. reticulata, Chilopsis linearis, Fallugia paradoxa, Frangula californica (= Rhamnus californica), Fraxinus velutina, Ostrya knowltonii, Pinus edulis, Platanus occidentalis, Platanus wrightii, Quercus* spp., *Rhus glabra, Rhus trilobata, Salix gooddingii, Salix nigra, Sapindus saponaria, Ungnadia speciosa*, and/or *Vitis arizonica*. The understory is composed primarily of perennial grasses such as *Andropogon gerardii, Bouteloua curtipendula, Bouteloua gracilis, Carex* spp., and *Schizachyrium scoparium var. scoparium (= Schizachyrium scoparium ssp. neomexicanum)*. Forb cover was reported by Szaro (1989) to be sparse and typically weedy.

ENVIRONMENT & DYNAMICS

Environmental Description: It is found along perennial, intermittently and temporarily flooded streams. Sites include dry rocky ravines, arroyos, and streambeds from approximately 700 to 2300 m elevation. Stream gradients are to be 8-9 m per kilometer, fairly low gradients (Szaro 1989). The headwaters of these streams are in montane areas, and even when the streambed is dry, it is usually subirrigated by a shallow water table. Following monsoonal rains, the streambed can be shallowly inundated for several weeks at a time. Soils are fairly coarse and have been described as limestone cobbles, flat-bedded limestone streambeds, boulder, gravelly and "rubble-bottomed."

Dynamics: *Juglans microcarpa* is shade-intolerant. Young individuals direct much of their energy into developing a large, deep taproot, which permits saplings to survive the periods of extreme drought that are common.

Brown (1982a) states that the mixed broad-leaved types, of which *Juglans major* is included, are relictual communities. The present distribution reflects a contraction of the formerly widespread, Early Tertiary mixed mesophytic forest. These riparian forests are vernally adapted to Early Tertiary climates and have retreated to pockets where the warm temperate climate persists.

DISTRIBUTION

Geographic Range: Communities within this alliance occur throughout southern Arizona and the southwestern "boot heel" of New Mexico. Given the range of the nominal species, it is likely the alliance also occurs in Mexico (Elias 1987).

Nations: MX?, US
States/Provinces: AZ, MXSO?, NM
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Juglans microcarpa* Community Type (Szaro 1989)
- **?** Interior and Californian Riparian Deciduous Forests and Woodlands (Brown 1982a) [within Warm-Temperate Wetlands.]
- **?** Little Walnut Series (Dick-Peddie 1993)
- **?** Temperate Riparian Deciduous Forest Biome; Mixed Broadleaf Series (Pase and Layser 1977)

LOWER LEVEL UNITS

Associations:

- CEGL001102 *Juglans major* Flooded Forest
- CEGL004594 *Juglans microcarpa / Sorghastrum nutans* Flooded Scrub Woodland
- CEGL000858 *Pinus ponderosa / Juglans major* Flooded Woodland
- CEGL004593 *Juglans microcarpa / Cladium mariscus ssp. jamaicense* Flooded Scrub Woodland
- CEGL005326 *Juglans major - Prosopis velutina* Flooded Forest
- CEGL005954 *Juglans major - Acer negundo / Rhus trilobata var. trilobata* Flooded Forest
- CEGL005955 *Juglans major - Celtis laevigata var. reticulata / Brickellia californica* Flooded Forest
- CEGL005957 *Juglans major / Forestiera pubescens var. pubescens* Flooded Forest
- CEGL005956 *Juglans major / Bouteloua curtipendula* Flooded Forest
- CEGL001103 *Juglans microcarpa* Scrub
- CEGL001101 *Juglans major - Pinus edulis / Bromus carinatus* Flooded Forest

AUTHORSHIP

Primary Concept Source: D. Culver, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:

Version Date: 2014/12/18

REFERENCES

References: Brown 1982a, Diamond 1993, Dick-Peddie 1993, Elias 1987, Faber-Langendoen et al. 2017b, Freeman and Dick-Peddie 1970, Henry 1981, Kearney et al. 1969, Pase and Layser 1977, Szaro 1989

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1. Forest & Woodland
1.B.3.Nd. Western North American Interior Flooded Forest
G797. Western Interior Riparian Forest & Woodland

A0945. Juglans microcarpa Riparian Scrub Alliance

Type Concept Sentence: This alliance is found primarily along intermittently to temporarily flooded low-elevation (below 1500 m) streambeds and stream margins in desert canyons and valleys. Stream gradients are gentle. The headwaters of these streams are often in montane areas, and even when the streambed is dry, it is usually subirrigated. Following monsoonal rains, the streambed can be shallowly inundated for several weeks at a time. These are riparian scrublands with *Juglans microcarpa* as a dominant.

OVERVIEW

Scientific Name: *Juglans microcarpa* Riparian Scrub Alliance
Common Name (Translated Scientific Name): Little Walnut Riparian Scrub Alliance
Colloquial Name: Little Walnut Riparian Scrub

Type Concept: This alliance is found primarily along intermittently to temporarily flooded low-elevation (below 1500 m) streambeds and stream margins in desert canyons and valleys. Stream gradients are gentle. The headwaters of these streams are often in montane areas, and even when the streambed is dry, it is usually subirrigated. Following monsoonal rains, the streambed can be shallowly inundated for several weeks at a time. These are riparian scrublands with *Juglans microcarpa* as a dominant. Other woody species can include *Celtis laevigata var. reticulata, Fallugia paradoxa, Brickellia laciniata, Salix gooddingii, Salix nigra, Platanus occidentalis, Ungnadia speciosa*, and *Quercus* spp.

Classification Comments: The old alliance A.945 has been split, with two associations (CEGL004593 and CEGL004594) moving to A0957 in M508. These two associations are likely to be closely related to other riparian vegetation of New Mexico, Arizona, and Mexico. There may also be undescribed associations representing this alliance. In addition, the group placement of this alliance needs review and more information is needed to fully document the range and floristics of this alliance.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: *Juglans microcarpa*; open, scrubby riparian vegetation.

VEGETATION

Physiognomy and Structure: This alliance consists of structurally variable broad-leaved deciduous shrublands. The woody vegetation varies in both height and density, and from shrubby growth to well-developed small trees. The canopy of the woody plants may be dense to somewhat open or consist of widely scattered individuals. Woody vines are common in some stands, and most have an herbaceous layer, usually dominated by graminoids.

Floristics: This alliance is composed of structurally and compositionally variable riparian shrublands, with *Juglans microcarpa* being the most abundant and characteristic woody species. Other woody shrubs and small trees that can be present can include *Celtis laevigata var. reticulata, Fallugia paradoxa, Fraxinus velutina, Ostrya knowltonii, Chilopsis linearis, Brickellia laciniata, Salix gooddingii, Salix nigra, Platanus occidentalis, Ungnadia speciosa*, and *Quercus* spp. The understory, particularly in the Texas examples, is composed primarily of perennial grasses typical of adjacent upland vegetation, such as *Leptochloa dubia, Bothriochloa barbinodis (= var. barbinodis), Bouteloua curtipendula, Schizachyrium scoparium var. scoparium (= Schizachyrium scoparium ssp. neomexicanum)*, and *Andropogon gerardii*. *Cladium mariscus ssp. jamaicense* is the graminoid dominant in one association in Texas. Woody vines, such as *Vitis arizonica* can be important in stands in New Mexico.

ENVIRONMENT & DYNAMICS

Environmental Description: Little information is available about the environmental factors related to this alliance. It is found primarily along intermittently to temporarily flooded low-elevation (below 1500 m) streambeds and stream margins in desert canyons and valleys. Stream gradients were reported by Szaro (1989) to be 8 to 9 m per kilometer, fairly low gradients. The headwaters of these streams are in montane areas, and even when the streambed is dry, it is usually subirrigated. Following monsoonal rains, the streambed can be shallowly inundated for several weeks at a time. In western Texas and the Edwards Plateau,

this alliance occurs on limestone cobbles or flat-bedded limestone streambeds. New Mexico sites are reported to be bouldery or gravelly

Dynamics: *Juglans microcarpa* is shade-intolerant. Young individuals direct much of their energy into developing a large, deep taproot, which permits the walnut to survive the periods of extreme drought that are common.

DISTRIBUTION

Geographic Range: This alliance has been reported from the Edwards Plateau region of Texas.

Nations: MX?, US
States/Provinces: TX
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Juglans microcarpa* Community Type (Szaro 1989)
- **?** Little Walnut Series (Dick-Peddie 1993)

LOWER LEVEL UNITS

Associations:
- CEGL002166 *Celtis laevigata var. reticulata - Juglans microcarpa / Leptochloa dubia* Riparian Woodland
- CEGL004932 *Juglans microcarpa - Brickellia laciniata / Indigofera lindheimeriana* Edwards Plateau Riparian Scrub

AUTHORSHIP

Primary Concept Source: J. Teague, in Faber-Langendoen et al. (2013)
Author of Description: J. Teague and M. Pyne
Acknowledgments:
Version Date: 2014/12/19

REFERENCES

References: Diamond 1993, Dick-Peddie 1993, Faber-Langendoen et al. 2017b, Szaro 1989

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1. Forest & Woodland
1.B.3.Nd. Western North American Interior Flooded Forest
G797. Western Interior Riparian Forest & Woodland

A3801. Platanus wrightii Riparian Forest Alliance

Type Concept Sentence: This alliance consists of riparian woodlands dominated by the broad-leaved, cold-deciduous tree *Platanus wrightii*. *Fraxinus velutina* and *Juglans major* are common associates in the upper canopy. It occurs along perennial or seasonally intermittent streams in Arizona, southwestern New Mexico and northern Mexico.

OVERVIEW

Scientific Name: *Platanus wrightii* Riparian Forest Alliance
Common Name (Translated Scientific Name): Arizona Sycamore Riparian Forest Alliance
Colloquial Name: Arizona Sycamore Riparian Forest

Type Concept: This alliance consists of riparian woodlands dominated by the broad-leaved cold-deciduous tree *Platanus wrightii*. *Fraxinus velutina* and *Juglans major* are common associates in the upper canopy. *Populus fremontii* can be an emergent tree but sites are not dominated by this species. Other trees present include *Celtis laevigata var. reticulata, Juglans major, Juniperus monosperma, Prosopis velutina, Quercus arizonica, Quercus emoryi, Robinia neomexicana*, and *Salix gooddingii*. The vine stratum is dominated by *Vitis arizonica*. The shrub layer is often present and contains several of the following: *Alnus oblongifolia, Amorpha fruticosa, Baccharis salicifolia, Rhus trilobata, Salix bonplandiana*, and *Toxicodendron radicans*. The herbaceous layer commonly includes *Aristida* spp., *Bouteloua curtipendula, Carex* spp., *Choisya dumosa var. arizonica (= Choisya arizonica), Datura inoxia (= Datura meteloides), Elymus elymoides, Eriogonum* spp., *Gutierrezia sarothrae, Marrubium vulgare, Muhlenbergia emersleyi, Muhlenbergia* spp., *Oenothera elata ssp. hookeri (= Oenothera hookeri)*, and *Sporobolus cryptandrus*. This alliance is found in Arizona, southwestern New Mexico and northern Mexico. It occurs along perennial or seasonally intermittent streams, in narrow stream valleys, on gently sloping alluvial terraces. These vegetation types require reliable surface flow during the winter-spring

months, they are periodically inundated during spring runoff and generally are found along small, perennial streams. The soils are depositional and silty loam in texture.

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics:

VEGETATION

Physiognomy and Structure: The tree canopy is dominated by a broad-leaved, cold-deciduous tree, from 3-15 m tall, with an understory of tree seedlings and shrubs from 0.5-3 m tall.

Floristics: Vegetation types within this alliance are characterized as temporarily flooded, cold-deciduous forests. *Platanus wrightii* dominates the tree stratum. *Fraxinus velutina* and *Juglans major* are common codominants. *Populus fremontii* often is an emergent tree from the canopy. The tree subcanopy species may include *Alnus oblongifolia, Celtis laevigata var. reticulata, Fraxinus pennsylvanica, Juglans major, Juniperus monosperma, Prosopis velutina, Quercus arizonica, Quercus emoryi, Robinia neomexicana*, *Salix bonplandiana*, and *Salix gooddingii*. The shrub layer is often present and contains any number of the following: *Alnus oblongifolia, Amorpha fruticosa, Baccharis salicifolia, Rhus trilobata, Salix bonplandiana*, and *Toxicodendron radicans*. The herbaceous layer is common (no percent cover data available) and can include *Aristida* spp., *Bouteloua curtipendula, Carex* spp., *Choisya dumosa var. arizonica (= Choisya arizonica), Datura inoxia (= Datura meteloides), Elymus elymoides, Eriogonum* spp., *Gutierrezia sarothrae, Marrubium vulgare, Muhlenbergia emersleyi, Muhlenbergia* spp., *Oenothera elata ssp. hookeri (= Oenothera hookeri)*, and/or *Sporobolus cryptandrus*.

ENVIRONMENT & DYNAMICS

Environmental Description: This riparian forest and woodland alliance is located along perennial or seasonally intermittent streams in the American Southwest and adjacent Mexico. Stands occur in narrow stream valleys, on gently sloping alluvial terraces. Elevations range from 600-1800 m. These vegetation types require reliable surface flow during the winter-spring months. They are periodically inundated during spring runoff and generally are found along small, perennial streams. Soils are silty or sandy, shallow, with large cobbles. The surface water is present for brief periods during the growing season, but the water table usually lies well below the soil surface.

Dynamics: Occurrences require reliable surface flow during the winter-spring months. They are periodically inundated during spring runoff and generally are found along small, perennial streams. Anderson et al. (1985) state that this woodland type is very sensitive to even moderate levels of livestock grazing. Grazing can inhibit reproduction of the dominant tree species due to their high palatability.

DISTRIBUTION

Geographic Range: This alliance is common throughout lower elevations (<1800 m) in Arizona, New Mexico, and northern Mexico.

Nations: MX, US
States/Provinces: AZ, MXCH, MXSO, NM
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** Arizona Cypress: 240 (Eyre 1980)
- **><** Forest Type: *Platanus wrightii* series (Bassett et al. 1987)
- **><** Interior and Californian Riparian Deciduous Forests and Woodlands (Brown 1982a) [within Warm-Temperate Wetlands.]
- **><** Temperate Riparian Deciduous Forest Biome: Mixed Broadleaf Series (Pase and Layser 1977)

LOWER LEVEL UNITS

Associations:

- CEGL000644 *Platanus wrightii - Fraxinus velutina* Riparian Forest
- CEGL000645 *Platanus wrightii - Juglans major* Riparian Forest
- CEGL000937 *Platanus wrightii* Riparian Woodland
- CEGL002686 *Platanus wrightii - Alnus oblongifolia / Baccharis salicifolia* Riparian Forest
- CEGL005338 *Platanus wrightii / Quercus oblongifolia* Riparian Woodland
- CEGL002712 *Platanus wrightii / Sporobolus cryptandrus* Riparian Forest
- CEGL005959 *Platanus wrightii / Brickellia californica* Riparian Forest
- CEGL005960 *Platanus wrightii* / Sparse Riparian Forest
- CEGL005991 *Platanus wrightii / Bouteloua curtipendula* Riparian Forest
- CEGL002710 *Platanus wrightii / Muhlenbergia rigens* Riparian Forest

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Anderson et al. 1985, Bassett et al. 1987, Bourgeron et al. 1993b, Bourgeron et al. 1995a, Brown 1982a, Dick-Peddie 1993, Eyre 1980, Faber-Langendoen et al. 2017b, Hickman 1993, Kartesz 1994a, Kearney et al. 1969, Pase and Layser 1977, Szaro 1989, Willis 1939

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1. Forest & Woodland
1.B.3.Nd. Western North American Interior Flooded Forest
G797. Western Interior Riparian Forest & Woodland

A3798. Populus deltoides ssp. wislizeni - Populus deltoides ssp. monilifera - Salix amygdaloides Riparian Woodland Alliance

Type Concept Sentence: This alliance consists of woodlands dominated by *Populus deltoides ssp. wislizeni, Populus deltoides ssp. monilifera*, or *Salix amygdaloides*. Other tree species include *Acer negundo*. Stands are found on alluvial floodplains, terraces and streambanks of rivers and streams, and sometimes around lakes and ponds. These stands occur along rivers and streams of Wyoming, Colorado, New Mexico, and on to the Colorado Plateau of Utah.

OVERVIEW

Scientific Name: *Populus deltoides ssp. wislizeni - Populus deltoides ssp. monilifera - Salix amygdaloides* Riparian Woodland Alliance
Common Name (Translated Scientific Name): Rio Grande Cottonwood - Plains Cottonwood - Peachleaf Willow Riparian Woodland Alliance
Colloquial Name: Rio Grande Cottonwood - Plains Cottonwood - Peachleaf Willow Riparian Woodland

Type Concept: This alliance is dominated by *Populus deltoides ssp. wislizeni, Populus deltoides ssp. monilifera*, or *Salix amygdaloides*. Other tree species include *Acer negundo*. Shrub species present many include *Artemisia tridentata, Prunus virginiana, Rhus trilobata, Salix exigua*, and *Symphoricarpos occidentalis*. Typical herbaceous species include *Carex* spp., *Distichlis spicata, Elymus* spp., *Equisetum* spp., *Juncus* spp., and *Pascopyrum smithii*. Exotics found in this alliance are *Poa pratensis, Melilotus officinalis*, and *Bromus inermis*, among many others. Stands of this alliance are found on alluvial floodplains and terraces of rivers and streams, and sometimes around lakes and ponds. These communities tolerate and depend on periodic flooding and seasonal soil saturation in the spring and after heavy rains. The soils are silts, loams, and sands, and are derived from alluvial material. This alliance occurs near rivers and large streams of Montana, Wyoming, Colorado, Idaho, Arizona and New Mexico; from the western slope of Colorado it extends into mountain valleys and on to the Colorado Plateau of Utah.

Classification Comments:

Internal Comments: GK 9-16: ID added for Minidoka.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Riparian gallery forests and woodland dominated by *Populus deltoides ssp. wislizeni, Populus deltoides ssp. monilifera*, or *Salix amygdaloides*.

VEGETATION

Physiognomy and Structure: The tree layer is dominated by tall (20-35 m) single-stemmed, deciduous species. The canopy is open, generally forming 25-60% cover. The herbaceous layer is dominated by both graminoids and forbs with up to 20% cover.

Floristics: This alliance is dominated by *Populus deltoides ssp. wislizeni, Populus deltoides ssp. monilifera*, or *Salix amygdaloides*. Secondary canopy species include *Acer negundo* or (rarely) *Populus angustifolia*. A shrub layer may be present, including *Cornus sericea, Prunus virginiana, Salix exigua, Salix ligulifolia, Salix lucida, Salix lutea, Symphoricarpos occidentalis*, and others. Herbaceous layer may have *Carex pellita (= Carex lanuginosa), Carex* spp., *Cenchrus longispinus, Elymus* spp., *Equisetum* spp., *Glycyrrhiza lepidota, Juncus* spp., *Pascopyrum smithii, Phalaris arundinacea*, and *Poa palustris*. Common exotics found in this alliance are *Bromus inermis, Cirsium arvense, Melilotus officinalis (= Melilotus albus)*, and *Poa pratensis*.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands of this alliance are found on level to gently sloping topography along rivers, streams, lakes, and ponds. The areas may have been very recently deposited by water action or they may have been deposited earlier and occupied by other communities. The water table fluctuates with the level of the adjacent water body. This can lead to periods of flooding and soil saturation in the spring and after heavy rains and also to periods of drought when the water level falls in the summer and fall. The soils are silts, loams, and sands, and are derived from alluvial material. Stands are located on immediate streambanks, or on distance river terraces, in backwater areas and overflow channels of large rivers, on narrow floodplains of small creeks, and on the edges of ponds and lakes. The water table is within 1 m of the soil surface during the growing season (Hansen et al. 1995), and the vegetation is tolerant of prolonged flooding.

Dynamics: Cottonwood forests grow within an alluvial environment that is continually changing due to the ebb and flow of the river. Riparian vegetation successional stage is "re-set" by flooding disturbance. Cottonwood communities are early-, mid- or late-seral, depending on the age class of the trees and the associated species of the stand. Mature cottonwood stands do not regenerate in place, but regenerate in different settings up and down a river reach. Over time, a healthy riparian area supports all stages of cottonwood communities. The process of cottonwood regeneration is well-documented. Periodic flooding events can leave sandbars of bare, mineral substrate. Cottonwood seedlings germinate and become established on newly-deposited, moist sandbars. In the absence of large floods in subsequent years, seedlings begin to trap sediment. In time, the sediment accumulates and the sandbar rises. The young forest community is then above the annual flood zone of the river channel. In addition, seasonal floods that leave fresh deposits of sediment are also areas available for colonization. This process often favors the establishment of aggressive native and exotic plants, as well as cottonwood seedlings.

Salix amygdaloides requires a moist, mineral substrate for seeds to germinate. Seeds can germinate under a sparse canopy of vegetation (Johnson 1992, cited in Jones and Walford 1995).

DISTRIBUTION

Geographic Range: This alliance occurs near rivers and large streams of Montana, Wyoming, Colorado, Idaho, Arizona and New Mexico; from the western slope of Colorado it extends into mountain valleys and on to the Colorado Plateau of Utah.

Nations: CA, US
States/Provinces: AZ, CO, ID, MT, NM, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Salix amygdaloides* Community Type (Hansen et al. 1995)
- **><** Cottonwood: 63 (Eyre 1980)
- **><** Eastern Broadleaf Forests: 98: Northern Floodplain Forest (*Populus-Salix-Ulmus*) (Küchler 1964)
- **?** Peachleaf Willow Dominance Type (Jones and Walford 1995)

LOWER LEVEL UNITS

Associations:

- CEGL000939 *Populus deltoides (ssp. wislizeni, ssp. monilifera) / Distichlis spicata* Riparian Woodland
- CEGL002685 *Populus deltoides (ssp. wislizeni, ssp. monilifera) / Salix exigua* Riparian Woodland
- CEGL000947 *Salix amygdaloides* Riparian Woodland
- CEGL000948 *Salix amygdaloides / Salix exigua* Riparian Woodland
- CEGL000940 *Populus deltoides ssp. wislizeni / Rhus trilobata* Riparian Woodland

- CEGL002680 *Populus deltoides (ssp. wislizeni, ssp. monilifera) / Pascopyrum smithii* Riparian Woodland

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2016/09/29

REFERENCES

References: Bunin 1985, Christy 1973, Cooper 1988, Crouch 1961a, Crouch 1961b, Crouch 1978, Crouch 1979a, Crouch 1979b, Eyre 1980, Faber-Langendoen et al. 2017b, Fitzgerald 1978, Hansen et al. 1991, Hansen et al. 1995, Jackson 1972, Jackson and Lindauer 1978, Jones and Walford 1995, Keammerer 1974a, Keammerer 1974b, Kittel and Lederer 1993, Kittel et al. 1996, Kittel et al. 1997a, Kittel et al. 1999a, Knopf 1985, Küchler 1964, Lindauer 1970, Lindauer 1978, Lindauer and Christy 1972, Lindauer and Fitzgerald 1974, Lindauer and Ward 1968, Lindauer et al. 1973, Masek 1979, McEachern 1979, Moseley et al. 1992, Moulton et al. 1981, Thilenius and Smith 1985, Thilenius et al. 1995, USBOR 1976, Welsh et al. 1987

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1. Forest & Woodland
1.B.3.Nd. Western North American Interior Flooded Forest
G797. Western Interior Riparian Forest & Woodland

A0644. Populus fremontii Great Basin Riparian Forest Alliance

Type Concept Sentence: This alliance contains riparian woodlands dominated by *Populus fremontii*. It occurs along stream channels on alluvial fans, in lower canyons in desert mountains, and valleys with dependable subsurface groundwater that varies considerably during the year. In the southwestern U.S., it occurs in western New Mexico, throughout Arizona, lower elevations of Utah, southern and central Nevada and just into the eastern desert of California.

OVERVIEW

Scientific Name: *Populus fremontii* Great Basin Riparian Forest Alliance
Common Name (Translated Scientific Name): Fremont Cottonwood Great Basin Riparian Forest Alliance
Colloquial Name: Great Basin Fremont Cottonwood Riparian Forest

Type Concept: This alliance contains riparian woodlands dominated by *Populus fremontii*. Individuals of *Populus fremontii* are scattered or occur in groves and may reach 30 m in height and 2 m in diameter. Other species that may occur in the canopy/subcanopy include *Baccharis salicifolia, Celtis laevigata var. reticulata, Fraxinus berlandieriana, Fraxinus velutina, Juglans microcarpa, Populus deltoides ssp. wislizeni, Prosopis glandulosa, Prosopis pubescens, Prosopis velutina, Salix amygdaloides, Salix exigua, Salix gooddingii*, and *Salix lasiolepis*. The understory of most examples has been considerably altered by grazing and other factors, thus the composition and cover of the native understory are difficult to ascertain, but frequently consists of shrubs and small trees (1-5 m tall). The herbaceous stratum varies in composition and coverage but is characterized by mixed annuals and short-lived perennials. Some areas have high amounts of *Tamarix* spp. and other exotic invasive trees. This woodland alliance occurs as small isolated stands or as linear bands that parallel stream channels on alluvial fans, in lower canyons in desert mountains, and valleys with dependable subsurface groundwater that varies considerably during the year. In the southwestern U.S., it occurs in western New Mexico, throughout Arizona, lower elevations of Utah, southern and central Nevada and just into the eastern desert of California.

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: *Populus fremontii* has >30% relative cover.

VEGETATION

Physiognomy and Structure: The tree stratum is dominated by a tall (10-25 to 30 m) broad-leaved deciduous tree. The canopy is open to dense (25-60%) depending on the stand. The tree subcanopy is dominated by multi-stemmed, broad-leaved shrubs. The herbaceous layer is sparse and often dominated by introduced hay grasses.

Floristics: The canopy is dominated by open stands of *Populus fremontii* generally forming 30-70% cover; individuals may be scattered or occur in groves. This species may reach 30 m in height and 2 m in diameter. Other woody species that may occur in the canopy/subcanopy include *Baccharis salicifolia, Celtis laevigata var. reticulata, Fraxinus berlandieriana, Fraxinus velutina, Juglans*

microcarpa, Populus deltoides ssp. wislizeni, Prosopis glandulosa, Prosopis pubescens, Prosopis velutina, Salix amygdaloides, Salix exigua, Salix gooddingii, and *Salix lasiolepis*. The understories of most examples have been considerably altered by grazing and other factors, thus the composition and cover of the native understory is difficult to ascertain, but frequently consists of shrubs and small trees (1-5 m tall) of the above species. The herbaceous stratum varies in composition and coverage, but is characterized by mixed annuals and short-lived perennials.

ENVIRONMENT & DYNAMICS

Environmental Description: This riparian alliance is found in floodplains and on lower alluvial terraces along the perennial streams that occur in the southern deserts. Elevations range from 335-2500 m. Stands are restricted to the floodplains and corridors of perennial streams by the arid upland environment. This vegetation type is dependent on a subsurface water supply and varies considerably with the water table levels. Major flood events and consequent flood scour, overbank deposition of water and sediments, and stream meandering are important factors that shape these woodlands. These woodlands occur as small isolated stands or as linear bands that parallel stream channels. Sites are flat to gently sloping and occur in lower canyons in desert mountains, alluvial fans and valleys. Substrates are generally well-drained, coarse-textured soils derived from stratified alluvium composed of sand, loam, gravel and cobbles. The soils may be slightly alkaline and saline. Climate is arid to semi-arid with hot summers and typically mild winters, but with freezing temperatures not uncommon in northern stands. Mean annual precipitation ranges from 15-28 cm, but can vary greatly from year to year. Drought is not uncommon.

Dynamics: This alliance is dependent on a subsurface water supply and varies considerably with the water table levels. Major flood events and consequent flood scour, overbank deposition of water and sediments, and stream meandering are important factors that shape these woodlands.

DISTRIBUTION

Geographic Range: This alliance is found in southeastern California, southern and central Nevada, Utah, Arizona and New Mexico.

Nations: US
States/Provinces: AZ, CA, NM, NV, UT
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** *Populus fremontii* (Fremont cottonwood forest) Alliance (Sawyer et al. 2009) [61.130.00]
- **?** *Populus fremontii* Alliance (Fremont cottonwood forest) (Buck-Diaz et al. 2012)
- **?** Broadleaf Cottonwood-Mixed Deciduous Series (Dick-Peddie 1993) [included in the Montane Riparian Vegetation Type.]
- **><** Central Coast Cottonwood-Sycamore Riparian Forest (#61210) (Holland 1986b)
- **><** Cottonwood - Willow: 235 (Eyre 1980)
- **?** Cottonwood Series (Dick-Peddie 1993) [included in the Floodplain Riparian Vegetation Type.]
- **?** Cottonwood-Willow Series (Dick-Peddie 1993) [included in the Floodplain Riparian Vegetation Type.]
- **?** Cottonwood-Willow Series (224.53) (Brown 1982a) [included within Sonoran Riparian and Oasis Forests]
- **><** Fremont Cottonwood series (Sawyer and Keeler-Wolf 1995)
- **><** Great Valley Cottonwood Riparian Forest (#61410) (Holland 1986b)
- **><** Great Valley Mixed Riparian Forest (#61420) (Holland 1986b)
- **><** IIA7d. Western Cottonwood - Willow Riverfront Forest (Allard 1990)
- **><** Modoc-Great Basin Cottonwood-Willow Riparian Forest (#61610) (Holland 1986b)
- **><** Mojave Riparian Forest (#61700) (Holland 1986b)
- **><** Sonoran Cottonwood-Willow Riparian Forest (#61810) (Holland 1986b)
- **><** Southern Cottonwood-Willow Riparian Forest (#61330) (Holland 1986b)

LOWER LEVEL UNITS

Associations:

- CEGL000943 *Populus fremontii / Salix geyeriana* Riparian Woodland
- CEGL000666 *Populus fremontii / Salix exigua* Riparian Forest
- CEGL002756 *Populus fremontii / Leymus triticoides* Riparian Woodland
- CEGL002981 *Populus fremontii / Betula occidentalis* Wooded Shrubland
- CEGL002473 *Populus fremontii* / Mesic Graminoids Riparian Woodland
- CEGL005365 *Populus fremontii / Artemisia tridentata* Riparian Woodland

- CEGL002465 *Populus fremontii / Ericameria nauseosa* Riparian Woodland
- CEGL003998 *Populus fremontii / Distichlis spicata* Riparian Woodland
- CEGL004003 *Populus fremontii / Sporobolus airoides* Riparian Woodland
- CEGL004002 *Populus fremontii / Salix (ligulifolia, lutea)* Riparian Woodland
- CEGL003775 *Populus fremontii / Equisetum* spp. Riparian Woodland
- CEGL002470 *Populus fremontii* / Mesic Forbs Riparian Woodland

AUTHORSHIP

Primary Concept Source: K.D. Patterson, D. Culver, G. Kittel, J. Evens, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Allard 1990, Barbour and Major 1977, Boles and Dick-Peddie 1983, Brown 1982a, Buck-Diaz et al. 2012, Campbell and Dick-Peddie 1964, Diamond et al. 1992, Dick-Peddie 1993, Evens and San 2006, Eyre 1980, Faber-Langendoen et al. 2017b, Holland 1986b, Klein and Evens 2006, Metcalfe 1902, Muldavin 1987, Muldavin et al. 2000a, NHNM unpubl. data, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Sproul et al. 2011, Stromberg 1993a, Stromberg 1995b, Szaro 1989, Von Loh et al. 2002, Webb and Brotherson 1988

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1. Forest & Woodland
1.B.3.Nd. Western North American Interior Flooded Forest
G797. Western Interior Riparian Forest & Woodland

A3752. Salix gooddingii - Salix laevigata Riparian Forest Alliance

Type Concept Sentence: This alliance consists of riparian woodlands dominated by *Salix gooddingii* and/or *Salix laevigata*, either as single-species stands or as mixed stands. Stands are generally without *Populus fremontii*. It occurs in California.

OVERVIEW

Scientific Name: *Salix gooddingii - Salix laevigata* Riparian Forest Alliance
Common Name (Translated Scientific Name): Goodding's Willow - Red Willow Riparian Forest Alliance
Colloquial Name: Goodding's Willow - Red Willow Riparian Forest

Type Concept: This alliance consists of riparian woodlands and forests dominated by *Salix gooddingii* and/or *Salix laevigata*, either as single-species stands or as mixed stands. Stands may or may not include *Populus fremontii*, and if they do, it is a minor component relative to dominant overstory canopy species. Other tree species present include *Acer macrophyllum, Alnus rhombifolia, Alnus rubra, Celtis laevigata var. reticulata, Fraxinus velutina, Juglans microcarpa, Platanus racemosa, Populus balsamifera, Prosopis glandulosa, Quercus pungens, Salix hookeriana, Salix sitchensis, Sapindus saponaria var. drummondii*, and/or *Ungnadia speciosa*. These stands occur throughout California riparian areas with deep alluvial soils generally restricted to less than 2000 m in elevation.

Classification Comments: For those stands without cottonwood.

Internal Comments: mjr 3-16: WY added based on false attribute to CEGL000950; WY removed. MSR 1-16: add NM, UT, WY.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: One of the three nominals has 30% relative cover or combined have >30% relative cover and *Populus fremontii* is not present or, if present, then has <5% cover.

VEGETATION

Physiognomy and Structure: This seasonally flooded/saturated broad-leaved cold-deciduous forest forms a continuous tree canopy less than 15 m in height. Shrubs are sparse below the tree canopy, and the herbaceous layer is variable.

Floristics: These riparian woodland and forest stands are dominated by *Salix gooddingii* and/or *Salix laevigata*, either as single-species stands or as mixed stands. They generally are without *Populus fremontii*, but when present, it is not abundant. Other tree species present include *Acer macrophyllum, Alnus rhombifolia, Alnus rubra, Celtis laevigata var. reticulata, Fraxinus velutina, Juglans microcarpa, Platanus racemosa, Populus balsamifera, Populus fremontii, Prosopis glandulosa, Quercus pungens, Salix hookeriana, Salix sitchensis, Sapindus saponaria var. drummondii*, and/or *Ungnadia speciosa*. Shrubs may include *Baccharis emoryi, Baccharis salicifolia, Cornus sericea, Rhus trilobata, Salix exigua*, and/or *Sambucus nigra ssp. caerulea (= Sambucus mexicana)*, as well as other

riparian shrubs. The herbaceous layer is highly variable depending on season, length of time since last inundation, and degree of disturbance.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs on floodplains, streamsides, ditches, lake edges, and low-gradient deposits along rivers, that are seasonally flooded or seasonally have saturated soils. Stands occur from sea level to 2700 m elevation. Because of the climate throughout the range of this alliance, flooding can occur throughout the winter and spring. Annual rainfall totals are between 60 and 80 cm.

Dynamics: This alliance requires seasonal inundation or seasonal saturation. Stands occur on low-gradient streamside depositions and in floodplains which receive low-intensity flooding at least every few years.

DISTRIBUTION

Geographic Range: This alliance ranges from California to New Mexico.

Nations: US
States/Provinces: CA, NM, UT
TNC Ecoregions [optional]: 11:C, 17:C
USFS Ecoregions (2007): 322Ad:CCC, 341Fe:CCC
Omernik Ecoregions:
Federal Lands [optional]: BLM (Carrizo Plain); NPS (Death Valley, Joshua Tree)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** *Salix gooddingii* (Black willow thickets) Alliance (Sawyer et al. 2009) [61.211.00]
- **>** *Salix gooddingii* Alliance (Black willow thickets) (Buck-Diaz et al. 2012)
- **?** *Salix gooddingii* Community Type (Szaro 1989)
- **>** *Salix gooddingii* Woodland Alliance (Evens et al. 2012)
- **>** *Salix laevigata* (Red willow thickets) Alliance (Sawyer et al. 2009) [61.205.00]
- **>** *Salix laevigata* Temporarily Flooded Woodland Alliance (Keeler-Wolf et al. 2012)
- **>** *Salix laevigata* Alliance (Red willow thickets) (Buck-Diaz et al. 2012)
- **>** *Salix laevigata* Woodland Alliance (Evens et al. 2014)
- **>** *Salix lucida* Alliance (Shining willow groves) (Buck-Diaz et al. 2012)
- **><** Central Coast Riparian Scrub (#63200) (Holland 1986b)
- **><** Great Valley Mixed Riparian Forest (#61420) (Holland 1986b)
- **><** Red Alder Riparian Forest (#61130) (Holland 1986b)

LOWER LEVEL UNITS

Associations:

- CEGL002874 *Salix laevigata - Salix lasiolepis / Baccharis salicifolia* Riparian Woodland
- CEGL000950 *Salix laevigata - Fraxinus velutina* Riparian Woodland
- CEGL005316 *Salix laevigata / Artemisia douglasiana - Rubus ursinus* Riparian Woodland
- CEGL003778 *Salix gooddingii / Salix exigua* Riparian Woodland
- CEGL002952 *Salix laevigata* Riparian Woodland

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2016/01/17

REFERENCES

References: Buck-Diaz et al. 2012, Evens et al. 2012, Evens et al. 2014, Faber-Langendoen et al. 2017b, Holland 1986b, Keeler-Wolf et al. 2012, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Sproul et al. 2011, Stout et al. 2013, Szaro 1989, VegCAMP and AIS 2013

M298. Interior West Ruderal Flooded & Swamp Forest & Woodland

This macrogroup consists of low-elevation riparian and lacustrine areas throughout the southwestern U.S. and into Mexico that are dominated by non-native invasive woody species such as *Tamarix* spp., *Elaeagnus angustifolia*, or *Phoenix dactylifera*.

1. Forest & Woodland
1.B.3.Nd. Western North American Interior Flooded Forest
1.B.3.Nd.90.a. M298 Interior West Ruderal Flooded & Swamp Forest & Woodland

G510. Interior West Ruderal Riparian Forest & Scrub

Type Concept Sentence: Stands of *Tamarix* spp., *Elaeagnus angustifolia*, or other introduced facultative wet-tolerant species in low-elevation riparian areas throughout the western U.S. and into Mexico.

OVERVIEW

Scientific Name: *Tamarix* spp. - *Elaeagnus angustifolia* Ruderal Riparian Forest & Scrub Group
Common Name (Translated Scientific Name): Tamarisk species - Russian-olive Ruderal Riparian Forest & Scrub Group
Colloquial Name: Ruderal Box-elder Riparian Forest

Type Concept: This group consists of low-elevation riparian areas, seeps and springs throughout the southwestern U.S. and into Mexico that are dominated by non-native invasive woody species. Present to abundant species include *Elaeagnus angustifolia, Myoporum laetum, Phoenix canariensis, Prunus mahaleb, Robinia pseudoacacia, Schinus molle, Schinus terebinthifolius, Tamarix* spp., *Ulmus pumila*, or *Washingtonia robusta*. Salt-cedar habitats tend to support fewer species and individuals than native habitats. If present, native species contribute less than 10% relative cover. Elevation ranges from sea level to above 2135 m (7000 feet). Sites are typically streambanks and benches, floodplains and canyons with permanent, intermittent or temporary waterflow.

Classification Comments: The name is "scrub" rather than forest or woodland to capture lower heights and more open canopy densities and the fact that some dominant species are multi-stemmed and may not meet "forest" or "woodland" criteria. Planted stands of *Washingtonia robusta, Washingtonia filifera*, and *Phoenix canariensis* are not part of this group but would be considered "cultural" vegetation. *Washingtonia robusta* is native to Mexico, so only naturalized stands within the U.S. belong to this group.

Similar NVC Types:
- G797 Western Interior Riparian Forest & Woodland

Diagnostic Characteristics: Tall, deciduous trees dominated by naturalized, invasive species not considered native to North America or, if native to North America, naturalized beyond their native ranges.

VEGETATION

Physiognomy and Structure: Open- to closed-canopy riparian woodlands that can have a scrubby appearance (multi-stemmed, 1-20 m tall) dominated by non-native woody species, generally following linear paths of adjacent streams, rivers and floodplains.

Floristics: Present to abundant species include *Elaeagnus angustifolia, Myoporum laetum, Phoenix canariensis, Prunus mahaleb, Robinia pseudoacacia, Schinus molle, Schinus terebinthifolius, Tamarix* spp., *Ulmus pumila*, or *Washingtonia robusta*. Some of these are not necessarily restricted to riparian/wetland settings. Salt-cedar habitats tend to support fewer species and individuals than native habitats (Smith and Douglas 1989, Barbour et al. 2007, Sogge et al. 2008, Sawyer et al. 2009). Non-native understory species may include *Acroptilon repens, Aegilops* sp., *Agrostis gigantea, Agrostis stolonifera, Alopecurus geniculatus, Alopecurus pratensis, Arundo donax, Conyza canadensis, Cirsium arvense, Echinochloa crus-galli, Eichhornia crassipes, Hordeum murinum, Phalaris arundinacea, Phleum pratense, Phragmites australis, Poa palustris, Poa pratensis, Rumex crispus*, and *Sonchus arvensis*.

ENVIRONMENT & DYNAMICS

Environmental Description: Elevation ranges from sea level to above 2135 m (7000 feet). *Climate:* Warm Temperate. *Soil/substrate/hydrology:* Sites are typically alluvial streambanks and floodplains, with slightly alkaline soils and water heavy in agricultural runoff (Smith and Douglas 1989, Barbour et al. 2007, Sogge et al. 2008, Sawyer et al. 2009).

Dynamics:

DISTRIBUTION

Geographic Range: This group is found throughout the western interior of the U.S. and into Mexico.

Spatial Scale & Pattern [optional]: Large patch, Linear
Nations: MX, US
States/Provinces: AZ, CA, ID, NM, NV, OK, TX
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:

Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Alliances:

- A4160 *Rubus armeniacus - Sesbania punicea - Ficus carica* Ruderal Riparian Scrub Alliance
- A4155 *Acer negundo - Populus* spp. - *Picea* spp. Ruderal Riparian Forest Alliance
- A4161 *Phoenix dactylifera - Washingtonia filifera* Ruderal Riparian Woodland Alliance
- A4218 *Prosopis* spp. Lowland Ruderal Understory Wet Scrub Alliance
- A3566 *Elaeagnus angustifolia* Ruderal Riparian Scrub Alliance
- A0842 *Tamarix* spp. Ruderal Riparian Scrub Alliance
- A4192 *Salix alba - Salix fragilis* Ruderal Riparian Forest Alliance

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2011)
Author of Description: G. Kittel
Acknowledgments:

REFERENCES

1. Forest & Woodland
1.B.3.Nd. Western North American Interior Flooded Forest
G510. Interior West Ruderal Riparian Forest & Scrub

A4155. Acer negundo - Populus spp. - Picea spp. Ruderal Riparian Forest Alliance [Low - Poorly Documented]

Type Concept Sentence:

OVERVIEW

Scientific Name: *Acer negundo - Populus* spp. - *Picea* spp. Ruderal Riparian Forest Alliance
Common Name (Translated Scientific Name): Box-elder - Cottonwood species - Spruce species Ruderal Riparian Forest Alliance
Colloquial Name: Ruderal Box-elder Riparian Forest

Type Concept:

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics:

VEGETATION

Physiognomy and Structure:

Floristics:

ENVIRONMENT & DYNAMICS

Environmental Description:

Dynamics:

DISTRIBUTION

Geographic Range:

Nations: US
States/Provinces: AZ, CO, ID, NM, UT, WY
TNC Ecoregions [optional]:

USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

LOWER LEVEL UNITS

Associations:

- CEGL005485 *Populus fremontii / Tamarix* sp. Ruderal Riparian Woodland
- CEGL002693 *Acer negundo* / Disturbed Understory Riparian Woodland
- CEGL003749 *Populus angustifolia* / Invasive Perennial Grasses Ruderal Riparian Woodland
- CEGL005958 *Picea pungens / Poa pratensis* Ruderal Riparian Woodland
- CEGL003810 *Populus deltoides ssp. wislizeni* / Disturbed Understory Ruderal Flooded Woodland
- CEGL005961 *Populus angustifolia - Acer negundo / Poa pratensis* Ruderal Riparian Woodland

AUTHORSHIP

Primary Concept Source: G. Kittel
Author of Description:
Acknowledgments:

REFERENCES

1. Forest & Woodland
1.B.3.Nd. Western North American Interior Flooded Forest
G510. Interior West Ruderal Riparian Forest & Scrub

A3566. Elaeagnus angustifolia Ruderal Riparian Scrub Alliance [Low - Poorly Documented]

Type Concept Sentence: This alliance is dominated by the introduced tree species *Elaeagnus angustifolia* with a variety of native and introduced species in the shrub and herbaceous layers. It is a widespread woodland alliance found throughout much of the southwestern United States. It is a naturalized species whose seeds are spread by birds. Stands tend to be small and linear and occur in a variety of native habitats, particularly more mesic ones, such as near streams and rivers, upland basins and drainages.

OVERVIEW

Scientific Name: *Elaeagnus angustifolia* Ruderal Riparian Scrub Alliance
Common Name (Translated Scientific Name): Russian-olive Ruderal Riparian Scrub Alliance
Colloquial Name: Ruderal Russian-olive Riparian Scrub

Type Concept: This wooded alliance is dominated by the introduced tree species *Elaeagnus angustifolia* with a variety of native and introduced species in the shrub and herbaceous layers. Additional associated species have not been documented. The alliance is widespread and found throughout much of the southwestern United States. It is a naturalized species that has been widely planted in hedgerows for windbreaks. It has since spread (by birds distributing their seeds) to a variety of native habitats, particularly more mesic ones, such as near streams and rivers. Stands tend to be small and linear.

Classification Comments: Often a co-inhabitant with tamarisk but forms woodlands and stands in slightly less wet and less frequently flooded areas than tamarisk.

Internal Comments: GK 9-16: ID added for Minidoka.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Woodlands dominated by *Elaeagnus angustifolia*.

VEGETATION

Physiognomy and Structure:

Floristics: The vegetation in this ruderal alliance is characterized by the dominance of the introduced tree species *Elaeagnus angustifolia* with a variety of native and introduced species in the shrub and herbaceous layers. Native species present include (with less than 10% cover) *Amorpha fruticosa, Atriplex patula, Distichlis spicata, Hordeum jubatum, Pascopyrum smithii, Populus fremontii,*

Salix exigua, and *Sporobolus airoides*. Introduced species that may also be present include *Bassia scoparia (= Kochia scoparia), Descurainia sophia, Lepidium latifolium, Tamarix ramosissima*, and many others.

ENVIRONMENT & DYNAMICS

Environmental Description: *Elaeagnus angustifolia* has since spread to a variety of native habitats, particularly more mesic ones, such as near streams and rivers. Habitats include shorelines of lakes, streambanks and floodplains of rivers, subirrigated upland basins and drainages.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is found throughout disturbed mesic areas of the southwestern U.S.

Nations: US
States/Provinces: AZ, CO, ID, ND, SD, UT
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL005269 *Elaeagnus angustifolia* Ruderal Riparian Woodland

AUTHORSHIP

Primary Concept Source: D. Faber-Langendoen and K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Faber-Langendoen et al. 2017b

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1. Forest & Woodland
1.B.3.Nd. Western North American Interior Flooded Forest
G510. Interior West Ruderal Riparian Forest & Scrub

A4218. Prosopis spp. Lowland Ruderal Understory Wet Scrub Alliance [Low - Poorly Documented]

Type Concept Sentence:

OVERVIEW

Scientific Name: *Prosopis* spp. Lowland Ruderal Understory Wet Scrub Alliance
Common Name (Translated Scientific Name): Mesquite species Lowland Ruderal Understory Wet Scrub Alliance
Colloquial Name: Ruderal Lowland Mesquite Wet Scrub

Type Concept:

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics:

VEGETATION

Physiognomy and Structure:

Floristics:

ENVIRONMENT & DYNAMICS

Environmental Description:

Dynamics:

DISTRIBUTION

Geographic Range:

Nations: MX?, US
States/Provinces: AZ, MXSO?
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

LOWER LEVEL UNITS

Associations:

AUTHORSHIP

Primary Concept Source: M. Reid, in Faber-Langendoen et al.
Author of Description:
Acknowledgments:

REFERENCES

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1. Forest & Woodland
1.B.3.Nd. Western North American Interior Flooded Forest
G510. Interior West Ruderal Riparian Forest & Scrub

A4160. Rubus armeniacus - Sesbania punicea - Ficus carica Ruderal Riparian Scrub Alliance

Type Concept Sentence: This ruderal shrubland alliance forms an open to continuous shrub layer with *Ficus carica* dominant and characteristic. *Nerium oleander* is sometimes present as an associated non-native. The alliance was sampled at only two mountain springs in the Death Valley region of California.

OVERVIEW

Scientific Name: *Rubus armeniacus - Sesbania punicea - Ficus carica* Ruderal Riparian Scrub Alliance
Common Name (Translated Scientific Name): Himalayan Blackberry - Rattlebox - Edible Fig Ruderal Riparian Scrub Alliance
Colloquial Name: Californian Ruderal Riparian Scrub

Type Concept: This ruderal shrubland alliance forms an open to continuous shrub layer. *Ficus carica* is the dominant and characteristic shrub. *Nerium oleander* is sometimes present as an associated non-native, and other shrubs may include *Ambrosia dumosa, Atriplex canescens, Ericameria cuneata*, and *Larrea tridentata*. Adjacent woody riparian stands include those dominated by *Baccharis sergiloides, Pluchea sericea, Populus fremontii, Prosopis glandulosa*, and *Salix laevigata*, as well as culturally planted stands of *Fraxinus velutina, Nerium oleander*, and *Tamarix aphylla*. The alliance was sampled at only two mountain springs in the Death Valley region of California, and patches are small in size (<0.1 ha). Elevations range from approximately 728 to 1401 m. This alliance requires more data to adequately describe, and its small stands are likely an artifact of cultural plantings with escaped individuals.

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: This alliance is characterized by an open to continuous shrub layer with *Ficus carica* strongly dominant. *Nerium oleander* is sometimes present as an associated non-native.

VEGETATION

Physiognomy and Structure:

Floristics: The alliance forms a continuous shrub layer and the overall shrub cover ranges from 60 to 100%. The tree layer is sparse or absent. *Ficus carica* is the dominant and characteristic shrub. *Nerium oleander* is sometimes present as an associated non-native, and other shrubs may include *Ambrosia dumosa, Atriplex canescens, Ericameria cuneata*, and *Larrea tridentata*. Adjacent woody riparian stands include those dominated by *Baccharis sergiloides, Pluchea sericea, Populus fremontii, Prosopis glandulosa*, and *Salix laevigata*, as well as culturally planted stands of *Fraxinus velutina, Nerium oleander*, and *Tamarix aphylla*.

ENVIRONMENT & DYNAMICS

Environmental Description: The alliance is found in localized mountain springs in Death Valley. The elevations range from mid to high (approximately 728-1401 m).

Dynamics: *Ficus carica* is not common in the region, and the fig's presence is apparently from cultural plantings and naturally escaping at a very small degree.

DISTRIBUTION

Geographic Range: The alliance is scattered in Death Valley National Monument in mid to upper elevation mountain springs. Samples were taken from two springs at Mint Spring and Warm Spring, and patches are small in size (<0.1 hectare).

Nations: US
States/Provinces: CA
TNC Ecoregions [optional]: 11:C, 17:C
USFS Ecoregions (2007): 322Af:CCC, 341Ff:CCC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** *Ficus carica* Semi-Natural Shrubland Alliance (Evens et al. 2014)

LOWER LEVEL UNITS

Associations:
- CEPP006709 *Ficus carica* Ruderal Riparian Scrub

AUTHORSHIP

Primary Concept Source: J.M. Evens, K. Sikes, D. Hastings, and J. Ratchford (2014)
Author of Description: J. Evens
Acknowledgments:
Version Date: 2015/01/23

REFERENCES

References: Evens et al. 2014, Faber-Langendoen et al. 2017b

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1. Forest & Woodland
1.B.3.Nd. Western North American Interior Flooded Forest
G510. Interior West Ruderal Riparian Forest & Scrub

A4192. Salix alba - Salix fragilis Ruderal Riparian Forest Alliance [Low - Poorly Documented]

Type Concept Sentence: Naturalized stands of *Salix fragilis* and/or *Salix alba* occurring along riverbanks and lakeside margins and found throughout the western U.S. and probably in the western Great Plains.

OVERVIEW

Scientific Name: *Salix alba - Salix fragilis* Ruderal Riparian Forest Alliance
Common Name (Translated Scientific Name): White Willow - Crack Willow Ruderal Riparian Forest Alliance
Colloquial Name: Ruderal White Willow - Crack Willow Riparian Forest

Type Concept: *Salix fragilis* and *Salix alba* are large tree willows that were introduced to the United States as ornamental and/or shade trees. These have naturalized along streams and rivers throughout the western U.S. and probably in the western Great Plains. They can reproduce vegetatively and will spread slowly, and usually not far from their source planting. They appear both as individual trees and in large stands. Ecologically they compete with the native tree willows, such as *Salix amygdaloides, Salix nigra*, and *Salix gooddingii*, as well as native cottonwoods. Native shrubs such as *Salix exigua*, and *Toxicodendron rydbergii* may be present. Understory species include native sedges, grasses and forbs such as *Beckmannia syzigachne, Carex aquatilis, Carex utriculata, Carex nebrascensis, Carex hystericina, Calamagrostis* spp., *Galium* spp., *Maianthemum stellatum, Mentha arvensis*, and *Urtica dioica*, and others. Non-native herbaceous species can also be abundant, such as *Arctium minus, Cynoglossum officinale, Bromus tectorum, Bromus inermis, Poa pratensis, Phleum pratense, Cirsium arvense, Melilotus officinalis, Dactylis glomerata, Conium maculatum*, and others. Stands are found in disturbed places, generally near settlements, that are wet naturally or irrigated, such as riparian areas, golf courses, city parks, floodplains, streambanks, ditches and lake margins below 2286 m (7500 feet) in elevation.

Classification Comments: Hybrids between *Salix fragilis* and *Salix alba* exist, and can be difficult to identify. Also, they are known to hybridize with native willows, such as *Salix nigra* and *Salix amygdaloides*.

Internal Comments: GK 9-16: AZ, CA, CO, MT, NM, NV, OR, UT, WA, WY added.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics:

VEGETATION

Physiognomy and Structure:

Floristics: *Salix fragilis* and *Salix alba* are large tree willows that were introduced to the United States as ornamental and/or shade trees. These have naturalized along streams and rivers throughout the western U.S. and probably in the western Great Plains. They can reproduce vegetatively and will spread slowly, and usually not far from their source planting. They appear both as individual trees and in large stands. Ecologically it competes with the native tree willows, such as *Salix amygdaloides, Salix nigra*, and *Salix gooddingii*, as well as native cottonwoods. Native shrubs such as *Salix exigua*, and *Toxicodendron rydbergii* may be present. Understory species include native sedges, grasses and forbs such as *Beckmannia syzigachne, Carex aquatilis, Carex utriculata, Carex nebrascensis, Carex hystericina, Calamagrostis* spp., *Galium* spp., *Maianthemum stellatum, Mentha arvensis*, and *Urtica dioica*, and others. Non-native herbaceous species can also be abundant, such as *Arctium minus, Cynoglossum officinale, Bromus tectorum, Bromus inermis, Poa pratensis, Phleum pratense, Cirsium arvense, Melilotus officinalis, Dactylis glomerata, Conium maculatum*, and others.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands are found in disturbed places, generally near settlements, that are wet naturally or irrigated, such as riparian areas, golf courses, city parks, floodplains, streambanks, ditches and lake margins below 2286 m (7500 feet) in elevation.

Dynamics: *Salix fragilis* is called crack willow because it is highly susceptible to wind, ice and snow damage. It has escaped cultivation and can form pure stands. Willows can spread easily from detached twigs floating downstream.

DISTRIBUTION

Geographic Range: This alliance is known from throughout the western U.S. and probably also occurs in the western Great Plains.

Nations: US
States/Provinces: AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

LOWER LEVEL UNITS

Associations:

- CEGL005622 *Salix (fragilis, alba)* Ruderal Riparian Woodland

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2015)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2016/09/28

REFERENCES

References: Czarapata 2005, Faber-Langendoen et al. 2017b, Hickman 1993

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1. Forest & Woodland
1.B.3.Nd. Western North American Interior Flooded Forest
G510. Interior West Ruderal Riparian Forest & Scrub

A0842. Tamarix spp. Ruderal Riparian Scrub Alliance [Low - Poorly Documented]

Type Concept Sentence: This alliance is composed of shrublands dominated by introduced species of *Tamarix*, including *Tamarix chinensis, Tamarix gallica, Tamarix parviflora*, and *Tamarix ramosissima*. It forms moderately dense to dense thickets on banks of larger streams, rivers and playas across the southwestern U.S. and northern Mexico.

OVERVIEW

Scientific Name: *Tamarix* spp. Ruderal Riparian Scrub Alliance
Common Name (Translated Scientific Name): Tamarisk species Ruderal Riparian Scrub Alliance
Colloquial Name: Ruderal Tamarisk Riparian Scrub

Type Concept: This alliance is composed of shrublands dominated by introduced species of *Tamarix*, including *Tamarix chinensis, Tamarix gallica, Tamarix parviflora*, and *Tamarix ramosissima*. It forms moderately dense to dense thickets on banks of larger streams, rivers and playas across the southwestern U.S. and northern Mexico. Introduced from the Mediterranean, *Tamarix* spp. have become naturalized in various sites, including salt flats, springs, and especially along streams and regulated rivers, often replacing *Salix* or *Prosopis* spp. shrublands or other native vegetation. A remnant herbaceous layer may be present, depending on the age and density of the shrub layer. These species have become a critical nuisance along most large rivers in the semi-arid western U.S.

Classification Comments: Stands also occur in Oklahoma, and this alliance includes them as well.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Riparian woodlands and washes dominated by *Tamarix* spp.

VEGETATION

Physiognomy and Structure:

Floristics: This alliance consists of shrublands with moderate to dense cover of a tall-shrub layer that is solely or strongly dominated by *Tamarix*, including (commonly) *Tamarix chinensis, Tamarix gallica, Tamarix parviflora*, and *Tamarix ramosissima*. Other introduced species of *Tamarix* have been documented in the U.S., but whether these form full stands is yet to be documented. Additional *Tamarix* species include *Tamarix africana, Tamarix aphylla, Tamarix aralensis, Tamarix canariensis*, and *Tamarix tetragyna* (Kartesz 1999). Other native shrubs may be present and include species of *Salix* (especially *Salix exigua*) and *Prosopis, Rhus trilobata*, and *Sarcobatus vermiculatus*, but with low cover (if shrub species are codominant, then stand may be classified as a native shrubland type). Scattered native *Acer negundo, Elaeagnus angustifolia, Populus* spp., or *Salix amygdaloides* trees may also be present. Depending on stand age and density of the shrub layer, an herbaceous layer may be present. Associated native species include *Distichlis spicata, Sporobolus airoides*, and introduced forage species such as *Agrostis gigantea, Agrostis stolonifera*, and *Poa pratensis*. Other introduced herbaceous species such as *Conyza canadensis, Lepidium latifolium*, and *Polypogon monspeliensis* may also be present.

ENVIRONMENT & DYNAMICS

Environmental Description: These widespread shrublands are common along larger streams, rivers, and around playas. Elevation ranges from 75 m below sea level to 1860 m. Sites include riverbanks, floodplains, basins, sandbars, side channels, springs, salt flats,

and other saline habitats. Substrates are commonly thin sandy loam soil over alluvial deposits of sand, gravel or cobbles. Stands grow especially well along regulated rivers and rivers with agricultural runoff that increase the salts in the water.

Dynamics: *Tamarix* spp. are extremely drought- and salt-tolerant, produce prolific wind-dispersed seeds over much of the growing season, can resprout after burning or cutting, and, if kept moist, buried or broken branches will develop adventitious roots and grow. Stands seem to favor disturbed and flow-regulated rivers, but establish well in pristine areas, too. Once established, stands are extremely difficult to eradicate, requiring cutting and herbicide application on stumps to prevent resprouting (Smith and Douglas 1989).

In California, tamarisk species are among the most invasive, widely distributed, and troublesome non-natives to infest wetlands. Multiple, interacting factors facilitate tamarisk invasion, including intentional planting for erosion control and windbreaks; land conversion to agriculture; reduced flood frequencies after damming rivers; changing and stabilizing waterflows, times, and rates downstream from reservoirs; and increased salinity levels in the rivers from evaporation in the reservoirs (Everitt 1980). Tamarisk vigorously sprouts and increases flowering and seed production after fire. Mixed riparian stands often change to tamarisk-dominated stands after fires (Zouhar 2003b, Brooks and Minnich 2006). Active programs to remove tamarisk are ongoing in the state (Lovich 2000). Discouraging tamarisk establishment by biological and mechanical control is the most effective method of control. Once established in large stands, control and eradication efforts are difficult and costly; many managers recommend integrated management approaches (Lovich 2000, Zouhar 2003b, Carpenter 2005).

DISTRIBUTION

Geographic Range: This alliance is found throughout the southwestern U.S. and northern Mexico.

Nations: MX, US
States/Provinces: AZ, CA, CO, MT, MXCH, MXCO, MXSO, NM, NV, OK, TX, UT, WY
TNC Ecoregions [optional]: 11:C, 13:C, 15:C, 16:C, 17:C, 23:C
USFS Ecoregions (2007): 261B:CC, 262A:CC, 322Ab:CCC, 322Al:CCC, 322At:CCC, 322Av:CCC, 322Ay:CCC, 322Az:CCC, 322B:CC, 322C:CC, 341Fc:CCC, M261A:CC, M261B:CC, M261C:CC, M261F:CC, M262A:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Joshua Tree, Lake Mead, Mojave)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

- **=** *Tamarix* spp. (Tamarisk thickets) Semi-natural Stands (Sawyer et al. 2009) [63.810.00]
- **?** *Tamarix chinensis* Community Type (Hansen et al. 1995)
- **?** *Tamarix chinensis* shrubland alliance (Hoagland 1998a)
- **?** *Tamarix pentandra* Community Type (Szaro 1989)
- **?** *Tamarix ramosissima* (Salt cedar) Association (Nachlinger and Reese 1996)
- **=** *Tamarix* spp. Semi-Natural Shrubland Stands (Evens et al. 2012)
- **=** *Tamarix* spp. Semi-Natural Stands (Tamarisk thickets) (Buck-Diaz et al. 2012)
- **=** *Tamarix* spp. Semi-natural Shrubland Alliance (Evens et al. 2014)
- **=** *Tamarix* spp. Shrubland Semi-Natural Alliance (CNPS 2017) [63.810.00]
- **?** Salt cedar series (Paysen et al. 1980)
- **=** Saltcedar Alliance (Muldavin et al. 2000a)
- **?** Saltcedar Series (Dick-Peddie 1993)
- **=** Tamarisk Scrub (#63810) (Holland 1986b)
- **=** Tamarisk series (Sawyer and Keeler-Wolf 1995)

LOWER LEVEL UNITS

Associations:
- CEPP005697 *Tamarix chinensis* Ruderal Lakeshore Scrub
- CEGL003114 *Tamarix* spp. Ruderal Riparian Shrubland

AUTHORSHIP

Primary Concept Source: M.S. Reid and K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Brooks and Minnich 2006, Brown 1982a, Buck-Diaz et al. 2012, CNPS 2017, Campbell and Dick-Peddie 1964, Carpenter 2005, DiTomaso and Healy 2007, Dick-Peddie 1993, Evens and San 2006, Evens et al. 2012, Evens et al. 2014, Faber-Langendoen et al. 2017b, Hansen et al. 1995, Hefley 1937, Hoagland 1998a, Holland 1986b, Johnson 1987b, Keeler-Wolf et al. 1998a, Keeler-Wolf et al. 2005, Klein and Evens 2006, Little 1996, Lovich 2000, Muldavin et al. 2000a, Nachlinger and Reese 1996, Neill 1985, Paysen et al. 1980, Powell 1988b, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Smith and Douglas 1989, Sproul et al. 2011, Szaro 1989, Thomas et al. 2004, USBOR 1976, Von Loh et al. 2002, Zouhar 1993b

2. SHRUB & HERB VEGETATION

Grasslands, shrublands, open tree savannas, marshes, bogs and fens dominated by broadly mesomorphic (including scleromorphic) shrub and herb growth forms (including *broad-leaved, needle-leaved*, and *sclerophyllous shrubs*, and *forb* and *graminoid herbs*) with an irregular horizontal canopy structure, mesomorphic trees typically <10% cover (but tropical tree savannas typically <40%), tropical to boreal and subalpine climates, and wet to dry substrate conditions.

2.B. Temperate & Boreal Grassland & Shrubland

Temperate & Boreal Grassland & Shrubland is dominated by mesomorphic grasses and shrubs, with or without scattered trees (and trees typically <10% cover), ranging from temperate coastal to inland lowland and montane grasslands and shrublands, with a strongly seasonal climate and at least some frost to extended cold seasons.

2.B.2. Temperate Grassland & Shrubland

Temperate Grassland, Meadow & Shrubland is dominated by perennial grasses, forbs and shrubs typical of moderately dry to moist habitats, and is found in the mid-latitude regions of all continents (23° to 55°N and S), varying from large open grassland landscapes to droughty hillside meadows in forested landscapes.

2.B.2.Na. Western North American Grassland & Shrubland

This division contains cool-temperate lowland to subalpine shrubland, grassland, and meadow communities that are dominated by cold-deciduous shrubs or cool-season bunchgrasses or mesic forbs in the mountainous regions of western North America, from Alaska's Aleutian Islands south to the central coast of California, and down through the Intermountain West ranges and Rocky Mountains to Arizona and New Mexico.

M049. Southern Rocky Mountain Montane Shrubland

This shrubland macrogroup is found in the foothills, canyon slopes and montane zone of mountains of the southern Rocky Mountains and Colorado Plateau and extends out onto outcrops and canyon slopes in the western and southern Great Plains. The vegetation is characterized by an open to dense shrub layer typically dominated by *Cercocarpus montanus, Purshia tridentata*, and/or *Quercus gambelii*, and several other characteristic shrubs.

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
2.B.2.Na.1.a. M049 Southern Rocky Mountain Montane Shrubland

G277. Southern Rocky Mountain Gambel Oak - Mixed Montane Shrubland

Type Concept Sentence: This group occurs in the mountains, plateaus and foothills of the southern Rocky Mountains and Colorado Plateau, and is typically dominated by *Quercus gambelii* alone or codominant with *Amelanchier alnifolia, Amelanchier utahensis, Artemisia tridentata, Cercocarpus montanus, Fraxinus anomala, Prunus virginiana, Purshia stansburiana, Purshia tridentata, Robinia neomexicana, Symphoricarpos oreophilus*, or *Symphoricarpos rotundifolius*.

OVERVIEW

Scientific Name: *Quercus gambelii - Amelanchier* spp. - *Prunus virginiana* Southern Rocky Mountain Montane Shrubland Group
Common Name (Translated Scientific Name): Gambel Oak - Serviceberry species - Chokecherry Southern Rocky Mountain Montane Shrubland Group
Colloquial Name: Fendler's Ceanothus Shrubland & Shrub-Steppe

Type Concept: This group occurs in the mountains, plateaus and foothills of the southern Rocky Mountains and Colorado Plateau, including the Uinta and Wasatch ranges and the Mogollon Rim. The vegetation is typically dominated by *Quercus gambelii* alone or codominant with *Amelanchier alnifolia, Amelanchier utahensis, Artemisia tridentata, Cercocarpus montanus, Fendlera rupicola, Fraxinus anomala, Holodiscus dumosus, Jamesia americana, Prunus virginiana, Purshia stansburiana, Purshia tridentata, Robinia neomexicana, Symphoricarpos oreophilus*, or *Symphoricarpos rotundifolius*. There may be inclusions of other mesic montane shrublands with *Quercus gambelii* absent or as a relatively minor component. These shrublands are most commonly found along dry foothills, lower mountain slopes, and at the edge of the western Great Plains from approximately 2000 to 2900 m in elevation, and are often situated above pinyon-juniper woodlands. Substrates are variable and include soil types ranging from calcareous, heavy, fine-grained loams to sandy loams, gravelly loams, clay loams, deep alluvial sand, or coarse gravel. This group intergrades with Southern Rocky Mountain Mountain-mahogany - Mixed Foothill Shrubland Group (G276) and shares many of the same site characteristics. However, this group includes more mesic communities. Density and cover of *Quercus gambelii* and *Amelanchier* spp. often increase after fire.

Classification Comments: Disjunct *Quercus gambelii*-dominated shrublands found in the Davis Mountains and probably the Guadalupe Range in the Trans-Pecos of Texas are included in the concept of Eastern Madrean Chaparral Group (G280). *Quercus gambelii* apparently occurs as a significant component of a shrubland of the Trans-Pecos of Texas; however, most of the other species that codominate in this group do not occur in the Trans-Pecos. This group is not currently attributed to Texas, and it seems more appropriate to modify the description of Eastern Madrean Chaparral Group (G280) to allow for the presence of *Quercus gambelii* as a significant component of some occurrences. However, *Quercus gambelii / Symphoricarpos oreophilus* Shrubland (CEGL001117) is an association found in the Trans-Pecos. Also, there is a need to clarify the concept of Southern Rocky Mountain Mountain-mahogany - Mixed Foothill Shrubland Group (G276).

Similar NVC Types:
- G272 Central Rocky Mountain Montane-Foothill Deciduous Shrubland
- G276 Southern Rocky Mountain Mountain-mahogany - Mixed Foothill Shrubland

Diagnostic Characteristics: Stands of this group are typically dominated by broad-leaved, deciduous shrubs, which are typical of the montane zones of the southern Rocky Mountains. *Quercus gambelii* is the main species in most occurrences, although some may have equal amounts of (or only) *Amelanchier alnifolia, Amelanchier utahensis, Artemisia tridentata, Cercocarpus montanus, Ceanothus fendleri, Fendlera rupicola, Fraxinus anomala, Holodiscus dumosus, Jamesia americana, Prunus virginiana, Purshia stansburiana, Purshia tridentata, Rhus trilobata, Robinia neomexicana, Symphoricarpos oreophilus*, or *Symphoricarpos rotundifolius*. The herbaceous layer is not consistent, having sparse to moderately dense cover and mostly composed of graminoids, including *Carex geyeri, Carex inops, Festuca thurberi, Hesperostipa comata, Muhlenbergia montana*, and *Poa fendleriana*.

VEGETATION

Physiognomy and Structure: The vegetation may occur as sparse to dense broad-leaved deciduous shrublands composed of moderate to tall shrubs, or occasionally small trees. Occurrences may be multi-layered, with some short shrubby species occurring in the understory of the dominant overstory species. They can range from dense thickets with little understory to relatively mesic mixed shrublands with a rich understory of shrubs, grasses and forbs. These shrubs often have a patchy distribution with grass growing in between. Scattered trees are occasionally present in stands.

Floristics: In many occurrences of this group, the canopy is dominated by the broad-leaved deciduous shrub *Quercus gambelii*, which occasionally reaches small tree size. It may form dense thickets with little understory or be relatively open with a rich understory of shrubs, grasses and forbs. Scattered trees are occasionally present and typically include species of *Juniperus* or *Pinus*. Characteristic shrubs that may co-occur, or be singularly dominant, include *Amelanchier alnifolia, Amelanchier utahensis, Arctostaphylos patula, Artemisia tridentata, Ceanothus fendleri, Cercocarpus montanus, Fendlera rupicola, Fraxinus anomala, Holodiscus dumosus, Jamesia americana, Ptelea trifoliata, Prunus virginiana, Purshia stansburiana, Robinia neomexicana, Rosa* spp., *Symphoricarpos oreophilus*, and *Symphoricarpos rotundifolius*. The herbaceous layer is sparse to moderately dense, ranging from 1-40% cover. Perennial graminoids are the most abundant species, particularly *Bouteloua curtipendula, Bouteloua eriopoda, Bouteloua gracilis, Aristida* spp., *Carex inops, Carex geyeri, Elymus arizonicus, Eragrostis* spp., *Festuca* spp., *Koeleria macrantha, Muhlenbergia* spp., and *Hesperostipa* spp. Many forb and fern species can occur, but none have much cover. Commonly present forbs include *Achillea millefolium, Artemisia* spp., *Geranium* spp., *Maianthemum stellatum, Thalictrum fendleri*, and *Vicia americana*. Ferns include species of *Cheilanthes* and *Woodsia*. Annual grasses and forbs are seasonally present, and weedy annuals are often present, at least seasonally.

ENVIRONMENT & DYNAMICS

Environmental Description: This group typically occupies the lower slope positions of the foothill and lower montane zones. Stands may occur on level to steep slopes, cliffs, escarpments, rimrock slopes, rocky outcrops, and scree slopes. Climate is semi-arid and

characterized by mostly hot-dry summers with mild to cold winters and annual precipitation of 25 to 70 cm. Precipitation mostly occurs as winter snows but may also consist of some late-summer rains. Soils are typically poorly developed, rocky to very rocky, and well-drained. Parent materials include alluvium, colluvium, and residuum derived from igneous, metamorphic or sedimentary rocks such as granite, gneiss, limestone, quartz, monzonite, rhyolite, sandstone, schist, and shale.

Climate: Climate is semi-arid and characterized by mostly hot-dry summers with mild to cold winters and annual precipitation of 25 to 70 cm. Precipitation mostly occurs as winter snows but may also consist of some late-summer or monsoonal rains.
Soil/substrate/hydrology: Soils are typically poorly developed, rocky to very rocky, and well-drained. Parent materials include alluvium, colluvium, and residuum derived from igneous, metamorphic or sedimentary rocks such as granite, gneiss, limestone, quartz, monzonite, rhyolite, sandstone, schist, and shale.

Dynamics: Fire typically plays an important role, causing die-back of the dominant shrub species in some areas, promoting stump sprouting of the dominant shrubs in other areas, and controlling the invasion of trees into the shrubland system. Natural fires typically result in a mosaic of dense shrub clusters and openings dominated by herbaceous species. In some instances, these associations may be seral to the adjacent *Pinus ponderosa, Abies concolor*, and *Pseudotsuga menziesii* woodlands and forests. Ream (1964) noted that on many sites in Utah, Gambel oak may be successional and replaced by *Acer grandidentatum*.

DISTRIBUTION

Geographic Range: This group occurs in the mountains, plateaus and foothills of the southern Rocky Mountains and Colorado Plateau, including the Uinta and Wasatch ranges and the Mogollon Rim.

Spatial Scale & Pattern [optional]: Large patch
Nations: US
States/Provinces: AZ, CO, NM, NV?, UT, WY
TNC Ecoregions [optional]: 9:P, 10:P, 11:P, 18:C, 19:C, 20:C, 21:C
USFS Ecoregions (2007): 313A:CC, 313B:CC, 313C:C?, 313D:CC, 315A:CC, 315B:CC, 315H:CC, 321A:CC, 322A:CC, 331B:CC, 331F:CC, 331G:CC, 331I:CC, 331J:CC, 331M:CC, 341A:CC, 341B:CC, 341C:CC, 341F:CC, 342A:CC, 342E:CC, 342G:CC, 342J:CC, M313A:CC, M313B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M334A:??, M341A:CC, M341B:CC, M341C:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Arches)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **=** Gambel Oak (413) (Shiflet 1994)

LOWER LEVEL UNITS

Alliances:
- A3737 *Ceanothus fendleri* Shrubland & Shrub-Steppe Alliance
- A3735 *Quercus gambelii - Symphoricarpos oreophilus* Shrubland Alliance
- A3738 *Quercus gambelii - Robinia neomexicana* Shrubland Alliance
- A3736 *Fraxinus anomala - Rhus trilobata - Fendlera rupicola* Talus & Rock Outcrop Shrubland Alliance

AUTHORSHIP

Primary Concept Source: R.D. Ream (1960)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 11/09/2015
Classif Resp Region: West
Internal Author: MEH 3-10, 9-13, mod. KAS 11-15

REFERENCES

References: Christensen 1955, Faber-Langendoen et al. 2017a, Kunzler and Harper 1980, Kunzler et al. 1981, McKell 1950, Ream 1960, Ream 1964, Shiflet 1994

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G277. Southern Rocky Mountain Gambel Oak - Mixed Montane Shrubland

A3737. Ceanothus fendleri Shrubland & Shrub-Steppe Alliance

Type Concept Sentence: This alliance is characterized by either shrubland and shrub-steppe vegetation where the dominant shrub is *Ceanothus fendleri*. It is described from Bandelier National Monument in north-central New Mexico and Grand Canyon National Park in northern Arizona and likely occurs elsewhere in the southern Rocky Mountains and Colorado Plateau.

OVERVIEW

Scientific Name: *Ceanothus fendleri* Shrubland & Shrub-Steppe Alliance
Common Name (Translated Scientific Name): Fendler's Ceanothus Shrubland & Shrub-Steppe Alliance
Colloquial Name: Fendler's Ceanothus Shrubland & Shrub-Steppe

Type Concept: The vegetation is characterized by an open to moderately dense short-shrub layer dominated by *Ceanothus fendleri*. The herbaceous layer is usually moderately dense to dense (to 80% total cover) with *Muhlenbergia montana* or *Poa fendleriana* predominant. Codominants often include *Elymus elymoides, Muhlenbergia wrightii, Pascopyrum smithii*, or *Schizachyrium scoparium*. Forb cover is highly variable. This montane shrubland and steppe alliance is described from Bandelier National Monument in north-central New Mexico and Grand Canyon National Park in northern Arizona and likely occurs elsewhere in the southern Rocky Mountains and Colorado Plateau. Stands are found on gently rolling mesatops and high level plateaus (5-15% slope), though occasionally they can be found on moderately steep upper sideslopes (30% slope). Aspect is variable. Soils are primarily well-developed, silty or sandy loams. This alliance occurs in areas that have experienced somewhat recent high-intensity, stand-replacing fire events, and typically occurs within a matrix of live *Pinus ponderosa* woodlands, so scattered *Pinus ponderosa* are occasionally present as seedlings or remnant live mature trees.

Classification Comments: This alliance is geographically broad, but conceptually narrow in scope consisting of two poorly documented associations documented only from Grand Canyon National Park and Bandelier National Monument. More survey and classification work are needed to fully characterize this type.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Temperate broad-leaved, deciduous shrubland or shrub-steppe in which *Ceanothus fendleri* is the dominant shrub. The understory is dominated by perennial grasses and may reach as much as 80% cover. The most common dominants are *Poa fendleriana* and *Muhlenbergia montana*.

VEGETATION

Physiognomy and Structure: Vegetation in this shrubland and shrub-steppe alliance is characterized by a moderately dense cover of broad-leaved deciduous short shrubs (2-8 cm tall). The graminoid layer is open to dense (to 80% cover) and dominated by medium-tall bunchgrasses. The forb layer is generally sparse but may have high species diversity. Annual grasses and forbs are seasonally present.

Floristics: This shrubland and shrub-steppe alliance is characterized by an open to moderately dense short-shrub layer dominated by *Ceanothus fendleri*. *Quercus gambelii* and *Robinia neomexicana* are frequent associates, but are usually poorly represented and are clearly not dominant. The herbaceous layer is usually moderately dense to dense (>80% total cover) with *Muhlenbergia montana* or *Poa fendleriana* predominant. Codominants often include *Elymus elymoides, Muhlenbergia wrightii, Pascopyrum smithii*, or *Schizachyrium scoparium*. Forb cover is highly variable from stand to stand; common associates include *Artemisia carruthii, Chenopodium* sp., *Epilobium brachycarpum, Erigeron divergens, Gayophytum diffusum, Heterotheca villosa* and *Solidago velutina*. Exotic species *Bromus tectorum* and *Conyza canadensis* are frequent in disturbed stands. Scattered *Pinus ponderosa* saplings and mature trees can occur, but cover is less than 10%.

ENVIRONMENT & DYNAMICS

Environmental Description: This montane shrubland and shrub-steppe is described from Bandelier National Monument in north-central New Mexico and Grand Canyon National Park in northern Arizona and likely occurs elsewhere in the southern Rocky Mountains and Colorado Plateau. Elevation ranges between 2200 and 2575 m (7210-8422 feet). Stands are found on gently rolling mesatops and high level plateaus (5-15% slope), though occasionally they can be found on moderately steep upper sideslopes (30% slope). Aspect is variable with lower elevation stands occurring on north-facing slopes and higher elevation stands occurring on warmer south-facing slopes. Soils are primarily well-developed, silty or sandy loams, including Mollisols derived from pumice or rhyolitic tuff alluvium or colluvium parent materials, or on occasion, fine-textured Alfisols developed from eolian deposits over rhyolitic tuff parent materials. The ground surface is characterized by scattered patches of exposed soil and herbaceous litter amid an abundant herbaceous layer. This alliance occurs in areas that have experienced somewhat recent high-intensity, stand-replacing

fire events, and typically occurs within a matrix of live *Pinus ponderosa* woodlands, so scattered *Pinus ponderosa* are occasionally present as seedlings or remnant live mature trees.

Dynamics: This seral alliance occurs in areas that have experienced somewhat recent high-intensity, stand-replacing fire events.

DISTRIBUTION

Geographic Range: This montane shrubland and shrub-steppe alliance is described from Bandelier National Monument in north-central New Mexico and Grand Canyon National Park in northern Arizona and likely occurs elsewhere in the southern Rocky Mountains and Colorado Plateau.

Nations: US
States/Provinces: AZ, NM
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL005501 *Ceanothus fendleri / Poa fendleriana* Shrub-Steppe
- CEGL005376 *Ceanothus fendleri / Muhlenbergia montana* Shrubland

AUTHORSHIP

Primary Concept Source: E. Muldavin et al. (2011b)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by K. Christie and K.S. King after A. Browder and E. Muldavin.
Version Date: 2014/12/18

REFERENCES

References: Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Muldavin et al. 2011b, Reid and Hall 2010

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G277. Southern Rocky Mountain Gambel Oak - Mixed Montane Shrubland

A3736. Fraxinus anomala - Rhus trilobata - Fendlera rupicola Talus & Rock Outcrop Shrubland Alliance

Type Concept Sentence: This mixed shrub alliance of the southern Rocky Mountains encompasses shrublands dominated by *Brickellia californica, Fraxinus anomala, Fendlera rupicola, Jamesia americana, Prunus virginiana*, and/or *Rhus trilobata* occupying talus, scree, rock outcrop and moderate to steep colluvial slope sites.

OVERVIEW

Scientific Name: *Fraxinus anomala - Rhus trilobata - Fendlera rupicola* Talus & Rock Outcrop Shrubland Alliance
Common Name (Translated Scientific Name): Singleleaf Ash - Skunkbush Sumac - Cliff Fendlerbush Talus & Rock Outcrop Shrubland Alliance
Colloquial Name: Singleleaf Ash - Skunkbush Sumac - Cliff Fendlerbush Talus & Rock Outcrop Shrubland

Type Concept: This shrubland alliance occurs in Colorado Plateau, southern Rocky Mountains, and Great Basin. Vegetation in this mixed, short (<2 m tall) shrubland alliance is variable. The shrub canopy has sparse to moderate cover, often with irregularly distributed dense shrub patches located below cliffs, on benches, in dry channels, on toeslopes and lower slopes, and near seeps where soil moisture is more available. Stands are often characterized by a sparse to low cover (<15% total cover) mix of xeric shrubs; *Brickellia californica, Fraxinus anomala, Fendlera rupicola*, and *Rhus trilobata* are conspicuous and usually at least codominant. At higher elevations and in microsites, mesic- and cool-site shrubs such as *Jamesia americana, Prunus virginiana, Ribes cereum, Rubus deliciosus, Holodiscus dumosus, Dasiphora fruticosa ssp. floribunda*, and *Acer glabrum* are characteristic. Many other shrub species may be present. The herbaceous layer is also variable depending on site characteristics and may include many species but none provides more than a few percent cover. Biological soil crust formation is rare on active slopes. Lichens provide large amounts of foliar cover, at times from 30-60% on more stable rock. This shrubland alliance occurs in canyons, plateaus, foothill and mountain

slopes or rocky colluvial slopes and rock outcrop/large cliff faces. Elevations range from 1268 to 2715 m (4160-8900 feet). Slopes are moderate to very steep and are often oriented to the cooler north or east aspects. Soils tend to be sandy and skeletal.

Classification Comments: Associations included here not only have overlapping environmental characteristics, but floristics as well with the exception of *Jamesia americana - (Physocarpus monogynus, Holodiscus dumosus)* Rock Outcrop Shrubland (CEGL002783) which has a more unique suite of species and has been added here provisionally.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Temperate cold-deciduous shrublands dominated by *Brickellia californica, Fraxinus anomala, Fendlera rupicola, Jamesia americana, Prunus virginiana*, and/or *Rhus trilobata* occupying talus, scree, rock outcrop and moderate to steep colluvial slope sites.

VEGETATION

Physiognomy and Structure: Temperate cold-deciduous shrublands with sparse to moderately dense, often patchy short-shrub layer (<20 tall) with a sparse herbaceous layer of a mixture of species.

Floristics: Vegetation in this mixed, short (<20 m tall) shrubland alliance is variable. The shrub canopy has sparse to moderate cover, often with irregularly distributed dense shrub patches located below cliffs, on benches, in dry channels, on toeslopes and lower slopes, and near seeps where soil moisture is more available. Stands are often characterized by a sparse to low cover (<15% total cover) mix of xeric shrubs; *Brickellia californica, Fraxinus anomala, Fendlera rupicola*, and *Rhus trilobata* are conspicuous and usually at least codominant. At higher elevations and in microsites, mesic- and cool-site shrubs such *Jamesia americana, Prunus virginiana, Ribes cereum, Rubus deliciosus, Holodiscus dumosus, Dasiphora fruticosa ssp. floribunda*, and *Acer glabrum* are characteristic. Many other shrub species may be present, including *Artemisia bigelovii, Artemisia tridentata, Atriplex confertifolia, Cercocarpus montanus, Chrysothamnus viscidiflorus, Ephedra torreyana, Ephedra viridis, Ericameria nauseosa, Gutierrezia sarothrae, Opuntia* spp., and *Philadelphus microphyllus*. If *Quercus gambelii* is present, it has low cover (<5%) and does not dominate the site. The herbaceous layer is also variable depending on site characteristics and may include many species but none provides more than a few percent cover. *Achnatherum hymenoides, Artemisia dracunculus, Artemisia ludoviciana, Bouteloua gracilis, Chamaesyce fendleri, Muhlenbergia montana, Pleuraphis jamesii, Stanleya pinnata*, and *Xylorhiza* spp. are the most consistent species. Biological soil crust formation is rare on active slopes. Lichens provide large amounts of foliar cover, at times from 30-60% on more stable rock.

ENVIRONMENT & DYNAMICS

Environmental Description: This shrubland alliance occurs in canyons, foothill, plateaus and mountain slopes or rocky colluvial slopes and rock outcrop/large cliff faces in the Colorado Plateau, southern Rocky Mountains, and Great Basin. Elevations range from 1268 to 2715 m (4160-8900 feet). Slopes are moderate to very steep and are often oriented to cooler north or east aspects. The shrubs often grow within the cracks on the rocks and around the base of the rocks where accumulations of small gravel and soil occur. The high cover of rock on the ground surface acts both to concentrate runoff and as mulch to slow evaporation from the soil. Thus, relatively mesic species are able to persist on otherwise dry sites. The unvegetated surface is mostly covered by rocks, gravel, boulders, bedrock and bare soil, with little litter or dead wood evident. Soils tend to be sandy, skeletal, with a few stands on silt loams or clay loams derived from shale.

Dynamics:

DISTRIBUTION

Geographic Range: This shrubland alliance is known from canyons, plateaus and mountain slopes in the Colorado Plateau, southern Rocky Mountains, and Great Basin of Utah, Colorado, New Mexico and Nevada.

Nations: US
States/Provinces: CO, NM, NV, UT
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** *Fendlera rupicola* Shrubland Alliance (Coles et al. 2009a)
- **>** *Jamesia americana* Shrubland Alliance (Muldavin et al. 2011b)
- **>** *Prunus virginiana* Shrubland Alliance (Schulz and Hall 2011)

LOWER LEVEL UNITS

Associations:

- CEGL003493 *Brickellia californica - Rhus trilobata* Shrubland
- CEGL002783 *Jamesia americana - (Physocarpus monogynus, Holodiscus dumosus)* Rock Outcrop Shrubland
- CEGL005444 *Prunus virginiana* - Mixed Shrub Talus Shrubland
- CEGL002765 *Fendlera rupicola* Talus Shrubland
- CEGL003963 *Fraxinus anomala - Rhus trilobata* Dry Talus and Slickrock Shrubland

AUTHORSHIP

Primary Concept Source: M.E. Hall, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by G. Kittel and M.E. Hall.
Version Date: 2014/12/18

REFERENCES

References: Coles et al. 2009a, Faber-Langendoen et al. 2017b, Muldavin et al. 2011b, Reid and Hall 2010, Schulz and Hall 2011

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G277. Southern Rocky Mountain Gambel Oak - Mixed Montane Shrubland

A3738. Quercus gambelii - Robinia neomexicana Shrubland Alliance

Type Concept Sentence: This alliance of north-central New Mexico and the Mogollon Rim in north-central Arizona is characterized by shrublands dominated or codominated by *Quercus gambelii* and/or *Robinia neomexicana*.

OVERVIEW

Scientific Name: *Quercus gambelii - Robinia neomexicana* Shrubland Alliance
Common Name (Translated Scientific Name): Gambel Oak - New Mexico Locust Shrubland Alliance
Colloquial Name: Gambel Oak - New Mexico Locust Shrubland

Type Concept: This alliance occurs in desert mountains in southern New Mexico north into the southern Rocky Mountains in northern New Mexico and west to the Mogollon Rim in north-central Arizona. Stands are characterized by shrublands dominated or codominated by *Robinia neomexicana* and *Quercus gambelii*. Stands have a moderately dense to dense woody layer up to 2-5 m tall. The understory may be dominated by mesic forbs such as *Thalictrum fendleri*, but little other information is available. Stands in the montane conifer zone are considered seral and may have seedlings of *Pinus ponderosa, Abies concolor*, or conifer species that are colonizing the stand. *Robinia neomexicana* is considered a semi-riparian species by some researchers. Thickets occur along drainages in canyons at lower elevations (1500-2000 m). On upland sites it is restricted to cooler north aspects at lower montane elevations, but may occur on any aspects at higher montane elevations. Sites are nearly level to moderately steep slopes. Substrate ranges from alluvial deposits on stream terraces to colluvial slopes.

Classification Comments: Several Rocky Mountain *Quercus gambelii* associations were combined with the former *Robinia neomexicana* alliance recognizing their more southern and eastern distribution as well as floristic elements of those regions.

Internal Comments:
Other Comments:

Similar NVC Types:

- A3735 *Quercus gambelii - Symphoricarpos oreophilus* Shrubland Alliance: may be codominated by *Quercus gambelii*, but lacks *Robinia neomexicana*.

Diagnostic Characteristics: Temperate cold-deciduous shrublands dominated or codominated by *Quercus gambelii* and/or *Robinia neomexicana* ranging up to 5 m tall. Understories may be either forb-, grass- or sedge-dominated.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a moderate to dense layer of extremely xeromorphic deciduous shrubs that is less than 5 m tall. The herbaceous layer is typically sparse and dominated by perennial forbs and graminoids with annual grasses and forbs seasonally present.

Floristics: This alliance is characterized by a moderately dense to dense shrub layer (>80% cover) up to 2-5 m tall that is dominated or codominated by deciduous broadleaf shrub *Robinia neomexicana* with *Quercus gambelii* absent to codominant. *Robinia neomexicana* and *Quercus gambelii* can occur as either a tall or short shrub depending upon duration since the last fire. *Mahonia repens* is common at low cover. While infrequent, stands can sometimes have significant cover of *Ceanothus fendleri* and *Rosa woodsii*. The herbaceous layer richness is moderate, but variable in cover (5-80%) depending on density of the shrub layer and substrate. Characteristic graminoids include *Carex inops ssp. heliophila* and other deer sedges (*Carex geophila, Carex occidentalis*, and *Carex rossii*), *Koeleria macrantha, Muhlenbergia montana*, and *Poa fendleriana*. On sites that have been seeded following fire, common to abundant species may include *Agropyron cristatum, Bromus inermis, Elymus trachycaulus*, and *Pascopyrum smithii*, among others. While forbs are diverse, composition is variable from stand to stand, and cover is usually less than 10%. Fire-adapted *Gayophytum diffusum, Erigeron divergens, Solidago velutina*, and *Chenopodium* sp. are common components of the understory. Mesic stands may include *Thalictrum fendleri*. Stands in the montane conifer zone are considered seral and may have seedlings of *Pinus ponderosa, Abies concolor, Pseudotsuga menziesii*, or conifer species that are colonizing the stand.

ENVIRONMENT & DYNAMICS

Environmental Description: Shrublands included in this alliance have been described in south-central New Mexico, the southern Rocky Mountains of northern New Mexico and west to the Mogollon Rim across central Arizona north to the Grand Canyon. Climate is arid to semi-arid. Precipitation varies with elevation. *Robinia neomexicana* is considered a semi-riparian species by Dick-Peddie (1993). Thickets occur along drainages in canyons at lower elevations (1500-2150 m). Sites are nearly level to moderately steep slopes. Substrate ranges from alluvial deposits on stream terraces to colluvial slopes. On upland sites it is restricted to cooler north aspects at lower montane elevations, but may occur on any aspects at higher montane elevations. Elevation ranges between 2000 and 2700 m. This montane shrubland typically occurs in burned areas that once supported pine and mixed conifer forests. At mid-elevations, stands occur on sites with moderate to high solar exposure that increases with elevation. Stands occur on gentle to moderate slopes (5-20%), including rolling mesatops and mountain shoulder slopes, and occasionally on steep canyon or mountain slopes (>40%). Soils are primarily well-developed Mollisols derived from pumice, or occasionally fine-textured Alfisols derived from eolian deposits over rhyolitic tuff residuum. The ground surface is typically characterized by scattered bunchgrasses amid litter, pumice gravel, or exposed soil. Adjacent stands may include xeric grasslands, other shrublands, riparian forests, montane conifer forests and encinal woodlands.

Dynamics: *Robinia neomexicana*-dominated stands occur along riparian corridors and as patches of montane upland scrub. Dick-Peddie (1993) wrote that *Robinia neomexicana* and a common associate, *Quercus gambelii*, form persistent seral thickets in disturbed areas within conifer forests. The species is a common understory species in *Abies concolor*- or *Quercus gambelii*-dominated woodlands (Dick-Peddie 1993). This alliance is associated with very high-intensity stand-replacing fires, and typically occurs within a larger matrix of unburned *Pinus ponderosa* woodlands.

DISTRIBUTION

Geographic Range: This alliance is known from the southern Rocky Mountains, Colorado Plateau, Arizona-New Mexico Mountains and desert mountains in the northern Chihuahuan Desert.

Nations: US
States/Provinces: AZ, NM
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** *Quercus gambelii - Robinia neomexicana* Plant Association (Muldavin et al. 1994a)
- **<** *Quercus gambelii* Association (132.111) (Brown 1982a) [included within Great Basin Montane Scrub, Oak-scrub Series.]
- **<** *Quercus gambelii* Series (Johnston 1987)
- **>** Gambel oak - New Mexico locust deciduous scrub (Anderson et al. 1985)
- **=** Oak-Locust Successional Series (Dick-Peddie 1993) [only mixed stands of *Quercus gambelii* and *Robinia neomexicana*.]

LOWER LEVEL UNITS

Associations:

- CEGL001125 *Robinia neomexicana / Thalictrum fendleri* Shrubland
- CEGL001116 *Quercus gambelii / Robinia neomexicana / Symphoricarpos rotundifolius* Shrubland
- CEGL001115 *Quercus gambelii / Robinia neomexicana* Shrubland
- CEGL005505 *Robinia neomexicana* Shrubland
- CEGL005379 *Quercus gambelii - Robinia neomexicana / Carex inops ssp. heliophila* Shrubland
- CEGL005380 *Quercus gambelii - Robinia neomexicana / Muhlenbergia montana* Shrubland
- CEGL005375 *Robinia neomexicana / Carex inops ssp. heliophila* Shrubland

AUTHORSHIP

Primary Concept Source: W.A. Dick-Peddie (1993)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Anderson et al. 1985, Baker 1982b, Blackhawk Coal Company 1981, Boucek 1986, Brown 1982a, Cedar Creek Associates, Inc. 1987, Christensen 1949, Christensen 1955, Clary 1992, Dick-Peddie 1993, Dillinger 1970, Ellis and Hackney 1981, Erdman 1962, Evans 1926, Evans 1936, Faber-Langendoen et al. 2017b, Ferchau 1973, Forsling and Storm 1929, Hanson and Ball 1928, Hess and Wasser 1982, Hinckley 1944, Hoffman and Alexander 1980, Johnston 1987, Keammerer and Peterson 1981, Kearney et al. 1969, Kittel et al. 1994, Kittel et al. 1999a, Komarkova et al. 1988a, Komarkova et al. 1988b, Kunzler et al. 1981, Livingston 1947, Livingston 1949, McKell 1950, Muldavin and Mehlhop 1992, Muldavin et al. 1994a, Muldavin et al. 1998b, Muldavin et al. 2011b, Neilson and Wullstein 1983, Ream 1960, Reid and Hall 2010, Schmoll 1935, Soil Conservation Service 1978, Szaro 1989, Thorne Ecological Institute 1973a, Vories 1974, Wallmo 1955, Warren and Treadwell 1980, Warren et al. 1982, Watson 1912, Whittaker and Niering 1964

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G277. Southern Rocky Mountain Gambel Oak - Mixed Montane Shrubland

A3735. Quercus gambelii - Symphoricarpos oreophilus Shrubland Alliance

Type Concept Sentence: This shrubland alliance of the Colorado Plateau and southern Rocky Mountains is characterized by dominance or codominance of *Quercus gambelii* in association with other mid-elevation shrubs.

OVERVIEW

Scientific Name: *Quercus gambelii - Symphoricarpos oreophilus* Shrubland Alliance
Common Name (Translated Scientific Name): Gambel Oak - Mountain Snowberry Shrubland Alliance
Colloquial Name: Gambel Oak - Mountain Snowberry Shrubland

Type Concept: This shrubland alliance occurs in the Colorado Plateau and southern Rocky Mountains and is characterized by dominance or codominance of *Quercus gambelii* in a moderately dense to dense tall- or short-shrub layer, typically 2-5 m tall, but can also occur as 1-m tall clumps to small trees over 5 m tall. The variable structure includes patches of oak shrubs with grass growing in between, dense oak thickets with little understory, and relatively mesic, tall shrublands with a rich understory of short shrubs, grasses and forbs. Scattered trees are occasionally present in stands and typically include species of *Pinus* or *Juniperus*. Characteristic shrubs that may codominate or form a separate short-shrub layer include *Amelanchier alnifolia, Amelanchier utahensis, Artemisia tridentata, Cercocarpus montanus, Fendlera rupicola, Prunus virginiana, Rhus trilobata, Symphoricarpos oreophilus*, and *Symphoricarpos rotundifolius*. The herbaceous layer is sparse to moderately dense, ranging from 1-40% cover and is dominated by perennial graminoids, particularly *Bouteloua curtipendula, Bouteloua gracilis, Carex geyeri, Carex inops, Elymus arizonicus, Festuca thurberi, Koeleria macrantha, Muhlenbergia montana, Hesperostipa comata*, and *Poa fendleriana*. Many forb and fern species can occur, but none has much cover. Stands occur in the foothills and lower montane slopes, mesas and canyons. Elevations range from 1550-2950 m. Sites range from nearly level mesatops to steep (to 80%), rocky slopes on upper slopes and ridgetops. Other stands occur in canyon bottoms and along drainages. Soils are generally deep, coarse-textured, and well-drained.

Classification Comments:

Internal Comments: KAS 12-14: move CEGL002951 Symphoricarpos oreophilus Shrubland to A3208 *Artemisia tridentata ssp. vaseyana* - Mixed Shrubland Alliance (better fit).
Other Comments:

Similar NVC Types:

- A3738 *Quercus gambelii - Robinia neomexicana* Shrubland Alliance: is dominated or codominated by *Robinia neomexicana* and occurs in the southern extent of this group's range.

Diagnostic Characteristics: Temperate cold-deciduous shrublands 1-2 m tall dominated or codominated by *Quercus gambelii* in association with other mid-elevation shrubs. Understories are sparse to dense and typically grass- or sedge-dominated. Stands codominated by *Robinia neomexicana* are not included in this alliance.

VEGETATION

Physiognomy and Structure: Vegetation in this shrubland alliance is characterized by a moderately dense cover of broad-leaved deciduous shrubs. The graminoid layer is sparse to moderately dense and dominated by medium-tall bunchgrasses. The forb layer is generally sparse but may have high species diversity. Annual grasses and forbs are seasonally present.

Floristics: This shrubland alliance is characterized by dominance or codominance of *Quercus gambelii* in a moderately dense to dense tall- or short-shrub layer, typically 2-5 m tall, but can also occur as 1-m tall clumps to small trees over 5 m tall. The variable structure includes patches of oak shrubs with grass growing in between, dense oak thickets with little understory, and relatively mesic, tall shrublands with a rich understory of short shrubs, grasses and forbs. Scattered trees are occasionally present in stands and typically include *Pinus edulis, Pinus ponderosa*, or *Juniperus* spp. Characteristic shrubs that may codominate or form a separate short-shrub layer include *Arctostaphylos patula, Amelanchier alnifolia, Amelanchier utahensis, Artemisia tridentata, Cercocarpus montanus, Fendlera rupicola, Holodiscus dumosus, Paxistima myrsinites, Ptelea trifoliata, Prunus virginiana, Rhus trilobata, Rosa* spp., *Symphoricarpos oreophilus*, and *Symphoricarpos rotundifolius*. The herbaceous layer is sparse to moderately dense, ranging from 1-40% cover and is dominated by perennial graminoids, particularly *Bouteloua curtipendula, Bouteloua eriopoda, Bouteloua gracilis, Carex geyeri, Carex inops, Elymus arizonicus, Festuca thurberi, Koeleria macrantha, Muhlenbergia montana, Hesperostipa comata*, and *Poa fendleriana*. Many forb and fern species can occur, but none has much cover. Commonly present forbs include *Achillea millefolium, Artemisia* spp., *Geranium* spp., *Maianthemum stellatum, Thalictrum fendleri*, and *Vicia americana*. Ferns include species of *Cheilanthes* and *Woodsia*. Annual grasses and forbs are seasonally present. In Texas occurrences, associated species can include *Holodiscus dumosus* and *Symphoricarpos oreophilus*. Additional species found in associations of this alliance include *Cercocarpus montanus, Carex geyeri, Amelanchier alnifolia, Amelanchier utahensis, Artemisia tridentata, Carex inops, Paxistima myrsinites, Rhus trilobata* and *Symphoricarpos rotundifolius*.

ENVIRONMENT & DYNAMICS

Environmental Description: Shrublands included in this alliance occur in the foothills and lower montane slopes of isolated desert mountain ranges, mesas and canyons from Nevada to western Texas, as well as in the lower montane zone of the southern Rocky Mountains, Uinta Mountains and high plateaus of southern Utah. Elevations range from 1550-2950 m. Climate is semi-arid. Summers are generally hot, and winters range from mild with cold periods and occasional snows in the southern part of its range to extended periods of freezing temperatures in the northern part of its range. The seasonality of precipitation varies, but most of the 35-70 cm of mean annual precipitation occurs during the growing season. Stands occur on nearly level to steep (to 80%), rocky slopes in canyons, mountain slopes and ridgetops while other stands occur in canyon bottoms and along drainages. Aspect does not seem important except in the southern range extent where stands are restricted to the more mesic north slopes. Soils are generally deep, coarse-textured, and well-drained. Soil texture is typically a cobbly and gravelly loamy sand and gravelly loam, but the alliance also occurs on well-drained clay soil. Parent materials are varied and include quartzite, monzonite, shale and alluvium. Adjacent vegetation at higher elevations is typically conifer woodlands or forests dominated by *Pinus ponderosa, Pinus contorta*, or *Pseudotsuga menziesii*, but *Populus tremuloides* forests are also common in the northern part of its range. Adjacent vegetation below these stands is often medium-tall grasslands in southeastern Colorado or shrublands dominated by *Artemisia* spp. in western Colorado.

Dynamics: The distribution of *Quercus gambelii* was studied by Neilson and Wullstein (1983) with respect to climatic patterns. They found the species to be limited by seedling mortality from severe spring frosts and summer drought. The northern extent of the species is in alignment with the winter polar front that runs along the boundary between southern Wyoming and Colorado and Utah. Its western range limit aligns with the westward extent of summer moisture from the Arizona monsoon, which approximates the western Arizona border. Reproducing stands in northern Utah that exist north of summer monsoon moisture are restricted to more mesic sites. Seedling recruitment is more common in the southern part of its range than the northern (Neilson and Wullstein 1983).

Quercus gambelii is a fire-adapted species (Clary 1992). The root systems are well-developed and draw moisture from a large volume of soil allowing for rapid resprouting after fire. Muldavin et al. (1998b) reported that, in the Organ Mountains in southwestern New Mexico after a severe fire, *Quercus gambelii* resprouted into a dense thicket that excluded both herbaceous understory and conifer species. They suggested frequent small cool fires would favor the establishment of conifers and maintain an herbaceous understory. *Quercus gambelii* shrubs also resprout vigorously after stems are killed with almost all herbicides or

removed by chaining or cutting for firewood (Clary 1992). Altered fire regimes, fuelwood harvest, and grazing by livestock have significant impacts to the quality of sites. More study is needed to understand and manage these shrublands ecologically.

DISTRIBUTION

Geographic Range: This alliance is known from the Colorado Plateau, southern Rocky Mountains, Great Basin, Utah High Plateaus, and Wyoming basins of Utah, Colorado, Wyoming, New Mexico and Arizona.

Nations: US
States/Provinces: AZ, CO, NM, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **=** *Quercus gambelii* Association (132.111) (Brown 1982a) [included within Great Basin Montane Scrub, Oak-scrub Series]
- **=** *Quercus gambelii* Series (Johnston 1987)

LOWER LEVEL UNITS

Associations:

- CEGL002695 *Arctostaphylos patula - Quercus gambelii - (Amelanchier utahensis)* Shrubland
- CEGL005995 *Quercus gambelii / Carex geyeri* Shrubland
- CEGL001113 *Quercus gambelii - Cercocarpus montanus / (Carex geyeri)* Shrubland
- CEGL001109 *Quercus gambelii / Amelanchier alnifolia* Shrubland
- CEGL001111 *Quercus gambelii / Artemisia tridentata* Shrubland
- CEGL002915 *Quercus gambelii / Hesperostipa comata* Shrubland
- CEGL002949 *Quercus gambelii / Poa fendleriana* Shrubland
- CEGL001114 *Quercus gambelii / Paxistima myrsinites* Shrubland
- CEGL001117 *Quercus gambelii / Symphoricarpos oreophilus* Shrubland
- CEGL002805 *Quercus gambelii / Festuca thurberi* Shrubland
- CEGL001112 *Quercus gambelii / Carex inops* Shrubland
- CEGL002910 *Rhus trilobata* Rocky Mountain Shrubland
- CEGL002337 *Quercus gambelii* / Sparse Understory Shrubland
- CEGL002338 *Quercus gambelii / Rhus trilobata* Shrubland
- CEGL002341 *Quercus gambelii - Holodiscus dumosus* Shrubland
- CEGL002477 *Quercus gambelii* Shrubland
- CEGL004010 *Quercus gambelii / Fendlera rupicola* Shrubland
- CEGL005994 *Quercus gambelii / Prunus virginiana* Shrubland
- CEGL001110 *Quercus gambelii / Amelanchier utahensis* Shrubland

AUTHORSHIP

Primary Concept Source: D.E. Brown (1982a)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Anderson et al. 1985, Baker 1982b, Barbour and Major 1977, Blackhawk Coal Company 1981, Boucek 1986, Brown 1982a, Cedar Creek Associates, Inc. 1987, Christensen 1949, Christensen 1955, Clary 1992, Conard and Radosevich 1982, Dillinger 1970, Ellis and Hackney 1981, Erdman 1962, Evans 1926, Evans 1936, Faber-Langendoen et al. 2017b, Ferchau 1973, Forsling and Storm 1929, Hanson and Ball 1928, Hess and Wasser 1982, Hinckley 1944, Hoffman and Alexander 1980, Johnston 1987, Keammerer and Peterson 1981, Kittel et al. 1994, Kittel et al. 1999a, Komarkova et al. 1988a, Komarkova et al. 1988b, Kunzler et al. 1981, Livingston 1947, Livingston 1949, McKell 1950, Mozingo 1987, Muldavin 1994, Muldavin and Mehlhop 1992, Muldavin et al. 1998b, Neilson and Wullstein 1983, Ream 1960, Schmoll 1935, Soil Conservation Service 1978, Thorne Ecological Institute 1973a, Townsend 1966, Vories 1974, Warren and Treadwell 1980, Warren et al. 1982, Watson 1912

2.B.2.Na.1.b. M049 Southern Rocky Mountain Montane Shrubland

G276. Southern Rocky Mountain Mountain-mahogany - Mixed Foothill Shrubland

Type Concept Sentence: This foothills shrubland group occurs in the Rocky Mountains and Colorado Plateau from lower montane zone to canyons and breaks in the western Great Plains and is characterized by an open to closed shrub layer of nearly pure *Cercocarpus montanus* or a mixed shrub layer with *Amelanchier utahensis, Quercus x pauciloba, Purshia tridentata, Rhus trilobata, Ribes cereum*, or *Symphoricarpos oreophilus*.

OVERVIEW

Scientific Name: *Cercocarpus montanus - Quercus x pauciloba - Rhus trilobata* Foothill Shrubland Group
Common Name (Translated Scientific Name): Alderleaf Mountain-mahogany - Wavyleaf Oak - Skunkbush Sumac Foothill Shrubland Group
Colloquial Name: Utah Serviceberry - Mountain-mahogany Shrubland

Type Concept: This Rocky Mountain foothill shrubland group ranges from southern New Mexico north into Wyoming, and west into the Intermountain West region. *Cercocarpus montanus* dominates pure stands in parts of Wyoming and Colorado. The vegetation is typically dominated by a variety of shrubs, including *Amelanchier utahensis, Cercocarpus montanus, Quercus x pauciloba, Purshia tridentata, Rhus trilobata, Ribes cereum, Symphoricarpos oreophilus*, or *Yucca glauca*. Grasses and sedges are dominant in the understory and may include *Achnatherum scribneri, Bouteloua curtipendula, Carex geyeri, Elymus lanceolatus, Hesperostipa comata, Hesperostipa neomexicana, Leymus ambiguus, Muhlenbergia montana*, and *Pseudoroegneria spicata*. Scattered trees or inclusions of grassland patches or steppe may be present. Stands are found in the foothills, canyon slopes and lower mountains of the Rocky Mountains and on outcrops and canyon slopes in the western Great Plains. These shrublands occur between 1500 and 2900 m elevation and are usually associated with exposed sites, rocky substrates, and dry conditions, which limit tree growth. It is common where *Quercus gambelii* is absent, such as the northern Colorado Front Range and in drier foothills and prairie hills. This group is generally drier than Southern Rocky Mountain Gambel Oak - Mixed Montane Shrubland Group (G277), but may include mesic montane shrublands where *Quercus gambelii* does not occur. Fires play an important role in this group as the dominant shrubs usually have a severe die-back, although some plants will stump sprout. *Cercocarpus montanus* requires a disturbance such as fire to reproduce, either by seed sprout or root-crown sprouting. Fire suppression may have allowed an invasion of trees into some of these shrublands, but in many cases, sites are too xeric for tree growth.

Classification Comments: While *Cercocarpus montanus* is the common dominant shrub in this group, it is not the only dominant, and in many occurrences is not found at all. In addition, in some occurrences, shrub cover is low, which allows for some stands to be graminoid-dominated. In Wyoming, stands where *Cercocarpus montanus* is a component of mixed shrublands are placed in Central Rocky Mountain Montane-Foothill Deciduous Shrubland Group (G272).

Similar NVC Types:
- G277 Southern Rocky Mountain Gambel Oak - Mixed Montane Shrubland
- G272 Central Rocky Mountain Montane-Foothill Deciduous Shrubland

Diagnostic Characteristics: Open to dense broadleaf shrublands or shrub-grasslands where *Cercocarpus montanus* occurs as the most often dominant shrub, but may be a codominant or be absent in some stands. Other characteristic shrubs include *Amelanchier utahensis, Artemisia tridentata, Cercocarpus intricatus, Fallugia paradoxa, Fendlera rupicola, Glossopetalon spinescens, Purshia tridentata, Quercus x pauciloba, Ribes cereum*, and *Rhus trilobata*. The herbaceous layer is characterized by an open to dense layer of grasses and sedges. Typical species include *Achnatherum scribneri, Bouteloua curtipendula, Carex geyeri, Elymus lanceolatus, Hesperostipa comata, Hesperostipa neomexicana, Leymus ambiguus, Muhlenbergia montana*, and *Pseudoroegneria spicata*.

VEGETATION

Physiognomy and Structure: Open to dense, broadleaf deciduous shrublands or shrub-grasslands with canopies 1-2 m tall. Occurrences are typically multi-layered shrub-dominated stands where grasses occur in canopy openings. In occurrences where shrub cover is open, grasses may attain higher cover than overstory shrubs.

Floristics: This group consists of two major cover types: those most commonly dominated by *Cercocarpus montanus* or by *Purshia tridentata*. Within these communities, either nominal may be dominant, codominant or absent. Other shrubs include *Amelanchier utahensis, Artemisia tridentata, Cercocarpus intricatus, Fallugia paradoxa, Fendlera rupicola, Glossopetalon spinescens, Quercus x pauciloba, Rhus trilobata, Ribes cereum, Symphoricarpos oreophilus*, or *Yucca glauca*. Grasses are prominent and include *Andropogon gerardii, Achnatherum scribneri, Bouteloua curtipendula, Elymus lanceolatus ssp. lanceolatus, Hesperostipa comata, Hesperostipa neomexicana, Muhlenbergia montana*, and *Pseudoroegneria spicata*.

ENVIRONMENT & DYNAMICS

Environmental Description: This group is found on gentle to extremely steep slopes (5-60%) on slopes, ridges, canyons, mesas, and less often sand dunes. Sites are often subject to drought stress. Elevations range from 1500 to 2700 m. Geologic substrates can include sandstone, shale, basalt, and limestone. Soils are generally poorly developed, rapidly drained and include sand, sandy loam, coarse gravels, loams, and clay loams.

Dynamics:

DISTRIBUTION

Geographic Range: This group is found in the foothills, canyon slopes and lower mountains of the southern Rocky Mountains and on outcrops and canyon slopes in the western and southern Great Plains. It ranges from southern New Mexico, extending north into Wyoming, and west into the Intermountain West region.

Spatial Scale & Pattern [optional]: Large patch
Nations: US
States/Provinces: CO, MT, NE?, NM, NV?, SD, TX, UT, WY
TNC Ecoregions [optional]: 9:P, 10:C, 11:P, 18:C, 19:C, 20:C, 21:C, 25:C, 26:C, 27:C
USFS Ecoregions (2007): 313A:CC, 313B:CC, 315A:CC, 315B:CC, 315H:CP, 321A:CC, 331B:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 331J:CC, 341B:CC, 341C:CC, 342E:CC, 342F:CC, 342G:CC, M313B:CC, M331A:CP, M331B:CP, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332G:??, M334A:??, M341B:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **=** Mountain Mahogany - Mixed Shrub Series (Dick-Peddie 1993)

LOWER LEVEL UNITS

Alliances:
- A3733 *Cercocarpus montanus - Quercus x pauciloba* Shrubland Alliance
- A3731 *Purshia tridentata - Ribes cereum* Shrubland Alliance
- A3730 *Fallugia paradoxa - Rhus trilobata* Shrubland Alliance
- A3732 *Amelanchier utahensis - Cercocarpus montanus - Cercocarpus intricatus* Shrubland Alliance

AUTHORSHIP

Primary Concept Source: K. Hess and C.H. Wasser (1982)
Author of Description: M.E. Hall and K.A. Schulz
Acknowledgments:
Version Date: 11/09/2015
Classif Resp Region: West
Internal Author: MEH 3-10, 9-13, mod, KAS 11-15

REFERENCES

References: Dick-Peddie 1993, Faber-Langendoen et al. 2017a, Hess 1981, Hess and Wasser 1982, Johnston 1987, Marriott and Faber-Langendoen 2000, Muldavin 1994, Muldavin et al. 2000b, Shiflet 1994, Thilenius et al. 1995

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G276. Southern Rocky Mountain Mountain-mahogany - Mixed Foothill Shrubland

A3732. Amelanchier utahensis - Cercocarpus montanus - Cercocarpus intricatus Shrubland Alliance

Type Concept Sentence: This alliance is characterized by shrublands dominated by *Amelanchier utahensis, Cercocarpus montanus* or *Cercocarpus intricatus* in the southern Rocky Mountains, Wyoming Basins, Colorado Plateau and extending west to the Great Basin.

OVERVIEW

Scientific Name: *Amelanchier utahensis - Cercocarpus montanus - Cercocarpus intricatus* Shrubland Alliance
Common Name (Translated Scientific Name): Utah Serviceberry - Alderleaf Mountain-mahogany - Littleleaf Mountain-mahogany Shrubland Alliance
Colloquial Name: Utah Serviceberry - Mountain-mahogany Shrubland

Type Concept: This alliance is known from the southern Rocky Mountains, Wyoming Basins, Colorado Plateau and extending west to the Great Basin. Stands are characterized by mixed tall-shrub canopies dominated by *Amelanchier utahensis, Cercocarpus montanus*, or *Cercocarpus intricatus*. Species that may codominate in some stands include *Artemisia tridentata, Fendlera rupicola, Glossopetalon spinescens*, and *Rhus trilobata*. Total canopy cover ranges from sparse to moderately dense. Occasional trees, such as *Juniperus* spp., *Quercus* spp., *Pinus edulis, Pinus ponderosa*, or *Pseudotsuga menziesii*, may be scattered in some stands. The herbaceous layer is variable and may have sparse to moderate cover. The most typical dominants are graminoids and may include *Carex geyeri, Elymus lanceolatus ssp. lanceolatus, Hesperostipa comata*, and *Pseudoroegneria spicata*. Elevations range from 1800-2700 m. Sites are variable but are generally xeric and rocky with moderate to very steep slopes or on ridges. Stands are found on various aspects, but typically the higher elevation and northern sites are on warmer, southern exposures, and lower elevation and southern stands are restricted to more mesic north slopes.

Classification Comments: Inclusion of *Cercocarpus intricatus* Montane Shrubland (CEGL002587) is tentative as it occupies the same geographic range and montane environments of other associations in this alliance and has similar floristics. *Cercocarpus intricatus - Glossopetalon spinescens* Shrubland (CEGL005426) is included in that it is montane with some floristic overlap, but is a geographic outlier, therefore placement here is low in confidence. Other *Cercocarpus intricatus* associations are more associated with slickrock environments and range more western and southern.

Internal Comments: mjr 12-14: CA added for MOJN.
Other Comments:

Similar NVC Types: This alliance is distinguished from the alliance listed above in have species with more northern distributions.
- A3733 *Cercocarpus montanus - Quercus x pauciloba* Shrubland Alliance: has species with more southern distributions.

Diagnostic Characteristics: Mixed montane shrublands dominated *Amelanchier utahensis, Cercocarpus montanus*, or occasionally *Cercocarpus intricatus*. Shrub cover may be sparse to moderate. These shrublands may be either codominated by other shrub species or have sparse to dense understories of graminoids. Tree may be present, but are scattered and have low cover.

VEGETATION

Physiognomy and Structure: This alliance is characterized by a moderate to dense canopy of cold-deciduous shrubs up to 4 m in height. There is often another stratum (sometimes two) of low cold-deciduous shrubs from 0.5-2 m tall. The ground layer is usually a species-rich assemblage of cespitose graminoids and erect forbs.

Floristics: These shrublands are typically sparse to dense and tall with multiple vegetation layers. The upper shrub layer is typically dominated by *Amelanchier utahensis, Cercocarpus montanus*, or *Cercocarpus intricatus*. Species that may codominate in some stands include *Artemisia tridentata, Fendlera rupicola, Glossopetalon spinescens*, and *Rhus trilobata*. Other shrub associates may include *Chrysothamnus viscidiflorus, Ephedra viridis, Eriogonum corymbosum, Holodiscus dumosus, Mahonia repens, Purshia tridentata, Ribes cereum, Rosa woodsii, Symphoricarpos oreophilus*, and *Tetradymia canescens*. Occasional trees, such as *Juniperus* spp., *Quercus* spp., *Pinus edulis, Pinus ponderosa* or *Pseudotsuga menziesii*, may be scattered in some stands. The herbaceous layer is variable and may have sparse to moderate cover and is most often dominated by graminoids. Dominant graminoids may include *Carex geyeri, Elymus lanceolatus ssp. lanceolatus, Hesperostipa comata*, and *Pseudoroegneria spicata*. Other associated graminoids may include *Achnatherum hymenoides, Koeleria macrantha, Leymus salinus, Poa fendleriana*, and *Poa fendleriana*. Forbs do not contribute significant cover, but may be diverse in some stands. Associates may include *Artemisia ludoviciana, Balsamorhiza sagittata, Collinsia parviflora, Hedeoma hispida, Lathyrus pauciflorus*, and *Symphyotrichum oblongifolium (= Aster oblongifolius)*.

ENVIRONMENT & DYNAMICS

Environmental Description: Plant associations in this alliance occur at middle elevations (1850-2700 m) of mountains. Climate is semi-arid. Summers are hot and winters are typically cold, with freezing temperatures and snow common, however, stands on the southwestern U.S. may have mild winter temperatures. Precipitation ranges from 30-50 cm annually with a large proportion falling as winter snow. Sites are variable but are generally xeric and rocky with moderate to very steep slopes or on ridges. Stands are found on various aspects, but typically the higher elevation and northern sites are on warmer, southern exposures, and lower elevation and southern stands are restricted to more mesic north slopes. Environments include sheltered rocky canyons, mesa slopes, slickrock, moderate to very steep slopes and ridges. Soils are variable, from shallow and skeletal near rock outcroppings, to moderately deep with abundant organic matter. Soil textures range from sandy loam to clay. Soils range from slightly acidic to slightly alkaline depending on parent material, which includes alluvium, colluvium and residuum from igneous, metamorphic or sedimentary rocks such as granite, gneiss, limestone, quartz monzonite, rhyolite, sandstone, schist and shale.

Dynamics: Yake and Brotherson (1979) noted that regeneration of *Amelanchier utahensis* was most favorable on moderately deep, fine-textured soils of northerly-aspected sites. They noted that seedling herbivory by native ungulates was greater at such sites. Annual grasses were noted to have a negative effect on seedling densities. *Amelanchier utahensis* hybridizes with *Amelanchier*

alnifolia, and distinctions between the two species may become blurred in areas where their ranges overlap. *Cercocarpus montanus* is a dominant understory species in several woodland and forests dominated by *Juniperus deppeana, Juniperus monosperma, Juniperus osteosperma, Juniperus scopulorum, Pinus edulis, Pinus ponderosa, Pseudotsuga menziesii, Quercus gambelii, Quercus grisea*, and *Quercus x pauciloba*. *Cercocarpus montanus* stands often occur in the more xeric habitat below these woodland and forest stands. In xeric habitats studied by Greenwood and Brotherson (1978), *Cercocarpus montanus* sites had significantly more rock than the *Pinus edulis* and *Juniperus osteosperma* sites. Brotherson et al. (1984) suggested that stands are moisture-limited because stands on southern aspects were always higher in elevation than stands on northern aspects. They also found that the *Cercocarpus montanus* stands were more likely to occur on northern slopes than on southern in central Utah. However, *Cercocarpus montanus* did not typically occur with mesic shrubs such as *Symphoricarpos oreophilus* and *Amelanchier alnifolia*. There is often a broad *Cercocarpus montanus* shrub/herbaceous ecotone between these shrublands and grasslands. Ecological factors that control shrub densities such as fire and drought need more investigation. Unlike other species of *Cercocarpus, Cercocarpus montanus* is a fire-resistant species because it can resprout from the base after a fire has killed the top (Cronquist et al. 1997). In the southern portion of its range, *Cercocarpus montanus* functions as an evergreen shrub by retaining leaves during mild winters and losing them during cold winters (Dick-Peddie 1993). *Cercocarpus montanus* is preferred winter range browse for deer (Roughton 1966, 1972, Hoffman and Alexander 1987). Stands can also produce significant forage that can be utilized by grazing livestock provided the slopes are not too steep (Hoffman and Alexander 1987). More information is needed on the effects of livestock grazing and wildlife browsing on the structure and function of these shrublands.

DISTRIBUTION

Geographic Range: This alliance is known from the southern Rocky Mountains, Arizona-New Mexico mountains, north to the Wyoming Basins, east to escarpments of the Great Plains and west to the Colorado Plateau and parts of the Great Basin.

Nations: US
States/Provinces: AZ, CA, CO, NE, NM, NV, SD, TX, UT, WY
TNC Ecoregions [optional]: 11:C, 17:C
USFS Ecoregions (2007): 322Aj:CCC, 341Fb:CCC, 341Fc:CCC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Great Basin, Mojave)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **>** *Cercocarpus intricatus* (Small leaf mountain mahogany scrub) Provisional Alliance (Sawyer et al. 2009) [76.300.00]
- **>** *Cercocarpus intricatus* Shrubland Alliance (Evens et al. 2014)

LOWER LEVEL UNITS

Associations:

- CEGL003494 *Chamaebatiaria millefolium - Yucca baccata - (Mahonia repens)* Shrubland
- CEGL001069 *Amelanchier utahensis / Pseudoroegneria spicata* Shrubland
- CEGL001067 *Amelanchier utahensis* Shrubland
- CEGL001090 *Cercocarpus montanus / Pseudoroegneria spicata* Shrubland
- CEGL002912 *Cercocarpus montanus - Rhus trilobata / Andropogon gerardii* Shrubland
- CEGL001087 *Cercocarpus montanus / Elymus lanceolatus ssp. lanceolatus* Shrubland
- CEGL001070 *Amelanchier (utahensis, alnifolia) - Cercocarpus montanus* Shrubland
- CEGL001092 *Cercocarpus montanus / Hesperostipa comata* Shrubland
- CEGL002798 *Cercocarpus montanus* Shale Shrubland
- CEGL002587 *Cercocarpus intricatus* Montane Shrubland
- CEGL003817 *Amelanchier utahensis - Fendlera rupicola* Shrubland
- CEGL003820 *Cercocarpus montanus - Fendlera rupicola* Shrubland
- CEGL005805 *Cercocarpus montanus - Artemisia tridentata* Shrubland
- CEGL005393 *Cercocarpus intricatus - (Quercus turbinella)* Mixed Shrubland
- CEGL005426 *Cercocarpus intricatus - Glossopetalon spinescens* Shrubland
- CEGL001068 *Amelanchier utahensis* - Mixed Shrub / *Carex geyeri* Shrubland

AUTHORSHIP

Primary Concept Source: D. Sarr, J. Coles, K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Brotherson and Barnes 1984, Cronquist et al. 1997, Dick-Peddie 1993, Evens et al. 2014, Faber-Langendoen et al. 2017b, Greenwood and Brotherson 1978, Hoffman and Alexander 1987, Roughton 1966, Roughton 1972, Sawyer et al. 2009, Thomas et al. 2004, Yake and Brotherson 1979

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G276. Southern Rocky Mountain Mountain-mahogany - Mixed Foothill Shrubland

A3733. Cercocarpus montanus - Quercus x pauciloba Shrubland Alliance

Type Concept Sentence: This alliance is characterized by shrublands dominated or codominated by *Cercocarpus montanus* and *Quercus x pauciloba* occurring in the southern Rocky Mountains south to the northern Chihuahuan Desert and east to the Southern Shortgrass Prairie with outlying occurrences in adjacent ecoregions.

OVERVIEW

Scientific Name: *Cercocarpus montanus - Quercus x pauciloba* Shrubland Alliance
Common Name (Translated Scientific Name): Alderleaf Mountain-mahogany - Wavyleaf Oak Shrubland Alliance
Colloquial Name: Alderleaf Mountain-mahogany - Wavyleaf Oak Shrubland

Type Concept: The vegetation of this alliance is characterized by shrublands most commonly dominated by *Cercocarpus montanus*, but in the southern portion of its range is codominated by *Quercus x pauciloba*. Structure varies from dense to having little to no canopy overlap with lush herbaceous layers. Shrub associates may include *Ceanothus greggii, Dasylirion leiophyllum, Quercus grisea* (shrub form), and *Quercus turbinella*. The understory is most commonly graminoid-dominated by *Bouteloua curtipendula, Hesperostipa neomexicana, Muhlenbergia montana*, or *Petrophytum caespitosum*. Additional species may include *Achnatherum scribneri, Bouteloua gracilis, Carex geyeri, Elymus albicans (= Elymus lanceolatus ssp. albicans), Festuca arizonica*, and the perennial forbs *Helianthus pumilus, Heterotheca villosa, Potentilla fissa*, and *Scutellaria brittonii*. Introduced annual grass *Bromus tectorum* is often present. This alliance primarily occurs in the southern Rocky Mountains, northern Chihuahuan Desert and east to the Southern Shortgrass Prairie, but has outlying occurrences in adjacent ecoregions. It occurs on montane slopes at 915 to 2440 m (3000-8000 feet) elevation. Stands are found on various aspects, but typically the higher elevation and northern sites are on warmer, southern exposures, and lower elevation and southern stands are restricted to more mesic north slopes.

Classification Comments: This alliance includes *Cercocarpus montanus* associations previously included in one larger Rocky Mountain alliance, but has been created separately to reflect the more southern floristic elements of this new alliance. Stands in this alliance appear to be separated from stands in *Cercocarpus montanus* Madrean Montane Chaparral Alliance (A3791) by the density of the shrub layer alone. Stands in this shrub-herbaceous alliance have only been described from southwestern New Mexico but may occur throughout the range of *Cercocarpus montanus*. A *Cercocarpus montanus / Stipa neomexicana* shrubland has been described from the Colorado Front Range foothills by the Colorado Natural Heritage Program but has not yet been included in the National Vegetation Classification (S. Kettler pers. comm.).

Internal Comments:
Other Comments:

Similar NVC Types:
- A3732 *Amelanchier utahensis - Cercocarpus montanus - Cercocarpus intricatus* Shrubland Alliance
- A3791 *Cercocarpus montanus* Madrean Montane Chaparral Alliance

Diagnostic Characteristics: Broad-leaved shrublands dominated or codominated by the hybrid scrub oak *Quercus x pauciloba* and *Cercocarpus montanus* with grasses predominant in the understory. Understory associated species tend to reflect southern distributions.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a moderately sparse to moderately dense cover of broad-leaved deciduous shrubs 2 m tall. The sparse to moderately dense herbaceous layer is usually less than 1 m tall and dominated by graminoids. Some stands have herbaceous layers dominated by perennial forbs, but generally forb cover is sparse. Annuals are seasonally present.

Floristics: The sparse to moderately dense shrub layer is 1-2 m tall and is dominated by the cold-deciduous, broad-leaved shrub *Cercocarpus montanus* or the hybrid oak *Quercus x pauciloba*. Occasional trees, such as *Juniperus* spp., *Pinus edulis, Pinus ponderosa, Pseudotsuga menziesii*, or *Quercus* spp., may be scattered in some stands. Shrub cover is generally denser on northern aspects and increases with elevation. Lower elevation stands grade into shrub savannas with decreasing elevation. The herbaceous

layer is sparse to moderately dense depending on the density of the shrub layer and soil moisture. It is dominated by perennial graminoids or forbs with annuals present seasonally. Associated species vary with location. In the western Great Plains, *Artemisia frigida* and *Rhus trilobata* are common woody species. The herbaceous layer is sparse to moderately dense and is dominated by the warm-season, perennial midgrass *Bouteloua curtipendula*. *Achnatherum hymenoides (= Oryzopsis hymenoides), Aristida purpurea, Elymus elymoides, Hesperostipa comata (= Stipa comata)*, and *Piptatheropsis micrantha (= Oryzopsis micrantha)* may also be present. Common forbs are *Artemisia ludoviciana, Hedeoma hispida*, and *Symphyotrichum oblongifolium (= Aster oblongifolius)*. Stands in the Rocky Mountain foothills are similar, but with the graminoid layer usually dominated by the cool-season, perennial mid grasses *Bouteloua gracilis, Hesperostipa comata*, or *Hesperostipa neomexicana (= Stipa neomexicana)*. In addition to *Artemisia frigida* and *Rhus trilobata*, associated shrubs and dwarf-shrubs may include *Purshia tridentata, Quercus gambelii*, and *Ribes cereum*. Other associated species, such as *Allium textile, Artemisia ludoviciana, Astragalus parryi, Bouteloua gracilis, Eriogonum umbellatum, Helianthus pumilus*, and *Poa* spp., are common in the herbaceous layer. In the Chihuahuan Desert montane scrublands, the dominant species may be a different subspecies, *Cercocarpus montanus var. paucidentatus*. Associated shrubs and dwarf-shrubs include Madrean elements such as *Agave parryi, Ceanothus greggii, Dasylirion leiophyllum, Dasylirion wheeleri, Ericameria laricifolia, Garrya flavescens, Garrya wrightii, Petrophytum caespitosum, Quercus grisea* (shrub form), *Quercus turbinella, Yucca baccata*, and shrubby species of *Opuntia*, sometimes forming a mixed cold-deciduous/evergreen stand. Occasional trees such as *Quercus arizonica, Quercus gambelii*, and other *Quercus* spp. and conifers such as *Juniperus deppeana* may be present. The herbaceous layer is sparse on the very rocky sites to moderately dense, and usually is dominated by perennial grasses, including *Aristida ternipes, Bothriochloa barbinodis, Bouteloua curtipendula, Bouteloua gracilis, Eragrostis intermedia, Koeleria macrantha, Lycurus phleoides, Muhlenbergia emersleyi, Muhlenbergia montana*, and *Muhlenbergia pauciflora*. Forbs may be diverse and include *Artemisia ludoviciana, Eriogonum jamesii, Hedeoma plicata, Heliomeris longifolia, Heliomeris multiflora, Mirabilis multiflora*, and *Viguiera dentata*.

ENVIRONMENT & DYNAMICS

Environmental Description: Shrublands included in this alliance are found on prairie breaks and on slopes of foothills, mountains and canyons. Elevations range from 915 to 2440 m (3000-8000 feet). Climate is semi-arid. Summers are hot and winters are typically cold, with freezing temperatures and snow common. Mean annual precipitation ranges from 24-55 cm with precipitation occurring bimodally during the winter and late summer with a droughty period in late spring/early summer. The late-summer rain often occurs as high-intensity thunderstorms. Sites are variable but are generally xeric and rocky with moderate to very steep slopes or on ridges. Stands are found on various aspects, but typically the higher elevation and northern sites are on warmer, southern exposures, and lower elevation and southern stands are restricted to more mesic north slopes. Substrates are typically thin, well-drained, poorly developed, lithic soils with abundant rock outcrops. Soil textures range from sandy loam to clay. Soils range from slightly acidic to slightly alkaline depending on parent material, which includes alluvium, colluvium and residuum from igneous, metamorphic or sedimentary rocks such as granite, gneiss, limestone, quartz monzonite, rhyolite, sandstone, schist and shale.

Dynamics: *Cercocarpus montanus* is a dominant understory species in several woodland and forests dominated by *Juniperus deppeana, Juniperus monosperma, Juniperus osteosperma, Juniperus scopulorum, Pinus edulis, Pinus ponderosa, Pseudotsuga menziesii, Quercus gambelii, Quercus grisea*, and *Quercus x pauciloba*. *Cercocarpus montanus* stands often occur in the more xeric habitat below these woodland and forest stands. In xeric habitats studied by Greenwood and Brotherson (1978), *Cercocarpus montanus* sites had significantly more rock than the *Pinus edulis* and *Juniperus osteosperma* sites. Brotherson et al. (1984) suggested that stands are moisture-limited because stands on southern aspects were always higher in elevation than stands on northern aspects. However, *Cercocarpus montanus* did not typically occur with mesic shrubs such as *Symphoricarpos oreophilus* and *Amelanchier alnifolia*. There is often a broad *Cercocarpus montanus* shrub/herbaceous ecotone between these shrublands and grasslands. Ecological factors that control shrub densities such as fire and drought need more investigation. Unlike other species of *Cercocarpus, Cercocarpus montanus* is a fire-resistant species because it can resprout from the base after a fire has killed the top (Cronquist et al. 1997). In the southern portion of its range, *Cercocarpus montanus* functions as an evergreen shrub by retaining leaves during mild winters and losing them during cold winters (Dick-Peddie 1993). *Cercocarpus montanus* is preferred winter range browse for deer (Roughton 1966, 1972, Hoffman and Alexander 1987). Stands can also produce significant forage that can be utilized by grazing livestock provided the slopes are not too steep (Hoffman and Alexander 1987). More information is needed on the effects of livestock grazing and wildlife browsing on the structure and function of these shrublands.

DISTRIBUTION

Geographic Range: This alliance is known from the southern Rocky Mountains south to the northern Chihuahuan Desert and east to the Southern Shortgrass Prairie of Colorado, New Mexico and Texas.

Nations: US
States/Provinces: CO, NM, TX
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:

Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Cercocarpus montanus - Rhus aromatica / Bouteloua curtipendula* Plant Association (Johnston 1987) [*Rhus aromatica* is a synonym for *R. tridentata*]
- **?** *Cercocarpus montanus / Bouteloua curtipendula* Habitat Type (Hoffman and Alexander 1987)
- **?** *Cercocarpus montanus* (Mountain Mahogany) Series (Muldavin et al. 1998b)
- **?** Mountain Mahogany-Mixed Shrub Series (Dick-Peddie 1993) [included within the Montane Scrubland Vegetation Type]
- **?** Mountain mahogany Series (133.34) (Brown 1982a) [included within Interior Chaparral]

LOWER LEVEL UNITS

Associations:

- CEGL004589 *Cercocarpus montanus var. paucidentatus / Petrophyton caespitosum* Shrubland
- CEGL002913 *Cercocarpus montanus / Achnatherum scribneri* Shrubland
- CEGL002914 *Cercocarpus montanus / Muhlenbergia montana* Shrubland
- CEGL005378 *Quercus x pauciloba / Bouteloua curtipendula* Shrubland
- CEGL001118 *Quercus x pauciloba / Cercocarpus montanus* Shrubland
- CEGL001091 *Cercocarpus montanus / Rhus trilobata var. trilobata* Shrubland
- CEGL002911 *Cercocarpus montanus / Hesperostipa neomexicana* Shrubland
- CEGL001086 *Cercocarpus montanus / Bouteloua curtipendula* Shrubland

AUTHORSHIP

Primary Concept Source: M.S. Reid and K.A. Schulz, in Faber-Langendoen et al. (2014)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Brotherson et al. 1984, Brown 1982a, Cronquist et al. 1997, Diamond 1993, Dick-Peddie 1993, Faber-Langendoen et al. 2017b, Greenwood and Brotherson 1978, Hoffman and Alexander 1987, Johnston 1987, Kettler pers. comm., Muldavin et al. 1998b, Roughton 1966, Roughton 1972

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G276. Southern Rocky Mountain Mountain-mahogany - Mixed Foothill Shrubland

A3730. Fallugia paradoxa - Rhus trilobata Shrubland Alliance

Type Concept Sentence: This alliance is characterized by short, open shrublands occupying lava flows of El Malpais National Monument dominated by *Fallugia paradoxa, Ribes cereum*, or *Rhus trilobata* singly or in combination.

OVERVIEW

Scientific Name: *Fallugia paradoxa - Rhus trilobata* Shrubland Alliance
Common Name (Translated Scientific Name): Apache Plume - Skunkbush Sumac Shrubland Alliance
Colloquial Name: Apache Plume - Skunkbush Sumac Shrubland

Type Concept: This alliance is characterized by short, open shrublands occupying lava flows of El Malpais National Monument dominated by *Fallugia paradoxa, Ribes cereum*, or *Rhus trilobata* singly or in combination. Tree species such as *Juniperus monosperma, Pinus edulis*, or *Populus tremuloides* are frequently present in these shrublands as saplings or mature individuals, but never exceed 10% total cover. Frequent shrub associates include *Forestiera pubescens* and *Holodiscus dumosus*. *Bouteloua gracilis, Bouteloua curtipendula, Elymus elymoides, Piptatheropsis micrantha (= Piptatherum micranthum), Poa fendleriana*, and *Schizachyrium scoparium* are the most frequently occurring graminoids, though cover of any individual species is low. Forbs can range as high as 20% total cover and may include *Artemisia carruthii* and *Heterotheca villosa*. These shrublands occur between 2000-2400 m in elevation on gently rolling lava plateaus and collapse features. The ground surface cover is composed of lava rock and gravel, with areas interspersed where finer wind- or water-borne soils have accumulated.

Classification Comments: This alliance is poorly documented, but likely found elsewhere regionally on course volcanic substrates within the region. This could be potentially grouped into another alliance within this group, but is distinguished by occurring on volcanic substrates.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Vegetation is characterized by short shrublands of varying cover, ranging from sparse to well-developed on volcanic substrates and dominated by *Fallugia paradoxa, Ribes cereum*, or *Rhus trilobata* singly or in combination.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance is dominated by a moderately dense layer of cold-deciduous shrubs. A sparse to moderately dense herbaceous layer may be present that is dominated by perennial graminoids. Scattered perennial forbs are usually present. Annual forbs and grasses are seasonally present.

Floristics: These shrublands are dominated by *Fallugia paradoxa, Ribes cereum*, or *Rhus trilobata* singly or in combination. Tree species such as *Juniperus monosperma, Pinus edulis*, or *Populus tremuloides* are frequently present in these shrublands as saplings or mature individuals, but never exceed 10% total cover. Frequent shrub associates include *Forestiera pubescens* and *Holodiscus dumosus*. *Bouteloua gracilis, Bouteloua curtipendula, Elymus elymoides, Piptatheropsis micrantha (= Piptatherum micranthum), Poa fendleriana*, and *Schizachyrium scoparium* are the most frequently occurring graminoids, though cover of any individual species is low. Forbs can range as high as 20% total cover and may include *Artemisia carruthii* and *Heterotheca villosa*.

ENVIRONMENT & DYNAMICS

Environmental Description: These shrublands occur between 2000-2400 m in elevation on gently rolling lava plateaus and collapse features. The ground surface cover is composed of lava rock and gravel, with areas interspersed where finer wind- or water-borne soils have accumulated.

Dynamics: *Rhus trilobata* has seeds that are impermeable and exhibit embryonic dormancy. Germination requires scarification either through cold stratification, fire, or animal ingestion. However, the primary means of reproduction is vegetative through root sprouts which can result in dense thickets.

DISTRIBUTION

Geographic Range: This alliance is currently only known from El Malpais National Monument in northwestern New Mexico.

Nations: US
States/Provinces: NM
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** *Fallugia paradoxa - Rhus trilobata* Shrubland (Muldavin et al. 2013c)

LOWER LEVEL UNITS

Associations:
- CEGL002330 *Fallugia paradoxa* / Rockland Shrubland
- CEGL002222 *Fallugia paradoxa - Rhus trilobata* Shrubland
- CEGL002333 *Rhus trilobata - Ribes cereum* Shrubland

AUTHORSHIP

Primary Concept Source: E. Muldavin et al. (2013c)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Faber-Langendoen et al. 2017b, Muldavin et al. 2013c

G276. Southern Rocky Mountain Mountain-mahogany - Mixed Foothill Shrubland

A3731. Purshia tridentata - Ribes cereum Shrubland Alliance

Type Concept Sentence: This alliance is characterized by shrublands of the eastern Front Range of Colorado within canyons dominated by *Purshia tridentata* or *Ribes cereum*.

OVERVIEW

Scientific Name: *Purshia tridentata - Ribes cereum* Shrubland Alliance
Common Name (Translated Scientific Name): Antelope Bitterbrush - Wax Currant Shrubland Alliance
Colloquial Name: Antelope Bitterbrush - Wax Currant Shrubland

Type Concept: This shrubland alliance is found on gentle to very steep slopes in the foothills and mountains in the Colorado Front Range. Shrublands included in this alliance are characterized by a *Purshia tridentata*- or *Ribes cereum*-dominated shrub canopy. *Artemisia frigida* is the most constant shrub associate. *Arctostaphylos uva-ursi, Artemisia tridentata ssp. vaseyana, Ceanothus fendleri, Chrysothamnus viscidiflorus, Ericameria nauseosa (= Chrysothamnus nauseosus), Jamesia americana, Juniperus communis, Prunus virginiana, Rhus trilobata*, and *Rubus deliciosus* are sometimes present. Scattered trees such as *Juniperus scopulorum, Pinus ponderosa*, and *Pseudotsuga menziesii* may be present at low covers. Graminoids are the most common herbaceous dominants, the most constant being *Hesperostipa comata, Leymus ambiguus*, and *Muhlenbergia montana*. Other common herbaceous associates include *Achillea millefolium, Achnatherum scribneri (= Stipa scribneri), Antennaria* sp., *Artemisia ludoviciana, Astragalus* sp., *Bouteloua gracilis, Chenopodium leptophyllum, Cryptantha virgata, Elymus albicans, Erigeron* spp., *Geranium caespitosum, Harbouria trachypleura, Helianthus pumilus, Heterotheca villosa, Penstemon virens, Phacelia heterophylla, Potentilla fissa, Scutellaria brittonii*, and *Symphyotrichum falcatum*. Sites where found are exposed, steep (30-90% slope) mountain slopes with southerly aspects on the eastern slopes of the Front Range, from 1700 to 2800 m in elevation. These sites are typically too xeric to support extensions of the surrounding coniferous forests. Parent materials are colluvial and residual metamorphic rocks.

Classification Comments: This alliance is very narrowly defined and may be better included in a *Cercocarpus montanus* alliance as the range is overlapping. The inclusion of *Ribes cereum* is tentative here since it occupies steeper, talus slope environments than those of the other associations, but has some floristic and geographic overlap.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: broad-leaved semi-evergreen shrublands of steep canyons and mountain slopes dominated by *Purshia tridentata* or *Ribes cereum*. Shrub cover may range from sparse to open.

VEGETATION

Physiognomy and Structure: These are typically moderately dense to open (15-40% cover) microphyllous evergreen (or late cold-deciduous) shrublands with the dominant shrubs varying from 0.5-3 m in height. Maximum shrub height generally decreases with latitude and altitude, reaching a minimum in subalpine stands. A second tier of microphyllous evergreen or cold-deciduous shrubs may be present. Cespitose graminoids are typical herbaceous associates and may strongly dominate the ground layer. Some regional variants may have a substantial forb component as well. Lichens and mosses may cover the ground surface in good-condition stands.

Floristics: Shrublands included in this alliance are characterized by a *Purshia tridentata*- or *Ribes cereum*-dominated shrub canopy. Canopies are 1-2 m tall and total cover ranges from 15-40%. Other shrubs are poorly represented, but *Artemisia frigida* is the most constant shrub associate. *Arctostaphylos uva-ursi, Artemisia tridentata ssp. vaseyana, Ceanothus fendleri, Chrysothamnus viscidiflorus, Ericameria nauseosa (= Chrysothamnus nauseosus), Jamesia americana, Juniperus communis, Prunus virginiana, Rhus trilobata*, and *Rubus deliciosus* are sometimes present. Scattered trees such as *Juniperus scopulorum, Pinus ponderosa*, and *Pseudotsuga menziesii* may be present at low covers. The herbaceous layer is dominated by perennial graminoids 0.5-m tall, the most constant species being *Hesperostipa comata, Leymus ambiguus*, and *Muhlenbergia montana*. Other common herbaceous associates include *Achillea millefolium, Achnatherum scribneri (= Stipa scribneri), Antennaria* sp., *Artemisia ludoviciana, Astragalus* sp., *Bouteloua gracilis, Chenopodium leptophyllum, Cryptantha virgata, Elymus albicans, Erigeron* spp., *Geranium caespitosum, Harbouria trachypleura, Helianthus pumilus, Heterotheca villosa, Penstemon virens, Phacelia heterophylla, Potentilla fissa, Scutellaria brittonii, Symphyotrichum falcatum*.

ENVIRONMENT & DYNAMICS

Environmental Description: Most of the region where this alliance occurs is arid to semi-arid with annual precipitation ranging from 15 to 75 cm. The entire range is under a continental temperature regime of cold winters, cool to warm summers and large diurnal variation. These shrublands are found on exposed, steep (30-90% slope) mountain slopes with southerly aspects on the eastern

slopes of the Front Range (Hess 1981). Elevations range from 1700 to 2800 m. These sites are typically too xeric to support extensions of the surrounding coniferous forests. Parent materials are colluvial and residual metamorphic rocks which have developed into soils classified as Entisols. These soils are poorly developed and rocky, with loamy and sandy textures, and shallow A horizons over rocky C horizons. The soil surface is also moderately rocky.

Dynamics: Sawyer and Keeler-Wolf (1995) report that stands of *Purshia tridentata* can reach 125 years of age on deep, well-drained sites, but more commonly become decadent at 30 years, and die at 40-50 years of age. Stands appear to result from either a disturbance event (such as fire), or from rare years when many seedlings survive. This results in even-aged stands (Sawyer and Keeler-Wolf 1995). *Purshia tridentata* displays considerable plasticity in growth across its range. The broad range in height and form of different populations appears to be related to ecotypic variation (Mozingo 1987). Although mycorrhizae are considered important in establishment and growth of individual plants, *Purshia tridentata* is one of the first species to colonize barren volcanic substrates following eruption. The species is valuable as winter browse for native ungulates and livestock and is used extensively. Moderate livestock utilization (<60% of the year's current growth) has been reported to stimulate twig growth the following spring (Mueggler and Stewart 1980).

DISTRIBUTION

Geographic Range: This alliance is currently known from the eastern Front Range of Colorado.

Nations: US
States/Provinces: CO
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Elymus ambiguus* Series (Hess 1981) [*Elymus ambiguus/Ribes cereum* is the sole habitat type in this series.]
- **><** *Ribes* spp. Series (Johnston 1987)

LOWER LEVEL UNITS

Associations:
- CEGL001057 *Purshia tridentata / Muhlenbergia montana* Shrubland
- CEGL001055 *Purshia tridentata / Artemisia frigida / Hesperostipa comata* Shrubland
- CEGL001124 *Ribes cereum / Leymus ambiguus* Shrubland

AUTHORSHIP

Primary Concept Source: D. Sarr and K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Faber-Langendoen et al. 2017b, Hess 1981, Johnston 1987, Mozingo 1987, Sawyer and Keeler-Wolf 1995

M048. Central Rocky Mountain Montane-Foothill Grassland & Shrubland

This macrogroup occurs in the foothills and mountains throughout the Central Rockies, from central and eastern Wyoming north and west into British Columbia and Alberta and is composed of shrub- and/or herbaceous-dominated stands forming shrublands, shrub-steppe, or grasslands. Characteristic shrubs include *Acer glabrum, Amelanchier alnifolia, Holodiscus discolor, Menziesia ferruginea, Physocarpus malvaceus, Symphoricarpos albus, Symphoricarpos occidentalis*, and species of *Prunus, Rhus, Ribes, Rosa, Rubus parviflorus, Spiraea*, and *Vaccinium*. The herbaceous layer is characterized by *Festuca idahoensis, Pseudoroegneria spicata*, and other cool-season graminoids.

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
2.B.2.Na.2.a. M048 Central Rocky Mountain Montane-Foothill Grassland & Shrubland

G267. Central Rocky Mountain Montane Grassland

Type Concept Sentence: This central Rocky Mountains grassland group occurs in an upper montane to subalpine zone and is dominated by perennial grasses, particularly *Achnatherum nelsonii, Festuca idahoensis*, and *Leucopoa kingii*, with many other graminoid and forb species present to codominant.

OVERVIEW

Scientific Name: *Leymus innovatus - Festuca idahoensis - Leucopoa kingii* Grassland Group
Common Name (Translated Scientific Name): Downy Ryegrass - Idaho Fescue - Spike Fescue Grassland Group
Colloquial Name: Central Rocky Mountain Montane Mesic Idaho Fescue Grassland

Type Concept: This is an upper montane to subalpine grassland group is dominated by perennial grasses and forbs on relatively dry sites in the northern Rocky Mountains and Cascades, but is more extensive in the Rocky Mountains cordillera, from the Canadian Rockies south into western Montana, northern Wyoming, eastern Oregon, eastern Washington, and Idaho. The herbaceous layer is frequently composed of *Achnatherum nelsonii, Calamagrostis rubescens, Festuca idahoensis*, and *Leucopoa kingii* with many other perennial graminoid species present to codominant, such as *Achnatherum occidentale (= Stipa occidentalis), Achnatherum richardsonii (= Stipa richardsonii), Danthonia intermedia, Deschampsia cespitosa, Elymus trachycaulus, Koeleria macrantha, Leymus innovatus (= Elymus innovatus), Phleum alpinum, Poa fendleriana, Trisetum spicatum*, and a variety of Carices, such as *Carex filifolia, Carex hoodii, Carex elynoides, Carex obtusata*, and *Carex scirpoidea*. Important forbs include *Chamerion angustifolium (= Epilobium angustifolium), Eriogonum caespitosum, Fragaria virginiana, Lupinus argenteus var. laxiflorus, Lupinus sericeus, Oxytropis campestris, Phlox pulvinata, Potentilla diversifolia*, and *Potentilla flabellifolia*. The upper montane to subalpine dry grassland stands range from small meadows to large open parks surrounded by conifer trees but lack tree cover within them. In relatively mesic areas such as the northern Rocky Mountains and Cascades, it is found on drier sites, particularly south-facing slopes or ridgetops. In general, soil textures are much finer, and soils are often deeper under grasslands than in the neighboring forests. Although these grasslands are composed primarily of tussock-forming species, they do exhibit a dense sod that makes root penetration difficult for tree species. Disturbance such as fire also plays a role in maintaining these open grassy areas. This group is similar to Central Rocky Mountain Lower Montane, Foothill & Valley Grassland Group (G273) but is found at higher elevations and is more often composed of species of *Festuca, Achnatherum*, and/or *Hesperostipa* with additional floristic components of more subalpine taxa. It is also similar to Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow Group (G271), differing by occurring in drier settings and being predominantly grasslands rather than forby and grassy mesic meadows. Occurrences of this group are often more forb-rich than Southern Rocky Mountain Montane-Subalpine Grassland Group (G268), which tends to be drier.

Classification Comments: For now, this group is kept as a separate unit, but it is possible it should be merged with Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow Group (G271). Another possibility is to consider this "grassland" group to contain what people refer to as "mesic grassy meadows," and the mesic herbaceous meadow group to contain predominantly forb meadows and tall forblands which in many cases are more seasonally wet than mesic. In addition, the Rockies and Cascades support a number of forb types found on talus and rocky scree slopes, which are not sparsely vegetated, and which often have little to no grass component, though Carices may be abundant. These types often have heavy snow loading in winter, or are adjacent to snow fields, and sub-surface moisture below the rocks/scree is significant throughout the growing season. These forb types are poorly documented, and their group placement presently is in Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow Group (G271).

Similar NVC Types:
- G273 Central Rocky Mountain Lower Montane, Foothill & Valley Grassland
- G271 Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow
- G268 Southern Rocky Mountain Montane-Subalpine Grassland

Diagnostic Characteristics: This meadow group is dominated by graminoids, typically forming 70 to 80% cover. Bunchgrasses are the major lifeform, and the important taxa include *Leymus innovatus, Koeleria macrantha, Festuca idahoensis, Achnatherum occidentale, Achnatherum richardsonii, Elymus trachycaulus*, and a variety of sedges such as *Carex hoodii, Carex obtusata*, and *Carex scirpoidea*.

VEGETATION

Physiognomy and Structure: Structurally simple grasslands dominated by perennial bunch grasses and forbs on relatively dry sites.

Floristics: Typical dominant species are *Achnatherum nelsonii, Festuca idahoensis*, and *Leucopoa kingii* with many other perennial graminoid species present to codominant such as *Achnatherum occidentale (= Stipa occidentalis), Achnatherum richardsonii (= Stipa richardsonii), Danthonia intermedia, Deschampsia cespitosa, Elymus trachycaulus, Koeleria macrantha, Leymus innovatus (= Elymus innovatus), Phleum alpinum, Poa fendleriana, Trisetum spicatum*, and a variety of Carices, such as *Carex filifolia, Carex hoodii, Carex*

elynoides, Carex obtusata, and *Carex scirpoidea*. Important forbs include *Chamerion angustifolium (= Epilobium angustifolium), Eriogonum caespitosum, Fragaria virginiana, Lupinus argenteus var. laxiflorus, Lupinus sericeus, Oxytropis campestris, Phlox pulvinata, Potentilla diversifolia*, and *Potentilla flabellifolia*. Grasslands dominated by *Calamagrostis rubescens* are also in this group.

ENVIRONMENT & DYNAMICS

Environmental Description: This is an upper montane to subalpine grassland group dominated by perennial grasses and forbs on dry sites (in the context of the northern Rocky Mountains and Cascades), particularly south-facing slopes or ridgetops. Many occurrences are small patch in spatial character, and are often found in mosaics with woodlands, more dense shrublands, or just below alpine communities. Elevations range from 600 to 2011 m (2000-7500 feet) in the northern Rocky Mountains and up to 2286 to 2682 m (7500-8800 feet) in the mountains of southwestern Montana and Wyoming. These communities occur on gentle to moderate-gradient slopes, although occasionally on steep slopes. Soils are typically seasonally moist in the spring, but dry out later in the growing season. In general, soil textures are much finer, and soils are often deeper under grasslands than in the neighboring forests. Although these grasslands are composed primarily of tussock-forming species (bunchgrasses), they do exhibit a dense sod that makes root penetration difficult for tree species.

Dynamics: Disturbance such as fire plays a role in maintaining these open grassy areas in predominantly forested landscapes.

DISTRIBUTION

Geographic Range: This group is most extensive in the Canadian Rockies portion of the Rocky Mountains cordillera, extending south into western Montana, northwestern Wyoming, central and eastern Oregon, eastern Washington, and Idaho. It also occurs in the "island ranges" of central Montana, though it is not common, and is also found in the Bighorn Range of north-central Wyoming. A couple of associations in this group also occur in Colorado.

Spatial Scale & Pattern [optional]: Large patch
Nations: CA, US
States/Provinces: AB, BC, CO, ID, MT, OR, WA, WY
TNC Ecoregions [optional]: 3:P, 4:P, 7:C, 8:C, 9:C, 26:C, 68:C
USFS Ecoregions (2007): 331A:??, 341G:CC, 342A:CP, 342C:CC, 342D:CC, 342H:CC, 342I:C?, 342J:CC, M242B:C?, M242C:CP, M242D:CC, M331A:PP, M331B:PP, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CP, M333A:CC, M333B:CC, M333C:CC, M333D:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Alliances:

- A3966 *Festuca idahoensis - Calamagrostis rubescens - Achnatherum nelsonii* Central Rocky Mountain Montane Mesic Grassland Alliance
- A3965 *Festuca idahoensis - Carex scirpoidea - Danthonia intermedia* Central Rocky Mountain Subalpine Dry Grassland Alliance
- A1323 *Leucopoa kingii - Carex elynoides - Phlox pulvinata* Central Rocky Mountain Subalpine-Alpine Grassland Alliance

AUTHORSHIP

Primary Concept Source: W.F. Mueggler and W.L. Stewart (1980)
Author of Description: M.S. Reid and K.A. Schulz
Acknowledgments:
Version Date: 11/09/2015
Classif Resp Region: West
Internal Author: MSR 3-10, mod. KAS 11-15

REFERENCES

References: Cooper et al. 1995, Faber-Langendoen et al. 2017a, Johnson 2004, Mueggler and Stewart 1980, Shiflet 1994

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G267. Central Rocky Mountain Montane Grassland

A3966. Festuca idahoensis - Calamagrostis rubescens - Achnatherum nelsonii Central Rocky Mountain Montane Mesic Grassland Alliance

Type Concept Sentence: This alliance is characterized by a moderately dense to dense and diverse herbaceous layer dominated by medium-tall perennial graminoids *Achnatherum nelsonii, Calamagrostis rubescens, Carex hoodii, Deschampsia cespitosa*, or *Festuca idahoensis* with *Achnatherum richardsonii, Carex filifolia, Elymus trachycaulus, Koeleria macrantha*, or perennial forb *Lupinus sericeus* present to codominant. It is described from relatively mesic sites on montane slopes in the central Rocky Mountains of central and southern Idaho, western and south-central Montana, eastern Oregon, Washington and northwestern Wyoming.

OVERVIEW

Scientific Name: *Festuca idahoensis - Calamagrostis rubescens - Achnatherum nelsonii* Central Rocky Mountain Montane Mesic Grassland Alliance
Common Name (Translated Scientific Name): Idaho Fescue - Pinegrass - Columbia Needlegrass Central Rocky Mountain Montane Mesic Grassland Alliance
Colloquial Name: Central Rocky Mountain Montane Mesic Idaho Fescue Grassland

Type Concept: The vegetation of this grassland alliance is characterized by a moderately dense to dense and diverse herbaceous layer dominated by medium-tall perennial graminoids with perennial forbs. The dominant and diagnostic species are *Achnatherum nelsonii, Calamagrostis rubescens, Carex hoodii, Deschampsia cespitosa*, or *Festuca idahoensis* with *Achnatherum richardsonii, Carex filifolia, Elymus trachycaulus, Koeleria macrantha, Lupinus sericeus, Pseudoroegneria spicata*, or *Pascopyrum smithii* present to codominant. Commonly associated forbs are often relatively mesic, such as *Achillea millefolium, Packera pseudaurea (= Senecio pseudaureus), Symphyotrichum foliaceum (= Aster foliaceus)*, and *Zigadenus elegans*. Shrubs may be present with up to 25% cover, but are not diagnostic of this alliance. Shrub species are relatively mesic with *Amelanchier alnifolia, Rubus parviflorus*, and *Symphoricarpos albus* most common. This alliance is described from montane slopes in the central Rocky Mountains of central and southern Idaho, western and south-central Montana, eastern Oregon, Washington and northwestern Wyoming. These grasslands form in openings on the slopes and benches in shrublands, woodlands and forests ranging from 1100-3322 m (3600-10,900 feet) elevation. Stands occur on mesic sites under a broad range of environmental conditions, ranging from gentle, broad, dissected plateau ridgetops to steep mountain sideslopes at 1830-2410 m (6000-7900 feet) elevation. Sites are nearly level to gently sloping with gentle topography. The soils are shallow to moderately deep and have high organic matter content. Soil texture varies from loam to sandy loam.

Classification Comments: Stands of *Festuca idahoensis - Elymus trachycaulus* Grassland (CEGL001614) reported from Colorado need additional review for inclusion in this central Rocky Mountain grassland alliance.

Internal Comments:
Other Comments:

Similar NVC Types: This alliance has similarities to other temperate grassland alliances that are dominated or codominated by *Festuca idahoensis* in several other groups, such as G141, G268, G269, G271, G273, and G331.

- A1323 *Leucopoa kingii - Carex elynoides - Phlox pulvinata* Central Rocky Mountain Subalpine-Alpine Grassland Alliance: occurs on high subalpine and alpine sites in the central Rocky Mountains and is typically codominated by cushion plants.
- A3965 *Festuca idahoensis - Carex scirpoidea - Danthonia intermedia* Central Rocky Mountain Subalpine Dry Grassland Alliance: occurs on dry and often rocky, wind-desiccated sites on subalpine and lower alpine slopes in the central Rocky Mountains.

Diagnostic Characteristics: The relatively mesic vegetation is characterized by a moderately dense to dense and diverse herbaceous layer dominated by medium-tall perennial graminoids. The diagnostic species *Achnatherum nelsonii, Calamagrostis rubescens*, or *Festuca idahoensis* dominate with *Achnatherum richardsonii, Carex filifolia, Carex hoodii, Deschampsia cespitosa, Elymus trachycaulus, Koeleria macrantha, Lupinus sericeus, Pseudoroegneria spicata*, or *Pascopyrum smithii* codominating. Commonly associated forbs are *Achillea millefolium, Arnica sororia, Antennaria parvifolia, Antennaria rosea, Arenaria congesta, Fragaria virginiana, Gaillardia aristata, Galium boreale, Gentiana affinis, Geum triflorum, Hieracium cynoglossoides, Lupinus argenteus var. laxiflorus, Packera pseudaurea, Symphyotrichum foliaceum*, and *Zigadenus elegans*. Scattered mesic shrubs may also be present, such as *Amelanchier alnifolia, Dasiphora fruticosa ssp. floribunda, Rubus parviflorus*, and *Symphoricarpos albus*.

VEGETATION

Physiognomy and Structure: This alliance is characterized by moderately dense to dense cover of perennial graminoids. The graminoid stratum is dominated by both sedges and bunch grasses, ranging from 60-100% cover. The forb stratum is dominated by perennials, with 25-60% cover. Scattered shrubs may also be present.

Floristics: The vegetation is characterized by a moderately dense to dense and diverse herbaceous layer dominated by medium-tall perennial graminoids with perennial forbs. The dominant and diagnostic species are *Achnatherum nelsonii, Calamagrostis rubescens,*

Carex hoodii, Deschampsia cespitosa, or *Festuca idahoensis* with *Achnatherum richardsonii, Carex filifolia, Elymus trachycaulus, Koeleria macrantha, Lupinus sericeus, Pseudoroegneria spicata*, or *Pascopyrum smithii* present to codominant. Other associated graminoids include *Achnatherum occidentale (= Stipa occidentalis), Carex geyeri*, and *Danthonia intermedia*. Commonly associated forbs are a mix of relatively mesic and dry species such as *Achillea millefolium, Arnica sororia, Antennaria parvifolia, Antennaria rosea, Arenaria congesta, Fragaria virginiana, Gaillardia aristata, Galium boreale, Gentiana affinis, Geranium viscosissimum, Geum triflorum, Hieracium scouleri var. albertinum (= Hieracium albertinum), Lupinus argenteus var. laxiflorus (= Lupinus laxiflorus), Packera pseudaurea (= Senecio pseudaureus), Symphyotrichum foliaceum (= Aster foliaceus)*, and *Zigadenus elegans*. Shrubs may be present with up to 25% cover when perennial graminoid cover is high (>50% cover), but are not diagnostic of this alliance. Shrub species tend to be relatively mesic; *Amelanchier alnifolia, Dasiphora fruticosa ssp. floribunda, Rubus parviflorus*, and *Symphoricarpos albus* are the most common. *Artemisia tridentata, Mahonia repens, Rosa woodsii*, and *Vaccinium cespitosum* may also be present in low amounts. Tree saplings may also be present with significant cover.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance is described from relatively mesic sites on montane slopes in the central Rocky Mountains of central and southern Idaho, western and south-central Montana, eastern Oregon, Washington and northwestern Wyoming. These grasslands form in openings on mesic slopes and benches in shrublands, woodlands and forests ranging from 1100-3322 m (3600-10,900 feet) elevation. Stands occur on mesic sites under a broad range of environmental conditions, ranging from gentle, broad, dissected plateau ridgetops to steep mountain sideslopes at 1830-2410 m (6000-7900 feet) elevation. Sites are nearly level to gently sloping and include drier sites in extensive moist meadows. The soils are shallow to deep and have high organic matter content. Soils are typically medium-textured loams to sandy loams from a variety of parent materials.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is described from montane slopes in the central Rocky Mountains in Waterton Lakes National Park, Alberta, and on the west side of Glacier National Park, Montana, in the mountains of southwestern Montana and northern Wyoming on both sides of the Continental Divide, in the Blue Mountains of eastern Oregon and Washington, and Idaho on high-elevation ridges of the Wallowa and Seven Devil mountains.

Nations: CA, US
States/Provinces: AB, ID, MT, NV, OR, UT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Associations:

- CEGL001614 *Festuca idahoensis - Elymus trachycaulus* Grassland
- CEGL001900 *Festuca idahoensis - Deschampsia cespitosa* Grassland
- CEGL005862 *Calamagrostis rubescens* Grassland
- CEGL005469 *Achnatherum nelsonii - Lupinus argenteus* Grassland
- CEGL001609 *Festuca idahoensis - Carex hoodii* Grassland
- CEGL001898 *Festuca idahoensis - Carex filifolia* Grassland
- CEGL005860 *Achnatherum nelsonii - Lupinus sericeus* Grassland
- CEGL001595 *Carex hoodii - Festuca idahoensis* Grassland
- CEGL001625 *Festuca idahoensis - Achnatherum richardsonii* Grassland
- CEGL001707 *Achnatherum nelsonii - Koeleria macrantha* Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by M.S. Reid for group description.
Version Date: 2014/03/14

REFERENCES

References: Cronquist et al. 1977, Dastrup 1963, Faber-Langendoen et al. 2017b, Graham 1937, Hermann 1970, Tisdale 1986, Welsh et al. 1987

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G267. Central Rocky Mountain Montane Grassland

A3965. Festuca idahoensis - Carex scirpoidea - Danthonia intermedia Central Rocky Mountain Subalpine Dry Grassland Alliance

Type Concept Sentence: This alliance is characterized by a sparse to moderately dense herbaceous layer dominated by the diagnostic perennial bunchgrass *Festuca idahoensis* with *Carex obtusata, Carex scirpoidea, Danthonia intermedia, Eriogonum caespitosum, Leucopoa kingii*, or *Potentilla diversifolia* codominating. It is described from dry and often rocky subalpine and lower alpine slopes exposed to desiccating winds in the central Rocky Mountains of central and southern Idaho, western and south-central Montana, and northwestern Wyoming.

OVERVIEW

Scientific Name: *Festuca idahoensis - Carex scirpoidea - Danthonia intermedia* Central Rocky Mountain Subalpine Dry Grassland Alliance
Common Name (Translated Scientific Name): Idaho Fescue - Northern Single-spike Sedge - Timber Oatgrass Central Rocky Mountain Subalpine Dry Grassland Alliance
Colloquial Name: Central Rocky Mountain Subalpine Dry Idaho Fescue Grassland

Type Concept: The vegetation of this grassland alliance is characterized by a sparse to moderately dense herbaceous layer dominated by the diagnostic perennial bunchgrass *Festuca idahoensis* with *Carex obtusata, Carex scirpoidea, Danthonia intermedia, Eriogonum caespitosum, Leucopoa kingii (= Festuca kingii)*, or *Potentilla diversifolia* codominating. In more exposed settings, *Festuca idahoensis* sometimes relinquishes dominance to *Festuca campestris*. Many other species are reported to occur, the most abundant being *Agoseris glauca, Antennaria corymbosa, Carex filifolia, Carex praticola, Deschampsia cespitosa, Erigeron linearis, Eriogonum ovalifolium, Galium boreale, Geum triflorum, Ivesia gordonii, Lupinus argenteus, Packera cana (= Senecio canus), Phleum alpinum, Phlox hoodii, Potentilla diversifolia, Pseudoroegneria spicata*, and *Stenotus acaulis (= Haplopappus acaulis)*. Cushion plants are common on more exposed sites. Scattered low shrubs (*Artemisia frigida* or *Artemisia tridentata ssp. vaseyana*) may be present. This alliance is described from subalpine and lower alpine slopes in the central Rocky Mountains of central and southern Idaho, western and south-central Montana, and northwestern Wyoming. Stands range from 1980-2655 m (6500-8700 feet) elevation. Sites are dry and often rocky, and exposed to desiccating winds. This dry meadow vegetation occurs on a variety of soil types on upland slopes and broad ridgetops. The composition of the vegetation depends in part on soil type; graminoid cover reaches its maximum in stands on coarse-textured soils derived from granitic bedrock, and forb cover reaches its maximum in stands on finer-textured soils derived from sedimentary bedrock.

Classification Comments: There are similarities between *Festuca idahoensis - Carex scirpoidea* Grassland (CEGL001899) and *Festuca idahoensis - (Festuca campestris) / Potentilla diversifolia* Grassland (CEGL001623) that may warrant classifying the two types into one association. In addition, Hurd (1961) reported a *Festuca idahoensis / Carex obtusata* grassland for the Bighorn Mountains in Wyoming, between 2135 and 2560 m elevation. The Pryor Mountains in Montana are a northwestern extension of the Bighorns. *Carex obtusata* and *Carex scirpoidea* are closely related and could possibly be confused. These two grasslands may actually be the same (Reid et al. 1994). For further confusion, *Festuca idahoensis - Carex scirpoidea* Grassland (CEGL001899) was based on a single stand in central Montana that had 40% cover of *Carex scirpoidea* and 10% cover of *Festuca idahoensis* (Mueggler and Stewart 1980).

~*Festuca idahoensis* Grassland (CEGL001897) in this alliance is reported from alpine habitats in Colorado, Oregon and possibly California, but is poorly defined. *Festuca idahoensis*-dominated stands in California need further investigation and association-level description, especially any alpine types that may be included in this alliance (Sawyer and Keeler-Wolf 1995). Some of the associations included in this alliance occur largely in the alpine and may be considered alpine turf.

Internal Comments:
Other Comments:

Similar NVC Types: This alliance has similarities to other temperate grassland alliances that are dominated or codominated by *Festuca idahoensis* in several other groups, such as G141, G268, G269, G271, G273, and G331

- A1323 *Leucopoa kingii - Carex elynoides - Phlox pulvinata* Central Rocky Mountain Subalpine-Alpine Grassland Alliance: occurs on high subalpine and alpine sites in the central Rocky Mountains and is typically codominated by cushion plants.
- A3966 *Festuca idahoensis - Calamagrostis rubescens - Achnatherum nelsonii* Central Rocky Mountain Montane Mesic Grassland Alliance: occurs on relatively mesic sites.

Diagnostic Characteristics: This alliance is characterized by a sparse to moderately dense herbaceous layer dominated by the diagnostic perennial bunchgrass *Festuca idahoensis* with other diagnostic species codominating, including *Carex obtusata, Carex scirpoidea, Danthonia intermedia, Eriogonum caespitosum, Leucopoa kingii*, or *Potentilla diversifolia*. In more exposed settings, *Festuca idahoensis* sometimes relinquishes dominance to *Festuca campestris*. Associated species include *Agoseris glauca, Antennaria corymbosa, Artemisia frigida, Artemisia tridentata ssp. vaseyana, Carex filifolia, Carex praticola, Deschampsia cespitosa, Erigeron linearis, Eriogonum ovalifolium, Galium boreale, Geum triflorum, Ivesia gordonii, Lupinus argenteus, Packera cana, Phleum alpinum, Phlox hoodii, Potentilla diversifolia, Pseudoroegneria spicata*, and *Stenotus acaulis*.

VEGETATION

Physiognomy and Structure: Vegetation in this alliance is characterized by moderate to dense cover of graminoids that is dominated by perennial bunch grasses less than 0.5 m tall. There is also a sparse to moderate cover of perennial forbs (<0.5 m tall). Annual forbs (and grasses) may be seasonally present but have very low cover.

Floristics: The vegetation is characterized by a sparse to moderately dense herbaceous layer dominated by the diagnostic perennial bunchgrass *Festuca idahoensis* with *Carex obtusata, Carex scirpoidea, Danthonia intermedia, Eriogonum caespitosum, Leucopoa kingii (= Festuca kingii)*, or *Potentilla diversifolia* codominating. In more exposed settings, *Festuca idahoensis* sometimes relinquishes dominance to *Festuca campestris*. Many other species are reported to occur, the most abundant being *Agoseris glauca, Antennaria corymbosa, Arenaria capillaris, Campanula rotundifolia, Carex filifolia, Carex praticola, Deschampsia cespitosa, Erigeron linearis, Eriogonum ovalifolium, Eriophyllum lanatum, Galium boreale, Geum triflorum, Ivesia gordonii, Lathyrus nevadensis, Lupinus arcticus ssp. subalpinus, Lupinus argenteus, Packera cana (= Senecio canus), Phleum alpinum, Phlox hoodii, Polygonum bistortoides, Potentilla diversifolia, Pseudoroegneria spicata*, and *Stenotus acaulis (= Haplopappus acaulis)*. Cushion plants are common on more exposed sites. Scattered low shrubs (*Artemisia frigida* or *Artemisia tridentata ssp. vaseyana*) may be present. Occasional trees may be scattered in these stands such as individuals of *Abies lasiocarpa*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance is described from subalpine and lower alpine slopes in the central Rocky Mountains of central and southern Idaho, western and south-central Montana, and northwestern Wyoming. Stands range from 1980-2655 m (6500-8700 feet) elevation. Sites are dry and often rocky, and exposed to desiccating winds. This dry meadow vegetation occurs on a variety of soil types on gentle to moderately steep upland slopes and broad ridgetops. The composition of the vegetation depends in part on soil type; graminoid cover reaches its maximum in stands on coarse-textured soils derived from granitic bedrock, and forb cover reaches its maximum in stands on finer-textured soils derived from sedimentary bedrock. The alliance appears to be restricted to high-elevation sites of intermediate productivity where combined factors of duration of snow cover, exposure to winter desiccation, and growing-season soil-moisture availability allow its occurrence.

Dynamics: These stands occur in alpine and in upper subalpine parks and meadows that have been created by fire or where other disturbance or edaphic factors limit tree growth. Environmental factors important to alpine vegetation include soil moisture, amount and length of snow cover, aspect, and exposure to wind. These stands are on warmer/drier southern and western exposures where snow clears relatively early (mid-June) and wind exposure is less than the cushion plant vegetation types (Kuramoto and Bliss 1970).

DISTRIBUTION

Geographic Range: This alliance is described from subalpine and lower alpine slopes of the Pioneer, White Knob, and Beaverhead mountains of central Idaho and western Montana, the Pryor Mountains in south-central Montana, Blackpine Mountains of southern Idaho, the Bighorn Mountain sand central plateau of Yellowstone National Park and adjacent Grand Teton National Park in northern Wyoming.

Nations: CA?, US
States/Provinces: AB?, CA?, CO, ID, MT, OR, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **<** *Festuca idahoensis* Series (Johnston 1987) [includes thirteen *Festuca idahoensis*-dominated plant associations.]
- **<** *Festuca idahoensis* Series (Tisdale 1986)
- **><** Subalpine and Alpine Grasslands (Chappell et al. 1997)

LOWER LEVEL UNITS

Associations:
- CEGL001899 *Festuca idahoensis - Carex scirpoidea* Grassland
- CEGL001611 *Festuca idahoensis - Carex obtusata* Grassland
- CEGL001623 *Festuca idahoensis - (Festuca campestris) / Potentilla diversifolia* Grassland
- CEGL001615 *Festuca idahoensis - Eriogonum caespitosum* Grassland
- CEGL001897 *Festuca idahoensis* Grassland
- CEGL001901 *Festuca idahoensis - Leucopoa kingii* Grassland
- CEGL001612 *Festuca idahoensis - Danthonia intermedia* Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments: S.V. Cooper contributed to Classification Comments, and M.S. Reid wrote the group description.
Version Date: 2014/03/14

REFERENCES

References: Caicco 1983, Chappell et al. 1997, Cooper and Lesica 1992, Cooper et al. 1995, Cooper et al. 1997, Crawford et al. 1994, Daubenmire 1970, Daubenmire 1992, DeVelice and Lesica 1993, Evans et al. 1984, Faber-Langendoen et al. 2017b, Hansen 1985, Hansen and Hoffman 1988, Hurd 1961, Johnson 1970a, Johnson and Clausnitzer 1992, Johnson and Simon 1985, Johnston 1987, Klish 1977, Kuramoto and Bliss 1970, Lang 1961, Lewis 1971, MTNHP unpubl. data, Macdonald 1989, Magee 1985, Mattson 1984, McLean 1970, Moseley 1987a, Mueggler and Stewart 1980, Paulsen 1969, Poulton 1955, Reid et al. 1994, Sawyer and Keeler-Wolf 1995, Terwilliger et al. 1979a, Tisdale 1947, Tisdale 1986, Tisdale and Bramble-Brodahl 1983, Turner and Dortignac 1954, WNHP unpubl. data

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G267. Central Rocky Mountain Montane Grassland

A1323. Leucopoa kingii - Carex elynoides - Phlox pulvinata Central Rocky Mountain Subalpine-Alpine Grassland Alliance

Type Concept Sentence: This alliance is characterized by a sparse to moderately dense herbaceous layer dominated by diagnostic graminoid *Leucopoa kingii* with *Carex elynoides, Oxytropis campestris, Phlox pulvinata*, or *Poa fendleriana ssp. fendleriana* present to codominant. It occurs on windward exposures on broad, gentle alpine slopes and ridges of the Challis Volcanics and Beaverhead Mountains in east-central Idaho and similar high subalpine sites in northwestern Wyoming.

OVERVIEW

Scientific Name: *Leucopoa kingii - Carex elynoides - Phlox pulvinata* Central Rocky Mountain Subalpine-Alpine Grassland Alliance
Common Name (Translated Scientific Name): Spike Fescue - Blackroot Sedge - Cushion Phlox Central Rocky Mountain Subalpine-Alpine Grassland Alliance
Colloquial Name: Central Rocky Mountain Upper Subalpine-Alpine Spike Fescue Grassland

Type Concept: Vegetation of this grassland alliance is dominated by diagnostic graminoid species *Leucopoa kingii (= Festuca kingii)* with *Carex elynoides, Oxytropis campestris, Phlox pulvinata*, or *Poa fendleriana ssp. fendleriana* present to codominant. Other associated species include *Agoseris glauca, Cymopterus nivalis, Erigeron compositus, Lupinus argenteus, Minuartia obtusiloba, Oxytropis sericea, Poa secunda*, and *Potentilla ovina*. This alliance occurs on broad, gentle alpine slopes and ridges of the Challis Volcanics and Beaverhead Mountains in east-central Idaho and similar high subalpine sites in northwestern Wyoming. Stands occur on gentle to moderately steep, convex, southwest- to north-facing ridgetops. Sites are often on windward exposures at 2990-3170 m (9800-10,400 feet) elevation. Soils are shallow to moderately deep gravelly soils derived from limestone, siliceous volcanic rocks, and quartzite.

Classification Comments: This alliance needs review for possible inclusion in Rocky Mountain-Sierran Alpine Turf & Fell-Field Group (G314). Some of the associations in this alliance have similar species compositions and need to be crosswalked to identify redundant associations. Cooper et al. (1997) described Moseley's (1987a) community types as variants or phases of the *Hesperochloa kingii / Oxytropis campestris* community type in southwestern Montana. *Leucopoa kingii* stands may also occur in Utah (Ream 1964).

Internal Comments:
Other Comments:

Similar NVC Types: This alliance has similarities to other temperate grassland alliances that are dominated or codominated by *Festuca idahoensis* in several other groups, such as G141, G268, G269, G271, G273, and G331

- A3965 *Festuca idahoensis - Carex scirpoidea - Danthonia intermedia* Central Rocky Mountain Subalpine Dry Grassland Alliance: occurs on dry and often rocky, wind-desiccated sites on subalpine and lower alpine slopes in the Central Rocky Mountains.
- A3966 *Festuca idahoensis - Calamagrostis rubescens - Achnatherum nelsonii* Central Rocky Mountain Montane Mesic Grassland Alliance: occurs on relatively mesic sites.

Diagnostic Characteristics: This grassland alliance is dominated by diagnostic graminoid species *Leucopoa kingii* with *Carex elynoides, Oxytropis campestris, Phlox pulvinata*, or *Poa fendleriana ssp. fendleriana* present to codominant. Other associated species include *Agoseris glauca, Cymopterus nivalis, Erigeron compositus, Lupinus argenteus, Minuartia obtusiloba, Oxytropis sericea, Poa secunda*, and *Potentilla ovina*.

VEGETATION

Physiognomy and Structure: Vegetation in this alliance is characterized by a moderate to dense cover of graminoids that is dominated by perennial bunch grasses less than 0.5 m tall. There is also a sparse to moderate cover of perennial forbs (cushion plants) <0.5 m tall. Annual forbs and grasses are sparse, if present.

Floristics: Stands in this alliance are dominated by diagnostic graminoid species *Leucopoa kingii (= Festuca kingii)* with *Carex elynoides, Oxytropis campestris, Phlox pulvinata*, or *Poa fendleriana ssp. fendleriana* present to codominant. Other associated species include *Agoseris glauca, Cymopterus nivalis, Erigeron compositus, Lupinus argenteus, Minuartia obtusiloba, Oxytropis sericea, Poa secunda (= Poa scabrella), Potentilla ovina* and *Solidago multiradiata*. Scattered shrubs and dwarf-shrubs may be present in lower elevation stands, such as *Artemisia frigida, Artemisia tridentata*, and *Chrysothamnus viscidiflorus*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs on broad, gentle alpine slopes and ridges of the Challis Volcanics and Beaverhead Mountains in east-central Idaho and similar high subalpine sites in northwestern Wyoming. Stands occur on gentle to moderately steep, convex, southwest- to north-facing ridgetops. Sites are often on windward exposures at 2990-3170 m (9800-10,400 feet) elevation. Soils are shallow to moderately deep gravelly soils derived from limestone, siliceous volcanic rocks, and quartzite.

Dynamics: Alpine vegetation is controlled mostly by a moisture-exposure gradient with soil movement and geologic substrate also important (Moseley 1987a). Turf communities are associated with sites with relatively gentle terrain where the wind scours the winter snow. Where wind exposure increases, the soils are shallow, rocky, less developed and support cushion plant communities (Cooper et al. 1997). The presence of species such as *Phlox pulvinata* indicate a relatively stable substrate, as opposed to *Leucopoa kingii* stands on steep, unstable or eroding slopes, which tend to have lower vegetative cover, higher cover of bare ground, lack mat species such as *Phlox pulvinata*, and instead include disturbance indicators such as *Achillea millefolium, Penstemon attenuatus*, and *Poa secunda* (Moseley 1987a).

DISTRIBUTION

Geographic Range: This alliance occurs in the central Rocky Mountains on broad, gentle alpine ridges of the Challis Volcanics and Beaverhead Mountains in east-central Idaho and similar high subalpine sites in northwestern Wyoming.

Nations: US
States/Provinces: ID, MT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **>** *Hesperochloa kingii / Oxytropis campestris* community type (Cooper et al. 1997)

LOWER LEVEL UNITS

Associations:

- CEGL001913 *Leucopoa kingii - Phlox pulvinata* Grassland
- CEGL001910 *Leucopoa kingii* Grassland
- CEGL001912 *Leucopoa kingii - Oxytropis campestris* Grassland
- CEGL001914 *Leucopoa kingii - Poa fendleriana ssp. fendleriana* Grassland
- CEGL001911 *Leucopoa kingii - Carex elynoides* Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by M.S. Reid for group description.
Version Date: 2014/03/14

REFERENCES

References: Comer et al. 1999, Cooper and Lesica 1992, Cooper et al. 1997, Faber-Langendoen et al. 2017b, MTNHP unpubl. data, Moseley 1987a, Nesser et al. 1997, Ream 1964

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
2.B.2.Na.2.b. M048 Central Rocky Mountain Montane-Foothill Grassland & Shrubland

G272. Central Rocky Mountain Montane-Foothill Deciduous Shrubland

Type Concept Sentence: This is a dry central Rocky Mountain shrubland group where dominant shrubs are *Amelanchier alnifolia, Holodiscus discolor, Physocarpus malvaceus, Prunus emarginata, Prunus virginiana, Rhus glabra, Rosa nutkana, Rosa woodsii, Symphoricarpos albus*, and/or *Symphoricarpos oreophilus*, and understory grasses and forbs are common. Stands occur across the western U.S. and Canada within the matrix of surrounding low-elevation grasslands and sagebrush shrublands of low to mid elevations of the Rocky Mountains.

OVERVIEW

Scientific Name: *Amelanchier alnifolia* - *Symphoricarpos* spp. - *Rhus glabra* Central Rocky Mountain Shrubland Group
Common Name (Translated Scientific Name): Saskatoon Serviceberry - Snowberry species - Smooth Sumac Central Rocky Mountain Shrubland Group
Colloquial Name: Central Rocky Mountain Montane-Foothill Saskatoon Serviceberry Shrubland

Type Concept: This shrubland group is found in the lower montane and foothill regions around the Columbia Basin, and north and east into the Northern Rockies. The most common dominant shrubs are *Amelanchier alnifolia, Holodiscus discolor, Physocarpus malvaceus, Prunus emarginata, Prunus virginiana, Rhus glabra, Rosa nutkana, Rosa woodsii, Symphoricarpos albus*, and *Symphoricarpos oreophilus*, occurring alone or any combination. Stands in central and eastern Wyoming can include *Artemisia tridentata ssp. vaseyana* and *Cercocarpus montanus*, but neither of these species are dominant, and where they occur the stands are truly mixes of shrubs, often with *Amelanchier alnifolia, Prunus virginiana*, and others being the predominant taxa. *Aristida purpurea, Calamagrostis rubescens, Carex geyeri, Deschampsia cespitosa, Festuca campestris, Festuca idahoensis, Koeleria macrantha, Poa secunda*, and *Pseudoroegneria spicata* are the most important grasses. *Achnatherum thurberianum* and *Leymus cinereus* can be locally important. *Bromus tectorum* and *Phleum pratense* are common introduced grasses. *Balsamorhiza sagittata, Geum triflorum, Lomatium triternatum, Oenanthe sarmentosa, Potentilla gracilis, Xerophyllum tenax*, and species of *Eriogonum, Phlox*, and *Erigeron* are important forbs. These shrublands typically occur below treeline, within the matrix of surrounding low-elevation grasslands and sagebrush shrublands. They also occur in the ponderosa pine and Douglas-fir zones, but rarely up into the subalpine zone, where they are restricted to dry sites. The shrublands are usually found on steep slopes of canyons and in areas with some soil development, either loess deposits or volcanic clays; they occur on all aspects. Fire, flooding and erosion all impact these shrublands, but they typically will persist on sites for long periods. These communities also develop near talus slopes as garlands, at the heads of dry drainages, and toeslopes in the moist shrub-steppe and steppe zones.

Classification Comments: This group needs review from Northern Rockies ecologists. Its transition to Southern Rocky Mountain Mountain-mahogany - Mixed Foothill Shrubland Group (G276) will need to be further clarified, but there are definitely distinct floristics separating the two groups. In addition, the southern Rocky Mountain group tends to be drier than this group.

Similar NVC Types:
- G276 Southern Rocky Mountain Mountain-mahogany - Mixed Foothill Shrubland
- G277 Southern Rocky Mountain Gambel Oak - Mixed Montane Shrubland

Diagnostic Characteristics: Shrublands found in lower montane or foothill settings of the northern Rocky Mountains, typically in dry and warm settings.

VEGETATION

Physiognomy and Structure: These are variable shrublands composed of broad-leaved, cold-deciduous taxa, generally between 1 and 3 m in height. Shrub density will vary with substrate, fire and grazing history, and moisture, but these are rarely dense "thickets." They are typically found in small patches within the lower montane zone of Douglas-fir or ponderosa woodlands, or in a mosaic with sage shrub-steppe or valley grasslands. Grasses and forbs are the herbaceous component and can be abundant to sparse.

Floristics: The most common dominant shrubs are *Amelanchier alnifolia, Holodiscus discolor, Physocarpus malvaceus, Prunus emarginata, Prunus virginiana, Rhus glabra, Rosa nutkana, Rosa woodsii, Symphoricarpos albus*, and *Symphoricarpos oreophilus* occurring alone or any combination. Occurrences in central and eastern Wyoming can include *Artemisia tridentata ssp. vaseyana* and *Cercocarpus montanus*, but neither of these species are dominant, and where they occur the stands are truly mixes of shrubs, often with *Amelanchier alnifolia, Prunus virginiana*, and others being the predominant taxa. The open to moderately dense herbaceous layer is dominated by bunchgrasses, especially *Festuca idahoensis* and *Pseudoroegneria spicata*. *Aristida purpurea, Festuca campestris, Calamagrostis rubescens, Carex geyeri, Deschampsia cespitosa, Koeleria macrantha*, and *Poa secunda* are other important grasses. *Achnatherum thurberianum* and *Leymus cinereus* can be locally important. *Bromus tectorum* and *Phleum pratense* are common introduced grasses. Important forbs are *Balsamorhiza sagittata, Geum triflorum, Lomatium triternatum, Oenanthe sarmentosa, Potentilla gracilis, Xerophyllum tenax* and species of *Eriogonum, Phlox*, and *Erigeron*.

ENVIRONMENT & DYNAMICS

Environmental Description: This small-patch shrubland group is found in foothill and lower montane sites around the Columbia Basin and Northern Rockies and extends into the northwestern Great Plains at elevations of 500-2500 m depending on latitude. These shrublands typically occur below treeline, within the matrix of surrounding low-elevation grasslands and sagebrush shrublands. They also occur in the ponderosa pine and Douglas-fir zones, but rarely up into the subalpine zone, where they are restricted to dry sites. The shrublands are usually found on steep slopes of canyons and in areas with some soil development, either loess deposits or volcanic clays; they occur on all aspects. Fire, flooding and erosion all impact these shrublands, but they typically will persist on sites for long periods. These communities also develop near talus slopes as garlands, at the heads of dry drainages, and toeslopes in the moist shrub-steppe and steppe zones.

Dynamics:

DISTRIBUTION

Geographic Range: This group is found in the lower montane and foothill regions around the Columbia Basin, and north and east into the Northern Rockies, including east into central Montana around the "Sky Island" ranges. It also occurs farther south into central and eastern Wyoming, where it forms compositionally diverse shrublands. They also extend north into Alberta along the foothills of the Front Range.

Spatial Scale & Pattern [optional]: Large patch
Nations: CA, US
States/Provinces: AB, BC, CA?, CO, ID, MT, NV, OR, UT, WA, WY
TNC Ecoregions [optional]: 3:?, 4:?, 6:C, 7:C, 8:C, 9:C, 10:C, 11:C, 26:C, 68:C
USFS Ecoregions (2007): 331A:CC, 331D:CP, 331N:CC, 341G:PP, 342A:CP, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342H:CC, 342I:CC, 342J:CC, M242C:CC, M242D:CC, M261D:PP, M261G:P?, M331A:CC, M331B:CC, M331D:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M334A:CC, M341A:PP
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate. USNVC Confidence from peer reviewer, not AE.

SYNONYMY

- **><** Bittercherry (419) (Shiflet 1994)
- **><** Chokecherry - Serviceberry - Rose (421) (Shiflet 1994)
- **<** MS Montane Shrub/Grassland Dry Subdivision sites (Ecosystems Working Group 1998)

LOWER LEVEL UNITS

Alliances:

- A3963 *Amelanchier alnifolia* Central Rocky Mountain Montane-Foothill Shrubland Alliance
- A3964 *Rhus glabra - Rhus trilobata* Central Rocky Mountain Montane-Foothill Shrubland Alliance
- A3967 *Rosa nutkana* Central Rocky Mountain Shrubland Alliance
- A3975 *Physocarpus malvaceus - Symphoricarpos albus* Mesic Shrubland Alliance

AUTHORSHIP

Primary Concept Source: E.W. Tisdale (1986)
Author of Description: M.S. Reid and K.A. Schulz
Acknowledgments:
Version Date: 05/20/2015
Classif Resp Region: West
Internal Author: MSR 3-10, mod. KAS 5-15, mod. GK 12-15

REFERENCES

References: Ecosystems Working Group 1998, Faber-Langendoen et al. 2017a, Franklin and Dyrness 1973, Hall 1973, Johnson and Clausnitzer 1992, Johnson and Simon 1987, Knight 1994, Mueggler and Stewart 1980, Poulton 1955, Shiflet 1994, Tisdale 1986

2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G272. Central Rocky Mountain Montane-Foothill Deciduous Shrubland

A3963. Amelanchier alnifolia Central Rocky Mountain Montane-Foothill Shrubland Alliance

Type Concept Sentence: This shrubland alliance is characterized by the dominance of *Amelanchier alnifolia* and is found in the lower montane and foothill regions around the northern Great Basin, Columbia Basin and central Rocky Mountains.

OVERVIEW

Scientific Name: *Amelanchier alnifolia* Central Rocky Mountain Montane-Foothill Shrubland Alliance
Common Name (Translated Scientific Name): Saskatoon Serviceberry Central Rocky Mountain Montane-Foothill Shrubland Alliance
Colloquial Name: Central Rocky Mountain Montane-Foothill Saskatoon Serviceberry Shrubland

Type Concept: The shrubland vegetation is characterized by the dominance of *Amelanchier alnifolia*. Other shrubs may include *Acer glabrum, Artemisia tridentata, Holodiscus discolor, Prunus emarginata, Prunus virginiana, Purshia tridentata, Rosa* spp., *Rubus parviflorus, Spiraea betulifolia*, and *Symphoricarpos albus*. A moderate to dense herbaceous layer is present and may be diverse. Graminoids consist primarily of *Carex geyeri, Calamagrostis rubescens, Festuca idahoensis*, or *Pseudoroegneria spicata*. Common forb species include *Fragaria virginiana, Achillea millefolium*, and *Galium boreale*. *Xerophyllum tenax* may dominate some northern Rocky Mountains stands. Other grasses present include both native and exotic species, such as *Bromus carinatus, Poa pratensis*, and *Phleum pratense*. This small-patch shrubland alliance is found in foothill and lower montane sites around the Columbia Basin and Central Rockies and extends into the northwestern Great Plains at elevations of 1330-2500 m depending on latitude. In the drier Intermountain West, it occurs on all aspects in mesic ranges but is generally best developed on north-facing slopes in xeric areas. Soils are variable, from shallow and skeletal near rock outcroppings, to moderately deep with abundant organic matter. To the north it has been described from sites as disparate as the foothill's mosaic of grasslands, shrublands and forest openings, a gravelly alluvial fan at foothills/mountains transition, to an upper subalpine site that has experienced a hot burn in the last 50 years. Here this type is largely successional, having resulted from stand-replacing fire. Stands occur primarily on south- through west-facing, moderate to steep slopes, often on spur ridges or wind-buffeted slope shoulders. These sites probably had shallow soils before burning, and there are indications that soil loss occurred following the fires. There is also considerable exposed substrate and rock. Soils are moderately to well-drained sandy or clay loams or, occasionally, rapidly drained soils on glacio-fluvial or till deposits. Most of the ground surface is covered with litter and duff.

Classification Comments: Further clarification of the concept and characteristics of this alliance are needed. The placement of *Amelanchier alnifolia / Symphoricarpos oreophilus* Shrubland (CEGL002569) in this alliance needs further review as it is known only from Dinosaur National Monument in northwestern Colorado, which is peripheral to the central Rocky Mountains. Finally, *Amelanchier alnifolia / Xerophyllum tenax* Grassland (CEGL001066) is included in this alliance, but is very poorly documented. Del Moral (1973) is the only reference source presently known for this association, which needs further review. Stands included in *Amelanchier alnifolia* Shrubland (CEGL002183) are in placed *Prunus virginiana - Symphoricarpos occidentalis - Amelanchier alnifolia* Great Plains Shrubland Alliance (A4036) in Northern Great Plains Mesic Mixedgrass Prairie Group (G141), which primarily occurs in North Dakota and Saskatchewan and extends into Wyoming. Some stands of this alliance may be similar to stands in this alliance, especially in transition areas in Montana and Alberta where *Amelanchier alnifolia / Pseudoroegneria spicata* - Bunchgrass Shrubland (CEGL001065) extends into the northwestern Great Plains.

Internal Comments: KAS 2-14: Johnston (1987) needs to be reviewed to evaluate *Amelanchier* spp.-dominated plant associations classified and referenced from northern Colorado and Wyoming for his *Amelanchier* spp. Series.
Other Comments:

Similar NVC Types: *Amelanchier alnifolia* Shrubland (CEGL002183) in *Prunus virginiana - Symphoricarpos occidentalis - Amelanchier alnifolia* Great Plains Shrubland Alliance (A4036), in Northern Great Plains Mesic Mixedgrass Prairie Group (G141) is similar but primarily occurs in North Dakota and Saskatchewan and extends into Wyoming.

- A4036 *Prunus virginiana - Symphoricarpos occidentalis - Amelanchier alnifolia* Great Plains Shrubland Alliance: also may have stands dominated or codominated by *Amelanchier alnifolia*.

Diagnostic Characteristics: The vegetation is characterized by the dominance of diagnostic shrub species *Amelanchier alnifolia*. Other shrubs may include *Acer glabrum, Artemisia tridentata, Holodiscus discolor, Prunus emarginata, Prunus virginiana, Purshia tridentata, Rosa* spp., *Rubus parviflorus, Spiraea betulifolia*, and *Symphoricarpos albus*. High-constancy graminoid associates consist primarily of *Carex geyeri, Calamagrostis rubescens, Festuca idahoensis*, or *Pseudoroegneria spicata*. *Xerophyllum tenax* may dominate this layer in some northern Rocky Mountains stands. Other common grasses present include both native *Bromus carinatus* and introduced *Poa pratensis* and *Phleum pratense*.

VEGETATION

Physiognomy and Structure: These communities are characterized by a moderate to dense canopy of cold-deciduous shrubs up to 4 m in height. There is often another stratum (sometimes two) of low cold-deciduous shrubs from 0.5-2 m tall. The herbaceous layer is usually a species-rich assemblage of cespitose graminoids and erect forbs.

Floristics: This alliance is distinguished by dominance of *Amelanchier alnifolia* in the upper shrub layer. It is best described from the Rocky Mountain and ranges in the northern Great Basin, where it forms a prominent component of montane shrublands. Such stands typically contain a tall-shrub layer of *Amelanchier alnifolia*, often with other shrubs of various sizes that sometimes form a short-shrub layer. These shrubs differ somewhat by region and include *Acer glabrum, Arctostaphylos uva-ursi, Artemisia tridentata, Chrysothamnus viscidiflorus, Dasiphora fruticosa ssp. floribunda, Holodiscus discolor, Purshia tridentata, Rhus trilobata, Ribes aureum, Rosa woodsii, Rubus parviflorus, Spiraea betulifolia, Symphoricarpos albus*, and *Symphoricarpos oreophilus*. The dwarf-shrubs *Juniperus communis, Mahonia repens*, and *Paxistima myrsinites* may also occur in the more protected sites. The open to dense herbaceous layer is composed of primarily perennial graminoids especially bunchgrasses and also differs slightly by region. In the Rocky Mountains *Bromus carinatus, Carex geyeri*, and *Festuca campestris* are more important to the north and *Achnatherum nelsonii ssp. dorei (= Stipa columbiana), Carex rossii, Leucopoa kingii (= Festuca kingii)*, and *Pseudoroegneria spicata* more important to the south. In drier southern portions *Achnatherum lettermanii, Elymus glaucus, Elymus trachycaulus, Hesperostipa comata*, and/or *Poa fendleriana* occur. *Festuca idahoensis* is constant throughout much of the western range. Other associated graminoid species include *Calamagrostis rubescens, Elymus elymoides, Poa secunda (= Poa sandbergii)*, and *Pseudoroegneria spicata*, as well as exotic species *Poa pratensis* and *Phleum pratense*. There are no diagnostic forbs, but a number with high constancy that also occur in mesic grasslands/open forests include *Achillea millefolium, Balsamorhiza sagittata, Campanula rotundifolia, Eriogonum flavum, Eriogonum umbellatum, Eurybia conspicua (= Aster conspicuus), Fragaria virginiana, Galium boreale, Geranium viscosissimum, Lithospermum ruderale, Lomatium dissectum, Potentilla gracilis, Potentilla glandulosa*, and *Penstemon confertus*. *Xerophyllum tenax* may dominate this layer in some northern Rocky Mountains stands. Nonvascular species cover is insignificant. In some cases, individuals or small clumps of the trees *Populus tremuloides* and *Juniperus scopulorum* may occur but do not contribute enough cover to constitute a stratum. In the higher elevation stands, occasional *Betula papyrifera, Picea engelmannii, Pinus ponderosa*, or *Pseudotsuga menziesii* are present within a young tree canopy, but these have insignificant cover.

ENVIRONMENT & DYNAMICS

Environmental Description: This shrubland alliance is found in foothill and lower montane sites around the Columbia Basin and Central Rockies, and extends northeast into the northwestern Great Plains. Climate is cold temperate. Precipitation ranges from 30-50 cm annually with a large proportion falling as winter snow. This small-patch alliance occurs at middle elevations (1800-2500 m) of mountains in the Intermountain West where it occurs on all aspects in mesic ranges but is generally best developed on north-facing slopes in xeric areas. Soils are variable, from shallow and skeletal near rock outcroppings, to moderately deep with abundant organic matter. It has been documented from Montana and extends northward along the Rocky Mountain Front and foothills well into Alberta, at elevations down to 1330 m. To the north it has been described from sites as disparate as the foothill's mosaic of grasslands, shrublands and forest openings, a gravelly alluvial fan at foothills/mountains transition, to an upper subalpine site that has experienced a hot burn in the last 50 years. In Glacier National Park and Waterton Lakes National Park, this type is largely successional, having resulted from stand-replacing fire. Stands occur primarily on south- through west-facing, moderate to steep slopes, often on spur ridges or wind-buffeted slope shoulders. These sites probably had shallow soils before burning, and there are indications (e.g., pedicelling) that soil loss occurred following the fires and continues to this day. There is considerable exposed substrate and rock, not infrequently exceeding 20% on northern examples of this alliance. Soils tend to be moderately to well-drained sandy or clay loams or, occasionally, a rapidly drained Orthic Regosol. Sites are usually situated on glacio-fluvial or till deposits. Most of the ground surface is covered with litter and duff.

Dynamics: In the southern portion of the type's range and in certain locations in the foothills and lower elevation sites along the Rocky Mountain Front, this is conceived to be a long-term stable (climax) vegetation type. Northward in its range this type becomes

more associated with disturbance phenomena, particularly stand-replacing fire and erosion (subsequent) and is distinctly a seral type. However, reforestation may require well in excess of 100 years if soil loss has accompanied the disturbance. Stumps and burned downed logs are common on some sites within the northern range. Also ubiquitous in the northern range is the severe browsing on *Amelanchier*; on some sites this species is no higher than 0.4-0.5 m, though its potential is several times this height.

Amelanchier utahensis hybridizes with *Amelanchier alnifolia* and distinctions between the two species may be come blurred in areas where their ranges overlap. *Amelanchier* spp. are palatable to both livestock and native ungulates and compose a valuable element of the winter range in the Great Basin and Rocky Mountains.

DISTRIBUTION

Geographic Range: This small-patch shrubland alliance is found in the prairie breaks, foothill and lower montane sites in the northern Great Basin, Columbia Basin and Central Rockies extending from northwestern Colorado across Wyoming, along the Rocky Mountains of Montana and Alberta and extends out into the northwestern Great Plains.

Nations: CA, US
States/Provinces: AB, CA?, CO, MT, NV, UT, WA?, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **>** *Amelanchier* spp. Series (Johnston 1987) [USFS Region 2 is mostly outside the central Rocky Mountains and includes two plant associations not described in this alliance.]

LOWER LEVEL UNITS

Associations:
- CEGL001065 *Amelanchier alnifolia / Pseudoroegneria spicata* - Bunchgrass Shrubland
- CEGL001064 *Amelanchier alnifolia / Artemisia tridentata / Festuca idahoensis* Shrubland
- CEGL002569 *Amelanchier alnifolia / Symphoricarpos oreophilus* Shrubland
- CEGL005885 *Amelanchier alnifolia* / (Mixed Grass, Forb) Shrubland
- CEGL001066 *Amelanchier alnifolia / Xerophyllum tenax* Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by M.S. Reid and D. Sarr
Version Date: 2014/03/14

REFERENCES

References: Blackburn et al. 1968a, Bunin 1975c, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Harvey 1980, Johnston 1987, Komarkova 1986, Mozingo 1987, Terwilliger and Smith 1978, Terwilliger and Tiedemann 1978, del Moral 1973

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G272. Central Rocky Mountain Montane-Foothill Deciduous Shrubland

A3975. Physocarpus malvaceus - Symphoricarpos albus Mesic Shrubland Alliance

Type Concept Sentence: This mesic shrubland alliance is dominated by diagnostic species *Physocarpus malvaceus, Rosa acicularis, Rosa nutkana, Rosa woodsii*, and/or *Symphoricarpos albus*. It is known from canyons of the northern Wallowa Mountains, Imnaha River, and Snake River within the Columbia Plateau, the foothills and plains of the central Rocky Mountains and ranges in the Great Basin and eastern California.

OVERVIEW

Scientific Name: *Physocarpus malvaceus - Symphoricarpos albus* Mesic Shrubland Alliance
Common Name (Translated Scientific Name): Mallow Ninebark - Common Snowberry Mesic Shrubland Alliance
Colloquial Name: Mallow Ninebark - Common Snowberry Mesic Shrubland

Type Concept: The vegetation of this mesic shrubland alliance is characterized by a moderately dense to dense, sometimes patchy shrub layer (usually less than 2 m tall) that is dominated by diagnostic species *Physocarpus malvaceus, Rosa acicularis, Rosa*

nutkana, Rosa woodsii, and/or *Symphoricarpos albus*. Other low-cover associated shrubs may include scattered *Amelanchier alnifolia, Crataegus douglasii, Mahonia repens, Prunus virginiana, Salix scouleriana*, and *Spiraea betulifolia*. *Toxicodendron rydbergii* may be present with moderate cover. The herbaceous layer is typically relatively sparse to moderate (typically 10-25% cover), but may be dense depending on shrub cover, and is composed of a mixture of perennial bunchgrasses such as *Pseudoroegneria spicata* and *Festuca idahoensis* and perennial forbs. Moss and lichen cover is often important and ranges from 10-90% cover. Introduced herbaceous species are sometime abundant, including the forage grass *Poa pratensis*, the weedy forb *Cirsium arvense*, and the annual grass *Bromus briziformis*. This mesic shrubland alliance is known from canyons of the northern Wallowa Mountains, Imnaha River, and Snake River within northeastern Oregon, southeastern Washington, and west-central Idaho, the mountains, foothills and plains of Montana, Idaho, Nevada, and eastern California. It is found on upper slope positions of steep, northeast- to northwest-facing canyon slopes, on flat to gentle benches, valley floors, alluvial terraces, ridges, and slopes and occurs in floodplains and on alluvial terraces along rivers and streams, on hillsides below springs, and in ravines and swales where overland flow from snowmelt and summer thunderstorms provides additional moisture. Soils are moderately deep with textures ranging from sandy and silt loams to silts to clays.

Classification Comments: Stands of *Festuca idahoensis - Symphoricarpos albus* Grassland (CEGL001509) may be similar but have sparse shrub layers and are not included in this alliance. Hall (1973) described similar vegetation from the Blue Mountains of Oregon that needs further investigation if it is to be included in this alliance. Stands classified as *Physocarpus malvaceus - Symphoricarpos albus* by Johnson and Simon (1987) were considered to have marginal potential for tree establishment. Other *Physocarpus malvaceus*-dominated communities are known to occur but are poorly documented within the Pacific Northwest region.

Internal Comments:
Other Comments:

Similar NVC Types: Stands dominated or codominated by *Rosa nutkana* are placed in two other alliances in two other groups: *Rosa nutkana - Festuca idahoensis* Grassland (CEGL001626) is place in *Festuca idahoensis - Pseudoroegneria spicata - Poa secunda* Dry Grassland Alliance (A3987) in Central Rocky Mountain Lower Montane, Foothill & Valley Grassland Group (G273). *Rosa nutkana / Deschampsia cespitosa* Shrubland (CEGL003344) and *Rosa nutkana / Oenanthe sarmentosa* Shrubland (CEGL003457) both are placed in *Rosa nutkana* Central Rocky Mountain Shrubland Alliance (A3967) in Central Rocky Mountain-North Pacific High Montane Mesic Shrubland Group (G305).

- A3967 *Rosa nutkana* Central Rocky Mountain Shrubland Alliance: occurs in Oregon in moist areas and is dominated by *Rosa nutkana*.

Diagnostic Characteristics: The vegetation is dominated by diagnostic species *Physocarpus malvaceus, Rosa acicularis, Rosa nutkana, Rosa woodsii*, and/or *Symphoricarpos albus*. Other associated shrubs may include *Artemisia tridentata, Ribes aureum, Symphoricarpos occidentalis*, and *Toxicodendron rydbergii*.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a moderate to dense, cold-deciduous, broad-leaved short-shrub layer (<2 m tall) with a moderately dense to dense herbaceous layer (<1 m tall) that is typically dominated by perennial graminoids, but may be codominated by perennial forbs. Sparse cover of annual forbs and grasses may be seasonally present.

Floristics: This central Rocky Mountains and Columbia Plateau shrubland alliance is characterized by a moderately dense to dense, sometimes patchy shrub layer (usually less than 2 m tall) that is dominated by cold-deciduous broad-leaved shrubs. Dominant and diagnostic species are *Physocarpus malvaceus, Rosa acicularis, Rosa nutkana, Rosa woodsii*, and/or *Symphoricarpos albus*. Other low-cover associated shrubs may include scattered *Amelanchier alnifolia, Crataegus douglasii, Mahonia repens, Prunus virginiana, Salix scouleriana*, and *Spiraea betulifolia*. *Toxicodendron rydbergii* may be present with moderate cover in some stands. The herbaceous layer is typically relatively sparse to moderate (typically 10-25% cover), but may be dense depending on shrub cover. It is composed of a mixture of perennial bunchgrasses such as *Pseudoroegneria spicata* and *Festuca idahoensis* and perennial forbs. Associated forbs include *Achillea millefolium, Agastache urticifolia, Ambrosia psilostachya, Artemisia ludoviciana, Balsamorhiza sagittata, Cirsium brevifolium, Fragaria virginiana, Frasera albicaulis, Geum macrophyllum, Geum triflorum, Hieracium scouleri var. albertinum (= Hieracium albertinum), Lomatium dissectum, Perideridia gairdneri, Plectritis macrocera*, and *Solidago canadensis*. Other perennial graminoids may be present such as *Carex* spp., *Elymus glaucus, Juncus balticus*, and *Muhlenbergia racemosa*. The annual forb *Galium aparine* may be present to abundant. Moss and lichen cover is often important and ranges from 10-90% cover. Introduced herbaceous species are sometime abundant. Stands described by Hansen et al. (1995) had a moderately dense to dense herbaceous layer dominated by the exotic forage grass *Poa pratensis* and the weedy forb *Cirsium arvense*. The exotic species *Bromus briziformis* is often present and may be relatively abundant.

ENVIRONMENT & DYNAMICS

Environmental Description: This mesic shrubland alliance is known from canyonlands of the northern Wallowa Mountains, Imnaha River, and Snake River within northeastern Oregon, southeastern Washington, and west-central Idaho, the mountains, foothills and plains of Montana, Idaho, Nevada, and eastern California. Stands in the Snake and Salmon river canyons in Idaho and eastern Oregon and eastern Washington occur at elevations from 670-1370 m, and on north slopes in the central Rocky Mountains in Montana are at elevations of 500-1770 m. The climate is temperate continental with mean annual precipitation of approximately 25-30 cm. Precipitation primarily occurs in the winter as snow or rain. This moisture is stored in the soil and utilized during the typically dry summers. Stands are typically found on moderately steep to steep upper and middle canyon slopes. Sites need to be relatively mesic to support these shrubs in the bunchgrass zone, and at lower elevations they are often restricted to north aspects and ravines, swales and depressions where deep snow drifts form and snowmelt and summer thunderstorms provide additional moisture. Stands also occur in floodplains and on alluvial terraces along rivers and streams, on hillsides below springs where soil moisture concentrates, and near the footslopes of rocky slopes where water may seep. These sites are flat to moderately steep and aspect does not appear important because stands have supplemental moisture. Although these sites are temporarily flooded, they are well-drained and do not have a shallow water table. Soils are moderately deep with textures ranging from sandy and silt loams to silts to clays (Hansen et al. 1995). Rock fragments are less than 15% of the soil volume. Parent materials include loess, basalt colluvium, lava, tuff, ash and other volcanic rock. Adjacent stands include grasslands dominated by *Pseudoroegneria spicata* or *Festuca idahoensis* on hotter/drier aspects, and *Pseudotsuga menziesii / Physocarpus malvaceus* forests and woodlands on mid or lower slopes where soil moisture is concentrated from slope seepage. Along rivers and streams, adjacent vegetation includes *Salix exigua* or *Salix amygdaloides* riparian shrublands, and riparian woodlands dominated by *Fraxinus pennsylvanica* or *Acer negundo*.

Dynamics: Dominant shrub species *Physocarpus malvaceus, Rosa* spp., and *Symphoricarpos albus* are adapted to low- to moderate-intensity fires by responding with basal sprouting or sprouting from rhizomes located in mineral soil; however, high-intensity fires will kill these species (FEIS 1998, Johnson and Simon 1987). Stands are restricted to relatively mesic northern slopes in river canyons and mountains. Periodic fires may be important in maintaining these stands where *Pseudotsuga menziesii* trees may invade. Exotic plants have invaded many of these stands. Exotic annual grasses, such as *Bromus briziformis, Bromus arvensis*, and *Bromus tectorum*, are often present and may be relatively abundant. Many of these stands have been invaded by the perennial species *Poa pratensis*. Cover of *Poa pratensis* has also increased because of its tolerance to both grazing and shading from the shrubs (Johnson and Simon 1987). Other exotics often include forage species such as *Bromus inermis, Phleum pratense*, and *Dactylis glomerata* (Hansen et al. 1995) and highly invasive forbs such as *Cirsium arvense*.

DISTRIBUTION

Geographic Range: This central Rocky Mountain and Columbia Plateau shrubland alliance is known from canyonlands of the northern Wallowa Mountains, Imnaha River, and Snake River plain of northeastern Oregon, southeastern Washington, and southern Idaho, the mountains, foothills and plains of Montana, Idaho, Nevada, and eastern California.

Nations: CA?, US
States/Provinces: CA, ID, MT, NV, OR, SK?, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** *Symphoricarpos albus* Series (Tisdale 1986)

LOWER LEVEL UNITS

Associations:
- CEGL001130 *Symphoricarpos albus - Rosa nutkana* Shrubland
- CEGL001171 *Physocarpus malvaceus - Symphoricarpos albus* Shrubland
- CEGL005606 *Prunus virginiana / Leymus cinereus* Shrubland
- CEGL005890 *Symphoricarpos albus* Shrubland
- CEGL005602 *Philadelphus lewisii / Penstemon deustus* Open Shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Daubenmire 1970, FEIS 1998, Faber-Langendoen et al. 2017b, Hall 1973, Hansen et al. 1990, Hansen et al. 1991, Hansen et al. 1995, Johnson and Simon 1987, Johnston 1987, Manning and Padgett 1995, Sawyer et al. 2009, Tisdale 1986

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G272. Central Rocky Mountain Montane-Foothill Deciduous Shrubland

A3964. Rhus glabra - Rhus trilobata Central Rocky Mountain Montane-Foothill Shrubland Alliance

Type Concept Sentence: This shrubland alliance is characterized by a sparse to moderately dense shrub layer dominated by *Rhus glabra* or *Rhus trilobata* with a sparse to moderately dense herbaceous layer composed of grasses such as *Aristida purpurea, Festuca idahoensis*, and *Pseudoroegneria spicata*. It is found in the lower montane and foothill regions around the Columbia Basin, including river canyons, and extends north and east into the Central Rockies and to the foothills and breaks in the western Great Plains.

OVERVIEW

Scientific Name: *Rhus glabra - Rhus trilobata* Central Rocky Mountain Montane-Foothill Shrubland Alliance
Common Name (Translated Scientific Name): Smooth Sumac - Skunkbush Sumac Central Rocky Mountain Montane-Foothill Shrubland Alliance
Colloquial Name: Central Rocky Mountain Montane-Foothill Sumac Shrubland

Type Concept: The vegetation is characterized by a sparse to moderately dense shrub layer dominated by *Rhus glabra* or *Rhus trilobata*. The sparse to moderately dense herbaceous layer is composed of *Aristida purpurea var. longiseta, Festuca idahoensis, Pseudoroegneria spicata*, and other graminoids or forbs. This shrubland alliance is found in the lower montane and foothill regions around the Columbia Basin, including river canyons, and extends north and east into the Central Rockies and to the foothills and breaks in the western Great Plains. Stands occur on a variety of sites, including steep lower slopes in canyons and valley bottoms where gravel and boulder colluvium accumulates, near talus slopes as garlands, at the heads of dry drainages, and toeslopes in the moist shrub-steppe zones. Stands also occur in patches or strips along the shoulder slopes of river breaks. Soils are often shallow and rocky.

Classification Comments: It is often difficult to determine the borders of stands within this alliance because one of the primary distinguishing features of this alliance, the presence of a 10-25% canopy of *Rhus trilobata*, is not continuous over the entire stand (Johnson and Simon 1987). When grassland communities adjoin stands of this alliance, they usually contain many of the same species. The presence and approximate limits of stands within this alliance is judged from physiognomic and sometimes floristic differences between adjacent stands. In the dry environments in which stands of this alliance are found, certain species not commonly found in the open grow in the shade of shrubs (Hansen and Hoffman 1988).

In his *Rhus aromatica ssp. trilobata* Series, Johnston (1987) described two other plant associations with *Sporobolus cryptandrus*- and *Muhlenbergia montana*-dominated herbaceous layers that need to be reviewed for possible inclusion into this alliance. Grasslands with clumps of *Rhus trilobata* are common in the foothills of the Colorado Front Range and also need association-level classification and review for possible inclusion in this alliance.

Internal Comments: KAS 2-14: Stands included from the plains and Southern Rockies are included in this alliance and may need further review to determine if this is appropriate.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: The vegetation is characterized by the dominance of diagnostic species *Rhus glabra* or *Rhus trilobata*. High-constancy associated graminoid species consist primarily of *Aristida purpurea var. longiseta, Festuca idahoensis*, or *Pseudoroegneria spicata*.

VEGETATION

Physiognomy and Structure: Vegetation in this alliance has a sparse to dense, sometimes patchily distributed layer of cold-deciduous shrubs (10-85% cover) that are less than 2 m tall with the sparse to moderately dense herbaceous layer dominated by perennial graminoids, mostly bunch grasses. There is also a sparse cover of perennial forbs. Annual forbs and grasses are seasonally present.

Floristics: This shrubland alliance is characterized by a short (1 m tall), relatively sparse to moderately dense (10-60% cover), broad-leaved deciduous shrub layer that is dominated by *Rhus glabra* or *Rhus trilobata* (Mueggler and Stewart 1980, Hansen and Hoffman 1988). However, the shrub layer may range up to 85% cover and exceed 3 m in protected sites (Johnson and Simon 1987). Small amounts of other shrubs, such as *Artemisia tridentata, Chrysothamnus* spp., *Prunus virginiana, Ribes cereum, Symphoricarpos*

occidentalis, and dwarf-shrubs *Artemisia frigida, Gutierrezia sarothrae, Rosa* spp., or *Yucca glauca*, may also be present. The herbaceous cover ranges from sparse to moderately dense (5-60% cover) and is often dominated by *Aristida purpurea var. longiseta, Festuca idahoensis*, or *Pseudoroegneria spicata* (Brown 1971, Mueggler and Stewart 1980, Thilenius et al. 1995). Other characteristic species include graminoids such as *Bouteloua curtipendula, Bouteloua gracilis, Calamovilfa longifolia, Carex filifolia, Carex inops ssp. heliophila, Dalea purpurea, Hesperostipa comata, Koeleria macrantha, Muhlenbergia cuspidata, Pascopyrum smithii, Poa secunda, Schizachyrium scoparium*, and *Sporobolus cryptandrus*, and forbs such as *Achillea millefolium, Artemisia dracunculus, Astragalus inflexus, Echinacea angustifolia, Erigeron pumilus, Eriogonum* spp., *Gaura coccinea, Heterotheca villosa, Liatris punctata, Lomatium macrocarpum, Opuntia polyacantha, Phacelia heterophylla, Phlox hoodii, Phlox colubrina, Scutellaria angustifolia, Sphaeralcea coccinea*, and *Symphyotrichum ericoides* (Brown 1971, Mueggler and Stewart 1980, Thilenius et al. 1995). Mosses and lichens are present and average about 5% cover. Exotic species, namely *Bromus tectorum, Bromus arvensis (= Bromus japonicus)*, and *Bromus briziformis*, are often present and may dominate the herbaceous layer of some disturbed stands. Cover of nonvascular plants such as *Selaginella densa* may be common on grazed stands (DeVelice et al. 1995).

ENVIRONMENT & DYNAMICS

Environmental Description: This shrubland alliance is found in the lower montane and foothill regions around the Columbia Basin, including river canyons, and extends north and east into the Central Rockies and to the foothills and breaks in the western Great Plains. Valley bottom and canyon sites range from less than 200 m to slightly over 610 m elevation, while sites in the surrounding plateaus and mountains may be over 2700 m. Plains sites range from 1000-1400 m elevation. The climate is temperate, relatively xeric and continental. The east slope and plains sites have a mean annual precipitation of 33-50 cm with most of the precipitation (75%) occurring during the growing season from April to September. Columbia Basin sites have a mean annual precipitation of approximately 25-30 cm that primarily occurs in the winter as snow or rain. This moisture is stored in the fractures in the highly weathered bedrock and utilized during the typically dry summers. Stands are typically found on steep footslopes and toeslopes in canyons, valley bottoms where gravel and boulder colluvium accumulates, near talus slopes as garlands, at the heads of dry drainages, and toeslopes in the moist shrub-steppe zones. Stands also occur in patches or strips along the shoulder slopes of river breaks (but may extend to the footslopes), and on gently rolling to steep, rocky hillsides (Mueggler and Stewart 1980, Hansen and Hoffman 1988, MTNHP 1988). Sites are predominately on hot, dry southern to western aspects, although it may occur on all aspects.

Soils are typically shallow to moderately deep, well-drained, neutral to slightly alkaline (pH 7-7.9) loams or sandy loams that often have a high percentage of rock fragments (greater than 35% by volume and 50% ground cover). However, some valley bottom sites have deep, nearly stone-free, sandy alluvial soils (Hansen and Hoffman 1988, Thilenius et al. 1995). In the Columbia Basin parent materials are colluvium and alluvium derived from basalt, metabasalt, or granitic colluvium and loess. The more common gravelly substrates are less stable than boulder-sized ones. Some stands are reported from colluvial talus cones. Northwestern plains substrates include calcareous sandstones, shales, porcelanite and occasionally extrusive volcanic rock (Brown 1971, DeVelice et al. 1995). A biological crust may be present on better sites with less disturbance, while litter may cover as much as 65% of the ground surface. Most stands of this association have been severely disturbed by livestock grazing and have been converted to a zootic climax, dominated by herbaceous annuals, such as *Bromus tectorum, Bromus arvensis*, and *Erodium cicutarium*.

Dynamics: The dominant shrubs *Rhus glabra* and *Rhus trilobata* are adapted to tolerate fires. It is rarely killed when burned and sprouts vigorously from underground rhizomes following a fire (FEIS 1998, Mueggler and Stewart 1980). Vegetative reproduction is the primary mode of re-establishment after fire; however, *Rhus glabra* and *Rhus trilobata* may also reproduce through seed. Fire has variable effects on *Pseudoroegneria spicata* bunch grasses. Plants usually survive burning and growth is often stimulated, except when fire occurs in the driest month when the crowns will burn because of low moisture in the vegetation and the meristems are damaged (Johnson and Simon 1987). In fact, post-fire sprouts and seedlings may not compete well with grassland vegetation, and frequent fire is thought to exclude *Rhus glabra* from grasslands (Johnson and Simon 1987). Stands occur on rocky slopes that are likely to have few fires (Johnson and Simon 1987).

Livestock grazing does not impact stands on the steeper slopes, but where stands are more accessible, heavy summer use will reduce the abundance of the more palatable species such as *Pseudoroegneria spicata, Festuca idahoensis* and *Hesperostipa comata*. Less palatable species such as *Artemisia frigida, Heterotheca villosa*, and *Achillea millefolium* will increase. *Rhus trilobata* may also be favored by continued overgrazing (Mueggler and Stewart 1980).

The biggest threat is exotic plants that have invaded many stands. Common exotics include annual grasses such as *Bromus tectorum, Bromus arvensis*, and *Bromus briziformis*, and the perennial forbs *Hypericum perforatum* and *Conyza canadensis*. *Bromus tectorum* often occurs in these stands and contributes significant cover on sites disturbed by livestock or small mammals (Mueggler and Stewart 1980).

DISTRIBUTION

Geographic Range: This shrubland alliance is found in the lower montane and foothill regions around the Columbia Basin, including the Salmon, Snake and Imnaha river canyons, and extends north and east into the Central Rockies and to the foothills and breaks in the western and northwestern Great Plains steppe of Montana and Wyoming.

Nations: US

States/Provinces: ID, MT, OR, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** *Rhus aromatica ssp. trilobata* Series (Johnston 1987) [USFS Region 2 is mostly outside the central Rocky Mountains and includes two habitat types not described in this alliance: a subalpine type in Colorado and a sandy plains type in Oklahoma,]
- **>** *Rhus glabra* Series (Tisdale 1986)
- **>** *Rhus trilobata* Series (Mueggler and Stewart 1980)

LOWER LEVEL UNITS

Associations:

- CEGL001120 *Rhus trilobata / Pseudoroegneria spicata* Shrub Grassland
- CEGL001505 *Rhus trilobata / Festuca idahoensis* Shrub Grassland
- CEGL001122 *Rhus glabra / Pseudoroegneria spicata* Shrub Grassland
- CEGL001507 *Rhus glabra / Aristida purpurea var. longiseta* Shrub Grassland

AUTHORSHIP

Primary Concept Source: K.A Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Brown 1971, Culwell and Scow 1982, Daubenmire 1970, DeVelice et al. 1995, FEIS 1998, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Hansen 1985, Hansen and Hoffman 1986, Hansen and Hoffman 1988, Hansen et al. 1984, Johnson and Simon 1987, Johnston 1987, MTNHP 1988, Mueggler and Stewart 1980, Thilenius et al. 1995, Tisdale 1986, Tweit and Houston 1980

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G272. Central Rocky Mountain Montane-Foothill Deciduous Shrubland

A3967. Rosa nutkana Central Rocky Mountain Shrubland Alliance

Type Concept Sentence: Shrublands in this alliance are dominated by *Rosa nutkana* with an herbaceous layer dominated by *Deschampsia cespitosa* or *Oenanthe sarmentosa*. It is found in the mountains of Oregon at montane elevations.

OVERVIEW

Scientific Name: *Rosa nutkana* Central Rocky Mountain Shrubland Alliance
Common Name (Translated Scientific Name): Nootka Rose Central Rocky Mountain Shrubland Alliance
Colloquial Name: Central Rocky Mountain Nootka Rose Shrubland

Type Concept: The vegetation of this Pacific Northwest shrubland alliance is characterized by a *Rosa nutkana*-dominated shrub layer. Common associates are *Cornus sericea* and *Symphoricarpos albus* which may occur with low cover. The moderate to dense herbaceous layer is dominated by mesic perennial graminoids and forbs, including *Deschampsia cespitosa* or *Oenanthe sarmentosa*. Scattered trees may be present with low cover. This small-patch shrubland alliance is found in the mountains of Oregon at montane elevations. It typically occurs in moist sites such as in floodplains, along open streambanks, and in mesic meadows.

Classification Comments: Kept as a single-dominant alliance as it is composed of two S1 and S2 associations in Oregon.

Internal Comments: KAS 2-14: We need to contact ORNHP and get information on these G1 and G2 *Rosa nutkana* shrubland plant associations.
Other Comments:

Similar NVC Types: Stands dominated or codominated by *Rosa nutkana* are placed in two other alliances in two other groups in the NVC. *Rosa nutkana - Festuca idahoensis* Grassland (CEGL001626) is placed in *Festuca idahoensis - Pseudoroegneria spicata - Pascopyrum smithii* Mesic Grassland Alliance (A3988) in Central Rocky Mountain Lower Montane, Foothill & Valley Grassland Group

(G273). *Symphoricarpos albus - Rosa nutkana* Shrubland (CEGL001130) is placed in *Physocarpus malvaceus - Symphoricarpos albus* Mesic Shrubland Alliance (A3975) in Central Rocky Mountain Montane-Foothill Deciduous Shrubland Group (G272).

- A3975 *Physocarpus malvaceus - Symphoricarpos albus* Mesic Shrubland Alliance

Diagnostic Characteristics: This alliance is characterized by a dominance of diagnostic species *Rosa nutkana* in the shrub layer with an herbaceous layer dominated by *Deschampsia cespitosa* or *Oenanthe sarmentosa*.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a moderate to dense, cold-deciduous, broad-leaved, short-shrub layer (<2 m tall) with a moderately dense to dense herbaceous layer (<1 m tall) that is typically dominated by perennial graminoids.

Floristics: This shrubland alliance is characterized by a moderate to dense shrub layer dominated by *Rosa nutkana*. Common associates are *Cornus sericea* and *Symphoricarpos albus* which may occur with low cover. The moderate to dense herbaceous layer is dominated by mesic perennial graminoids and forbs. High constancy, sometimes dominant species include *Deschampsia cespitosa* or *Oenanthe sarmentosa*. Scattered trees may be present with low cover, such as *Populus tremuloides* and *Populus balsamifera ssp. trichocarpa (= Populus trichocarpa)* (Reed 1993).

ENVIRONMENT & DYNAMICS

Environmental Description: This Pacific Northwest shrubland alliance is found in the mountains of Oregon at montane elevations. This small-patch alliance typically occurs in moist sites such as in floodplains, along open streambanks, and in mesic meadows (Reed 1993). *Rosa nutkana* grows best at pH ranges of 5.6 to 7.0. It thrives on moderately fertile, well-drained clay loam, sandy loam, or sandy soils (Haeussler et al. 1990, Reed 1993).

Dynamics: *Rosa nutkana* is frequently top-killed by fire and will root-sprout from rhizomes and root crowns following fire and may also regenerate from surviving seed in the seed bank (Haeussler et al. 1990, Reed 1993). However, high-severity fire may kill *Rosa* shrubs when root crowns and rhizomes are shallowly buried (Haeussler et al. 1990, Reed 1993). The species is tolerant of both sun and shade and shows increased growth and fruit production with increasing light (Haeussler et al. 1990, Reed 1993).

DISTRIBUTION

Geographic Range: This shrubland alliance is known from the mountains of Oregon.

Nations: US
States/Provinces: OR
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Associations:

- CEGL003457 *Rosa nutkana / Oenanthe sarmentosa* Shrubland
- CEGL003344 *Rosa nutkana / Deschampsia cespitosa* Shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Aller et al. 1981, Faber-Langendoen et al. 2017b, Haeussler et al. 1990, Reed 1993a

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
2.B.2.Na.2.c. M048 Central Rocky Mountain Montane-Foothill Grassland & Shrubland

G273. Central Rocky Mountain Lower Montane, Foothill & Valley Grassland

Type Concept Sentence: This wide-ranging lower montane, foothill and valley grassland group is found in the central Rocky Mountains and extends north onto the Okanagan and Fraser plateaus, the valleys around the Fraser, Nicola, and Similkameen rivers in British Columbia, and foothills in Alberta and is dominated by cool-season perennial bunchgrasses, such as *Festuca campestris, Festuca idahoensis*, and *Pseudoroegneria spicata* with diverse forbs (>25% cover) and sometimes a sparse (<10% cover) shrub layer.

OVERVIEW

Scientific Name: *Festuca campestris - Festuca idahoensis - Pseudoroegneria spicata* Central Rocky Mountain Foothill Grassland Group
Common Name (Translated Scientific Name): Rough Fescue - Idaho Fescue - Bluebunch Wheatgrass Central Rocky Mountain Foothill Grassland Group
Colloquial Name: Kinnikinnick / Fescue - Bluebunch Wheatgrass Steppe

Type Concept: These grasslands of the northern Rocky Mountains are found at lower montane to foothill elevations in the mountains and large valleys of northwestern Wyoming and western Montana, west through Idaho into the Blue Mountains of Oregon, and north into the Okanagan and Fraser plateaus of British Columbia and the Canadian Rockies. They also occur to the east in the central Montana mountain "islands" foothills, as well as the Rocky Mountain Front and Big and Little Belt ranges. They also extend along the eastern slopes of the Alberta Rockies. The most important species are cool-season perennial bunchgrasses and forbs (>25% cover), sometimes with a sparse (<10% cover) shrub layer. *Festuca campestris* and *Festuca idahoensis* are dominants, and *Pseudoroegneria spicata* occurs as a codominant, as well as a diversity of other native grasses. To the north, *Danthonia parryi* becomes codominant. Forb diversity is typically high in both mesic and dry aspects of this group. A soil crust of lichen covers almost all open soil between clumps of grasses; *Cladonia* and *Peltigera* species are the most common lichens. Unvegetated mineral soil is commonly found between clumps of grass and the lichen cover. *Festuca campestris* is easily eliminated by grazing and does not occur in all areas of this group.

This group also includes grasslands commonly known as "Palouse Prairie." These northern lower montane and valley grasslands represent a shift in the precipitation regime from summer monsoons and cold snowy winters found in the Southern Rockies to predominantly dry summers and winter precipitation. The Palouse region is characterized by rolling topography composed of loess hills and plains over basalt plains. The climate of this region has warm-hot, dry summers and cool, wet winters. Annual precipitation is high, 38-76 cm (15-30 inches). The soils are typically deep, well-developed, and old.

Outside of the Palouse Prairie region, these grasslands are influenced by shorter summers, colder winters, and young soils derived from recent glacial and alluvial material. In the eastern portion of its range in Montana, winter precipitation is replaced by a huge spring peak in precipitation. Elevations range from 300 to 1650 m, ranging from small meadows to large open parks surrounded by conifers in the lower montane, to extensive foothill and valley grasslands below the lower treeline. Many of these valleys may have been primarily sage-steppe with patches of grassland in the past, but because of land-use history post-settlement (herbicide, grazing, fire suppression, pasturing, etc.), they have been converted to grassland-dominated areas. Soils are relatively deep, fine-textured, often with coarse fragments, and non-saline, often with a microphytic crust.

In Alberta, this group occurs along the lower and eastern flanks of the Foothills Geologic Belt, primarily in the Foothills Fescue Grassland and Foothills Parkland Natural subregions. Glaciation and bedrock topography in combination result in a complex physiography from sloping lower foothills to hummocky to rolling uplands, mainly on glacial till, with significant lacustrine materials in valleys. Elevation ranges from 500 to 1525 m. At upper elevations, stands may be small-patch grasslands on southern slopes between *Populus tremuloides* woodlands or *Salix bebbiana* shrublands becoming quite extensive on moister sites at lower elevation. Soils are deep, usually Black Chernozems.

Classification Comments: This is the same as the Interior Plateau Grassland also called "Northern Plateau Grassland" of the Okanagan Ecoregional Plan. In Wyoming, this is distinguished from northwestern Great Plains mixedgrass prairies by the presence of *Festuca idahoensis* or *Carex rossii*, the lack of *Bouteloua gracilis* (which is common in mixedgrass prairie), or the presence of *Artemisia nova* or *Artemisia tripartita ssp. rupicola*, neither of which occur in mixedgrass prairie. This group is also similar to Central Rocky Mountain Montane Grassland Group (G267) in that some of the dominant grasses are shared between the lower and higher elevation grasslands, but the associated forbs shift, as do some of the other graminoid taxa.

Similar NVC Types:
- G267 Central Rocky Mountain Montane Grassland
- G271 Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow
- G331 Northern Great Plains Dry Mixedgrass Prairie
- G332 Northern Great Plains Rough Fescue Prairie
- G141 Northern Great Plains Mesic Mixedgrass Prairie
- G311 Intermountain Semi-Desert Grassland

Diagnostic Characteristics: Herbaceous communities dominated by cool-season bunchgrasses, found in the lower montane and foothill zones of the northern Rocky Mountains and in the inter-montane valleys. These are typically extensive grasslands, not grass-dominated patches within the sagebrush shrub-steppe group. *Festuca campestris, Pseudoroegneria spicata*, and *Festuca idahoensis* are the major grasses, although a number of other species occur, including *Hesperostipa comata, Achnatherum hymenoides, Achnatherum occidentale, Achnatherum richardsonii, Achnatherum scribneri, Danthonia* species, *Elymus lanceolatus, Leymus condensatus, Leymus cinereus, Koeleria macrantha, Pascopyrum smithii*, or *Poa secunda*.

VEGETATION

Physiognomy and Structure: Herbaceous communities dominated by cool-season bunchgrasses, generally less than 1 m in height, and often dense in cover. Forb diversity is typically high in both mesic and dry aspects of this group. On slightly more mesic or protected sites (north slopes, toeslopes, swales), scattered or even dense patches of deciduous, broadleaf shrubs can occur (when the patches are large enough they can form associations that are included in one of the shrubland groups). A soil crust of lichen covers almost all open soil between clumps of grasses; *Cladonia* and *Peltigera* species are the most common lichens. Unvegetated mineral soil is commonly found between clumps of grass and the lichen cover.

Floristics: On pristine moist sites, *Festuca campestris* can form a nearly continuous cover and is interspersed with *Festuca idahoensis* and the rhizomatous ecotype of *Pseudoroegneria spicata*. *Danthonia parryi* becomes codominant moving north into the Alberta foothills. Other graminoids include *Achnatherum occidentale, Achnatherum richardsonii, Danthonia* spp., *Koeleria macrantha, Poa secunda, Pascopyrum smithii, Elymus lanceolatus*, and *Leymus cinereus*. These moister sites support a forb-rich community that includes species such as *Balsamorhiza sagittata, Achillea millefolium, Lupinus sericeus, Geranium viscosissimum, Lomatium triternatum, Potentilla glandulosa, Potentilla gracilis, Penstemon confertus, Delphinium bicolor, Oxytropis* spp., *Gentiana affinis, Fragaria virginiana*, and *Castilleja* spp. Endemic rare species such as *Silene spaldingii* inhabit the moister aspects of this group.

On drier sites dominated by *Festuca idahoensis* and the bunchgrass ecotype of *Pseudoroegneria spicata*, common forbs include *Achillea millefolium, Gaillardia aristata, Galium boreale, Geum triflorum, Arnica sororia, Antennaria microphylla, Potentilla gracilis, Lupinus argenteus, Lupinus sericeus, Lomatium macrocarpum, Phlox alyssifolia, Phlox hoodii, Liatris punctata, Lithospermum ruderale, Eriogonum* spp., *Penstemon eriantherus, Solidago missouriensis, Oxytropis* spp., *Heuchera* spp., *Pulsatilla patens, Opuntia fragilis, Artemisia ludoviciana, Artemisia frigida*, and *Erigeron* spp. Endemic species in the northwestern Great Plains, such as *Douglasia montana, Penstemon nitidus*, and *Penstemon albertinus*, are common in the drier, rocky sites of this group. Other graminoids present within this drier community include *Achnatherum scribneri, Achnatherum hymenoides, Danthonia intermedia, Koeleria macrantha, Poa secunda, Carex geyeri, Carex filifolia*, and *Carex petasata*. On pristine sites, *Selaginella densa* and a soil crust of lichen covers almost all open soil between clumps of grasses. *Cladonia* and *Peltigera* spp. are the most common lichens present. Important exotic grasses include *Phleum pratense, Bromus inermis*, and *Poa pratensis*.

Shrub species may be scattered or patchy, including *Dasiphora fruticosa ssp. floribunda, Rosa nutkana, Rosa woodsii, Rosa arkansana, Arctostaphylos uva-ursi, Symphoricarpos* spp., *Artemisia tridentata, Juniperus communis*, and in Wyoming *Artemisia tripartita ssp. rupicola*. Several species of *Eriogonum* are also common. *Amelanchier alnifolia, Crataegus douglasii*, and *Prunus virginiana* often occur as patches on north-facing slopes of foothills where snow persists longer into the growing season. *Salix bebbiana* copses form a unique groveland area in Alberta.

ENVIRONMENT & DYNAMICS

Environmental Description: These grasslands of the northern Rocky Mountains are found at lower montane to foothill elevations along the mountain flanks, in the mountains and in large intermountain valleys. This group also includes grasslands commonly known as Palouse Prairie. These northern lower montane and valley grasslands reflect a shift in the precipitation regime from summer monsoons and cold snowy winters found in the Southern Rockies to predominantly dry, cool summers and winter precipitation. The Palouse region is characterized by rolling topography composed of loess hills and plains over basalt plains. The climate of this region has warm-hot, dry summers and cool, wet winters. Annual precipitation is high, 38-76 cm (15-30 inches). The soils are typically deep, well-developed, and old. Outside of the Palouse Prairie region, these grasslands are influenced by shorter cooler summers, colder winters, and young soils derived from recent glacial and alluvial material. In the eastern portion of its range in Montana, winter precipitation is replaced by a huge spring peak in precipitation. Elevations range from 300 to 1650 m, ranging from small meadows to large open parks surrounded by conifers in the lower montane, to extensive foothill and valley grasslands below the lower treeline.

Climate: These northern lower montane and valley grasslands reflect a shift in the precipitation regime from summer monsoons and cold snowy winters found in the southern Rockies to predominantly dry summers and winter precipitation. In the Palouse region the climate has warm-hot, dry summers and cool, wet winters. Annual precipitation is high, 38-76 cm (15-30 inches). Outside of the Palouse Prairie region, these grasslands are influenced by shorter summers and colder winters. In the eastern portion of its range in Montana, winter precipitation is replaced by a huge spring peak in precipitation. *Soil/substrate/hydrology:* The Palouse region is characterized by rolling topography composed of loess hills and plains over basalt plains. The soils are typically deep, well-developed, and old. Outside of the Palouse Prairie region, these grasslands occur on young soils derived from recent

glacial and alluvial material. Soils are relatively deep, fine-textured, often with coarse fragments, and non-saline, often with a microphytic crust.

Dynamics: The natural fire regime of this group likely maintains patchy distribution of shrubs, so the general aspect of the vegetation is a grassland. The fire regime of this group maintains a grassland due to rapid fire return that retards shrub invasion or landscape isolation and fragmentation that limits seed dispersal of native shrub species. Fire frequency is presumed to be less than 20 years. These are extensive grasslands, not grass-dominated patches within the sagebrush shrub steppe group. Shrubs may increase following heavy grazing and/or with fire suppression. Microphytic crust is very important in this group. Summer overgrazing for 2 to 3 years can result in the loss of *Festuca campestris*, which is very grazing sensitive. Long-term heavy grazing on moister sites can result in a shift to a *Poa pratensis - Phleum pratense* type. *Pseudoroegneria spicata* shows an inconsistent reaction to grazing, increasing on some grazed sites while decreasing on others. It seems to recover more quickly from overgrazing than *Festuca campestris*, tolerates dormant-period grazing well but is sensitive to defoliation during the growing season. Light spring use or fall grazing can help retain plant vigor. Exotic species threatening this group through invasion and potential complete replacement of native species include *Bromus arvensis, Potentilla recta, Euphorbia esula*, and all manner of knapweed, especially *Centaurea stoebe ssp. micranthos*. In the Palouse Prairie, excessive grazing, past land use and invasion by introduced annual species have resulted in a massive conversion to agriculture or shrub-steppe and annual grasslands dominated by *Artemisia* spp. and *Bromus tectorum* or *Poa pratensis*. Remnant grasslands are now typically associated with steep and rocky sites or small and isolated sites within an agricultural landscape.

DISTRIBUTION

Geographic Range: This lower montane, foothill and valley grassland group occurs throughout the southern interior and southern portion of the Fraser Plateau, as well as the valleys around the Fraser River in the Pavilion Ranges, the Nicola River and the Similkameen River in British Columbia. It includes high-elevation grasslands along the eastern mountain slopes down to rolling valleys in Alberta. It also occurs in the mountains and large valleys of northwestern Wyoming and western Montana, east to the central Montana Rocky Mountain Front and mountain "island" ranges, west through Idaho into the Blue Mountains of Oregon, mountains in northeastern California, and central Washington.

Spatial Scale & Pattern [optional]: Large patch
Nations: CA, US
States/Provinces: AB, BC, CA, ID, MT, NV?, OR, UT?, WA, WY
TNC Ecoregions [optional]: 4:C, 6:C, 7:C, 8:C, 9:C, 10:P, 26:C, 68:C
USFS Ecoregions (2007): 331A:CC, 331D:CC, 331N:CC, 341G:CC, 342A:CC, 342B:CC, 342C:CC, 342D:CP, 342F:CP, 342H:CC, 342I:CC, 342J:CC, M242C:CC, M242D:CC, M331A:CP, M331B:CC, M331D:CP, M331J:CP, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CP, M333C:CC, M333D:CP, M341A:C?
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: High. USNVC Confidence from peer reviewer, not AE.

SYNONYMY

- **>** Idaho Fescue - Western Wheatgrass (309) (Shiflet 1994)
- **>** Rough Fescue - Bluebunch Wheatgrass (311) (Shiflet 1994)

LOWER LEVEL UNITS

Alliances:

- A3985 *Elymus lanceolatus - Hesperostipa comata - Phacelia hastata* Central Rocky Mountain Sand Deposit Grassland Alliance
- A3987 *Festuca idahoensis - Pseudoroegneria spicata - Poa secunda* Dry Grassland Alliance
- A3989 *Festuca idahoensis - Pseudoroegneria spicata* Palouse Grassland Alliance
- A3988 *Festuca idahoensis - Pseudoroegneria spicata - Pascopyrum smithii* Mesic Grassland Alliance
- A4095 *Arctostaphylos uva-ursi / Festuca* spp. - *Pseudoroegneria spicata* Steppe Alliance
- A3986 *Festuca campestris - Festuca idahoensis* Mesic Grassland Alliance
- A4096 *Dasiphora fruticosa ssp. floribunda / Festuca campestris - Festuca idahoensis* Shrub-steppe Alliance

AUTHORSHIP

Primary Concept Source: E.W. Tisdale (1982)
Author of Description: M.S. Reid, L. Allen and K.A. Schulz
Acknowledgments:
Version Date: 11/09/2015
Classif Resp Region: West
Internal Author: MSR 3-10, mod. L. Allen 9-13, mod. KAS 11-15

REFERENCES

References: BCCDC unpubl. data, Daubenmire 1988, Ecosystems Working Group 1998, Faber-Langendoen et al. 2017a, Mueggler and Stewart 1980, Natural Regions Committee 2006, Shiflet 1994, Steen and Coupé 1997, Tisdale 1982

2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G273. Central Rocky Mountain Lower Montane, Foothill & Valley Grassland

A4095. Arctostaphylos uva-ursi / Festuca spp. - Pseudoroegneria spicata Steppe Alliance

Type Concept Sentence: This central Rocky Mountain alliance is characterized by an open to dense, usually patchy dwarf-shrub layer dominated by *Arctostaphylos uva-ursi* with a sparse to moderately dense cover of perennial graminoids dominated by *Festuca campestris, Festuca idahoensis*, or *Pseudoroegneria spicata*. It occurs in the subalpine and lower alpine zones mountains of northwestern Montana and southwestern Alberta.

OVERVIEW

Scientific Name: *Arctostaphylos uva-ursi / Festuca* spp. - *Pseudoroegneria spicata* Steppe Alliance
Common Name (Translated Scientific Name): Kinnikinnick / Fescue species - Bluebunch Wheatgrass Steppe Alliance
Colloquial Name: Kinnikinnick / Fescue - Bluebunch Wheatgrass Steppe

Type Concept: The vegetation of this central Rocky Mountain alliance is characterized by an open to dense, usually patchy dwarf-shrub layer with sparse to moderately dense cover of perennial graminoids and diverse forb associates. *Arctostaphylos uva-ursi* cover is widely variable (5-75%, averaging 30%) and dominates or codominates the dwarf-shrub layer along with wind-dwarfed *Dasiphora fruticosa ssp. floribunda, Juniperus communis, Juniperus horizontalis*, or *Rosa woodsii* shrubs. *Festuca campestris, Festuca idahoensis*, or *Pseudoroegneria spicata* typically dominate or codominate the herbaceous layer with 25-35% cover combined. The forb component is highly diverse, though individual stands are not as diverse. Total forb cover is typically less than graminoids (<20%). The forbs with higher constancy or abundance include *Achillea millefolium, Agoseris glauca, Anemone multifida, Campanula rotundifolia, Galium boreale, Hedysarum sulphurescens*, and *Lupinus sericeus*. This central Rocky Mountain alliance occurs in the mountains of northwestern Montana and southwestern Alberta. This alliance is a prominent small-patch or linear type found in the subalpine and lower alpine zones and may extend down into the montane zone on exposed ridges. Elevation ranges from 1340 to 2130 m (4400-7000 feet). It occurs predominantly on moderate to steep slopes with southerly exposures, though it has been found on all aspects. Substrates are predominantly limestones and siltstones that have weathered into thin, fine-textured, and well- to excessively drained soils. Adjacent vegetation is usually subalpine or alpine grasslands, or subalpine woodlands or krummholz composed of *Abies lasiocarpa* or *Pinus albicaulis*.

Classification Comments: This alliance is variable and can express itself structurally as a grassland with an open evergreen dwarf-shrub layer dominated by *Arctostaphylos uva-ursi* or an *Arctostaphylos uva-ursi*-dominated dwarf-shrubland. Floristic composition does not vary much except when comparing montane stands to lower alpine stands, which obviously have some alpine species also present. Because of the typically prominent graminoid layer dominated by *Festuca campestris, Festuca idahoensis*, or *Pseudoroegneria spicata*, it is placed in this group with other grasslands dominated by *Festuca campestris, Festuca idahoensis*, or *Pseudoroegneria spicata*. However, it could also be reasonably placed in Central Rocky Mountain Montane Grassland Group (G267) or Rocky Mountain-Sierran Alpine Dwarf-shrubland & Krummholz Group (G316). The cover values for the diagnostic grasses for this alliance are considerably less than half those reported for the next most closely related association, *Festuca campestris - Festuca idahoensis* (Mueggler and Stewart 1980).

Internal Comments: KAS 2-14: I left it in G273 for now, but we may need to revisit.
Other Comments:

Similar NVC Types: The other *Arctostaphylos uva-ursi*-dominated association described from Montana is included in *Dryas integrifolia - Dryas octopetala - Arctostaphylos uva-ursi* Rocky Mountain Fell-field Dwarf-shrubland Alliance (A3178) in Rocky Mountain-Sierran Alpine Dwarf-shrubland & Krummholz Group (G316).

- A4086 *Arctostaphylos uva-ursi* Cascadian Alpine Dwarf-shrubland Alliance
- A3178 *Dryas integrifolia - Dryas octopetala - Arctostaphylos uva-ursi* Rocky Mountain Fell-field Dwarf-shrubland Alliance

Diagnostic Characteristics: This alliance is characterized by a sparse to dense dwarf-shrub layer dominated by dominant (and diagnostic) species *Arctostaphylos uva-ursi*. Associated wind-dwarfed shrubs (<0.5 m tall) may include *Amelanchier alnifolia, Dasiphora fruticosa ssp. floribunda, Juniperus horizontalis, Juniperus communis*, or *Rosa woodsii*. There is an open to moderately dense perennial graminoid layer dominated by diagnostic bunch grasses *Festuca campestris, Festuca idahoensis*, or *Pseudoroegneria spicata*. Associated graminoids include *Calamagrostis purpurascens, Carex elynoides, Danthonia parryi*, and *Koeleria macrantha*.

Associated forb include *Achillea millefolium, Agoseris glauca, Anemone multifida, Campanula rotundifolia, Galium boreale, Hedysarum sulphurescens*, and *Lupinus sericeus*.

VEGETATION

Physiognomy and Structure: Vegetation is characterized by an open to dense (5-75% cover) evergreen dwarf-shrub layer (<0.5 m tall) and a sparse to moderately dense herbaceous layer dominated by perennial bunch grasses. Forbs are present with sparse to moderate cover.

Floristics: This central Rocky Mountain alliance occurs on wind-battered slopes and is composed of an open to dense, usually patchy dwarf-shrub layer with a sparse to moderately dense cover of perennial graminoids and diverse forb associates. *Arctostaphylos uva-ursi* cover is widely variable (5-75%, averaging 30%) and dominates or codominates the dwarf-shrub layer (<50 cm tall). Other consistently present constituents of this layer are wind-dwarfed *Dasiphora fruticosa ssp. floribunda, Juniperus horizontalis, Juniperus communis*, or *Rosa woodsii* shrubs. Extremely browsed specimens of *Amelanchier alnifolia* are often present. *Arctostaphylos* cover appears to be loosely inversely correlated with cover of the dominant (and diagnostic) grasses. *Festuca campestris, Festuca idahoensis*, or *Pseudoroegneria spicata* usually dominate or codominate the herbaceous layer with about 25-35% cover combined. Other graminoids frequently present are *Carex obtusata, Danthonia parryi* (mesic stands), *Koeleria macrantha*, and at high-elevation sites *Calamagrostis purpurascens* and *Carex elynoides*. The forb component is highly diverse, though individual stands are not as diverse. Total forb cover is typically less than graminoids (<20%). The forbs with higher constancy or abundance include *Achillea millefolium, Agoseris glauca, Anemone multifida, Campanula rotundifolia, Galium boreale, Hedysarum sulphurescens*, and *Lupinus sericeus*. Other forbs present in at least half the stands include *Allium cernuum, Erigeron caespitosus, Fragaria virginiana, Gaillardia aristata, Oxytropis sericea, Packera cana (= Senecio canus), Penstemon confertus, Sedum lanceolatum*, and *Zigadenus elegans*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs in the central Rocky Mountains and is well-documented from Glacier-Waterton International Peace Park. It is a prominent small-patch or linear type found in the subalpine and lower alpine zones and may extend down into the montane zone on exposed ridges. Elevation ranges from 1340 to 2130 m (4400-7000 feet). It occurs predominantly on moderate to steep slopes with southerly exposures, though it has been found on all aspects. Whether it occurs on lower or upper slopes, flat or convex topography, it is associated with positions that can be inferred to be wind-battered. It has been recorded exclusively from sedimentary substrates, predominantly limestones and siltstones. These have weathered into thin, fine-textured, and well- to excessively drained soils whose water regime is characterized as predominantly subxeric, ranging from xeric to submesic.

Dynamics: Increased grazing pressure leads to a decline in *Pseudoroegneria* and associated *Festuca* spp. and allows low-growing forbs and *Carex* spp. to increase.

DISTRIBUTION

Geographic Range: This central Rocky Mountain alliance occurs in mountains of northwestern Montana and southwestern Alberta and is well-documented from Glacier-Waterton International Peace Park.

Nations: CA, US
States/Provinces: AB, MT
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** *Arctostaphylos uva-ursi / Festuca campestris - Festuca idahoensis* Dwarf-shrubland (Reid et al. 2004)
- **>** *Arctostaphylos uva-ursi / Pseudoroegneria spicata* Dwarf-shrubland (Reid et al. 2004)
- **>** *Festuca scabrella - Arctostaphylos uva-ursi* Vegetation Type (Willoughby 2001)
- **>** *Festuca scabrella - Arctostaphylos uva-ursi* Vegetation Type (Achuff et al. 2002)
- **>** *Festuca scabrella - Carex obtusata / Arctostaphylos uva-ursi* Community Type (Willoughby et al. 2001)
- **>** *Solidagini multiradiatae - Arctostaphyletum uva-ursi* plant association (Damm 2001)

LOWER LEVEL UNITS

Associations:

- CEGL005831 *Arctostaphylos uva-ursi / Pseudoroegneria spicata* Dwarf-shrubland
- CEGL005830 *Arctostaphylos uva-ursi / Festuca campestris - Festuca idahoensis* Dwarf-shrubland

AUTHORSHIP

Primary Concept Source: M.S. Reid, S.V. Cooper, and G. Kittel (2004)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by M.S. Reid.
Version Date: 2014/03/14

REFERENCES

References: Achuff et al. 2002, Damm 2001, Faber-Langendoen et al. 2017b, Hop et al. 2007, Reid et al. 2004, Willoughby 2001, Willoughby et al. 2001

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G273. Central Rocky Mountain Lower Montane, Foothill & Valley Grassland

A4096. Dasiphora fruticosa ssp. floribunda / Festuca campestris - Festuca idahoensis Shrub-steppe Alliance

Type Concept Sentence: This small-patch alliance is characterized by an open to moderately dense short-shrub layer dominated by diagnostic species *Dasiphora fruticosa ssp. floribunda*and a moderate to dense herbaceous layer dominated by medium-tall perennial bunchgrasses *Festuca campestris* and *Festuca idahoensis*. It occurs infrequently in the central Rocky Mountains and the northwestern Great Plains.

OVERVIEW

Scientific Name: *Dasiphora fruticosa ssp. floribunda / Festuca campestris - Festuca idahoensis* Shrub-steppe Alliance
Common Name (Translated Scientific Name): Shrubby-cinquefoil / Prairie Fescue - Idaho Fescue Shrub-steppe Alliance
Colloquial Name: Shrubby-cinquefoil / Fescue Shrub-steppe

Type Concept: Vegetation is characterized by an open to moderately dense short-shrub layer (10-45% cover) and a moderate to dense (40-100% cover) herbaceous layer with very high species diversity. The shrub layer is dominated by diagnostic species *Dasiphora fruticosa ssp. floribunda*. A moderate to dense (40-100% cover) graminoid layer is dominated by medium-tall perennial bunchgrasses *Festuca campestris* and *Festuca idahoensis*. Associated graminoids include *Agrostis scabra, Bouteloua gracilis, Carex geyeri, Carex obtusata, Danthonia intermedia, Danthonia parryi, Koeleria macrantha, Pseudoroegneria spicata*, and *Schizachyrium scoparium*. Forb species are typically diverse and include species common in both the foothill and montane zones and northwestern Great Plains. This small-patch alliance occurs infrequently in the central Rocky Mountains and the northwestern Great Plains. Stands occur between 1360-2600 m elevation. It usually occurs on level and gently sloping or rolling topography to steep slopes of all aspects. Soils are loamy and moderately deep derived from a variety of parent materials, including sedimentary rocks and granitics.

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types: This alliance is similar to other *Festuca campestris*- and *Festuca idahoensis*-dominated alliances in this group, but has a diagnostic short-shrub layer dominated by *Dasiphora fruticosa ssp. floribunda*.

- A0958 *Dasiphora fruticosa ssp. floribunda* Wet Shrubland Alliance: occurs in wet meadow and wetland sites is classified in Vancouverian-Rocky Mountain Subalpine Snowbed, Wet Meadow & Dwarf-shrubland Group (G520).
- A3175 *Ribes cereum - Ribes montigenum - Dasiphora fruticosa ssp. floribunda* Alpine Shrubland Alliance

Diagnostic Characteristics: The shrub layer is dominated by diagnostic species *Dasiphora fruticosa ssp. floribunda* which characterizes this alliance when there is a moderate to dense (40-100% cover) herbaceous layer dominated by medium-tall perennial bunch grasses *Festuca campestris* and *Festuca idahoensis*. Associated graminoids include *Agrostis scabra, Bouteloua gracilis, Carex geyeri, Carex obtusata, Danthonia intermedia, Danthonia parryi, Koeleria macrantha, Muhlenbergia cuspidata, Pseudoroegneria spicata*, and *Schizachyrium scoparium*,. Associate forb species are diverse. The introduced grass *Phleum pratense* and *Poa pratensis* may be abundant, especially in mesic lowland areas.

VEGETATION

Physiognomy and Structure: Stands within this alliance have an open to moderately dense (10-45% cover) cold-deciduous short-shrub layer (0.5-1 m tall) and a moderate to dense (40-100% cover) herbaceous layer (0.5-1 m tall). The herbaceous layer is dominated by medium-tall, perennial bunch grasses. Other graminoids and perennial broad-leaved forbs are present to codominant.

Floristics: This alliance is characterized by an open to moderately dense short-shrub layer (10-45% cover) and a moderate to dense (40-100% cover) herbaceous layer with very high species diversity. The shrub layer has 5-30% canopy cover of diagnostic species

Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda) and may have up to 20% cover of *Artemisia cana* in alluvial bench stands. Other shrubs may be present with low cover and include *Amelanchier alnifolia, Arctostaphylos uva-ursi, Artemisia frigida, Gutierrezia sarothrae, Juniperus horizontalis, Mahonia repens, Penstemon fruticosus*, and *Rosa woodsii*. At lower elevations, stands have 90-100% herbaceous cover, while higher elevation stands have 40-70% total herbaceous cover. The herbaceous layer is dominated by medium-tall perennial graminoids. Forb species are typically diverse and include species common in both montane zones and the northwestern Great Plains. The dominant and diagnostic graminoid species are bunchgrasses *Festuca campestris* and *Festuca idahoensis*. Associated graminoids include *Agrostis scabra, Bouteloua gracilis, Carex geyeri, Carex obtusata, Danthonia intermedia, Danthonia parryi, Koeleria macrantha, Muhlenbergia cuspidata, Pseudoroegneria spicata*, and *Schizachyrium scoparium*. Forb species are diverse, with *Achillea millefolium, Agoseris glauca, Arenaria congesta, Besseya wyomingensis, Campanula rotundifolia, Fragaria virginiana, Gaillardia aristata, Galium boreale, Geum triflorum, Hedysarum sulphurescens, Heuchera cylindrica, Lupinus sericeus, Penstemon confertus, Potentilla gracilis*, and *Pulsatilla patens ssp. multifida* being the most consistent. The introduced grass *Phleum pratense* and *Poa pratensis* may be abundant, especially in mesic lowland areas.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs infrequently in the central Rocky Mountains and the northwestern Great Plains where it is found on gently sloping or rolling topography to steep slopes (1-45%) at elevations from 1360-2600 m. Stands tend to occur on south-facing low and midslopes but can occur on all aspects, and on basin floors. They have been described from relatively mesic, gentle upland slopes with moderately deep soils derived from granitic parent materials in northwestern Montana, and on gently sloping to undulating alluvial benches along drainages in the mesic transition zone between riparian and dry upland areas in Wyoming and Idaho. However, these soils are deeper and derived from glacio-fluvial deposits of limestone, siltstone, sandstone or shale parent materials. Soil textures are sandy loam, loam or silty clay loam. Soils are moderately deep, moderately to well-drained with 25- to 46-cm (10- to 18-inch) rooting depth. Surface rock can be abundant, but little bare ground is exposed. Argillite and limestone rock and gravel are common in the soil profile. Litter may dominate the ground surface, ranging between 6-45%. Small rock, bare soil, and moss are consistently common in most occurrences.

Dynamics: *Dasiphora fruticosa ssp. floribunda* will increase in abundance with heavy grazing, and *Festuca campestris, Festuca idahoensis*, and *Pseudoroegneria spicata* will decrease.

DISTRIBUTION

Geographic Range: This alliance is found in the central Rocky Mountains and northwestern Great Plains from northern Wyoming and southern Idaho north into southwestern Alberta, and east into western North Dakota and southern Saskatchewan.

Nations: CA, US
States/Provinces: AB, ID, MT, ND, NV, SK, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **>** *Dasiphora fruticosa ssp. floribunda* Shrub Herbaceous Alliance (A.1534) (Hop et al. 2007)
- **>** *Dasiphora fruticosa ssp. floribunda* Shrub Herbaceous Alliance (A.1534) (Reid et al. 2004)

LOWER LEVEL UNITS

Associations:
- CEGL001502 *Dasiphora fruticosa ssp. floribunda / Festuca idahoensis* Shrub Grassland
- CEGL001503 *Dasiphora fruticosa ssp. floribunda / Festuca campestris* Shrub Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2014)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by M.S. Reid and G. Kittel.
Version Date: 2014/03/14

REFERENCES

References: Bourgeron and Engelking 1994, Faber-Langendoen et al. 2017b, Hirsch 1985, Hop et al. 2007, Mattson 1984, Mueggler and Stewart 1980, Reid et al. 2004, Thompson and Knijt 1976, Tweit and Houston 1980, Youngblood et al. 1985a

2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G273. Central Rocky Mountain Lower Montane, Foothill & Valley Grassland

A3985. Elymus lanceolatus - Hesperostipa comata - Phacelia hastata Central Rocky Mountain Sand Deposit Grassland Alliance

Type Concept Sentence: This alliance is characterized by a sparse to moderately dense herbaceous layer dominated by the medium-tall perennial graminoid *Elymus lanceolatus* with *Hesperostipa comata* or *Phacelia hastata* present to codominant and occurs in the Centennial Valley Sandhills in southwestern Montana, a high and cold valley on open, sandy flats in the Columbia River plains.

OVERVIEW

Scientific Name: *Elymus lanceolatus - Hesperostipa comata - Phacelia hastata* Central Rocky Mountain Sand Deposit Grassland Alliance
Common Name (Translated Scientific Name): Streambank Wheatgrass - Needle-and-Thread - Silverleaf Scorpionweed Central Rocky Mountain Sand Deposit Grassland Alliance
Colloquial Name: Central Rocky Mountain Sand Deposit Grassland

Type Concept: The vegetation of this grassland alliance is characterized by a sparse to moderately dense herbaceous layer dominated by the medium-tall perennial graminoid *Elymus lanceolatus* with *Hesperostipa comata* or *Phacelia hastata* present to codominant. *Elymus lanceolatus* binds the loose sand providing 5-25% cover. Other associated species include shrubs such as *Ericameria nauseosa (= Chrysothamnus nauseosus), Tetradymia canescens*, grasses *Achnatherum hymenoides (= Oryzopsis hymenoides), Poa secunda*, and forbs *Astragalus sclerocarpus, Eriogonum ovalifolium var. purpureum, Linum perenne, Oenothera pallida, Phlox longifolia*, and *Psoralidium tenuiflorum (= Psoralea tenuiflora)*. Non-native species include *Bromus tectorum, Centaurea diffusa, Sisymbrium altissimum*, and *Salsola kali*. This alliance occurs in the Centennial Valley Sandhills in southwestern Montana and sandy plains along the Columbia River. Stands found in a high and cold Centennial Valley are at 2000-2135 m elevation and occur in a mosaic with active sand dunes and dune shrublands with occurrences less than one acre in size. Along the Columbia River, stands range from 300-765 m elevation. Sites are level to moderately sloping sandy plains and low dunes. Soils are deep loess or sand. Disturbance is important to the maintenance of these seral communities, and it is associated with recent blowouts.

Classification Comments:

Internal Comments: GK 9-16: ID added for Minidoka. KAS 2-14: Based on association information, Utah and Wyoming were added to the distribution range. The Utah stands might better fit into Southern Rocky Mountain Montane-Subalpine Grassland Group (G268). Information on those stands needs to be included in description of this alliance.
Other Comments:

Similar NVC Types: There are two other *Elymus lanceolatus*-dominated associations in the NVC. One is included in *Hesperostipa curtiseta - Elymus lanceolatus* Grassland Alliance (A4029), which is placed in Northern Great Plains Dry Mixedgrass Prairie Group (G331) and the other is in *Festuca arizonica - Muhlenbergia montana - Poa fendleriana* Southern Rocky Mountain Montane Grassland Alliance (A3953) in Southern Rocky Mountain Montane-Subalpine Grassland Group (G268).

Diagnostic Characteristics: This sand deposit grassland alliance is characterized by a sparse to moderately dense herbaceous layer dominated by the medium-tall diagnostic perennial graminoid *Elymus lanceolatus* often with *Hesperostipa comata* or *Phacelia hastata* present to codominant. Associated species include shrubs such as *Ericameria nauseosa, Tetradymia canescens*, grasses *Achnatherum hymenoides, Poa secunda*, and forbs *Astragalus sclerocarpus, Eriogonum ovalifolium var. purpureum, Linum perenne, Oenothera pallida, Phlox longifolia*, and *Psoralidium tenuiflorum*.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a sparse to moderately dense herbaceous layer dominated by medium-tall perennial grasses with perennial forbs. Scattered evergreen and deciduous shrubs may be present. Annual forbs and grasses are common in some stands.

Floristics: These sparse grasslands have been described from the Columbia River plains and the sandhills in the Centennial Valley in southwestern Montana. The cool-season perennial grass *Elymus lanceolatus* is usually the dominant species. It is a rhizomatous perennial grass that binds the loose sand providing 5-25% cover or higher. The bunchgrass *Hesperostipa comata (= Stipa comata)* and the perennial forb *Phacelia hastata* are codominant in some stands. Other species that may be present with sparse cover include grasses, such as *Achnatherum hymenoides (= Oryzopsis hymenoides), Poa secunda*, and forbs such as *Achillea millefolium, Astragalus sclerocarpus, Eriogonum ovalifolium, Linum perenne, Oenothera pallida, Phlox longifolia*, and *Psoralidium tenuiflorum (= Psoralea tenuiflora)*. Very scattered patches of 1- to 2-m tall shrubs occasionally occur, including evergreen and deciduous species

such as *Artemisia tridentata, Ericameria nauseosa (= Chrysothamnus nauseosus), Purshia tridentata*, and *Tetradymia canescens*. Non-native species are common especially in the Columbia Basin stands and include *Bromus tectorum, Centaurea diffusa, Salsola kali*, and *Sisymbrium altissimum*. Diagnostic of this alliance is the dominance of *Elymus lanceolatus* with *Hesperostipa comata* and *Phacelia hastata* in the herbaceous layer.

ENVIRONMENT & DYNAMICS

Environmental Description: This vegetation occurs as an open, sandy grassland on flat Columbia River plains and in the Centennial Valley Sandhills, a high and cold valley in southwestern Montana. The climate is semi-arid, with average annual precipitation varying across this region from 20-40 cm. Summers are typically hot and dry. Winters are moderately cold, with most precipitation falling during October through May. Stands along the Columbia River occur from 300-765 m elevations on topography composed of very low (0.5 m) dunes. Open sand comprises almost 50-90% of the cover. Sites are flat to gentle slopes with dry, deep loess or sandy soils. It often is found in a patchwork with sand dunes and dune shrublands. In southwestern Montana, elevations range from approximately 2050-2500 m. Stands are patchily distributed in the sandhills area with occurrences less than one acre in size. Sites are level to moderately sloping sandy plains and dunes. Disturbance is important to the maintenance of these seral communities, and it is associated with recent blowouts. Adjacent vegetation includes shrublands dominated by *Artemisia tridentata* and *Artemisia tripartita*.

Dynamics: This seral vegetation is scattered across open sandy areas where disturbance has created habitat for the strongly rhizomatous *Elymus lanceolatus ssp. lanceolatus* to colonize the open sandy area and stabilize the sand, providing 10-15% cover. In stands in Montana, regular fires, grazing and small mammal digging initiate the blowouts that provide the disturbance that maintains this vegetation and the habitat for a number of sensitive species. Were one to suppress fire and remove cattle over this landscape, succession would lead to stable *Artemisia tridentata ssp. vaseyana*- and *Artemisia tripartita*-dominated communities and the probable loss of the sensitive species.

DISTRIBUTION

Geographic Range: This alliance occurs in the Centennial Valley Sandhills in southwestern Montana, a high and cold valley and on open, sandy flats in the Columbia River and Snake River plains in Oregon, Washington and Idaho. It is also reported from Utah and Wyoming.

Nations: US
States/Provinces: ID, MT, OR, UT?, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **=** *Elymus lanceolatus* Herbaceous Alliance (Bourgeron and Engelking 1994)

LOWER LEVEL UNITS

Associations:
- CEGL001746 *Elymus lanceolatus - Hesperostipa comata* Grassland
- CEGL005595 *Elymus lanceolatus - Lupinus argenteus* Grassland
- CEGL001745 *Elymus lanceolatus - Phacelia hastata* Grassland

AUTHORSHIP

Primary Concept Source: P.S. Bourgeron and L.D. Engelking (1994)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2016/09/29

REFERENCES

References: Bourgeron and Engelking 1994, Cooper et al. 1995, Cooper et al. 1999, Copeland 1978, DeVelice 1992, Faber-Langendoen et al. 2017b, Kagan 1987c, Mayfield and Kjelmyr 1984, Reid et al. 1994

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G273. Central Rocky Mountain Lower Montane, Foothill & Valley Grassland

A3986. Festuca campestris - Festuca idahoensis Mesic Grassland Alliance

Type Concept Sentence: Vegetation of this mesic grassland alliance is characterized by herbaceous cover ranging from 60-100% codominated by diagnostic perennial bunchgrasses *Festuca campestris* and *Festuca idahoensis*. It occurs in the northwestern Great Plains west into the central Rocky Mountains, including the Blue Mountains of eastern Oregon and Washington. Some stands may extend up to montane and subalpine elevations.

OVERVIEW

Scientific Name: *Festuca campestris - Festuca idahoensis* Mesic Grassland Alliance
Common Name (Translated Scientific Name): Rough Fescue - Idaho Fescue Mesic Grassland Alliance
Colloquial Name: Rough Fescue - Idaho Fescue Mesic Grassland

Type Concept: Vegetation of this mesic grassland alliance is characterized by herbaceous cover ranging from 60-100% dominated by diagnostic perennial bunchgrasses *Festuca campestris* with *Festuca idahoensis* often codominant. *Achnatherum richardsonii (= Stipa richardsonii), Carex obtusata*, or *Geranium viscosissimum* may also codominate the herbaceous layer. Occasional shrubs can be present, are generally low in stature (<0.5 m) and cover (<10% total) and include *Artemisia frigida, Artemisia tridentata ssp. vaseyana, Gutierrezia sarothrae, Juniperus communis, Juniperus horizontalis, Rosa arkansana, Rosa woodsii*, and *Symphoricarpos albus*. *Arctostaphylos uva-ursi* or *Dasiphora fruticosa ssp. floribunda* are typically absent or have low cover (<5%). Other abundant graminoid species include *Carex filifolia, Danthonia intermedia*, and *Koeleria macrantha*, with *Bouteloua gracilis, Muhlenbergia cuspidata*, and *Hesperostipa comata* being more common on prairie sites. Forb species typically present include *Achillea millefolium, Agoseris glauca, Antennaria rosea, Eriogonum umbellatum, Galium boreale, Geum triflorum, Hedysarum sulphurescens, Heterotheca villosa, Liatris punctata, Lupinus sericeus, Oxytropis sericea, Packera cana (= Senecio canus), Penstemon confertus, Sedum lanceolatum*, and *Zigadenus elegans*. This alliance occurs in the northwestern Great Plains west into the central Rocky Mountains, including the Blue Mountains of eastern Oregon and Washington. Stands occur in glaciated landscapes, on prairies, foothills and mountain slopes. Elevations range from 500-2100 m, but are found only below 1500 m in Canada. Some stands may extend up to montane and subalpine elevations. It occurs on mesic sites on any aspect, becoming restricted to west- and southwest-facing slopes farther north. Slopes vary from flat to gentle toeslopes and lowslopes, generally less than 30%. Soils are loamy and moderately deep on a variety of soil parent materials.

Classification Comments: *Festuca campestris* is generally recognized as part of the *Festuca scabrella* complex which includes two other species, *Festuca altaica* and *Festuca hallii* (Aiken and Darbyshire 1996, Aiken et al. 1996). *Festuca campestris* is thought to occur as far east as the western edge of the Great Plains. The other two species occur in the northern Great Plains of Saskatchewan and Manitoba, Canada, and likely North Dakota. The range of *Festuca altaica* extends north to Alaska. Further investigation is needed to confirm the distribution of the species in the *Festuca altaica* complex.

Tisdale (1947) described an "Upper Grassland" from British Columbia, Canada, that closely resembles *Festuca campestris - Pseudoroegneria spicata* Grassland (CEGL001629). Looman (1969) reported *Festuca altaica* grasslands occurring across southwestern Canada from British Columbia to western Manitoba. Although it is likely stands in eastern Saskatchewan and Manitoba are dominated by *Festuca hallii*, the stands in British Columbia, Alberta and western Saskatchewan may be dominated by *Festuca campestris*.

Internal Comments: KAS 2-14: With *Arctostaphylos uva-ursi / Festuca* spp. - *Pseudoroegneria spicata* Dwarf-shrub Herbaceous Alliance (A3989) being defined broadly to include 5% or more cover of *Arctostaphylos uva-ursi*.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: This mesic grassland alliance is characterized by herbaceous cover ranging from 60-100% codominated by diagnostic perennial bunch grasses *Festuca campestris* and *Festuca idahoensis*. *Achnatherum richardsonii, Carex obtusata*, or *Geranium viscosissimum* may codominant. Other graminoid associates include *Carex filifolia, Danthonia intermedia*, and *Koeleria macrantha*. Forb species typically present include *Achillea millefolium, Agoseris glauca, Anemone multifida, Antennaria parvifolia, Antennaria rosea, Campanula rotundifolia, Eriogonum umbellatum, Galium boreale, Geum triflorum, Hedysarum sulphurescens, Lomatium triternatum, Lupinus sericeus, Oxytropis sericea, Packera cana, Penstemon confertus, Sedum lanceolatum*, and *Zigadenus elegans*. Scattered shrubs such as *Artemisia frigida, Artemisia tridentata ssp. vaseyana, Artemisia frigida, Gutierrezia sarothrae, Juniperus communis, Juniperus horizontalis, Rosa acicularis, Rosa arkansana, Rosa woodsii*, and *Symphoricarpos albus* may be present with low cover (<10% total). If *Arctostaphylos uva-ursi* is present, then cover is <5%.

VEGETATION

Physiognomy and Structure: Vegetation in this alliance is characterized by a moderate to dense cover of graminoids that is dominated by perennial bunch grasses. There is also sparse to moderate cover of perennial forbs. Annual forbs and grasses are seasonally present.

Floristics: Stands have a moderate to dense graminoid layer of cool-season, medium-tall bunchgrasses that is dominated by *Festuca campestris* sometimes with culms that may be taller than 75 cm. Codominants may include *Achnatherum richardsonii, Festuca idahoensis* or *Geranium viscosissimum*. *Carex obtusata* may be common, especially on more mesic sites. *Festuca campestris* is usually less abundant on disturbed sites. The forb layer is sparse to moderately dense, often with relatively high species diversity. Scattered woody species may also be present. Annuals are typically sparse. Overall species composition varies with geography with stands east of the Continental Divide resembling Northern Mixed Prairie and stands west of the divide floristically related to the Intermountain Basin. The east side stands may lack *Festuca idahoensis*, but often include grasses *Bouteloua gracilis, Hesperostipa comata (= Stipa comata), Muhlenbergia cuspidata*; forbs *Artemisia ludoviciana, Heterotheca villosa, Liatris punctata, Lomatium triternatum*; and the dwarf-shrubs *Artemisia frigida* and *Gutierrezia sarothrae*. West of the divide, forbs *Balsamorhiza sagittata, Besseya wyomingensis, Castilleja lutescens*, and *Lomatium triternatum* are more common. Other rangewide associate species include graminoids *Achnatherum nelsonii, Achnatherum occidentale (= Stipa occidentalis), Carex filifolia, Calamagrostis rubescens, Carex petasata, Danthonia intermedia, Koeleria macrantha, Poa secunda*, and *Pseudoroegneria spicata*, and forbs *Achillea millefolium, Antennaria rosea, Castilleja rhexiifolia, Eriogonum umbellatum, Galium boreale, Geum triflorum, Lupinus sericeus, Penstemon confertus, Potentilla gracilis, Potentilla glandulosa*, and *Selaginella densa*. Total shrub cover is usually less than 10%. Shrub species that may be present include *Amelanchier alnifolia, Artemisia campestris, Artemisia frigida, Rosa arkansana*, and *Symphoricarpos albus*. If *Arctostaphylos uva-ursi* is present, then cover is <5%.

ENVIRONMENT & DYNAMICS

Environmental Description: This mesic grassland alliance occurs in the northwestern Great Plains west into the central Rocky Mountains, including the Blue Mountains of eastern Oregon and Washington. Elevations range from 500-2100 m, but are found only below 1500 m in Canada. Climate is temperate, and mean annual precipitation ranges from 40-60 cm. Winters are cold and snowy. Summers are cool. Stands occur in glaciated landscapes, on prairies, foothills and mountain slopes. Sites are mesic, mostly flat to gentle toeslopes and lowslopes on any aspect, but may include steep slopes. In the northern extent it is restricted to warmer west- and southwest-facing slopes. Soils are loamy and moderately deep on a variety of soil parent materials (Mueggler and Stewart 1980). In Glacier National Park, soils are moderately well-drained sandy loams, silt loams or sandy clay loams with neutral pH. Parent material is coarse quartzite and argillite developed on morainal and glacio-fluvial landforms. Litter dominates the ground surface. Bare soil ranges from 5 to 70% cover, and rock and litter is generally less than 40% combined cover. Higher elevation grasslands typically occur in a mosaic with montane forests dominated by *Pinus contorta*.

Dynamics: *Festuca campestris* is highly palatable throughout the grazing season. Summer overgrazing for 2-3 years can result in the loss of *Festuca campestris* in the stand (Hodgkinson and Young 1973). Although a light stocking rate for 32 years did not affect range condition, a modest increase in stocking rate led to a marked decline in range condition. The major change was a measurable reduction in basal area of *Festuca campestris* (Willms et al. 1985). Long-term heavy grazing on moister sites can result in a shift to a Kentucky bluegrass - timothy type (Willoughby 1997). Willms and Fraser (1992) found *Festuca campestris* to be highly susceptible to grazing during the growing season, and conclude that optimum management would include dormant-season grazing. Mueggler and Stewart (1980) also suggest that *Festuca campestris* is least susceptible to grazing damage in fall and winter. Primary increasers include *Artemisia frigida, Antennaria rosea, Cerastium arvense*, and *Heterotheca villosa*. *Festuca campestris* and *Festuca idahoensis* decrease in cover and vigor with grazing (Mueggler and Stewart 1980).

Festuca campestris is well-adapted to periodic burning. Burn intervals of 5-10 years have been recommended for *Festuca* maintenance. Two to three years are needed to recover from a burn, so short fire-return intervals impede *Festuca* re-establishment. Longer intervals result in excessive litter build-up that causes high tussock mortality. Growing-season burns reduce plant vigor and recovery takes longer. Floral development is initiated in the fall, so spring burning can result in a reduction in seed production (FEIS 1998). *Festuca idahoensis* is also highly palatable in most seasons, but can withstand occasional heavy grazing. It is "a fire-sensitive species that can be severely damaged by summer and fall fires," and may take many years to recover its pre-fire cover (FEIS 1998). The size of clumps affects fire sensitivity, with smaller ones being less sensitive due to lower fuel build-up. Late summer (August) burns cause more damage than fall (September) burns (FEIS 1998). *Pseudoroegneria spicata* shows an inconsistent reaction to grazing, increasing on some grazed sites while decreasing on others. It seems to recover more quickly from overgrazing than *Festuca campestris* (Mueggler and Stewart 1980). It tolerates dormant-period grazing well, but is sensitive to defoliation during the growing season. Light spring use or fall grazing can help retain plant vigor. Plants usually survive fire, but regrowth may be variable. It is particularly sensitive to defoliation in late spring (FEIS 1998).

DISTRIBUTION

Geographic Range: This mesic grassland alliance occurs in the northwestern Great Plains and montane and foothill slopes in the central Rocky Mountains, including Montana, western Saskatchewan and southern Alberta, southwest to the Blue Mountains of eastern Oregon and Washington. A disjunct occurrence is reported for the Steens Mountains in southeastern Oregon. The alliance likely occurs in British Columbia, but has not yet been described from there.

Nations: CA, US

States/Provinces: AB, BC?, ID, MT, OR, SK, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** *Festuca campestris* Herbaceous Alliance (Bourgeron and Engelking 1994)
- **>** *Festuca idahoensis* Series (Tisdale 1986)
- **?** *Festuca idahoensis* Series (Johnston 1987) [includes thirteen *Festuca idahoensis*-dominated plant associations.]
- **>** Fescue Grassland (Coupland 1952)
- **>** Fescue Prairie (Coupland 1992b)
- **?** Upper Grassland (Tisdale 1947)

LOWER LEVEL UNITS

Associations:

- CEGL001629 *Festuca campestris - Pseudoroegneria spicata* Grassland
- CEGL005875 *Festuca campestris - Festuca idahoensis* Grassland
- CEGL001627 *Festuca campestris* Grassland
- CEGL005870 *Festuca campestris - Festuca idahoensis - Geranium viscosissimum* Grassland
- CEGL005869 *Festuca campestris - (Festuca idahoensis) - Achnatherum richardsonii* Grassland

AUTHORSHIP

Primary Concept Source: P.S. Bourgeron and L.D. Engelking (1994)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by J. Drake.
Version Date: 2014/03/14

REFERENCES

References: Aiken and Darbyshire 1990, Aiken et al. 1996, Bamberg and Major 1968, Bourgeron and Engelking 1994, Caicco 1983, Chappell et al. 1997, Comer et al. 1999, Cooper and Lesica 1992, Cooper et al. 1995, Cooper et al. 1997, Coupland 1952, Coupland 1992b, Crawford et al. 1994, Daubenmire 1970, Daubenmire 1992, DeVelice and Lesica 1993, Evans et al. 1984, FEIS 1998, Faber-Langendoen et al. 2017b, Franklin and Dyrness 1973, Harrington 1978, Hess 1981, Hess and Wasser 1982, Hodgkinson and Young 1973, Hop et al. 2007, Johnson and Clausnitzer 1992, Johnson and Simon 1985, Johnson and Simon 1987, Johnston 1987, Lang 1961, Looman 1969, Macdonald 1989, Magee 1985, McLean 1970, Mueggler and Stewart 1980, Paulsen 1969, Pfister et al. 1977, Poulton 1955, Reid et al. 1994, Reid et al. 2004, Tisdale 1947, Tisdale 1982, Tisdale 1986, Tisdale and Bramble-Brodahl 1983, Tisdale and McLean 1957, Turner and Dortignac 1954, WNHP unpubl. data, Willms and Fraser 1992, Willms et al. 1985, Willoughby 1997

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G273. Central Rocky Mountain Lower Montane, Foothill & Valley Grassland

A3988. Festuca idahoensis - Pseudoroegneria spicata - Pascopyrum smithii Mesic Grassland Alliance

Type Concept Sentence: This mesic grassland association is characterized by an open to moderately dense herbaceous layer dominated by diagnostic perennial grass *Festuca idahoensis* or *Pseudoroegneria spicata* with mesic-site indicator species *Bromus marginatus, Elymus lanceolatus, Koeleria macrantha*, or *Pascopyrum smithii* and is found primarily east of the Continental Divide in foothills in northwestern Montana.

OVERVIEW

Scientific Name: *Festuca idahoensis - Pseudoroegneria spicata - Pascopyrum smithii* Mesic Grassland Alliance
Common Name (Translated Scientific Name): Idaho Fescue - Bluebunch Wheatgrass - Western Wheatgrass Mesic Grassland Alliance
Colloquial Name: Idaho Fescue - Wheatgrass Mesic Grassland

Type Concept: This alliance is composed of mesic to subhygric, diverse grasslands characterized by a lush meadow dominated by diagnostic perennial grasses *Festuca idahoensis* and/or *Pseudoroegneria spicata*. Mesic indicator species *Bromus marginatus, Elymus lanceolatus, Koeleria macrantha*, or *Pascopyrum smithii* are present to codominant in the graminoid layer. The short shrubs *Symphoricarpos albus, Rosa nutkana*, or *Rosa woodsii* are frequently present and may form an open layer or scattered clumps, usually with less than a quarter of the bunchgrass cover. *Artemisia frigida* is common in eastern stands. Other grass associates include *Poa cusickii* and *Poa secunda (= Poa sandbergii)*. The forb component has high species diversity and less cover than

graminoids. Non-native grasses *Bromus briziformis, Phleum pratense*, and *Poa palustris* are important in some stands. The biological crust is very well-developed on undisturbed sites. This alliance found in the central Rocky Mountains from the Palouse region and Blue Mountains to the foothills east of the Continental Divide in northwestern and Montana and Alberta. Stands occur on gentle to steep slopes at 370 to 2015 m elevation from sites on the dissected basalt plateaus, canyon and mountain slopes of the lower Snake River drainage and on the eastern flanks of the Blue Mountains on relatively deep loessal soils that overlay basalt rock or colluvium. Stands range northeast to east of the Continental Divide on gentle slopes at elevations from 1200-1800 m, but may be found up to 2400 m on moderately deep, moderately well-drained, coarse-textured soils. Litter and small rock dominate the ground surface. Stands typically occur where moisture is available well into summer drought because of cool aspect or subsurface seepage.

Classification Comments: These three relatively mesic *Festuca idahoensis*- and *Pseudoroegneria spicata*-dominated associations are grouped into this central Rocky Mountain grassland alliance. More vegetation survey and classification work are needed to clarify the extent of its component associations. *Bromus marginatus - Pseudoroegneria spicata* Grassland (CEGL005861) occurs in subalpine Alberta and may be better classified in Central Rocky Mountain Montane Grassland Group (G267).

Internal Comments: KAS 2-14: There are mixed reports on distribution of *Festuca idahoensis - Symphoricarpos albus* Herbaceous Vegetation (CEGL001509). Some claim it occurs in Wyoming, others claim it is restricted to the Palouse region of Washington and Idaho or the central third of Bailey's section 331A. It has been eliminated from adjacent areas of Oregon and Idaho.
Other Comments:

Similar NVC Types:
- A3987 *Festuca idahoensis - Pseudoroegneria spicata - Poa secunda* Dry Grassland Alliance: occurs on drier sites.

Diagnostic Characteristics: This alliance is characterized by an open to moderately dense herbaceous layer dominated by diagnostic perennial grass *Festuca idahoensis* or *Pseudoroegneria spicata*. Mesic-site indicator species *Bromus marginatus, Elymus lanceolatus, Koeleria macrantha*, or *Pascopyrum smithii* are present to codominant. The short shrubs *Symphoricarpos albus, Rosa nutkana*, or *Rosa woodsii* are frequently present and may form an open shrub layer. Forbs have high diversity and typically low cover. Associated forb species include *Achillea millefolium, Antennaria rosea, Aquilegia flavescens, Artemisia frigida, Balsamorhiza sagittata, Clarkia pulchella, Erigeron peregrinus, Fragaria virginiana, Gaillardia aristata, Galium boreale, Geranium viscosissimum, Hedysarum sulphurescens, Koeleria macrantha, Lithospermum ruderale, Lupinus sericeus, Phlox hoodii, Poa cusickii, Poa secunda, Thalictrum occidentale*, and *Zigadenus elegans*.

VEGETATION

Physiognomy and Structure: Vegetation in this alliance is characterized by a moderate to dense cover of graminoids that is dominated by perennial bunch grasses less than 1 m tall. There is also sparse to moderate cover of perennial forbs. Annual forbs and grasses are seasonally present and may be abundant. Occasional scattered deciduous shrubs and dwarf-shrubs may be present and sometimes form an open layer.

Floristics: Vegetation in this alliance is characterized by a lush meadow with a moderate to dense herbaceous layer dominated by diagnostic perennial grasses *Festuca idahoensis* and/or *Pseudoroegneria spicata*. *Bromus marginatus, Elymus lanceolatus, Koeleria macrantha*, or *Pascopyrum smithii* frequently codominate the graminoid layer on these sites and are indicative of more mesic environments. The short shrubs *Symphoricarpos albus, Rosa nutkana*, or *Rosa woodsii* are frequently present and may form an open layer or scattered clumps, usually with less than a quarter of the bunchgrass cover. *Artemisia frigida* is common in eastern stands. Other grass associates include *Poa cusickii* and *Poa secunda (= Poa sandbergii)*. Non-native grasses *Bromus briziformis, Phleum pratense*, and *Poa palustris* are important in some stands. Graminoids are far more abundant than shrubs and forbs. Forbs species are often diverse, and are present to abundant. The most prominent forbs are *Achillea millefolium, Anemone multifida, Antennaria rosea, Aquilegia flavescens, Arnica sororia, Balsamorhiza sagittata, Calochortus apiculatus, Castilleja hispida, Clarkia pulchella, Erigeron peregrinus, Eurybia conspicua (= Aster conspicuus), Fragaria virginiana, Frasera albicaulis, Gaillardia aristata, Galium boreale, Geranium viscosissimum, Hedysarum sulphurescens, Hieracium scouleri var. albertinum (= Hieracium albertinum), Lithospermum ruderale, Lomatium triternatum, Lupinus sericeus, Osmorhiza occidentalis, Phlox hoodii, Thalictrum occidentale, Triteleia grandiflora var. grandiflora (= Brodiaea douglasii), Valeriana dioica*, and *Zigadenus elegans*. The biological crust is very well-developed on undisturbed sites. Grazing reduces the cover of the native perennial grasses. Reduction or elimination of grazing does not appear to restore the native perennial grasses. Other species invading grazed stands include *Lagophylla ramosissima, Myosurus apetalus var. borealis (= Myosurus aristatus), Sanguisorba annua (= Sanguisorba occidentalis)*, and *Veronica arvensis*.

ENVIRONMENT & DYNAMICS

Environmental Description: This is a mesic to subhygric, diverse grassland found in the central Rocky Mountains from the Palouse region and Blue Mountains to the northeast in foothills on the east slope of the Continental Divide in northwestern and Montana and Alberta. Stands occur on gentle to steep, northwest- to northeast-facing slopes at 370 to 2015 m elevation from sites on the dissected basalt plateaus, biscuit-and-swale (mound) formations, and high- and low-elevation canyon and mountain slopes of the

lower Snake River drainage and on the eastern flanks and in the rainshadow of the Blue Mountains on relatively deep loessal soils that overlay basalt rock or colluvium. (Daubenmire 1970). Stands range to east of the Continental Divide on gentle slopes at elevations from 1200-1800 m, but may be found up to 2400 m on moderately deep, moderately well-drained, coarse-textured soils developed on morainal or soils derived from sedimentary rock (Reid et al. 2004). Litter and small rock dominate the ground surface. Stands typically occur where moisture is available well into summer drought because of cool aspect or subsurface seepage.

Dynamics: Fire has variable effects on bunch grasses *Pseudoroegneria spicata* and *Festuca idahoensis*. Plants usually survive burning, and growth is often stimulated, except when fire occurs in the driest month when the crowns will burn because of low moisture in the vegetation, and the meristems are damaged (Johnson and Simon 1987). Grazing impacts are concentrated on the gentler slopes accessible to livestock. *Pseudoroegneria spicata* shows an inconsistent reaction to grazing, increasing on some grazed sites while decreasing on others. It seems to recover more quickly from overgrazing than *Festuca campestris* (Mueggler and Stewart 1980). It tolerates dormant-period grazing well, but is sensitive to defoliation during the growing season. Light spring use or fall grazing can help retain plant vigor. It is particularly sensitive to defoliation in late spring (Comer et al. 1999). The exotic species *Bromus tectorum* occurs in many stands of the alliance and contributes significant cover on sites disturbed by livestock.

DISTRIBUTION

Geographic Range: This mesic grassland alliance is found in the central Rocky Mountains from the Palouse region and Blue Mountains in eastern Oregon, southwestern Washington, and Idaho to the foothills east of the Continental Divide in northwestern and Montana and Alberta.

Nations: CA, US
States/Provinces: AB, ID, MT, OR, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **><** *Festuca idahoensis* Series (Tisdale 1986)
- **>** Idaho Fescue Series (Sawyer and Keeler-Wolf 1995)

LOWER LEVEL UNITS

Associations:
- CEGL005653 *Pascopyrum smithii* Central Rocky Mountain Grassland
- CEGL001621 *Festuca idahoensis - Pascopyrum smithii* Grassland
- CEGL005654 *Pascopyrum smithii* Southern Rocky Mountain Grassland
- CEGL001626 *Rosa nutkana - Festuca idahoensis* Grassland
- CEGL005861 *Bromus marginatus - Pseudoroegneria spicata* Grassland
- CEGL001509 *Festuca idahoensis - Symphoricarpos albus* Grassland
- CEGL001620 *Festuca idahoensis - Koeleria macrantha* Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Anderson 1956, Bighorn Coal Mine n.d., Caicco 1983, Chappell et al. 1997, Cooper and Lesica 1992, Cooper et al. 1995, Cooper et al. 1997, Cotter-Ferguson Project n.d., Crawford et al. 1994, Daubenmire 1970, Daubenmire 1992, DeVelice 1992, DeVelice and Lesica 1993, DeVelice et al. 1995, Despain 1973a, Evans et al. 1984, Faber-Langendoen et al. 2017b, Fisser et al. 1965, Ganskopp 1979, Hall 1973, Hansen 1985, Hansen and Hoffman 1988, Hansen et al. 1988a, Harrington 1978, Hurd 1961, Hyde 1964, Johnson and Clausnitzer 1992, Johnson and Simon 1985, Johnson and Simon 1987, Lang 1961, Lesica and DeVelice 1992, Lewis 1971, MTNHP unpubl. data, Macdonald 1989, Magee 1985, Mattson 1984, McLean 1970, Mueggler and Stewart 1980, Paulsen 1969, Poulton 1955, Price and Brotherson 1987, Prodgers 1978, Reid et al. 1994, Ross et al. 1973, Sawyer and Keeler-Wolf 1995, Tisdale 1947, Tisdale 1979, Tisdale 1986, Tisdale and Bramble-Brodahl 1983, Turner and Dortignac 1954, Tweit and Houston 1980, WNHP unpubl. data, Ward and Keith 1962, Williams 1961

2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G273. Central Rocky Mountain Lower Montane, Foothill & Valley Grassland

A3987. Festuca idahoensis - Pseudoroegneria spicata - Poa secunda Dry Grassland Alliance

Type Concept Sentence: This widespread dry grassland alliance is characterized by an open to moderately dense herbaceous layer dominated by diagnostic perennial bunchgrasses *Festuca idahoensis, Pseudoroegneria spicata*, and/or *Poa secunda* and occurs in the northwestern Great Plains, central Rocky Mountains and interior Pacific Northwest.

OVERVIEW

Scientific Name: *Festuca idahoensis - Pseudoroegneria spicata - Poa secunda* Dry Grassland Alliance
Common Name (Translated Scientific Name): Idaho Fescue - Bluebunch Wheatgrass - Sandberg Bluegrass Dry Grassland Alliance
Colloquial Name: Idaho Fescue - Bluebunch Wheatgrass - Sandberg Bluegrass Dry Grassland

Type Concept: Vegetation of this dry grassland alliance is characterized by an open to moderately dense herbaceous layer dominated by diagnostic perennial bunchgrasses *Festuca idahoensis, Pseudoroegneria spicata*, and/or *Poa secunda*. *Balsamorhiza sagittata, Balsamorhiza serrata, Carex filifolia, Eriogonum heracleoides, Hesperostipa comata, Hieracium cynoglossoides*, or *Lomatium cous* may codominate the herbaceous layer. Scattered shrubs may be present, are generally low in stature (<0.5 m) and cover (<5%) and include browsed *Amelanchier alnifolia, Artemisia frigida, Artemisia tridentata, Chrysothamnus viscidiflorus, Ericameria nauseosa, Gutierrezia sarothrae, Juniperus communis*, and *Juniperus horizontalis*. Other common graminoid species include *Achnatherum occidentale (= Stipa occidentalis), Danthonia intermedia, Leymus cinereus (= Elymus cinereus)*, and *Poa cusickii*. Forb species are typically diverse with low cover. This widespread dry grassland alliance occurs in the northwestern Great Plains, central Rocky Mountains and interior Pacific Northwest. Stands are found on relatively dry valley bottoms, stream terraces, rolling uplands, canyon benches and slopes, hills, ridges, plateaus and buttes, badlands, foothills, expansive park meadow openings in montane forests, and glacial outwash plains. Elevation ranges from 200-2500 m on any aspect, becoming restricted to west- and southwest-facing slopes farther north. Substrates are variable and range from shallow and lithic soils with a rocky surface of gravel, cobbles or scoria, to moderately deep soils with little rock.

Classification Comments: This alliance includes most of the associations from former *Pseudoroegneria spicata* Herbaceous Alliance (A.1265), former *Poa secunda* Herbaceous Alliance (A.1291), and selected drier site associations from former *Festuca idahoensis* Herbaceous Alliance (A.1251). Some of the associations are variable or not well-defined environmentally and need further review for alliance placement.

Internal Comments:
Other Comments:

Similar NVC Types:
- A3988 *Festuca idahoensis - Pseudoroegneria spicata - Pascopyrum smithii* Mesic Grassland Alliance: is typical on relatively dry sites.

Diagnostic Characteristics: This alliance is characterized by an open to moderately dense herbaceous layer dominated by diagnostic perennial bunch grasses *Festuca idahoensis, Pseudoroegneria spicata*, and/or *Poa secunda*. Additional diagnostic species include *Balsamorhiza sagittata, Balsamorhiza serrata, Carex filifolia, Eriogonum heracleoides, Hesperostipa comata, Hieracium cynoglossoides*, or *Lomatium cous*, which may codominate the herbaceous layer and indicate relatively dry sites.

VEGETATION

Physiognomy and Structure: Vegetation in this alliance is characterized by a sparse to dense cover of graminoids that is dominated by perennial bunch grasses less than 1 m tall. There is also sparse to moderate cover of perennial forbs. Occasional scattered shrubs and dwarf-shrubs may be present. Annual forbs and grasses are seasonally present.

Floristics: Vegetation is characterized by an open to moderately dense herbaceous layer dominated by diagnostic perennial bunchgrasses *Festuca idahoensis, Pseudoroegneria spicata*, and/or *Poa secunda*. *Balsamorhiza sagittata, Balsamorhiza serrata, Carex filifolia, Eriogonum heracleoides, Hesperostipa comata, Hieracium cynoglossoides*, or *Lomatium cous* may codominate the herbaceous layer. Scattered shrubs present are generally low in stature (<0.5 m) and cover (<5%) and include browsed *Amelanchier alnifolia, Artemisia frigida, Artemisia tridentata, Chrysothamnus viscidiflorus, Ericameria nauseosa, Gutierrezia sarothrae, Juniperus communis*, and *Juniperus horizontalis*. Other common graminoid species include *Achnatherum occidentale (= Stipa occidentalis), Danthonia intermedia, Leymus cinereus (= Elymus cinereus)*, and *Poa cusickii*. Forb species typically present include *Achillea millefolium, Antennaria rosea, Arenaria congesta, Campanula rotundifolia, Erigeron corymbosus, Eriogonum umbellatum, Frasera*

albicaulis, Galium boreale, Geum triflorum, Hedysarum sulphurescens, Lithophragma glabrum (= Lithophragma bulbiferum), Lomatium bicolor var. leptocarpum, Lupinus caudatus, Lupinus sericeus, Phlox hoodii, Phlox longifolia, and *Trifolium macrocephalum*.

ENVIRONMENT & DYNAMICS

Environmental Description: This widespread western dry grassland alliance occurs in the northwestern Great Plains, foothills and montane zones in the central Rocky Mountains from northwestern Montana, extending north into Alberta, west across the interior Pacific Northwest to the foothills of the eastern Cascades, and south to the Grand Teton Mountains of northwestern Wyoming, and ranges in northern Utah, Nevada and northeastern California. It occurs on dry sites on any aspect from 200-2500 m elevation depending on region, becoming restricted to warmer southerly and westerly aspects at higher elevations and northern latitudes. Climate is temperate and mostly continental. Mean annual precipitation ranges from 33-60 cm. Season of precipitation varies geographically. In the Columbia Basin precipitation comes mainly in the winter as snow or rain. This moisture is stored in the soil profile and utilized throughout the typically dry summers. Stands in the Rocky Mountains and northwestern Great Plains may receive up to 75% of the annual precipitation during the growing season. Stands are found on valley bottoms, stream terraces, rolling uplands, canyon benches and slopes, hills, ridges, plateaus and buttes, badlands, foothills, expansive park meadow openings in montane forests, and glacial outwash plains. Sites may be xeric or mesic, on nearly level to steep slopes. The alliance occurs on all aspects, but often on the drier southern and western slopes. Substrates are also variable and range from shallow and lithic soils with a rocky surface of gravel, cobbles or scoria, to moderately deep soils with little rock. Soils are moderately to well-drained, sometimes calcareous, with pH of 6.8-7.7. Soil texture ranges from gravelly, sandy loams to clay. Parent material may include alluvium, colluvium, residuum, glacial deposits or loess derived from lava, basalt, granite, quartz diorite, calcareous sandstone, limestone, acid shale, bentonite, marlstone and other volcanic materials. Litter, moss and lichen are important ground cover in some stands.

Dynamics: Fire has variable effects on *Pseudoroegneria spicata*. Plants usually survive burning, and growth is often stimulated, except when fire occurs in the driest month when the crowns will burn because of low moisture in the vegetation, and the meristems are damaged (Johnson and Simon 1987). Grazing impacts are concentrated on the gentler slopes accessible to livestock. *Pseudoroegneria spicata* shows an inconsistent reaction to grazing, increasing on some grazed sites while decreasing on others. It seems to recover more quickly from overgrazing than *Festuca campestris* (Mueggler and Stewart 1980). It tolerates dormant-period grazing well, but is sensitive to defoliation during the growing season. Light spring use or fall grazing can help retain plant vigor. It is particularly sensitive to defoliation in late spring (Comer et al. 1999). The exotic species *Bromus tectorum* occurs in many stands of the alliance and contributes significant cover on sites disturbed by livestock.

DISTRIBUTION

Geographic Range: This widespread dry grassland alliance occurs in the northwestern Great Plains and mountain and foothill slopes on both sides of the Continental Divide in the Central Rockies in northwestern Montana, extending north into the montane zone of Alberta, west into Idaho, and south to the Grand Teton Mountains of northwestern Wyoming. Stands also occur in the Okanogan Highlands of northeastern Washington and southern British Columbia and in the Columbia Basin of south-central Washington and north-central Oregon, extending west into the foothills of the eastern Cascades and east into foothills and canyon slopes of northeastern Oregon and western Idaho. It also occurs in northeastern California.

Nations: CA, US
States/Provinces: AB, BC, CA, ID, MT, NV, OR, UT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** *Agropyron spicatum* Series (Tisdale 1986)
- **>** *Agropyron spicatum* Series (Johnson and Simon 1987)
- **>** *Agropyron spicatum* Series (Tweit and Houston 1980)
- **><** *Festuca idahoensis* (Idaho fescue grassland) Alliance (Sawyer et al. 2009) [41.250.00]
- **>** *Pseudoroegneria spicata* (Bluebunch wheat grass grassland) Alliance (Sawyer et al. 2009) [41.040.00]
- **>** *Pseudoroegneria spicata* Grasslands (Chappell et al. 1997)
- **>** Bluebunch Wheatgrass Series (Sawyer and Keeler-Wolf 1995)
- **><** Idaho Fescue Series (Sawyer and Keeler-Wolf 1995)

LOWER LEVEL UNITS

Associations:

- CEGL001679 *Pseudoroegneria spicata - Hesperostipa comata* Grassland

- CEGL001665 *Pseudoroegneria spicata - Carex filifolia* Grassland
- CEGL001624 *Festuca idahoensis - Pseudoroegneria spicata* Grassland
- CEGL001619 *Festuca idahoensis - Hieracium cynoglossoides* Grassland
- CEGL001678 *Pseudoroegneria spicata - Poa secunda* Lithosolic Grassland
- CEGL005609 *Pseudoroegneria spicata - Crepis acuminata* Grassland
- CEGL001662 *Pseudoroegneria spicata - Balsamorhiza sagittata - Poa secunda* Grassland
- CEGL001782 *(Balsamorhiza serrata) - Poa secunda* Grassland
- CEGL001669 *Pseudoroegneria spicata - Festuca idahoensis* Canyon Grassland
- CEGL005607 *Pseudoroegneria spicata - Melica bulbosa* Grassland
- CEGL001616 *Festuca idahoensis - Eriogonum heracleoides* Grassland
- CEGL001668 *Pseudoroegneria spicata - Eriogonum heracleoides* Grassland
- CEGL001677 *Pseudoroegneria spicata - Poa secunda* Grassland
- CEGL001790 *Lomatium cous - Poa secunda* Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Chappell et al. 1997, Faber-Langendoen et al. 2017b, Johnson and Simon 1987, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Tisdale 1986, Tweit and Houston 1980

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G273. Central Rocky Mountain Lower Montane, Foothill & Valley Grassland

A3989. Festuca idahoensis - Pseudoroegneria spicata Palouse Grassland Alliance

Type Concept Sentence: This alliance is characterized by *Pseudoroegneria spicata, Festuca idahoensis*, and/or *Hesperostipa comata* dominating the midgrass layer and occurs in remnants of the Palouse Prairie of southeastern Washington, Oregon and Idaho.

OVERVIEW

Scientific Name: *Festuca idahoensis - Pseudoroegneria spicata* Palouse Grassland Alliance
Common Name (Translated Scientific Name): Idaho Fescue - Bluebunch Wheatgrass Palouse Grassland Alliance
Colloquial Name: Idaho Fescue - Bluebunch Wheatgrass Palouse Grassland

Type Concept: This alliance is characterized by medium-tall bunchgrasses *Pseudoroegneria spicata, Festuca idahoensis*, and/or *Hesperostipa comata* dominating the midgrass layer. Some stands have a short bunchgrass layer of *Poa secunda*. Broad-leaved herbs typically contribute little to the composition of individual sites but may include *Achillea millefolium var. occidentalis, Eriogonum heracleoides*, and *Lomatium* sp. Scattered *Ericameria* spp. (= *Chrysothamnus* spp.) shrubs can be present to abundant especially on disturbed sites. Annual grasses and forbs are common and can be diverse. In disturbed sites *Bromus tectorum* and *Plantago patagonica* are common. A diverse ground moss and lichen layer can cover much of the space between vascular plants, although it can be displaced with ground disturbance. This alliance occurs in remnants of the Palouse Prairie of southeastern Washington, Oregon and Idaho. Stands occur on ridgetops or on flat to concave surfaces on the middle or upper third of the slope between 1580-1935 m elevation. Slopes range from flat to 110%, and stands can be found on all aspects. This is an open to closed vegetation type with most of its total cover found in only the medium-tall bunchgrass lifeform.

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: This grassland alliance of the Palouse Prairie region is characterized by diagnostic species *Pseudoroegneria spicata, Festuca idahoensis*, and/or *Hesperostipa comata* dominating the midgrass layer. Associated species include *Achillea millefolium var. occidentalis* and *Eriogonum heracleoides*.

VEGETATION

Physiognomy and Structure: Vegetation in this alliance is characterized by a moderate to dense cover of graminoids that is dominated by perennial bunch grasses less than 1 m tall. There is also sparse to moderate cover of perennial forbs. Occasional scattered shrubs and dwarf-shrubs may be present. Annual forbs and grasses are seasonally present.

Floristics: This alliance is restricted to remnants of the Palouse Prairie. The vegetation is characterized by a moderately dense to dense graminoid layer dominated by medium-tall bunchgrasses *Pseudoroegneria spicata, Festuca idahoensis*, and/or *Hesperostipa comata* dominating the midgrass layer. Some stands have a short bunchgrass layer of *Poa secunda*. Species richness of perennial forbs can be low to high (up to 46 species), but their cover is generally less than 20%. Broad-leaved herbs typically contribute little to the composition of individual sites but may include *Achillea millefolium var. occidentalis, Calochortus macrocarpus, Eriogonum heracleoides, Lithophragma glabrum (= Lithophragma bulbiferum), Lomatium triternatum*, and annual *Plantago patagonica*. Scattered *Ericameria nauseosa (= Chrysothamnus nauseosus)* and *Chrysothamnus viscidiflorus* shrubs can be present to abundant especially on disturbed sites. Annual grasses and forbs are common and diverse, but many of them are non-native. Introduced annuals *Bromus tectorum, Draba verna, Holosteum umbellatum*, and *Sisymbrium altissimum* invade disturbed sites. *Bromus tectorum* can become permanently dominant in severely overgrazed stands. A diverse biological crust of moss and lichen can cover much of the space between vascular plants, although it can be displaced with ground disturbance.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance is restricted to remnants of the Palouse Prairie of southeastern Washington, Oregon and Idaho. The region is shrub-steppe, in the rainshadow of the Cascade Range, and too dry to support forest vegetation. The climate is characterized by moderately cold winters and warm to hot summers. Precipitation occurs primarily in the winter as rain and occasional snow. Elevations range from roughly 335-900 m (1100-2950 feet), and the slopes range from gentle to moderate. Stands occur on ridgetops or on flat to concave surfaces on the middle or upper third of the slope between 1580-1935 m elevation. Slopes range from flat to 110%, and stands can be found on all aspects. This is an open to closed vegetation type with most of its total cover found in only the medium-tall bunchgrass lifeform. In the Columbia Basin of southeastern Washington, it is primarily found in the *Pseudoroegneria - Poa* and *Pseudoroegneria - Festuca* zones of Daubenmire (1970). It occurs on sandy or gravelly soils, in some cases derived from strongly weathered volcanic ash. They are deep, coarse-textured and have low fertility. Additionally, sands and gravels have low moisture-holding capacity.

Dynamics: These grasslands are dominated by relatively deep-rooted grasses that use soil moisture below 0.5 m during the typically dry summers. The coarse-textured soils allow for rapid infiltration and storage of winter and summer precipitation (Kleiner 1968, Daubenmire 1970, Kleiner and Harper 1977, Thilenius et al. 1995). Fire has variable effects on *Pseudoroegneria spicata*. Plants usually survive burning, and growth is often stimulated, except when fire occurs in the driest month when the crowns will burn because of low moisture in the vegetation, and the meristems are damaged (Johnson and Simon 1987). However, burning generally kills or severely damages *Hesperostipa comata* plants. After fire, regeneration of this non-rhizomatous bunchgrass is through seed and may take many years to reach prefire densities (FEIS 1998).

Grazing impacts are concentrated on the gentler slopes accessible to livestock. *Pseudoroegneria spicata* shows an inconsistent reaction to grazing, increasing on some grazed sites while decreasing on others. It seems to recover more quickly from overgrazing than *Festuca campestris* (Mueggler and Stewart 1980). It tolerates dormant-period grazing well, but is sensitive to defoliation during the growing season. Light spring use or fall grazing can help retain plant vigor. It is particularly sensitive to defoliation in late spring (Comer et al. 1999).

The exotic species *Bromus tectorum, Draba verna, Lactuca serriola*, and *Tragopogon dubius* occur in many stands of the alliance and contribute significant cover on sites disturbed by livestock(Daubenmire 1970). The cool-season annual grass *Bromus tectorum* can be an effective competitor for winter soil moisture because it can germinate in the fall, overwinter, then begin regrowing in the early spring before it is warm enough for many perennial grasses, completing its lifecycle and depleting soil moisture before the dry summer weather begins. This annual species also produces abundant fine fuels that carry fire well and increase the frequency of fires (FEIS 1998).

DISTRIBUTION

Geographic Range: This alliance occurs in remnant stands in the Palouse Prairie of southeastern Washington, Oregon and Idaho. Much of the original extent has been converted to wheat fields.

Nations: CA, US
States/Provinces: ID, OR, WA
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **><** *Agropyron spicatum* Series (Tisdale 1986)
- **><** *Agropyron spicatum* Series (Johnson and Simon 1987)
- **><** *Pseudoroegneria spicata* Grasslands (Chappell et al. 1997)
- **=** Palouse prairie (Daubenmire 1992)

LOWER LEVEL UNITS

Associations:

- CEGL001670 *Pseudoroegneria spicata - Festuca idahoensis* Palouse Grassland
- CEGL001704 *Hesperostipa comata - Poa secunda* Grassland

AUTHORSHIP

Primary Concept Source: R.F. Daubenmire (1992)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Anderson 1956, Chappell et al. 1997, Daubenmire 1970, Daubenmire 1992, FEIS 1998, Faber-Langendoen et al. 2017b, Ganskopp 1979, Johnson and Clausnitzer 1992, Johnson and Simon 1985, Johnson and Simon 1987, Kleiner 1968, Kleiner 1983, Kleiner and Harper 1977, Mueggler and Stewart 1980, Poulton 1955, Price and Brotherson 1987, Prodgers 1978, Reid et al. 1994, Tisdale 1979, Tisdale 1986, Youtie 1990

M168. Rocky Mountain-Vancouverian Subalpine-High Montane Mesic Meadow

This macrogroup includes montane and subalpine mesic meadows from the Rocky Mountains west to the Sierra Nevada and eastern Cascades, and drier grasslands from the southern Rocky Mountains west in the high plateaus and ranges. Vegetation is composed of low (<1 m) open to dense perennial graminoid layer. Characteristic grassland species include *Danthonia intermedia, Danthonia parryi, Festuca arizonica, Festuca thurberi*, and *Muhlenbergia montana* in montane and subalpine grasslands in the southern Rocky Mountains. Dominant mesic meadow species include *Achillea millefolium, Carex spectabilis, Chamerion angustifolium, Erigeron speciosus, Lupinus latifolius, Senecio hydrophiloides, Senecio serra, Solidago canadensis, Symphyotrichum* spp., *Thalictrum occidentale*, and *Zigadenus elegans*.

2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
2.B.2.Na.3.a. M168 Rocky Mountain-Vancouverian Subalpine-High Montane Mesic Meadow

G268. Southern Rocky Mountain Montane-Subalpine Grassland

Type Concept Sentence: This southern Rocky Mountains grassland group typically occurs between 2200 and 3000 m elevation on flat to rolling plains and parks or on lower sideslopes that are dry, and is characterized by an open to dense perennial graminoid layer dominated by *Blepharoneuron tricholepis, Danthonia intermedia, Danthonia parryi, Festuca arizonica, Festuca idahoensis, Festuca thurberi, Muhlenbergia filiculmis, Muhlenbergia montana, Pascopyrum smithii*, or *Pseudoroegneria spicata*.

OVERVIEW

Scientific Name: *Festuca arizonica - Festuca thurberi - Muhlenbergia montana* Grassland Group
Common Name (Translated Scientific Name): Arizona Fescue - Thurber's Fescue - Mountain Muhly Grassland Group
Colloquial Name: Southern Rocky Mountain Montane Arizona Fescue - Muhly Grassland

Type Concept: This southern Rocky Mountains group extends west to high plateaus and mountains in the Colorado Plateau. Vegetation is characterized by an open to dense perennial graminoid layer. Larger occurrences usually consist of a mosaic of two or three plant associations with one of the following dominant grasses: *Blepharoneuron tricholepis, Danthonia parryi, Festuca arizonica, Muhlenbergia montana, Pascopyrum smithii*, or *Pseudoroegneria spicata* at lower elevation / warmer aspects, or *Danthonia intermedia, Festuca idahoensis, Festuca thurberi*, or *Muhlenbergia filiculmis* at subalpine elevation / cooler aspects. The common subdominants include *Bouteloua gracilis, Hesperostipa comata*, or *Poa secunda*. *Bouteloua gracilis* often dominates sites with warm aspects and heavy grazing history. Forb species such as *Potentilla hippiana* may be present to codominant. These large-patch grasslands are intermixed with matrix stands of spruce-fir, lodgepole pine, ponderosa pine, and aspen forests. In limited circumstances (e.g., South Park in Colorado), they form the "matrix" of high-elevation plateaus and inter-montane valleys. Stands typically occur between 2200 and 3000 m elevation on flat to rolling plains and parks or on lower sideslopes that are dry, but may

extend up to 3350 m on warm aspects. Soils resemble prairie soils in that the A-horizon is dark brown, relatively high in organic matter, slightly acidic, and usually well-drained. Small-patch representations of this group do occur at high elevations of the Trans-Pecos where they present as occurrences of *Festuca arizonica - Blepharoneuron tricholepis* Grassland (CEGL004508). These occurrences often occupy sites adjacent to Eastern Madrean Chaparral Group (G280).

Classification Comments: Montane grasslands are very similar and intergrade with their montane and subalpine counterparts. The transition of this group to Central Rocky Mountain Montane Grassland Group (G267) probably occurs somewhere in central Colorado or southern Wyoming. This Southern Rockies grassland group may co-occur with patches of the more mesic Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow Group (G271), which is distinguished by dominance of mesic forb and grass species such as *Deschampsia cespitosa* and *Mertensia ciliata*. *Pascopyrum smithii*-dominated grasslands tend to be restricted to mesic swales within drier upland types.

Similar NVC Types:
- G271 Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow
- G267 Central Rocky Mountain Montane Grassland

Diagnostic Characteristics: Vegetation is composed of an open to dense perennial graminoid layer that is generally less than 1 m tall. *Danthonia parryi, Festuca arizonica*, and *Muhlenbergia montana* are important species and typically dominate montane grasslands; *Danthonia intermedia* and *Festuca thurberi* are typical of subalpine grasslands in the southern Rocky Mountains. Other characteristic graminoid species that may be present to dominant include *Achnatherum lettermanii, Blepharoneuron tricholepis, Bouteloua gracilis, Carex duriuscula, Carex rossii, Carex siccata, Elymus lanceolatus, Festuca calligera, Festuca idahoensis, Hesperostipa comata, Muhlenbergia filiculmis, Poa fendleriana, Poa nervosa, Poa lettermanii*, and *Pseudoroegneria spicata*.

VEGETATION

Physiognomy and Structure: Vegetation is composed of an open to dense perennial graminoid layer that is generally less than 1 m tall. Forb cover is variable and may be present to codominant.

Floristics: Vegetation in this group is characterized by an open to dense perennial graminoid layer. Larger occurrences usually consist of a mosaic of two or three plant associations with one of the following dominant grasses: *Blepharoneuron tricholepis, Danthonia parryi, Festuca arizonica, Muhlenbergia montana, Pascopyrum smithii*, or *Pseudoroegneria spicata* at lower elevation / warmer aspects, or *Danthonia intermedia, Festuca idahoensis, Festuca thurberi*, or *Muhlenbergia filiculmis* at subalpine elevation / cooler aspects. Other characteristic graminoid species that may be present to dominant include *Achnatherum lettermanii, Blepharoneuron tricholepis, Bouteloua gracilis, Carex duriuscula, Carex rossii, Carex siccata, Elymus lanceolatus, Festuca calligera, Hesperostipa comata, Poa fendleriana, Poa nervosa*, and *Poa lettermanii*. The common subdominants include *Bouteloua gracilis, Hesperostipa comata*, or *Poa secunda*. *Bouteloua gracilis* often dominates sites with warm aspects and heavy grazing history. Forb species such as *Achillea millefolium, Castilleja* spp., *Erigeron simplex, Erigeron ursinus, Eriogonum umbellatum, Geranium viscosissimum, Hymenoxys richardsonii, Lathyrus lanszwertii, Oxytropis oreophila, Penstemon secundiflorus, Potentilla hippiana, Solidago multiradiata*, and *Symphyotrichum foliaceum (= Aster foliaceus)* may be present to codominant. In disturbed stands, species such as Heterotheca villosa may codominant. These large-patch grasslands are intermixed with matrix stands of spruce-fir, lodgepole pine, ponderosa pine, and aspen forests. In limited circumstances (e.g., South Park in Colorado), they form the "matrix" of high-elevation plateaus and inter-montane valleys. Small-patch representations of this group do occur at high elevations of the Trans-Pecos where they present as occurrences of *Festuca arizonica - Blepharoneuron tricholepis* Grassland (CEGL004508). These occurrences often occupy sites adjacent to Eastern Madrean Chaparral Group (G280).

ENVIRONMENT & DYNAMICS

Environmental Description: This Rocky Mountain grassland group typically occurs between 2200 and 3000 m elevation on flat to rolling plains and inter-montane parks or on lower sideslopes that are dry, but it may extend up to 3350 m on warm aspects. Soils resemble prairie soils in that the A-horizon is dark brown, relatively high in organic matter, slightly acidic, and usually well-drained.

Dynamics:

DISTRIBUTION

Geographic Range: This grassland group occurs between 2200 and 3000 m elevation in the southern Rocky Mountains and extends west to high plateaus and mountains in the Colorado Plateau.

Spatial Scale & Pattern [optional]: Large patch
Nations: US
States/Provinces: AZ, CO, NM, NV, SD, UT, WY
TNC Ecoregions [optional]: 11:C, 18:C, 19:C, 20:C, 21:C

USFS Ecoregions (2007): 313A:CC, 313B:CC, 313C:CP, 313D:CP, 315A:CC, 315H:CP, 321A:PP, 322A:??, 331B:CC, 331G:CC, 331H:CC, 331I:CC, 331J:CC, 341A:CC, 341B:CC, 341C:CC, 341F:CP, 342A:CC, 342E:CC, 342F:CC, 342G:CC, 342J:CC, M313A:CC, M313B:CC, M331A:CP, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M341A:CC, M341B:CC, M341C:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Great Basin)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **=** Rocky Mountain Alpine and Subalpine Grassland, Bunchgrass Series - 141.41 (Brown et al. 1979)

LOWER LEVEL UNITS

Alliances:

- A3953 *Festuca arizonica - Muhlenbergia montana - Poa fendleriana* Southern Rocky Mountain Montane Grassland Alliance
- A3954 *Festuca thurberi - Danthonia intermedia - Poa lettermanii* Southern Rocky Mountain Subalpine Grassland Alliance

AUTHORSHIP

Primary Concept Source: D.E. Brown, C.H. Lowe, and C.P. Pase (1979)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 11/09/2015
Classif Resp Region: West
Internal Author: KAS 3-10, 11-15

REFERENCES

References: Bowns and Bagley 1986, Brown 1982a, Brown et al. 1979, Faber-Langendoen et al. 2017a, Hess 1981, Hess and Wasser 1982, Moir 1967, Passey et al. 1982, Shepherd 1975, Stewart 1940, Turner 1975, Turner and Dortignac 1954

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G268. Southern Rocky Mountain Montane-Subalpine Grassland

A3953. Festuca arizonica - Muhlenbergia montana - Poa fendleriana Southern Rocky Mountain Montane Grassland Alliance

Type Concept Sentence: This grassland alliance is characterized by an open to dense perennial graminoid layer composed of bunchgrasses *Festuca arizonica* and *Muhlenbergia montana*, which are widespread dominants. It occurs largely in the southern Rocky Mountains extending west to the mountains and high plateaus of Arizona, Utah and Nevada and northeast to the Black Hills. Stands occur primarily in the montane zone (2440-3050 m [8000-10,000 feet]), but may extend down into the foothills.

OVERVIEW

Scientific Name: *Festuca arizonica - Muhlenbergia montana - Poa fendleriana* Southern Rocky Mountain Montane Grassland Alliance
Common Name (Translated Scientific Name): Arizona Fescue - Mountain Muhly - Muttongrass Southern Rocky Mountain Montane Grassland Alliance
Colloquial Name: Southern Rocky Mountain Montane Arizona Fescue - Muhly Grassland

Type Concept: Vegetation of this grassland alliance is characterized by an open to dense perennial graminoid layer composed of bunchgrasses *Festuca arizonica* and *Muhlenbergia montana*, which are widespread dominants, with *Achnatherum lettermanii, Blepharoneuron tricholepis, Carex duriuscula, Carex rossii, Carex siccata, Elymus lanceolatus, Hesperostipa comata, Muhlenbergia filiculmis, Poa fendleriana, Pseudoroegneria spicata*, or *Schizachyrium scoparium* often present to codominant. Forb species such as *Potentilla hippiana* may be present to codominant. This alliance occurs largely in the southern Rocky Mountains extending west to the mountains and high plateaus of Arizona, Utah and Nevada and northeast to the Black Hills. It primarily occurs in the montane zone (2440-3050 m [8000-10,000 feet]), but may extend down into the foothills. Stands are typically found in xeric forest openings or parks in the ponderosa pine zone with southern aspects on moderately steep slopes and ridgetops. Occasionally the stands occupy rolling parklands. The xeric nature of sites appears to be an important environmental factor. Soils are moderately deep Mollisols, with high coarse-fragment content, sandy loam textures, and a distinct clay horizon. Parent materials are primarily colluvium derived from granite and gneiss. Bare soil, exposed gravels, and small rocks account for as much as 50% of the ground surface area. These large-patch grasslands are intermixed with matrix stands of ponderosa pine, Douglas-fir and aspen forests. In limited circumstances (e.g., South Park in Colorado), they form the "matrix" of high-elevation plateaus and inter-montane valleys.

Classification Comments: Some characteristic species such as *Danthonia parryi* and *Achnatherum lettermanii* have wide ecological amplitudes occurring in subalpine also. Associations are classified as a best fit.

Internal Comments: KAS-1-14: with more time I might find a published Primary Concept Source.
Other Comments:

Similar NVC Types: This alliance has similarities to montane grassland alliances in other groups in the Rocky Mountain region, such as G267, G271, G273, and G274.

- A3954 *Festuca thurberi - Danthonia intermedia - Poa lettermanii* Southern Rocky Mountain Subalpine Grassland Alliance: is similar but floristic composition is representative of cooler, subalpine grasslands in the southern Rocky Mountains.

Diagnostic Characteristics: Dominant/diagnostic species of this montane grassland alliance are *Festuca arizonica* and *Muhlenbergia montana*. Other species with high fidelity include *Blepharoneuron tricholepis, Carex rossii, Hesperostipa comata, Muhlenbergia filiculmis, Poa fendleriana*, or *Pseudoroegneria spicata*.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a sparse to moderately dense graminoid layer dominated by medium-tall and short, bunch and sod grasses. Forbs usually have sparse cover (<10%), although degraded sites may exhibit higher cover. Lichen ground cover ranges from 2-12%.

Floristics: Vegetation is characterized by an open to dense perennial graminoid layer composed of bunchgrasses *Festuca arizonica* and *Muhlenbergia montana*, which are widespread dominants, with *Achnatherum lettermanii, Achnatherum richardsonii, Blepharoneuron tricholepis, Carex duriuscula, Carex rossii, Carex siccata, Elymus lanceolatus, Festuca calligera, Geranium caespitosum, Hesperostipa comata, Muhlenbergia filiculmis, Poa fendleriana, Pseudoroegneria spicata, Schizachyrium scoparium*, or *Sporobolus heterolepis* often present to codominant. Other common graminoids include *Bouteloua curtipendula, Bouteloua gracilis, Carex inops ssp. heliophila, Carex obtusata, Carex occidentalis, Danthonia parryi, Festuca brachyphylla, Koeleria macrantha, Pascopyrum smithii, Poa secunda*, and *Schizachyrium scoparium*. The non-native perennial grass *Poa pratensis* is common in some of these stands. The typically sparse forb layer may be diverse with a variety of taxa, such as *Achillea millefolium, Agoseris glauca, Allium geyeri, Antennaria parvifolia, Antennaria rosea, Arenaria fendleri, Castilleja flava, Castilleja integra, Eriogonum racemosum, Eriogonum umbellatum, Harbouria trachypleura, Heterotheca villosa, Hymenoxys richardsonii, Hymenoxys subintegra, Lupinus argenteus, Mertensia lanceolata, Opuntia polyacantha, Penstemon secundiflorus, Phlox diffusa, Potentilla concinna, Potentilla hippiana*. *Pseudocymopterus montanus, Ranunculus cardiophyllus, Sphaeralcea coccinea, Solidago nana*, and *Vicia americana*. Except for the abundant dwarf-shrub *Artemisia frigida*, scattered *Amelanchier utahensis, Artemisia tridentata, Chrysothamnus viscidiflorus, Ericameria nauseosa, Ericameria parryi, Krascheninnikovia lanata, Ribes cereum, Symphoricarpos oreophilus*, and *Tetradymia canescens* shrubs, or occasional *Pinus ponderosa* trees, woody species are sparse (<10% cover) or absent. *Selaginella densa* is common, and lichens are important on the soil surface, sometimes providing abundant cover (about 25%).

In stands in the Black Hills, *Achnatherum richardsonii, Danthonia intermedia*, and *Sporobolus heterolepis* are prominent with a rich diversity of grasses and forbs, including *Astragalus alpinus, Balsamorhiza sagittata, Delphinium bicolor, Hesperostipa curtiseta, Hesperostipa spartea, Iris missouriensis, Lupinus sericeus, Nassella viridula*, and *Oryzopsis asperifolia*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance primarily occurs in the montane zone (2440-3050 m [8000-10,000 feet]), but may extend down into the foothills to 1600 m (5250 feet). Stands are typically found in xeric forest openings or parks in the ponderosa pine zone with southern aspects on moderately steep slopes and ridgetops. Occasionally the stands occupy rolling parklands. Climate is cool temperate. Summers are warm and winters are cold with freezing temperatures and often heavy snow. Summer precipitation peaks during the monsoon in July and August. The mean annual precipitation is 25-90 cm. Sites are gentle to moderately steep (5-30%) slopes with southern and western aspects. Rocks and boulders are common, especially on the steeper slopes The xeric nature of sites appears to be an important environmental factor in maintaining the grassland. Soils are moderately deep Mollisols, with high coarse-fragment content, sandy loam textures, and a distinct clay horizon. Parent material includes alluvium, colluvium and residuum from a variety of igneous, metamorphic and sedimentary rocks such as andesite, basalt, cinder, gneiss, granite, limestone, rhyolite, sandstone, schist, shale and tuff. Bare soil, exposed gravels, and small rocks account for as much as 50% of the ground surface area. These large-patch grasslands are intermixed with matrix stands of ponderosa pine, Douglas-fir and aspen forests. In limited circumstances (e.g., South Park in Colorado), they form the "matrix" of high-elevation plateaus and inter-montane valleys.

Dynamics: Historically, much of the area where this alliance occurs was heavily grazed by livestock, primarily sheep and cattle (Shepherd 1975). Under moderate grazing, the shorter grass *Muhlenbergia filiculmis* may have had a competitive advantage over the taller and more palatable *Festuca arizonica* (West 1992). Season of use is also important. In stands with cool-season *Festuca arizonica* or *Hesperostipa comata* and warm-season *Muhlenbergia montana*, fall grazing will favor the cool-season grasses over the later-blooming, warm-season *Muhlenbergia montana* (Clary 1978). The reverse is true if grazing is always limited to late summer.

Overgrazing will reduce or eliminate *Festuca arizonica, Hesperostipa comata, Muhlenbergia filiculmis, Muhlenbergia montana*, and the other palatable species, leaving the more grazing-tolerant *Bouteloua gracilis* and less palatable plants such as *Hymenoxys, Artemisia* and *Chrysothamnus* species to dominate the site (West 1992). Clary (1978) reported that complete natural recovery of montane *Festuca arizonica* range may require over 100 years, based on areas where recovery had reached only the "half-shrub" stage after 10 years. Because of the long time needed for recovery, much of the range may be in a seral state. If the range is properly managed, *Muhlenbergia* and *Festuca arizonica* grasslands could potentially become more common.

DISTRIBUTION

Geographic Range: This grassland alliance occurs largely in the southern Rocky Mountains extending west to the mountains and high plateaus of Utah and Arizona and northeast to the Black Hills.

Nations: US
States/Provinces: AZ, CO, MT, NM, NV, SD, TX?, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** *Festuca arizonica* Series (Johnston 1987)
- **>** *Muhlenbergia montana* Series (Johnston 1987)
- **>** *Muhlenbergia montana* Series (Muldavin 1994) [includes *Muhlenbergia montana/Trisetum montanum* Plant Association that is not yet included in this alliance.]
- **>** *Stipa comata-Muhlenbergia montana* Habitat Type (Hess 1981)
- **=** Fescue Series (Dick-Peddie 1993) [includes *Festuca arizonica-Muhlenbergia montana* Vegetation Type]
- **>** Habitat types #13 and #35 (Shepherd 1975)
- **>** Pine Dropseed-Mountain Muhly Series (Dick-Peddie 1993)

LOWER LEVEL UNITS

Associations:

- CEGL002240 *Sporobolus heterolepis - Achnatherum richardsonii - Danthonia intermedia* Grassland
- CEGL001874 *Carex duriuscula* Grassland
- CEGL004508 *Festuca arizonica - Blepharoneuron tricholepis* Grassland
- CEGL001647 *Muhlenbergia montana - Hesperostipa comata* Grassland
- CEGL001646 *Muhlenbergia montana* Grassland
- CEGL001606 *Festuca arizonica - Muhlenbergia montana* Grassland
- CEGL001925 *Poa fendleriana* Grassland
- CEGL001660 *Pseudoroegneria spicata* Grassland
- CEGL001780 *Muhlenbergia filiculmis* Grassland
- CEGL002588 *Elymus lanceolatus* Grassland
- CEGL005354 *Achnatherum lettermanii* Grassland
- CEGL005388 *Carex siccata - Carex rossii* Grassland
- CEGL005381 *Muhlenbergia montana - Schizachyrium scoparium* Grassland
- CEGL001605 *Festuca arizonica - Muhlenbergia filiculmis* Grassland
- CEGL005500 *Festuca (calligera, arizonica, brachyphylla)* Grassland
- CEGL001676 *Pseudoroegneria spicata - Poa fendleriana* Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Baumann 1978a, Buttery 1955, Clary 1978, Currie 1975, Dick-Peddie 1993, Faber-Langendoen et al. 2017b, Fish 1966, Hess 1981, Johnson 1953, Johnson 1956a, Johnson and Niederhof 1941, Johnson and Reid 1958, Johnson and Reid 1964, Johnston 1987, Komarkova 1986, Loveless 1963, Loveless 1967, McIntosh 1923, Merkle 1962, Muldavin 1994, Muldavin et al. 1994a, Mutel

1976, Ramaley 1915, Ramaley 1916a, Ramaley 1916b, Reid 1974, Reid et al. 1994, Shepherd 1975, Smith 1967, Soil Conservation Service 1978, Stewart 1940, USFS 1983b, Wasser and Hess 1982, West 1992

2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G268. Southern Rocky Mountain Montane-Subalpine Grassland

A3954. Festuca thurberi - Danthonia intermedia - Poa lettermanii Southern Rocky Mountain Subalpine Grassland Alliance

Type Concept Sentence: This grassland alliance is characterized by an open to dense perennial graminoid layer composed of bunchgrasses, especially *Festuca thurberi* and *Danthonia intermedia*, with other diagnostic and sometimes dominant species that include *Festuca idahoensis, Poa lettermanii*, and *Poa nervosa*. It occurs largely in the southern Rocky Mountains extending west to the high plateaus and mountains of Arizona, Utah and Nevada primarily in the subalpine zone.

OVERVIEW

Scientific Name: *Festuca thurberi - Danthonia intermedia - Poa lettermanii* Southern Rocky Mountain Subalpine Grassland Alliance
Common Name (Translated Scientific Name): Thurber's Fescue - Timber Oatgrass - Letterman's Bluegrass Southern Rocky Mountain Subalpine Grassland Alliance
Colloquial Name: Southern Rocky Mountain Subalpine Thurber's Fescue - Timber Oatgrass Grassland

Type Concept: Vegetation of this subalpine grassland alliance is characterized by an open to dense perennial graminoid layer composed of bunchgrasses, especially *Festuca thurberi* and *Danthonia intermedia*. Other diagnostic and sometimes dominant species include *Achnatherum richardsonii, Danthonia parryi, Festuca idahoensis, Geranium viscosissimum, Lathyrus lanszwertii var. leucanthus, Poa lettermanii, Poa nervosa, Potentilla hippiana, Solidago multiradiata*, and *Sporobolus heterolepis*. This alliance occurs largely in the southern Rocky Mountains extending west to the high mountains and plateaus of Arizona, Utah and Nevada. Stands primarily occur in the subalpine and lower alpine slopes in dry meadows and on ridges above subalpine forests in the southern Rocky Mountains, but may extend up into lower alpine and down into montane zones. Elevations range from 2500-3810 m. Climate is temperate with short growing seasons and heavy snowfall in winter. Stands are found on level valley bottoms, expansive park meadow openings in the subalpine forest, and on ridges above subalpine forests. Sites are nearly level to steeply sloping, typically on southern or western exposures. Soils are generally deep, well-drained loams or silt loams with pH of 5.8-7.0, and derived from alluvium and colluvium.

Classification Comments: Some characteristic species such as *Danthonia parryi* and *Achnatherum lettermanii* have wide ecological amplitudes occurring in montane zone also. Associations are classified as a "best fit" into the USNVC alliances.

Internal Comments: KAS-1-14: with more time I might find a published Primary Concept Source.
Other Comments:

Similar NVC Types: This alliance has similarities to subalpine grassland alliances in other groups in the Rocky Mountain region, such as G267 and G271.

- A3953 *Festuca arizonica - Muhlenbergia montana - Poa fendleriana* Southern Rocky Mountain Montane Grassland Alliance: is similar but floristic composition is representative of warmer, montane grasslands in the southern Rocky Mountains.

Diagnostic Characteristics: These subalpine grasslands are typically dominated or codominated by *Danthonia intermedia, Danthonia parryi, Festuca idahoensis, Festuca thurberi, Poa lettermanii*, and *Poa nervosa*.

VEGETATION

Physiognomy and Structure: Vegetation in this alliance is characterized by a moderate to dense cover of graminoids that is dominated by perennial bunch grasses. There is also a sparse to moderate cover of perennial forbs. Annual forbs and grasses are seasonally present.

Floristics: Vegetation included in this alliance has a moderately sparse to dense herbaceous layer, depending on the amount of rock cover. These grasslands are characterized by an open to dense perennial graminoid layer composed bunchgrasses, especially *Festuca thurberi* and *Danthonia intermedia*. Other diagnostic and sometimes dominant species include *Achnatherum richardsonii, Danthonia parryi, Festuca idahoensis, Geranium viscosissimum, Lathyrus lanszwertii var. leucanthus, Poa lettermanii, Poa nervosa, Potentilla hippiana, Solidago multiradiata* and *Sporobolus heterolepis*. *Muhlenbergia montana* and *Festuca arizonica* may be present to codominant (on warmer/drier sites). These grasslands have high diversity of species. Other characteristic graminoids may include *Agrostis variabilis, Bromus* spp., *Carex engelmannii, Carex geyeri, Carex haydeniana, Carex microptera, Carex siccata (= Carex foenea), Carex scirpoidea, Danthonia parryi, Elymus trachycaulus, Festuca brachyphylla, Juncus drummondii*, and *Trisetum spicatum*.

Forb species are diverse and may codominate the herbaceous layer with species such as *Achillea millefolium, Arenaria capillaris, Artemisia* spp., *Cerastium beeringianum, Erigeron simplex, Erigeron speciosus, Erigeron ursinus, Eriogonum umbellatum var. majus (= Eriogonum subalpinum), Geum rossii var. turbinatum, Hymenoxys hoopesii, Iris missouriensis, Lewisia pygmaea, Minuartia obtusiloba, Polygonum bistortoides, Potentilla diversifolia, Saxifraga rhomboidea, Solidago multiradiata, Symphyotrichum foliaceum (= Aster foliaceus), Vicia americana*, and many others. On moist sites *Veratrum californicum* may be codominant. Grazed stands often have moderate cover of non-native species such as *Poa pratensis* and *Taraxacum officinale*. The ground surface is often covered with nonvascular plants such as lichens, liverworts, and mosses forming a biological crust. Adjacent stands include subalpine conifer woodlands, and herbaceous- or shrub-dominated wetlands.

ENVIRONMENT & DYNAMICS

Environmental Description: This grassland alliance occurs largely in the southern Rocky Mountains extending west to the high plateaus and mountains of Arizona, Utah and Nevada. Stands primarily occur in the subalpine and lower alpine slopes in dry meadows and on ridges above subalpine forests in the southern Rocky Mountains, but extend up into lower alpine and down into montane zones. Elevations range from 2500-3810 m (8200-12500 feet). Climate is temperate with short growing seasons and heavy snowfall in winter, although prevailing winter winds allow only moderate snow accumulations in high-elevation stands. Stands are found on level valley bottoms, expansive park meadow openings in the subalpine forest, and on ridges above subalpine forests. Sites are nearly level to steeply sloping, typically on southern or western exposures. Soils are shallow to deep, well-drained, acidic (pH of 5.8-7.0), nutrient-poor, gravelly loams to silt loams and gravelly clay loams derived from basalt lava, granite, schist and sandstone. The ground surface has a biological crust of lichens, liverworts, and mosses.

Dynamics: *Festuca thurberi* grasslands typically have sharp ecotones with adjacent *Picea engelmannii*- and *Abies lasiocarpa*-dominated subalpine forests. There is rarely any invasion by tree seedlings in the adjacent grasslands. These high-elevation meadows are typically dry with southern or western aspects. The soils are deep and well-developed, typical of sites with long histories of being grassland. They may need catastrophic disturbance, such as forest-destroying crown fire, to be created. It is unclear how these grasslands were maintained in the subalpine forest zone; however, it is thought to be by a combination of factors such as herbivory, fire, deep soils, early summer drought and competition from grass species (Moir 1967, Andrews 1983). In addition, south- and west-facing clearcuts are often difficult to reforest because seedlings are damaged by full sun. The ecotones between stands adjacent to *Populus tremuloides*-dominated subalpine forests are not as sharp because the forest understory consists of the same graminoid and forb species (Anderson 1983).

Where the soil is thinner and rockier in these subalpine parks, *Danthonia parryi* becomes the dominant species with *Festuca thurberi* and *Artemisia* spp. subdominant (Anderson 1983). The spread of the exotic species *Poa pratensis* and *Taraxacum officinale* in subalpine parks is likely from heavy grazing by livestock (Moir 1967, Anderson 1983). These species are more common in heavily grazed bottomlands and near trails in the uplands (Moir 1967).

DISTRIBUTION

Geographic Range: This grassland alliance occurs largely in the southern Rocky Mountains extending west to the high mountains and plateaus of Arizona, Utah and Nevada.

Nations: US
States/Provinces: AZ, CO, NM, NV, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **>** *Festuca thurberi* Series (Johnston 1987) [includes five *Festuca thurberi* dominated plant associations.]
- **>** *Festuca thurberi* Series (Komarkova 1986) [includes seven *Festuca thurberi* dominated habitat types/associations.]
- **><** Alpine Dwarf Shrublands, Fellfields, and Sedge Turf (Chappell et al. 1997)

LOWER LEVEL UNITS

Associations:

- CEGL001630 *Festuca thurberi* - (*Lathyrus lanszwertii var. leucanthus, Potentilla* spp.) Grassland
- CEGL001656 *Poa nervosa - Achnatherum lettermanii* Grassland
- CEGL001927 *Poa lettermanii* Grassland
- CEGL001794 *Danthonia intermedia* Grassland
- CEGL001618 *Festuca idahoensis - Geranium viscosissimum* Grassland
- CEGL005377 *Festuca thurberi - Danthonia parryi / Potentilla hippiana* Grassland

- CEGL001631 *Festuca thurberi* Subalpine Grassland
- CEGL001879 *Danthonia intermedia - Solidago multiradiata* Grassland
- CEGL001617 *Festuca idahoensis - Festuca thurberi* Grassland
- CEGL001795 *Danthonia parryi* Grassland
- CEGL002734 *Achnatherum lettermanii - Oxytropis oreophila* Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Anderson 1983, Andrews 1983, Baker 1983a, Boyce 1977, Chappell et al. 1997, Eddleman 1967, Faber-Langendoen et al. 2017b, Giese 1975, Hall 1971, Harrington 1978, Hess 1981, Hess and Wasser 1982, Holway 1962a, Johnson 1939, Johnson 1970a, Johnston 1987, Johnston 2001, Keammerer and Stoecker 1980, Klemmedson 1953, Klish 1977, Komarkova 1976, Komarkova 1986, Komarkova and Gordon 1982, Komarkova and Webber 1978, Langenheim 1956, Marr et al. 1974, Miller 1964, Moir 1967, Morgan 1969, Paulsen 1960, Paulsen 1970a, Paulsen 1970b, Ramaley 1942, Rydberg 1915, Turner and Dortignac 1954, Wasser and Hess 1982

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
2.B.2.Na.3.b. M168 Rocky Mountain-Vancouverian Subalpine-High Montane Mesic Meadow

G271. Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow

Type Concept Sentence: This Rocky Mountain, northern Vancouverian and Sierran group is typically lush meadow dominated by a diversity of taller forbs, including *Achillea millefolium, Agastache urticifolia, Balsamorhiza sagittata, Geranium viscosissimum, Ligusticum* spp., *Rudbeckia occidentalis, Thalictrum occidentale, Valeriana sitchensis*, and *Xerophyllum tenax*, typically with grasses intermingled in many of them. However, it includes stands dominated by grasses with relatively broad and soft blades and a few mesic Carices, such as *Calamagrostis breweri, Carex filifolia, Carex straminiformis, Elymus trachycaulus, Festuca viridula*, and *Phleum alpinum*.

OVERVIEW

Scientific Name: *Festuca viridula - Deschampsia cespitosa - Ligusticum* spp. Rocky Mountain-Vancouverian Grassland & Meadow Group
Common Name (Translated Scientific Name): Greenleaf Fescue - Tufted Hairgrass - Licorice-root species Rocky Mountain-Vancouverian Grassland & Meadow Group
Colloquial Name: Montane Nettleleaf Giant-hyssop - Sticky Purple Geranium - Western Brackenfern Mesic Meadow

Type Concept: This Rocky Mountain, northern Vancouverian and Sierran group is restricted to sites from lower montane to subalpine where finely textured soils, snow deposition, rocky substrates, or windswept dry conditions limit tree establishment. Many occurrences are small-patch in spatial character, and are often found in mosaics with woodlands, more dense shrublands, or just below alpine communities. These are typically lush meadows dominated by a diversity of tall forbs, with grasses intermingled in many of them. The vegetation is typically forb-rich, with forbs often contributing more to overall herbaceous cover than graminoids. However, some stands are composed of dense grasslands, these often being taxa with relatively broad and soft blades, such as *Elymus trachycaulus, Festuca viridula*, and *Phleum alpinum*, but where the moist habitat promotes a rich forb component. Important taxa includes *Achillea millefolium, Balsamorhiza sagittata, Rudbeckia occidentalis, Thalictrum occidentale, Valeriana sitchensis, Xerophyllum tenax*, and numerous species of Asteraceae, *Campanula, Erigeron, Ligusticum, Lomatium, Lupinus, Mertensia, Phlox, Penstemon, Solidago*, and *Wyethia*. Important graminoids include *Deschampsia cespitosa, Koeleria macrantha, Luzula glabrata*, perennial *Bromus* spp., and a number of *Carex* species. In the Cascades, this group includes *Festuca viridula* meadows. *Dasiphora fruticosa ssp. floribunda* and *Symphoricarpos* spp. are occasional but not abundant. In the Sierra Nevada *Calamagrostis breweri, Carex filifolia, Carex straminiformis, Juncus drummondii, Oreostemma alpigenum, Solidago canadensis*, and *Trisetum spicatum* may dominate stands with diagnostics forbs *Oreostemma alpigenum*, and *Solidago canadensis*. Dwarf-shrubs such as *Vaccinium cespitosum* may have significant cover. Burrowing mammals can increase the forb diversity. This group is typically found above 2000 m in elevation in the southern part of its range and above 600 m in the northern part. These upland communities occur on gentle to moderate-gradient slopes and relatively moist habitats. The soils are typically seasonally moist to saturated in the spring but, if so, will dry out later in the growing season. These sites are not as wet as those found in Vancouverian-Rocky Mountain Subalpine-Alpine Snowbed, Wet Meadow & Dwarf-Shrubland Group (G520) and Vancouverian-Rocky Mountain Montane Wet Meadow & Marsh Group (G521), although some species are certainly shared with wet meadows, such as *Deschampsia*.

Classification Comments: The Rockies and Cascades support a number of forb types found on talus and rocky scree slopes, which are not sparsely vegetated, and which often have little to no grass component, though Carices may be abundant. These types often have heavy snow loading in winter, or are adjacent to snowfields, and subsurface moisture below the rocks/scree is significant throughout the growing season. These forb types are poorly documented; for now they are placed in this group, as many of the taxa are also found in mesic grassy meadows. Splitting them into a separate group would be hard to justify floristically.

Similar NVC Types:
- G267 Central Rocky Mountain Montane Grassland
- G273 Central Rocky Mountain Lower Montane, Foothill & Valley Grassland
- G268 Southern Rocky Mountain Montane-Subalpine Grassland
- G520 Vancouverian-Rocky Mountain Subalpine-Alpine Snowbed, Wet Meadow & Dwarf-shrubland
- G320 North Pacific Alpine-Subalpine Tundra
- G317 North Pacific Alpine-Subalpine Dwarf-shrubland & Heath
- G316 Rocky Mountain-Sierran Alpine Dwarf-shrubland & Krummholz

Diagnostic Characteristics: Herbaceous communities found in the mountains of the Rockies and eastern Cascades, dominated by forbs and graminoids. These are relatively mesic or sometimes seasonally wet communities, and the combination of moisture and soil conditions results in forbs, often tall, being the predominant lifeform. Grasses and sedges are common, typically being taxa with broad and soft blades. Forb communities found on talus and scree slopes with subsurface moisture are included here, in particular when they are not sparsely vegetated.

VEGETATION

Physiognomy and Structure: This group includes herbaceous communities found in the montane and subalpine throughout much of the Rockies, eastern Cascades and Sierra Nevada, dominated by flowering forbs, often tall (but still <1 m in height usually). Grasses with broad, soft blades are common, but these are more typically forb-rich meadows with grasses or other graminoids not the dominant lifeform. Cover is generally dense or can be patchy. Burrowing mammals in places will disrupt the soil.

Floristics: Species composition in this mesic meadow differs some between montane and subalpine elevations, but across its range, this is a very diverse group. Tall forb-dominated mesic meadows are typically composed of a wide diversity of genera and contribute more to overall herbaceous cover than graminoids. At montane elevations, important forbs include *Allium schoenoprasum, Angelica arguta, Arnica chamissonis, Athyrium filix-femina, Camassia quamash, Campanula rotundifolia, Chamerion angustifolium, Delphinium x occidentale, Erigeron speciosus, Eucephalus* spp., *Geum macrophyllum, Hackelia* spp., *Heracleum maximum, Ligusticum porteri, Ligusticum tenuifolium, Lupinus parviflorus, Mertensia* spp., *Osmorhiza occidentalis, Pteridium aquilinum, Senecio hydrophiloides, Senecio serra, Solidago canadensis, Symphyotrichum* spp., *Thalictrum occidentale, Trollius laxus, Vicia americana* and *Zigadenus elegans*. Early-successional stages may be dominated by *Achillea millefolium, Agastache urticifolia, Chamerion angustifolium, Urtica dioica*, and small amounts of mesic grasses such as *Bromus carinatus* and *Deschampsia cespitosa*. At montane elevations, graminoids form a minor component and are usually taxa with relatively broad and soft blades such as *Bromus carinatus, Bromus sitchensis, Carex geyeri, Carex hoodii, Carex microptera, Carex raynoldsii, Deschampsia cespitosa, Elymus glaucus, Festuca rubra*, and *Melica spectabilis*. Broadleaf deciduous shrubs such as *Dasiphora fruticosa ssp. floribunda* and *Symphoricarpos* spp. are occasional, but not abundant.

At subalpine elevations, *Angelica* spp., *Arnica latifolia, Castilleja miniata, Erigeron peregrinus, Erythronium grandiflorum, Eucephalus ledophyllus, Ligusticum* spp., *Lupinus argenteus var. laxiflorus, Lupinus latifolius, Senecio triangularis, Valeriana* spp., and *Veratrum viride* are commonly the dominant forbs. Other locally abundant forbs include *Hydrophyllum fendleri, Phacelia hastata, Phlox diffusa, Saussurea americana*, and *Xerophyllum tenax*. Burrowing mammals can increase the forb diversity. Graminoids are typically a minor component of the canopy, with typically less than 20% cover. Common species include *Agrostis variabilis, Carex microptera, Carex paysonis, Carex spectabilis, Deschampsia cespitosa, Elymus trachycaulus, Juncus drummondii, Luzula glabrata, Luzula parviflora, Phleum alpinum, Poa alpina*, and *Vahlodea atropurpurea*. However, this group also includes *Festuca viridula*-dominated meadows in the Cascades. In the Sierra Nevada *Calamagrostis breweri, Carex filifolia, Carex straminiformis, Juncus drummondii*, and *Trisetum spicatum* may dominate stands with diagnostics forbs *Oreostemma alpigenum*, and *Solidago canadensis*. Dwarf-shrubs such as *Vaccinium cespitosum* may have moderate cover in some stands. Early-successional stages may be dominated by *Achillea millefolium, Hypericum scouleri, Sibbaldia procumbens*, and other forbs, and small amounts of mesic graminoids such as *Carex* spp., *Deschampsia cespitosa, Phleum alpinum*, and *Poa alpina*.

ENVIRONMENT & DYNAMICS

Environmental Description: In the Rocky Mountains, these meadows occupy a wide variety of environments, including moderate to steep slopes and glacio-fluvial flats and swales that lose their snow cover relatively late in the season. Generally the group is restricted to sites from lower montane to subalpine where finely textured soils, snow deposition, rocky substrates, or windswept dry

conditions limit tree establishment. Many occurrences are small-patch in spatial character, and are often found in mosaics with woodlands, more dense shrublands, or just below alpine communities. This group is typically found above 2000 m to 3700 m in elevation in the southern part of its range and above 600 m in the northern extent. These upland communities occur on gentle to moderate-gradient slopes and relatively moist habitats. The soils are typically seasonally moist to saturated in the spring but, if so, will dry out later in the growing season. At montane elevations, this group occurs within *Pinus-Pseudotsuga* or mixed conifer-dominated forests. At subalpine elevations, these meadows are found below treeline, usually within *Abies lasiocarpa-Picea* species-dominated forests.

Climate: Approximately two-thirds of the region's precipitation occurs in just half the year (October from March), with the remaining third occurring in late spring to early summer. Generally, the east slopes of the Cascades and Sierra Nevada ranges east to the northern Rocky Mountains of Montana and Wyoming receive greater than 100 cm of precipitation annually.

Soil/substrate/hydrology: Soils are typically seasonally moist to saturated during spring and early summer after snowmelt, but will dry out later in the growing season. At montane elevations, soils are usually clays or silt loams with an A horizon greater than 10 cm. Some sites may have inclusions of hydric soils in low, depressional areas within this group. At subalpine elevations, soils are derived from a variety of parent materials, and can be acidic or calcareous. The A horizon is typically less than 10 cm, and soils are usually rocky or gravelly with good aeration and drainage, but with a well-developed organic layer. A third setting includes talus or scree slopes, or colluvial fields of rocks and small boulders, where subsurface moisture is provided by melting snow throughout much of the growing season. Soils are developed from colluvium and more recently alluvium are often derived from limestone, sandstone, shale parent materials (Gregory 1983, Youngblood et al. 1985a), or weathered volcanic extrusives such as basalt, pumice and ash or loess deposits. Soil texture is variable and ranges from coarser-textured sandy loams to finer-textured silt loams, clay or clay loams with an average pH of 6.4 (Gregory 1983). Surface rock averages 46%, but varies from 1-90%. Bare ground cover is usually less than 15%.

Dynamics:

DISTRIBUTION

Geographic Range: This group is very widespread in the Rocky Mountains cordillera from New Mexico (where it is uncommon) and Colorado north into Canada, and west into the eastern Cascades and Sierra Nevada. It also occurs in the mountain ranges of Nevada, northern Utah and Wyoming, and has been observed on the Snake River plain, as well as the "island ranges" of central Montana.

Spatial Scale & Pattern [optional]: Small patch, Large patch
Nations: CA, US
States/Provinces: AB, BC, CA?, CO, ID, MT, NM, NV, OR, WA, WY
TNC Ecoregions [optional]: 3:C, 4:C, 7:C, 8:C, 9:C, 11:C, 18:C, 19:C, 20:C, 21:P, 26:C, 68:C
USFS Ecoregions (2007): 341B:C?, 341E:CP, 341G:CC, 342B:CP, 342C:CC, 342D:CC, 342E:C?, 342H:CC, 342J:CC, M313A:PP, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M334A:??, M341A:CC, M341B:CC, M341C:CC, M341D:CP
Omernik Ecoregions:
Federal Lands [optional]: NPS (Great Basin); USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate. This is a solid group in its core concept, it's more a question of clarifying exactly how it relates to drier predominantly grass-dominated groups, and also the relationship of specific associations to wet meadow groups.

SYNONYMY

- **><** Idaho Fescue - Tufted Hairgrass (308) (Shiflet 1994)
- **><** Tall Forb (409) (Shiflet 1994)
- **><** Tufted Hairgrass - Sedge (313) (Shiflet 1994) [Forb-rich portions of this SRM type overlap with this group.]

LOWER LEVEL UNITS

Alliances:
- A4165 *Poa secunda - Muhlenbergia richardsonis - Carex douglasii* Moist Meadow Alliance
- A3951 *Ligusticum* spp. - *Lupinus* spp. - *Delphinium* spp. Montane Mesic Meadow Alliance
- A3950 *Agastache urticifolia - Geranium viscosissimum - Pteridium aquilinum* Montane Mesic Meadow Alliance
- A4119 *Carex straminiformis - Solidago canadensis* Meadow Alliance
- A3364 *Calamagrostis breweri* Mesic Grassland Alliance
- A3949 *Phleum alpinum - Elymus trachycaulus - Agrostis variabilis* Subalpine Mesic Meadow Alliance
- A1257 *Festuca viridula - Carex hoodii - Lupinus* spp. Subalpine Mesic Meadow Alliance
- A3948 *Valeriana sitchensis - Luzula glabrata var. hitchcockii - Xerophyllum tenax* Subalpine Mesic Meadow Alliance

- A1294 *Carex filifolia* Mesic Grassland Alliance

AUTHORSHIP

Primary Concept Source: T.N. Shiflet (1994)
Author of Description: M.S. Reid, T. Luna, K.A. Schulz
Acknowledgments:
Version Date: 09/29/2016
Classif Resp Region: West
Internal Author: MSR 3-10, 3-11, mod. KAS 5-15, 11-15, mod. GK 9-16

REFERENCES

References: Buckner 1977, Ellison 1954, Faber-Langendoen et al. 2017a, Fritz 1981, Gregory 1983, Hall 1971, Marr 1977a, Meidinger and Pojar 1991, Potkin and Munn 1989, Shiflet 1994, Starr 1974, Youngblood et al. 1985a

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G271. Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow

A3950. Agastache urticifolia - Geranium viscosissimum - Pteridium aquilinum Montane Mesic Meadow Alliance

Type Concept Sentence: Plant associations within this montane mesic meadow alliance are characterized by the dominance of *Agastache urticifolia, Geranium viscosissimum, Heliomeris multiflora, Mertensia ciliata, Pteridium aquilinum*, or *Wyethia amplexicaulis* and occur in the central Rocky Mountains of Wyoming, Utah and Idaho extending west to ranges in Nevada.

OVERVIEW

Scientific Name: *Agastache urticifolia - Geranium viscosissimum - Pteridium aquilinum* Montane Mesic Meadow Alliance
Common Name (Translated Scientific Name): Nettleleaf Giant-hyssop - Sticky Purple Geranium - Western Brackenfern Montane Mesic Meadow Alliance
Colloquial Name: Montane Nettleleaf Giant-hyssop - Sticky Purple Geranium - Western Brackenfern Mesic Meadow

Type Concept: The vegetation of this montane mesic meadow alliance is characterized by an often patchy, moderately dense to dense herbaceous layer dominated by perennial forbs. Diagnostic and dominant species are *Agastache urticifolia, Geranium viscosissimum, Heliomeris multiflora, Mertensia ciliata, Pteridium aquilinum*, and/or *Wyethia amplexicaulis*. Associated species are diverse and include widespread forbs such as *Achillea millefolium* or *Senecio triangularis*, and mesic graminoids such as *Bromus carinatus, Carex microptera*, and *Elymus trachycaulus*. Scattered clumps of the deciduous shrub *Symphoricarpos oreophilus* are common, and occasional *Populus tremuloides* trees may also be present. Plant associations occur in the central Rocky Mountains of Wyoming, Utah and Idaho extending west to ranges in Nevada. Sites vary from gentle to steep slopes with eastern to southwestern aspects, but are most often moderately steep mid to upper slopes. Stands also occur along small streams, benches near seeps, and on moist toeslopes in narrow valley bottoms. Elevations range from 1970-2835 m. Soils are moderately deep to deep, well-drained loams with a thick mollic horizon. The water table ranges to depths of 20 cm. Soils are developed from colluvium and more recently alluvium and are derived from limestone, sandstone or shale parent materials and have clay or clay loam textures.

Classification Comments: This is a poorly documented alliance and may be more extensive than currently known. Subalpine forb meadow communities are not well-studied anywhere in the West. Possible occurrences of *Mertensia ciliata* communities in Colorado and the Centennial Mountains in Montana need to be investigated (Johnston 1987, Padgett et al. 1989).

Internal Comments:
Other Comments:

Similar NVC Types:
- A1257 *Festuca viridula - Carex hoodii - Lupinus* spp. Subalpine Mesic Meadow Alliance: is dominated or codominated by *Festuca viridula* in the interior Pacific Northwest and central Rocky Mountains.
- A3948 *Valeriana sitchensis - Luzula glabrata var. hitchcockii - Xerophyllum tenax* Subalpine Mesic Meadow Alliance: is typically dominated by *Valeriana sitchensis* or *Xerophyllum tenax* with *Carex geyeri, Carex spectabilis, Chamerion angustifolium, Luzula glabrata var. hitchcockii*, and *Veratrum viride* sometimes abundant.
- A3949 *Phleum alpinum - Elymus trachycaulus - Agrostis variabilis* Subalpine Mesic Meadow Alliance: is dominated by *Phleum alpinum, Elymus trachycaulus*, or *Agrostis variabilis*.
- A3951 *Ligusticum* spp. - *Lupinus* spp. - *Delphinium* spp. Montane Mesic Meadow Alliance: is dominated by *Ligusticum filicinum, Ligusticum porteri, Ligusticum tenuifolium, Lupinus argenteus*, or *Lupinus parviflorus ssp. myrianthus*.

Diagnostic Characteristics: These are high-altitude mesic meadows dominated or codominated by forbs; especially diagnostic and often dominant species include *Agastache urticifolia, Geranium viscosissimum, Heliomeris multiflora, Mertensia ciliata, Pteridium aquilinum*, or *Wyethia amplexicaulis*.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a moderately dense to dense (40-100% cover), medium-tall (0.4-0.8 m) herbaceous layer that often occurs in patches. It is dominated by perennial forbs with consistent but low perennial graminoid cover. Scattered cold-deciduous shrubs are often present, and occasional cold-deciduous trees may present in these stands.

Floristics: The vegetation is characterized by an often patchy, moderately dense to dense (40-100% cover) herbaceous layer dominated by perennial forbs. Diagnostic and dominant species are *Agastache urticifolia, Geranium viscosissimum, Heliomeris multiflora, Mertensia ciliata, Pteridium aquilinum*, and/or *Wyethia amplexicaulis* (Gregory 1983). Associated species include *Achillea millefolium, Bromus carinatus, Carex microptera, Collomia linearis, Delphinium x occidentale, Eucephalus engelmannii, Elymus trachycaulus, Geranium richardsonii, Heracleum maximum, Hymenoxys hoopesii, Lupinus argenteus, Poa palustris* (exotic), *Rudbeckia occidentalis, Saxifraga odontoloma, Senecio triangularis*, and *Senecio serra*. Scattered clumps of the deciduous shrub *Symphoricarpos oreophilus* are common, and occasional *Populus tremuloides* trees may also be present.

ENVIRONMENT & DYNAMICS

Environmental Description: Plant associations within this montane mesic meadow alliance occur in the central Rocky Mountains of Wyoming, Utah and Idaho extending west to ranges in Nevada. Elevations range from 1970-2835 m. Sites vary from gentle to steep (5-70%) slopes with eastern to southwestern aspects, but are most often moderately steep (40%) mid to upper slopes. Stands also occur along small streams, benches near seeps, and on moist toeslopes in narrow valley bottoms. The water table ranges to depths of 20 cm. Soils are moderately deep to deep, well-drained loams with a thick mollic horizon. Soils are developed from colluvium and more recently alluvium and are derived from limestone, sandstone or shale parent materials (Gregory 1983, Youngblood et al. 1985a). Soil texture includes silt loams, clay or clay loams with an average pH of 6.4 (Gregory 1983). Surface rock averages 46%, but varies from 1-90%. Bare ground cover is usually less than 15%.

Dynamics: When disturbed by extensive sheep grazing, this community is converted to a *Rudbeckia occidentalis*- or *Veratrum californicum*-dominated community (Padgett et al. 1989). *Pteridium aquilinum* has been associated with recently disturbed, mesic ground on steep slopes in Grand Tetons National Park.

DISTRIBUTION

Geographic Range: This alliance occurs in the subalpine zone in the central Rocky Mountains of Wyoming, Utah and Idaho extending west to ranges in Nevada.

Nations: US
States/Provinces: ID, NV, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** *Mertensia ciliata* Series (Johnston 1987)

LOWER LEVEL UNITS

Associations:
- CEGL001944 *Mertensia ciliata* Meadow
- CEGL001937 *Agastache urticifolia - Heliomeris multiflora* Meadow
- CEGL002544 *Pteridium aquilinum* Meadow
- CEGL002536 *Geranium viscosissimum* Meadow
- CEGL001947 *Wyethia amplexicaulis* Meadow

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by M. Damm.
Version Date: 2014/03/14

REFERENCES

References: Bissell 1973, Faber-Langendoen et al. 2017b, Gregory 1983, Johnston 1987, Norton et al. 1981, Padgett et al. 1989, Welsh et al. 1987, Youngblood et al. 1985a

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G271. Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow

A1294. Carex filifolia Mesic Grassland Alliance

Type Concept Sentence: This alliance is dominated by *Carex filifolia* in the herbaceous layer. Plants grow in tight clumps that form closed to open turf. This short grassland of dry subalpine and alpine meadows occurs on slopes and ridges from 1500-3700 m elevation in the Sierra Nevada of California and possibly east into the mountain ranges of western Nevada.

OVERVIEW

Scientific Name: *Carex filifolia* Mesic Grassland Alliance
Common Name (Translated Scientific Name): Threadleaf Sedge Mesic Grassland Alliance
Colloquial Name: Threadleaf Sedge Mesic Grassland

Type Concept: This alliance is dominated by *Carex filifolia* in the herbaceous layer. Plants grow in tight clumps that form closed to open turf. Other herbs may include *Achillea millefolium var. occidentalis (= Achillea lanulosa), Antennaria rosea, Calamagrostis muiriana, Cistanthe monosperma, Cistanthe umbellata, Deschampsia cespitosa, Dicentra uniflora, Erigeron algidus (= Erigeron petiolaris), Juncus mertensianus, Lewisia pygmaea, Lupinus breweri, Oreostemma alpigenum (= Aster alpigenus), Penstemon heterodoxus, Potentilla* spp., *Saxifraga aprica, Solidago multiradiata*, and *Trisetum spicatum*. Emergent *Eriogonum nudum* plants may be present at low cover. This alliance forms large stands. Herbs are <0.3 m in height, and the canopy coverage is open to continuous. This short grassland of dry subalpine and alpine meadows occurs on slopes and ridges, and edges of subalpine meadows and basins from 1500-3700 m elevation in the Sierra Nevada of California and possibly east into the mountain ranges of western Nevada. Stands often grow on the upper margins of meadows, or just beyond the zone of seasonal soil saturation if the stand is adjacent to a lake. Soils are well-drained sands or loams. The precipitation regime where this alliance occurs is strongly seasonal, with most precipitation falling in the winter months. Most precipitation in the upper elevational range falls as snow. Summers are very dry.

Classification Comments: This alliance could possibly be merged with *Calamagrostis breweri* Mesic Grassland Alliance (A3364), but occurs on somewhat drier sites, whereas *Calamagrostis breweri* requires subsurface moisture, and is seasonally flooded. In California, this is apparently *Carex filifolia var. erostrata* (Hickman 1993, Ball and Reznicek 2002), which in Kartesz (1999) is synonymous with *Carex exserta*. All of the associations in the USNVC for California should be renamed from *Carex filifolia* to *Carex exserta* or else to *Carex filifolia var. erostrata*.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Dominated by *Carex filifolia* in the herbaceous layer. *Carex filifolia* >=50% relative cover or is conspicuous (>=1% absolute cover) if other herbaceous species present. *Calamagrostis muiriana* or other short subalpine grasses and sedges are either subdominant or absent.

VEGETATION

Physiognomy and Structure: This short, alpine or subalpine sod grassland is dominated by forbs less than 30 cm in height. The herbaceous canopy can be open to continuous. Emergent shrubs (1-2 m) may be present.

Floristics: This alliance is dominated by *Carex filifolia* in the herbaceous layer. Plants grow in tight clumps that form closed to open turf. Other herbs may include *Achillea millefolium var. occidentalis (= Achillea lanulosa), Antennaria rosea, Calamagrostis muiriana, Cistanthe monosperma, Cistanthe umbellata, Deschampsia cespitosa, Dicentra uniflora, Erigeron algidus (= Erigeron petiolaris), Juncus mertensianus, Lewisia pygmaea, Lupinus breweri, Oreostemma alpigenum (= Aster alpigenus), Penstemon heterodoxus, Potentilla* spp., *Saxifraga aprica, Solidago multiradiata*, and *Trisetum spicatum*. Emergent *Eriogonum nudum* plants may be present at low cover.

ENVIRONMENT & DYNAMICS

Environmental Description: This short grassland of dry subalpine and alpine meadows occurs on slopes and ridges, and edges of subalpine meadows and basins from 1500-3700 m elevation. Stands often grow on the upper margins of meadows, or just beyond

the zone of seasonal soil saturation if the stand is adjacent to a lake. Soils are well-drained sands or loams. The precipitation regime where this alliance occurs is strongly seasonal, with most precipitation falling in the winter months. Most precipitation in the upper elevational range falls as snow. Summers are very dry.

Dynamics: No information available.

DISTRIBUTION

Geographic Range: This alliance occurs in the Sierra Nevada of California and possibly east into the mountain ranges of western Nevada.

Nations: US
States/Provinces: CA, NV?
TNC Ecoregions [optional]: 12:C
USFS Ecoregions (2007): M261E:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **=** *Carex filifolia* (Shorthair sedge turf) Alliance (Sawyer et al. 2009) [45.140.00]
- **=** *Carex filifolia* Herbaceous Alliance (CNPS 2017) [45.140.00]
- **><** Dry Subalpine or Alpine Meadow (#45220) (Holland 1986b)
- **=** Shorthair sedge series (Sawyer and Keeler-Wolf 1995)

LOWER LEVEL UNITS

Associations:

- CEGL008653 *Vaccinium cespitosum / Carex filifolia* Dwarf-shrubland
- CEGL008663 *Carex filifolia - Trisetum spicatum* Grassland
- CEGL008660 *Carex filifolia - Cistanthe* spp. Grassland
- CEGL008662 *Carex filifolia - Penstemon heterodoxus* Grassland

AUTHORSHIP

Primary Concept Source: M. Schindel, in Faber-Langendoen et al. (2013)
Author of Description: M.S. Reid
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Allen-Diaz 1994, Ball and Reznicek 2002, Benedict 1983, Bennett 1965, Burke 1982, CNPS 2017, Faber-Langendoen et al. 2017b, Hauser 2006b, Hickman 1993, Holland 1986b, Kartesz 1999, Keeler-Wolf et al. 2003a, Klikoff 1965, Major and Taylor 1977, Paysen et al. 1980, Potter 2005, Ratliff 1979, Ratliff 1982, Ratliff 1985, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Taylor 1984

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G271. Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow

A4119. Carex straminiformis - Solidago canadensis Meadow Alliance [Low - Poorly Documented]

Type Concept Sentence:

OVERVIEW

Scientific Name: *Carex straminiformis - Solidago canadensis* Meadow Alliance
Common Name (Translated Scientific Name): Shasta Sedge - Canada Goldenrod Meadow Alliance
Colloquial Name: Shasta Sedge - Canada Goldenrod Meadow

Type Concept:

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics:

VEGETATION

Physiognomy and Structure:

Floristics:

ENVIRONMENT & DYNAMICS

Environmental Description:

Dynamics:

DISTRIBUTION

Geographic Range:

Nations: US
States/Provinces: CA, NV
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

- **>** *Carex straminiformis* (Mount Shasta sedge meadows) Provisional Alliance (Sawyer et al. 2009) [45.185.00]
- **>** *Carex straminiformis* Provisional Herbaceous Alliance (CNPS 2017) [45.185.00]
- **>** *Solidago canadensis* (Canada goldenrod patches) Provisional Alliance (Sawyer et al. 2009) [45.420.00]
- **>** *Solidago canadensis* Provisional Herbaceous Alliance (CNPS 2017) [45.420.00]

LOWER LEVEL UNITS

Associations:

- CEGL001793 *Carex straminiformis* Grassland
- CEGL003161 *Solidago canadensis - Achillea millefolium* Grassland

AUTHORSHIP

Primary Concept Source: M.S. Reid
Author of Description:
Acknowledgments:

REFERENCES

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G271. Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow

A1257. Festuca viridula - Carex hoodii - Lupinus spp. Subalpine Mesic Meadow Alliance

Type Concept Sentence: This high-elevation grassland alliance is dominated or codominated by diagnostic species *Festuca viridula*, which may form dense, continuous stands in pristine situations. It occurs in cold, dry sites throughout the Pacific Northwest extending east to the central Rocky Mountains in northern Idaho and Wyoming.

OVERVIEW

Scientific Name: *Festuca viridula - Carex hoodii - Lupinus* spp. Subalpine Mesic Meadow Alliance
Common Name (Translated Scientific Name): Greenleaf Fescue - Hood's Sedge - Lupine species Subalpine Mesic Meadow Alliance
Colloquial Name: Subalpine Greenleaf Fescue Mesic Meadow

Type Concept: Vegetation of this high-elevation grassland alliance is dominated or codominated by *Festuca viridula* with *Carex hoodii, Eucephalus ledophyllus, Festuca idahoensis, Lupinus argenteus var. laxiflorus*, or *Lupinus latifolius*. These diagnostic species form dense, continuous stands in pristine situations. Dwarf-shrub and subshrub species include *Paxistima myrsinites* and *Phlox*

diffusa. Adjacent vegetation is often subalpine forests of *Tsuga mertensiana* or *Abies lasiocarpa*, and at wetter sites, *Carex* spp. meadows or *Phyllodoce - Cassiope* shrublands are typical. This alliance occurs in cold, dry sites throughout the Pacific Northwest extending east to the central Rocky Mountains in northern Idaho. Stands occur from 1370 m in the northern Cascade Range and Olympic Mountains to 1586-1769 m in northern Idaho to over 2400 m in the mountains of northeastern Oregon. They are typically associated with south-facing or exposed slopes where snow cover is blown or melted off relatively early. Soils are usually well-drained and vary in texture from coarse colluvium on steep slopes to fine-textured loams in low-gradient subalpine meadows.

Classification Comments: The range of this alliance needs to be reviewed as some associations extend into the Pacific Northwest west of the Cascades and may exceed that of the range of Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow Group (G271). Some *Festuca viridula*-dominated grasslands in the Blue and Wallowa mountains of Oregon (Johnson and Simon 1987, Johnson and Clausnitzer 1992) are described as dense, sod-forming clumps of *Festuca viridula* and nearly forb-free, with much litter and no bare ground or exposed gravel or rock particles, which may be better classified in a grassland group.

Internal Comments: mjr 3-16: Festuca viridula does not occur in WY (removed). KAS-1-14: More review of *Festuca viridula - Festuca idahoensis* Herbaceous Vegetation (CEGL001633) is needed to verify placement in this alliance in a mesic meadow group as some stands in the Blue and Wallowa mountains of Oregon (Johnson and Simon 1987, Johnson and Clausnitzer 1992) are described as dense, sod-forming *Festuca viridula*-dominated grasslands that are nearly forb-free, with much litter and no bare ground or exposed gravel or rock particles.
Other Comments:

Similar NVC Types: *Festuca idahoensis - Calamagrostis rubescens - Achnatherum nelsonii* Central Rocky Mountain Montane Mesic Grassland Alliance (A3966) in Central Rocky Mountain Montane Grassland Group (G267) has two *Carex hoodii*-codominated associations that are similar to stands in *Festuca viridula - Carex hoodii* Meadow (CEGL001596) in this alliance. Further review of these similar types is needed.

- A3950 *Agastache urticifolia - Geranium viscosissimum - Pteridium aquilinum* Montane Mesic Meadow Alliance: is dominated by *Agastache urticifolia, Geranium viscosissimum, Heliomeris multiflora, Mertensia ciliata, Pteridium aquilinum*, or *Wyethia amplexicaulis*.
- A3948 *Valeriana sitchensis - Luzula glabrata var. hitchcockii - Xerophyllum tenax* Subalpine Mesic Meadow Alliance: is typically dominated by *Valeriana sitchensis* or *Xerophyllum tenax* with *Carex geyeri, Carex spectabilis, Chamerion angustifolium, Luzula glabrata var. hitchcockii* and *Veratrum viride* sometimes abundant.
- A3949 *Phleum alpinum - Elymus trachycaulus - Agrostis variabilis* Subalpine Mesic Meadow Alliance: is dominated by *Phleum alpinum, Elymus trachycaulus*, or *Agrostis variabilis*.
- A3951 *Ligusticum* spp. - *Lupinus* spp. - *Delphinium* spp. Montane Mesic Meadow Alliance: is dominated by *Ligusticum filicinum, Ligusticum porteri, Ligusticum tenuifolium, Lupinus argenteus* or *Lupinus parviflorus ssp. myrianthus*.

Diagnostic Characteristics: This subalpine mesic meadow is characterized by dominance or codominance of *Festuca viridula* with *Carex hoodii, Eucephalus ledophyllus, Festuca idahoensis, Lupinus argenteus var. laxiflorus*, or *Lupinus latifolius*, which are the diagnostic species. Most stands are mixed with several other graminoid or forb species and occasionally with dwarf-shrub and subshrub species.

VEGETATION

Physiognomy and Structure: Vegetation in this alliance is characterized by a dense layer of cespitose graminoids between 0.5-1 m in height. Forbs are usually scattered through the graminoid matrix and may be abundant in some stands. Evergreen or cold-deciduous shrubs may be scattered through the stand, but are typically very sparse.

Floristics: This alliance is characterized by a moderate to dense herbaceous layer dominated or codominated by *Festuca viridula* with *Carex hoodii, Eucephalus ledophyllus, Festuca idahoensis, Lupinus argenteus var. laxiflorus*, or *Lupinus latifolius* the diagnostic species. Most stands are mixed with several other graminoid or forb species and occasionally with dwarf-shrub and subshrub species such as *Paxistima myrsinites* and *Phlox diffusa*. Other associated graminoids include *Achnatherum lettermanii, Achnatherum occidentale, Carex geyeri, Carex spectabilis, Elymus elymoides, Phleum alpinum*, and *Poa cusickii*. Common forb associates include *Antennaria lanata, Arnica parryi, Eriogonum heracleoides, Erysimum arenicola, Hieracium gracile, Juncus parryi, Ligusticum grayi, Lomatium martindalei, Luetkea pectinata, Lupinus arcticus, Lupinus caudatus, Nothocalais alpestris, Oreostemma alpigenum, Penstemon confertus, Penstemon globosus, Penstemon procerus, Polemonium pulcherrimum, Polygonum bistortoides, Polygonum phytolaccifolium*, and *Potentilla flabellifolia*. In early-seral stands, *Achillea millefolium, Hackelia micrantha (= Hackelia jessicae)*, and *Rudbeckia occidentalis* can provide significant cover. *Festuca viridula*-dominated grasslands in the Blue and Wallowa mountains of Oregon (Johnson and Simon 1987, Johnson and Clausnitzer 1992) are described as dense, sod-forming clumps of this grass with low cover of forbs.

ENVIRONMENT & DYNAMICS

Environmental Description: This high-elevation grassland alliance occurs in cold, dry sites throughout the Pacific Northwest extending east to the central Rocky Mountains in northern Idaho. Elevations range from 1370 m in the northern Cascade Range and Olympic Mountains and 1586-1769 m in northern Idaho to over 2400 m in the mountains of northeastern Oregon. This alliance is typically associated with rainshadow areas of the higher mountains and may extend into lower alpine zones. Stands are typically associated with moderate (10-30%) south-facing or exposed slopes, plateaus or ridgetops where snow cover is blown or melted off relatively early. However, west of the Cascades some stands occur on moist sites along ridgetops, seepy sideslopes and interforest meadows. Summer lightning is common, and lightning fires may also serve to prevent tree or shrub encroachment. Soils are generally well-drained, fairly shallow (76 cm) and stony and vary in texture from coarse colluvium on steep slopes to fine-textured loams in low-gradient subalpine meadows. Parent materials are usually weathered volcanic extrusives such as basalt, pumice and ash or loess deposits.

Dynamics: These mesic grasslands are associated with sites where soils are too droughty for forest growth. Daubenmire and Daubenmire (1968) noted that these communities tended to occur near the summits of south-facing mountains, where snow was blown off by southerly winds, resulting in severe soil drought in summer. Most of these communities were severely grazed in the early part of the 20th century allowing increases in forbs, needlegrass (*Hesperostipa* spp., *Achnatherum* spp.), and bare ground in these communities. Most stands are now considered disclimax associations which are in various stages of recovery (Johnson and Simon 1987).

DISTRIBUTION

Geographic Range: These high-altitude mesic grasslands occur in cold, dry sites throughout the Pacific Northwest extending east to the central Rocky Mountains in northern Idaho, near the border with Canada, in Kaniksu National Forest in the Selkirk Mountains.

Nations: CA?, US
States/Provinces: CA?, ID, OR, WA
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **=** V.A.5.N.d. *Festuca viridula* Herbaceous Alliance (A.1257). (Bourgeron and Engelking 1994)

LOWER LEVEL UNITS

Associations:

- CEGL001568 *Festuca rubra* Montane Meadow
- CEGL001633 *Festuca viridula - Festuca idahoensis* Meadow
- CEGL001632 *Festuca viridula - Eucephalus ledophyllus* Meadow
- CEGL001596 *Festuca viridula - Carex hoodii* Meadow
- CEGL001634 *Festuca viridula - Lupinus argenteus var. laxiflorus* Meadow
- CEGL001635 *Festuca viridula - Lupinus latifolius* Meadow

AUTHORSHIP

Primary Concept Source: P.S. Bourgeron and L.D. Engelking (1994)
Author of Description: K.A. Schulz
Acknowledgments: We acknowledge D. Sarr for writing the original alliance description.
Version Date: 2014/03/14

REFERENCES

References: Bourgeron and Engelking 1994, Daubenmire 1981, Daubenmire and Daubenmire 1968, Douglas and Bliss 1977, Faber-Langendoen et al. 2017b, Franklin and Dyrness 1973, Hall 1967, Hamann 1972, Head 1959, Henderson 1973, Henderson and Peter 1982, Johnson and Simon 1985, Johnson and Simon 1987, Kuramoto and Bliss 1970, Layser 1980, Reid et al. 1980, Tisdale 1986

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G271. Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow

A3951. Ligusticum spp. - Lupinus spp. - Delphinium spp. Montane Mesic Meadow Alliance

Type Concept Sentence: Plant associations within this typically montane mesic meadow alliance are characterized by the dominance of diagnostic species *Ligusticum filicinum, Ligusticum porteri, Ligusticum tenuifolium, Lupinus argenteus*, or *Lupinus parviflorus ssp. myrianthus* and occur in the central Rocky Mountains of Wyoming and Idaho extending south to ranges in Colorado.

OVERVIEW

Scientific Name: *Ligusticum* spp. - *Lupinus* spp. - *Delphinium* spp. Montane Mesic Meadow Alliance
Common Name (Translated Scientific Name): Licorice-root species - Lupine species - Larkspur species Montane Mesic Meadow Alliance
Colloquial Name: Montane Licorice-root - Lupine - Larkspur Mesic Meadow

Type Concept: The vegetation of this montane mesic meadow alliance is characterized by a moderately dense, medium-tall herbaceous layer that is dominated by perennial forbs and composed of diagnostic and dominant species *Ligusticum filicinum, Ligusticum porteri, Ligusticum tenuifolium, Lupinus argenteus*, or *Lupinus parviflorus ssp. myrianthus*. This vegetation has high species richness. Other high frequency taxa include *Delphinium x occidentale, Fragaria virginiana, Osmorhiza occidentalis, Pedicularis bracteosa, Senecio crassulus, Trollius laxus ssp. albiflorus*, and *Vicia americana*. A few graminoids are frequent such as *Elymus trachycaulus, Festuca thurberi, Phleum alpinum, Poa alpina*, or *Trisetum spicatum*, but have sparse cover. Plant associations occur in the central Rocky Mountains of Wyoming and Idaho extending south to ranges in Colorado. Stands typically occur in montane zones but extend into upper subalpine meadows in swales, depressions and protected areas. Elevation ranges from 2170-3800 m. Sites may be flat to steeply sloped, but all are moist during most of the growing season, and often on lower slopes near snow drifts that are saturated from snowmelt. Aspects are often cooler north- to east-facing. Soils are moderately deep; the upper horizons are well-drained, but stay moist because of a slowly permeable dense clay in the lower horizons.

Classification Comments: One association in this alliance, *Lupinus* spp. - *Poa* spp. Meadow (CEGL001943), is based on standing crop data from just three small plots (5x5 m) on Carter Mountain in northwestern Wyoming (Thilenius and Brown 1987). Cover data and more information on this type from Carter Mountain are needed to show whether it is a distinct association or simply a patch in a larger alpine vegetation type. These stands were also disturbed by past domestic sheep grazing. Also, Johnston (1987) reported that Bowns and Bagley (1986) described similar stands at 2800 m in southwestern Utah, which are currently outside the range of this alliance.

Internal Comments:
Other Comments:

Similar NVC Types:
- A3950 *Agastache urticifolia - Geranium viscosissimum - Pteridium aquilinum* Montane Mesic Meadow Alliance: is dominated by species such as *Agastache urticifolia, Heliomeris multiflora, Geranium viscosissimum, Mertensia ciliata, Pteridium aquilinum*, or *Wyethia amplexicaulis*.
- A3948 *Valeriana sitchensis - Luzula glabrata var. hitchcockii - Xerophyllum tenax* Subalpine Mesic Meadow Alliance: is typically dominated by *Valeriana sitchensis* or *Xerophyllum tenax* with *Carex geyeri, Carex spectabilis, Chamerion angustifolium, Luzula glabrata var. hitchcockii*, and *Veratrum viride* sometimes abundant.
- A3949 *Phleum alpinum - Elymus trachycaulus - Agrostis variabilis* Subalpine Mesic Meadow Alliance: is dominated by *Phleum alpinum, Elymus trachycaulus*, or *Agrostis variabilis*.
- A1257 *Festuca viridula - Carex hoodii - Lupinus* spp. Subalpine Mesic Meadow Alliance: is dominated or codominated by *Festuca viridula* in the interior Pacific Northwest and central Rocky Mountains.

Diagnostic Characteristics: These are mesic meadows dominated or codominated by forbs; especially diagnostic and often dominant species are *Ligusticum filicinum, Ligusticum porteri, Ligusticum tenuifolium, Lupinus argenteus*, or *Lupinus parviflorus ssp. myrianthus*. Other high frequency associated species include *Delphinium x occidentale, Fragaria virginiana, Osmorhiza occidentalis, Pedicularis bracteosa, Poa* spp., *Senecio crassulus, Trollius laxus ssp. albiflorus*, and *Vicia americana*.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a moderately dense to dense (60-100% cover), medium tall (0.5-0.7 m) herbaceous layer that is dominated by perennial forbs. Perennial graminoids are also a consistent component of the vegetation and may form a short herbaceous layer less than 0.5 m tall, but have typically lower cover than the forb layer.

Floristics: This alliance is characterized by a moderately dense, medium-tall herbaceous layer that is dominated by perennial forbs and composed of diagnostic and dominant species *Ligusticum filicinum, Ligusticum porteri, Ligusticum tenuifolium, Lupinus argenteus*, or *Lupinus parviflorus ssp. myrianthus*. This vegetation has high species richness with an average of 27 species per plot (Gregory 1983). Other associated species include forbs such as *Achillea millefolium, Delphinium x occidentale, Eurybia integrifolia,*

Geranium viscosissimum var. viscosissimum, Helianthella quinquenervis, Lathyrus lanszwertii var. leucanthus, Osmorhiza occidentalis, Pedicularis bracteosa, Potentilla gracilis, Symphyotrichum foliaceum, and *Vicia americana* from lower elevation stands, and at higher elevations, *Arenaria congesta, Geranium viscosissimum var. incisum, Geum rossii, Polygonum bistortoides, Senecio crassulus*, and *Trollius laxus ssp. albiflorus*, sometimes forming an additional short herbaceous layer of cushion plants and short grasses in the upper subalpine/alpine ecotone (Gregory 1983, Thilenius and Brown 1987). A few graminoids are frequent, such as *Bromus carinatus, Elymus trachycaulus, Festuca idahoensis, Festuca thurberi, Melica spectabilis, Phleum alpinum, Poa alpina*, or *Trisetum spicatum*, but have sparse cover.

ENVIRONMENT & DYNAMICS

Environmental Description: Plant associations within this mesic meadow alliance are found in the central Rocky Mountains of Wyoming and Idaho extending south to ranges in Colorado. Sites are typically montane but extend into the upper subalpine to near treeline with elevations ranging from 2170-3800 m. Stands often occur in swales, depressions and protected areas. Sites may be flat to steeply sloped (0-60%), but all are moist during most of the growing season and often on lower slopes near snow drifts that are saturated from snowmelt. Cooler north- to east-facing aspects are prevalent. Soils are variable but are often moderately deep with the upper horizons well-drained, but staying moist because of slowly permeable dense clay in the lower horizons. Soil texture is gravelly loam to silty clay loam. Soil pH is 5.7-6.8. Parent materials may include glacial till, limestone, loess, quartzite, sandstone, siltstone, and shale. Adjacent communities are subalpine forests dominated by *Picea engelmannii* or *Abies lasiocarpa*.

Dynamics: Disturbance by gophers appears to be necessary to maintaining forb dominance in these subalpine meadows. Gregory (1983) reports that the use of herbicides to control *Delphinium x occidentale*, which is poisonous to cattle, may have caused grass species to be more important in these meadows than they would be in untreated situations.

DISTRIBUTION

Geographic Range: This alliance occurs in subalpine zones in the central Rocky Mountains in Wyoming, Utah and Idaho and extends south into the Colorado Rockies.

Nations: US
States/Provinces: CO, ID, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **>** *Ligusticum porteri* Series (Johnston 1987)
- **>** Upland Herb Community Type (Langenheim 1962) [central Colorado?]

LOWER LEVEL UNITS

Associations:
- CEGL003491 *Lupinus latifolius* Meadow
- CEGL001917 *Ligusticum tenuifolium - Trollius laxus ssp. albiflorus* Meadow
- CEGL001941 *Ligusticum filicinum - Delphinium x occidentale* Meadow
- CEGL001915 *Ligusticum porteri - Lupinus parviflorus ssp. myrianthus* Meadow
- CEGL001916 *Ligusticum porteri - Vicia americana* Meadow
- CEGL001942 *Lupinus argenteus - Fragaria virginiana* Meadow
- CEGL001943 *Lupinus* spp. - *Poa* spp. Meadow

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Bowns and Bagley 1986, Faber-Langendoen et al. 2017b, Gregory 1983, Hess and Wasser 1982, Johnston 1987, Langenheim 1962, Terwilliger et al. 1979a, Thilenius and Brown 1987

G271. Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow

A3949. Phleum alpinum - Elymus trachycaulus - Agrostis variabilis Subalpine Mesic Meadow Alliance

Type Concept Sentence: Plant associations within this upper subalpine to lower alpine mesic meadow alliance are characterized by the dominance of *Phleum alpinum, Elymus trachycaulus*, or *Agrostis variabilis* and occur in the central Rocky Mountains of Wyoming, Utah and Idaho extending west to ranges in Nevada.

OVERVIEW

Scientific Name: *Phleum alpinum - Elymus trachycaulus - Agrostis variabilis* Subalpine Mesic Meadow Alliance
Common Name (Translated Scientific Name): Alpine Timothy - Slender Wheatgrass - Mountain Bentgrass Subalpine Mesic Meadow Alliance
Colloquial Name: Subalpine Alpine Timothy - Slender Wheatgrass - Mountain Bentgrass Mesic Meadow

Type Concept: The vegetation of this upper subalpine to lower alpine mesic meadow alliance is characterized by a mesic herbaceous layer that has moderate to dense cover dominated or codominated by diagnostic perennial grass species *Agrostis variabilis, Elymus trachycaulus*, or *Phleum alpinum*. Dominant forb species are *Achillea millefolium* and *Symphyotrichum foliaceum (= Aster foliaceus)*, with *Antennaria corymbosa, Agoseris glauca, Epilobium ciliatum ssp. glandulosum (= Epilobium glandulosum)*, and exotic *Taraxacum officinale* frequently present. The ground surface is covered with nonvascular plants such as lichens, liverworts, and mosses forming a cryptogamic crust. Plant associations occur in the central Rocky Mountains including the Yellowstone Plateau, south into the Colorado Plateau west to high ranges in the Great Basin and possibly Sierra Nevada. Elevations range from 2500 to 3900 m. Associations are found in mesic to wet meadows, floodplains, and near seeps and streambanks on medium-textured, mineral soils.

Classification Comments: *Agrostis variabilis* Meadow (CEGL001846) is only known from one location in southern Utah and needs additional survey, description and classification work to understand its expression over its full range. The stands described by Hall (1971) may be the result of disturbance by livestock and may not be an accurate description of "natural" vegetation. Nachlinger (1985) describes *Phleum alpinum - Achillea millefolium*-dominated subalpine meadows in the Lake Tahoe region, California and Nevada.

Internal Comments:
Other Comments:

Similar NVC Types:
- A3950 *Agastache urticifolia - Geranium viscosissimum - Pteridium aquilinum* Montane Mesic Meadow Alliance: is dominated by mesic species such as *Agastache urticifolia, Geranium viscosissimum, Heliomeris multiflora, Mertensia ciliata, Pteridium aquilinum*, or *Wyethia amplexicaulis*.
- A3948 *Valeriana sitchensis - Luzula glabrata var. hitchcockii - Xerophyllum tenax* Subalpine Mesic Meadow Alliance: is typically dominated by *Valeriana sitchensis* or *Xerophyllum tenax* with *Carex geyeri, Carex spectabilis, Chamerion angustifolium, Luzula glabrata var. hitchcockii*, and *Veratrum viride* sometimes abundant.
- A3951 *Ligusticum* spp. - *Lupinus* spp. - *Delphinium* spp. Montane Mesic Meadow Alliance: is dominated by *Ligusticum filicinum, Ligusticum porteri, Ligusticum tenuifolium, Lupinus argenteus*, or *Lupinus parviflorus ssp. myrianthus*.
- A1257 *Festuca viridula - Carex hoodii - Lupinus* spp. Subalpine Mesic Meadow Alliance: is dominated or codominated by *Festuca viridula* in the interior Pacific Northwest and central Rocky Mountains.

Diagnostic Characteristics: These are high-altitude mesic meadows dominated by diagnostic mesic graminoid species *Phleum alpinum, Elymus trachycaulus*, or *Agrostis variabilis*. Dominant forb species are *Achillea millefolium* and *Symphyotrichum foliaceum*. Associated forb species include *Antennaria corymbosa, Antennaria parvifolia, Agoseris glauca, Cerastium beeringianum, Epilobium ciliatum ssp. glandulosum, Erigeron flagellaris, Lupinus lepidus, Penstemon procerus, Veronica serpyllifolia*, and exotic *Taraxacum officinale* (Hall 1971, Mattson 1984). Associated graminoids include *Blepharoneuron tricholepis, Carex engelmannii, Carex microptera, Deschampsia cespitosa, Festuca brachyphylla*, and *Poa* spp.

VEGETATION

Physiognomy and Structure: This alliance is characterized by a moderately dense to dense tufted perennial graminoid layer. The forb layer, typically of rhizomatous perennials, codominates. The ground surface has a cryptogamic crust of lichens, liverworts, and mosses (<0.1 m tall).

Floristics: The vegetation included in this subalpine meadow alliance is characterized by a mesic herbaceous layer that has moderate to dense cover depending on the amount of exposed rock. The herbaceous layer is dominated or codominated by diagnostic perennial grass species *Agrostis variabilis, Elymus trachycaulus*, or *Phleum alpinum*. Dominant forb species are *Achillea millefolium* and *Symphyotrichum foliaceum (= Aster foliaceus)*, with *Antennaria corymbosa, Agoseris glauca, Epilobium ciliatum ssp. glandulosum (= Epilobium glandulosum)*, and exotic *Taraxacum officinale* frequently present (Hall 1971, Mattson 1984). Associated

graminoids include *Blepharoneuron tricholepis, Carex engelmannii, Carex microptera, Deschampsia cespitosa, Festuca brachyphylla*, and *Poa* spp. Other associated perennial forb species include *Antennaria parvifolia, Cerastium beeringianum, Erigeron flagellaris, Lupinus lepidus, Penstemon procerus*, and *Veronica serpyllifolia*. Annual forbs include *Gentianella amarella ssp. acuta (= Gentiana amarella), Gentianella tenella (= Gentiana tenella), Polygonum polygaloides ssp. confertiflorum (= Polygonum watsonii)*, and *Veronica peregrina* (Hall 1971, Mattson 1984). The ground surface is covered with nonvascular plants such as lichens, liverworts, and mosses forming a cryptogamic crust.

ENVIRONMENT & DYNAMICS

Environmental Description: Plant associations within this upper subalpine to lower alpine mesic meadow alliance occur in the central Rocky Mountains including the Yellowstone Plateau, south into the Colorado Plateau west to high ranges in the Great Basin and possibly Sierra Nevada. Elevations range from 2500 to 3900 m. Climate is temperate. Summers are warm and winters are cold with freezing temperatures and heavy snow. The precipitation has a bimodal distribution, with about 70% of it occurring from October to April and 30% falling during the summer, often as high-intensity convection storms in the southern extent (Hall 1971). Associations are found in mesic to wet meadows, floodplains, and near seeps and streambanks on medium-textured, mineral soils (Hall 1971, Mattson 1984).

Stands on the Aquarius Plateau are located on gentle slopes (7%) on any aspect, midway between temporarily flooded basins and rock outcrops (Hall 1971). They may also occur on other somewhat mesic sites such as below talus slopes and along streams. Soil is a shallow, acidic (pH 5), nutrient-poor clay loam or loam derived from the basaltic lava that caps the plateau (Hall 1971). The ground surface has a cryptogamic crust of lichens, liverworts, and mosses. Although the soil profile is considered relatively shallow (54 cm), it is the deepest soil associated with the six herbaceous communities described in this meadow (Hall 1971). Water relations appear to be the dominant environmental factor that controls species composition (Hall 1971). This community is classified as dry-mesic (21% soil moisture) which is an intermediate grouping in a soil moisture gradient that ranges from hydric to rocky-xeric (51-5%) (Hall 1971).

Nachlinger (1985) did a detailed soil description on stands in the Sierra Nevada where sites were well-drained, typically occurring on gentle slopes ranging from 4-10° with southeast, south or west aspects. The water table generally is greater than 1 m below the surface (Nachlinger 1985). The A horizon averages 34 cm and is very dark brown to dark gray brown. Structure and texture vary from massive or single grain, loamy sand or sandy loam to massive or weak, angular blocky sandy clay loam, clay loam, or clay. She also reports an acid pH (4.7) in the A horizon. The B horizon is thick averaging 53 cm. It is most often dark brown sandy clay loam with a strongly acidic pH of 5.4 (Nachlinger 1985).

Adjacent vegetation on a large scale is subalpine forest dominated by species of *Abies, Picea*, or *Populus tremuloides*. On a smaller scale adjacent vegetation described by Hall (1971) includes mesic, wet-mesic or hydric meadows dominated by *Danthonia intermedia, Deschampsia cespitosa*, or *Carex aquatilis*, respectively. More xeric sites are dominated by *Festuca brachyphylla*.

Dynamics: Many areas in the western U.S. such as the Aquarius Plateau have had a long history of livestock grazing and may have significant deterioration to the vegetation (Hall 1971). Ranges were once heavily overstocked as evidenced by stocking rate records and reports of continuous sod of lush grasses from early inhabitants (Hall 1971). Currently, the Aquarius Plateau shows signs of past erosion and is dominated by relatively short grasses and an abundance of forbs, including the exotic *Taraxacum officinale* (Hall 1971).

DISTRIBUTION

Geographic Range: This alliance occurs in the subalpine zone in the central Rocky Mountains and extends south into the Colorado Plateau at and west to ranges in the Great Basin and possibly Sierra Nevada.

Nations: US
States/Provinces: CA?, NV, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **>** *Agrostis variabilis* Herbaceous Vegetation (Hall 1971)
- **>** *Phleum alpinum - Agropyron caninum* habitat type (Mattson 1984)

LOWER LEVEL UNITS

Associations:
- CEGL001920 *Phleum alpinum - Achillea millefolium* Meadow
- CEGL005427 *Elymus trachycaulus* Meadow

- CEGL001923 *Phleum alpinum - Elymus trachycaulus* Meadow
- CEGL001846 *Agrostis variabilis* Meadow

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by D. Culver.
Version Date: 2014/03/14

REFERENCES

References: Cronquist et al. 1977, Faber-Langendoen et al. 2017b, Hall 1971, Martin and Hutchins 1980, Mattson 1984, Nachlinger 1985, Sawyer and Keeler-Wolf 1995, Welsh et al. 1987

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G271. Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow

A4165. Poa secunda - Muhlenbergia richardsonis - Carex douglasii Moist Meadow Alliance [Low - Poorly Documented]

Type Concept Sentence: Moist deep-soil meadows dominated by graminoids *Poa secunda, Muhlenbergia richardsonis, Poa cusickii*, and/or *Carex douglasii*, found at low to high elevations throughout the interior of the western U.S.

OVERVIEW

Scientific Name: *Poa secunda - Muhlenbergia richardsonis - Carex douglasii* Moist Meadow Alliance
Common Name (Translated Scientific Name): Sandberg Bluegrass - Mat Muhly - Douglas' Sedge Moist Meadow Alliance
Colloquial Name: Bluegrass - Muhly - Sedge Moist Meadow

Type Concept: These moist meadows are dominated by *Poa secunda, Poa cusickii, Carex douglasii*, or *Muhlenbergia richardsonis*, usually with a diversity of other graminoids and forbs. They are found on gentle slopes of uplands or drainages, between approximately 10 and 3240 m (30-10,630 feet) elevation. Soils are moist to wet in the spring but dry by the end of the growing season. These meadows are found throughout the interior western United States.

Classification Comments:

Internal Comments: MSR 12-15: these communities are not always alkaline and fit well with Mesic herb meadow group.
Other Comments:

Similar NVC Types:
- A3471 *Deschampsia cespitosa* Serpentine Seep Alliance

Diagnostic Characteristics:

VEGETATION

Physiognomy and Structure:

Floristics: The vegetation is characterized by a somewhat open to dense graminoid canopy dominated by the short bunchgrass/graminoid *Poa secunda, Poa cusickii, Carex douglasii*, or *Muhlenbergia richardsonis*. The herbaceous layer is diverse, with additional graminoids such as *Aristida purpurea, Blepharipappus scaber, Bromus arvensis (= Bromus japonicus), Bromus rubens, Carex microptera, Carex praegracilis, Danthonia unispicata, Eleocharis palustris, Eleocharis quinqueflora (= Eleocharis pauciflora), Elymus caninus, Elymus elymoides, Elymus multisetus, Hesperostipa comata, Hordeum brachyantherum ssp. californicum, Juncus balticus, Koeleria macrantha, Leymus simplex, Leymus triticoides, Pascopyrum smithii, Sporobolus cryptandrus*, and *Triteleia hyacinthina*; however, these provide low to moderate cover. Forbs provide moderate cover and include *Achillea millefolium, Agoseris glauca, Linanthus pungens (= Leptodactylon pungens), Lomatium bicolor, Iris missouriensis, Iva axillaris, Potentilla gracilis, Senecio* sp., and *Trifolium* spp. Shrubs such as *Artemisia arbuscula, Artemisia tridentata*, or *Chrysothamnus viscidiflorus* may be present with sparse cover. Introduced species may also be common in some stands, especially *Bromus tectorum, Descurainia pinnata, Onopordum acanthium, Poa pratensis*, and *Sisymbrium altissimum*.

ENVIRONMENT & DYNAMICS

Environmental Description: This widespread grassland association occurs across the intermountain western U.S. Elevation ranges from 10 to 3240 m (32-10,630 feet). Stands occur on relatively flat terrain characterized as valley bottoms with shallow water tables, inactive floodplains, terraces, and dry basins, in swales, on upland gentle slopes and drainage bottoms, often with easterly facing

aspects, and sometimes on the dry fringes of wetter meadows. Substrates are deep, well-drained sandy loam and clay loam soils. The soils are moist in spring and tend to be dry by mid-summer, and are often on the dry fringe of wetter areas. This alliance has a wide tolerance of pH conditions and has been documented on serpentine soils, alkaline soils of sand dunes and acidic soils on sandstone and granitic substrates. USFWS wetland Inventory recognizes *Poa secunda* as an FACU.

Dynamics:

DISTRIBUTION

Geographic Range: These meadows are found in the western interior mountains and valleys of the western U.S.

Nations: US
States/Provinces: CA, CO, ID, MT, NV, OR, UT, WA?
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley); USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

- **>** *Carex douglasii* Herbaceous Alliance (Evens et al. 2014)
- **>** *Carex douglasii* Provisional Herbaceous Alliance (CNPS 2017) [45.169.00]
- **>** *Muhlenbergia richardsonis* (Mat muhly meadows) Provisional Alliance (Sawyer et al. 2009) [41.277.00]
- **>** *Poa secunda* (Curly blue grass grassland) Alliance (Sawyer et al. 2009) [41.180.00]
- **><** Alkali Meadow (#45310) (Holland 1986b)
- **><** Cusick Bluegrass Association (Kovalchik 1987)
- **><** Dry Meadow (Volland 1976)
- **><** Dry Montane Meadow (#45120) (Holland 1986b)
- **><** Dry Subalpine or Alpine Meadow (#45220) (Holland 1986b)
- **<** Sedge series (Sawyer and Keeler-Wolf 1995)

LOWER LEVEL UNITS

Associations:

- CEGL001602 *Deschampsia cespitosa - Carex douglasii* Moist Meadow
- CEGL005605 *Poa secunda - Linanthus pungens* Moist Meadow
- CEGL001768 *Carex douglasii* Moist Meadow
- CEGL001655 *Poa cusickii* Moist Meadow
- CEGL001657 *Poa secunda* Moist Meadow
- CEGL002755 *Poa secunda - Muhlenbergia richardsonis* Moist Meadow

AUTHORSHIP

Primary Concept Source: M.S. Reid, in Faber-Langendoen et al. (2015)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2016/09/27

REFERENCES

References: CNPS 2017, Evens et al. 2014, Faber-Langendoen et al. 2017b, Holland 1986b, Kovalchik 1987, Manning 1988, Padgett and Manning 1988, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Smith 1998b, Volland 1976

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G271. Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow

A3948. Valeriana sitchensis - Luzula glabrata var. hitchcockii - Xerophyllum tenax Subalpine Mesic Meadow Alliance

Type Concept Sentence: This alliance is characterized by a moderately dense and diverse herbaceous layer with one or more of several diagnostic species present and often abundant such as *Carex geyeri, Carex spectabilis, Chamerion angustifolium, Erythronium grandiflorum, Ligusticum grayi, Luzula glabrata var. hitchcockii, Sanguisorba officinalis, Valeriana sitchensis, Veratrum viride*, and *Xerophyllum tenax*. It is found in subalpine meadows in the central Rocky Mountains and extends west into the Olympic Mountains and Cascade Range.

OVERVIEW

Scientific Name: *Valeriana sitchensis - Luzula glabrata var. hitchcockii - Xerophyllum tenax* Subalpine Mesic Meadow Alliance
Common Name (Translated Scientific Name): Sitka Valerian - Hitchcock's Smooth Woodrush - Common Beargrass Subalpine Mesic Meadow Alliance
Colloquial Name: Subalpine Sitka Valerian - Smooth Woodrush - Beargrass Mesic Meadow

Type Concept: Vegetation is characterized by a moderately dense herbaceous layer with one or more of several diagnostic species present and often abundant, including *Carex geyeri, Carex spectabilis, Chamerion angustifolium, Erythronium grandiflorum, Ligusticum grayi, Luzula glabrata var. hitchcockii, Sanguisorba officinalis, Valeriana sitchensis, Veratrum viride*, and *Xerophyllum tenax*. The herbaceous layer has a fairly diverse flora that averages of 30 species per stand. Associated species include *Arnica latifolia, Athyrium filix-femina, Carex nigricans, Castilleja parviflora, Claytonia cordifolia, Elymus glaucus, Epilobium anagallidifolium, Erigeron peregrinus, Festuca viridula, Lupinus arcticus ssp. subalpinus, Oxyria digyna, Polygonum bistortoides, Potentilla flabellifolia, Pulsatilla occidentalis, Senecio triangularis*, and *Thalictrum occidentale* that are often present with low cover. This alliance is found in subalpine and lower alpine meadows in the central Rocky Mountains and extends west into the Olympic Mountains and Cascade Range. This small-patch alliance occurs from 1350 to 2300 m (5800-7550 feet) elevation. Stands occur on gentle to steep slopes having predominantly southerly exposures. It is a component of a complexly patterned environment representing those positions that accumulate a deep snowload and retain it long into the growing season assuring ample soil moisture well into August. Soils are moderately well- to poorly drained.

Classification Comments: Both *Carex geyeri* and *Chamerion angustifolium* are wide-ranging species in the Rocky Mountains. *Chamerion angustifolium* is particularly abundant following disturbances such as fire. Stands dominated by these species outside the central Rocky Mountains may need to be classified and placed in a different group.

Some associations included in this alliance are have both Cascadian and Rocky Mountain expressions of this type that may be different enough to warrant splitting the associations and placing them in separate alliances. For example, *Xerophyllum tenax - Sanguisorba officinalis* Meadow (CEGL003439) is described from the wet meadows in the northern Coast Ranges of Oregon and may not be the best fit for this alliance as its florist composition, other than the dominant species, is quite different from the stands in the central Rocky Mountains. More review is needed.

Internal Comments:
Other Comments:

Similar NVC Types:

- A3950 *Agastache urticifolia - Geranium viscosissimum - Pteridium aquilinum* Montane Mesic Meadow Alliance: is dominated by mesic species such as *Agastache urticifolia, Geranium viscosissimum, Heliomeris multiflora, Mertensia ciliata, Pteridium aquilinum*, or *Wyethia amplexicaulis*.
- A3949 *Phleum alpinum - Elymus trachycaulus - Agrostis variabilis* Subalpine Mesic Meadow Alliance: is dominated by *Phleum alpinum, Elymus trachycaulus*, or *Agrostis variabilis*.
- A3951 *Ligusticum* spp. - *Lupinus* spp. - *Delphinium* spp. Montane Mesic Meadow Alliance: is dominated by *Ligusticum filicinum, Ligusticum porteri, Ligusticum tenuifolium, Lupinus argenteus*, or *Lupinus parviflorus ssp. myrianthus*.
- A1257 *Festuca viridula - Carex hoodii - Lupinus* spp. Subalpine Mesic Meadow Alliance: is dominated or codominated by *Festuca viridula* in the interior Pacific Northwest and central Rocky Mountains.

Diagnostic Characteristics: These are high-altitude mesic meadows dominated or codominated by one or more diagnostic and often dominant species that include *Carex geyeri, Carex spectabilis, Chamerion angustifolium, Erythronium grandiflorum, Ligusticum grayi, Luzula glabrata var. hitchcockii, Sanguisorba officinalis, Valeriana sitchensis, Veratrum viride*, or *Xerophyllum tenax*. Associated species include *Arnica latifolia, Athyrium filix-femina, Carex nigricans, Castilleja parviflora, Claytonia cordifolia, Elymus glaucus, Epilobium anagallidifolium, Erigeron peregrinus, Festuca viridula, Lupinus arcticus ssp. subalpinus, Oxyria digyna, Polygonum bistortoides, Potentilla flabellifolia, Pulsatilla occidentalis, Senecio triangularis*, and *Thalictrum occidentale* that are often present with low cover.

VEGETATION

Physiognomy and Structure: This alliance is characterized by a moderate to dense cover of mainly rhizomatous, perennial forb and graminoid species.

Floristics: Vegetation is characterized by a moderately dense herbaceous layer with one or more of several diagnostic and often abundant species present, including *Carex geyeri, Carex spectabilis, Chamerion angustifolium, Erythronium grandiflorum, Ligusticum grayi, Luzula glabrata var. hitchcockii, Sanguisorba officinalis, Valeriana sitchensis, Veratrum viride*, and *Xerophyllum tenax*. The herbaceous layer has a fairly diverse flora that averages of 30 species per stand. Associated graminoids are indicative of various degrees of snowbed condition and include *Carex nigricans, Juncus drummondii, Juncus parryi*, and *Vahlodea atropurpurea*. On the more poorly drained sites, a variable suite of forbs associated with mesic to subhygric moisture regimes may exceed the graminoid cover; these forbs include *Arnica x diversifolia, Arnica latifolia, Epilobium anagallidifolium (= Epilobium alpinum), Erigeron peregrinus, Hieracium gracile*, and *Hypericum scouleri*. Other associated species that may be present with typically low cover include forbs such as *Antennaria rosea, Aquilegia flavescens, Arenaria capillaris, Arnica rydbergii, Athyrium filix-femina, Balsamorhiza sagittata, Campanula rotundifolia, Castilleja parviflora, Cirsium hookerianum, Claytonia cordifolia, Eriogonum flavum, Eriogonum umbellatum, Galium boreale, Hieracium scouleri var. albertinum (= Hieracium albertinum), Lomatium dissectum, Lupinus arcticus ssp. subalpinus, Oxyria digyna, Polygonum bistortoides, Potentilla diversifolia, Potentilla flabellifolia, Pulsatilla occidentalis, Sedum stenopetalum, Senecio megacephalus, Senecio triangularis, Symphyotrichum foliaceum (= Aster foliaceus), Thalictrum occidentale*, and graminoids *Elymus elymoides, Elymus glaucus, Festuca idahoensis, Festuca viridula, Koeleria macrantha, Phleum alpinum, Poa cusickii*, and *Pseudoroegneria spicata*. Shrubs may be absent or may include scattered individuals of *Amelanchier alnifolia, Artemisia tridentata ssp. spiciformis, Mahonia repens, Rubus parviflorus, Spiraea betulifolia*, and *Symphoricarpos oreophilus*, none with more than 5% cover. Both lichen and bryophyte cover are minimal, seldom exceeding 5%.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance is found in subalpine meadows in the central Rocky Mountains and extends west into the Cascade Range and Olympic Mountains. This is a small-patch alliance found at lower alpine and mid to upper subalpine zones from 1770 to 2300 m (5800-7550 feet) elevation throughout much of its range and down to 1350 m in the Olympic Mountains on east- to northeast-facing, moderate-gradient slopes that are generally too dry for tree establishment. In the Central Rockies stands occur on gentle to steep slopes having predominantly southerly exposures. It is a component of a complexly patterned environment representing those positions that accumulate a deep snowload and retain it long into the growing season. It generally occupies gently rolling terrain, particularly depressions within, and extends to gentle slopes and even steep slopes if conditions are conducive to snow accumulation and retention. It often occurs as narrow patches between tree-dominated atolls at the highest elevations of tree development. Other stands are found on gully slopes where streambeds are deeply incised in colluvium, resulting in unstable surfaces. In winter these gullies can fill with snow, which persists long into the growing season, assuring ample soil moisture well into August. Though the vegetation pattern can be regular, these sites are most often heterogeneous with patches of vegetation interspersed with bare gravel, scattered talus, as well as exposed bedrock. Because of persistent sheet erosion, soil development is restricted to the clumps or patches of grass and sedge. Parent materials include predominantly calcareous and noncalcareous fine-textured sedimentary rock. Soils are moderately well- to poorly drained. The great majority of the ground surface is covered with litter from the abundant vegetation.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is found in subalpine meadows in the central Rocky Mountains in Alberta, Idaho, Montana, and northwestern Wyoming and extends west into the Cascade Range and Olympic Mountains in Oregon, Washington and British Columbia.

Nations: CA, US
States/Provinces: AB, BC, ID, MT, OR, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** *Valeriana sitchensis - Carex spectabilis* Communities (Franklin and Dyrness 1973)
- **>** Moist *Valeriana* forb type (Kuramoto and Bliss 1970)

LOWER LEVEL UNITS

Associations:
- CEGL005856 *Chamerion angustifolium* Rocky Mountain Meadow
- CEGL003439 *Xerophyllum tenax - Sanguisorba officinalis* Meadow
- CEGL001997 *Valeriana sitchensis - Ligusticum grayi* Meadow
- CEGL001996 *Valeriana sitchensis - Carex spectabilis* Meadow
- CEGL005859 *Xerophyllum tenax* Meadow
- CEGL005864 *Carex geyeri* Meadow
- CEGL001998 *Valeriana sitchensis - Veratrum viride* Meadow
- CEGL005873 *Luzula glabrata var. hitchcockii - Erythronium grandiflorum* Meadow

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by M.S. Reid and M. Damm.
Version Date: 2014/03/14

REFERENCES

References: Faber-Langendoen et al. 2017b, Franklin and Dyrness 1973, Kuramoto and Bliss 1970

M493. Western North American Ruderal Grassland & Shrubland

This upland macrogroup contains ruderal grasslands, meadows and shrublands found on human-disturbed sites, and dominated by non-native and generalist native species that occur in temperate areas throughout the western U.S. (Rockies westward) and southwestern Canada.

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
2.B.2.Na.90.a. M493 Western North American Ruderal Grassland & Shrubland

G624. Western North American Interior Ruderal Grassland & Shrubland

Type Concept Sentence: This group includes grasslands dominated by the non-native grass *Elymus repens* and is known from disturbed valley bottoms, alluvial flats, fans and lower valley wall sites in western Colorado and northwestern Montana.

OVERVIEW

Scientific Name: Western North American Interior Ruderal Grassland & Shrubland Group
Common Name (Translated Scientific Name): Western North American Interior Ruderal Grassland & Shrubland Group
Colloquial Name: Western Ruderal Perennial Grassland

Type Concept: This montane, mesic to subhygric herbaceous group has low overall species diversity due to the dominance of *Elymus repens*, an exotic rhizomatous grass. *Elymus repens* is a highly invasive species in mesic areas and tends to exclude other species once established. Overall herbaceous cover ranges from 25-85% with *Elymus repens* clearly dominating with 5-80% cover. This group occurs in western Colorado, northwestern Montana, and southern Idaho. Sites include disturbed valley bottoms, alluvial flats, fans and lower valley wall sites between 1450 and 2300 m in elevation.

Classification Comments:

Similar NVC Types:
- G678 Californian Ruderal Forest
- G819 North American Warm Desert Ruderal Scrub
- G677 North American Warm Desert Ruderal Grassland
- G600 Great Basin-Intermountain Ruderal Dry Shrubland & Grassland

Diagnostic Characteristics:

VEGETATION

Physiognomy and Structure:

Floristics:

ENVIRONMENT & DYNAMICS

Environmental Description:

Dynamics:

DISTRIBUTION

Geographic Range:

Spatial Scale & Pattern [optional]:
Nations: CA, US
States/Provinces: CA, CO, KS, MT, ND, NE, NV, SD, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Alliances:
- A4191 *Rumex crispus* - (other FAC & Dryland Forb Species) Ruderal Meadow Alliance
- A2658 *Elymus repens* Ruderal Grassland Alliance
- A3254 *Agropyron cristatum - Bromus inermis - Poa pratensis* Ruderal Grassland Alliance

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2011)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 11/23/2016
Classif Resp Region: West
Internal Author: KAS 9-11; GK 11-16

REFERENCES

References: Faber-Langendoen et al. 2017a

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G624. Western North American Interior Ruderal Grassland & Shrubland

A3254. Agropyron cristatum - Bromus inermis - Poa pratensis Ruderal Grassland Alliance [Low - Poorly Documented]

Type Concept Sentence: This alliance occurs in disturbed dry to mesic grasslands and meadows found in lowland, montane and subalpine elevations (sea level to 3600 m) throughout the western U.S. and Canada. Vegetation can be a monoculture of a single non-native graminoid species, or a mix of several non-native forbs and graminoids. Graminoids include *Agropyron cristatum* and *Bromus inermis* (which has been purposefully seeded to prevent soil erosion), as well as many introduced forage species, especially in more mesic montane uplands such as *Alopecurus pratensis, Dactylis glomerata, Phleum pratense, Poa pratensis*, and *Psathyrostachys juncea*. Highly invasive and wind- and animal-distributed non-native forb species include *Sisymbrium altissimum, Descurainia sophia*, and *Lappula occidentalis*.

OVERVIEW

Scientific Name: *Agropyron cristatum - Bromus inermis - Poa pratensis* Ruderal Grassland Alliance
Common Name (Translated Scientific Name): Crested Wheatgrass - Smooth Brome - Kentucky Bluegrass Ruderal Grassland Alliance
Colloquial Name: Western Ruderal Perennial Grassland

Type Concept: This alliance occurs in disturbed dry to mesic grasslands and meadows found in lowland, montane and subalpine elevations (sea level to 3600 m) throughout the western U.S. and Canada. Vegetation can be a monoculture of a single non-native graminoid species, or a mix of several non-native forbs and graminoids. Graminoids include *Agropyron cristatum* and *Bromus inermis* (which has been purposefully seeded to prevent soil erosion), as well as many introduced forage species, especially in more mesic montane uplands, such as *Alopecurus pratensis, Dactylis glomerata, Phleum pratense, Poa pratensis*, and *Psathyrostachys juncea (=*

Elymus junceus). Highly invasive and wind- and animal-distributed non-native forb species include *Sisymbrium altissimum, Descurainia sophia*, and *Lappula occidentalis*.

Classification Comments: Successful introductions of non-native forage species have created stands of late-seral grasslands that are difficult to restore to native species.

Internal Comments:
Other Comments:

Similar NVC Types:
- A4148 *Agropyron cristatum* Western Ruderal Perennial Grassland Alliance

Diagnostic Characteristics: Dominant diagnostic species for this alliance are invasive, perennial grass species such as *Agropyron cristatum, Alopecurus pratensis, Dactylis glomerata, Phleum pratense, Poa pratensis, Psathyrostachys juncea*, and many others.

VEGETATION

Physiognomy and Structure:

Floristics:

ENVIRONMENT & DYNAMICS

Environmental Description:

Dynamics:

DISTRIBUTION

Geographic Range: This alliance occurs in lowland, montane and subalpine elevations (sea level to 3600 m) throughout the western U.S. and Canada.

Nations: CA, US
States/Provinces: CO, KS, MT, ND, NE, NV, SD, SK, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL005266 *Agropyron cristatum - (Pascopyrum smithii, Hesperostipa comata)* Ruderal Grassland
- CEGL005264 *Bromus inermis - (Pascopyrum smithii)* Ruderal Grassland
- CEGL005471 *Agropyron cristatum - Bromus tectorum* Ruderal Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2013/09/27

REFERENCES

References: Faber-Langendoen et al. 2017b

2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G624. Western North American Interior Ruderal Grassland & Shrubland

A2658. Elymus repens Ruderal Grassland Alliance

Type Concept Sentence: This alliance is dominated by the non-native grass *Elymus repens* and is known from disturbed valley bottoms, alluvial flats, fans and lower valley wall sites in western Colorado and northwestern Montana.

OVERVIEW

Scientific Name: *Elymus repens* Ruderal Grassland Alliance
Common Name (Translated Scientific Name): Quackgrass Ruderal Grassland Alliance
Colloquial Name: Ruderal Quackgrass Grassland

Type Concept: This montane, mesic to subhygric herbaceous alliance has low overall species diversity due to the dominance of *Elymus repens (= Elytrigia repens var. repens)*, an exotic rhizomatous grass. *Elymus repens* is a highly invasive species in mesic areas and tends to exclude other species once established. Overall herbaceous cover ranges from 25-85% with *Elymus repens* clearly dominating this association with 5-80% cover. This alliance is known western Colorado, northwestern Montana and southern Idaho. Sites include disturbed valley bottoms, alluvial flats, fans and lower valley wall sites between 1450 and 2300 m in elevation.

Classification Comments:

Internal Comments: GK 11-16: ID added for Minidoka.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Temperate semi-natural sod grasslands of disturbed areas characterized by a near monoculture of *Elymus repens*.

VEGETATION

Physiognomy and Structure: This alliance is characterized by a moderate to dense layer of medium-tall (0.5-1 m) perennial graminoids.

Floristics: This montane, mesic to subhygric herbaceous association has low overall species diversity due to the dominance of *Elymus repens (= Elytrigia repens var. repens)*, an exotic rhizomatous grass. *Elymus repens* is a highly invasive species in mesic areas and tends to exclude other species once established. Overall herbaceous cover ranges from 25-85% with *Elymus repens* clearly dominating this association with 5-80% cover. Other species sometimes present with low cover include *Achillea millefolium, Cerastium arvense, Carex* spp., *Equisetum laevigatum, Iva axillaris, Poa palustris, Penstemon confertus, Symphyotrichum laeve (= Aster laevis)*, and *Taraxacum officinale*.

ENVIRONMENT & DYNAMICS

Environmental Description: It occurs on flat to gently sloping lower slopes, toeslopes and valley bottoms at elevations between 1450 and 1555 m (4750-5100 feet) in Montana and between 1710 and 2285 m (5610-7500 feet) in Colorado. Soils are derived from glacial or fluvial deposits but are variable in soil texture, ranging from moderately well-drained sandy loams to clay loams to poorly drained gravel and rock. Litter dominates the ground surface.

Dynamics: Although characterized as an early-seral dominant (Gross and Werner 1982), *Elymus repens* is a highly invasive species in mesic areas and tends to exclude other species once established. It is tolerant of mildly saline conditions. It hybridizes readily with other wheatgrasses (e.g., *Pascopyrum smithii, Pseudoroegneria spicata*) and has fair to good forage value for domestic livestock. Many of the occurrences in the western U.S. can be traced to plantings of *Elymus repens* or hybrids for pasture or hay (Beetle 1955).

DISTRIBUTION

Geographic Range: This alliance is currently known from western Colorado, northwestern Montana, and southern Idaho.

Nations: US
States/Provinces: CO, ID, MT
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL005868 *Elymus repens* Ruderal Grassland

AUTHORSHIP

Primary Concept Source: J. Coles, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2016/11/23

REFERENCES

References: Beetle 1955, Faber-Langendoen et al. 2017b, Gross and Werner 1982

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G624. Western North American Interior Ruderal Grassland

A4191. Rumex crispus - (other FAC & Dryland Forb Species) Ruderal Meadow Alliance [Low - Poorly Documented]

Type Concept Sentence:

OVERVIEW

Scientific Name: *Rumex crispus* - (other FAC & Dryland Forb Species) Ruderal Meadow Alliance
Common Name (Translated Scientific Name): Curly Dock - (and other FAC & Dryland Forb Species) Ruderal Meadow Alliance
Colloquial Name: Ruderal FAC & Dryland Forb Meadow

Type Concept:

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics:

VEGETATION

Physiognomy and Structure:

Floristics:

ENVIRONMENT & DYNAMICS

Environmental Description:

Dynamics:

DISTRIBUTION

Geographic Range:

Nations: US
States/Provinces: ID
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL005621 *Rumex crispus* Ruderal Grassland

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2015)
Author of Description:
Acknowledgments:

REFERENCES

2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
2.B.2.Na.90.b. M493 Western North American Ruderal Grassland & Shrubland

G648. Southern Vancouverian Lowland Ruderal Grassland & Shrubland

Type Concept Sentence: This group is dominated by non-native invasive shrub or herbaceous species, such as *Agrostis capillaris, Anthoxanthum odoratum, Cytisus scoparius, Rubus armeniacus*, or many other introduced species, generally occurring on disturbed land throughout Pacific coastal areas below approximately 1500 m (5000 feet) in elevation.

OVERVIEW

Scientific Name: Southern Vancouverian Lowland Ruderal Grassland & Shrubland Group
Common Name (Translated Scientific Name): Southern Vancouverian Lowland Ruderal Grassland & Shrubland Group
Colloquial Name: Pacific Northwest Ruderal Coastal Grassland

Type Concept: This group is dominated by non-native species, such as introduced and invasive shrubs *Cytisus scoparius, Rubus armeniacus, Ulex europaeus*, and the introduced grasses *Agrostis capillaris, Anthoxanthum odoratum, Bromus hordeaceus, Holcus lanatus*, and/or *Poa pratensis*. It is abundant in waste areas and disturbed land throughout Pacific coastal areas either as abandoned pastures, roadside margins or other weedy places, below approximately 1500 m (5000 feet) in elevation. Sites are not mowed or otherwise maintained. Generally, these are areas that have been heavily disturbed by heavy equipment, such as old plowed fields, townsites, and abandoned millsites, livestock holding areas, and other once heavily used places that have been left as "waste" places.

Classification Comments: Restoration stands of planted or seeded native grasses such as *Festuca idahoensis ssp. roemeri, Festuca rubra*, or *Leymus mollis* are considered ruderal due to the fact that the planted species are the only native species present. If long-term restoration efforts succeed in reestablishing composition typical of a native plant associations, then stands could be reclassified into that type.

Similar NVC Types:
- G497 Californian Ruderal Grassland, Meadow & Scrub
- G647 North Pacific Maritime Coastal Ruderal Dune
- G677 North American Warm Desert Ruderal Grassland
- G819 North American Warm Desert Ruderal Scrub
- G600 Great Basin-Intermountain Ruderal Dry Shrubland & Grassland

Diagnostic Characteristics:

VEGETATION

Physiognomy and Structure:

Floristics: Sites are dominated by non-native herbaceous species, or introduced shrubs such as *Cytisus scoparius, Rubus armeniacus, Ulex europaeus*, and *Lupinus arboreus*, or areas planted/seeded with native grasses undergoing restoration. In some areas, stands may be dominated by native herbaceous species; however, these cases occur on clearly disturbed ground. Non-native graminoids that can be abundant include *Agrostis avenacea, Agrostis capillaris, Agrostis stolonifera, Anthoxanthum odoratum, Arrhenatherum elatius, Bromus diandrus ssp. rigidus (= Bromus rigidus), Bromus hordeaceus, Bromus madritensis, Bromus sterilis, Cynosurus echinatus, Schedonorus arundinaceus (= Schedonorus phoenix), Lolium perenne*, and *Vulpia bromoides (= Festuca bromoides)*. Other graminoids that are present to abundant include *Aira caryophyllea, Aira praecox, Dactylis glomerata, Elymus repens, Holcus lanatus*, and *Poa pratensis*. Some areas are dominated by non-native forbs such as *Cirsium arvense, Hypochaeris radicata, Leucanthemum vulgare, Medicago lupulina, Rumex acetosella, Sisymbrium altissimum, Taraxacum officinale, Teesdalia nudicaulis*, and *Trifolium dubium*.

Of course, some waste areas are a mix of non-native grasses and forbs, or a mix of native and non-native species. Other non-native forbs that may be present include *Centaurium erythraea, Cirsium vulgare, Trifolium pratense, Vicia hirsuta*, and *Vicia sativa*.

Native graminoids that may be present include *Carex inops, Bromus sitchensis, Elymus glaucus, Festuca rubra ssp. rubra*, and *Leymus mollis*. Stands of planted or seeded areas of native grasses (areas undergoing restoration) are included in this group until they mature into recognizable native plant associations. Native forbs and ferns that can be increasers with disturbance may be present and include *Cerastium arvense, Galium aparine, Heracleum maximum, Marah oreganus*, and *Pteridium aquilinum*. Some native shrubs may be scattered about with low abundance and include *Rubus ursinus, Symphoricarpos albus* and *Rosa nutkana*. Some areas have small to extensive patches of the introduced shrub *Rubus armeniacus* that is usually interspersed with the non-native grasses mentioned above.

ENVIRONMENT & DYNAMICS

Environmental Description: This group is widespread throughout the coastal areas of the Pacific Northwest, but has been intensively studied in the Puget Sound specifically. Stands occur on soils that have been disturbed in the past from plowing, grazing or animal holding areas such as old corrals or rabbit warrens. Soils are mostly shallow and textures range from gravel, sand, sandy loam to loam. These areas are mostly flat or on low slopes and are usually well-drained. Hydrology ranges from very dry south-facing slopes to somewhat mesic north-facing protected sites. This group does not include sand dunes.

Dynamics: This group is generally a product of disturbance or abandonment of human or livestock activity, and once established is a quite permanent part of the landscape.

DISTRIBUTION

Geographic Range: This group occurs in the Pacific Northwest in disturbed sites and waste areas along the coast from California to Washington and possibly elsewhere.

Spatial Scale & Pattern [optional]:
Nations: CA?, US
States/Provinces: BC?, CA, OR, WA
TNC Ecoregions [optional]: 1:C, 2:C, 14:C, 15:C
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Alliances:
- A2063 *Anthoxanthum odoratum - Holcus lanatus* Ruderal Coastal Grassland Alliance
- A2062 *Cytisus scoparius - Ulex europaeus* Coastal Ruderal Scrub Alliance

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2012)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 05/20/2015
Classif Resp Region: West
Internal Author: GK 5-12, 5-15

REFERENCES

References: Faber-Langendoen et al. 2017a

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G648. Southern Vancouverian Lowland Ruderal Grassland & Shrubland

2.B.2.Nb. Central North American Grassland & Shrubland

This division is found in the central plains of North America, and is dominated by grassland vegetation commonly referred to as shortgrass, mixedgrass and tallgrass prairie, interspersed with evergreen and deciduous shrublands. The vegetation occurs on either glaciated or non-glaciated substrates, rolling to rugged topography, and fine-textured to coarse-textured soils, and natural disturbances include grazing and fire.

M051. Great Plains Mixedgrass & Fescue Prairie

The macrogroup is dominated by mixed grasses and scattered to moderately dense shrubs. It is found from northern Texas to southern Alberta across to southwest in the region between the tallgrass prairies to the east and the shortgrass prairies to the west. It occurs on both glaciated and non-glaciated substrates on a wide variety of landforms, and natural disturbances include grazing and fire.

2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
2.B.2.Nb.2.a. M051 Great Plains Mixedgrass & Fescue Prairie

G133. Central Great Plains Mixedgrass Prairie

Type Concept Sentence: This group occurs in the central Great Plains where grasslands are dominated by *Bouteloua curtipendula, Pascopyrum smithii*, and *Schizachyrium scoparium*, often with tallgrass or shortgrass species present to codominant.

OVERVIEW

Scientific Name: *Schizachyrium scoparium - Bouteloua curtipendula - Pascopyrum smithii* Mixedgrass Prairie Group
Common Name (Translated Scientific Name): Little Bluestem - Sideoats Grama - Western Wheatgrass Mixedgrass Prairie Group
Colloquial Name: Seep Muhly Grassland

Type Concept: This mixedgrass prairie group ranges from South Dakota into the Rolling Plains and the western Edwards Plateau of Texas. The loessal regions in west-central Kansas and central Nebraska, the Red Hills region of south-central Kansas and northern Oklahoma are all located within this group. Because of its proximity to other ecoregions, this group contains elements from both shortgrass and tallgrass prairies, which combine to form the mixedgrass prairie group throughout its range. The distribution, species richness and productivity of plant species within the mixedgrass group is controlled primarily by environmental conditions, in particular soil moisture and topography. Grazing and fire are important dynamic processes in this group. The relative dominance of the various grass and forb species within different associations in the group also can strongly depend on the degree of natural or human disturbance. This group can contain grass species such as *Andropogon gerardii, Hesperostipa comata*, and *Sporobolus heterolepis*, although the majority of the associations within the region are dominated by *Pascopyrum smithii* or *Schizachyrium scoparium*, often with substantial *Bouteloua gracilis* or *Bouteloua curtipendula*. *Muhlenbergia reverchonii* can be a dominant in the southern part of the group's range. Numerous forb and sedge species (*Carex* spp.) can also occur within the mixedgrass group in the western Great Plains. *Bouteloua dactyloides (= Buchloe dactyloides)* and *Yucca glauca* can be common in drier or overgrazed areas. Some common forb species include *Ambrosia psilostachya, Echinacea angustifolia*, and *Lygodesmia juncea*. Oak species such as *Quercus macrocarpa* can occur also in areas protected from fire due to topographic position, which may resemble an oak savanna, and fire suppression may result in a closed canopy and expansion of bur oak beyond sheltered areas. Likewise, within the mixedgrass prairie, small seeps may occur, especially during the wettest years. Although these are not considered a separate group, the suppression of fire within the region has enabled the invasion of both exotics and some shrub species such as *Juniperus virginiana* and also allowed for the establishment of *Pinus ponderosa* in the northwestern parts of the range.

Classification Comments: This group was originally split into a dry group and a mesic group. It was combined into one group as the difference between mesic and dry appeared more appropriately separated at the alliance level.

Similar NVC Types: This group contains elements from both Great Plains Shortgrass Prairie Group (G144) and Central Tallgrass Prairie Group (G333). It is similar in structure and contains some similar species to both Northern Great Plains Mesic Mixedgrass Prairie Group (G141) and Northern Great Plains Dry Mixedgrass Prairie Group (G331).

- G144 Great Plains Shortgrass Prairie
- G141 Northern Great Plains Mesic Mixedgrass Prairie
- G068 Great Plains Sand Grassland
- G333 Central Tallgrass Prairie

Diagnostic Characteristics: This group contains elements from both shortgrass prairies to the west and tallgrass prairies to the north and east, which combine to form the mixedgrass prairie group throughout its range. Dominance by some combination of *Schizachyrium scoparium, Bouteloua curtipendula*, and *Bouteloua gracilis* in the central Great Plains is characteristic.

VEGETATION

Physiognomy and Structure: The vegetation is characterized by a dense to sparse mixture of tall, mid, and short grasses interspersed with forbs. Woody vegetation is uncommon in most examples but can become common in the prolonged absence of fire, especially in the wetter, eastern part of this group's range.

Floristics: This group typically contains mixedgrass species such as *Pascopyrum smithii, Bouteloua curtipendula, Schizachyrium scoparium, Hesperostipa comata, Sporobolus heterolepis*, and *Bouteloua gracilis*. Some tallgrass species may be common, such as *Andropogon gerardii, Sorghastrum nutans*, and *Panicum virgatum*. *Bouteloua dactyloides (= Buchloe dactyloides)* can become common on overgrazed sites. Common forb species include *Ambrosia psilostachya, Echinacea angustifolia*, and *Lygodesmia juncea*. Scattered patches of trees, often *Juniperus virginiana* and *Quercus macrocarpa* but also *Pinus ponderosa* in the northwest, and shrubs, typically *Artemisia filifolia* (on sandier soils), *Gutierrezia sarothrae, Prosopis glandulosa* (in the south), *Prunus virginiana*, and *Yucca glauca*, occur in some stands and these can increase in the prolonged absence of fire.

ENVIRONMENT & DYNAMICS

Environmental Description: Topographic and soil characteristics also vary across the range of this group. It is often characterized by rolling to extremely hilly landscapes with soils developed from loess, shale, limestone, or sandstone parent material. Mollisol soils are most prevalent and range from silt loams and silty clay loams with sandy loams possible on the western edge of the range. The Red Hills region of Kansas and Oklahoma, which contains examples of this group, contains somewhat unique soil characteristics and has developed from a diversity of sources including red shale, red clay, sandy shale, siltstone, or sandstone. These soils have developed a characteristic reddish color from the primary material. They can consist of silt, loam, or clay and can have textures ranging from fine sandy loam to a more clayey surface.

Dynamics: Fire and grazing are the primary processes occurring within the group. The diversity in this mixedgrass group likely reflects both the short- and long-term responses of the vegetation to these often concurrent disturbance regimes. Fire suppression and overgrazing can lead to the invasion of woody species such as *Juniperus virginiana* and *Pinus ponderosa*. Likewise, fire suppression may lead to a more closed canopy of *Quercus macrocarpa*.

DISTRIBUTION

Geographic Range: This group is found throughout the central and southern areas of the Western Great Plains ranging from southern South Dakota and possibly southern North Dakota into Texas with a few occurrences in the tallgrass-dominated landscapes of western Iowa, eastern Nebraska, and northwestern Missouri.

Spatial Scale & Pattern [optional]: Matrix
Nations: CA, US
States/Provinces: CO, IA, KS, ND, NE, NM, OK, SD, TX
TNC Ecoregions [optional]: 27:P, 28:P, 29:C, 32:C, 33:C, 36:C, 37:P
USFS Ecoregions (2007): 223A:??, 251A:CP, 251B:CC, 251E:CP, 251F:CC, 251H:CC, 255A:??, 315F:CC, 331B:CC, 331C:CC, 331E:CC, 331F:CC, 331H:CC, 331I:CC, 331M:CP, 332B:CC, 332C:CC, 332D:CC, 332E:CC, 332F:CC
Omernik Ecoregions: 9.4.2.27:C, 9.4.2.27d:C, 9.4.2.27g:C, 9.4.2.27h:C, 9.4.2.27i:C, 9.4.2.27k:C, 9.4.2.27l:C, 9.4.2.27n:C, 9.4.2.27o:C, 9.4.2.27r:C, 9.4.3.26:C, 9.4.3.26a:C, 9.4.3.26c:C
Federal Lands [optional]: DOD (Fort Hood)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** Blue Grama - Western Wheatgrass (704) (Shiflet 1994)
- **<** Bluestem - Grama (709) (Shiflet 1994)
- **>** Bluestem - Grama Prairie (604) (Shiflet 1994)
- **>** Eastern Redcedar: 46 (Eyre 1980) [Only on really degraded sites.]

LOWER LEVEL UNITS

Alliances:

- A4042 *Schizachyrium scoparium - Bouteloua curtipendula* Central Great Plains Grassland Alliance
- A4038 *Rhus trilobata* Great Plains Shrubland Alliance
- A4039 *Pascopyrum smithii - Bouteloua gracilis* Great Plains Grassland Alliance
- A4040 *Muhlenbergia reverchonii* Grassland Alliance

AUTHORSHIP

Primary Concept Source: S. Menard and K. Kindscher, in Faber-Langendoen et al. (2011)
Author of Description: S. Menard, K. Kindscher, D. Faber-Langendoen and J. Drake
Acknowledgments: B. Hoagland
Version Date: 05/07/2015
Classif Resp Region: Midwest
Internal Author: SEM 12-10, mod. DFL/BH 10-13, mod. JD 5-15

REFERENCES

References: Barbour and Billings 1988, Comer et al. 2003, Eyre 1980, Faber-Langendoen et al. 2017a, Ricketts et al. 1999, Shiflet 1994, Tolstead 1941, Tolstead 1942, Weaver and Albertson 1956, Weaver and Bruner 1948

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G133. Central Great Plains Mixedgrass Prairie

A4040. Muhlenbergia reverchonii Grassland Alliance

Type Concept Sentence: This alliance consists of grasslands of limestone slopes and associated seeps of the Edwards Plateau and central Oklahoma where *Muhlenbergia reverchonii* is dominant or codominant.

OVERVIEW

Scientific Name: *Muhlenbergia reverchonii* Grassland Alliance
Common Name (Translated Scientific Name): Seep Muhly Grassland Alliance
Colloquial Name: Seep Muhly Grassland

Type Concept: This alliance consists of grasslands of limestone slopes and associated seeps of the Edwards Plateau and the Arbuckle Mountains of Oklahoma. This type is characterized by *Muhlenbergia reverchonii*, vernally moist to wet from seepage flow; examples often co-occur with clumps of *Juniperus virginiana* and *Juniperus ashei*. Other typical species include *Stenaria nigricans (= Hedyotis nigricans)* and *Dodecatheon meadia*. In Texas, this alliance occurs in a matrix of *Juniperus ashei* and *Quercus fusiformis* woodlands. Dominant species include *Muhlenbergia reverchonii* and *Bouteloua hirsuta var. pectinata (= Bouteloua pectinata)*. Other species present include *Andropogon glomeratus, Eupatorium serotinum, Heliotropium tenellum, Schizachyrium scoparium*, and *Dodecatheon meadia*.

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: This alliance is characterized by sites wet in the spring or from seepage and dominated by *Muhlenbergia reverchonii*.

VEGETATION

Physiognomy and Structure: This alliance is dominated by mid grasses. Sites are often with clumps of short trees and may be partially shaded by them.

Floristics: This type is characterized by *Muhlenbergia reverchonii*, vernally moist to wet from seepage flow; examples often co-occur with clumps of *Juniperus virginiana* and *Juniperus ashei*. Other typical species include *Stenaria nigricans (= Hedyotis nigricans)* and *Dodecatheon meadia*. In Texas, this alliance occurs in a matrix of *Juniperus ashei* and *Quercus fusiformis* woodlands. Dominant species include *Muhlenbergia reverchonii* and *Bouteloua hirsuta var. pectinata (= Bouteloua pectinata)*. Other species present include *Schizachyrium scoparium* and *Dodecatheon meadia*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance consists of grasslands of limestone slopes and associated seeps of the Edwards Plateau and central Oklahoma, and small-patch occurrences (mostly less than 1 acre in size) in the Fort Worth Prairie and Western Crosstimbers regions of Texas and to a lesser extent the Whiterock Cuesta of the Blackland Prairie region of Texas.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance occurs in the Edwards Plateau of Texas and the Arbuckle Mountains of Oklahoma.

Nations: US
States/Provinces: OK, TX
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Muhlenbergia reverchonii* herbaceous alliance (Hoagland 1998a)

LOWER LEVEL UNITS

Associations:

- CEGL004785 *Muhlenbergia reverchonii - Croton monanthogynus* Grassland
- CEGL004520 *Muhlenbergia reverchonii - Bouteloua hirsuta var. pectinata - Carex microdonta* Grassland
- CEGL004219 *Muhlenbergia reverchonii - Bouteloua curtipendula - Desmanthus velutinus* Grassland

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments: We have incorporated significant descriptive information previously compiled by B. Hoagland.
Version Date: 2014/12/18

REFERENCES

References: Dale 1959, Faber-Langendoen et al. 2017b, Hoagland 1998a

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G133. Central Great Plains Mixedgrass Prairie

A4039. Pascopyrum smithii - Bouteloua gracilis Great Plains Grassland Alliance

Type Concept Sentence: This alliance is found in the southwestern Great Plains to western New Mexico where *Pascopyrum smithii* and *Bouteloua gracilis* dominate in swales and valleys.

OVERVIEW

Scientific Name: *Pascopyrum smithii - Bouteloua gracilis* Great Plains Grassland Alliance
Common Name (Translated Scientific Name): Western Wheatgrass - Blue Grama Great Plains Grassland Alliance
Colloquial Name: Great Plains Western Wheatgrass - Blue Grama Grassland

Type Concept: This alliance of the southern Great Plains, Chihuahuan Desert and western New Mexico mountains of the United States was once an extensive grassland. Ground cover is characterized by scattered bunchgrasses and patches of the rhizomatous grasses and litter with exposed soil and gravel in the intergrass spaces. Luxuriant cover that can be dominated by either *Bouteloua gracilis* or *Pascopyrum smithii* typifies this grassland. Graminoid diversity is usually low, with scattered grasses such as *Elymus elymoides, Koeleria macrantha*, and *Muhlenbergia repens* often present. In Kansas, *Bouteloua curtipendula* and *Bouteloua dactyloides (= Buchloe dactyloides)* may also be present. The shrub layer is very open and moderate in diversity and generally includes *Atriplex canescens* and *Krascheninnikovia lanata* (which both occur as phases and can become dominant in disturbed areas), as well as *Cylindropuntia imbricata (= Opuntia imbricata)* and *Opuntia phaeacantha*. Forb diversity and cover are generally low. Stands occur within montane swales or along upland valley bottoms. It generally occurs on northerly or northeasterly aspects at elevations between 915 and 2440 m (3000-8000 feet). Slopes are typically gentle with fine-textured and well-developed soils that are predominantly from eroded Paleozoic sandstone and limestone.

Classification Comments: This alliance currently contains only one association (CEGL001578). This alliance should be considered in relation to *Pascopyrum smithii - Nassella viridula* Northwestern Great Plains Grassland Alliance (A4031). This alliance (A4039) has similar dominants, though it occurs further south than A4031.

Internal Comments:
Other Comments:

Similar NVC Types:

- A4031 *Pascopyrum smithii - Nassella viridula* Northwestern Great Plains Grassland Alliance: is found in the northern Great Plains; diagnostic criteria for these two alliances in the northern Great Plains are not well-established.

Diagnostic Characteristics: This alliance is characterized by stands dominated by *Pascopyrum smithii* and *Bouteloua gracilis*.

VEGETATION

Physiognomy and Structure: This is an herbaceous alliance, dominated by short to mid-height graminoids. Mid grasses are the dominant vegetation in most examples of this alliance, although short grasses can be codominant. The vegetation tends to be

denser where the mid grasses are predominant and more open where shorter graminoids are abundant. The mid grasses grow to 0.5-1.0 m on favorable sites, while the short grasses are less than 0.5 m tall. Both forb and shrub species are minor in this alliance. If shrubs are present, they are typically less than 1 m in height.

Floristics: Luxuriant cover that can be dominated by either *Bouteloua gracilis* or *Pascopyrum smithii* typifies this grassland. *Juniperus monosperma* or *Pinus edulis* communities usually surround this swale association the mountains of New Mexico. In New Mexico, *Atriplex canescens* is the most frequently occurring and abundant shrub, with *Ericameria nauseosa, Opuntia phaeacantha*, and *Gutierrezia sarothrae* common associates, but overall cover seldom exceeds 2.5%. Graminoid diversity is usually low, with scattered grasses such as *Elymus elymoides, Koeleria macrantha*, and *Muhlenbergia repens* often present. In Kansas, *Bouteloua curtipendula* and *Bouteloua dactyloides (= Buchloe dactyloides)* may also be present. The shrub layer is very open and moderate in diversity and generally includes *Atriplex canescens* and *Krascheninnikovia lanata* (which both occur as phases and can become dominant in disturbed areas), as well as *Cylindropuntia imbricata (= Opuntia imbricata)* and *Opuntia phaeacantha*. Forb diversity and cover are generally low. In New Mexico, forbs are common but variable; the most abundant are *Artemisia campestris ssp. caudata, Engelmannia peristenia, Glandularia bipinnatifida*, and *Penstemon virgatus*. Trees and shrubs are accidental or absent.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands occur within montane swales or along upland valley bottoms. It generally occurs on northerly or northeasterly aspects at elevations between 915 and 2500 m (3000-8000 feet). Slopes are typically gentle with fine-textured and well-developed soils that are predominantly from eroded Paleozoic sandstone and limestone. In Kansas, stands are common on nearly level uplands or shallow depressions in uplands. Soils are silty clay loam with an impermeable or slowly permeable claypan subsoil layer. Ground cover is characterized by scattered bunchgrasses and patches of the rhizomatous grasses and litter with exposed soil and gravel in the intergrass spaces.

Dynamics: *Pascopyrum smithii* is rhizomatous and is tolerant of moderate grazing. If severely overgrazed, *Pascopyrum smithii* will decline and may be replaced by less desirable warm-season grasses and exotic species such as *Poa pratensis*.

DISTRIBUTION

Geographic Range: This alliance is found in the southern Great Plains, Chihuahuan Desert and western New Mexico mountains in the United States, ranging from Colorado and Kansas south to Texas. It has also been reported from Wyoming.

Nations: CA, US
States/Provinces: CO, KS, NE?, NM, OK, TX, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL001578 *Pascopyrum smithii - Bouteloua gracilis* Grassland

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Branson et al. 1964, Branson et al. 1965, Bujakiewicz 1975, Bunin 1985, Costello 1944b, Culwell and Scow 1982, Dick-Peddie 1993, Donart et al. 1978a, Faber-Langendoen et al. 2017b, Hadley and Branson 1965, Hanson et al. 1931, Johnston 1987, Moir 1969b, Muldavin and Mehlhop 1992, Mutel 1976, Ramaley 1927, Rogers 1953, Shantz 1906, Shantz 1923, Soil Conservation Service 1978, Vestal 1919, Weaver and Albertson 1956, Wooten 1980

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G133. Central Great Plains Mixedgrass Prairie

A4038. Rhus trilobata Great Plains Shrubland Alliance

Type Concept Sentence: This alliance has been identified in the northern panhandle of Texas but is likely more widespread in the southwestern Great Plains. It occurs on steep talus slopes with a moderate short-shrub canopy dominated by *Rhus trilobata* with lesser amounts of *Dalea formosa, Mimosa borealis*, and *Yucca glauca* and a herbaceous layer dominated by *Bouteloua curtipendula* and *Schizachyrium scoparium*.

OVERVIEW

Scientific Name: *Rhus trilobata* Great Plains Shrubland Alliance
Common Name (Translated Scientific Name): Skunkbush Sumac Great Plains Shrubland Alliance
Colloquial Name: Great Plains Skunkbush Sumac Shrubland

Type Concept: This alliance has been identified in the northern panhandle of Texas and Oklahoma, but is likely more widespread in the southwestern Great Plains. There is a moderate short-shrub canopy dominated by *Rhus trilobata* with lesser amounts of *Dalea formosa, Mimosa borealis*, and *Yucca glauca*. North-facing slopes often have denser shrub cover. There are also scattered individuals of *Ptelea trifoliata* and shrubby *Celtis laevigata* scattered throughout. *Bouteloua curtipendula* and *Schizachyrium scoparium* dominate the moderate to dense herbaceous stratum. Many other herbaceous species, including *Andropogon gerardii, Bouteloua hirsuta, Erioneuron pilosum, Elymus canadensis, Eriogonum longifolium*, and *Tetraneuris scaposa*, can occur in this type, but none are abundant. This alliance occurs on steep talus slopes consisting of large and small boulders. Stands occur on north- and south-facing slopes and typically have loamy soils.

Classification Comments: This alliance currently has one association that was described from a location in the Texas Panhandle. *Rhus trilobata* communities in the southwestern Great Plains are more widespread and more diverse than is reflected in this description.

Internal Comments: BH 10-13: OK added.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: This alliance occurs in the southwestern Great Plains on rocky slopes with >25% canopy of short shrubs. *Rhus trilobata* is the most abundant shrub. Short and mid grasses, particularly *Schizachyrium scoparium* and *Bouteloua curtipendula*, dominate the herbaceous stratum.

VEGETATION

Physiognomy and Structure: This alliance has a short-shrub (<1 m) canopy, typically with low to moderate cover (25-60%). Short and mid grasses can have moderate to dense cover. Scattered small trees may be present.

Floristics: The shrub stratum in this alliance is dominated or codominated by *Rhus trilobata*. Associated shrubs include *Dalea formosa, Mimosa borealis*, and *Yucca glauca* and scattered scrubby trees of *Ptelea trifoliata* and *Celtis laevigata*. *Bouteloua curtipendula* and *Schizachyrium scoparium* dominate the moderate to dense (30-50% cover) herbaceous stratum. Many other herbaceous species, including *Andropogon gerardii, Artemisia ludoviciana, Calylophus serrulatus, Chaetopappa ericoides (= Leucelene ericoides), Elymus canadensis, Eriogonum longifolium*, and *Tetraneuris scaposa*, can occur in this alliance, but none is abundant. Forbs are variable depending on site characteristics.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs on steep talus slopes consisting of large and small boulders. Stands occur on north- and south-facing slopes and typically have loamy soils.

Dynamics: *Rhus trilobata* has seeds that are impermeable and exhibit embryonic dormancy. Germination requires scarification either through cold stratification, fire, or animal ingestion. However, the primarily means of reproduction is vegetative through root sprouts which can result in dense thickets.

DISTRIBUTION

Geographic Range: This alliance has been identified only in Oklahoma and northern Texas but is likely more widespread on rocky slopes in the southwestern Great Plains.

Nations: US
States/Provinces: OK, TX
TNC Ecoregions [optional]:
USFS Ecoregions (2007):

Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL005026 *Rhus trilobata / Bouteloua curtipendula - Schizachyrium scoparium* Shrubland

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments: We have incorporated significant descriptive information previously compiled by B. Hoagland.
Version Date: 2014/12/18

REFERENCES

References: Belcher 1985, Faber-Langendoen et al. 2017b

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G133. Central Great Plains Mixedgrass Prairie

A4042. Schizachyrium scoparium - Bouteloua curtipendula Central Great Plains Grassland Alliance

Type Concept Sentence: This alliance is common in the central and southern Great Plains on slopes and rolling uplands where *Schizachyrium scoparium* and *Bouteloua curtipendula* are dominant or codominant, possibly with a variety of other short, mid, and tallgrass species.

OVERVIEW

Scientific Name: *Schizachyrium scoparium - Bouteloua curtipendula* Central Great Plains Grassland Alliance
Common Name (Translated Scientific Name): Little Bluestem - Sideoats Grama Central Great Plains Grassland Alliance
Colloquial Name: Central Great Plains Little Bluestem - Sideoats Grama Grassland

Type Concept: This alliance is found largely in the central and southern Great Plains with some occurrences in the northern Great Plains. It is widespread and common. Across its range, the vegetation is dominated by mid grasses. The vegetation cover can be moderately sparse to dense. Tall grasses and short grasses contribute substantially to the vegetation cover in most communities. The dominants are the nominal species *Schizachyrium scoparium* and *Bouteloua curtipendula*. *Bouteloua gracilis* and *Bouteloua hirsuta* are common associates across this alliance's range. Other graminoids that are present to codominant are *Andropogon gerardii, Andropogon hallii* (on sandier soils), *Bouteloua dactyloides (= Buchloe dactyloides)* (in the south and west of this alliance's range), *Calamovilfa longifolia* (on sandier soils), *Koeleria macrantha, Pascopyrum smithii, Sporobolus cryptandrus, Sporobolus compositus var. compositus* (in the south), and *Sporobolus heterolepis* (in the east). There are a great number of forbs that occur in communities of this alliance, although they do not make up a large part of the herbaceous canopy. *Ambrosia psilostachya, Amorpha canescens, Dalea purpurea, Echinacea angustifolia, Gaura coccinea, Liatris punctata, Lygodesmia juncea, Ratibida columnifera, Sphaeralcea coccinea, Symphyotrichum ericoides*, and *Symphyotrichum oblongifolium* are found in many communities in this alliance. Shrubs are not abundant, but *Artemisia filifolia, Artemisia frigida, Rhus trilobata, Rosa* spp., *Symphoricarpos occidentalis*, and *Yucca glauca* may be scattered among the herbaceous species. Communities within this alliance are most commonly found on slopes but can occur on level ground. Loam and silt soils appear to be the most common; however, in the southwest of this alliance's range, some communities are predominantly on sandy soils.

Classification Comments: Two associations in this alliance appear to represent the same or very similar communities. *Juniperus virginiana var. virginiana / Schizachyrium scoparium - Bouteloua curtipendula* Great Plains Grassland (CEGL004066) and *Juniperus virginiana var. virginiana / Schizachyrium scoparium* Wooded Grassland (CEGL004209) should be considered for merging or more clearly differentiated.

Internal Comments: mjr 6-16: MX? added based on members.
Other Comments:

Similar NVC Types:
- A4034 *Schizachyrium scoparium* Northwestern Great Plains Grassland Alliance: is found further north and west.
- A4058 *Schizachyrium scoparium - Bouteloua curtipendula - Sorghastrum nutans* Central Bedrock Grassland Alliance

- A4028 *Andropogon gerardii - Sorghastrum nutans* Mixedgrass Western Plains Grassland Alliance
- A1919 *Juniperus virginiana / Schizachyrium scoparium - Bouteloua curtipendula* Alkaline Bedrock Scrub Grassland Alliance

Diagnostic Characteristics: This alliance is concentrated in the central and southern Great Plains. Stands are mixedgrass communities dominated by *Schizachyrium scoparium*, often with *Bouteloua curtipendula* and possibly a variety of other grasses.

VEGETATION

Physiognomy and Structure: Across its range, this alliance is dominated by mid grasses. The vegetation cover can be moderately sparse to dense. Tall and short grasses contribute substantially to the vegetation cover in most communities. The proportions of these two lifeforms are typically negatively correlated with each other and vary with the specific community and site. The tall grasses are more prevalent on sandier soils and on moderate or gentle lower slopes. The short grasses tend to be more common on flat uplands or steep slopes with heavier soils (Weaver and Albertson 1956). Shrubs and small trees are usually absent or rare but can become common in the absence of fire, particularly in the eastern portion of this alliance's range.

Floristics: The dominants are the nominal species *Schizachyrium scoparium* and *Bouteloua curtipendula*. *Bouteloua gracilis* and *Bouteloua hirsuta* are common associates across this alliance's range. Other graminoids that are present to codominant are *Andropogon gerardii, Andropogon hallii* (on sandier soils), *Bouteloua dactyloides (= Buchloe dactyloides)* (in the south and west of this alliance's range), *Calamovilfa longifolia* (on sandier soils), *Koeleria macrantha, Pascopyrum smithii, Sporobolus cryptandrus, Sporobolus compositus var. compositus* (in the south), and *Sporobolus heterolepis* (in the east). There are a great number of forbs that occur in communities of this alliance, although they do not make up a large part of the herbaceous canopy. *Ambrosia psilostachya, Amorpha canescens, Dalea purpurea, Echinacea angustifolia, Gaura coccinea, Liatris punctata, Lygodesmia juncea, Ratibida columnifera, Sphaeralcea coccinea, Symphyotrichum ericoides*, and *Symphyotrichum oblongifolium* are found in many communities in this alliance. Shrubs are not abundant, but *Artemisia filifolia, Artemisia frigida, Rhus trilobata, Rosa* spp., *Symphoricarpos occidentalis*, and *Yucca glauca* may be scattered among the herbaceous species. In the eastern portion of this alliance's range, *Juniperus virginiana* can become abundant in the absence of fire or other methods of control.

ENVIRONMENT & DYNAMICS

Environmental Description: Communities within this alliance are most commonly found on slopes but can occur on level ground. Soils and substrates vary considerably for this alliance. Loam and silt soils appear to be the most common; however, in the southwest of this alliance's range, some communities are predominantly on sandy soils (Weaver and Albertson 1956). Some communities are found on loess soils.

Dynamics: Fire is important to prevent the invasion of woody species into stands, especially in the eastern portion of this alliance's range. However, fire is not as important as in more mesic grasslands, because drought conditions slow encroachment by woody species.

DISTRIBUTION

Geographic Range: This alliance is common from the central Great Plains south to northern Texas and has scattered occurrences in the north-central Great Plains.

Nations: MX?, US
States/Provinces: CO, IA, KS, MO, ND, NE, OK, SD, TX
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** *Schizachyrium scoparium / Juniperus virginiana* herbaceous alliance (Hoagland 1998a)
- **><** Bluestem-Grama Prairie (Küchler 1974)
- **><** Cedar Hills Prairie (Küchler 1974)
- **><** Chalkflat Prairie (Küchler 1974)
- **?** Mixed prairie [*Stipa-Bouteloua* association] (Bruner 1931)
- **?** T5B1aI1a. *Schizachyrium scoparium* (Foti et al. 1994)
- **?** T5B1aI1c. *Bouteloua curtipendula* (Foti et al. 1994)
- **?** Various communities (Weaver and Albertson 1956)

LOWER LEVEL UNITS

Associations:

- CEGL002246 *Schizachyrium scoparium - Bouteloua curtipendula - Bouteloua gracilis* Central Plains Grassland
- CEGL002238 *Hilaria belangeri - Bouteloua curtipendula* Grassland
- CEGL005031 *Sporobolus cryptandrus - Schizachyrium scoparium - Bouteloua curtipendula* Grassland
- CEGL002247 *Schizachyrium scoparium - Bouteloua curtipendula* Chalkflat Grassland
- CEGL002036 *Schizachyrium scoparium - Bouteloua curtipendula* Loess Mixedgrass Grassland
- CEGL002035 *Schizachyrium scoparium - Bouteloua curtipendula - Bouteloua hirsuta - (Yucca glauca)* Grassland
- CEGL002248 *Schizachyrium scoparium - Bouteloua curtipendula* Red Hills Grassland
- CEGL004066 *Juniperus virginiana var. virginiana / Schizachyrium scoparium - Bouteloua curtipendula* Great Plains Grassland
- CEGL001594 *Schizachyrium scoparium - Bouteloua curtipendula* Western Great Plains Grassland
- CEGL002252 *Schizachyrium scoparium - Lesquerella gordonii - Castilleja purpurea var. citrina* Grassland
- CEGL004209 *Juniperus virginiana var. virginiana / Schizachyrium scoparium* Wooded Grassland
- CEGL004070 *Schizachyrium scoparium - Bouteloua curtipendula - Nassella leucotricha* Grassland

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments: We have incorporated significant descriptive information previously compiled by B. Hoagland.
Version Date: 2014/12/18

REFERENCES

References: Bruner 1931, Diamond 1993, Faber-Langendoen et al. 2017b, Foti et al. 1994, Hansen and Hoffman 1988, Hoagland 1997, Hoagland 1998a, Johnston 1987, Küchler 1974, Lauver et al. 1999, Nelson 1985, Soil Conservation Service 1978, Weaver and Albertson 1956

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
2.B.2.Nb.2.c. M051 Great Plains Mixedgrass & Fescue Prairie

G141. Northern Great Plains Mesic Mixedgrass Prairie

Type Concept Sentence: This group is widespread in the northern Great Plains and has scattered occurrences in the western Great Plains; sites are dominated by a mixture of short, medium, and tall grasses, including *Andropogon gerardii, Carex inops ssp. heliophila, Carex filifolia, Nassella viridula, Panicum virgatum, Pascopyrum smithii, Schizachyrium scoparium*, and *Sorghastrum nutans*.

OVERVIEW

Scientific Name: *Pascopyrum smithii - Hesperostipa comata - Schizachyrium scoparium* Mixedgrass Prairie Group
Common Name (Translated Scientific Name): Western Wheatgrass - Needle-and-Thread - Little Bluestem Mixedgrass Prairie Group
Colloquial Name: Western Plains Mixedgrass Grassland

Type Concept: This mixedgrass group is widespread from northern Nebraska into southern Canada and westward to the Rocky Mountain Front Range in Montana and Wyoming, on both glaciated and non-glaciated substrates. It also extends south along the Front Range to northeastern New Mexico and western Oklahoma. The vegetation is dominated by moderate to moderately dense medium-tall grasses or sometimes, in the western Great Plains and Sandhills of Nebraska, a mix of tall and medium-tall grasses. Shrubs are usually scattered or absent but can form dense, local patches, particularly in swales or low areas. Dominant species include *Pascopyrum smithii, Schizachyrium scoparium, Carex inops ssp. heliophila*, and *Carex filifolia*. In Montana, this includes *Festuca idahoensis*. Sites with a strong component of *Nassella viridula* indicate a more favorable moisture balance and perhaps a favorable grazing regime as well because this is one of the most palatable of the midgrasses. *Calamovilfa longifolia* is often found with high cover values on sandier soils, and *Koeleria macrantha* cover increases on degraded sites. Common or dominant tallgrasses in the western Great Plains are *Andropogon gerardii, Panicum virgatum*, and *Sorghastrum nutans*. Other common species include *Bouteloua curtipendula, Bouteloua gracilis, Hesperostipa curtiseta, Hesperostipa neomexicana, Muhlenbergia montana, Pseudoroegneria spicata, Sorghastrum nutans*, and *Sporobolus cryptandrus*. Common woody species include *Amelanchier alnifolia, Artemisia cana, Dasiphora fruticosa ssp. floribunda, Juniperus horizontalis, Prunus virginiana, Rhus trilobata*, and *Symphoricarpos occidentalis*. Some examples may range into more of a shrub-steppe. Fire and grazing constitute the primary dynamics affecting this group. Drought can also impact it, in general favoring the shortgrass component at the expense of the midgrasses. With intensive grazing, cool-season exotics such as *Poa pratensis, Bromus inermis*, and *Bromus arvensis (= Bromus japonicus)* can increase in dominance. Shrub species such as *Juniperus virginiana* can also increase in dominance with fire suppression. Conversion to

agriculture likewise has decreased the range of this group. This group occurs on a wide variety of landforms (e.g., mesatops, stream terraces) and in proximity to a diversity of other groups. Soils range from fine-textured loams to sandy or gravelly soils.

Classification Comments: This group originally included all mixedgrass prairies in the northwestern Great Plains, then was split into mesic and dry components (G331 was the dry mixedgrass prairie), was re-formed as a single group, and then re-split into Northern Great Plains Dry Mixedgrass Prairie Group (G331) and this group (G141). The range of the group, as currently defined, extends into northeastern New Mexico in the form of western Great Plains tallgrass prairies. The Colorado and New Mexico stands should possibly be moved to a separate group [see *Andropogon gerardii - Schizachyrium scoparium* Western Great Plains Grassland (CEGL001463)].

Similar NVC Types:
- G273 Central Rocky Mountain Lower Montane, Foothill & Valley Grassland
- G133 Central Great Plains Mixedgrass Prairie
- G331 Northern Great Plains Dry Mixedgrass Prairie
- G332 Northern Great Plains Rough Fescue Prairie
- G068 Great Plains Sand Grassland

Diagnostic Characteristics: This group is dominated by medium-tall graminoids, or tall and medium-tall grasses in the western Great Plains, particularly the midgrasses *Nassella viridula, Pascopyrum smithii*, and *Schizachyrium scoparium* and tallgrasses *Andropogon gerardii, Panicum virgatum*, and *Sorghastrum nutans*, and occurs in the northwestern Great Plains and along the Front Range south to northeastern New Mexico. The group also includes shrub-dominated sites with abundant *Amelanchier alnifolia, Dasiphora fruticosa ssp. floribunda, Juniperus horizontalis, Prunus americana, Prunus virginiana*, and *Symphoricarpos occidentalis*. Sites dominated by *Festuca* spp. are in a separate group with the exception of *Festuca idahoensis* stands in Great Plains of central Montana and Wyoming which are left here.

VEGETATION

Physiognomy and Structure: The vegetation is characterized by a dense to sparse mixture of tall and short grasses interspersed with forbs. Dwarf-shrubs can be dominant in some stands in the northern part of the group's range and medium or tall shrubs (1-3 m tall) can be locally common to dense.

Floristics: Dominant species include *Pascopyrum smithii, Schizachyrium scoparium, Carex inops ssp. heliophila*, and *Carex filifolia*. In Montana, this includes *Festuca idahoensis*. Sites with a strong component of *Nassella viridula* indicate a more favorable moisture balance and perhaps a favorable grazing regime as well because this is one of the most palatable of the midgrasses. *Calamovilfa longifolia* is often found with high cover values on sandier soils, and *Koeleria macrantha* cover increases on degraded sites. Common or dominant tallgrasses in the western Great Plains are *Andropogon gerardii, Panicum virgatum*, and *Sorghastrum nutans*. Other common species include *Bouteloua curtipendula, Bouteloua gracilis, Hesperostipa curtiseta, Hesperostipa neomexicana, Muhlenbergia montana, Pseudoroegneria spicata, Sorghastrum nutans*, and *Sporobolus cryptandrus*. *Hesperostipa comata* may be present but sites where it is abundant are usually too dry for this group. Common woody species include *Amelanchier alnifolia, Artemisia cana, Dasiphora fruticosa ssp. floribunda, Juniperus horizontalis, Prunus virginiana, Rhus trilobata*, and *Symphoricarpos occidentalis*.

ENVIRONMENT & DYNAMICS

Environmental Description: This group occurs on a wide variety of landforms and in proximity to a diversity of other groups. Climate and growing season length for the region in which it occurs are intermediate to the shortgrass regions to the west and southwest and the tallgrass regions to the east. Soils range from loams, clay loams, silty clays, and clays to more coarse-textured sandy or gravelly soils. Some examples may include an impermeable or slowly permeable claypan subsoil layer.

Dynamics: Fire and grazing constitute the primary dynamics affecting this group. Drought can also impact it, in general favoring the shortgrass component at the expense of the midgrasses. With intensive grazing, cool-season exotics such as *Poa pratensis, Bromus inermis*, and *Bromus arvensis* can increase in dominance. Shrub species such as *Juniperus virginiana* can also increase in dominance with fire suppression. Conversion to agriculture likewise has decreased the range of this group.

DISTRIBUTION

Geographic Range: This group occurs throughout the Western Great Plains from northern Nebraska into southern Canada, and west to central Montana. It also occurs in a narrow to broad transitional band between the Rocky Mountains and the Shortgrass Steppe ranging from the Rocky Mountain foothills and piedmont and adjacent plains, extending farther east on the Palmer Divide, north alongside the Chalk Bluffs near the Colorado-Wyoming border, and south on and below mesas and escarpments in southeastern Colorado, northeastern New Mexico, and the panhandles of Oklahoma and Texas.

Spatial Scale & Pattern [optional]: Large patch
Nations: CA, US
States/Provinces: AB, CO, KS, MB, MT, ND, NE, NM, OK, SD, SK, TX?, WY
TNC Ecoregions [optional]: 10:C, 20:C, 21:C, 24:C, 25:P, 26:P, 27:C, 28:P, 33:C, 34:C, 66:P, 67:C
USFS Ecoregions (2007): 315A:CC, 315B:CC, 315H:CC, 331B:CC, 331C:CC, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 331J:CC, 331K:CC, 331L:CC, 331M:CC, 331N:CC, 332B:CC, 332C:CC, 332D:CC, 342A:CP, 342F:CC, 342G:CC, M313A:CP, M313B:CC, M331A:CP, M331B:CC, M331F:CC, M331G:CC, M331I:CC, M331J:C?, M334A:CC, M341A:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** Bluestem Prairie (601) (Shiflet 1994)
- **>** Bluestem Prairie (710) (Shiflet 1994)
- **><** Fescue Grassland (613) (Shiflet 1994)
- **>** Wheatgrass (610) (Shiflet 1994)
- **><** Wheatgrass - Bluestem - Needlegrass (606) (Shiflet 1994)
- **>** Wheatgrass - Grama (609) (Shiflet 1994)
- **>** Wheatgrass - Grama - Needlegrass (608) (Shiflet 1994)
- **>** Wheatgrass - Needlegrass (607) (Shiflet 1994)
- **><** Wheatgrass - Saltgrass - Grama (615) (Shiflet 1994)

LOWER LEVEL UNITS

Alliances:
- A0954 *Crataegus douglasii - Crataegus succulenta* Shrubland Alliance
- A4035 *Juniperus horizontalis - Dasiphora fruticosa ssp. floribunda / Schizachyrium scoparium* Shrubland Alliance
- A4036 *Prunus virginiana - Symphoricarpos occidentalis - Amelanchier alnifolia* Great Plains Shrubland Alliance
- A4034 *Schizachyrium scoparium* Northwestern Great Plains Grassland Alliance
- A4031 *Pascopyrum smithii - Nassella viridula* Northwestern Great Plains Grassland Alliance
- A1537 *Rhus trilobata / Schizachyrium scoparium - Carex filifolia* Shrub Grassland Alliance
- A4028 *Andropogon gerardii - Sorghastrum nutans* Mixedgrass Western Plains Grassland Alliance

AUTHORSHIP

Primary Concept Source: S. Menard, in Faber-Langendoen et al. (2011)
Author of Description: S. Menard and J. Drake
Acknowledgments:
Version Date: 05/07/2015
Classif Resp Region: Midwest
Internal Author: SEM 12-10, mod. JD 9-13, 5-15

REFERENCES

References: Bailey et al. 1994, Barbour and Billings 1988, Comer et al. 2003, Faber-Langendoen et al. 2017a, Hess and Wasser 1982, Lauenroth and Milchunas 1992, Lauver et al. 1999, MTNHP 2002b, Mast et al. 1997, Mast et al. 1998, Neely et al. 2001, Opler and Krizek 1984, Ricketts et al. 1999, Shiflet 1994, Weaver 1954, Weaver and Albertson 1956

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G141. Northern Great Plains Mesic Mixedgrass Prairie

A4028. Andropogon gerardii - Sorghastrum nutans Mixedgrass Western Plains Grassland Alliance

Type Concept Sentence: This alliance is found in the northern and western Great Plains on sites where moisture availability is greater than the surrounding landscape. The vegetation is characterized by a mix of tall and mid grasses within a mixedgrass landscape, commonly with *Andropogon gerardii, Bouteloua curtipendula, Sorghastrum nutans*, and *Schizachyrium scoparium*.

OVERVIEW

Scientific Name: *Andropogon gerardii - Sorghastrum nutans* Mixedgrass Western Plains Grassland Alliance
Common Name (Translated Scientific Name): Big Bluestem - Indiangrass Mixedgrass Western Plains Grassland Alliance
Colloquial Name: Western Plains Mixedgrass Grassland

Type Concept: This alliance is found in the western Great Plains from central North Dakota west to eastern Montana and south to northeastern New Mexico. The vegetation is characterized by a mix of tall and mid grasses within a mixedgrass landscape. *Andropogon gerardii, Bouteloua curtipendula, Sorghastrum nutans*, and *Schizachyrium scoparium* are common through most of the range. *Pascopyrum smithii, Panicum virgatum*, and *Sporobolus heterolepis* are often present to abundant. Through the broad range of this alliance, other grasses can be locally common, including *Hesperostipa spartea* and *Festuca idahoensis* in the north and *Muhlenbergia montana* and *Sporobolus cryptandrus* in the south. Shrubs can be scattered but are not abundant across large areas. It occurs west of the predominant tallgrass prairie on sites where moisture availability is greater than the surrounding landscape, such as riparian areas, swales, or on lower slopes. The greater moisture availability can be a result of coarse-textured surface soils and finer subsoils that allow rapid infiltration of precipitation or low areas in the landscape. In the central Dakotas and Nebraska where precipitation is more abundant, it can occur in a wider variety of settings.

Classification Comments: This alliance has a broad range from near the U.S.-Canadian border south along the Front Range to northeastern New Mexico. Splitting this alliance into a northern Great Plains and central Great Plains alliance should be investigated. This split could possibly involve *Andropogon gerardii - Schizachyrium scoparium* Northern Plains Grassland (CEGL002205), *Andropogon gerardii - Sporobolus heterolepis - Schizachyrium scoparium - Pascopyrum smithii* Grassland (CEGL002376), and the northern part of *Andropogon gerardii - Schizachyrium scoparium* Western Great Plains Grassland (CEGL001463) and *Andropogon gerardii - Sorghastrum nutans* Western Great Plains Grassland (CEGL001464), *Andropogon gerardii - Sporobolus heterolepis* Western Foothills Grassland (CEGL001465), vs. the southern part of CEGL001463. This would split the associations roughly along the Wyoming-Colorado border or a little south and would parallel the split between the northern and central mixedgrass prairie Northern Great Plains Mesic Mixedgrass Prairie Group (G141) and Central Great Plains Mixedgrass Prairie Group (G133). *Festuca idahoensis* and *Hesperostipa spartea* seem to be more common in the north, while *Muhlenbergia montana* and maybe *Sporobolus cryptandrus* are more common in the south.

Internal Comments:
Other Comments:

Similar NVC Types:
- A4042 *Schizachyrium scoparium - Bouteloua curtipendula* Central Great Plains Grassland Alliance: lacks dominance by tall grasses, though intermediate stands can be hard to classify.
- A4057 *Andropogon gerardii - Sorghastrum nutans - Coreopsis palmata* Central Grassland Alliance: can have similar dominants but occurs further east, has fewer mid grasses, and tends to have more forbs.
- A4056 *Andropogon gerardii - Panicum virgatum* Wet Prairie Alliance

Diagnostic Characteristics: This alliance is characterized by the dominance of tall and mid grasses in mixedgrass prairie landscape of the northern or western Great Plains. *Andropogon gerardii* and *Sorghastrum nutans* are the most common tallgrass dominants.

VEGETATION

Physiognomy and Structure: This is a mesic, tallgrass prairie alliance, dominated by a moderately dense to very dense layer of graminoids up to 2 m tall. Forbs are typically abundant in these vegetation types. Woody species are uncommon.

Floristics: The vegetation is characterized by a mix of tall and mid grasses within a mixedgrass landscape. *Andropogon gerardii, Bouteloua curtipendula, Sorghastrum nutans*, and *Schizachyrium scoparium* are common through most of the range. *Pascopyrum smithii, Panicum virgatum*, and *Sporobolus heterolepis* are often present to abundant. Through the broad range of this alliance, other grasses can be locally common, including *Hesperostipa spartea* and *Festuca idahoensis* in the north and *Muhlenbergia montana* and *Sporobolus cryptandrus* in the south. Trees and tall shrubs are infrequent in high-quality stands. Among those that may be found are scattered *Symphoricarpos occidentalis* (in the northern Great Plains), *Rhus* spp., and *Pinus ponderosa* (along the Front Range). In the far western extent, vegetation in this alliance is either relict true prairie found along the eastern foothills and floodplains of the Front Range of the Rocky Mountains or a western version of the northern tallgrass prairie along the Missouri basin. *Andropogon gerardii* is the major diagnostic species, as well as *Sorghastrum nutans, Panicum virgatum, Schizachyrium scoparium, Sporobolus heterolepis*, the other common tallgrass prairie species. *Bouteloua curtipendula* and *Pascopyrum smithii* are also common grasses.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs west of the predominant tallgrass prairie on sites where moisture availability is greater than the surrounding landscape (Hanson and Whitman 1938). Along the Front Range, "relict" true prairie is found along the foothills in parks and on slopes below *Pinus ponderosa* woodlands (Livingston 1952, Bichel 1959). Soils are coarse-textured, and runoff and seeps enhance soil moisture. The alliance is also found in floodplains adjacent to streams where the water table is within reach of plant roots. On the plains the alliance can be found in areas with gravelly soil where water infiltrates below the surface, but is held by an impermeable subsurface layer. Floodplain and toeslope soils are deep and fine-textured, whereas the foothills soils are

coarse-textured, often with cobble-sized rocks. In the northwestern plains, this alliance is found on lower slopes of hills, creeks and creek terraces. Soils are generally finer-textured (clay loams).

Dynamics: Overgrazing can change a tallgrass prairie site to a mixedgrass and eventually a shortgrass site. Heavy summer grazing is especially hard on the warm-season tallgrass species. Introduced *Poa* spp. and weedy herbs often replace the tall grasses. Fire is important to maintain the grassland from invading woody vegetation and maintain species diversity. Much potential habitat in the Colorado Front Range foothills may have been invaded by *Pinus ponderosa* because of decades of fire suppression.

DISTRIBUTION

Geographic Range: This alliance is found in the western Great Plains from central North Dakota west to eastern Montana and south to northeastern New Mexico.

Nations: CA, US
States/Provinces: CO, KS, MB, MT, ND, NE, NM, OK, SD, SK, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** *Andropogon gerardii* herbaceous alliance (Hoagland 1998a)
- **?** Big Bluestem (Hanson and Whitman 1938)

LOWER LEVEL UNITS

Associations:
- CEGL002205 *Andropogon gerardii - Schizachyrium scoparium* Northern Plains Grassland
- CEGL002376 *Andropogon gerardii - Sporobolus heterolepis - Schizachyrium scoparium - Pascopyrum smithii* Grassland
- CEGL002023 *Andropogon gerardii - Panicum virgatum* Sandhills Grassland
- CEGL001465 *Andropogon gerardii - Sporobolus heterolepis* Western Foothills Grassland
- CEGL001464 *Andropogon gerardii - Sorghastrum nutans* Western Great Plains Grassland
- CEGL001463 *Andropogon gerardii - Schizachyrium scoparium* Western Great Plains Grassland

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Bichel 1959, Branson et al. 1961, Branson et al. 1965, Culwell and Scow 1981, Culwell and Scow 1982, Faber-Langendoen et al. 2017b, Hadley and Branson 1965, Hansen et al. 1984, Hanson and Dahl 1956, Hanson and Whitman 1938, Hoagland 1998a, James 1930, Johnston 1987, Kettler pers. comm., Kittel et al. 1996, Küchler 1964, Livingston 1947, Livingston 1952, Marr 1964b, Moir 1969b, Moir 1972, Mutel 1976, Ramaley and Kelso 1931, Robbins 1917, Soil Conservation Service 1978, Tatina 1987, Taylor and Holst 1976, Tolstead 1942, Vestal 1914, Wasser and Hess 1982

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G141. Northern Great Plains Mesic Mixedgrass Prairie

A0954. Crataegus douglasii - Crataegus succulenta Shrubland Alliance

Type Concept Sentence: Stands of this temporarily flooded alliance occur in mesic draws and along streams in the northern Great Plains and adjacent foothills with a typically dense, tall (to 2.5 m) shrub layer that is dominated by *Crataegus douglasii* or *Crataegus succulenta*, either alone or together.

OVERVIEW

Scientific Name: *Crataegus douglasii - Crataegus succulenta* Shrubland Alliance
Common Name (Translated Scientific Name): Black Hawthorn - Fleshy Hawthorn Shrubland Alliance
Colloquial Name: Black Hawthorn - Fleshy Hawthorn Shrubland

Type Concept: Stands of this temporarily flooded alliance have a typically dense, tall (to 2.5 m), deciduous shrub layer that is dominated by *Crataegus douglasii* or *Crataegus succulenta (= Crataegus columbiana var. occidentalis)*, either alone or together. This tall-shrub layer often includes a substantial amount of *Prunus virginiana* and may include substantial amounts of *Amelanchier alnifolia* and *Prunus americana*. *Viburnum lentago* may also be present. This tall-shrub layer often is so thick as to be all but impenetrable, but it may contain openings. A short-shrub layer (0.5-1 m tall) dominated by *Amorpha canescens, Rosa woodsii, Symphoricarpos occidentalis*, or *Symphoricarpos albus* is present in stands with patchy tall-shrub layers, with the lower shrubs growing beneath the openings in the taller shrub canopy. The herbaceous layer, present in stands with patchy shrub layers, usually consists of exotic species (*Bromus inermis, Poa pratensis, Phleum pratense, Cirsium arvense*), although several native species (*Carex sprengelii, Elymus glaucus, Elymus virginicus, Elymus trachycaulus ssp. trachycaulus, Galium boreale, Galium aparine, Galium triflorum*) often are present and may have constituted the original understories. Herbaceous species are sparse beneath dense shrub overstories. In northeastern Wyoming, the surrounding matrix vegetation typically is grassland. In Montana, vegetation on adjacent wetter sites may be *Populus* or *Salix* stands, or *Fraxinus pennsylvanica* or *Acer negundo* woodlands. Stands occur in mesic draws and along streams in the northern Great Plains and adjacent foothills of Montana and Wyoming. Elevations range up to1370 m. Stands grow in mesic draws, ravines, and on alluvial terraces on higher surfaces in streamside riparian areas. Sites are flat to gently sloping and temporarily flooded by spring runoff or after storms. Soils are moderately deep with soil textures ranging from sandy loam to clay loam derived from alluvium. Water tables are shallow (usually less than 1 m deep) except during dry periods.

Classification Comments: Similar stands occur on north-facing slopes in the Judith and Snowy mountains in Montana that are not flooded and would not be included in this alliance (Hansen et al. 1995). Group concept appears to include primarily mesic streamside terrace types that are not wetlands, as well as wetland types. It may be that this and other alliances in this group need to move to an upland alliance.

Internal Comments:
Other Comments:

Similar NVC Types:
- A4036 *Prunus virginiana - Symphoricarpos occidentalis - Amelanchier alnifolia* Great Plains Shrubland Alliance: lacks dominance by *Crataegus* spp. and can be found in both riparian and upland settings but can otherwise be similar.
- A0918 *Elaeagnus commutata* Wet Shrubland Alliance: occurs in the same setting and may share several species but is dominated by *Elaeagnus commutata*.
- A3590 *Shepherdia argentea* Wet Shrubland Alliance: occurs in the same setting and may share several species but is dominated by *Shepherdia argentea*.

Diagnostic Characteristics: Tall-shrub stands in ravines and along streams dominated by *Crataegus douglasii* or *Crataegus succulenta*. Other tall shrubs, including *Prunus americana, Prunus virginiana*, and *Amelanchier alnifolia*, may be common. Stands may flood for short periods.

VEGETATION

Physiognomy and Structure: This vegetation is dominated by a dense (near 100% cover) tall-shrub layer (to 2.5 m tall) of broad-leaved deciduous shrubs. If there are openings present in the tall canopy a broad-leaved, a deciduous short-shrub layer (0.5-1 m tall) may also be present. Herbaceous layers are generally relatively sparse because of the dense woody canopy, but may be important in stands with a patchy shrub canopy. This layer is often dominated by perennial graminoid species with perennial forbs present to abundant.

Floristics: Stands have a typically dense, tall (to 2.5 m), deciduous shrub layer that is dominated or codominated by *Crataegus douglasii* or *Crataegus succulenta (= Crataegus columbiana var. occidentalis*), either alone or together. This tall-shrub layer often includes a substantial amount of *Prunus virginiana* and may include substantial amounts of *Amelanchier alnifolia* and *Prunus americana*. *Viburnum lentago* may also be present. This tall-shrub layer often is so thick as to be all but impenetrable, but it may contain openings. A short-shrub layer (0.5-1 m tall) dominated by *Symphoricarpos occidentalis* or *Symphoricarpos albus* is present in stands with patchy tall-shrub layers, with the lower shrubs growing beneath the openings in the taller shrub canopy. The herbaceous layer, present in stands with patchy shrub layers, usually consists of exotic species (*Bromus inermis, Poa pratensis, Phleum pratense, Cirsium arvense*), although several native species (*Carex sprengelii, Elymus glaucus, Elymus virginicus, Elymus trachycaulus ssp. trachycaulus, Galium boreale, Galium aparine, Galium triflorum*) often are present and may have constituted the original understories. Herbaceous species are sparse beneath dense shrub overstories.

ENVIRONMENT & DYNAMICS

Environmental Description: Shrublands included in this temporarily flooded alliance are found in the plains and adjacent foothills of Montana and Wyoming and the northwestern and central Great Plains. Elevations range up to1370 m. Stands grow in mesic draws, ravines and on alluvial terraces on higher surfaces in streamside riparian areas (Hansen et al. 1995, Thilenius et al. 1995). Sites are

flat to gently sloping and temporarily flooded by spring runoff or after storms. Soils are moderately deep with soil textures ranging from sandy loam to clay loam derived from alluvium. Water tables are shallow (usually less than 1 m deep) except during dry periods. In northeastern Wyoming, the surrounding matrix vegetation typically is grassland (WNDD unpubl. data). In Montana, vegetation on adjacent wetter sites may be *Populus* or *Salix* stands, or *Fraxinus pennsylvanica* or *Acer negundo* woodlands (Hansen et al. 1995).

Dynamics: Hansen et al. (1995) state that stands of this type are grazing disclimaxes and that the undisturbed vegetation is *Fraxinus pennsylvanica* woodland or *Acer negundo* woodland. This may be untrue for many of the stands in northeastern Wyoming, which grow in draws and ravines that appear to be too dry to support *Fraxinus pennsylvanica* or *Acer negundo* woodlands (WNDD unpubl. data). *Crataegus succulenta* and *Crataegus douglasii* have fair palatability for cattle and sheep, and heavy grazing and browsing in stands of this type will cause the amount of *Rosa* spp., *Symphoricarpos* spp., and *Poa pratensis* to increase. Excessive disturbance will expose bare soil (Hansen et al. 1995).

DISTRIBUTION

Geographic Range: Stands in this alliance occur in mesic draws and along streams in the northern and central Great Plains and adjacent foothills of Montana and Wyoming.

Nations: US
States/Provinces: MT, SD, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** *Crataegus erythropoda-Prunus virginiana* Vegetation Type (Thilenius et al. 1995)
- **><** *Crataegus succulenta* Community Type (Hansen et al. 1995)

LOWER LEVEL UNITS

Associations:
- CEGL001097 *Crataegus succulenta* Shrubland
- CEGL001093 *Crataegus douglasii - (Crataegus chrysocarpa)* Shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Dusek 1980, Faber-Langendoen et al. 2017b, Hansen et al. 1995, Thilenius et al. 1995, WNDD unpubl. data

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G141. Northern Great Plains Mesic Mixedgrass Prairie

A4035. Juniperus horizontalis - Dasiphora fruticosa ssp. floribunda / Schizachyrium scoparium Shrubland Alliance

Type Concept Sentence: This alliance is found on hillslopes in the northwestern Great Plains where *Juniperus horizontalis* and *Dasiphora fruticosa ssp. floribunda* dominate a sparse to moderate short-shrub layer mixed with moderate to dense cover of midgrasses.

OVERVIEW

Scientific Name: *Juniperus horizontalis - Dasiphora fruticosa ssp. floribunda / Schizachyrium scoparium* Shrubland Alliance
Common Name (Translated Scientific Name): Creeping Juniper - Shrubby-cinquefoil / Little Bluestem Shrubland Alliance
Colloquial Name: Creeping Juniper - Shrubby-cinquefoil / Little Bluestem Shrubland

Type Concept: This alliance is found on moderate to steep slopes in the northwestern Great Plains. The vegetation is characterized by moderate to dense graminoids and >10% cover by dwarf-shrubs. The most abundant dwarf-shrubs are *Juniperus horizontalis* and

Dasiphora fruticosa ssp. floribunda. Other shrubs such as *Rosa* spp., *Symphoricarpos occidentalis, Rhus trilobata*, and *Prunus virginiana* can be present but never dominant. *Schizachyrium scoparium* is nearly always present and often the dominant graminoid. Other common species include *Calamovilfa longifolia, Carex filifolia, Carex inops ssp. heliophila, Carex duriuscula, Koeleria macrantha*, and *Muhlenbergia cuspidata*. Slopes are usually north-facing. Soils are often shallow. Scoria or gravel is frequently in the upper soil layers.

Classification Comments: The shrub herbaceous association *Dasiphora fruticosa ssp. floribunda / Schizachyrium scoparium* Shrub Grassland (CEGL002198) is included in this alliance. This association appears intermediate both floristically and physiognomically between this alliance and a grass-dominated one. It was placed here based on the consistent presence of shrubs, even if at low cover, and because the environment (moderate to steep north-facing slopes) fits well with the other associations in the alliance.

Internal Comments:
Other Comments:

Similar NVC Types:

- A4034 *Schizachyrium scoparium* Northwestern Great Plains Grassland Alliance: has fewer shrubs and is not as closely linked to north-facing slopes, but the two alliances occur in the same area and the herbaceous stratum can be very similar.

Diagnostic Characteristics: Stands are on moderate to steep slopes with abundant mid and short grasses and typically >25% cover by dwarf-shrubs, particularly *Juniperus horizontalis* and *Dasiphora fruticosa ssp. floribunda*. Stands with 10-25% cover by dwarf-shrubs but which still have abundant *Schizachyrium scoparium* and other graminoids typical of this alliance are also placed here.

VEGETATION

Physiognomy and Structure: This alliance is dominated by short shrubs and graminoids. Shrubs are nearly always <1 m tall and many are <0.5 m. Shrub cover is typically >25% but some stands may have 10-25% shrub cover. Dominant graminoids are also generally <1 m tall and can have open to moderate cover. Total vegetation cover is typically high (Hansen et al. 1984, Hansen and Hoffman 1988). Trees and taller shrubs are rare or absent.

Floristics: This alliance is found in the northern Great Plains. The most abundant species is the creeping shrub *Juniperus horizontalis*. This species can cover 80% of the ground (Hansen et al. 1984, Hansen and Hoffman 1988). *Dasiphora fruticosa ssp. floribunda* dominates the shrub stratum of some stands, though usually the total shrub cover in those is low (10-30%). *Schizachyrium scoparium* and *Carex inops ssp. heliophila* are typically the most abundant graminoids. In most stands the four species provide the majority of the vegetation cover. Other shrubs that may be present are *Symphoricarpos occidentalis, Rosa arkansana, Rhus aromatica*, and *Artemisia frigida*. Associated graminoids include *Bouteloua gracilis, Calamovilfa longifolia, Carex duriuscula (= Carex eleocharis), Carex filifolia, Elymus lanceolatus, Festuca idahoensis, Festuca altaica, Koeleria macrantha, Muhlenbergia cuspidata*, and *Hesperostipa comata (= Stipa comata)*. Forbs are present but do not usually contribute greatly to the canopy. Common forbs are *Campanula rotundifolia, Dalea purpurea, Echinacea angustifolia, Galium boreale, Linum perenne, Packera plattensis (= Senecio plattensis), Pulsatilla patens ssp. multifida (= Anemone patens)*, and *Thermopsis rhombifolia*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance is found in the northern Great Plains on moderate to steep, rarely gentle, slopes. These are usually north-facing in the United States but south-facing in southern Canada. The climate is interior continental with warm to hot summers and cold winters. Elevations where stands of the alliance are found range from roughly 700 to 1075 m. Parent materials are siltstone, claystone, sandstone, and glacial till (USFS 1992). The soils are clay loams, silty loams, and sandy loams (Johnston 1987). There is an impermeable layer of scoria, gravel, or sandstone beneath shallow upper soils in some locations.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is found in the northwestern Great Plains from western South Dakota and eastern Wyoming to Montana and southwestern Manitoba.

Nations: CA, US
States/Provinces: MB, MT, ND, SD, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL001394 *Juniperus horizontalis / Schizachyrium scoparium* Dwarf-shrubland
- CEGL001393 *Juniperus horizontalis / Carex inops ssp. heliophila* Dwarf-shrubland
- CEGL002198 *Dasiphora fruticosa ssp. floribunda / Schizachyrium scoparium* Shrub Grassland

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: DeVelice et al. 1991, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Hansen and Hoffman 1988, Hansen et al. 1984, Hirsch 1985, Johnston 1987, USFS 1992

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G141. Northern Great Plains Mesic Mixedgrass Prairie

A4031. Pascopyrum smithii - Nassella viridula Northwestern Great Plains Grassland Alliance

Type Concept Sentence: This alliance is found in the northern Great Plains on fine-textured soils in mesic settings where the midgrasses *Pascopyrum smithii* and *Nassella viridula* are dominant or codominant.

OVERVIEW

Scientific Name: *Pascopyrum smithii - Nassella viridula* Northwestern Great Plains Grassland Alliance
Common Name (Translated Scientific Name): Western Wheatgrass - Green Needlegrass Northwestern Great Plains Grassland Alliance
Colloquial Name: Northwestern Great Plains Mesic Western Wheatgrass Grassland

Type Concept: This alliance is found in the northern Great Plains from the southern Prairie Provinces of Canada to Colorado and western Nebraska. Midgrasses are dominant, especially *Pascopyrum smithii*. Other common species are *Elymus lanceolatus, Nassella viridula, Koeleria macrantha*, and *Hesperostipa comata*. The short graminoids *Bouteloua gracilis, Carex filifolia, Carex inops ssp. heliophila, Carex duriuscula*, and the exotics *Bromus racemosus (= Bromus commutatus)* and *Bromus tectorum* can contribute substantial cover. Shrubs and scattered trees can often be found in the mesic settings occupied by this alliance. It usually occurs on fine-textured soils in mesic settings. Some stands can be on deep sandy soils. It is often in swales or valleys but can also be on rolling uplands.

Classification Comments: This alliance shares some abundant species with the poorly described *Hesperostipa curtiseta - Elymus lanceolatus* Grassland Alliance (A4029) which probably occurs in similar habitats and is on the margin of the range of this alliance (A4031). These alliances should be considered for merging in some fashion. *Pascopyrum smithii* is a common constituent in many communities in the Great Plains. Its presence in so many communities can make it difficult to distinguish communities within this alliance from other dry-mesic midgrass communities in other alliances. The dominance of *Pascopyrum smithii* is typically a good diagnostic feature. Stands that have other species as codominants or even dominants may be difficult to classify.

Internal Comments:
Other Comments:

Similar NVC Types:
- A4029 *Hesperostipa curtiseta - Elymus lanceolatus* Grassland Alliance: Little information is available about this alliance but it shares some dominant species and habitat features; A4031 has >25% *Pascopyrum smithii* or dominance by *Nassella viridula*.
- A4033 *Hesperostipa comata* Northwestern Great Plains Grassland Alliance
- A4039 *Pascopyrum smithii - Bouteloua gracilis* Great Plains Grassland Alliance
- A3586 *Artemisia cana ssp. cana* Wet Shrubland Alliance
- A0918 *Elaeagnus commutata* Wet Shrubland Alliance

Diagnostic Characteristics: This northern Great Plains alliance is dominated by mid grasses, especially *Pascopyrum smithii* but also *Elymus lanceolatus* and *Nassella viridula*. These species should contribute more cover than *Hesperostipa comata*.

VEGETATION

Physiognomy and Structure: This is an herbaceous alliance, dominated by short to mid-height graminoids. Mid grasses are the dominant vegetation in most examples of this alliance, although short grasses and sedges can be codominant. The vegetation tends to be denser where the mid grasses are predominant and more open where shorter graminoids are abundant. The mid grasses grow to 0.5-1.0 m on favorable sites, while the short grasses and sedges are less than 0.5 m tall. Both forb and shrub species are minor in this alliance. If shrubs are present, they are typically less than 1 m in height.

Floristics: The most abundant midgrass across all sites is *Pascopyrum smithii*. Some sites are dominated by *Nassella viridula*. Common associates include *Elymus trachycaulus, Hesperostipa comata (= Stipa comata), Hesperostipa spartea (= Stipa spartea), Koeleria macrantha, Poa* spp., and *Schizachyrium scoparium*. In the drier communities of this alliance *Bouteloua gracilis* is the most common shortgrass. Other short graminoids typically found in the drier communities include *Aristida purpurea, Bouteloua curtipendula, Carex duriuscula (= Carex eleocharis), Carex filifolia*, and *Carex inops ssp. heliophila*. Forbs and shrubs are generally minor components of communities within this alliance. If shrubs are present, they are rarely taller than 1 m. Some forbs that are usually scattered about are *Amorpha canescens, Astragalus* spp., *Gaura coccinea, Sphaeralcea coccinea*, and *Tragopogon dubius*. Shrubs include *Artemisia cana, Artemisia frigida, Opuntia* spp., and *Symphoricarpos occidentalis*.

ENVIRONMENT & DYNAMICS

Environmental Description: Grasslands included in this alliance occur across the Great Plains, on several different soil types (Hanson and Whitman 1938, Johnston 1987, USFS 1992). The soil is most often clay or clay loam; however, it can be loam or sandy loam. In the eastern and central part of this alliance's range, these communities can be found on flat or rolling uplands, hillslopes, or along streams or depressions. In the western part of the range, communities are found where local conditions are wetter than the average. This includes such areas as localized depressions, the base of slopes or along rivers or streams (Weaver and Albertson 1956, Jones 1992b).

Dynamics: *Pascopyrum smithii* is rhizomatous and is tolerant of moderate grazing. If severely overgrazed, *Pascopyrum smithii* will decline and may be replaced by less desirable warm-season grasses and exotic species such as *Poa pratensis*.

DISTRIBUTION

Geographic Range: This alliance is found in the northern Great Plains from the southern Prairie Provinces of Canada to Colorado and western Nebraska.

Nations: CA, US
States/Provinces: AB, CO, MB, MT, ND, NE, SD, SK, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** *Elytrigia smithii* Series (Johnston 1987)

LOWER LEVEL UNITS

Associations:
- CEGL002034 *Pascopyrum smithii - Hesperostipa comata* Central Mixedgrass Grassland
- CEGL002543 *Nassella viridula - Hesperostipa comata* Grassland
- CEGL001579 *Pascopyrum smithii - Bouteloua gracilis - Carex filifolia* Grassland
- CEGL001583 *Pascopyrum smithii - Nassella viridula* Grassland
- CEGL001713 *Nassella viridula* Grassland

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Baker and Kennedy 1985, Branson et al. 1961, Branson et al. 1964, Branson et al. 1965, Bujakiewicz 1975, Bunin 1985, Costello 1944b, Culwell and Scow 1982, DeVelice et al. 1991, Faber-Langendoen et al. 2017b, Hadley and Branson 1965, Hansen 1985, Hansen and Hoffman 1988, Hansen et al. 1984, Hanson and Dahl 1956, Hanson and Whitman 1938, Hanson et al. 1931, Hyder et al. 1966, Johnston 1987, Jones 1992b, Kahler 1973, Moir 1969b, Mutel 1976, Ramaley 1927, Ramaley 1942, Shantz 1911, Shantz 1923, Soil Conservation Service 1978, Thompson and Hansen 2002, USFS 1992, Vanderhorst et al. 1998, Vestal 1913, Vestal 1914, Vestal 1919, Weaver and Albertson 1956, Wooten 1980

2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G141. Northern Great Plains Mesic Mixedgrass Prairie

A4036. Prunus virginiana - Symphoricarpos occidentalis - Amelanchier alnifolia Great Plains Shrubland Alliance

Type Concept Sentence: This alliance is composed of shrublands in the northern Great Plains and adjacent areas dominated by the deciduous shrubs *Amelanchier alnifolia, Prunus* spp., and *Symphoricarpos occidentalis* with >25% cover.

OVERVIEW

Scientific Name: *Prunus virginiana - Symphoricarpos occidentalis - Amelanchier alnifolia* Great Plains Shrubland Alliance
Common Name (Translated Scientific Name): Chokecherry - Western Snowberry - Saskatoon Serviceberry Great Plains Shrubland Alliance
Colloquial Name: Great Plains Chokecherry - Western Snowberry - Saskatoon Serviceberry Shrubland

Type Concept: This alliance is centered in the northern Great Plains with some occurrences in the western tallgrass prairie region. Shrubs generally 1-3 m tall form a canopy 25-100% cover. Stands tend to be small and distinct in a grass-dominated landscape of the Great Plains or Rocky Mountain foothills. Stands can be strongly dominated by one or two species or a more even mix. The most typical shrub species are *Prunus virginiana, Prunus americana, Amelanchier alnifolia*, and *Symphoricarpos occidentalis*. The herbaceous understory varies in inverse proportion to the amount of shrub canopy. In the Great Plains, a variety of tall, mid, and short grasses can occur with the shrubs, though mid grasses tend to be most common. *Pascopyrum smithii, Elymus lanceolatus*, and the exotics *Bromus inermis, Elymus repens*, and *Poa pratensis* are typical. These shrubland usually occur in swales, ravines, and floodplains.

Classification Comments: *Crataegus douglasii - Crataegus succulenta* Shrubland Alliance (A0954) appears to be quite similar, though there is not much descriptive information, and it should be considered for merging or at least moving the two alliances into the same group.

Internal Comments:
Other Comments:

Similar NVC Types:
- A3963 *Amelanchier alnifolia* Central Rocky Mountain Montane-Foothill Shrubland Alliance
- A0954 *Crataegus douglasii - Crataegus succulenta* Shrubland Alliance: appears very similar, with some differences in dominants but an overall similarity in floristic and environmental characteristics. *Crataegus douglasii* and *Crataegus succulenta*
- A4208 *Corylus americana - Malus ioensis - Ceanothus americanus* Central Shrubland Alliance: occurs further east, may have more *Cornus drummondii* and *Rhus glabra*, though some stands do not have much of those, and has tallgrass species in the shrub canopy.
- A3590 *Shepherdia argentea* Wet Shrubland Alliance

Diagnostic Characteristics: This alliance is characterized by >25% cover by shrubs 1 m or taller within the predominantly prairie landscape of the northern Great Plains. Dominant shrubs are *Prunus virginiana, Prunus americana, Amelanchier alnifolia*, and *Symphoricarpos occidentalis*.

VEGETATION

Physiognomy and Structure: This alliance is characterized by a moderate to dense canopy of cold-deciduous shrubs, generally 1-3 m tall. Where tall shrubs (2-3 m) are abundant, there may be another lower stratum of shrubs 0.5-1 m tall. The herbaceous stratum cover varies in inverse proportion to the shrub strata. Stands with an open or moderately open shrub canopy tend to have an herbaceous stratum dominated by graminoids common in the surrounding prairie landscape. Stands with a dense shrub canopy or that have been subject to heavy grazing often have a higher proportion of forbs.

Floristics: The shrub canopy is often strongly dominated by one or two shrub species but may be a mix of several. Dominant shrubs include *Amelanchier alnifolia, Prunus virginiana*, and *Symphoricarpos occidentalis*. Other shrubs that may be found include *Rhus aromatica* and *Rosa woodsii*. Typical herbaceous species include *Bouteloua gracilis, Pascopyrum smithii, Hesperostipa comata (= Stipa comata)*, and other species characteristic of mixedgrass prairie. Other herbaceous species include *Achillea millefolium, Artemisia ludoviciana, Bromus inermis, Bromus tectorum, Cirsium arvense, Galium boreale, Glycyrrhiza lepidota*, and *Poa pratensis*. Woody vines sometimes occur, most commonly *Parthenocissus vitacea*. *Symphoricarpos occidentalis* shrublands often have a significant component of exotic species, especially where grazing has been intense (Hansen and Hoffman 1988, Jones and Walford 1995). *Bromus inermis, Cirsium arvense*, and *Poa pratensis* are the most abundant of these exotics. Overgrazing of prairies can lead to the expansion of degraded forms of this alliance. Where there is enough moisture to support them, generally in riparian areas, scattered small trees such as *Fraxinus pennsylvanica* and *Ulmus americana* may be present.

ENVIRONMENT & DYNAMICS

Environmental Description: The vegetation in this alliance occurs in riparian habitats and in upland swales and ravines in the northern Great Plains and in foothill canyons of the Rocky Mountains. Stands are located on terraces above the floodplain of large rivers, on small and intermittent creeks, and on hillsides below springs or seeps. Stands are found between 600 and 2000 m elevation. Soils are classified as Entisols (Fluvents), Mollisols (Borolls), Regosols or Chernozems. The soils are fertile and well-drained to imperfectly drained silts and loams (Johnston 1987, Jones and Walford 1995). The upper soil horizon is usually deep, although a thin layer of sand may be present if the site has been recently flooded (Jones and Walford 1995). Soil textures range from well-drained loamy sands to poorly drained silty clays. The upper soil horizon is relatively thick. The vegetation is tolerant of brief flooding.

Dynamics: In Montana, *Prunus virginiana* communities may be grazing-induced successional stages of the *Fraxinus pennsylvanica / Prunus virginiana* community type (Hansen et al. 1995). Both *Prunus virginiana* and *Symphoricarpos occidentalis* are tolerant of fire and will usually sprout after fires and grow into even denser stands. Dense stands of *Prunus virginiana* may preclude use by livestock, while open stands may provide adequate grazing opportunities. However, if grazed for the entire season, the strongly rhizomatous *Rosa woodsii* and non-native grasses may become established (Hansen et al. 1988b, Manning and Padgett 1995).

Symphoricarpos occidentalis shrublands often have a significant component of exotic species, especially where grazing has been intense (Hansen and Hoffman 1988b, Jones and Walford 1995). *Bromus inermis, Cirsium arvense*, and *Poa pratensis* are the most abundant of these exotics. Overgrazing of prairies can lead to the expansion of degraded forms of this alliance. Hansen et al. (1988b) consider the presence of *Symphoricarpos occidentalis* to indicate a grazing-induced community type. In Colorado and Wyoming, the presence of *Symphoricarpos occidentalis* seems to indicate a lack of grazing. There is a dramatic fenceline contrast between grazed and ungrazed areas along small creeks in the Pawnee National Grassland. On the grazed side of the fence, *Symphoricarpos occidentalis* is widely spaced and nearly hidden by the tall *Thinopyrum intermedium*. While on the ungrazed side of the fence, *Symphoricarpos occidentalis* and *Prunus virginiana* grow in thick, impenetrable stands (Kittel et al. 1996).

DISTRIBUTION

Geographic Range: This alliance is common as small patches in the northern Great Plains west to the Rocky Mountain foothills.

Nations: CA, US
States/Provinces: CO, IA, MT, ND, NE, SD, SK?, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Prunus virginiana* Community Type (Hansen et al. 1995)
- **?** *Symphoricarpos occidentalis/Elytrigia smithii* Shrubland (Johnston 1987)
- **?** *Symphoricarpos occidentalis* Community (Hansen and Hoffman 1988)
- **?** *Symphoricarpos occidentalis* Community (Hansen et al. 1984)
- **?** Common Chokecherry Dominance Type (Jones and Walford 1995)
- **?** Western Snowberry Dominance Type (Jones and Walford 1995)

LOWER LEVEL UNITS

Associations:

- CEGL005453 *Prunus virginiana* Great Plains Shrubland
- CEGL002183 *Amelanchier alnifolia* Shrubland
- CEGL001131 *Symphoricarpos occidentalis* Shrubland

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Christy 1973, Clark et al. 1980, Faber-Langendoen et al. 2017b, Hansen and Hoffman 1988, Hansen et al. 1984, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Harvey 1980, Johnston 1987, Jones and Walford 1995, Kittel et al. 1996, Manning and Padgett 1995, Meyer 1985, Thompson and Hansen 2002

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G141. Northern Great Plains Mesic Mixedgrass Prairie

A1537. Rhus trilobata / Schizachyrium scoparium - Carex filifolia Shrub Grassland Alliance

Type Concept Sentence: This alliance is found in the northwestern Great Plains on moderate to steep slopes where short shrubs, especially *Rhus trilobata*, are scattered in a mixedgrass prairie generally dominated by *Schizachyrium scoparium* and *Carex filifolia*.

OVERVIEW

Scientific Name: *Rhus trilobata / Schizachyrium scoparium - Carex filifolia* Shrub Grassland Alliance
Common Name (Translated Scientific Name): Skunkbush Sumac / Little Bluestem - Threadleaf Sedge Shrub Grassland Alliance
Colloquial Name: Skunkbush Sumac / Little Bluestem - Threadleaf Sedge Shrub Grassland

Type Concept: This alliance is found in the northwestern Great Plains. Total vegetation cover is usually moderate and dominated by herbaceous species. Short shrubs (0.5-1 m tall) form an open canopy (usually 10-25% but sometimes more). Dominant herbaceous species usually include *Schizachyrium scoparium* and *Carex filifolia*. Other common species found in the shade of shrubs are *Carex inops ssp. heliophila, Elymus lanceolatus, Hesperostipa comata, Koeleria macrantha*, and *Muhlenbergia cuspidata*. *Rhus trilobata* is the most common shrub by far with lesser amounts of *Artemisia frigida, Gutierrezia sarothrae, Rosa arkansana*, and *Symphoricarpos occidentalis*. The alliance is found on moderate to steep slopes. Soils are shallow and rocky and may be sandy loam, loamy sand, or loam.

Classification Comments: It is often difficult to determine the borders of stands within this alliance because one of the primary distinguishing features of this alliance, the presence of a 10-25% canopy of *Rhus trilobata*, is not continuous over the entire stand. When grassland communities adjoin stands of this alliance, they usually contain many of the same species. The presence and approximate limits of stands within this alliance is judged from physiognomic and sometimes floristic differences between adjacent stands. In the dry environments in which stands of this alliance are found, certain species not commonly found in the open grow in the shade of shrubs (Hansen and Hoffman 1988).

In his *Rhus aromatica ssp. trilobata* Series, Johnson (1987) described two other plant associations with *Sporobolus cryptandrus*- and *Muhlenbergia montana*-dominated herbaceous layers that need to be reviewed for possible inclusion into this alliance. Grasslands with clumps of *Rhus trilobata* are common in the foothills of the Colorado Front Range and also need association-level classification.

Internal Comments:
Other Comments:

Similar NVC Types:

- A4034 *Schizachyrium scoparium* Northwestern Great Plains Grassland Alliance: has less shrub cover but can be very similar, otherwise.

Diagnostic Characteristics: This alliance is characterized by a mid- and shortgrass community on moderate to steep slopes with 10-25% cover (or sometimes greater) by short shrubs, particularly *Rhus trilobata*. Dominant graminoids are *Schizachyrium scoparium* and *Carex filifolia*.

VEGETATION

Physiognomy and Structure: Vegetation in this alliance has a moderately dense graminoid layer that is dominated by perennial bunchgrasses. There is a sparse but conspicuous, patchily distributed layer of cold-deciduous shrubs that averages 10-25% in cover and is less than 1 m tall. Sparse to moderate cover of perennial forbs is also present. Annual forbs and grasses are seasonally present.

Floristics: The cold-deciduous shrub *Rhus trilobata* is diagnostic of these stands and often occurs in dense patches 0.5-1 m tall. High cover of bare ground and rock cover also contribute to the patchy nature of this vegetation. In addition to *Rhus trilobata* there are small amounts of *Artemisia tridentata, Chrysothamnus* spp., *Prunus virginiana, Ribes* spp., and *Symphoricarpos occidentalis*. Shorter shrubs, such as *Artemisia frigida, Gutierrezia sarothrae, Rosa* spp., and *Yucca glauca* may be present. The herbaceous layer is dominated by graminoids, such as *Bouteloua gracilis, Calamovilfa longifolia, Carex inops ssp. heliophila, Carex filifolia, Festuca idahoensis, Hesperostipa comata (= Stipa comata), Muhlenbergia cuspidata, Pseudoroegneria spicata, Pascopyrum smithii*, and *Schizachyrium scoparium*. Forbs that may occur in communities within this alliance include *Artemisia dracunculus, Dalea purpurea, Echinacea angustifolia, Heterotheca villosa var. villosa, Gaura coccinea, Liatris punctata, Phlox hoodii, Sphaeralcea coccinea*, and *Symphyotrichum ericoides (= Aster ericoides)*. Annual forbs and grasses are seasonally present, but do not contribute much to total vegetation cover unless the site is disturbed. Cover of nonvascular plants such as *Selaginella densa* may be common on grazed stands (DeVelice et al. 1995).

ENVIRONMENT & DYNAMICS

Environmental Description: Stands included in this shrub-herbaceous alliance are found on breaks and hillsides in the northwestern Great Plains steppe of Montana, Wyoming and the Dakotas. Elevations range from 1000-1400 m. Climate is temperate, relatively xeric and continental with mean annual precipitation of 33-50 cm. Most of the precipitation (75%) occurs during the growing season from April to September. Stands occur in patches or strips along the shoulder slopes of river breaks (but may extend to the footslopes), and on gently rolling to steep, rocky hillsides (Mueggler and Stewart 1980, Hansen and Hoffman 1988, MTNHP 1988). These communities may occur on any aspect, but are most common on warm-dry south- and west-facing slopes. Soils are typically shallow and rocky, neutral to slightly alkaline (pH 7-7.9) often with high cover (>50%) of rock/gravel and bare ground. Soil texture is typically coarse and may be sand, sandy loam, loamy sand, or loam (Hansen and Hoffman 1988, Thilenius et al. 1995). Substrates include calcareous sandstones, shales, porcelanite and occasionally extrusive volcanic rock (Brown 1971, DeVelice et al. 1995). Adjacent stands include woodlands dominated by *Pinus ponderosa* or *Juniperus* spp., *Artemisia tridentata* shrublands, and other dry grasslands dominated by species common in this vegetation.

Dynamics: *Rhus trilobata* sprouts vigorously from rhizomes or from the root crown when above-ground vegetation is burned (Mueggler and Stewart 1980). Vegetative reproduction is the primary mode of re-establishment after fire; however, *Rhus trilobata* may also reproduce through seed. Fire has variable effects on *Pseudoroegneria spicata* bunchgrasses. Plants usually survive burning; growth is often stimulated, except when fire occurs in the driest month when the crowns will burn because of low moisture in the vegetation and the meristems are damaged (Johnson and Simon 1987).

Livestock grazing does not impact stands on the steeper slopes, but where stands are more accessible, heavy summer use will reduce the abundance of the more palatable species such as *Pseudoroegneria spicata, Festuca idahoensis*, and *Hesperostipa comata*. Less palatable species such as *Artemisia frigida, Heterotheca villosa*, and *Achillea millefolium* will increase. *Rhus trilobata* may also be favored by continued overgrazing (Mueggler and Stewart 1980). The exotic species *Bromus tectorum* often occurs in these stands and contributes significant cover on sites disturbed by livestock or small mammals (Mueggler and Stewart 1980).

DISTRIBUTION

Geographic Range: This alliance is found in the northwestern Great Plains from the western Dakotas into Montana and Wyoming.

Nations: US
States/Provinces: MT, ND, SD, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Rhus aromatica ssp. trilobata* Series (Johnston 1987) [includes two habitats types not described in this alliance: a subalpine type in Colorado and a sandy plains type in Oklahoma]
- **=** *Rhus aromatica/Carex filifolia* (Hansen and Hoffman 1988)
- **><** *Rhus trilobata* Series (Mueggler and Stewart 1980)

LOWER LEVEL UNITS

Associations:
- CEGL001504 *Rhus trilobata / Carex filifolia* Shrub Grassland
- CEGL001506 *Rhus trilobata / Schizachyrium scoparium* Shrub Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Brown 1971, Culwell and Scow 1982, DeVelice et al. 1995, Faber-Langendoen et al. 2017b, Hansen and Hoffman 1986, Hansen and Hoffman 1988, Hansen et al. 1984, Johnson and Simon 1987, Johnston 1987, MTNHP 1988, Mueggler and Stewart 1980, Thilenius et al. 1995, Tweit and Houston 1980

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G141. Northern Great Plains Mesic Mixedgrass Prairie

A4034. Schizachyrium scoparium Northwestern Great Plains Grassland Alliance

Type Concept Sentence: This alliance is found in the northwestern Great Plains on coarse- or medium-textured soils where *Schizachyrium scoparium* is the dominant grass but other mid and short grasses and sedges can be abundant, particularly *Bouteloua curtipendula, Bouteloua gracilis, Carex inops ssp. heliophila*, and *Carex filifolia*.

OVERVIEW

Scientific Name: *Schizachyrium scoparium* Northwestern Great Plains Grassland Alliance
Common Name (Translated Scientific Name): Little Bluestem Northwestern Great Plains Grassland Alliance
Colloquial Name: Northwestern Great Plains Little Bluestem Grassland

Type Concept: This alliance is found in the northwestern Great Plains. *Schizachyrium scoparium* is the dominant grass but other mid and short grasses and sedges can be abundant, particularly *Bouteloua curtipendula, Bouteloua gracilis, Carex inops ssp. heliophila*, and *Carex filifolia*. In a few stands in eastern Montana and possibly western North Dakota, *Muhlenbergia cuspidata* can be a codominant. Several other mid or tall grasses can be present, including *Andropogon gerardii, Calamovilfa longifolia, Hesperostipa comata, Koeleria macrantha, Nassella viridula*, and *Pascopyrum smithii*. Forbs do not contribute greatly to the canopy and shrubs and trees are absent or sparse. The alliance is found on coarse- or medium-textured soils and nearly always on moderate or steep slopes.

Classification Comments: This alliance is similar to *Schizachyrium scoparium - Bouteloua curtipendula* Central Great Plains Grassland Alliance (A4042). Both tend to be dominated by *Schizachyrium scoparium* but the ranges are generally distinct (with some overlap in South Dakota and Wyoming) and short sedges (*Carex filifolia, Carex inops ssp. heliophila*) seem to be less common in the central Great Plains and south. Whether these are truly good differential species should be reviewed.

Internal Comments:
Other Comments:

Similar NVC Types:
- A1537 *Rhus trilobata / Schizachyrium scoparium - Carex filifolia* Shrub Grassland Alliance: has a sparse canopy (10-30%) of short shrubs, usually dominated by *Rhus trilobata*.
- A4035 *Juniperus horizontalis - Dasiphora fruticosa ssp. floribunda / Schizachyrium scoparium* Shrubland Alliance
- A4042 *Schizachyrium scoparium - Bouteloua curtipendula* Central Great Plains Grassland Alliance: is found further south and lacks some northern species such as *Carex inops ssp. heliophila* and *Carex filifolia*.

Diagnostic Characteristics: This alliance is found in the northwestern Great Plains. Stands are dominated by *Schizachyrium scoparium*, though other mid and short grasses and sedges may be common.

VEGETATION

Physiognomy and Structure: This alliance is dominated by mid grasses. The vegetation cover can be moderately sparse to dense. Short graminoids contribute substantially to the vegetation cover in most communities. The short grasses tend to be more common on flat uplands or steep slopes with heavier soils (Weaver and Albertson 1956). Trees and shrubs are rare to absent.

Floristics: *Schizachyrium scoparium* is the dominant grass but other mid and short grasses and sedges can be abundant, particularly *Bouteloua curtipendula, Bouteloua gracilis, Carex inops ssp. heliophila*, and *Carex filifolia*. In a few stands in eastern Montana and possibly western North Dakota, *Muhlenbergia cuspidata* can be a codominant. Several other mid or tall grasses can be present, including *Andropogon gerardii, Calamovilfa longifolia, Hesperostipa comata, Koeleria macrantha, Nassella viridula*, and *Pascopyrum*

smithii. Forb species richness is high, but cover is low (15-20%). *Artemisia ludoviciana* and *Phlox hoodii* are the most common forbs. Other forbs may include *Astragalus gracilis, Cerastium arvense, Echinacea pallida, Gaura coccinea, Helianthus pauciflorus (= Helianthus rigidus), Heterotheca villosa, Pediomelum argophyllum (= Psoralea argophylla)*, and many others. Scattered short shrubs and dwarf-shrubs (<5% cover) may be present such as *Artemisia cana, Artemisia frigida, Calylophus serrulatus (= Oenothera serrulata), Rhus trilobata, Rosa arkansana*, and *Symphoricarpos occidentalis*. Annual forbs and grasses may be seasonally present, especially in disturbed areas.

ENVIRONMENT & DYNAMICS

Environmental Description: The alliance is found on coarse- or medium-textured soils and nearly always on moderate or steep slopes (Hanson and Whitman 1938, Hansen et al. 1984, Johnston 1987).

Dynamics: These grasslands are dominated by deep-rooted perennial mid grasses that are able to utilize moisture that penetrates deep into these well-drained, coarse-textured soils (Morris and Lovegrove 1975). Fire is important to prevent the invasion of these vegetation types by woody species. However, fire is not as important as in more mesic grasslands, because drought conditions slow encroachment by woody species.

DISTRIBUTION

Geographic Range: This alliance is found in the northwestern Great Plains from southern Saskatchewan and Manitoba to central South Dakota and eastern Wyoming.

Nations: CA, US
States/Provinces: MB, MT, ND, SD, SK, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** *Andropogon scoparius/Carex filifolia* (Hansen and Hoffman 1988)
- **?** *Andropogon scoparius* community (Prodgers 1978) [This community description was cited in Culwell and Scow (1982).]
- **><** *Muhlenbergia cuspidata/Andropogon scoparius* Habitat Type (Jorgensen 1979)
- **?** Sidehill (grassland) community (Ansc/Cahe/Bocu/Calo) (Culwell and Scow 1982)
- **?** Various communities (Weaver and Albertson 1956)

LOWER LEVEL UNITS

Associations:

- CEGL001683 *Schizachyrium scoparium - Muhlenbergia cuspidata* Grassland
- CEGL001682 *Schizachyrium scoparium - Carex inops ssp. heliophila* Grassland
- CEGL001681 *Schizachyrium scoparium - Bouteloua (curtipendula, gracilis) - Carex filifolia* Grassland

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Culwell and Scow 1982, Faber-Langendoen et al. 2017b, Hansen and Hoffman 1988, Hansen et al. 1984, Hanson and Dahl 1956, Hanson and Whitman 1938, Johnston 1987, Jorgensen 1979, Klipple and Costello 1960, Morris and Lovegrove 1975, Prodgers 1978, Soil Conservation Service 1978, Thilenius et al. 1995, Vestal 1913, Vestal 1914, Weaver and Albertson 1956

M053. Western Great Plains Shortgrass Prairie

This macrogroup is composed of the matrix short grasslands in the western Great Plains, from southeastern Wyoming to the Texas panhandle, and is characterized the dominance of short grasses *Bouteloua gracilis* and *Bouteloua dactyloides*.

G144. Great Plains Shortgrass Prairie

Type Concept Sentence: This semi-arid shortgrass grassland group occurs in the western half of the Western Great Plains and is usually composed of *Bouteloua gracilis* as the dominant or codominant species with associated graminoids *Aristida purpurea, Bouteloua curtipendula, Bouteloua hirsuta, Bouteloua dactyloides, Hesperostipa comata, Hesperostipa neomexicana, Pascopyrum smithii, Pleuraphis jamesii, Sporobolus cryptandrus*, and scattered shrubs, dwarf-shrubs and cacti.

OVERVIEW

Scientific Name: *Bouteloua gracilis - Bouteloua dactyloides - Pleuraphis jamesii* Shortgrass Prairie Group
Common Name (Translated Scientific Name): Blue Grama - Buffalograss - James' Galleta Shortgrass Prairie Group
Colloquial Name: Fringed Sagebrush - Featherplume - Broom Snakeweed Dwarf-shrubland

Type Concept: This group occurs in the western half of the Western Great Plains Division in the rainshadow of the Rocky Mountains and forms the matrix grassland with *Bouteloua gracilis* as the typical dominant species. Associated graminoids may include *Aristida purpurea, Bouteloua curtipendula, Bouteloua hirsuta, Bouteloua dactyloides (= Buchloe dactyloides), Hesperostipa comata, Hesperostipa neomexicana, Koeleria macrantha (= Koeleria cristata), Pascopyrum smithii (= Agropyron smithii), Pleuraphis jamesii*, and *Sporobolus cryptandrus*. Although mid-height grass species may be present, especially on more mesic land positions and sandy soils, they are secondary in importance to the sod-forming short grasses. Scattered shrub and dwarf-shrub species such as *Artemisia filifolia, Artemisia frigida, Artemisia tridentata, Atriplex canescens, Eriogonum effusum, Gutierrezia sarothrae*, and *Lycium pallidum* may also be present. Also, because this group spans a wide range, there can be some differences in the relative dominance of some species from north to south and from east to west. This group occurs primarily on flat to rolling uplands with loamy, ustic soils ranging from sandy to clayey ranging from the Nebraska Panhandle south into Texas, Oklahoma and New Mexico, although grazing-impacted examples may reach as far north as southern Canada where it grades into Northern Great Plains Dry Mixedgrass Prairie Group (G331). In eastern Colorado and western Kansas and Nebraska, it grades into Central Great Plains Mixedgrass Prairie Group (G133).

Large-scale processes such as climate, fire and grazing influence this group. High variation in amount and timing of annual precipitation impacts the relative cover of cool- and warm-season herbaceous species. In contrast to other prairie groups, fire is less important, especially in the western range of this group. This is because the dry to xeric climate conditions produce less vegetation/fuel load, so relative fire frequency is lower within the group. However, historically, fires that did occur were often very expansive, especially after a series of years with above average precipitation when litter/fine fuels could build up. Currently, fire suppression and more extensive grazing in the region have likely decreased the fire frequency even more, and it is unlikely that these processes could occur at a natural scale. A large part of the range for this group (especially in the east and near rivers) has been converted to agriculture. Areas of the central and western range have been impacted by the unsuccessful attempts to develop dryland cultivation during the Dust Bowl of the 1930s. The short grasses that dominate this group are extremely drought- and grazing-tolerant. These species evolved with drought and large herbivores and, because of their stature, are relatively resistant to overgrazing. This group, in combination with the associated wetland groups, represents one of the richest areas for mammals and birds. Endemic bird species to the shortgrass group may constitute one of the fastest declining bird populations.

Classification Comments: The dominant grass in this group, *Bouteloua gracilis*, is tolerant of heavy grazing and drought, which favor it over other taller and less xeric grass species (Weaver and Albertson 1956). Some ecologists consider stands in this group to be disclimax grassland of mixedgrass prairie resulting from overgrazing by livestock (Weaver and Albertson 1956). Because this group classifies existing vegetation, it includes both early-seral "disclimax" and late-seral "climax" stands extending from the northwestern mixedgrass region in Montana and Canada, south into the Texas Panhandle. The Shortgrass Prairie grassland type in Sims et al. (1978) is closest conceptually to this group. Many others, such as Singh et al. (1983), Lauenroth and Milchunas (1992), Dick-Peddie (1993), Sims and Risser (2000), and Lauenroth and Burke (2008), recognize only the central and southern portions of this group as shortgrass steppe or prairie as they are looking at climate or other environmental or geographic factors.

Similar NVC Types:
- G487 Madrean Juniper Open Woodland
- G130 Hardwood - Loblolly Pine Nonriverine Wet Flatwoods
- G133 Central Great Plains Mixedgrass Prairie
- G068 Great Plains Sand Grassland
- G331 Northern Great Plains Dry Mixedgrass Prairie
- G192 Comanchian Mesquite - Mixed Scrub
- G069 Great Plains Sand Shrubland
- G489 Chihuahuan Semi-Desert Lowland Grassland

Diagnostic Characteristics: This group is characterized by a short, often discontinuous graminoid layer dominated or codominated by *Bouteloua gracilis*. Many other graminoids may be associated, including some medium-tall grasses; however, medium-tall and tall

grasses will not dominate. *Gutierrezia sarothrae* is often present to codominant, especially in disturbed areas. Other woody plants may be present but characteristically do not form a layer, e.g., less than 10% cover. To the south, this group transitions to desert grassland groups that are characterized by desert species.

VEGETATION

Physiognomy and Structure: This group is characterized by a short, often discontinuous herbaceous layer dominated by short perennial grasses.

Floristics: This group spans a wide range and thus there can be some differences in the relative dominance of some species from north to south and from east to west. This group is primarily dominated by *Bouteloua gracilis* throughout its range with various associated graminoid species depending on precipitation, soils and management. Associated graminoids may include *Achnatherum hymenoides, Aristida purpurea, Bouteloua curtipendula, Bouteloua hirsuta, Bouteloua dactyloides (= Buchloe dactyloides), Carex filifolia, Hesperostipa comata, Koeleria macrantha (= Koeleria cristata), Muhlenbergia torreyi, Pascopyrum smithii (= Agropyron smithii), Pleuraphis jamesii, Sporobolus airoides*, and *Sporobolus cryptandrus*. Although mid-height grass species may be present, especially on more mesic land positions and soils, they are secondary in importance to the sod-forming short grasses. Sandy soils have higher cover of *Hesperostipa comata, Sporobolus cryptandrus*, and *Yucca* spp. Scattered shrub and dwarf-shrub species such as *Artemisia filifolia, Artemisia frigida, Artemisia tridentata, Atriplex canescens, Eriogonum effusum, Gutierrezia sarothrae, Lycium pallidum*, and *Rhus trilobata* may also be present. High annual variation in amount and timing of precipitation impacts relative cover of herbaceous species. Cover of cool-season grasses is dependent on winter and early spring precipitation whereas warm-season grasses respond to mid-summer thunderstorms). Floristic information was compiled from Weaver and Albertson (1956), Sims et al. (1978), Brown et al. (1980, 1998), Barbour and Billings (1988), Milchunas et al. (1989), Lauenroth and Milchunas (1992), Dick-Peddie (1993), Ricketts et al. (1999), Sims and Risser (2000), and Lauenroth and Burke (2008).

ENVIRONMENT & DYNAMICS

Environmental Description: This group is located on primarily flat to rolling uplands. Soils typically are loamy and ustic and range from sandy to clayey. Climate is continental with mean annual precipitation generally about 300 mm ranging to 500 mm to the south in Texas. Most of the annual precipitation occurs during the growing season as thunderstorms (Sims et al. 1978). Precipitation events are mostly <10 cm with occasional larger events (Sala and Lauenroth 1982).

Dynamics: Climate, fire and grazing constitute the primary processes impacting this group. Drought-tolerant shortgrass species have root systems that extend up near the soil surface where they can utilize low precipitation events (Sala and Lauenroth 1982). Fire is less important in this group compared to other Western Great Plains prairie systems, especially in the western portion of its range (Milchunas et al. 1989). Previous comments in the literature citing *Opuntia* spp. increasing with overgrazing may not be borne out by more recent research (R. Rondeau pers. comm.). The Long expedition found extensive prickly-pear stands near the South Platt River above the forks in 1823 (Hart 2008). Milchunas et al. (2008) found that *Opuntia* spp. do not increase with grazing.

Upland *Prosopis glandulosa* shrublands have expanded in the shortgrass prairie in the last hundred years and most consider *Prosopis glandulosa* Prairie Ruderal Scrub Alliance (A3952) to be ruderal or novel vegetation. *Prosopis glandulosa* was reported in the Texas Panhandle in 1849 and along the Canadian River in New Mexico in 1715 prior to extensive cattle grazing (Hart 2008). However, conversion to agriculture and pastureland with subsequent irrigation has degraded and extirpated this group in some areas of its range.

Although *Prosopis glandulosa* has expanded in the shortgrass prairie in the last hundred years and some consider *Prosopis glandulosa* Prairie Ruderal Scrub Alliance (A3952) to be ruderal or novel vegetation, *Prosopis glandulosa* was reported in the Texas Panhandle in 1849 and along the Canadian River in New Mexico in 1715 prior to extensive cattle grazing (Hart 2008). However, conversion to agriculture and pastureland with subsequent irrigation has degraded and extirpated this group in some areas of its range.

DISTRIBUTION

Geographic Range: This group is found primarily in the western half of the Western Great Plains Division east of the Rocky Mountains and ranges from the Nebraska Panhandle south into the panhandles of Oklahoma and Texas and New Mexico, although some examples may reach as far north as southern Canada.

Spatial Scale & Pattern [optional]: Matrix
Nations: CA, US
States/Provinces: CO, KS, NE, NM, OK, TX, WY
TNC Ecoregions [optional]: 26:P, 27:C, 28:C, 33:P
USFS Ecoregions (2007): 315A:CC, 315B:CC, 315F:CC, 321A:CC, 331B:CC, 331C:CC, 331F:CC, 331H:CC, 331I:CC, 332C:CC, 332E:CC, 332F:CC, M313B:CC, M331F:CC, M331I:CC
Omernik Ecoregions: 9.4.2.27:C, 9.4.2.27d:C, 9.4.2.27g:C, 9.4.2.27h:C, 9.4.2.27i:C, 9.4.2.27k:C, 9.4.2.27l:C, 9.4.2.27n:C, 9.4.2.27o:C, 9.4.2.27r:C, 9.4.3.26:C, 9.4.3.26a:C, 9.4.3.26c:C, 9.4.6.30:C, 9.4.6.30a:C, 9.4.6.30d:C

Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **<** *Bouteloua-Buchloë* (Küchler 1964) [This potential natural vegetation type is broader than the NVC group existing vegetation.]
- **=** Grama "Shortgrass" Series - 142.12 (Brown et al. 1980)
- **=** Grama "Shortgrass" Series - 142.12 (Brown et al. 1998)
- **=** Grama - Buffalo Grass Section (3113) (Bailey 1980)
- **><** Mixed "Shortgrass" Series - 142.13 (Brown et al. 1998)
- **><** Mixed "Shortgrass" Series - 142.14 (Brown et al. 1980)
- **><** Plains and Mesas Grasslands (Dick-Peddie 1993)
- **=** Shortgrass Prairie (Sims et al. 1978)
- **=** Shortgrass Steppe (Singh et al. 1983)
- **><** Shrub-Grass Disclimax Series - 142.15 (Brown et al. 1980)

LOWER LEVEL UNITS

Alliances:

- A4000 *Bouteloua gracilis - Bouteloua dactyloides* Shortgrass Prairie Alliance
- A4002 *Bouteloua gracilis - Bouteloua hirsuta - Hesperostipa neomexicana* Shortgrass Prairie Alliance
- A3999 *Artemisia frigida - Dalea formosa - Gutierrezia sarothrae* Dwarf-shrubland Alliance
- A4001 *Bouteloua gracilis - Bouteloua hirsuta - Bouteloua curtipendula* Shortgrass Prairie Alliance

AUTHORSHIP

Primary Concept Source: P.L. Sims, J.S. Singh, and W.K. Lauenroth (1978)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 11/10/2015
Classif Resp Region: West
Internal Author: KAS 11-10, 8-15, 11-15, mod. B. Hoagland 9-13

REFERENCES

References: Bailey 1980, Barbour and Billings 1988, Brown et al. 1980, Brown et al. 1998, Dick-Peddie 1993, Faber-Langendoen et al. 2017a, Hart 2008, Küchler 1964, Lauenroth and Burke 2008, Lauenroth and Milchunas 1992, Milchunas et al. 1989, Milchunas et al. 2008, Ricketts et al. 1999, Rondeau pers. comm., Sala and Lauenroth 1982, Shiflet 1994, Sims and Risser 2000, Sims et al. 1978, Singh et al. 1983, Weaver and Albertson 1956

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G144. Great Plains Shortgrass Prairie

A3999. Artemisia frigida - Dalea formosa - Gutierrezia sarothrae Dwarf-shrubland Alliance

Type Concept Sentence: This dwarf-shrubland alliance is composed of a variety of shrubs, such as *Artemisia frigida, Dalea formosa, Gutierrezia sarothrae, Mimosa borealis*, and/or *Yucca glauca*, and occurs in the shortgrass steppe of the western Great Plains in a variety of environments but is common in shallow soils near escarpments.

OVERVIEW

Scientific Name: *Artemisia frigida - Dalea formosa - Gutierrezia sarothrae* Dwarf-shrubland Alliance
Common Name (Translated Scientific Name): Fringed Sagebrush - Featherplume - Broom Snakeweed Dwarf-shrubland Alliance
Colloquial Name: Fringed Sagebrush - Featherplume - Broom Snakeweed Dwarf-shrubland

Type Concept: This alliance occurs in the shortgrass steppe of the western Great Plains from eastern Colorado and New Mexico to the panhandle of Texas. Vegetation is dominated by dwarf-shrubs with variable cover of herbaceous plants. The dominant and diagnostic shrubs are *Artemisia bigelovii, Artemisia frigida, Dalea formosa, Gutierrezia sarothrae, Mimosa borealis*, and/or *Yucca glauca*. The herbaceous layer ranges from sparse to dense and is dominated by graminoids, especially *Bouteloua gracilis* with *Aristida purpurea, Bouteloua curtipendula, Elymus elymoides, Nassella viridula, Poa fendleriana, Schedonnardus paniculatus*, and *Sporobolus cryptandrus*. Forbs cover is often sparse and sometimes diverse. Species such as *Eriogonum jamesii* and *Sphaeralcea coccinea* are frequently present. This alliance occurs in a variety of environments and conditions, such as narrow bands along the tops of escarpments and narrow ridges where bedrock is at or very near the surface and soils are shallow, as well as in kipukas of old lavaflows, and areas with repeated disturbance such as sites associated with prairie dog towns and heavily grazed pastures in the vicinity of livestock watering ponds. Substrates are often derived from alluvium lava, limestone or sandstone.

Classification Comments: This alliance includes dwarf-shrublands on both rocky shallow soils near escarpments and deep loamy soils with prairie dog disturbance. Further classification work may result in separating scarp communities from prairie communities. Dwarf-shrublands dominated by *Artemisia bigelovii* or *Krascheninnikovia lanata* occur in the shortgrass steppe. Stands dominated by *Artemisia bigelovii* occur on breaks in the southern shortgrass steppe in southeastern Colorado and eastern New Mexico. These broadly defined associations also occur on the Colorado Plateau, and stands have been grouped with other *Artemisia bigelovii* communities in Intermountain Low & Black Sagebrush Steppe & Shrubland Group (G308) in Great Basin-Intermountain Dwarf Sagebrush Steppe & Shrubland Macrogroup (M170). Stands dominated by *Krascheninnikovia lanata* occur in the shortgrass steppe in eastern Colorado, eastern New Mexico and western Kansas. These broadly defined associations also occur in the intermountain western U.S., and stands have been grouped with other *Krascheninnikovia lanata* communities in Intermountain Semi-Desert Steppe & Shrubland Group (G310) in Great Basin-Intermountain Dry Shrubland & Grassland Macrogroup (M171). Further research is needed to determine if these associations should be split based on regional floristics.

Internal Comments: DFL 11-14: This is a very problematic alliance and needs further review; shortgrass with dwarf shrub okay as concept but needs further flushout. KAS 12-13: Stands of *Artemisia frigida / Bouteloua gracilis* Dwarf-shrubland (CEGL002782) are reported from montane parks and have been included.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: This alliance is dominated by diagnostic dwarf-shrubs *Artemisia frigida, Dalea formosa, Gutierrezia sarothrae, Mimosa borealis*, and/or *Yucca glauca*. The sparse to dense herbaceous layer is often dominated by *Bouteloua gracilis* with *Aristida purpurea, Bouteloua curtipendula, Elymus elymoides, Nassella viridula, Poa fendleriana, Schedonnardus paniculatus*, and *Sporobolus cryptandrus* present to codominant. Forbs cover is often sparse and diverse. Species such as *Eriogonum jamesii* and *Sphaeralcea coccinea* are frequently present.

VEGETATION

Physiognomy and Structure: This alliance is characterized by an open to moderately dense dwarf-shrub layer with an often discontinuous herbaceous layer dominated by short perennial grasses.

Floristics: This alliance is characterized by a variety of dwarf-shrubs with variable cover of herbaceous plants. The dominant and diagnostic shrubs are *Artemisia frigida, Dalea formosa, Gutierrezia sarothrae, Mimosa borealis, Opuntia polyacantha*, and/or *Yucca glauca*. Other shrubs present in lesser amounts include *Chrysothamnus viscidiflorus, Ericameria parryi, Krascheninnikovia lanata, Lycium pallidum, Rhus trilobata*, and *Rosa* spp. The herbaceous layer ranges from sparse to dense and is dominated by graminoids, especially *Bouteloua gracilis*. Associated grasses include *Aristida purpurea, Bouteloua curtipendula, Elymus elymoides, Hesperostipa comata, Nassella viridula, Pascopyrum smithii, Pleuraphis jamesii, Poa fendleriana, Schedonnardus paniculatus*, and *Sporobolus cryptandrus*. Forbs cover is often sparse (<5% cover) and may be diverse. Species such as *Chamaesyce* spp., *Eriogonum jamesii*, and *Sphaeralcea coccinea* are frequently present. However, in deeper soils on prairie dog towns, *Argentina anserina* and *Achillea millefolium* may be common. Non-native species such as *Bromus tectorum, Erodium cicutarium, Melilotus officinalis, Sisymbrium altissimum*, or *Salsola kali* may be present to codominant in herbaceous layers of some disturbed stands. Ground cover is mostly of bare soil and small gravel with some litter under shrubs and within bunchgrasses.

ENVIRONMENT & DYNAMICS

Environmental Description: This dwarf-shrub alliance is found in the shortgrass steppe of the western Great Plains. Climate is semi-arid, continental with more than half to the precipitation falling during the summer. Most stands occur at elevations below 1830 m (6000 feet), but outlier stands my occur in semi-arid foothills and mountain parks up to 2640 m (8660 feet). Stands occur in a variety of environments and conditions, such as narrow bands along the tops of escarpments and narrow ridges where bedrock is at or very near the surface and soils are shallow, as in kipukas of old lavaflows. Deeper soils may be present on sites associated with repeated disturbance such as prairie dog towns and heavily grazed pastures in the vicinity of livestock watering ponds. These soils are often finer-textured loams and clays that will support burrowing activity, but also occur on sandy substrates. Substrates are often derived from lava, scoria, basalt, limestone, sandstone or alluvium.

Dynamics: This dwarf-shrubland becomes established on disturbed sites such as prairie dogs towns, steep colluvial slopes and near edges of escarpments, and on sandy wind-blown sites. Other common sites include heavily grazed pastures, especially in the vicinity of livestock watering ponds. Historically, disturbance from large herds of bison may have created habitat. Stands of this alliance on prairie dogs towns were likely as extensive as the prairie dog towns themselves but have been reduced to a fraction of their former extent. *Artemisia frigida* is an increaser under livestock grazing regimes and is evidently unpalatable or less palatable to prairie dogs, as well. The age of the colony determines to what extent *Artemisia frigida* dominates the site, and the following description covers

sites that have been used by prairie dogs for several years. Prairie dog colonies that are densely occupied typically have vegetative cover values less than 40%.

Gutierrezia sarothrae occurs in many natural grassland and steppe communities in the western U.S. and is known to increase when these communities are disturbed mechanically or by overgrazing (USFS 1937, Stubbendieck et al. 1992). The role of disturbance in this association needs further study to understand its successional nature.

DISTRIBUTION

Geographic Range: This alliance occurs in the shortgrass steppe in the western Great Plains from eastern Colorado and New Mexico to the panhandles of Texas and likely Oklahoma.

Nations: US
States/Provinces: CO, NM, TX
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** *Dalea formosa - Mimosa borealis* Dwarf-shrubland (Bell 2005)
- **=** Shrub-Blue Grama Series (Dick-Peddie 1993)

LOWER LEVEL UNITS

Associations:
- CEGL005011 *Gutierrezia sarothrae - Yucca glauca* Dwarf-shrubland
- CEGL002782 *Artemisia frigida / Bouteloua gracilis* Dwarf-shrubland

AUTHORSHIP

Primary Concept Source: W.A. Dick-Peddie (1993)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Bell 2005, Dick-Peddie 1993, Faber-Langendoen et al. 2017b, Stubbendieck et al. 1992, USFS 1937

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G144. Great Plains Shortgrass Prairie

A4000. Bouteloua gracilis - Bouteloua dactyloides Shortgrass Prairie Alliance

Type Concept Sentence: This shortgrass alliance is characterized by a moderate to dense sod of short grasses *Bouteloua gracilis* and *Bouteloua dactyloides* on semi-arid prairies and is common across the western portions of the Great Plains.

OVERVIEW

Scientific Name: *Bouteloua gracilis - Bouteloua dactyloides* Shortgrass Prairie Alliance
Common Name (Translated Scientific Name): Blue Grama - Buffalograss Shortgrass Prairie Alliance
Colloquial Name: Blue Grama - Buffalograss Shortgrass Prairie

Type Concept: This shortgrass prairie alliance is common across the western portions of the central and southern Great Plains with outlier stands in the northern Great Plains. This vegetation is characterized by a moderate to dense sod of short grasses *Bouteloua gracilis* and *Bouteloua dactyloides (= Buchloe dactyloides)* with scattered midgrasses and forbs . Other short graminoids include *Bouteloua hirsuta, Carex duriuscula, Carex inops ssp. heliophila, Carex filifolia*, and *Muhlenbergia torreyi*. Midgrasses such as *Aristida purpurea, Bothriochloa saccharoides, Bouteloua curtipendula, Elymus elymoides, Hesperostipa comata (= Stipa comata), Pascopyrum smithii, Pleuraphis jamesii, Schizachyrium scoparium*, and *Sporobolus cryptandrus* are usually sparse and stunted by the semi-arid conditions and do not exceed 0.7 m in height. Forb cover is generally low but may be diverse and includes species of *Astragalus, Eriogonum, Machaeranthera, Opuntia, Psoralidium, Ratibida, Sphaeralcea*, and *Zinnia*. Scattered shrubs are rare and may include *Artemisia frigida, Atriplex canescens, Ericameria nauseosa (= Chrysothamnus nauseosus), Gutierrezia sarothrae*, and *Yucca glauca*. Climate is semi-arid continental, with over half the annual precipitation typically occurring during the summer. Stands often occur in lowland sites that have well-developed soils ranging from loams to clay and silty clay.

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:
- A4001 *Bouteloua gracilis - Bouteloua hirsuta - Bouteloua curtipendula* Shortgrass Prairie Alliance: is similar but *Bouteloua dactyloides* is absent or has low cover.

Diagnostic Characteristics: This alliance is characterized by an open to dense short herbaceous layer codominated by diagnostic species *Bouteloua gracilis* and *Bouteloua dactyloides*. Other short graminoid associates with lower cover may include *Bouteloua hirsuta, Carex duriuscula, Carex inops ssp. heliophila, Carex filifolia*, and *Muhlenbergia torreyi*. Midgrass associates may be present with low cover. Characteristic midgrasses include *Aristida purpurea, Bothriochloa saccharoides, Bouteloua curtipendula, Elymus elymoides, Hesperostipa comata, Pascopyrum smithii, Pleuraphis jamesii, Schizachyrium scoparium*, and *Sporobolus cryptandrus*. Forb associates are typical of shortgrass steppe and include *Astragalus* spp., *Eriogonum jamesii, Gaura coccinea, Machaeranthera pinnatifida var. pinnatifida, Opuntia polyacantha, Plantago patagonica, Psoralidium tenuiflorum, Ratibida columnifera, Sphaeralcea coccinea*, and *Zinnia grandiflora*.

VEGETATION

Physiognomy and Structure: Stands in this alliance have a graminoid layer dominated by short grasses that typically form a sod. Midgrasses may be present to codominate in some communities. Rarely, sparse scattered shrubs may be present. Some ungrazed stands may have a short bunchgrass form.

Floristics: This vegetation of this shortgrass prairie alliance is characterized by a moderate to dense sod of short grasses with scattered midgrasses and forbs. The dominant and diagnostic species are *Bouteloua gracilis* and *Bouteloua dactyloides (= Buchloe dactyloides)*. Other short graminoids include *Bouteloua hirsuta, Carex duriuscula, Carex inops ssp. heliophila*, and *Carex filifolia*. Midgrasses, if present, are usually stunted by the arid conditions and often do not exceed 0.7 m in height. They include *Aristida purpurea, Bothriochloa saccharoides, Bouteloua curtipendula, Elymus elymoides, Hesperostipa comata (= Stipa comata), Muhlenbergia torreyi, Pascopyrum smithii, Pleuraphis jamesii, Schizachyrium scoparium*, and *Sporobolus cryptandrus*. Characteristic forbs such as *Astragalus* spp., *Eriogonum jamesii, Gaura coccinea, Machaeranthera pinnatifida var. pinnatifida, Opuntia polyacantha, Plantago patagonica, Psoralidium tenuiflorum, Ratibida columnifera, Sphaeralcea coccinea*, and *Zinnia grandiflora* are common. Scattered shrubs are rare and may include *Artemisia frigida, Atriplex canescens, Ericameria nauseosa (= Chrysothamnus nauseosus), Gutierrezia sarothrae, Yucca glauca*, and *Cylindropuntia imbricata (= Opuntia imbricata)* (in the southern extent).

ENVIRONMENT & DYNAMICS

Environmental Description: This shortgrass prairie alliance is common across the western portions of the central and southern Great Plains with outlier stands in the northern Great Plains. Climate is semi-arid continental, with over half the annual precipitation typically occurring during the summer. Stands typically occur in lowland sites that have well-developed soils that range from loams to clay and silty clay (Weaver and Albertson 1956, Johnston 1987, Steinauer 1989).

Dynamics: Large-scale processes such as climate, fire and grazing constitute the primary processes impacting this alliance. The short grasses that dominate this alliance are extremely drought- and grazing-tolerant (Lauenroth and Milchunas 1992, Lauenroth et al. 1994, Milchunas and Lauenroth 2008). *Bouteloua gracilis* is one of the most widely distributed grasses in the western U.S. and is present in many different grassland, shrubland and woodland communities. It evolved with grazing by large herbivores and generally forms a short sod. However, in some stands, ungrazed plants develop the upright physiognomy of a bunchgrass. If *Bouteloua gracilis* is eliminated from an area by extended drought (3-4 years) or disturbance such as plowing, regeneration is slow because of very slow tillering rates (Samuel 1985), low and variable seed production (Coffin and Lauenroth 1992), minimal seed storage in the soil (Coffin and Lauenroth 1989c) and limited seedling germination and establishment due to particular temperature and extended soil moisture requirements for successful seedling establishment (Hyder et al. 1971, Briske and Wilson 1978, 1980). *Bouteloua dactyloides* is often abundant in swales and depressions. It is less drought-tolerant than *Bouteloua gracilis*, but following disturbance re-establishes more quickly via seeds and above-ground tillering (Peters et al. 2008).

DISTRIBUTION

Geographic Range: This shortgrass prairie alliance is common across much of the central and southern Great Plains of the United States with outlier stands in the northern Great Plains.

Nations: CA, US
States/Provinces: CO, KS, ND, NE, NM, OK, SD, TX, WY
TNC Ecoregions [optional]:

USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- = *Bouteloua gracilis-Buchloe dactyloides* (Bourgeron and Engelking 1994)
- = *Buchloe - Bouteloua* Community (Heitschmidt et al. 1970)
- = *Bulbilis-Bouteloua* Association (Bruner 1931) [Oklahoma]
- = Blue Grama-Buffalograss Series (Diamond 1993)
- = Buffalograss Type (Hanson and Whitman 1938)
- = Central and Eastern Grasslands: 65: Grama-Buffalo Grass (*Bouteloua-Buchloe*) (Küchler 1964)
- = Grama-Buffalograss Series (Dick-Peddie 1993)
- = Northern Grama-Buffalograss Prairie (Küchler 1974) [Kansas]
- = Southern Grama-Buffalograss Prairie (Küchler 1974) [Kansas]

LOWER LEVEL UNITS

Associations:

- CEGL002271 *Bouteloua gracilis - Bouteloua dactyloides - Pleuraphis jamesii* Grassland
- CEGL001756 *Bouteloua gracilis - Bouteloua dactyloides* Grassland
- CEGL002270 *Bouteloua gracilis - Bouteloua dactyloides* Xeric Soil Grassland

AUTHORSHIP

Primary Concept Source: H.C. Hanson and W. Whitman (1938)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Beavis et al. 1982, Bonham and Lerwick 1976, Bourgeron and Engelking 1994, Briske and Wilson 1978, Briske and Wilson 1980, Bruner 1931, Coffin and Lauenroth 1989, Coffin and Lauenroth 1992, Costello 1944b, Diamond 1993, Dick-Peddie 1993, Donart et al. 1978b, Faber-Langendoen et al. 2017b, Hanson 1950, Hanson and Whitman 1938, Heerwagen 1958, Heitschmidt et al. 1970, Hoagland 1998a, Hyder et al. 1971, Johnston 1987, Küchler 1964, Küchler 1974, Lauenroth and Burke 2008, Lauenroth and Milchunas 1992, Lauenroth et al. 1994a, Milchunas and Lauenroth 2008, Milchunas et al. 1989, Moir and Trlica 1976, Peters et al. 2008, Ramaley 1914, Robbins 1917, Rogers 1953, Samuel 1985, Shantz 1911, Shantz 1923, Steinauer 1989, Weaver and Albertson 1956, Zimmerman 1967

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G144. Great Plains Shortgrass Prairie

A4001. Bouteloua gracilis - Bouteloua hirsuta - Bouteloua curtipendula Shortgrass Prairie Alliance

Type Concept Sentence: This shortgrass prairie alliance is characterized by a moderate to dense layer of short grasses dominated by *Bouteloua gracilis, Bouteloua hirsuta*, and midgrass *Bouteloua curtipendula* with *Bouteloua dactyloides* absent or has low cover. It is common across the western portions of the central and southern Great Plains.

OVERVIEW

Scientific Name: *Bouteloua gracilis - Bouteloua hirsuta - Bouteloua curtipendula* Shortgrass Prairie Alliance
Common Name (Translated Scientific Name): Blue Grama - Hairy Grama - Sideoats Grama Shortgrass Prairie Alliance
Colloquial Name: Great Plains Grama Shortgrass Prairie

Type Concept: This shortgrass prairie alliance is common across the western portions of the central and southern Great Plains. This vegetation is characterized by a moderate to dense sod of dominated by short grasses, *Bouteloua gracilis, Bouteloua hirsuta* and midgrass, *Bouteloua curtipendula*. However, not all three species are always present. *Bouteloua dactyloides (= Buchloe dactyloides)* is absent or has low cover (<5%). Other grasses that may be present to codominant in *Aristida purpurea, Bouteloua eriopoda*, and *Muhlenbergia torreyi*. *Elymus elymoides, Hesperostipa comata (= Stipa comata), Pascopyrum smithii, Pleuraphis jamesii, Schedonnardus paniculatus, Schizachyrium scoparium*, and *Sporobolus cryptandrus* may also be present. Forbs have low cover but may be diverse including species of *Astragalus, Eriogonum, Gaura, Machaeranthera, Opuntia, Plantago, Psoralidium, Ratibida, Sphaeralcea* and *Zinnia*. Scattered shrubs are rare and may include *Artemisia frigida, Atriplex canescens, Ericameria nauseosa (=*

Chrysothamnus nauseosus), Gutierrezia sarothrae, and *Cylindropuntia imbricata (= Opuntia imbricata)* in the southern extent). Soils are well developed with texture ranging from sandy loam to clay loam.

Classification Comments: Stands containing a mix of *Bouteloua gracilis, Carex filifolia*, and moderate amounts of *Pascopyrum smithii* or *Hesperostipa comata* may present classification problems. *Bouteloua gracilis* increases with heavy grazing pressure as other species decline in many western plant communities, often resulting in difficulties in classification.

Internal Comments:
Other Comments:

Similar NVC Types:

- A4000 *Bouteloua gracilis - Bouteloua dactyloides* Shortgrass Prairie Alliance: is similar but codominated by *Bouteloua dactyloides*.

Diagnostic Characteristics: This alliance is characterized by an open to dense short herbaceous layer dominated by diagnostic species *Bouteloua gracilis, Bouteloua curtipendula*, and *Bouteloua hirsuta*. However, not all three species are always present. *Bouteloua dactyloides* is absent or has low cover (<5%). Other diagnostic grasses that may be present to codominant are *Aristida purpurea, Bouteloua eriopoda*, and *Muhlenbergia torreyi*. Additional associates include *Elymus elymoides, Hesperostipa comata, Pascopyrum smithii, Pleuraphis jamesii, Schedonnardus paniculatus, Schizachyrium scoparium*, and *Sporobolus cryptandrus*. Forb associates include *Astragalus* spp., *Eriogonum jamesii, Gaura coccinea, Machaeranthera pinnatifida var. pinnatifida, Opuntia polyacantha, Plantago patagonica, Psoralidium tenuiflorum, Ratibida columnifera, Sphaeralcea coccinea*, and *Zinnia grandiflora*.

VEGETATION

Physiognomy and Structure: Stands in this alliance have a graminoid layer dominated by short grasses that typically form a sod. Midgrasses may codominate in some communities. Rarely, sparse scattered shrubs may be present. Some ungrazed stands may have a short bunchgrass form.

Floristics: This vegetation of this alliance is characterized by a moderate to dense sod of short grasses, midgrasses and forbs. The dominant and diagnostic species are *Bouteloua gracilis, Bouteloua curtipendula*, and *Bouteloua hirsuta*. However, not all three species are always present. *Bouteloua dactyloides (= Buchloe dactyloides)* is absent or has low cover (<5%). Other grasses that may be present to codominant are *Aristida purpurea, Bouteloua eriopoda*, and *Muhlenbergia torreyi*. *Elymus elymoides, Hesperostipa comata (= Stipa comata), Pascopyrum smithii, Pleuraphis jamesii, Schedonnardus paniculatus, Schizachyrium scoparium*, and *Sporobolus cryptandrus* may also be present. Forbs such as *Astragalus* spp., *Eriogonum jamesii, Gaura coccinea, Machaeranthera pinnatifida var. pinnatifida, Opuntia polyacantha, Plantago patagonica, Psoralidium tenuiflorum, Ratibida columnifera, Sphaeralcea coccinea*, and *Zinnia grandiflora* are common throughout this community. Scattered shrubs are rare and may include *Artemisia frigida, Atriplex canescens, Ericameria nauseosa (= Chrysothamnus nauseosus), Gutierrezia sarothrae*, and *Cylindropuntia imbricata (= Opuntia imbricata)* (in the southern extent).

ENVIRONMENT & DYNAMICS

Environmental Description: This shortgrass prairie alliance is widespread across the western portions of the central and southern Great Plains. Climate is semi-arid continental, with over half the annual precipitation typically occurring during the summer. Soils are well-developed and range from sandy loam to clay loam.

Dynamics: *Bouteloua gracilis* is an extremely drought- and grazing-tolerant shortgrass species. It is one of the most widely distributed grasses in the western U.S. and is present in many different grassland, shrubland and woodland communities. It evolved with grazing by large herbivores and generally forms a short sod. However, in some stands, ungrazed plants develop the upright physiognomy of a bunchgrass.

DISTRIBUTION

Geographic Range: This shortgrass prairie alliance is common across the western portions of the central and southern Great Plains.

Nations: US
States/Provinces: CO, KS, NE, NM, OK, TX, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **<** *Bouteloua gracilis-Bouteloua curtipendula* (Bourgeron and Engelking 1994)
- **<** *Bouteloua gracilis-Bouteloua hirsuta* (Bourgeron and Engelking 1994)
- **>** *Bouteloua gracilis* herbaceous alliance (Hoagland 1998a)
- **<** *Bouteloua hirsuta-Bouteloua curtipendula* (Bourgeron and Engelking 1994)
- **?** *Bouteloua hirsuta* Series (Wood et al. 1998) [This also includes some of the shrub herbaceous alliances.]
- **<** *Bouteloua hirsuta* herbaceous alliance (Hoagland 1998a) [This only includes southern Great Plains associations.]
- **>** Central and Eastern Grasslands: 53: Grama-Galleta Steppe (*Bouteloua-Hilaria*) (Küchler 1964)
- **<** Grama-Galleta Series (Dick-Peddie 1993)
- **<** Grama-Threeawn Series (Dick-Peddie 1993)
- **<** Lower Slope (Beavis et al. 1982)
- **<** Plains-Mesa Grassland (Dick-Peddie 1993)

LOWER LEVEL UNITS

Associations:

- CEGL001755 *Bouteloua gracilis - Bouteloua hirsuta* Grassland
- CEGL005389 *Bouteloua gracilis - Muhlenbergia torreyi - Aristida purpurea* Grassland
- CEGL001761 *Bouteloua gracilis - Sporobolus cryptandrus* Grassland
- CEGL001754 *Bouteloua gracilis - Bouteloua curtipendula* Grassland
- CEGL002250 *Bouteloua curtipendula - Bouteloua (eriopoda, gracilis)* Grassland
- CEGL001764 *Bouteloua hirsuta - Bouteloua curtipendula* Grassland
- CEGL002673 *Bouteloua hirsuta* Grassland [Placeholder]

AUTHORSHIP

Primary Concept Source: W.A. Dick-Peddie (1993)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Beavis et al. 1982, Bonham and Lerwick 1976, Bourgeron and Engelking 1994, Bruner 1931, Clements and Goldsmith 1924, Costello 1944b, Diamond 1993, Dick-Peddie 1993, Donart et al. 1978b, Faber-Langendoen et al. 2017b, Heitschmidt et al. 1970, Hoagland 1998a, Klipple 1964, Küchler 1964, Küchler 1974, Milchunas et al. 1989, Moir and Trlica 1976, Moulton et al. 1981, Muldavin and Mehlhop 1992, Muldavin et al. 1998c, Muldavin et al. 2000b, Mutel 1976, Rogers 1953, Shantz 1923, Stearns-Roger, Inc. 1978, Steinauer 1989, Vestal 1914, Weaver and Albertson 1956, Wood et al. 1998, Zimmerman 1967

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G144. Great Plains Shortgrass Prairie

A4002. Bouteloua gracilis - Bouteloua hirsuta - Hesperostipa neomexicana Shortgrass Prairie Alliance

Type Concept Sentence: This mixedgrass alliance is characterized by a moderately dense grass layer of midgrass *Hesperostipa neomexicana* with a shortgrass layer composed of codominant *Bouteloua gracilis* and/or *Bouteloua hirsuta*. It is found from the northern Chihuahuan Desert north into the southwestern Great Plains on gentle to moderately steep slopes in foothills and escarpments.

OVERVIEW

Scientific Name: *Bouteloua gracilis - Bouteloua hirsuta - Hesperostipa neomexicana* Shortgrass Prairie Alliance
Common Name (Translated Scientific Name): Blue Grama - Hairy Grama - New Mexico Feathergrass Shortgrass Prairie Alliance
Colloquial Name: Blue Grama - Hairy Grama - New Mexico Feathergrass Shortgrass Prairie

Type Concept: Vegetation of this grassland alliance is characterized by a moderately dense midgrass layer of bunchgrass *Hesperostipa neomexicana* over a shortgrass layer composed of *Bouteloua gracilis* and/or *Bouteloua hirsuta*. Other grass species include *Aristida purpurea* and *Bouteloua curtipendula*, but stands are not codominated by desert grasses such as *Bouteloua eriopoda, Eragrostis intermedia, Muhlenbergia emersleyi*, or *Muhlenbergia setifolia*. The forb layer is variable and commonly includes *Lesquerella fendleri* and *Melampodium leucanthum*. Scattered shrubs, subshrubs or succulents may be present, but do not form a layer. This alliance occurs from the northern San Andres Mountains, Chupadera Mesa and the Oscura Mountains in the northern Chihuahuan Desert and extends north into the foothills of central New Mexico and Colorado and east on escarpments in the southwestern Great Plains. Stands occur on generally cool aspects on gentle to moderately steep slopes. The ground surfaces are generally gravelly, with scattered rocks and little exposed soil.

Classification Comments: This alliance includes grasslands that also occur in the Chihuahuan Desert. Currently they are placed in a Great Plains group. If a stand has lots of desert grasses present, such as *Bouteloua eriopoda, Bouteloua radicosa, Digitaria californica, Eragrostis intermedia, Muhlenbergia emersleyi, Muhlenbergia setifolia*, or is codominated by them, it may be better classified as a desert grassland.

~*Hesperostipa neomexicana* Grassland (CEGL001708) and *Hesperostipa neomexicana* Mixed Prairie Grassland (CEGL001711) from the archived *Hesperostipa neomexicana* Southwestern Great Plains Alliance (A4041) are now included here. The current description needs revision to reflect this merge.

Internal Comments: KAS-12-13: The diagnostic species *Hesperostipa neomexicana* occurs the foothills and mountains of the northern Chihuahuan Desert to foothills and escarpments in the southwestern Great Plains and Rocky Mountain Front Range into southern Wyoming. The associations in this alliance are very similar to *Hesperostipa neomexicana* Herbaceous Vegetation (CEGL001708) and *Hesperostipa neomexicana* Mixed Prairie Herbaceous Vegetation (CEGL001711) in Hesperostipa neomexicana Southwestern Great Plains Herbaceous Alliance (A4041), which is in Northern Great Plains Mixedgrass Mesic Prairie (G141). Also associations in this alliance are documented from White Sands Missile Range in the northern Chihuahuan Desert (Muldavin and Mehlhop 1992, Muldavin et al. 200b), so they may be more desert grassland than Great Plains. By definition, stands codominated by this species are mixedgrass so Great Plains Shortgrass Prairie Group (G144) may not be the best fit. Need more data on *Hesperostipa neomexicana* stands in southwestern Great Plains to clarify classification. If we determined to maintain this alliance, we show consider moving *Hesperostipa neomexicana* Mixed Prairie Herbaceous Vegetation (CEGL001711) from New Mexico into this alliance.

Other Comments:

Similar NVC Types: Stands in Chihuahuan Desert Foothill-Piedmont & Lower Montane Grassland Group (G490) may be similar in transition zone between the northern Chihuahuan Desert and southwestern Great Plains and need further review.

- A3206 *Muhlenbergia emersleyi - Muhlenbergia setifolia - Hesperostipa neomexicana* Madrean Lower Montane Grassland Alliance: may also codominated by *Hesperostipa neomexicana*.

Diagnostic Characteristics: This alliance is characterized by dominant and diagnostic species *Hesperostipa neomexicana* with a shortgrass layer composed of *Bouteloua gracilis* and/or *Bouteloua hirsuta* and sparsely scattered shrubs. Desert grasses may be present but do not codominate, especially *Bouteloua eriopoda, Eragrostis intermedia, Muhlenbergia emersleyi*, and *Muhlenbergia setifolia*.

VEGETATION

Physiognomy and Structure: Stands in this mixedgrass alliance are composed of a moderately dense to dense, medium-tall, bunchgrass layer with an open to moderately dense shortgrass layer composed of perennial grasses. Low cover of forbs is often present. Sparse scattered shrubs may be present but do not form a layer.

Floristics: This grassland alliance is characterized by a moderately dense to dense perennial grass layer composed of midgrass *Hesperostipa neomexicana* over an open to moderately dense shortgrass layer composed of *Bouteloua gracilis* and/or *Bouteloua hirsuta*. Other grasses may be present to codominant such as *Aristida purpurea* and *Bouteloua curtipendula*, but stands are not codominated by desert grasses such as *Bouteloua eriopoda, Eragrostis intermedia, Muhlenbergia emersleyi*, or *Muhlenbergia setifolia*. Scattered shrubs and dwarf-shrubs present may include *Artemisia bigelovii, Chrysothamnus pulchellus, Dalea formosa, Gutierrezia sarothrae*, and *Rhus trilobata*. Forb cover is generally sparse (<10%), but may be diverse. Common forbs include *Astragalus* spp., *Gaura coccinea, Lesquerella fendleri, Machaeranthera pinnatifida ssp. pinnatifida, Melampodium leucanthum, Plantago patagonica, Psoralidium tenuiflorum, Ratibida columnifera*, and *Sphaeralcea coccinea*. Succulents such as *Opuntia polyacantha* and *Opuntia phaeacantha* are common. Occasional *Juniperus monosperma* (live or standing dead) are common. Southern stands may have scattered *Agave palmeri, Dasylirion wheeleri, Nolina microcarpa*, or *Prosopis glandulosa* present.

ENVIRONMENT & DYNAMICS

Environmental Description: This grassland alliance occurs in the northern San Andres Mountains, Chupadera Mesa and the Oscura Mountains in the northern Chihuahuan Desert and extends north into foothills of central New Mexico and the Colorado Front Range extending out on escarpments and mesas in the southwestern Great Plains. Stands occur on generally cool aspects on gentle to moderately steep slopes at elevations ranging from 1525-2130 m (5000-7000 feet). Soils range from coarse loams to silty clays, but can be shallow and rocky and contain caliche layers derived from limestone and/or sandstones. The ground surfaces are generally gravelly, with scattered rocks and little exposed soil.

Dynamics:

DISTRIBUTION

Geographic Range: This grassland alliance occurs in the northern San Andres Mountains, Chupadera Mesa and the Oscura Mountains in the northern Chihuahuan Desert and extends north into foothills of central New Mexico and the Colorado Front Range extending east out on escarpments and mesas in the southwestern Great Plains.

Nations: US
States/Provinces: CO, NM
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **>** *Bouteloua gracilis - Stipa neomexicana* PA (Muldavin and Mehlhop 1992)
- **>** *Stipa neomexicana / Bouteloua hirsuta* PA (Muldavin and Mehlhop 1992)
- **=** Grama-Feathergrass Series (Dick-Peddie 1993) [This series includes semi-desert grasslands in both the Chihuahuan Desert and Great Plains.]
- **>** New Mexico Needlegrass-Blue Grama PA (Muldavin et al. 2000b)
- **>** New Mexico Needlegrass-Hairy Grama PA (Muldavin et al. 2000b)
- **=** Ridge (Beavis et al. 1982) [Ridge topographic was codominated by *Hesperostipa neomexicana* and *Bouteloua gracilis*.]

LOWER LEVEL UNITS

Associations:

- CEGL001763 *Bouteloua gracilis - Hesperostipa neomexicana* Grassland
- CEGL001766 *Bouteloua hirsuta - Hesperostipa neomexicana* Grassland
- CEGL001708 *Hesperostipa neomexicana* Grassland
- CEGL001711 *Hesperostipa neomexicana* Mixed Prairie Grassland

AUTHORSHIP

Primary Concept Source: W.A. Dick-Peddie (1993)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Beavis et al. 1982, Bonham and Lerwick 1976, Bourgeron et al. 1993b, Bruner 1931, Bujakiewicz 1975, Costello 1944b, Diamond 1993, Dick-Peddie 1993, Donart et al. 1978b, Faber-Langendoen et al. 2017b, Muldavin and Mehlhop 1992, Muldavin et al. 1994a, Muldavin et al. 1998a, Muldavin et al. 2000b, Mutel 1976, Ramaley 1914, Rogers 1953, Wood et al. 1998

M052. Great Plains Sand Grassland & Shrubland

This Great Plains macrogroup is found from Texas to southern Canada on somewhat excessively to excessively well-drained, deep sandy to loamy sand soils and contains grasses and scattered to moderately dense shrubs well-adapted to these soil conditions. Wind erosion, grazing and fire can significantly impact this macrogroup.

2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
2.B.2.Nb.4.a. M052 Great Plains Sand Grassland & Shrubland

G069. Great Plains Sand Shrubland

Type Concept Sentence: This group is found on sandy soils across most of the Great Plains where a sparse to dense shrub cover, mostly *Artemisia filifolia* but also *Amorpha canescens, Prosopis glandulosa, Prunus pumila var. besseyi, Rhus trilobata*, and *Yucca glauca*, occurs over medium-tall grasses.

OVERVIEW

Scientific Name: *Artemisia filifolia / Calamovilfa longifolia - Yucca glauca* Sand Shrubland Group
Common Name (Translated Scientific Name): Sand Sagebrush / Prairie Sandreed - Soapweed Yucca Sand Shrubland Group
Colloquial Name: Great Plains Sand Sagebrush Sand Prairie Scrub

Type Concept: This group is found mostly in south-central areas of the Western Great Plains Division ranging from southwestern Wyoming and southwestern Nebraska up into the Nebraska Sandhill region, south through eastern Colorado, and New Mexico to central Texas, although some examples may reach as far north as the Badlands of South Dakota. Typically, this group is characterized by a sparse to moderately dense woody layer dominated by *Artemisia filifolia*, but other characteristic species may be present, including *Amorpha canescens, Prosopis glandulosa* (southern stands), *Prunus angustifolia, Prunus pumila var. besseyi* (northern stands), *Rhus trilobata*, and *Yucca glauca*. In the southern range of this group, *Quercus havardii* may also be present to dominant and represents one succession pathway that develops over time following disturbance. Associated herbaceous species can vary with geography, amount and season of precipitation, disturbance, and soil texture. The herbaceous layer typically has a moderate to dense canopy but can be sparse. Several mid- to tallgrass species characteristic of sand substrates are usually present to dominant, such as *Andropogon hallii, Calamovilfa gigantea, Calamovilfa longifolia, Schizachyrium scoparium, Sporobolus cryptandrus, Sporobolus giganteus*, or *Hesperostipa comata*. Overgrazing can lead to decreasing dominance of some of the grass species, such as *Andropogon hallii, Calamovilfa gigantea*, and *Schizachyrium scoparium*, and may result in a shift from the Great Plains Sand Grassland Group (G068) to this group. In the western extent of this group in the shortgrass prairie, more xeric mid- and shortgrass species such as *Hesperostipa comata, Sporobolus cryptandrus*, and *Bouteloua gracilis* often dominate the herbaceous layer. The climate is semi-arid to arid for much of the region in which this group occurs. It occurs on somewhat excessively to excessively well-drained, deep sandy soils that are often associated with dune systems and ancient floodplains.

Classification Comments: Overgrazing can lead to decreasing dominance of some of the grass species such as *Andropogon hallii, Calamovilfa gigantea*, and *Schizachyrium scoparium* and may result in a shift to this group from Great Plains Sand Grassland Group (G068).

Similar NVC Types:
- G068 Great Plains Sand Grassland: contains several of the same graminoid species and may occur in a mosaic with this group, especially if overgrazing has occurred.
- G144 Great Plains Shortgrass Prairie
- G331 Northern Great Plains Dry Mixedgrass Prairie
- G491 Chihuahuan Sandy Plains Semi-Desert Grassland

Diagnostic Characteristics: This group is distinguished by a sparse to moderately dense shrub layer dominated by *Artemisia filifolia*. It occurs in semi-arid to arid areas of the Great Plains on somewhat excessively to excessively well-drained and deep sandy soils.

VEGETATION

Physiognomy and Structure: This group is characterized by a sparse to moderately dense shrub layer interspersed with scattered to dense graminoids.

Floristics: This group is distinguished by a sparse to moderately dense shrub layer dominated by *Artemisia filifolia*. Graminoid species, such as *Andropogon hallii, Calamovilfa longifolia, Calamovilfa gigantea, Hesperostipa comata, Schizachyrium scoparium, Sporobolus cryptandrus*, and *Bouteloua* spp., can also be found within this group. Other shrub species, such as *Yucca glauca, Rhus trilobata*, and *Prunus angustifolia*, may be present. The shrubs *Quercus havardii* and *Prosopis glandulosa* may also be present in the southern extent of this group, as can the grasses *Panicum havardii* and *Sporobolus giganteus*. In the extension of this group into the shortgrass prairie, more xeric mid- and shortgrass species such as *Hesperostipa comata, Sporobolus cryptandrus* and *Bouteloua gracilis* can dominate the herbaceous layer.

ENVIRONMENT & DYNAMICS

Environmental Description: This group is found primarily in semi-arid to arid areas of the Great Plains. It occurs on somewhat excessively to excessively well-drained and deep sandy soils. This group is often found associated with dune systems and/or ancient floodplains but may occur in soils derived from sandstone residuum and/or occur on sandstone outcrop ridges and down associated slopes.

Dynamics: Fire and grazing constitute the most important processes impacting this group. Burning shrublands reduces cover of *Artemisia filifolia* for several years, resulting in grassland patches that form a mosaic pattern with shrublands. Composition of grasslands depends on precipitation and management. Drought stress can also influence this group in some areas.

DISTRIBUTION

Geographic Range: This group is found primarily within the south-central areas of the Great Plains ranging from the Nebraska Sandhills south into central Texas. However, examples can be found north in the Badlands in South Dakota and parts of North Dakota and the southern Canadian Prairie Provinces and west into Wyoming and Montana.

Spatial Scale & Pattern [optional]: Large patch

Nations: CA, US
States/Provinces: AB, CO, KS, MB, MT, ND, NE, NM, OK, SD, SK, TX, WY
TNC Ecoregions [optional]: 26:C, 27:C, 28:C, 33:C, 34:P
USFS Ecoregions (2007): 315A:CC, 315B:CC, 315F:CC, 321A:CC, 331B:CC, 331C:CC, 331D:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 332C:CC, 332E:CC, 332F:CC, M313B:PP
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **><** Blue Grama - Sideoats Grama - Black Grama (707) (Shiflet 1994)
- **<** Bluestem - Dropseed (708) (Shiflet 1994)
- **>** Mesquite (southern type): 68 (Eyre 1980)
- **>** Mesquite (western type): 242 (Eyre 1980)
- **>** Mohrs (Shin) Oak: 67 (Eyre 1980)
- **>** Sand Bluestem - Little Bluestem Dunes (720) (Shiflet 1994)
- **=** Sand Sagebrush - Mixed Prairie (722) (Shiflet 1994)
- **>** Sand Shinnery Oak (730) (Shiflet 1994)
- **<** Sandsage Prairie (605) (Shiflet 1994)

LOWER LEVEL UNITS

Alliances:

- A0816 *Artemisia filifolia* Great Plains Sand Prairie Scrub Alliance
- A1540 *Yucca glauca* Prairie Scrub Alliance
- A4112 *Quercus havardii* Prairie Scrub Alliance
- A0627 *Sapindus saponaria* Prairie Scrub Alliance

AUTHORSHIP

Primary Concept Source: S. Menard and K. Kindscher, in Faber-Langendoen et al. (2011)
Author of Description: S. Menard and J. Drake
Acknowledgments:
Version Date: 05/07/2015
Classif Resp Region: Midwest
Internal Author: SEM 10-10, mod. JD 5-15

REFERENCES

References: Comer et al. 2003, Eyre 1980, Faber-Langendoen et al. 2017a, Ramaley 1939b, Shiflet 1994, Sims et al. 1976, Tolstead 1942

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G069. Great Plains Sand Shrubland

A0816. Artemisia filifolia Great Plains Sand Prairie Scrub Alliance

Type Concept Sentence: This alliance includes *Artemisia filifolia*-dominated shrublands occurring mostly in the western Great Plains from as far north as the Black Hills, south to the Trans-Pecos of western Texas and northern Chihuahuan Desert, extending northwest into the Colorado Plateau. These shrublands typically occur on flat, hummocky, or rolling terrain, as well as on partially stabilized dunes and sandsheets. Vegetation cover is sparse to moderately dense, with a shrub stratum approximately 1 m tall, dominated by *Artemisia filifolia*, interspersed with areas of bare substrate and scattered tall or midgrasses.

OVERVIEW

Scientific Name: *Artemisia filifolia* Great Plains Sand Prairie Scrub Alliance
Common Name (Translated Scientific Name): Sand Sagebrush Great Plains Sand Prairie Scrub Alliance
Colloquial Name: Great Plains Sand Sagebrush Sand Prairie Scrub

Type Concept: This alliance includes *Artemisia filifolia*-dominated shrublands occurring mostly in the western Great Plains from as far north as the Black Hills, south to the Trans-Pecos of western Texas and northern Chihuahuan Desert, extending northwest into the Colorado Plateau. Vegetation cover is sparse to moderately dense, with a shrub stratum approximately 1 m tall, dominated by *Artemisia filifolia*, interspersed with areas of bare substrate and scattered tall or midgrasses. Species composition varies with geography, precipitation, disturbance, and soil texture. Associated species may include *Andropogon hallii, Artemisia frigida,*

Bouteloua curtipendula, Bouteloua gracilis, Carex duriuscula (= Carex eleocharis), Calamovilfa gigantea, Calamovilfa longifolia, Calylophus serrulatus, Carex inops ssp. heliophila, Helianthus petiolaris, Hesperostipa comata (= Stipa comata), Heterotheca villosa var. villosa, Ipomoea leptophylla, Lathyrus polymorphus, Lygodesmia juncea, Opuntia spp., *Penstemon buckleyi, Prosopis glandulosa, Prunus angustifolia, Psoralidium lanceolatum, Schizachyrium scoparium, Sporobolus giganteus, Sporobolus cryptandrus*, and *Yucca glauca*. Communities associated with gypsum dunes have many gypsophiles or gypsum endemics. Colorado Plateau shrub associates include *Ericameria nauseosa, Ephedra torreyana, Ephedra viridis, Gutierrezia sarothrae, Atriplex canescens*, and the graminoids *Muhlenbergia pungens, Sporobolus cryptandrus, Bouteloua eriopoda*, and *Achnatherum hymenoides*. Some examples found in Texas and Oklahoma may be dominated by *Quercus havardii*. Degraded examples of this alliance may be dominated by *Prunus angustifolia*. Some examples in Oklahoma and Texas may be codominated by *Quercus havardii*. These shrublands typically occur on flat, hummocky, or rolling terrain, as well as on partially stabilized dunes and sandsheets. Soils supporting these communities have low water retention and nutrient availability, and are typically sand or loamy sand, primarily of eolian origin, but include sand deposits derived from sandstone residuum and cinder deposits. Less xeric sites tend to be more grass-dominated. In western Kansas and eastern Colorado, this alliance is found downwind of major waterways where alluvial sand is blown. In Texas these shrublands occur over sandy soils in the Rolling and High Plains and on gypsum dunes in the Trans-Pecos. On the Colorado Plateau, stands occur on a variety of sites including pockets of sand below sandstone cliffs, dunes and sheets of sand or cinder, floodplain terraces and alluvial fans. Timing and amount of growing-season precipitation can greatly affect species abundance from year to year. Drought or overgrazing stands of this alliance will reduce vegetation cover and can allow the wind to cause blowouts or active dunes.

Classification Comments: This alliance contains all the *Artemisia filifolia*-dominated associations and ranges across the entire Great Plains. More information may suggest a north-south separation. Name of the alliance needs to include better diagnostic species, as this alliance has a name very similar to A3181 (G312). For now, a geographic modifier is used to distinguish it.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Shrublands dominated by *Artemisia filifolia* within the Great Plains. Degraded examples may be dominated by *Prunus angustifolia* and some examples in Oklahoma and Texas may be codominated by *Quercus havardii*.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a sparse to moderately dense cover of microphyllous evergreen shrubs less than 1.5 m tall. The sparse to moderately dense graminoid layer is dominated by tall, medium-tall or short bunch grasses. Forb cover is generally sparse. Scattered broad-leaved deciduous tall shrubs may be present.

Floristics: This alliance includes *Artemisia filifolia*-dominated shrublands that occur on sandy sites in the central and southern Great Plains (extending as far north as the Black Hills), the Chihuahuan Desert, and the Colorado Plateau. The vegetation is characterized by a sparse to moderately dense woody layer approximately 1 m tall that is dominated by the microphyllous evergreen shrub *Artemisia filifolia*. These shrubs usually do not grow as clumps but as individuals with the interstices most often dominated by a sparse to moderately dense layer of tall, mid or short grasses (Bruner 1931, Ramaley 1939a, 1939b, Steinauer 1989, Dick-Peddie 1993). Associated shrub and dwarf-shrub composition varies with geography, precipitation, disturbance, and soils. In the Great Plains, some stands have *Prunus angustifolia* or *Quercus havardii* as a codominants in the shrub layer. This species often grows taller than *Artemisia filifolia* and may form thickets (McGregor and Barkley 1986). In northern stands, *Artemisia frigida* is more common, and Chihuahuan Desert stands may include *Dalea lanata, Psorothamnus scoparius, Tiquilia hispidissima*, or *Yucca elata*. On the Colorado Plateau, *Ericameria nauseosa, Ephedra torreyana, Ephedra viridis, Gutierrezia sarothrae*, or *Atriplex canescens* may codominate. *Coleogyne ramosissima* is typically absent. Species of *Opuntia* and *Yucca* are common in many stands throughout its range.

The sparse to moderately dense herbaceous layer is typically dominated by graminoids. The most abundant and widespread species are *Achnatherum hymenoides (= Oryzopsis hymenoides), Andropogon hallii, Bouteloua gracilis, Bouteloua curtipendula, Calamovilfa longifolia, Schizachyrium scoparium*, or *Sporobolus cryptandrus*. *Carex inops ssp. heliophila, Carex duriuscula (= Carex eleocharis)*, and *Hesperostipa comata (= Stipa comata)* are more common in northern stands, and *Bouteloua breviseta, Bouteloua eriopoda, Bouteloua trifida, Sporobolus flexuosus, Sporobolus giganteus*, and *Sporobolus nealleyi* are restricted to southern stands. *Muhlenbergia pungens, Sporobolus cryptandrus, Bouteloua eriopoda*, and *Achnatherum hymenoides* are important graminoids on the Colorado Plateau. Forbs are typically not abundant in these communities. Associated species include *Calylophus serrulatus, Heterotheca villosa var. villosa, Helianthus petiolaris, Ipomoea leptophylla, Lathyrus polymorphus, Lepidium montanum, Lygodesmia juncea, Mentzelia* spp., *Penstemon buckleyi*, and *Psoralidium lanceolatum*. Communities associated with gypsum dunes have many gypsophiles or gypsum endemics.

ENVIRONMENT & DYNAMICS

Environmental Description: Shrublands included in this alliance occur on sandy sites in the central and southern Great Plains into the Chihuahuan Desert and on the Colorado Plateau. Elevations range from 1122 to 1769 m (3680-5803 feet). The climate is semi-arid to arid, and mean annual precipitation ranges from 20-65 cm. Sites include flat to moderately sloping hummocky or rolling terrain to partially stabilized dunes. Stands can occur on any aspect. The soils are sand or loamy sand, primarily of eolian origin, but include sand deposits derived from sandstone residuum and cinder deposits. All substrates are well-drained to excessively well-drained. Water retention and nutrient availability of the soils are low because water infiltrates rapidly and percolates deeply into the coarse-textured substrate and is therefore only available to deep-rooted plants. In southwestern Kansas and southeastern Colorado, this alliance is found downwind of major waterways where alluvial sand is blown (Johnston 1987). In Texas these shrublands occur on sandy soils in the Rolling and High Plains and on gypsum dunes in the Trans-Pecos (Dick-Peddie 1993). On the Colorado Plateau, stands occur on a variety of sites including pockets of sand below sandstone cliffs, partially stabilized dunes and sheets of cinder or sand, floodplain terraces and alluvial fans. Adjacent vegetation varies by geographic location but is generally grasslands dominated by shortgrass and midgrass prairie species such as *Bouteloua gracilis, Pleuraphis jamesii, Calamagrostis canadensis*, and *Hesperostipa comata*. In desert areas it is surrounded by Chihuahuan Desert scrub dominated by *Larrea tridentata*.

Dynamics: These shrublands occur as any one of several stages in a successional sequence. Drought or overgrazing stands of this alliance will reduce vegetation cover and can allow the wind to cause blowouts or active dunes (Ramaley 1939b). Ramaley (1939b) describes the succession in Colorado from loose sand to a sandhills - mixed community dominated by *Muhlenbergia pungens*. It then may proceed to an *Artemisia filifolia* (sand sage) community or skip this stage and succeed to the sand prairie, late seral community dominated by *Hesperostipa comata, Calamovilfa longifolia*, and *Andropogon hallii*. This can happen relatively quickly with adequate precipitation and rest from grazing. Ramaley (1939b) also reported that unless protected from overgrazing and fires, the sand sage community will not succeed into the sand prairie community. However, in regions with marginal precipitation, such as occurs over much of eastern Colorado, the sand sage community may be the last successional stage (Ramaley 1939b).

A 10-year grazing study on sand sage pastures in Colorado by Sims et al. (1976) and Dahl and Norris (1965) found that *Bouteloua gracilis* abundance increased with increased cattle grazing, whereas *Calamovilfa longifolia* and *Hesperostipa comata* decreased. With heavy grazing, *Artemisia filifolia* density increased because of seedling recruitment. This may be due to decreased competition with grasses. In the lightly grazed treatments, *Hesperostipa comata* abundance more than doubled and the *Artemisia filifolia* density decreased slightly. Weaver and Albertson (1956) reported *Artemisia filifolia* and *Sporobolus cryptandrus* both increasing with grazing in sandhills of Oklahoma.

In Colorado, fire frequency and extent are thought to be low in these stands because sand sage areas are usually surrounded by other communities that are too moist or too sparse to carry a fire well (Ramaley 1939b). In the Great Plains, Wright and Bailey (1980) reported that after fire *Artemisia filifolia* will resprout and will also reproduce vigorously as seedlings. The shrubs *Prunus angustifolia* and *Rhus* spp. also vigorously resprouted after fire (Jackson 1965). Generally, however, fire reduces the vegetation cover that protects these shrublands from blowouts.

Timing and amount of growing-season precipitation can greatly affect species abundance from year to year. Normal to wet springs with a dry summer often result in biomass being dominated by cool-season species such as *Hesperostipa comata*. A year with a dry spring and normal to wet summer results in biomass being dominated by warm-season species such as *Andropogon hallii* and *Calamovilfa longifolia*. Similarly, timing of grazing can have the same result. Forb abundance and diversity can be very high during summers with significantly higher than average precipitation. *Panicum virgatum, Sorghastrum nutans*, and *Prunus pumila var. besseyi* are present in low abundance in good condition stands in Colorado but are often eliminated by heavy grazing (Soil Conservation Service 1978).

DISTRIBUTION

Geographic Range: This alliance occurs on sandy sites in the Great Plains and Chihuahuan Desert from the Black Hills in southwestern South Dakota south to Trans-Pecos Texas, southern New Mexico, and Arizona.

Nations: US
States/Provinces: CO, KS, NE, NM, OK, SD, TX, WY?
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Artemisia filifolia* Series #303 (Johnston 1987)
- **?** *Artemisia filifolia* Shrubland Alliance (Hoagland 2000)
- **?** *Artemisia filifolia* shrubland alliance (Hoagland 1998a)

- **=** SRM Cover Type #605 - Sandsage Prairie (Shiflet 1994)
- **?** Sand Sage Community (Ramaley 1939b) [Colorado]
- **?** Sand Sagebrush (Dick-Peddie 1993) [New Mexico]
- **?** Sandsage Prairie (Küchler 1974)

LOWER LEVEL UNITS

Associations:

- CEGL005000 *Artemisia filifolia - Rhus trilobata* Shrubland
- CEGL002176 *Artemisia filifolia / Bouteloua (curtipendula, gracilis)* Shrubland
- CEGL002178 *Artemisia filifolia / Schizachyrium scoparium - Andropogon hallii* Shrubland
- CEGL002177 *Artemisia filifolia / Calamovilfa longifolia* Shrubland
- CEGL001459 *Artemisia filifolia / Andropogon hallii* Shrubland
- CEGL002179 *Artemisia filifolia / Sporobolus cryptandrus* Shrubland
- CEGL002180 *Prunus angustifolia / Schizachyrium scoparium* Ruderal Shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: S. Menard
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Aldous and Shantz 1924, Bruner 1931, Costello and Turner 1944, Dahl and Norris 1965, Daley 1972, Diamond 1993, Dick-Peddie 1993, Evans 1964, Faber-Langendoen et al. 2017b, Garrison et al. 1977, Great Plains Flora Association 1986, Green 1969, Hoagland 1998a, Hoagland 2000, Jackson 1965, Johnston 1987, Küchler 1974, Maxwell and Brown 1968, McGregor and Barkley 1986, McMahan et al. 1984, Muldavin and Mehlhop 1992, Ramaley 1916b, Ramaley 1939a, Ramaley 1939b, Rogers 1950, Rogers 1953, Savage 1937, Shiflet 1994, Sims et al. 1976, Soil Conservation Service 1978, Steinauer 1989, Weaver and Albertson 1956, Wright and Bailey 1980

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G069. Great Plains Sand Shrubland

A1540. Yucca glauca Prairie Scrub Alliance

Type Concept Sentence: This alliance includes stands of herbaceous vegetation with a sparse shrub layer growing on sandstone outcrops and sandy soils in the northwestern Great Plains. Elevations range from 1100-1850 m. Stands of this alliance contain an open to moderately dense (at least 10% cover), low-shrub layer above a species-rich herbaceous layer. Dominance of the shrub layer by *Yucca glauca* is characteristic (cover ranging from 5-15%). *Artemisia tridentata ssp. wyomingensis* and *Artemisia cana ssp. cana* may be present but are sparse and contribute little cover.

OVERVIEW

Scientific Name: *Yucca glauca* Prairie Scrub Alliance
Common Name (Translated Scientific Name): Soapweed Yucca Prairie Scrub Alliance
Colloquial Name: Great Plains Soapweed Yucca Prairie Scrub

Type Concept: This alliance includes stands of herbaceous vegetation with a sparse shrub layer growing on caliche, sandstone outcrops and sandy soils in the northwestern Great Plains. Elevations range from 1100-1850 m. In the western Great Plains, precipitation occurs mostly in the spring. Summers are hot and dry, except for locally occurring, high-intensity convective storms. Stands typically occur along ridgetops and upper slopes, on sandstone or scoria outcrops and probably on stabilized sand dunes as well. Soils in some cases are residual and relatively deep, with genetic horizons. Texture varies from nearly pure sand on the surface to medium-textured and medium-coarse-textured at depth. Stands of this alliance contain an open to moderately dense (at least 10% cover), low-shrub layer above a species-rich herbaceous layer. Dominance of the shrub layer by *Yucca glauca* is characteristic (cover ranging from 5-15%). *Artemisia tridentata ssp. wyomingensis* and *Artemisia cana ssp. cana* may be present but are sparse and contribute little cover. In the herbaceous layer, *Hesperostipa comata (= Stipa comata)* and *Calamovilfa longifolia* are the most abundant and constant species, and *Bouteloua gracilis, Schizachyrium scoparium*, and *Carex filifolia* often are present but contribute much less cover than do *Hesperostipa* or *Calamovilfa*. *Pseudoroegneria spicata* is dominant in some stands. Forbs are common but contribute little cover; *Artemisia frigida* has the highest constancy, but no forbs are characteristic of the alliance. Litter covers can be high, up to 50% of the ground surface, and bare soil covers the rest of the ground surface.

Classification Comments: This alliance was not changed from the original. At least one association within this alliance is poorly described and needs more data to completely articulate the type. As association data are further developed, this alliance may need

to be revised. There are several *Yucca*-dominated areas within the southern Great Plains. These areas are mostly degraded, overgrazed and/or fire suppressed prairies, mostly from *Andropogon hallii* Sand Prairie Alliance (A1193).

Internal Comments:
Other Comments:

Similar NVC Types: This alliance can co-occur with other alliances in the northern Great Plains and many species overlap.
- A1201 *Calamovilfa longifolia* Sand Prairie Alliance
- A3586 *Artemisia cana ssp. cana* Wet Shrubland Alliance

Diagnostic Characteristics: This alliance contains grasslands with a shrub layer of *Yucca glauca* that occur on sandy soils and sandstone outcrops in the northwestern Great Plains.

VEGETATION

Physiognomy and Structure: This alliance is dominated by perennial bunch grasses, with scattered perennial forbs. Succulent shrubs form a sparse layer, ranging in cover from 5-25%.

Floristics: Stands of this alliance contain an open to moderately-dense (at least 10% cover), low-shrub layer above a species-rich herbaceous layer. Dominance of the shrub layer by *Yucca glauca* is characteristic (cover ranging from 5-15%). *Artemisia tridentata ssp. wyomingensis* and *Artemisia cana ssp. cana* may be present but are sparse and contribute little cover. In the herbaceous layer, *Hesperostipa comata (= Stipa comata)* and *Calamovilfa longifolia* are the most abundant and constant species and *Bouteloua gracilis, Schizachyrium scoparium*, and *Carex filifolia* often are present but contribute much less cover than do *Hesperostipa* or *Calamovilfa*. *Pseudoroegneria spicata* is dominant in some stands. Forbs are common but contribute little cover; *Artemisia frigida* has the highest constancy, but no forbs are characteristic of the alliance. Litter covers can be high, up to 50% of the ground surface, and bare soil covers the rest of the ground surface.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance includes stands of herbaceous vegetation with a sparse shrub layer growing on sandstone outcrops and sandy soils in the northwestern Great Plains. Elevations range from 1100-1850 m. The climate is temperate, mostly continental and semi-arid to arid. Mean annual precipitation ranges from 25-35 cm. In the western Great Plains, precipitation occurs mostly in the spring. Summers are hot and dry, except for locally occurring, high-intensity convective storms. Stands typically occur along ridge tops and upper slopes, on sandstone or scoria outcrops and probably on stabilized sand dunes as well (Prodgers 1978, Thilenius et al. 1995). Soils in some cases are residual and relatively deep, with genetic horizons. Texture varies from nearly pure sand on the surface to medium-textured and medium-coarse-textured at depth (Thilenius et al. 1995), such as loamy sand, sandy loam, fine sandy loam, or loam textural classes (Prodgers 1978).

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is found in the northwestern Great Plains in South Dakota, Montana and Wyoming.

Nations: US
States/Provinces: MT, SD, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL001499 *Yucca glauca / Pseudoroegneria spicata* Shrub Grassland
- CEGL002675 *Yucca glauca / Calamovilfa longifolia* Shrub Grassland

AUTHORSHIP

Primary Concept Source: M.S. Reid and G.P. Jones, in Faber-Langendoen et al. (2013)
Author of Description: M.S. Reid, G.P. Jones, and S. Menard
Acknowledgments:

Version Date: 2014/12/18

REFERENCES

References: Barnes et al. 1984, Faber-Langendoen et al. 2017b, Johnston 1987, Prodgers 1978, Ross and Hunter 1976, Thilenius et al. 1995

2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
2.B.2.Nb.4.b. M052 Great Plains Sand Grassland & Shrubland

G068. Great Plains Sand Grassland

Type Concept Sentence: This sand prairie is most common in the north-central Great Plains but occurs in other parts of the western plains, as well. Medium and tall grasses dominate the sandy soils of this group, typically *Andropogon hallii, Calamovilfa longifolia, Hesperostipa comata*, and *Panicum virgatum*.

OVERVIEW

Scientific Name: *Andropogon hallii - Calamovilfa longifolia - Hesperostipa comata* Sand Grassland Group
Common Name (Translated Scientific Name): Sand Bluestem - Prairie Sandreed - Needle-and-Thread Sand Grassland Group
Colloquial Name: Great Plains Sand Bluestem Grassland

Type Concept: The sand prairies constitute a very unique group within the Western Great Plains. These sand prairies are often considered part of the tallgrass or mixedgrass regions in the Western Great Plains but can contain elements from Great Plains Shortgrass Prairie Group (G144), Central Great Plains Mixedgrass Prairie Group (G133), and Northern Great Plains Mesic Mixedgrass Prairie Group (G141). The largest expanse of sand prairies (approximately 5 million ha) can be found in the Sandhills of north-central Nebraska and southwestern South Dakota. These areas are relatively intact. The unifying and controlling feature for this group is that coarse-textured soils predominate and the dominant grasses are well-adapted to this condition. Graminoid species dominate the sand prairies, although relative dominance can change due to impacts of wind disturbance. *Andropogon hallii* and *Calamovilfa longifolia* are the most common species, but other grass and forb species such as *Hesperostipa comata, Carex inops ssp. heliophila*, and *Panicum virgatum* may be present. Apparently only *Calamovilfa longifolia* functions as a dominant throughout the range of the group. In the western extent, *Hesperostipa comata* becomes more dominant, and *Andropogon hallii* is less abundant but still present. Communities of *Artemisia cana ssp. cana* are included here in central and eastern Montana. Patches of *Quercus havardii* can also occur within this group in the southern Great Plains. Soils in the sand prairies can be relatively undeveloped and are highly permeable. Soil texture and drainage along with a species' rooting morphology, photosynthetic physiology, and mechanisms to avoid transpiration loss are highly important in determining the composition of the sand prairies. In the northwestern portion of its range, stand size corresponds to the area of exposed caprock sandstone; small patches predominate, but large patches are also found embedded in the encompassing Northern Great Plains Mesic Mixedgrass Prairie Group (G141). Another important feature is their susceptibility to wind erosion. Blowouts and sand draws are some of the unique wind-driven disturbances in the sand prairies. In most of eastern Montana, substrates supporting this group have weathered in place from sandstone caprock; thus, the solum is relatively thin, and the wind-sculpted features present further east do not develop. In Colorado, examples of this group include active sand dunes in the shortgrass prairie and San Luis Valley with the largest occurrence occurring in Great Sand Dunes National Park and Preserve and surrounding dune field. Fire and grazing constitute the other major dynamic processes that can influence this group.

Classification Comments: Overgrazing can decrease the dominance of some of the grass species, such as *Andropogon hallii, Calamovilfa gigantea*, and *Schizachyrium scoparium*, facilitating an increased abundance of shrubs such as *Artemisia filifolia* and a change in classification to Great Plains Sand Shrubland Group (G069).

Similar NVC Types: This group can contain elements of Great Plains Shortgrass Prairie Group (G144), Central Great Plains Mixedgrass Prairie Group (G133), and Northern Great Plains Mesic Mixedgrass Prairie Group (G141). This group may occur in a mosaic with the Great Plains Sand Shrubland Group (G069).

- G144 Great Plains Shortgrass Prairie
- G133 Central Great Plains Mixedgrass Prairie
- G331 Northern Great Plains Dry Mixedgrass Prairie
- G069 Great Plains Sand Shrubland
- G141 Northern Great Plains Mesic Mixedgrass Prairie
- G491 Chihuahuan Sandy Plains Semi-Desert Grassland

Diagnostic Characteristics: This group is distinguished by sparse to moderately dense graminoids. It occurs in semi-arid to arid areas of the Great Plains on somewhat excessively to excessively well-drained and deep sandy soils. The most characteristic example of this group occurs in the Nebraska Sandhills region.

VEGETATION

Physiognomy and Structure: The vegetation is characterized by a dense to sparse layer of tall grasses interspersed with forbs.

Floristics: This group is distinguished by the dominance of graminoids such as *Andropogon hallii* and *Calamovilfa longifolia*. Other graminoids such as *Hesperostipa comata, Carex inops ssp. heliophila*, and *Panicum virgatum* may be present. Characteristic forbs differ by region, but species of *Psoralidium* and *Pediomelum* are a common feature. *Penstemon haydenii* (Federally listed endangered) is endemic to the sand prairie group and of special conservation concern because of its probable decline due to grazing and fire suppression. Very diffuse patches of *Rhus trilobata* are found on shallow sandy soils, often associated with breaklands; other shrubs occasionally occurring include *Artemisia cana ssp. cana, Betula occidentalis, Juniperus horizontalis*, and *Yucca glauca*. Many of the warm-season graminoids extend at least to the Rocky Mountain Front Range as dominant components on appropriate sites or as a response to disturbance. All the characteristic species mentioned for Nebraska and South Dakota are also found in Montana stands (and possibly Wyoming and perhaps the rest of the states cited). Some of the communities cited as part of the concept in Nebraska and South Dakota are only marginally present in Montana, but others are found throughout Montana's Great Plains region. In the southern range of this group, patches of *Quercus havardii* can also occur.

ENVIRONMENT & DYNAMICS

Environmental Description: The distribution, species richness and productivity of plant species within this group are controlled primarily by environmental conditions, in particular the temporal and spatial distribution of soil moisture and topography. Soil texture and drainage along with a species' rooting morphology, photosynthetic physiology, and mechanisms to avoid transpiration loss are highly important in determining the composition and distribution of communities/associations. This group is found primarily on sandy and sandy loam soils that can be relatively undeveloped and highly permeable. Another important aspect of soils in the sand prairies is their susceptibility to wind erosion. Blowouts and sand draws are some of the unique wind-driven disturbances which can profoundly impact vegetation composition and succession. This group is usually found in areas with a rolling topography and can occur on ridges, midslopes and/or lowland areas within a region. It often occurs on moving sand dunes, especially within the Sandhills region of Nebraska and South Dakota. In Montana, occurrences are intimately associated with Northern Great Plains Mixedgrass Prairie Group (G141), usually occupying higher positions in local landscapes due to the fact that sandy members of some formations (that are predominantly marine shales) constitute the highest (and most weathering-resistant) points in the landscape.

Dynamics: The distribution, species richness and productivity of plant species within this group are controlled primarily by environmental conditions, in particular the temporal and spatial distribution of soil moisture and topography. Another important aspect of this group is its susceptibility to wind erosion. Blowouts and sand draws are some of the unique wind-driven disturbances in the sand prairies, particularly the Nebraska Sandhills, which can profoundly impact vegetation composition and succession within this group. Fire and grazing constitute the other major disturbances that can influence this group. Overgrazing, fire and trampling that leads to the removal of vegetation within those areas susceptible to blowouts can either instigate a blowout or perpetuate one already occurring. Overgrazing can also lead to significant erosion.

DISTRIBUTION

Geographic Range: This group is found throughout the Western Great Plains Division ranging from North Dakota south to Texas. The largest and most intact example of this group is found within the Sandhills region of Nebraska and South Dakota. However, it is also common (though occurring in predominantly small patches) farther west into central and eastern Montana. Its western extent in Wyoming is still to be determined, but it does occur in the Wyoming Highlands (mapzone 29) on weathered-in-place sandy soils, where *Calamovilfa longifolia* is found, along with *Artemisia cana*.

Spatial Scale & Pattern [optional]: Large patch
Nations: CA, US
States/Provinces: CO, KS, MT, ND, NE, NM?, OK, SD, TX, WY
TNC Ecoregions [optional]: 26:C, 27:C, 28:C, 33:C, 34:C
USFS Ecoregions (2007): 251F:CC, 251H:CC, 255A:PP, 315A:CC, 315B:CC, 315F:CC, 321A:??, 331B:CC, 331C:CC, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 331H:CC, 331K:CC, 331L:CC, 331M:CP, 331N:C?, 332C:CC, 332D:CC, 332E:CC, 332F:CC
Omernik Ecoregions: 8.4.7.37:C, 8.4.7.37e:C, 9.2.4.40:C, 9.2.4.40b:C, 9.2.4.40d:C, 9.4.2.27:C, 9.4.2.27d:C, 9.4.2.27g:C, 9.4.2.27h:C, 9.4.2.27i:C, 9.4.2.27k:C, 9.4.2.27l:C, 9.4.2.27n:C, 9.4.2.27o:C, 9.4.2.27r:C, 9.4.5.29:C, 9.4.5.29b:C, 9.4.5.29d:C, 9.4.5.29g:C
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- >< Blue Grama - Sideoats Grama - Black Grama (707) (Shiflet 1994)
- < Bluestem - Dropseed (708) (Shiflet 1994)
- > Bluestem - Prairie Sandreed (602) (Shiflet 1994)
- > Grama - Bluestem (714) (Shiflet 1994) [Soil texture ranges from sand to clay loam? Inclusions?]
- > Mohrs (Shin) Oak: 67 (Eyre 1980)
- > Prairie Sandreed - Needlegrass (603) (Shiflet 1994) [This SRM type is found in the more northerly and northwest portions of this group (as far west as central Montana).]
- > Sand Bluestem - Little Bluestem Dunes (720) (Shiflet 1994)
- > Sand Bluestem - Little Bluestem Plains (721) (Shiflet 1994)
- >< Wheatgrass - Grama - Needlegrass (608) (Shiflet 1994) [Sandy portions of this SRM type are included in this group.]

LOWER LEVEL UNITS

Alliances:

- A1201 *Calamovilfa longifolia* Sand Prairie Alliance
- A1193 *Andropogon hallii* Sand Prairie Alliance

AUTHORSHIP

Primary Concept Source: S. Menard and K. Kindscher, in Faber-Langendoen et al. (2011)
Author of Description: S. Menard and K. Kindscher
Acknowledgments:
Version Date: 12/17/2010
Classif Resp Region: Midwest
Internal Author: SEM 12-10, mod. JD 5-15

REFERENCES

References: Barbour and Billings 1988, Comer et al. 2003, Eyre 1980, Faber-Langendoen et al. 2017a, Shiflet 1994, Tolstead 1942

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G068. Great Plains Sand Grassland

A1193. Andropogon hallii Sand Prairie Alliance

Type Concept Sentence: This alliance includes herbaceous vegetation with *Andropogon hallii*, occurring in the Great Plains from the United States-Canada border south to Texas. It is dominated by tall and midgrass species, with shortgrass species becoming important in the western portion of its range. *Andropogon hallii* is usually dominant or codominant.

OVERVIEW

Scientific Name: *Andropogon hallii* Sand Prairie Alliance
Common Name (Translated Scientific Name): Sand Bluestem Sand Prairie Alliance
Colloquial Name: Great Plains Sand Bluestem Grassland

Type Concept: This alliance includes herbaceous vegetation with *Andropogon hallii*, occurring in the Great Plains from the United States-Canada border south to Texas. It is dominated by tall and midgrass species, with shortgrass species becoming important in the western portion of its range. *Andropogon hallii* is usually dominant or codominant. *Calamovilfa longifolia* is present to codominant in most stands south of the South Dakota-Nebraska border. *Bouteloua gracilis, Bouteloua hirsuta, Eragrostis trichodes, Hesperostipa comata (= Stipa comata), Koeleria macrantha, Pascopyrum smithii, Schizachyrium scoparium*, and *Sporobolus cryptandrus* are typical grasses in stands of this alliance. Upland sedges are also very common, especially *Carex filifolia, Carex inops ssp. heliophila*, and *Carex duriuscula (= Carex eleocharis)*. Although graminoids are overwhelmingly dominant, several species of forbs can be found in many stands of this alliance. Some of the more common forbs are *Ambrosia psilostachya, Ipomoea leptophylla, Liatris punctata, Psoralidium* spp., and *Tradescantia occidentalis*. There may be widely scattered low shrubs, including *Rosa woodsii, Prunus pumila var. besseyi*, and *Yucca glauca*. In west Texas common associates on deep sands include *Panicum havardii, Sporobolus giganteus*, and *Calamovilfa gigantea*. Stands of this alliance occur on sand deposits, usually on gentle to steep slopes but sometimes on flat ground. The soils are sand, loamy sand, or sandy loam. They can be poorly to moderately well-developed. There is little runoff or evaporation because moisture quickly sinks into the coarse soil. Soil near the surface is consequently dry throughout much of the year, but moisture is present further down, favoring deep-rooting species such as *Andropogon hallii* and *Calamovilfa longifolia*. Wind sometimes scours sand and vegetation from small areas, creating blowouts. These bare spots are initially colonized by species that are uncommon in this alliance, such as *Muhlenbergia pungens* and *Redfieldia flexuosa*. Eventually, these blowouts succeed to one of the communities in this alliance. These grasslands occur on semi-stabilized quartz sand dunes in eastern Trans-Pecos Texas, where they form landscape mosaics with *Quercus havardii* shrublands, wetland dune swales, and sparsely vegetated dunes. In the southern plains, this alliance is a small-patch occurrence nested within the more common *Artemisia filifolia* shrublands. The rare plant

Penstemon haydenii, an endemic to dune blowouts in the sandhills of Nebraska, may be endangered by the decline in habitat because of fire suppression and low to moderate stocking rates.

Classification Comments: There is some overlap with *Calamovilfa longifolia* Sand Prairie Alliance (A1201) in those stands that contain both *Andropogon hallii* and *Calamovilfa longifolia*. Stands dominated by *Calamovilfa longifolia* and with *Andropogon hallii* present to moderately abundant present difficult classification questions. Sparsely vegetated, early-successional dune associations are also included in this alliance. They may need their own alliance but currently not enough data exist to justify a separate alliance.

Internal Comments:
Other Comments:

Similar NVC Types:
- A1201 *Calamovilfa longifolia* Sand Prairie Alliance: overlaps in those stands that contain both *Andropogon hallii* and *Calamovilfa longifolia*.

Diagnostic Characteristics: Stands are dominated by *Andropogon hallii* and are typically dry to dry-mesic.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a moderate to dense herbaceous layer (0.5-1.5 m tall) that is dominated by tall grasses and mid grasses, with short grasses common in the western portion of its range. There is usually a sparse forb layer. Widely scattered low shrubs may also be present.

Floristics: This alliance is found on sandy sites in the Great Plains from the U.S.-Canadian border south to Texas. It is dominated by tall- and midgrass species, with shortgrass species becoming important in the western portion of its range. The dominant species range from 0.5-1.5 m in height. *Andropogon hallii* is usually dominant or codominant. *Calamovilfa longifolia* is present to codominant in most stands north of the South Dakota-Nebraska border. *Bouteloua gracilis, Bouteloua hirsuta, Eragrostis trichodes, Hesperostipa comata (= Stipa comata), Koeleria macrantha, Pascopyrum smithii, Schizachyrium scoparium*, and *Sporobolus cryptandrus* are typical grasses in stands of this alliance. Upland sedges are also very common, especially *Carex filifolia, Carex inops ssp. heliophila*, and *Carex duriuscula (= Carex eleocharis)*. Although graminoids are overwhelmingly dominant, several species of forbs can be found in many stands of this alliance. Some of the more common forbs are *Ambrosia psilostachya, Ipomoea leptophylla, Liatris punctata, Psoralidium* spp., and *Tradescantia occidentalis*. There are widely scattered low shrubs, including *Rosa* spp., *Prunus pumila var. besseyi*, and *Yucca glauca*. In west Texas, common associates on deep sands include *Panicum havardii, Sporobolus giganteus*, and *Calamovilfa longifolia*.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands of this alliance occur on sand deposits in the Great Plains. The climate is semi-arid and continental, with annual precipitation ranging from 46-61 cm. Elevations are generally between 1000 and 1600 m. Sites where this alliance is found are usually on gentle to steep slopes but sometimes on flat ground (Tolstead 1942, Steinauer 1989). The soils are sand, loamy sand, or sandy loam, and they can be poorly to moderately well-developed (Johnston 1987, Steinauer 1989). There is little runoff or evaporation because moisture quickly sinks into the coarse soil. Soil near the surface is consequently dry throughout much of the year, but moisture is present deeper in the soil profile. This favors deep-rooting species such as *Andropogon hallii* and *Calamovilfa longifolia* (Barnes and Harrison 1982). In the northern and western extent, adjacent grasslands dominated by *Pascopyrum smithii* or *Bouteloua* spp. occur on fine-textured soils. In western Texas, these grasslands form mosaics with *Quercus havardii* shrublands.

Dynamics: Wind is a dominant factor that shapes the landscape where this alliance occurs. Wind sometimes scours sand and vegetation from small areas and creates blowouts. These bare spots are initially colonized by species that are relatively uncommon in this alliance, such as *Redfieldia flexuosa, Muhlenbergia pungens, Yucca glauca*, and *Achnatherum hymenoides*. Eventually, these blowouts succeed to other communities (Savage 1937, Ramaley 1939a, Tolstead 1942, Harrison 1980). Tolstead (1942) cites Nebraska pioneer accounts that dunes were less vegetated than at present, and blowouts and stands were more common before cattle ranching. Fire frequency and extent are also thought to have declined since settlement because of fuel removal by livestock grazing and fire control (Burzlaff 1965, Wolfe 1973). Consequently, active dunes and large blowouts are less common now, as are the pioneer plant species *Redfieldia flexuosa, Andropogon hallii* and *Yucca glauca* (Harrison 1980).

These grasslands provide excellent summer forage and need careful management to prevent grazing out desirable species. Tolstead (1942) found that *Andropogon hallii* and *Eragrostis trichodes* are less common on pastures that receive year-round grazing. Generally, overgrazing this alliance decreases the cover of species of *Andropogon, Calamovilfa, Eragrostis*, and *Hesperostipa*, and increases the cover of *Bouteloua gracilis, Bouteloua hirsuta, Muhlenbergia pungens, Achnatherum hymenoides*, and *Sporobolus cryptandrus* (Savage 1937, Ramaley 1939a, Tolstead 1942, Harrison 1980). Overgrazing also kills out desirable shrubs, especially *Amorpha canescens* and *Prunus pumila var. besseyi* (Ryan et al. 1994). This grassland responds rapidly to management. Deferment of

grazing in the late spring and summer favors warm-season grasses such as *Andropogon hallii, Bouteloua hirsuta, Bouteloua gracilis, Calamovilfa longifolia, Eragrostis trichodes, Koeleria macrantha*, and *Schizachyrium scoparium*.

Drought also causes declines in cover of all species, especially tall grasses, and can make the grassland more vulnerable to blowouts. Savage (1937) found large declines in tallgrass cover on sandy sites during drought in 1935. He ranked the cause of damage by decreasing effect: heat, drought, and, to a much lesser extent, grazing and then soil blowing. Ramaley (1939a) reports that in Colorado there is marginally enough precipitation to maintain this alliance. Drought causes retrogression to mixed sandhill, sand sage, or blow-out communities, which increases *Muhlenbergia pungens, Artemisia filifolia*, and *Achnatherum hymenoides*. Grazing during droughts increases the intensity of the damage (Ramaley 1939a).

DISTRIBUTION

Geographic Range: Grasslands in this alliance occur on sandy sites in the Great Plains in Texas, Oklahoma, Kansas, Colorado, Nebraska and Montana, and extends into Arizona, as well as southern Saskatchewan and southern Manitoba. It may also occur in South Dakota, North Dakota.

Nations: CA, US
States/Provinces: CO, KS, MB, MT, ND, NE, OK, SD, SK, TX
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Andropogon hallii* Series (Johnston 1987) [Colorado]
- **?** *Andropogon hallii* herbaceous alliance (Hoagland 1998a) [Oklahoma]
- **?** Bunchgrass Community (Weaver and Albertson 1956) [Nebraska]
- **?** Postclimax Grasses on Dunes (Tolstead 1941) [South Dakota]
- **?** Sand Prairie Community (Ramaley 1939a) [Colorado]
- **?** Sand-hills Mixed Type (Weaver and Albertson 1956) [Colorado]
- **?** Tall Grasses of the Dunes (Tolstead 1942) [Nebraska]
- **?** USDA-NRCS Deep Sand Range Sites #15,16,19 (Soil Conservation Service n.d.)

LOWER LEVEL UNITS

Associations:

- CEGL001467 *Andropogon hallii - Calamovilfa longifolia* Grassland
- CEGL001466 *Andropogon hallii - Carex inops ssp. heliophila* Grassland
- CEGL004016 *Andropogon hallii - Calamovilfa gigantea* Grassland
- CEGL002578 Forb Dune Sparse Vegetation
- CEGL002577 Shortgrass Dune Sparse Vegetation
- CEGL004591 *Andropogon hallii - Panicum havardii - Sporobolus giganteus* Grassland

AUTHORSHIP

Primary Concept Source: R.J. Pool (1913)
Author of Description: S. Menard
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Barnes and Harrison 1982, Bruner 1931, Burgess 1965, Burzlaff 1962, Comer et al. 1999, Culwell and Scow 1982, Drake and Faber-Langendoen 1997, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Harrison 1980, Hirsch 1985, Hoagland 1998a, Johnston 1987, Keeler et al. 1980, Küchler 1974, Looman 1980, Pool 1913, Ramaley 1939a, Ross et al. 1973, Ryan et al. 1994, Savage 1937, Savage and Runyon 1937, Soil Conservation Service 1978, Soil Conservation Service n.d., Steinauer 1989, TPWD 1996, Tolstead 1941, Tolstead 1942, Weaver and Albertson 1956, Wolfe 1973

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G068. Great Plains Sand Grassland

A1201. Calamovilfa longifolia Sand Prairie Alliance

Type Concept Sentence: This alliance, found in the northwestern Great Plains, occurs on sandy dry-mesic sites. Stands are almost exclusively found on sand deposits; a few are on coarse loams. There are two prominent vegetation layers in stands of this alliance and a moderate amount of bare ground. The tallest layer, about 0.6-1.5 m tall, is dominated by midgrasses, particularly *Calamovilfa longifolia*.

OVERVIEW

Scientific Name: *Calamovilfa longifolia* Sand Prairie Alliance
Common Name (Translated Scientific Name): Prairie Sandreed Sand Prairie Alliance
Colloquial Name: Great Plains Prairie Sandreed Prairie

Type Concept: This alliance, found in the northwestern Great Plains, occurs on sandy dry-mesic sites. There are two prominent vegetation layers in stands of this alliance and a moderate amount of bare ground. The tallest layer, about 0.6-1.5 m tall, is dominated by mid grasses, particularly *Calamovilfa longifolia*. Other species present include *Andropogon hallii, Hesperostipa comata (= Stipa comata), Schizachyrium scoparium, Koeleria macrantha*, and *Sporobolus cryptandrus*. The shorter layer includes several short graminoid species, forbs, and some small shrubs. Graminoids make up the majority of this layer, especially upland Carices. Among the most frequent are *Carex duriuscula (= Carex eleocharis, = Carex stenophylla), Carex inops ssp. heliophila*, and *Carex filifolia*. *Bouteloua gracilis* is prominent in some stands, especially in the western portion of this alliance's range. Forbs and shrubs do not usually contribute greatly to the vegetation cover, although forb species diversity can be moderately high. The forbs that are present typically include *Chenopodium leptophyllum, Lathyrus* spp., *Lygodesmia juncea, Phlox hoodii*, and *Liatris punctata*. *Psoralidium lanceolatum* and *Rumex venosus* are most common on the least stabilized locations. Shrubs are uncommon, but when they are present, short shrubs such as *Yucca glauca, Rosa* spp., and *Artemisia frigida* are the most likely to be found. *Artemisia cana* and *Elaeagnus commutata* may be associated with more northern stands. Stands of this alliance are almost exclusively found on sand deposits; a few are on coarse loams. Stands are usually on gentle slopes but can be on flat ground or steep slopes. The soil is sand, loamy sand, or sandy loam, and there is little horizon development. Water penetrates the coarse soil quickly. This results in the upper soil having little available moisture for most of the growing season. Water and wind erosion can be frequent disturbances in this alliance.

Classification Comments: There is some overlap with *Andropogon hallii* Sand Prairie Alliance (A1193) in those stands that contain both *Andropogon hallii* and *Calamovilfa longifolia*.

Internal Comments:
Other Comments:

Similar NVC Types: Communities in this alliance can be very similar to those in *Andropogon hallii* Sand Prairie Alliance (A1193). The latter generally has a more southern distribution but does extend into Montana and the Dakotas. Where these two alliances have overlapping ranges, stands in A1193 may tend to occur on sites with more moisture stress. Diagnostic species or environmental characteristics need to be developed to properly classify borderline stands.

- A1540 *Yucca glauca* Prairie Scrub Alliance
- A1193 *Andropogon hallii* Sand Prairie Alliance: overlaps in those stands that contain both *Andropogon hallii* and *Calamovilfa longifolia*.

Diagnostic Characteristics: These stands are on sandy soils throughout the Great Plains and are dominated by *Calamovilfa longifolia*.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a moderate to dense herbaceous layer (0.5-1.5 m tall) that is dominated by tall grasses and mid grasses, with short grasses common in the western portion of its range. There is usually a sparse forb layer. Widely scattered low shrubs may also be present.

Floristics: Stands have a medium to tall herbaceous layer dominated by widely spaced bunchgrasses 0.6-1.5 m tall. This layer is dominated by *Calamovilfa longifolia*. Other species present include *Achnatherum hymenoides (= Oryzopsis hymenoides), Andropogon hallii, Hesperostipa comata (= Stipa comata), Koeleria macrantha, Pascopyrum smithii* (clayey sites), *Schizachyrium scoparium*, and *Sporobolus cryptandrus*. Many of these stands also have a second herbaceous layer dominated by short graminoid species, forbs, and some small shrubs. Graminoids make up the majority of this layer, especially upland *Carex* spp. Among the most frequent are *Carex duriuscula (= Carex eleocharis*, *= Carex stenophylla), Carex inops ssp. heliophila*, and *Carex filifolia*. *Bouteloua gracilis* is prominent in some stands, especially in the western portion of this alliance's range. Forbs and shrubs do not usually contribute greatly to the vegetation cover, although forb species diversity can be moderately high (Hanson and Whitman 1938, USFS 1992). The forbs that are present typically include *Artemisia* spp., *Chenopodium leptophyllum, Lathyrus* spp., *Liatris punctata, Lygodesmia juncea*, and *Phlox hoodii*. *Psoralidium lanceolatum* and *Rumex venosus* are most common on the least stabilized

locations. Shrubs are uncommon, but when they are present, short shrubs such as *Artemisia filifolia, Artemisia frigida, Rhus trilobata, Rosa* spp., and *Yucca glauca* are the most likely to occur.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands of this alliance occur on sandy sites in the central and northern Great Plains. The climate is temperate, continental with annual precipitation ranging from 46-61 cm. Elevations are generally between 1000 and 1600 m. Stands are found on stabilized sand dunes, interdune valleys, colluvial sand on toeslopes and badland benches (DeVelice et al. 1995). Sites where this alliance is found are usually on gentle to steep slopes on any aspect, but sometimes occur on flat ground (Tolstead 1942, Steinauer 1989). The soils are sand, loamy sand, or sandy loam, and they can be poorly to moderately well-developed (Looman 1980, Johnston 1987, Steinauer 1989). Parent materials include eolian sand and coarse-textured colluvium from sandstone, shales and other sedimentary rocks. There is little runoff or evaporation because moisture quickly sinks into the coarse soil. Soil near the surface is consequently dry throughout much of the year, but moisture is present deeper in the soil profile. This favors deep-rooting species such as *Andropogon hallii* and *Calamovilfa longifolia* (Barnes and Harrison 1982). Water and wind erosion can be frequent disturbances in this alliance. In the north and western extent, adjacent grasslands dominated by *Pascopyrum smithii* or *Bouteloua* spp. occur on fine-textured soils.

Dynamics: Wind is a dominant factor that shapes the landscape where this alliance occurs. Wind sometimes scours sand and vegetation from small areas and creates blowouts. These bare spots are initially colonized by species that are relatively uncommon in this alliance, such as *Redfieldia flexuosa, Muhlenbergia pungens, Yucca glauca*, and *Achnatherum hymenoides*. Eventually, these blowouts succeed to other communities (Savage 1937, Ramaley 1939b, Tolstead 1942, Harrison 1980). Tolstead (1942) cites Nebraska pioneer accounts that dunes were less vegetated than at present, and blowouts and stands were more common before cattle ranching. Fire frequency and extent are also thought to have declined since settlement because of fuel removal by livestock grazing and fire control (Burzlaff 1962, Wolfe 1973). Consequently, active dunes and large blowouts are less common now, as are the pioneer plant species *Redfieldia flexuosa, Andropogon hallii*, and *Yucca glauca* (Harrison 1980).

These grasslands provide excellent summer forage and need careful management to prevent grazing out desirable species. Generally, overgrazing this alliance decreases the cover of species of *Andropogon, Calamovilfa, Eragrostis*, and *Hesperostipa*, and increases the cover of *Bouteloua gracilis, Bouteloua hirsuta, Muhlenbergia pungens, Achnatherum hymenoides*, and *Sporobolus cryptandrus* (Savage 1937, Tolstead 1942, Harrison 1980). Overgrazing also kills out desirable shrubs, especially *Amorpha canescens* and *Prunus pumila var. besseyi* (Ryan et al. 1994). This grassland responds rapidly to management. Deferment of grazing in the late spring and summer favors warm-season grasses such as *Andropogon hallii, Bouteloua hirsuta, Bouteloua gracilis, Calamovilfa longifolia, Eragrostis trichodes, Koeleria macrantha*, and *Schizachyrium scoparium*.

Drought also causes declines in cover of all species, especially tall grasses, and can make the grassland more vulnerable to blowouts. Savage (1937) found large declines in tallgrass cover on sandy sites during drought in 1935. He ranked the cause of damage by decreasing effect: heat, drought, and, to a much lesser extent, grazing and then soil blowing. Ramaley (1939a, b) reports that in Colorado there is marginally enough precipitation to maintain this alliance. Drought causes retrogression to mixed sandhill, sand sage, or blowout communities, which increases *Muhlenbergia pungens, Artemisia filifolia*, and *Achnatherum hymenoides*. Grazing during droughts increases the intensity of the damage (Ramaley 1939a, b). Many of these stands, especially those disturbed by wind and grazing, are vulnerable to invasion by exotic annual species of *Bromus* such as *Bromus arvensis, Bromus squarrosus*, or *Bromus tectorum* (Comer et al. 1999).

DISTRIBUTION

Geographic Range: Grasslands in this alliance occur on sandy sites in the central and northern Great Plains from Wyoming and Nebraska north to Alberta, Saskatchewan and Manitoba, Canada. Stands may potentially occur into Colorado or Kansas.

Nations: CA, US
States/Provinces: AB, CO?, MT, ND, NE, SD, SK, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Calamovilfa longifolia* Series (Johnston 1987) [Colorado]
- **?** Bunchgrass Community (Weaver and Albertson 1956) [Nebraska]
- **?** Postclimax Grasses on Dunes (Tolstead 1941) [South Dakota]
- **?** Sand Prairie Community (Ramaley 1939a) [Colorado]
- **?** Sand-hills Mixed Type (Weaver and Albertson 1956) [Colorado]

- **?** Tall Grasses of the Dunes (Tolstead 1942) [Nebraska]
- **?** USDA-NRCS Deep Sand Range Sites #15,16,19 (Soil Conservation Service 1978)

LOWER LEVEL UNITS

Associations:
- CEGL001473 *Calamovilfa longifolia - Hesperostipa comata* Grassland
- CEGL002219 *Calamovilfa longifolia - Achnatherum hymenoides* Grassland
- CEGL001471 *Calamovilfa longifolia - Carex inops ssp. heliophila* Grassland
- CEGL001457 *Rhus trilobata / Calamovilfa longifolia* Shrub Grassland
- CEGL002184 *Betula occidentalis - Juniperus horizontalis / Calamovilfa longifolia* Shrubland

AUTHORSHIP

Primary Concept Source: W.L. Tolstead (1942); J.E. Weaver and F.W. Albertson (1956)
Author of Description: S. Menard, K.A. Schulz, L. Allen
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Adams et al. 1997, BLM 1979b, Barnes and Harrison 1982, Burgess 1965, Burzlaff 1962, CDM Consultants n.d., Comer et al. 1999, DeVelice et al. 1995, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Hansen 1985, Hansen and Hoffman 1988, Hanson and Whitman 1938, Harrison 1980, Heerwagen 1958, Hirsch 1985, Johnston 1987, Looman 1980, MTNHP unpubl. data, Mine Reclamation Consultants 1977, Ramaley 1937, Ramaley 1939a, Ramaley 1939b, Ross et al. 1973, Ruangpanit 1977, Ryan et al. 1994, Savage 1937, Soil Conservation Service 1978, Steinauer 1989, Taylor and Holst 1976, Tolstead 1941, Tolstead 1942, USFS 1992, Weaver and Albertson 1956, Wolfe 1973

M498. Great Plains Ruderal Grassland & Shrubland

Type Concept Sentence: This macrogroup is found on dry to mesic sites in the central and western Great Plains dominated by exotic herbaceous species or deciduous shrubs.

2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
M498. Great Plains Ruderal Grassland & Shrubland

G679. Northern & Central Great Plains Ruderal Grassland & Shrubland

Type Concept Sentence: This group is found in the Great Plains from Nebraska and Colorado north where exotic grasses and forbs constitute >75% of the herbaceous cover and trees and shrubs each have less than 25% cover.

OVERVIEW

Scientific Name: *Poa pratensis - Phleum pratense - Cirsium arvense* Northern & Central Plains Ruderal Grassland & Shrubland Group
Common Name (Translated Scientific Name): Kentucky Bluegrass - Timothy - Canada Thistle Northern & Central Plains Ruderal Grassland & Shrubland Group

Type Concept: This group occurs in the northern two-thirds of the Great Plains. Sites are strongly dominated by exotic grasses and forbs, mostly perennial species but sometimes annuals. Examples range from having a mix of species to sites strongly dominated by one or two species. Abundant species vary across the group, depending on land-use history, including what may have been planted on the site, nearby seed sources, whether a site is mesic or dry, and other factors. Common abundant or dominant species include the grasses *Agropyron cristatum, Agrostis gigantea, Agrostis stolonifera, Bromus inermis, Lolium perenne, Phleum pratense, Poa annua, Poa pratensis*, and *Thinopyrum intermedium* and the forbs *Ambrosia* spp., *Cirsium arvense, Cirsium vulgare, Euphorbia esula*, and *Melilotus officinalis*.

Classification Comments: This group occurs when the floristics of a site are so changed that the natural vegetation type is no longer recognizable. This requires a very high cover by exotic and native weedy species. The cut-off is currently in the range of 75-90% cover.

Internal Comments: JD 5-15: KS?, MB, NE added.
Other Comments:

Similar NVC Types:
- G680 Great Plains Comanchian Ruderal Grassland & Shrubland

Diagnostic Characteristics: This group is found in the northern half of the Great Plains and is strongly dominated (>75%) by exotic and weedy native herbaceous species.

VEGETATION

Physiognomy and Structure: Grasses and forbs dominate this group with shrubs and trees sometimes present but with less than 25% cover. The herbaceous stratum is generally 0.5-1 m tall with some stands dominated by species approximately 2 m tall. Perennial species are typically most abundant but sites in the western part of the group's range or those that were recently disturbed may have significant amounts of annuals.

Floristics: Examples range from having a mix of species to sites strongly dominated by one or two species. Abundant species vary across the group, depending on land-use history, including what may have been planted on the site, nearby seed sources, whether a site is mesic or dry, and other factors. Common abundant or dominant species include the grasses *Agropyron cristatum, Agrostis gigantea, Agrostis stolonifera, Bromus inermis, Lolium perenne, Phleum pratense, Poa annua, Poa pratensis*, and *Thinopyrum intermedium* and the forbs *Ambrosia* spp., *Cirsium arvense, Cirsium vulgare, Euphorbia esula*, and *Melilotus officinalis*. Other common species include the annual grasses *Bromus arvensis, Bromus catharticus, Bromus hordeaceus, Bromus racemosus, Bromus secalinus, Bromus tectorum, Digitaria* spp., *Setaria faberi, Setaria italica, Setaria pumila, Setaria verticillata*, and *Setaria viridis* and the forbs *Bassia scoparia, Carduus* spp., *Centaurea* spp., *Chenopodium album, Datura stramonium, Lotus corniculatus, Rumex acetosella, Rumex crispus, Salsola* spp., *Sonchus* spp., *Trifolium arvense, Trifolium aureum, Trifolium campestre, Trifolium dubium, Trifolium hybridum, Trifolium repens*, and *Trifolium pratense*.

ENVIRONMENT & DYNAMICS

Environmental Description: This group can be found on a variety of environmental settings. It can occur on wet-mesic to dry-mesic sites ranging from swales and floodplains to drier ridges and slopes.

Dynamics: Examples of this group are, by definition, a result of a change in ecological processes or a direct introduction of exotic species. This is usually the result of some combination of a reduction in fire frequency, increased grazing pressure, intentional planting of exotic species or the unintentional spread of exotic species from nearby sources. Many of the exotic species are persistent once they are established on a site so reversion to a native vegetation type is not certain even if the disturbance that allowed the formation of this group is removed.

DISTRIBUTION

Geographic Range: This group is found across the northern two-thirds of the Great Plains from Colorado and Nebraska north with possible outlier occurrences in Utah. It is likely in Kansas, as well.

Nations: CA, US
States/Provinces: AB, CO, KS?, MB, MT, ND, NE, SD, SK, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Alliances:

AUTHORSHIP

Primary Concept Source:
Author of Description: J. Drake
Acknowledgments:
Version Date: 2015/05/07

REFERENCES

References: Faber-Langendoen et al. 2017a

2.C. Shrub & Herb Wetland

Shrub & Herb Wetland includes open bogs, fens, fresh and saltwater marshes, wet meadows and wet shrublands. The vegetation occurs from tropical to polar regions.

2.C.2. Temperate to Polar Bog & Fen

Temperate to Polar Bog & Fen includes temperate bogs and fens dominated by *Sphagnum* or brown mosses with ericaceous shrubs, graminoids, and low scrub tree growth forms, across the mid-latitudes of the Northern Hemisphere from 23° to 70°N, but is much less common in the southern mid-latitudes.

2.C.2.Na. North American Bog & Fen

This division includes open and treed bogs and fens throughout much of North America from the boreal zone in Canada south to northern California, montane areas in the western United States, the northern Great Plains, and much of the midwestern and northeastern United States and southeastern Canada.

M877. North American Boreal & Subboreal Alkaline Fen

This alkaline fen macrogroup occurs on peatlands across the boreal regions of North America, extending south into subboreal regions of the Rocky Mountains, Great Lakes, and northeastern and north-central U.S. *Sphagnum* peatmoss and ericaceous shrubs are patchy to absent and brown mosses, broad-leaved non-ericaceous shrubs, and thin-leaved graminoids are common.

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2. Shrub & Herb Vegetation
2.C.2.Na. North American Bog & Fen
2.C.2.Na.2.c. M877 North American Boreal & Subboreal Alkaline Fen

G516. Rocky Mountain Alkaline Fen

Type Concept Sentence: This group occurs throughout the Rocky Mountains from Colorado north into Canada, where it is confined to fens with groundwater discharge, soil chemistry (neutral to alkaline), and peat accumulation of at least 40 cm. Vegetation is dominated by graminoids and low shrubs and includes *Carex buxbaumii, Carex cusickii, Carex limosa, Carex saxatilis, Carex utriculata, Kobresia myosuroides*, and *Kobresia simpliciuscula*. Shrubs include *Betula glandulosa* and several *Salix* spp.

OVERVIEW

Scientific Name: *Kobresia myosuroides - Carex buxbaumii* Alkaline Fen Group
Common Name (Translated Scientific Name): Bellardi Bog Sedge - Buxbaum's Sedge Alkaline Fen Group
Colloquial Name: Dwarf Birch Alkaline Shrub Fen

Type Concept: This group occurs infrequently throughout the Rocky Mountains from Colorado north into Canada. It is confined to specific environments defined by groundwater discharge, soil chemistry (neutral to alkaline), and peat accumulation of at least 40 cm. Vegetation is dominated by graminoids and low shrubs and includes *Carex buxbaumii, Carex cusickii, Carex limosa, Carex saxatilis, Carex utriculata, Kobresia myosuroides*, and *Kobresia simpliciuscula*. Shrubs include *Betula glandulosa* and several *Salix* spp. Fens form at low points in the landscape or on slopes where groundwater intercepts the soil surface. Groundwater inflows maintain a fairly constant water level year-round, with water at or near the surface most of the time. Constant high water levels and cold winter temperatures lead to accumulation of organic material. In addition to peat accumulation and perennially saturated soils, soil chemistry is alkaline to neutral with nutrients high in base cations. Nitrogen (N) and potassium (K) are usually still limiting plant growth in rich fens. Rich fens are strongly influenced by geology and occur where limestone, dolostone, marble or where glacially-derived materials are calcareous. The surrounding landscape may be ringed with other wetland systems, e.g., riparian shrublands, or a variety of upland systems from grasslands to forests.

Classification Comments: This group contains alkaline and neutral fens. Acidic and poor fens are classified in Rocky Mountain Acidic Fen Group (G515). Some associations occur across the pH gradient, making placement into either an acidic group or neutral-alkaline group problematic. It may prove more useful to have all fens in one group and use the alliance level to tease out poor versus rich fens. Alkaline fens in Alaska are placed into either Western North American Boreal Alkaline Fen Group (G361) or North Pacific Alkaline Open Fen Group (G285).

Similar NVC Types:
- G361 Western North American Boreal Alkaline Fen

- G285 North Pacific Alkaline Open Fen: covers calcareous and other alkaline fens but with Pacific Northwest species such as *Myrica gale*.
- G284 North Pacific Acidic Open Bog & Fen: covers poor fens in the Pacific Northwest with species such as *Callitropsis nootkatensis, Pinus contorta var. contorta, Picea sitchensis*, and *Tsuga heterophylla*.
- G515 Rocky Mountain Acidic Fen: includes wet peatlands that have deep peat and are therefore less influenced by groundwater, or occur in non-calcareous bedrock; mineral influences are much less and pH of soil water is more neutral than in the alkaline fens.

Diagnostic Characteristics: Saturated year-round organic soils with >40 cm peat, bathed in mineral-rich groundwater discharge (pH neutral to alkaline) and dominated by wetland indicator plants, and the ground cover is dominated by *Sphagnum* mosses.

VEGETATION

Physiognomy and Structure: Wet peatlands with heavy moss ground cover, low-statured graminoid species, short and dwarf-shrubs that often occur in a mosaic of these types all adjacent to each other.

Floristics: Vegetation is dominated by graminoids and low shrubs and includes *Carex buxbaumii, Carex cusickii, Carex limosa, Carex saxatilis, Carex utriculata, Kobresia myosuroides*, and *Kobresia simpliciuscula*. Shrubs include *Betula glandulosa* and several *Salix* spp. Rare plants found in calcareous fens include *Salix candida, Salix myrtillifolia, Salix serissima, Primula egaliksensis, Eriophorum altaicum var. neogaeum, Carex viridula, Carex tenuiflora, Carex leptalea, Trichophorum pumilum*, and *Sisyrinchium pallidum* (Cooper 1986b, Windell et al. 1986, Cooper and Sanderson 1997, Steen and Coupe 1997).

ENVIRONMENT & DYNAMICS

Environmental Description: It is confined to specific environments defined by groundwater discharge, soil chemistry, and peat accumulation of at least 40 cm. Fens form at low points in the landscape or on slopes where groundwater intercepts the soil surface. Groundwater inflows maintain a fairly constant water level year-round, with water at or near the surface most of the time. Constant high water levels and cold winter temperatures lead to accumulation of organic material. In addition to peat accumulation and perennially saturated soils, soil chemistry is alkaline to neutral and nutrients high in base cations. Nitrogen (N) and potassium (K) are usually still limiting plant growth in rich fens. Rich fens are strongly influenced by geology and occur where limestone, dolostone, marble or where glacially-derived materials are calcareous (Cooper 1986b, Windell et al. 1986, Cooper and Sanderson 1997, Steen and Coupe 1997, Bedford and Godwin 2003).

Dynamics: Mountain fens act as natural filters cleaning ground and surface water. Fens also act as sponges by absorbing heavy precipitation, slowly releasing it downstream, minimizing erosion and recharging groundwater systems (Windell et al. 1986). The persistent groundwater and cold temperatures allow organic matter to accumulate (forming peat) which allows classification of wetlands within this group as fens. Fens produce peat that accumulates at the rate of 20 to 30 cm (8-11 inches) per 1000 years, making peatlands a repository of 10,000 years of post glacial history (Windell et al. 1986).

DISTRIBUTION

Geographic Range: This group occurs infrequently throughout the mountains of the interior west, the Sky Islands of Arizona and high mountains and plateaus of Nevada and Utah, and the Rocky Mountains of Utah, Colorado, Wyoming, Montana, Idaho, the Black Hills of South Dakota, and north into Canada.

Spatial Scale & Pattern [optional]: Small patch
Nations: CA, US
States/Provinces: AB, AZ, BC, CA, CO, ID, MT, NV, OR, SD, UT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Alliances:
- A3436 *Kobresia myosuroides - Kobresia simpliciuscula* Alkaline Graminoid Fen Alliance
- A3434 *Betula nana* Alkaline Shrub Fen Alliance
- A3435 *Carex limosa - Carex buxbaumii - Triglochin maritima* Alkaline Graminoid Fen Alliance

AUTHORSHIP

Primary Concept Source: J. Rocchio, D. Cooper, B. Bedford, in Faber-Langendoen et al. (2011)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 11/23/2015
Classif Resp Region: West
Internal Author: GK 11-10, 5-13, 11-15, mod. MSR 3-17

REFERENCES

References: Bedford and Godwin 2003, Cooper 1986b, Cooper and Sanderson 1997, Faber-Langendoen et al. 2017a, Rondeau 2001, Steen and Coupé 1997, Windell et al. 1986

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2. Shrub & Herb Vegetation
2.C.2.Na. North American Bog & Fen
G516. Rocky Mountain Alkaline Fen

A3434. Betula nana Alkaline Shrub Fen Alliance

Type Concept Sentence: This alliance covers shrub-dominated neutral to alkaline pH fens (organic soil wetlands) found at elevations of 1500-3350 m (5000-11,000 feet) within the Rocky Mountains. *Betula nana* is an indicator for the shrubby growth form on these fens; however, other shrub species may be dominant. There is usually herbaceous cover, and dense mosses cover the ground.

OVERVIEW

Scientific Name: *Betula nana* Alkaline Shrub Fen Alliance
Common Name (Translated Scientific Name): Dwarf Birch Alkaline Shrub Fen Alliance
Colloquial Name: Dwarf Birch Alkaline Shrub Fen

Type Concept: This alliance consists of shrubby wetlands dominated by several different shrub species, often represented by *Betula nana*. These wetlands are neutral to alkaline pH fens found at elevations of 1500-3350 m (5000-11,000 feet) within the Rocky Mountains. *Betula nana* is an indicator for the shrubby growth form on these fens; however, other shrub species may be dominant. There is usually herbaceous cover, and dense mosses cover the ground.

Classification Comments: Fens are neutral to alkaline pH, with shrubby growth.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Shrub cover is at least 25% over the shorter canopy of herbaceous growth.

VEGETATION

Physiognomy and Structure: The shrub layer is dominated by a broad-leaved deciduous, low, spreading erect shrub mostly 1-3 m tall. The canopy cover is sparse to moderate while the herbaceous layer cover is high. The fern layer is prominent, with up to 80% cover.

Floristics: Vegetation types within this alliance are described as seasonally flooded, cold-deciduous shrublands. *Betula glandulosa* dominates the canopy. Other shrubs present include *Alnus incana, Cornus sericea, Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda), Rhamnus alnifolia, Salix planifolia, Salix monticola*, and *Salix wolfii*. The herbaceous undergrowth is found on small hummocks and is usually dominated by a dense mixture of mesic forbs and mesic graminoids. Mesic graminoids include *Calamagrostis canadensis, Calamagrostis stricta, Carex aquatilis, Carex utriculata, Carex livida*, and *Deschampsia cespitosa*. Forb cover is sparse and may include *Caltha leptosepala, Epilobium ciliatum, Ligusticum filicinum, Ranunculus sceleratus, Sparganium natans (= Sparganium minimum)*, and *Thalictrum alpinum*. Fern allies present may include *Equisetum laevigatum*.

ENVIRONMENT & DYNAMICS

Environmental Description: Elevations range from 900 to 3000 m in the Rocky Mountains. Communities occur on peat soils in seeps, swales, and wet alluvial terraces adjacent to low-gradient meandering streams. They are found in areas where soils are saturated from seeps and springs. Soils are Histosols saturated all year. Quaking mats are typical of many stands.

Dynamics: As peatland hummocks develop (become more pronounced), they may become more heavily dominated by *Salix* species (Wendell et al. 1986, as cited in Kittel et al. 1999b). Due to cold temperatures and a short growing season, this process may take several decades to occur (Phillips 1977).

DISTRIBUTION

Geographic Range: Stands of this alliance are found in the Rocky Mountains of Idaho, Montana, Wyoming, and Colorado. These are likely to occur in Alberta and British Columbia as well.

Nations: CA?, US
States/Provinces: AB?, BC?, CO, ID, MT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Betula glandulosa* Series (Johnston 1987)

LOWER LEVEL UNITS

Associations:
- CEGL001188 *Salix candida / Carex utriculata* Shrub Fen
- CEGL002899 *Betula glandulosa / Sphagnum* spp. Shrub Fen
- CEGL002700 *Betula glandulosa / Carex lasiocarpa* Shrub Fen
- CEGL000229 *Salix farriae / Eleocharis quinqueflora* Shrub Fen

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Carsey et al. 2003a, Carsey et al. 2003b, Faber-Langendoen et al. 2017b, Hansen et al. 1991, Hansen et al. 1995, Hitchcock et al. 1964, Johnston 1987, Kartesz 1994a, Kettler and McMullen 1996, Kittel et al. 1995, Kittel et al. 1999a, Kittel et al. 1999b, Komarkova 1986, Phillips 1977, Sanderson and Kettler 1996

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2. Shrub & Herb Vegetation
2.C.2.Na. North American Bog & Fen
G516. Rocky Mountain Alkaline Fen

A3435. Carex limosa - Carex buxbaumii - Triglochin maritima Alkaline Graminoid Fen Alliance

Type Concept Sentence: This alliance covers neutral to alkaline herbaceous fens dominated by one or more *Carex* species. Some well-documented species include *Carex buxbaumii, Carex cusickii, Carex limosa*, and *Carex saxatilis*. *Carex aquatilis* and *Carex utriculata* may be present as well. This alliance occurs in the Rocky Mountains. Fens are seasonally or permanently saturated wetlands with an organic substrate that is at least 30 cm thick.

OVERVIEW

Scientific Name: *Carex limosa - Carex buxbaumii - Triglochin maritima* Alkaline Graminoid Fen Alliance
Common Name (Translated Scientific Name): Mud Sedge - Buxbaum's Sedge - Seaside Arrow-grass Alkaline Graminoid Fen Alliance
Colloquial Name: Rocky Mountain Alkaline Sedge Graminoid Fen

Type Concept: This alliance consists of neutral to alkaline herbaceous fens dominated by one or more *Carex* species. Some well-documented species include *Carex buxbaumii, Carex cusickii, Carex limosa*, and *Carex saxatilis*. *Carex aquatilis* and *Carex utriculata* may be present as well. Additional species may include *Caltha leptosepala, Deschampsia cespitosa, Drosera* spp., *Eleocharis quinqueflora, Eriophorum* spp., *Menyanthes trifoliata, Pedicularis groenlandica*, and *Trichophorum cespitosum (= Scirpus cespitosus)*. The source and quality of groundwater determine the nutrient content and pH of these fens, which most often occur as basin or depressional wetlands, but can also occur as slope and alluvial wetlands in terms of their hydrogeomorphic setting. These fens are seasonally or permanently saturated wetlands with an organic substrate that is at least 30 cm thick, and occur in the Rocky Mountains.

Classification Comments:

Internal Comments:

Other Comments:

Similar NVC Types:

Diagnostic Characteristics: These are herbaceous-dominated, neutral to alkaline pH fens with herbaceous cover as the dominant vegetation, usually with a high moss ground cover, but this may be submerged under water during part of the year.

VEGETATION

Physiognomy and Structure: This alliance is characterized by turf-forming, perennial graminoids. The graminoid stratum is dominated by one or two sedge species. The forb layer is typically present.

Floristics: Dominant species are *Carex buxbaumii, Carex cusickii, Carex limosa*, and *Carex saxatilis*, either singly or in various mixes. Common co-associates are *Carex aquatilis, Carex canescens, Carex lasiocarpa, Carex livida, Carex utriculata*, and *Deschampsia cespitosa*. Forbs are often present and can have high cover, but stands are usually dominated by their graminoid components. Forb species include *Caltha leptosepala, Drosera linearis, Ligusticum tenuifolium, Menyanthes trifoliata, Pedicularis groenlandica*, and *Pedicularis groenlandica*. Other species present may include *Scheuchzeria palustris*. A dense layer of *Sphagnum* spp. or other moss genera is typically the ground cover.

ENVIRONMENT & DYNAMICS

Environmental Description: Fens occur from 2400-3900 m in elevation and are located in narrow to broad mountain valleys, on organic substrates, with smooth to concave surface topography. Soils are commonly Histosols consisting of deep, fibric peat and are persistently saturated with standing water in the spring. Saturated conditions retard plant decomposition and favor organic matter accumulation.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is found in the mountains of Utah, Idaho, Montana, Wyoming, Colorado and New Mexico, and likely extends into Alberta and British Columbia, Canada.

Nations: CA?, US
States/Provinces: AB?, BC?, CO, ID, MT, NM, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Carex buxbaumii-Carex aquatilis* (Mattson 1984)
- **?** *Carex buxbaumii-Carex saxatilis* (Tuhy 1981)

LOWER LEVEL UNITS

Associations:
- CEGL001806 *Carex buxbaumii* Fen
- CEGL002549 *Carex diandra* Wet Meadow Fen
- CEGL002922 *Carex utriculata* Perched Wetland Fen
- CEGL000230 *Carex cusickii* Fen
- CEGL001811 *Carex limosa* Fen
- CEGL001769 *Carex saxatilis* Fen
- CEGL001995 *Triglochin maritima* Fen
- CEGL001877 *Carex microglochin* Fen

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Cronquist et al. 1977, Cronquist et al. 1997, Faber-Langendoen et al. 2017b, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Hermann 1970, Kettler and McMullen 1996, Lewis 1970, Mattson 1984, Moseley et al. 1991, Moseley et al. 1994, Padgett et al. 1989, Pierce 1986, Pierce and Johnson 1986, Sanderson and Kettler 1996, Sawyer and Keeler-Wolf 1995, Tuhy 1981

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2. Shrub & Herb Vegetation
2.C.2.Na. North American Bog & Fen
G516. Rocky Mountain Alkaline Fen

A3436. Kobresia myosuroides - Kobresia simpliciuscula Alkaline Graminoid Fen Alliance

Type Concept Sentence: This Rocky Mountain alliance contains strongly alkaline fens dominated by herbaceous species; indicators include *Kobresia myosuroides* and *Kobresia simpliciuscula*, the later indicating extremely rich conditions. The water chemistry is distinct in that it contains high levels of calcium and magnesium.

OVERVIEW

Scientific Name: *Kobresia myosuroides - Kobresia simpliciuscula* Alkaline Graminoid Fen Alliance
Common Name (Translated Scientific Name): Simple Bog Sedge - Bellardi Bog Sedge Alkaline Graminoid Fen Alliance
Colloquial Name: Bog Sedge Alkaline Graminoid Fen

Type Concept: This alliance consists of strongly alkaline fens dominated by herbaceous species; indicators include *Kobresia myosuroides* and *Kobresia simpliciuscula*, the later indicating extremely rich conditions. Other species present may include *Carex aquatilis, Carex simulata, Eleocharis quinqueflora, Juncus arcticus, Ptilagrostis porteri (= Ptilagrostis mongholica ssp. porteri), Salix brachycarpa, Salix candida, Thalictrum alpinum*, and *Trichophorum pumilum (= Scirpus pumilus)*. The water chemistry is distinct in that it contains high levels of calcium and magnesium. It is documented to occur in the Rocky Mountains of Colorado, but is likely to occur in Wyoming, Montana, Idaho, Utah, New Mexico, Alberta and British Columbia

Classification Comments: Shrub cover, if present, is <25%.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Alkaline pH herbaceous-dominated fens with *Kobresia myosuroides* or *Kobresia simpliciuscula* present to dominant.

VEGETATION

Physiognomy and Structure: Low cold-deciduous shrub cover of at least 25%.

Floristics: Indicators of this alliance include *Kobresia myosuroides* and *Kobresia simpliciuscula*, the later indicating extremely rich conditions. Other species present may include *Carex aquatilis, Carex simulata, Eleocharis quinqueflora, Juncus arcticus, Ptilagrostis porteri (= Ptilagrostis mongholica ssp. porteri), Salix brachycarpa, Salix candida, Thalictrum alpinum*, and *Trichophorum pumilum (= Scirpus pumilus)*.

ENVIRONMENT & DYNAMICS

Environmental Description: The water chemistry is distinct in that it contains high levels of calcium and magnesium.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is documented to occur in the Rocky Mountains of Colorado, but is likely to occur in Wyoming, Montana, Idaho, Utah, New Mexico, Alberta and British Columbia.

Nations: CA?, US
States/Provinces: AB?, BC?, CO, ID?, MT?, NM?, UT?, WY?
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Associations:

- CEGL002900 *Kobresia myosuroides - Thalictrum alpinum* Fen
- CEGL005661 *Glaux maritima - Poa secunda* Rich Fen
- CEGL002901 *Kobresia simpliciuscula - Trichophorum pumilum* Fen

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Cooper n.d., Faber-Langendoen et al. 2017b

2.C.4. Temperate to Polar Freshwater Marsh, Wet Meadow & Shrubland

Temperate to Polar Freshwater Marsh, Wet Meadow & Shrubland includes wet riparian and swamp shrublands, wet meadows, wet prairies, and shallow and deep emergent marshes. The vegetation comprises seasonal green emergent, hydrophytic shrubs and herbs with at least 10% cover, on mucky, inundated or saturated soils across the mid-latitudes of the Northern and Southern hemispheres from 23° to 70°.

2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

This division contains marshes, wet meadows and shrublands, singly and in mosaics, along riparian corridors, around vernal pools, depressions, seeps and springs on mineral soils or shallow organic layers over mineral substrates in temperate (and possibly southern boreal) latitudes of western North America.

M888. Arid West Interior Freshwater Marsh

These arid west freshwater marshes are found at all elevations below alpine throughout the interior basins and mountains of western North America, with dominant species such *Carex pellita, Carex praegracilis, Eleocharis palustris, Juncus arcticus ssp. littoralis, Paspalum distichum, Schoenoplectus americanus, Schoenoplectus pungens, Typha domingensis, Typha latifolia*, and species of *Bidens, Cicuta, Cyperus, Mimulus*, and *Phalaris*.

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
2.C.4.Nb.1.a. M888 Arid West Interior Freshwater Marsh

G531. Arid West Interior Freshwater Marsh

Type Concept Sentence: These arid west freshwater marshes are found at all elevations below alpine throughout the western interior basins and mountains of western North America, with dominant species such as *Carex pellita, Carex praegracilis, Eleocharis palustris, Juncus arcticus ssp. littoralis, Paspalum distichum, Schoenoplectus americanus, Schoenoplectus pungens, Typha domingensis, Typha latifolia*, and species of *Bidens, Cicuta, Cyperus, Mimulus*, and *Phalaris*.

OVERVIEW

Scientific Name: *Schoenoplectus* spp. - *Typha* spp. Interior Freshwater Marsh Group
Common Name (Translated Scientific Name): Clubrush species - Cattail species Interior Freshwater Marsh Group
Colloquial Name: Common Spikerush - Pale Spikerush Marsh

Type Concept: These arid west freshwater marshes are found at all elevations below timberline throughout the western interior basins and mountains of western North America. Vegetation is characterized by a lush, dense herbaceous layer with low diversity, sometimes occurring as a monoculture. Structure varies from emergent forbs which barely reach the water surface to tall graminoids that reach as tall as 4 m high. Dominant species include *Carex pellita (= Carex lanuginosa), Carex praegracilis, Eleocharis palustris, Juncus arcticus ssp. littoralis (= Juncus balticus), Paspalum distichum, Schoenoplectus americanus, Schoenoplectus pungens,*

Typha domingensis, Typha latifolia, and species of *Bidens, Cicuta, Cyperus, Mimulus*, and *Phalaris*. This group includes shallow freshwater to brackish waterbodies found in bottomlands along drainages, in river floodplain depressions, cienegas, oxbow lakes, below seeps, frequently flooded gravel bars, low-lying sidebars, in-fill side channels, small ponds, stockponds, ditches and slow-moving streams, perennial streams in valleys and mountain foothills, as well as in small depressions gouged into basalt by Pleistocene floods, channeled scablands of the Columbia Plateau and within dune fields in the intermountain western U.S. These wetlands are mostly small-patch, confined to limited areas in suitable floodplain or basin topography. They are mostly semipermanently flooded, but some marshes have seasonal hydrologic flooding. Water is on or above the surface for most of the growing season. A consistent source of freshwater is essential to the function of these communities. Soils are muck or mineral or muck over a mineral soil, and water is high-nutrient. It is often found along the borders of ponds, lakes or reservoirs that have more open water. Some occurrences are interdunal wetlands in wind deflation areas, where sands are scoured down to the water table. The water table may be perched over an impermeable layer of caliche or clay or, in the case of the Great Sand Dunes of Colorado, a geologic dike that creates a closed basin that traps water.

Classification Comments: This group does not include oceanic saline-influenced tidal areas (coastal saline marshes and brackish marshes) which belong to Temperate Pacific Salt Marsh Group (G499). Marshes in saline waters located at the edge of the Great Salt Lake are included in North American Desert Alkaline-Saline Marsh & Playa Group (G538).

Similar NVC Types:
- G521 Vancouverian-Rocky Mountain Montane Wet Meadow & Marsh
- G524 Western North American Ruderal Marsh, Wet Meadow & Shrubland
- G538 North American Desert Alkaline-Saline Marsh & Playa
- G544 Western North American Temperate Freshwater Aquatic Vegetation

Diagnostic Characteristics: Temperate continental, permanently saturated to seasonally flooded wetlands, often with standing water for much of the year, dominated by emergent graminoid herbaceous vegetation. Characteristic dominant species include *Typha* spp., *Schoenoplectus* spp., *Eleocharis palustris, Carex praegracilis, Carex pellita*, and *Cyperus* spp.

VEGETATION

Physiognomy and Structure: Vegetation is characterized by a lush, dense to open emergent herbaceous layer. The emergent vegetation is characterized by graminoids, annual or perennial forbs or a mixture of all three. Heights varies from low forbs that barely breaking the water surface to tall graminoids up to 4 m high. Sites are permanently or seasonally inundated which prevents the establishment of woody species. Ponds typically have concentric rings or zones of vegetation.

Floristics: These arid west interior marshes are dominated by emergent herbaceous species, mostly graminoids (*Carex, Scirpus* and/or *Schoenoplectus, Eleocharis, Juncus, Typha*,) but also some forbs. Stands vary in diversity, with some stands occurring as a monoculture of one of the dominant genera. Dominant species include *Carex pellita (= Carex lanuginosa), Carex praegracilis, Eleocharis palustris, Juncus arcticus ssp. littoralis (= Juncus balticus), Paspalum distichum, Schoenoplectus americanus, Schoenoplectus pungens, Typha domingensis, Typha latifolia*, and species of *Bidens, Cicuta, Cyperus, Mimulus*, and *Phalaris*.

ENVIRONMENT & DYNAMICS

Environmental Description: *Climate:* Temperate Continental climate. Environmental settings include bottomlands along drainages, in river floodplain depressions, cienegas, oxbow lakes, below seeps, frequently flooded gravel bars, low-lying sidebars, infilled side channels, small ponds, stockponds, ditches and slow-moving streams, perennial streams in valleys and mountain foothills. Elevations range from 890 to 1560 m (2930-5120 feet). *Soil/substrate/hydrology:* Substrates are variable but are generally fine-textured, alkaline, alluvial soil, coarse loam, sandy loam, sand, silt or peat. Hydrologic regimes vary from seasonal inundation followed by complete soil desiccation to year-round standing water. Water may be poorly oxygenated and nitrogen-rich. They are mostly semipermanently flooded, but some marshes have seasonal hydrologic flooding. Water is at or above the surface for most of the growing season. A consistent source of freshwater is essential to the function of these systems. Soils are muck or mineral or muck over a mineral soil, and water is high-nutrient. Environmental information compiled from Bowers (1982, 1984, 1986), Banner et al. (1986, 1993), Lloyd et al. (1990), MacKinnon et al. (1990), Cooper and Severn (1992), Viereck et al. (1992), Shiflet (1994), Holland and Keil (1995), Shephard (1995), Steen and Coupe (1997), Hammond (1998), Pineada et al. (1999), Boggs (2000), Pineda (2000), Rondeau (2001), Brand and Sanderson (2002), and Chappell and Christy (2004).

Dynamics: Sites are depressions, ponds, springs, and riparian areas that are heavily inundated for at least part of the growing season which impedes the establishment of woody species. Isolated marshes in dune systems are subject to changes in size and location of the wet swales as the sand dunes shift, due to active dune migration. Dune "blowouts" and subsequent stabilization through succession are characteristic processes of the active dunes which surround the interdunal swales.

DISTRIBUTION

Geographic Range: This group is found throughout the temperate western North America interior (Columbia Basin, Great Basin, Colorado Plateau, and higher intermountain basins of western North America). It is also know to occur in dune fields across the intermountain western U.S., including the Great Sand Dunes in southern Colorado and the Pink Coral Dunes in Utah, and may also occur in dune fields in northeastern Arizona and the Great Basin, as well as in southwestern Wyoming in the Killpecker Dunes and Ferris Dunes, and southern Idaho.

Spatial Scale & Pattern [optional]: Small patch
Nations: CA, MX, US
States/Provinces: AZ, BC, CA, CO, ID, KS, NM, NV, OK, OR, SD, TX, UT, WA, WY
TNC Ecoregions [optional]: 1:C, 2:C, 3:C, 4:C, 6:C, 10:C, 11:C, 12:C, 13:C, 14:C, 15:C, 16:C, 19:C, 20:C, 22:C, 23:C, 24:C, 28:C, 68:C, 69:C, 70:C, 81:C
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **<** III.A.3.d - Fresh sedge marsh (Viereck et al. 1992)
- **<** III.B.3.a - Fresh herb marsh (Viereck et al. 1992)
- **<** Wetlands (217) (Shiflet 1994)

LOWER LEVEL UNITS

Alliances:
- A3891 *Eleocharis palustris - Eleocharis macrostachya* Marsh Alliance
- A3894 *Paspalum distichum* Marsh Alliance
- A3895 *Schoenoplectus americanus - Schoenoplectus acutus - Schoenoplectus californicus* Marsh Alliance
- A3896 *Typha domingensis - Typha latifolia - Phragmites australis ssp. americanus* Western Marsh Alliance
- A3892 *Equisetum fluviatile - Equisetum x ferrissii* Marsh Alliance

AUTHORSHIP

Primary Concept Source: C. Chappell, R. Crawford, K.A. Schulz, in D. Faber-Langendoen et al. (2011)
Author of Description: M.E. Hall, G. Kittel and J. Christy
Acknowledgments: J. Christy
Version Date: 12/02/2015
Classif Resp Region: West
Internal Author: MEH 10-10, mod. GK 9-13, 12-15

REFERENCES

References: Banner et al. 1986, Banner et al. 1993, Bezanson 2000, Boggs 2000, Bowers 1982, Bowers 1984, Bowers 1986, Brand and Sanderson 2002, Brown 1982a, Carr 1991, Carr 2004, Chappell and Christy 2004, Comer et al. 2003, Cooper and Severn 1992, Crowe et al. 2004, Dick-Peddie 1993, El-Hage and Moulton 1998, Faber-Langendoen et al. 2017a, Hammond 1998, Hendrickson and Minckley 1984, Holland and Keil 1995, Jahrsdoerfer and Leslie 1988, Lloyd et al. 1990, MacKinnon et al. 1990, Muldavin et al. 1994b, Muldavin et al. 2000a, Muldavin et al. 2000b, Pineda 2000, Pineda et al. 1999, Rodriguez et al. 2017, Rondeau 2001, Shephard 1995, Shiflet 1994, Steen and Coupé 1997, Szaro 1989, TPWD 1989d, Ungar 1965, Ungar 1972, Viereck et al. 1992

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G531. Arid West Interior Freshwater Marsh

A3891. Eleocharis palustris - Eleocharis macrostachya Marsh Alliance

Type Concept Sentence: This herbaceous wetland alliance is dominated or codominated by *Eleocharis palustris* and/or *Eleocharis macrostachya*, and occurs in shallow, mostly still water throughout much of the western United States and into northern Mexico, from sea level to upper montane altitudes. Stands occur on a variety of landforms, including lake margins, stream terraces, floodplains, gravel bars, and around springs or wet basins (cienegas).

OVERVIEW

Scientific Name: *Eleocharis palustris - Eleocharis macrostachya* Marsh Alliance
Common Name (Translated Scientific Name): Common Spikerush - Pale Spikerush Marsh Alliance
Colloquial Name: Common Spikerush - Pale Spikerush Marsh

Type Concept: This herbaceous wetland alliance is characterized by an herbaceous layer that is dominated or codominated by *Eleocharis palustris* and/or *Eleocharis macrostachya*. Associates include *Carex praegracilis, Deschampsia cespitosa, Distichlis spicata, Juncus arcticus ssp. littoralis (= Juncus balticus), Muhlenbergia asperifolia, Panicum virgatum, Phalaris arundinacea (= Phalaroides arundinacea)*, and *Spartina pectinata*. Forb cover is also variable and may include *Berula erecta, Caltha leptosepala, Iris missouriensis, Lemna* spp., *Mentha arvensis, Pedicularis groenlandica, Potamogeton* spp., *Ranunculus cymbalaria, Rhodiola integrifolia, Nasturtium officinale (= Rorippa nasturtium-aquaticum), Rumex crispus*, and *Sparganium angustifolium*. Stands occur in shallow, mostly still water throughout much of the western United States and into northern Mexico, from sea level to upper montane altitudes. Stands occur on a variety of landforms, including lake margins, stream terraces, floodplains, gravel bars, and around springs or wet basins (cienegas).

Classification Comments: This alliance is primarily a freshwater alliance, although some stands may become brackish as ponds dry.

Internal Comments:
Other Comments:

Similar NVC Types:
- A4177 *Eleocharis macrostachya* Vernal Pool Alliance

Diagnostic Characteristics: Diagnostic of this herbaceous wetland alliance is the dominance or codominance of *Eleocharis palustris* and/or *Eleocharis macrostachya* and the presence of surface water for extended periods during the growing season.

VEGETATION

Physiognomy and Structure: This alliance is characterized by a rhizomatous perennial that dominates the graminoid stratum (up to 70% cover). The forb layer is sparse (0-20%) and contains both aquatic and terrestrial species.

Floristics: Associations within this alliance are dominated by *Eleocharis palustris* and/or *Eleocharis macrostachya*. Cover ranges from sparse to quite dense (10-80%). *Distichlis spicata* and *Muhlenbergia asperifolia* codominate the graminoid layer in cienegas (Arizona and New Mexico). Forb cover is composed of *Berula erecta* and *Nasturtium officinale (= Rorippa nasturtium-aquaticum)*, especially in stands with deep water (Cross 1991). At higher montane elevations, other graminoids present include *Carex aquatilis, Carex buxbaumii, Carex utriculata, Deschampsia cespitosa*, and *Eleocharis rostellata*. Forb cover is typically low, but can be up to 25% in some stands. Common forb species include *Caltha leptosepala, Pedicularis groenlandica*, and *Rhodiola integrifolia* (Hansen et al. 1995, Kittel et al. 1999a). Crowe and Clausnitzer (1997) state that *Eleocharis palustris* is an aggressive species, typically excluding other species from establishing. In Oregon stands, associated forbs include *Iris missouriensis, Mentha arvensis, Ranunculus cymbalaria*, and *Rumex crispus*.

In California, forb cover can be quite high, and a mixture of forbs will infrequently dominate the community. However, it is the cover of *Eleocharis*, which typically exceeds 50%, that distinguishes this community from others with high forb cover. Forbs present include *Berula erecta, Centaurea solstitialis, Euthamia occidentalis, Hydrocotyle umbellata, Melilotus indicus, Mentha arvensis, Mimulus guttatus, Perideridia parishii, Polygonum bistortoides, Pseudognaphalium canescens ssp. beneolens (= Gnaphalium canescens ssp. beneolens), Ranunculus californicus, Nasturtium officinale, Sonchus asper (= ssp. asper), Stachys pycnantha, Symphyotrichum spathulatum (= Aster occidentalis), Trifolium wormskioldii*, and *Urtica dioica ssp. holosericea*. In vernal pools and other seasonally flooded wetlands, other forbs include *Eryngium castrense* and/or *Eryngium vaseyi, Juncus* sp., *Plagiobothrys stipitatus var. micranthus*, and *Psilocarphus brevissimus var. brevissimus*. Graminoids present include the characteristic *Eleocharis macrostachya*, with *Aira caryophyllea, Bromus arenarius, Bromus hordeaceus, Carex barbarae, Carex nebrascensis, Carex* spp., *Eleocharis acicularis, Eleocharis rostellata, Juncus bufonius, Juncus effusus var. pacificus, Juncus nevadensis, Lemna minor, Lolium perenne ssp. multiflorum (= Lolium multiflorum), Polypogon monspeliensis, Schoenoplectus americanus (= Scirpus americanus)*, and *Vulpia myuros*.

ENVIRONMENT & DYNAMICS

Environmental Description: Elevation ranges from sea level in California to 3050 m in Colorado. Stands occur on a variety of landforms, including lake margins, stream terraces, floodplains, gravel bars, and wet basins (cienegas) or meadows. Stands occur on sites that are flat, 1% slope with all aspects (Crowe and Clausnitzer 1997). Most sites are permanently flooded or permanently saturated, but occasionally they can be seasonally saturated or seasonally flooded. Water is characteristically supplied from surface sheeting or subsurface flows originating upstream or upslope from the site. Soils vary from Histosols to Entisols. High-elevation stands consistently occur on organic (highly sapric) soils, or on a thick organic horizon that overlays fine to coarse alluvial material. Lower elevation stands occur on fresh alluvial deposits of fine-textured loamy sands, clays, and sandy clays (Kittel et al. 1999a). Soil reaction is often alkaline (Hansen et al. 1988). All sites are saturated throughout much of the growing season. Oregon stands are located on soils derived from volcanic (andesite, basalt) or sedimentary parent materials (Crowe and Clausnitzer 1997).

At higher elevation, *Carex aquatilis* or *Carex utriculata* meadows and *Salix wolfii* or *Salix planifolia* shrublands occur within the riparian mosaic. At lower elevation, *Schoenoplectus pungens* often occurs within the stream channel while wet meadow prairies of *Panicum virgatum* and *Sorghastrum nutans* occupy the immediate streambanks and low floodplains.

Dynamics: At lower elevation, *Eleocharis palustris* plant associations occur well within the active channel and are inundated annually. These early-seral communities colonize backwater eddies and shallow edges of slow-moving reaches of small and larger rivers. The stands are probably ephemeral, as the eddies and river edges are scoured out each year during high spring flows (Kittel et al. 1999a). These communities have also been described as early-seral stages by Padgett et al. (1989), who describe light-colored soils for the sites, indicating an early phase of soil development. Kovalchik (1987) reports that the lower elevation plant associations within this alliance frequently form seral communities in ponded sites between stream rehabilitation structures such as loose rock check dams. In the montane zone, associations within this alliance occur in ponded sites on faster moving streams. If siltation occurs, sites may become dominated by *Carex utriculata*. At higher elevations, the associations appear to be stable. Stands occur near seeps on soils with deep organic layers, often sapric, and are saturated throughout the growing season.

Crowe and Clausnitzer (1997) state that *Eleocharis palustris* is of little to no forage value to livestock and wild ungulates. On seasonally drier sites, ungulate trampling may cause this species to increase (Snyder 1992 as cited in Crowe and Clausnitzer 1997). However, this species does provide seed forage and cover to ducks and geese (Kovalchik 1987).

DISTRIBUTION

Geographic Range: This alliance is found in eastern Oregon and Washington, northeastern California, in the Sierra Nevada, Nevada, Idaho, Montana, Wyoming, Colorado, Utah, Arizona and New Mexico, and into northern Mexico.

Nations: MX, US
States/Provinces: AZ, CA, CO, ID, MT, MXSO, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Carex* spp. Series (Johnston 1987)
- **?** *Eleocharis macrostachya* (Pale spike rush marshes) Alliance (Sawyer et al. 2009) [45.230.00]
- **?** *Eleocharis macrostachya* Herbaceous Alliance (CNPS 2017) [45.230.00]
- **?** Montane, Plains, and Great Basin Marshlands (Brown 1982a)

LOWER LEVEL UNITS

Associations:
- CEGL002634 *Eleocharis palustris - Carex praegracilis - Berula erecta* Marsh
- CEGL005662 *Carex atherodes* Interior West Wet Meadow

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel, D. Culver, and M.J. Russo
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Baker 1983c, Baker and Kennedy 1985, Brotherson 1987, Brotherson and Barnes 1984, Brown 1982a, Bunin 1985, CNPS 2017, Cronquist et al. 1977, Cross 1991, Crowe and Clausnitzer 1997, Durkin et al. 1995a, Ellis et al. 1979, Faber-Langendoen et al. 2017b, Flowers 1962, Hall and Hansen 1997, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Hendrickson and Minckley 1984, Johnston 1987, Kettler and McMullen 1996, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1999a, Kovalchik 1987, Kovalchik 1993, Manning and Padgett 1995, Muldavin et al. 2000a, Mutel 1973, Mutel and Marr 1973, Padgett et al. 1988b, Padgett et al. 1989, Ramaley 1919a, Ramaley 1942, Reid et al. 1994, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Shupe et al. 1986, Stearns-Roger, Inc. 1978, Stewart 1940, Sturges 1968, Youngblood et al. 1985a

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G531. Arid West Interior Freshwater Marsh

A3892. Equisetum fluviatile - Equisetum x ferrissii Marsh Alliance

Type Concept Sentence: This alliance contains marshes dominated by emergent *Equisetum fluviatile, Equisetum laevigatum*, and/or *Equisetum x ferrissii* all of which can form monotypic stands. The water is shallow (<1 m) over mineral soils, usually sand/or silt, along wave-washed shores and stream channels of the western U.S. and Canada.

OVERVIEW

Scientific Name: *Equisetum fluviatile - Equisetum x ferrissii* Marsh Alliance
Common Name (Translated Scientific Name): Water Horsetail - Ferriss' Horsetail Marsh Alliance
Colloquial Name: Western Horsetail Marsh

Type Concept: This herbaceous alliance of shallow emergent marshes is dominated by *Equisetum fluviatile, Equisetum laevigatum*, and/or *Equisetum x ferrissii* as the most abundant species, which can form monotypic stands. In mixed stands, the graminoids *Agrostis gigantea, Alopecurus aequalis, Carex aquatilis, Carex rostrata, Carex utriculata, Eleocharis palustris (= Eleocharis smallii), Glyceria grandis, Juncus arcticus ssp. littoralis (= Juncus balticus), Muhlenbergia asperifolia, Scirpus* and/or *Schoenoplectus* spp., and the forbs *Bidens cernua, Epilobium leptophyllum, Galium trifidum, Mentha arvensis*, and *Scutellaria galericulata* may be present. Ponds are shallow (<1 m in depth), over mineral soils, usually sand or silt, located along wave-washed shores or lakes or stream channels, including the tidal reaches of the Columbia River. The water is nearly fresh with a very low salt content. In Montana, British Columbia and Alberta, stands occur in still water and on wet ground along the margins of ponds or protected bays in lakes and backwater areas of streams.

Classification Comments:

Internal Comments: MSR 1-17: AK removed. One of the associations in this alliance is probably very broad, and needs splitting.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Stands dominated by *Equisetum fluviatile, Equisetum laevigatum*, and/or *Equisetum x ferrissii*.

VEGETATION

Physiognomy and Structure: This alliance is characterized by a moderate to dense cover of emergent graminoids. The graminoids are rhizomatous perennials and the majority are less than 1 m in height. Few forb species are present.

Floristics: This herbaceous alliance contains stands dominated by *Equisetum fluviatile, Equisetum laevigatum*, and/or *Equisetum x ferrissii* as the most abundant species, which may form monotypic stands. In mixed stands, the graminoids *Agrostis gigantea, Alopecurus aequalis, Carex aquatilis, Carex rostrata, Carex utriculata, Eleocharis palustris (= Eleocharis smallii), Glyceria grandis, Juncus balticus, Muhlenbergia asperifolia, Scirpus* and/or *Schoenoplectus* spp., and the forbs *Bidens cernua, Cirsium arvense, Epilobium leptophyllum, Galium trifidum, Mentha arvensis, Plantago lanceolata, Scutellaria galericulata*, and *Tragopogon dubius* may be present.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands are typically found in shallow (<1 m) water over mineral soils, usually sand or silt. Stands are often located along wave-washed shores and stream channels (Harris et al. 1996), along the tidal reaches of the Columbia River, in still water and wet ground along the margins of ponds or protected bays in lakes and backwater areas of streams (Hansen et al. 1995), or within narrow valley floors and low alluvial terraces of small perennial streams subject to periodic scouring from flooding. Elevations range from sea level to 1785 m (0-5855 feet), slopes generally do not exceed 8%, and aspect varies. Soils are alluvium derived from shales, sandstones or igneous rocks. The soil surface may be bare if flooding has occurred recently, or covered by a mat of older *Equisetum* stems. The water is nearly fresh with a very low salt content (Kunze 1994).

Dynamics: Clonal growth by means of rhizomes is a feature of the genus *Equisetum* and is very important to its ability to utilize groundwater and tolerate disturbance. A single rhizome system may cover hundreds of square feet (Hauke 1993). The rhizomes can penetrate to soil depths of 4 m in some circumstances (Page 1997). This deep rhizome growth gives the plants the ability to survive environmental disturbances such as plowing, burial, flooding, fire, and drought. *Equisetum* species have a remarkable ability to reproduce vegetatively. An extensive rhizome system allows *Equisetum* species to rapidly colonize disturbed areas (Hauke 1993). This ability gives *Equisetum* a distinct advantage over species requiring seed establishment or which have slow-growing rhizomes. The ability of *Equisetum* to survive and spread in areas of heavy sediment accumulation was dramatically demonstrated after the eruption of Mount St. Helens in 1980 when *Equisetum* formed almost monotypic stands in the newly deposited tephra (Rothwell 1996). The deep rhizome system of *Equisetum* also allows these plants to survive fire and rapidly recolonize burned-over sites (Sullivan 1993). It is probable that the vigorous and extensive rhizomatous habit of *Equisetum* has been very important to the long-

term survival and spread of the genus (Hauke 1993). Fragmentation of rhizomes and stems allows *Equisetum* to disperse readily in suitable habitats where there is sufficient moisture. Even the aerial stem fragments can sprout and form new colonies (Wagner and Hammitt 1970). Hence, vegetative reproduction allows *Equisetum* clones to persist and spread even in the absence of sexual reproduction (Hauke 1993).

DISTRIBUTION

Geographic Range: This alliance occurs throughout the western U.S. and Canada.

Nations: CA, US
States/Provinces: AB, AZ, BC, ID, MT, OR, WA
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** Herbaceous and Sedge Wetlands (Chappell et al. 1997)
- **><** Marsh: Spikerush - Water Horsetail: Mineral Substrate type (W6) (Harris et al. 1996)

LOWER LEVEL UNITS

Associations:
- CEGL002746 *Equisetum fluviatile* Marsh
- CEGL005394 *Equisetum x ferrissii* Marsh

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel, M. Damm, L. Allen, J. Coles, M. Reid
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Bursik and Moseley 1995, Chappell et al. 1997, Christy 1991, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Hansen et al. 1991, Hansen et al. 1995, Harris et al. 1996, Hauke 1993, Hitchcock et al. 1977a, Kovalchik 1993, Kunze 1994, MacKenzie and Moran 2004, Page 1977, Rothwell 1996, Sullivan 1993a, Wagner and Hammitt 1970, Willoughby et al. 2004

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G531. Arid West Interior Freshwater Marsh

A3894. Paspalum distichum Marsh Alliance

Type Concept Sentence: This alliance consists of dense, nearly monotypic stands dominated by *Paspalum distichum*. These stands are found on mud or sand flats, moist places, marshes and ditches of low valleys of Oregon, Washington, Nevada and California.

OVERVIEW

Scientific Name: *Paspalum distichum* Marsh Alliance
Common Name (Translated Scientific Name): Knotgrass Marsh Alliance
Colloquial Name: Knotgrass Marsh

Type Concept: This alliance consists of dense, nearly monotypic stands dominated by *Paspalum distichum*. Sites are on mud or sand flats, moist places, marshes and ditches that are flooded seasonally but dry out in summer while water tables are not far below the soil surface. Most occurrences are known from the Willamette Valley, the Columbia River floodplain and lowlands of California and Nevada.

Classification Comments:

Internal Comments: GK 4-14: Should this be in G525 Temperate Pacific Freshwater Wet Mudflat? It seems to occur in more than just mudflat situations. In addition, more information is needed on this alliance, especially about its diversity and where this association occurs.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Concentric rings of wet to drying vegetation around ponds and marshes dominated by *Paspalum distichum*.

VEGETATION

Physiognomy and Structure: Rhizomatous perennial graminoid growing in dense mats from 0.2 to 0.6 m (7-20 inches) tall.

Floristics: This alliance consists of dense, nearly monotypic stands dominated by *Paspalum distichum*.

ENVIRONMENT & DYNAMICS

Environmental Description: Sites are on mud or sand flats, moist places, marshes and ditches that are flooded seasonally but dry out in summer while water tables are not far below the soil surface.

Dynamics:

DISTRIBUTION

Geographic Range: Most occurrences are known from the Willamette Valley of Oregon, the Columbia River floodplain of Washington, and lowlands of California and Nevada.

Nations: US
States/Provinces: CA, NV?, OR, WA
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL003320 *Paspalum distichum* Marsh

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Faber-Langendoen et al. 2017b

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G531. Arid West Interior Freshwater Marsh

A3895. Schoenoplectus americanus - Schoenoplectus acutus - Schoenoplectus californicus Marsh Alliance

Type Concept Sentence: This alliance covers western freshwater marshes where the most abundant species are *Schoenoplectus acutus, Schoenoplectus americanus, Schoenoplectus californicus, Bolboschoenus fluviatilis, Bolboschoenus maritimus, Schoenoplectus pungens, Schoenoplectus tabernaemontani*, and/or *Scirpus microcarpus*. Stands are found throughout the central midwestern and western U.S. and Canada on sites flooded (on average 1 m deep) for most of the growing season.

OVERVIEW

Scientific Name: *Schoenoplectus americanus - Schoenoplectus acutus - Schoenoplectus californicus* Marsh Alliance
Common Name (Translated Scientific Name): Chairmaker's Bulrush - Hardstem Bulrush - California Bulrush Marsh Alliance
Colloquial Name: Western Emergent Bulrush Marsh

Type Concept: This alliance contains freshwater marshes dominated by one or two species of *Schoenoplectus, Scirpus*, and/or *Bolboschoenus*, such as *Schoenoplectus acutus (= Scirpus acutus), Schoenoplectus americanus, Bolboschoenus fluviatilis (= Scirpus*

fluviatilis), Bolboschoenus maritimus (= Scirpus maritimus), Schoenoplectus pungens (= Scirpus pungens), Schoenoplectus tabernaemontani (= Scirpus tabernaemontani), and/or *Scirpus microcarpus*. *Phragmites australis* may be present. This alliance occurs throughout the central midwestern and western U.S. and Canada. Stands are flooded for most of the growing season up to 1.5 m deep and often drain completely in the winter, exposing bare ground.

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:
- A3896 *Typha domingensis - Typha latifolia - Phragmites australis ssp. americanus* Western Marsh Alliance: can have stands codominated with *Schoenoplectus* or *Scirpus*, but the characteristic dominant is *Typha*.
- A3903 *Bolboschoenus maritimus - Schoenoplectus californicus* Salt Marsh Alliance: includes tidal coastal salt marshes of the western Pacific coast.

Diagnostic Characteristics: Stands of emergent vegetation in shallow water (<2 m) dominated by *Bolboschoenus, Scirpus* spp. and/or *Schoenoplectus* spp.

VEGETATION

Physiognomy and Structure: Vegetation is characterized by medium to tall perennial graminoids which typically range from 1 m to over 2 m.

Floristics: The vegetation is moderately dense to dense. Stands are typically dominated by one or two species of *Bolboschoenus, Schoenoplectus*, and/or *Scirpus*, and often have several other species of graminoids and forbs that are much shorter in stature. Abundant species include *Phragmites australis, Schoenoplectus acutus (= Scirpus acutus), Schoenoplectus americanus, Bolboschoenus fluviatilis (= Scirpus fluviatilis), Bolboschoenus maritimus (= Scirpus maritimus), Schoenoplectus pungens (= Scirpus pungens), Schoenoplectus tabernaemontani (= Scirpus tabernaemontani)*, and/or *Scirpus microcarpus*. Lower stature (and generally less abundant) species may include *Chenopodium incanum, Distichlis spicata* (on drier margins), Monolepis nuttalliana, Picradeniopsis oppositifolia, Ruppia maritima, Suaeda calceoliformis, amongst many others. Species composition and abundance can vary from year to year depending mostly on water level fluctuations and degree of salinity (which is generally mild). Floating aquatic species may also be present, such as *Lemna* spp. and *Utricularia macrorhiza*.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands of this alliance are flooded for most or all of the growing season and can have water levels from completely drained (exposed soil) to approximately 1.5 m deep, but are usually is less than 1 m. Within a stand, water levels can vary by up to 1 m during the year. The water is fresh to mildly saline. Some species are quite tolerant of saline conditions, but generally the salinity is mild or if strong than only seasonally so. Soils are deep, poorly drained muck, peat, or mineral.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance occurs throughout the central midwestern and western U.S. and Canada.

Nations: CA, US
States/Provinces: AB, AZ, BC, CA, CO, ID, KS, MT, ND, NM, NV, OK, OR, SD, TX, UT, WA, WY
TNC Ecoregions [optional]: 11:C, 17:C
USFS Ecoregions (2007): 322Ab:CCC, 341Fc:CCC, 341Fd:CCC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley); USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** *Schoenoplectus acutus* (Hardstem bulrush marsh) Alliance (Sawyer et al. 2009) [52.122.00]
- **>** *Schoenoplectus acutus* Alliance (Hardstem bulrush marsh) (Buck-Diaz et al. 2012)
- **>** *Schoenoplectus americanus* Alliance (American bulrush marsh) (Buck-Diaz et al. 2012)
- **>** *Schoenoplectus americanus* Herbaceous Alliance (Evens et al. 2014)
- **><** *Schoenoplectus californicus* (California bulrush marsh) Alliance (Sawyer et al. 2009) [52.114.00]
- **>** *Schoenoplectus californicus* Alliance (California bulrush marsh) (Buck-Diaz et al. 2012)

- **>** *Scirpus acutus-Scirpus californicus* Herbaceous Alliance (Keeler-Wolf and Evens 2006)
- **><** *Scirpus microcarpus* (Small-fruited bulrush marsh) Alliance (Sawyer et al. 2009) [52.113.00]

LOWER LEVEL UNITS

Associations:

- CEGL001587 *Schoenoplectus pungens* Marsh
- CEGL001843 *Bolboschoenus maritimus* Marsh
- CEGL001840 *Schoenoplectus acutus* Marsh
- CEGL003469 *Schoenoplectus californicus - Typha latifolia* Salt Marsh
- CEGL005988 *Schoenoplectus pungens - Distichlis spicata* Marsh
- CEGL004592 *Schoenoplectus americanus - Flaveria chlorifolia - (Helianthus paradoxus)* Marsh
- CEGL002623 *Schoenoplectus tabernaemontani* Temperate Marsh
- CEGL005989 *Schoenoplectus pungens - Paspalum distichum* Marsh
- CEGL001841 *Schoenoplectus americanus* Western Marsh
- CEGL001585 *Schoenoplectus americanus - Eleocharis palustris* Marsh

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel and M.S. Reid
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Bradley 1970, Buck-Diaz et al. 2012, Evens et al. 2014, Faber-Langendoen et al. 2017b, Keeler-Wolf and Evens 2006, Keeler-Wolf and Vaghti 2000, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Sproul et al. 2011, VegCAMP and AIS 2013

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G531. Arid West Interior Freshwater Marsh

A3896. Typha domingensis - Typha latifolia - Phragmites australis ssp. americanus Western Marsh Alliance

Type Concept Sentence: This native alliance contains freshwater cattail marshes dominated by *Typha domingensis, Typha latifolia*, and/or *Phragmites australis ssp. americanus*, which can be monotypic stands or codominated by bulrush species such as *Schoenoplectus acutus, Schoenoplectus americanus*, or *Schoenoplectus pungens*. It is found most commonly along lake margins and in shallow basins, and occasionally in river backwaters in the semi-arid western U.S., including the semi-arid western Great Plains, and adjacent Canada, and possibly Mexico.

OVERVIEW

Scientific Name: *Typha domingensis - Typha latifolia - Phragmites australis ssp. americanus* Western Marsh Alliance
Common Name (Translated Scientific Name): Southern Cattail - Broadleaf Cattail - American Common Reed Western Marsh Alliance
Colloquial Name: Western Emergent Cattail - Common Reed Marsh

Type Concept: This alliance contains stands dominated by native species *Typha angustifolia, Typha domingensis*, and/or *Phragmites australis ssp. americanus* either alone as monotypic stands or in combination with other tall emergent freshwater marsh species. Associated species vary widely; they include many sedges such as *Carex aquatilis, Carex pellita (= Carex lanuginosa), Carex rostrata*, bulrushes such as *Schoenoplectus acutus (= Scirpus acutus), Schoenoplectus americanus (= Scirpus americanus)*, and *Schoenoplectus heterochaetus (= Scirpus heterochaetus)*, and broad-leaved herbs such as *Asclepias incarnata, Impatiens capensis, Sagittaria latifolia, Scutellaria lateriflora, Sparganium eurycarpum*, and *Verbena hastata*. It is found most commonly along lake margins and in shallow basins, and occasionally in river backwaters and other deep water habitats of the semi-arid western U.S., including the semi-arid western Great Plains, and adjacent Canada and possibly Mexico.

Classification Comments: This association is limited to the western U.S. and adjacent Mexico and Canada and is intended to cover the native stands of *Typha* and/or *Phragmites australis ssp. americanus*. Compare with similar monotypic stands in central Great Plains and eastern U.S. alliances. *Typha angustifolia* is considered to be non-native in the western U.S. and was removed as a nominal species from this alliance and placed into a ruderal marsh alliance. Disturbed stands may have *Typha angustifolia* present to codominant; monotypic stands of *Typha angustifolia* would indicate conversion to a ruderal vegetation type.

Internal Comments: KAS 8-17: The distributions and concepts of this alliance and its group G531 Schoenoplectus spp. - Typha spp. Interior Freshwater Marsh Group need to be better distinguished between A3487 Typha angustifolia - Typha latifolia - Schoenoplectus spp. Marsh Alliance and group G325 Typha spp. - Schoenoplectus americanus - Scolochloa festucacea Great Plains

Freshwater Marsh Group. Cascading effect on associations also needs to be addressed. MX? added. mjr 1-17: CNPS recommends a rank of G5/S5.

Other Comments:

Similar NVC Types:

- A3895 *Schoenoplectus americanus - Schoenoplectus acutus - Schoenoplectus californicus* Marsh Alliance: can have bulrush - cattail marshes, but bulrushes are the dominant taxa.

Diagnostic Characteristics: Stands of emergent vegetation in shallow water (<2 m) dominated by native *Phragmites australis ssp. americanus* and/or native *Typha domingensis* or *Typha latifolia*.

VEGETATION

Physiognomy and Structure: Tall, emergent graminoid species, with cover usually dense, and averaging over 2 m, but <3 m in height. Shorter graminoids and forbs may be present, but typically are not abundant due to the dense cover of the taller species. When there is standing water during the growing season, floating and submerged aquatic species may be present.

Floristics: This alliance is characterized by the dominance of *Phragmites australis ssp. americanus, Typha domingensis*, and/or *Typha latifolia*, either alone or in combination with other tall emergent marsh species. Other graminoids commonly present can include *Carex aquatilis, Carex pellita (= Carex lanuginosa), Carex rostrata, Cyperus* spp., *Distichlis spicata, Eleocharis* spp., *Glyceria* spp., *Juncus* spp., *Schoenoplectus acutus (= Scirpus acutus), Schoenoplectus americanus (= Scirpus americanus), Schoenoplectus heterochaetus (= Scirpus heterochaetus), Schoenoplectus pungens (= Scirpus pungens), Schoenoplectus tabernaemontani (= Scirpus tabernaemontani)*, and *Setaria magna*. Forbs may include *Ambrosia psilostachya, Anemopsis californica, Asclepias incarnata, Epilobium ciliatum, Glycyrrhiza lepidota, Hibiscus moscheutos, Impatiens capensis, Iva axillaris, Mentha arvensis, Polygonum amphibium, Sagittaria latifolia, Scutellaria lateriflora, Sparganium eurycarpum, Thelypteris palustris, Verbena hastata*, and many others. Aquatic species such as *Bacopa eisenii, Lemna minor, Potamogeton* spp., and *Sagittaria* spp. may be present and dominate the water surface (Anderson 1982, MNNHP 1993, Hansen et al. 1995).

Vegetative diversity and density are highly variable in response to water depth, water chemistry, and natural forces. Vegetation in this alliance may be natural or semi-natural and includes mixed stands of the nominal species, as well as essentially monospecific stands. *Typha* often occurs in pure stands, and can colonize areas recently exposed by either natural or human causes. These monospecific stands occur especially in artificial wetlands, such as borrow pits or ponds.

ENVIRONMENT & DYNAMICS

Environmental Description: These are palustrine and lacustrine non- tidal cattail marshes. Elevations range from near sea level to around 2000 m. Many have a muck-bottom zone bordering the shoreline, where cattails are rooted in the bottom substrate, and a floating mat zone, where the roots grow suspended in a buoyant peaty mat. This alliance occurs on hydric soils in wetlands, ditches, ponds, lakes, and rivers, as well as on shorelines and streambanks. Inundation is commonly 3-6 dm (1-2 feet) in depth but can be as deep as 1.5 m for a significant part of the growing season. Occurrences may display areas of open water, but emergent vegetation dominates (80% cover). Seasonal flooding during winter and spring or flooding during heavy rains help maintain these marshes by causing water exchange which replenishes freshwater and circulates nutrients and organic debris. Soils which support this community can be mineral or organic but are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part. Sites can be inter-dune ponds, mainland ponds, impoundments and tanks with brackish water from storm flooding, storm tides, or island overwash, adjacent to shallow lakes or ponds (Bundy et al. 1996), in areas of standing water or subirrigation along major stream bottoms (Baker 1982b), or in old oxbows (Haase 1972). Running water is uncommon, except during periods of extensive irrigation runoff or because of high precipitation. Usually if the water table is below the surface, capillary action will keep the soil saturated to the surface. In Nevada, soils were described by Bundy et al. (1996) to be very deep, somewhat poorly drained and composed of fine-grained alluvium. They may be slightly saline, but not strongly so. *Typha domingensis* is more tolerant of alkaline conditions than *Typha latifolia*. Soils are characterized by accumulations of organic matter over deposits of fine silt and clay (Hansen et al. 1995), or loams, sandy loams, or coarse sand (Jones and Walford 1995, Bundy et al. 1996). *Typha* often occurs in pure stands, and can colonize areas recently exposed by either natural or human causes.

Dynamics: *Typha* species are prolific seed producers, spreading rapidly to become the early colonizers of wet mineral soil and will persist under wet conditions (Hansen et al. 1995). Roots and lower stems are well-adapted to prolonged submergence, but periods of draw-down are required for seed germination to occur (Hansen et al. 1995). Haase (1972) reported that *Typha domingensis* communities have expanded their distribution in the lower Gila River basin, due to increased irrigation runoff. *Typha angustifolia* occupies inundated and disturbed ground and can tolerate deeper water and higher alkalinity levels than *Typha latifolia* (Great Plains Flora Association 1986). These are important wetland communities for many species of birds and waterfowl. Hansen et al. (1995) report that in Montana heavy livestock use may convert stands to *Carex nebrascensis*-dominated communities.

DISTRIBUTION

Geographic Range: This alliance occurs throughout interior non-tidal marshes of the western U.S., including the semi-arid western Great Plains, and adjacent Canada, and possibly Mexico.

Nations: CA, MX?, US
States/Provinces: AB, AZ, BC, CA, CO, ID, MT, NE, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]: 4:C, 5:C, 6:C, 11:C, 12:C, 13:C, 14:C, 15:C, 16:C, 17:C, 23:C
USFS Ecoregions (2007): 261A:CC, 261B:CC, 262A:CC, 263A:CC, 322Ab:CCC, 322Al:CCC, 322B:CC, 322C:CC, 341D:CC, 341Fc:CCC, 342B:CC, M261A:CC, M261B:CC, M261C:CC, M261D:CC, M261E:CC, M261F:CC, M261G:CC, M262A:CC, M262B:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Channel Islands, Death Valley, Mojave); USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **=** *Typha (angustifolia, domingensis, latifolia)* (Cattail marshes) Alliance (Sawyer et al. 2009) [52.050.00]
- **=** *Typha (angustifolia, domingensis, latifolia)* Alliance (Cattail marshes) (Buck-Diaz et al. 2012)
- **=** *Typha (angustifolia, domingensis, latifolia)* Herbaceous Alliance (Evens et al. 2014)
- **=** *Typha (angustifolia, latifolia) - (Scirpus* spp.) Semipermanently Flooded Herbaceous Alliance [Provisional] (Keeler-Wolf et al. 2012)
- **=** *Typha domingensis - Typha latifolia - Typha angustifolia* Western Herbaceous Emergent Alliance (Rodriguez et al. 2017)
- **?** *Typha latifolia* Habitat Type (Hansen et al. 1995)
- **=** *Typha* (*angustifolia*, *domingensis*, *latifolia*) Herbaceous Alliance (CNPS 2017) [52.050.00]
- **><** Bulrush-Cattail Series (Sawyer and Keeler-Wolf 1995)
- **><** Cattail Series (Sawyer and Keeler-Wolf 1995)
- **><** Cismontane Alkali Marsh (#52310) (Holland 1986b)
- **><** Coastal Brackish Marsh (#52200) (Holland 1986b)
- **><** Coastal and Valley Freshwater Marsh (#52410) (Holland 1986b)
- **><** Montane Freshwater Marsh (#52430) (Holland 1986b)
- **><** Transmontane Alkali Marsh (#52320) (Holland 1986b)
- **><** Transmontane Freshwater Marsh (#52420) (Holland 1986b)

LOWER LEVEL UNITS

Associations:
- CEGL002010 *Typha (latifolia, angustifolia)* Western Marsh
- CEGL006866 *Phragmites australis ssp. americanus* Native Western Marsh
- CEGL001845 *Typha domingensis* Western Marsh

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel, M.S. Reid and K.A. Schulz
Acknowledgments:
Version Date: 2017/08/14

REFERENCES

References: Apfelbaum 1985, Baker 1982b, Baker and Kennedy 1985, Buck-Diaz et al. 2012, Bundy et al. 1996, Bunin 1985, CNPS 2017, Christy 1973, Cronquist et al. 1977, DiTomaso and Healy 2007, Dilts and Weisberg 2010, Evens and Kentner 2006, Evens and San 2006, Evens et al. 2014, Faber-Langendoen et al. 2017b, Ferren et al. 1996b, Grace and Wetzel 1981, Great Plains Flora Association 1986, Haase 1972, Hansen et al. 1991, Hansen et al. 1995, Hickson and Keeler-Wolf 2007, Holland 1986b, Jones and Walford 1995, Junak et al. 2007, Keeler-Wolf and Evens 2006, Keeler-Wolf and Vaghti 2000, Keeler-Wolf et al. 2012, Kittel et al. 1996, Kittel et al. 1999a, Klein et al. 2007, Komarkova 1976, Komarkova 1986, Kovalchik 1993, Lambert et al. 2016, Lambertini 2016, Lindauer 1978, Lindauer and Christy 1972, MacDonald 1988, Masek 1979, McEachern 1979, Mitsch and Gosselink 1993, Muldavin et al. 1993b, Muldavin et al. 2000a, Padgett et al. 1989, Pickart 2006, Rocchio pers. comm., Rodriguez et al. 2017, Sada and Cooper 2012, Saltonstall 2002, Saltonstall et al. 2004, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Simkins 1931, Smith and Allred 2016, Sproul et al. 2011, TNC 1995b, Thorne 1982, VegCAMP and AIS 2013, Youngblood et al. 1985a, Zedler 1982

M075. Western North American Montane-Subalpine-Boreal Marsh, Wet Meadow & Shrubland

This macrogroup contains montane to subalpine and alpine wet meadows, marshes and wet shrublands throughout the Rocky Mountains of the U.S. and Canada, the Sierra Nevada, and Intermountain cordillera. Dominant species include graminoids such as *Calamagrostis canadensis, Carex scopulorum, Carex utriculata, Glyceria striata*, forbs such as *Caltha leptosepala, Dodecatheon jeffreyi, Sibbaldia procumbens*, and shrub species such as, but not limited to, *Alnus incana, Betula occidentalis, Betula glandulosa*, and many *Salix* species.

2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
2.C.4.Nb.2.a. M075 Western North American Montane-Subalpine-Boreal Marsh, Wet Meadow & Shrubland

G526. Rocky Mountain-Great Basin Lowland-Foothill Riparian Shrubland

Type Concept Sentence: This group consists of riparian shrublands dominated by low to tall shrubs such as *Acer glabrum, Artemisia* spp., *Cornus sericea, Crataegus* spp., *Dasiphora fruticosa ssp. floribunda, Forestiera pubescens, Oplopanax horridus, Philadelphus lewisii, Prunus virginiana, Rhus trilobata, Rosa* spp., *Salix* spp., *Shepherdia argentea*, and *Symphoricarpos* spp. They do not occur up in the mountains, but rather in between mountain valleys and lowlands of the Interior West.

OVERVIEW

Scientific Name: *Salix exigua - Crataegus* spp. - *Forestiera pubescens* Rocky Mountain-Great Basin Riparian Shrubland Group
Common Name (Translated Scientific Name): Narrowleaf Willow - Hawthorn species - Stretchberry Rocky Mountain-Great Basin Riparian Shrubland Group
Colloquial Name: Silver Sagebrush Wet Shrubland

Type Concept: These short to tall shrublands (0.5-5 m in height) occur along streams at and below lower treeline, that is, not up in the mountains, but in between mountain valleys and lowlands of the Interior West. Dominant shrubs include *Acer glabrum, Artemisia cana, Artemisia cana ssp. bolanderi, Artemisia cana ssp. viscidula, Artemisia tridentata ssp. tridentata, Cornus sericea, Crataegus douglasii, Crataegus rivularis, Dasiphora fruticosa ssp. floribunda, Forestiera pubescens, Oplopanax horridus, Philadelphus lewisii, Prunus virginiana, Rhus trilobata, Rosa nutkana, Rosa woodsii, Salix exigua, Salix irrorata, Salix melanopsis, Shepherdia argentea*, and *Symphoricarpos* spp. Herbaceous layers are often dominated by *Athyrium filix-femina, Carex flava (= Carex nevadensis), Carex* spp., *Elymus trachycaulus, Equisetum arvense, Deschampsia cespitosa, Festuca idahoensis, Galium triflorum, Glyceria striata, Gymnocarpium dryopteris, Heracleum maximum, Iris missouriensis, Juncus arcticus ssp. littoralis (= Juncus balticus), Juncus* spp., *Leymus cinereus, Maianthemum stellatum, Muhlenbergia filiformis, Muhlenbergia richardsonis, Pascopyrum smithii, Poa cusickii*, and *Poa secunda (= Poa nevadensis)*. Introduced forage species such as *Agrostis stolonifera, Poa pratensis, Phleum pratense*, and the invasive annual *Bromus tectorum* are often present in disturbed stands. Streams are permanent, intermittent and ephemeral. Stands occur in steep-sided canyons or in broad flat valleys. They can be large, wide occurrences on mid-channel islands in larger rivers or narrow bands on small, rocky canyon tributaries and well-drained benches. They also are typically found in backwater channels and other perennially wet but less scoured sites, such as floodplain swales and irrigation ditches, and they can occur in depressional wetlands and non-alkaline playas. Stands may also occur on upper benches away from active channel movement. Willow-dominated shrublands require flooding and bare gravels for reestablishment. Stands are maintained by annual flooding and hydric soils throughout the growing season. Sites are subject to temporary flooding during spring runoff. The water table is often just below the ground surface. Occurrences are found within the flood zone of rivers, on islands, sand or cobble bars, and immediate streambanks and upper benches, and occasionally on hillslope springs. This group occurs throughout the Rocky Mountain and Colorado Plateau regions from approximately 780 to 1850 m (2560-6000 feet) in elevation, around the edges and between the mountain ranges of the Great Basin and along the lower eastern slope of the Sierra Nevada at about 1220 m (4000 feet) in elevation, at lowland and montane elevations in the Columbia Plateau, on the periphery of the mountains surrounding the Columbia River Basin, and along major tributaries and the main stem of the Columbia at relatively low elevations. It also occurs in the foothills of the northern Rocky Mountains and the east slopes of the Cascades in the lower montane and foothill zones. Climate is generally semi-arid.

Classification Comments: This group represents a range of short to tall shrubs (0.5-5 m in height). This group also represents lower elevation and foothill elevations shrublands. Higher elevation shrublands belong to Western Montane-Subalpine Riparian & Seep Shrubland Group (G527).

Similar NVC Types:
- G322 Vancouverian Wet Shrubland
- G527 Western Montane-Subalpine Riparian & Seep Shrubland: includes riparian shrublands that occur at high elevations and are dominated by more montane species, for example *Salix monticola*.

- G545 Colorado Plateau Hanging Garden Seep
- G568 Great Plains Riverscour Vegetation
- G337 Great Plains Riparian Wet Meadow & Shrubland

Diagnostic Characteristics: Short to tall (0.5-5 m) riparian and wetland shrublands at foothill and lower elevations of the temperate interior West.

VEGETATION

Physiognomy and Structure: Wetland and mesic shrublands dominated by short to tall shrubs (0.5-5 m).

Floristics: Dominant shrubs include *Acer glabrum, Amelanchier alnifolia, Artemisia cana ssp. bolanderi, Artemisia cana ssp. viscidula, Artemisia cana, Artemisia tridentata ssp. tridentata, Cornus sericea, Crataegus douglasii, Crataegus rivularis, Dasiphora fruticosa ssp. floribunda, Forestiera pubescens, Oplopanax horridus, Philadelphus lewisii, Prunus virginiana, Rhus trilobata, Rosa nutkana, Rosa woodsii, Salix exigua (= ssp. exigua), Salix irrorata, Salix melanopsis, Shepherdia argentea*, and *Symphoricarpos* spp. Herbaceous layers are often dominated by *Athyrium filix-femina, Carex flava (= Carex nevadensis), Carex* spp., *Elymus trachycaulus, Equisetum arvense, Deschampsia cespitosa, Festuca idahoensis, Galium triflorum, Glyceria striata, Gymnocarpium dryopteris, Heracleum maximum, Iris missouriensis, Juncus arcticus ssp. littoralis (= Juncus balticus), Juncus* spp., *Leymus cinereus, Maianthemum stellatum, Muhlenbergia filiformis, Muhlenbergia richardsonis, Pascopyrum smithii, Poa cusickii*, and *Poa secunda (= Poa nevadensis)*. Introduced forage species such as *Agrostis stolonifera, Poa pratensis, Phleum pratense*, and the invasive annual *Bromus tectorum* are often present in disturbed stands. Floristic information was compiled from the following sources: Daubenmire (1952), Johnson and Simon (1985), Kovalchik (1987, 1992), Hansen et al. (1989), Manning and Padgett (1989, 1995), Padgett et al. (1989), Szaro (1989), MacKinnon et al. (1990), Banner et al. (1993), Delong et al. (1993), Sawyer and Keeler-Wolf (1995), Walford (1996), Crowe and Clausnitzer (1997), Steen and Coupe (1997), Walford et al. (1997, 2001), Kittel et al. (1999b), Muldavin et al. (2000a), Delong (2003), MacKenzie and Moran (2004), and Sawyer et al. (2009).

ENVIRONMENT & DYNAMICS

Environmental Description: *Climate:* Climate is generally semi-arid continental with typically cold winters and hot summers. *Soil/substrate/hydrology:* These shrublands occur along all streams at and below lower treeline, that is, not up in the mountains, but in the between- mountain valleys and lowlands of the interior west. Streams are permanent, intermittent and ephemeral. Stands occur in steep-sided canyons or in broad flat valleys. They can be large, wide occurrences on mid-channel islands in larger rivers or narrow bands on small, rocky canyon tributaries and well-drained benches. They also are typically found in backwater channels and other perennially wet but less scoured sites, such as floodplain swales and irrigation ditches, and they can occur in depressional wetlands and non-alkaline playas, on hillside seeps and springs. These shrublands require flooding and bare gravels for reestablishment. Willow-dominated stands are maintained by annual flooding and hydric soils throughout the growing season. Sites are subject to temporary flooding during spring runoff. The water table is often just below the ground surface. Occurrences are found within the flood zone of rivers, on islands, sand or cobble bars, immediate streambanks and upper benches. Soils are typically alluvial deposits of sand, clays, silts and cobbles that are highly stratified with depth due to flood scour and deposition. Highly stratified profiles consist of alternating layers of clay loam and organic material with coarser sand or thin layers of sandy loam over very coarse alluvium. Soils are fine-textured with organic material over coarser alluvium. Some soils are more developed due to a slightly more stable environment and greater input of organic matter. Environmental information was compiled from the following sources: Daubenmire (1952), Johnson and Simon (1985), Kovalchik (1987, 1992), Hansen et al. (1989), Manning and Padgett (1989, 1995), Padgett et al. (1989), Szaro (1989), MacKinnon et al. (1990), Banner et al. (1993), Delong et al. (1993), Sawyer and Keeler-Wolf (1995), Walford (1996), Crowe and Clausnitzer (1997), Steen and Coupe (1997), Walford et al. (1997, 2001), Kittel et al. (1999b), Muldavin et al. (2000a), Delong (2003), MacKenzie and Moran (2004), and Sawyer et al. (2009).

Dynamics: Willow-dominated associations are disturbance-driven systems that require flooding, scour and deposition for germination and maintenance. Livestock grazing is a major influence in altering structure, composition, and function of the community (Baker 1988, 1989a, Padgett et al. 1989).

DISTRIBUTION

Geographic Range: This group is found throughout the Rocky Mountain and Colorado Plateau regions from approximately 900 to 1850 m (3000-6000 feet) in elevation, in the mountain ranges of the Great Basin and along the eastern slope of the Sierra Nevada from about 1220 m (4000 feet) in elevation, at lowland and montane elevations in the Columbia Plateau, on the periphery of the mountains surrounding the Columbia River Basin, and along major tributaries and the main stem of the Columbia at relatively low elevations. It also occurs in the northern Rocky Mountains and the east slopes of the Cascades in the lower montane and foothill zones.

Spatial Scale & Pattern [optional]: Linear, Small patch
Nations: CA, US

States/Provinces: AB, AZ, BC, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]: 6:C, 7:C, 8:C, 9:C, 11:C, 12:C, 18:C, 19:C, 20:C, 25:C, 26:C, 68:C
USFS Ecoregions (2007): 313A:CC, 313B:CC, 313D:CC, 315A:CC, 315H:CC, 321A:CC, 322A:CC, 331A:CC, 331B:CC, 331D:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 331J:CC, 331K:C?, 331N:CP, 341A:CC, 341B:CC, 341C:CC, 341D:CC, 341E:CC, 341F:CC, 341G:CC, 342A:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:CC, 342I:CC, 342J:CC, M242C:CC, M242D:CP, M261D:CC, M261E:CC, M261G:CC, M313A:CC, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M341A:CC, M341B:CC, M341C:CC, M341D:CC
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **><** Other Sagebrush Types (408) (Shiflet 1994) [Artemisia cana ssp. viscidula shrublands are included.]
- **<** Riparian (422) (Shiflet 1994)

LOWER LEVEL UNITS

Alliances:
- A3800 *Salix exigua - Salix irrorata* Shrubland Alliance
- A2557 *Artemisia cana* Wet Shrubland Alliance
- A3799 *Rhus trilobata - Crataegus rivularis - Forestiera pubescens* Shrubland Alliance

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2011)
Author of Description: G. Kittel
Acknowledgments: J. Nachlinger, K. Schulz, J. Kagan, M.S. Reid
Version Date: 12/02/2015
Classif Resp Region: West
Internal Author: GK 12-10, 9-13, 12-15, 7-16

REFERENCES

References: Baker 1988, Baker 1989a, Baker 1989b, Baker 1990, Banner et al. 1993, Barbour and Billings 1988, Carsey et al. 2003a, Crowe and Clausnitzer 1997, Daubenmire 1952, DeLong 2003, DeLong et al. 1993, Eyre 1980, Faber-Langendoen et al. 2017a, Hansen et al. 1988b, Hansen et al. 1989, Johnson and Simon 1985, Kittel et al. 1999b, Kovalchik 1987, Kovalchik 1993, MacKenzie and Moran 2004, MacKinnon et al. 1990, Manning and Padgett 1989, Manning and Padgett 1995, Muldavin et al. 2000a, Padgett et al. 1989, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Shiflet 1994, Steen and Coupé 1997, Szaro 1989, Walford 1996, Walford et al. 1997, Walford et al. 2001

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G526. Rocky Mountain-Great Basin Lowland-Foothill Riparian Shrubland

A2557. Artemisia cana Wet Shrubland Alliance

Type Concept Sentence: This alliance consists of stands dominated by *Artemisia cana ssp. viscidula* or *Artemisia cana ssp. bolanderi*. It occurs in relatively moist environments, including riparian areas, alkaline or saline playa lakes, and is found throughout the northern half of the Intermountain West.

OVERVIEW

Scientific Name: *Artemisia cana* Wet Shrubland Alliance
Common Name (Translated Scientific Name): Silver Sagebrush Wet Shrubland Alliance
Colloquial Name: Silver Sagebrush Wet Shrubland

Type Concept: This is an alliance of shrublands dominated by *Artemisia cana ssp. viscidula* or *Artemisia cana ssp. bolanderi* where the shrub layer ranges from 0.5-1.5 m tall and the canopy cover ranges from 10-60%. In most stands, *Artemisia cana ssp. viscidula* or *Artemisia cana ssp. bolanderi* is the only dominant shrub, although other shrubs can be present. Herbaceous cover can be abundant to very sparse, but perennial graminoids generally total less than 20% cover. Species include *Danthonia intermedia, Deschampsia cespitosa, Eleocharis palustris, Elymus elymoides, Festuca idahoensis, Festuca ovina, Festuca thurberi, Leymus cinereus, Muhlenbergia richardsonis, Poa cusickii*, and *Poa secunda (= Poa nevadensis)*. It occurs in relatively moist environments, including riparian areas, alkaline or saline playa lakes. This alliance occurs throughout the northern half of the Intermountain West.

Classification Comments: Sites are subirrigated and are not always considered wet or riparian, but they are more moist than other upland sage types.

There are taxonomic problems with the subspecies of *Artemisia cana*. For example, according to Kartesz (1999), the subspecies *bolanderi* is not reported to occur in Oregon, but is reported to occur by the Oregon Natural Heritage Program. Thus, the distribution of this alliance is subject to change as updated information becomes available.

The relationship of this alliance to others dominated by *Artemisia cana* is unclear. The hydrological divisions in the *Artemisia cana* group are poorly distinguished, particularly in the literature. In montane and subalpine meadows and along riparian stringers of western mountain ranges, *Artemisia cana* communities are often the driest of the recognizable riparian habitats. This transitional position and the broad floodplains where these shrublands typically occur blur wetland/upland distinctions. Most of these riparian stands have been placed in the temporarily flooded alliance. Although these sites generally have seasonally saturated soils and shallow water tables, the frequency of flooding is probably highly variable.

Internal Comments:
Other Comments:

Similar NVC Types:
- A3200 *Artemisia cana ssp. bolanderi - Artemisia cana ssp. viscidula* Steppe & Shrubland Alliance

Diagnostic Characteristics: Valley bottom stands dominated by *Artemisia cana ssp. viscidula* or *Artemisia cana ssp. bolanderi*.

VEGETATION

Physiognomy and Structure: These are microphyllous evergreen shrublands, often with a well-developed graminoid layer. Shrubs can be widely spaced or close together. When widely spaced, robust bunch or rhizomatous grasses can dominate the understory. The graminoids may exceed the shrubs in height and total cover in the open stands.

Floristics: In most stands, *Artemisia cana ssp. viscidula* or *Artemisia cana ssp. bolanderi* will be the only dominant shrub. *Artemisia tridentata* is the most consistent associate shrub species across the range of this alliance. Other shrubs may be common, including *Artemisia frigida, Ericameria nauseosa (= Chrysothamnus nauseosus), Gutierrezia sarothrae, Purshia tridentata, Rosa woodsii, Symphoricarpos occidentalis*, or *Symphoricarpos oreophilus*. At higher elevations *Artemisia tridentata ssp. vaseyana* occasionally occurs, and in alkaline areas *Atriplex canescens, Ericameria nauseosa (= Chrysothamnus nauseosus)*, or *Sarcobatus vermiculatus* may be present. The herbaceous layer is usually well-represented, but bare ground may be common in particularly arid or disturbed stands. Important understory associates include *Achnatherum occidentale, Carex praegracilis, Danthonia intermedia, Deschampsia cespitosa, Distichlis spicata, Eleocharis palustris, Elymus caninus, Elymus elymoides, Elymus elymoides, Elymus trachycaulus, Festuca idahoensis, Festuca ovina, Festuca thurberi, Hesperostipa comata (= Stipa comata), Koeleria macrantha (= Koeleria nitida), Leymus cinereus, Muhlenbergia richardsonis, Nassella viridula, Pascopyrum smithii, Poa cusickii, Poa fendleriana ssp. fendleriana*, and *Poa secunda (= Poa nevadensis)*. Common exotic associates include *Poa pratensis, Taraxacum officinale*, and *Agrostis stolonifera*. Among the forbs that are typically found are *Achillea millefolium, Arnica* spp., *Artemisia ludoviciana, Astragalus lentiginosus, Astragalus* spp., *Camissonia tanacetifolia, Cirsium foliosum, Conyza canadensis, Epilobium brachycarpum, Fragaria virginiana, Gnaphalium palustre, Hymenoxys hoopesii (= Helenium hoopesii), Linum perenne, Lupinus argenteus, Madia gracilis, Navarretia intertexta, Orthocarpus* ssp., *Perideridia gairdneri ssp. borealis (= Perideridia montana), Polyctenium fremontii, Potentilla gracilis, Rorippa* spp., *Symphyotrichum campestre var. bloomeri (= Aster campestris var. bloomeri), Trifolium gymnocarpon*, and/or *Trifolium* spp.

ENVIRONMENT & DYNAMICS

Environmental Description: These shrublands are found between 1000 and 3300 m (3280-10,800 feet) in elevation. Stands occur on soils with a seasonally high table along low-gradient streams, in broad valleys, and in and around playas (internally drained basins with seasonal flooding). At its highest elevations, this alliance can be found in upland situations where more favorable soil conditions exist. Precipitation varies across the range, from less than 25 cm in semi-arid basins of southeastern Oregon, to over 90 cm in moist meadow habitats of the northern Rocky Mountains. The alliance occurs as an upper terrace community along mountain streams, where soils are saturated in spring and water tables remain within 0.5 m (2 feet) of the soil surface in May and June, dropping to 1.2-1.6 m (4-5.5 feet) below the soil surface in July through September. Other stands occur in valley bottoms without an active surface stream, but with subsurface irrigation. They can also occur in perennially moist, semi-alkaline playa lakebeds above 1065 m. Playas can be flooded for several months during the winter and early spring but rapidly dry up as the weather warms. Topography is usually mild, soils are fine to somewhat coarse alluvial soils, and some source of subsurface moisture is often present. Available water-holding capacity is moderately high. Some stands occur on well-drained, often sandy, glacial drift and sandy alluvium (Comer et al. 1999). Where herbaceous growth is vigorous and decomposition rates are low due to a high water table, soils may develop organic profiles.

Dynamics: This alliance is often grazed by domestic livestock and is strongly preferred during the growing season. Prolonged livestock use can decrease the abundance of native bunchgrasses and increase the cover of shrubs and non-native species, such as

Poa pratensis and *Taraxacum officinale*. Unlike other *Artemisia* spp., *Artemisia cana* resprouts vigorously following spring fire, and prescribed burning may increase shrub cover. Conversely, fire in the fall may decrease shrub abundance. Comparisons of grazed and protected (ungrazed) floodplain sites showed a tendency for *Artemisia cana* to occur more commonly in grazed than ungrazed sites with similar groundwater hydrology.

DISTRIBUTION

Geographic Range: This alliance is found west of the Continental Divide from the Rocky Mountains across the Great Basin to the Sierra Nevada and Cascade Range.

Nations: US
States/Provinces: CA, CO, ID, MT, NV, OR, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** *Artemisia cana* (Silver sagebrush scrub) Alliance (Sawyer et al. 2009) [35.150.00]
- **=** *Artemisia cana* Shrubland Alliance (CNPS 2017) [35.150.00]
- **<** SRM Cover Type #408 - Other Sagebrush Types (Shiflet 1994)

LOWER LEVEL UNITS

Associations:

- CEGL001552 *Artemisia cana ssp. viscidula / Festuca idahoensis* Shrub Wet Meadow
- CEGL001074 *Artemisia cana ssp. viscidula / Deschampsia cespitosa* Wet Shrubland
- CEGL001076 *Artemisia cana ssp. viscidula / Festuca ovina* Wet Shrubland
- CEGL001075 *Artemisia cana ssp. viscidula* - (*Salix* spp.) / *Festuca idahoensis* Wet Shrubland
- CEGL005998 *Artemisia cana / Juncus arcticus ssp. littoralis* Wet Shrubland
- CEGL001460 *Artemisia cana (ssp. bolanderi, ssp. viscidula) / Leymus cinereus* Wet Shrubland
- CEGL002987 *Artemisia cana ssp. bolanderi / Eleocharis palustris* Wet Shrubland
- CEGL001743 *Artemisia cana ssp. bolanderi / Muhlenbergia richardsonis* Wet Shrub Meadow
- CEGL003475 *Artemisia cana ssp. bolanderi / Iris missouriensis - Juncus arcticus ssp. littoralis* Wet Shrubland
- CEGL001548 *Artemisia cana (ssp. bolanderi, ssp. viscidula) / Poa secunda* Wet Shrubland

AUTHORSHIP

Primary Concept Source: S. Rust, D. Tart, D. Sarr, J. Tuhy, M.S. Reid, R.J. Rondeau, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Bramble-Brodahl 1978, CNPS 2017, Chappell et al. 1997, Comer et al. 1999, Cunningham 1971, Daubenmire 1970, Dealy 1971, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Francis 1983, Franklin and Dyrness 1973, Hansen et al. 1984, Hansen et al. 1991, Hansen et al. 1995, Hanson and Whitman 1938, Hess 1981, Hironaka et al. 1983, Jankovsky-Jones et al. 2001, Johnston 1987, Kartesz 1999, Kovalchik 1987, Manning and Padgett 1991, Manning and Padgett 1995, Mueggler and Stewart 1980, Mutz and Graham 1982, Mutz and Queiroz 1983, ORNHP unpubl. data, Padgett 1982, Padgett et al. 1988b, Padgett et al. 1989, Reid et al. 1994, Sarr 1995, Sawyer et al. 2009, Schlatterer 1972, Shiflet 1994, Soil Conservation Service 1978, Tiedemann et al. 1987, Tuhy 1981, Tuhy and Jensen 1982, Turner 1969, USFS 1992, Winward 1980b, Youngblood et al. 1985a

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G526. Rocky Mountain-Great Basin Lowland-Foothill Riparian Shrubland

A3799. Rhus trilobata - Crataegus rivularis - Forestiera pubescens Shrubland Alliance

Type Concept Sentence: This shrubland alliance is dominated by *Corylus cornuta, Crataegus rivularis, Elaeagnus commutata, Forestiera pubescens, Rhamnus alnifolia, Shepherdia argentea*, and/or *Rhus trilobata*. Usually these are single-species shrublands, but all occupy similar environments. It is an eclectic mix of mesic shrubs that form small, narrow stands at the base of steep hills and cliffs and along washes and upper benches and terraces of riparian areas in the Rocky Mountains and throughout the cool interior western U.S. These are "fringe" riparian shrublands that occur on upper benches and terraces, dry washes and areas near but not necessarily in the wettest part of riparian areas, but receive more moisture than surrounding upland slopes.

OVERVIEW

Scientific Name: *Rhus trilobata - Crataegus rivularis - Forestiera pubescens* Shrubland Alliance
Common Name (Translated Scientific Name): Skunkbush Sumac - River Hawthorn - Stretchberry Shrubland Alliance
Colloquial Name: Skunkbush Sumac - River Hawthorn - Stretchberry Shrubland

Type Concept: This semi-riparian shrubland alliance is dominated by *Corylus cornuta, Crataegus rivularis, Elaeagnus commutata, Forestiera pubescens, Rhamnus alnifolia, Shepherdia argentea*, and/or *Rhus trilobata*, generally in monotypic stands, but they can be mixed as well. Other shrub associates may include *Prunus virginiana*. It is an eclectic mix of mesic shrubs that form small, narrow stands at the base of steep hills and cliffs and along washes and upper benches and terraces of riparian areas. These are "fringe" riparian shrublands that occur on upper benches and terraces, dry washes and areas near but not necessarily in the wettest part of riparian areas, but which receive more moisture than surrounding upland slopes. Often these are single-species shrublands, but all occupy similar environments. The alliance has a broad north to south range in the Rocky Mountains and throughout the cool interior western U.S.

Classification Comments: Includes shrub species that generally do not form large stands in upland environments.

Internal Comments: mjr 12-14: CA added for MOJN.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Greater than 30% relative cover of *Corylus cornuta, Crataegus rivularis, Elaeagnus commutata, Forestiera pubescens, Rhamnus alnifolia*, and/or *Rhus trilobata*.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a typically dense, cold-deciduous shrub layer (approximately 70% cover). The herbaceous layer is also dense and is dominated by perennial graminoids (80%). Forbs have relatively sparse cover (<20%), but have high diversity. Moss has high cover in some stands (70%).

Floristics: Stands have a dense layer of cold-deciduous shrubs (<2 m) that are dominated by *Amelanchier alnifolia, Elaeagnus commutata, Lonicera involucrata, Prunus virginiana, Rhamnus alnifolia, Ribes lacustre, Rosa woodsii*, and/or *Symphoricarpos albus*. A few other shrubs species, such as *Salix bebbiana* or *Salix exigua*, may be co-associates, but these are not abundant and do not characterize the stand. The herbaceous layer is typically dense with graminoids such as *Calamagrostis canadensis, Elymus glaucus, Elymus lanceolatus, Hesperostipa comata (= Stipa comata)*, and *Koeleria macrantha*. Dominant forbs include *Dryas drummondii, Galium triflorum, Geum macrophyllum, Heracleum maximum (= Heracleum lanatum)*, and *Maianthemum stellatum*. The spikemoss *Selaginella densa* can be abundant in some stands. Introduced grasses such as *Bromus inermis, Poa pratensis*, and *Phleum pratense* can also be abundant.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands are generally found on elevated benches along streams, on floodplains, adjacent to seeps and can form narrow stringers on stream terraces. Elevations range from approximately 700 to 2400 m. Sites are gently sloping and are temporarily flooded during spring runoff and high-intensity rainstorms. Soils are alluvial or may be well-developed Mollisols.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is found throughout the Rocky Mountains and other areas of the cool interior western U.S. and is documented from eastern Oregon and Washington, Idaho, Alberta, Montana, Wyoming, Colorado, New Mexico, Utah and the highlands of northern Arizona.

Nations: CA, US
States/Provinces: AB, AZ, CA, CO, ID, MT, NM, OR, UT, WA, WY

TNC Ecoregions [optional]: 11:C, 17:C
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Mojave); USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** *Forestiera pubescens* (Desert olive patches) Alliance (Sawyer et al. 2009) [61.580.00]
- **>** *Forestiera pubescens* Alliance (Desert olive patches) (Buck-Diaz et al. 2012)
- **>** *Forestiera pubescens* Shrubland Alliance (Evens et al. 2014)
- **?** *Rhus trilobata* (Basket bush thickets) Provisional Alliance (Sawyer et al. 2009) [37.802.00]

LOWER LEVEL UNITS

Associations:

- CEGL001098 *Elaeagnus commutata* Wet Shrubland
- CEGL001132 *Rhamnus alnifolia* Riparian Wet Shrubland
- CEGL001168 *Forestiera pubescens* Wet Shrubland
- CEGL002889 *Crataegus rivularis* Wet Shrubland
- CEGL002903 *Corylus cornuta* Wet Shrubland
- CEGL001121 *Rhus trilobata* Moist Wet Shrubland
- CEGL001108 *Prunus virginiana - (Prunus americana)* Wet Shrubland

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2016/10/17

REFERENCES

References: Buck-Diaz et al. 2012, Bursik and Moseley 1995, DeVelice et al. 1995, Evens et al. 2014, Faber-Langendoen et al. 2017b, Hansen and Hoffman 1988, Hansen et al. 1995, Harvey 1980, Jones 1992b, Sawyer et al. 2009, Thompson and Hansen 2002, VegCAMP and AIS 2013, Welsh et al. 1987, Youngblood et al. 1985a

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G526. Rocky Mountain-Great Basin Lowland-Foothill Riparian Shrubland

A3800. Salix exigua - Salix irrorata Shrubland Alliance

Type Concept Sentence: This riparian shrubland alliance is dominated by *Salix exigua, Salix irrorata*, and/or *Salix melanopsis*. The canopy is tall (2-5 m), and typically many-branched with continuous cover of 60-100%. Communities occur along streams throughout the western U.S. They are found in streamsides, marshes and wet ditches.

OVERVIEW

Scientific Name: *Salix exigua - Salix irrorata* Shrubland Alliance
Common Name (Translated Scientific Name): Narrowleaf Willow - Dewystem Willow Shrubland Alliance
Colloquial Name: Narrowleaf Willow - Dewystem Willow Shrubland

Type Concept: Dominant species are *Salix exigua, Salix interior, Salix irrorata*, and/or *Salix melanopsis*. It is typically a monotypic stand with some herbaceous understory; however, other shrubs and trees can be present. The herbaceous stratum can have sparse to moderate cover, including a variety of pioneer species. Other codominants may include *Populus fremontii, Populus deltoides, Populus angustifolia*, and *Acer negundo*. Other shrubs within this alliance consist of *Alnus incana, Cornus sericea, Rosa* spp., *Rubus idaeus ssp. strigosus (= Rubus strigosus), Ribes aureum, Ribes inerme*, and other *Salix* species. Common herbaceous species include *Artemisia ludoviciana, Epilobium* spp., *Equisetum* spp., *Fragaria virginiana ssp. glauca (= Fragaria ovalis), Geranium* spp., *Hackelia* spp., *Maianthemum stellatum, Mertensia ciliata, Osmorhiza occidentalis, Thalictrum fendleri*, and *Urtica dioica*. Non-native species can be abundant, such as *Poa pratensis, Bromus inermis, Taraxacum officinale*, and *Cirsium arvense*. Elevation ranges from 0 to 2950 m (0-9680 feet). These shrublands are found on open sand and gravel bars without tree canopy shading, on a wide variety of streams and rivers and even ditches. *Salix exigua* is one of the most common willows found throughout the western U.S. *Salix irrorata* has similar habitat, but a much more limited range of distribution. Stands are associated with annual flooding and inundation and will grow well into the active stream channel, where it is flooded, even in drier years. Even though flooding is frequent, surface water may not be present for much of the growing season, and the water table is well below the surface,

especially in the warmer and hotter parts of the western U.S. Some stands form large, wide stands on mid-channel islands on larger rivers, or narrow stringer bands on small, rocky tributaries. Streams range widely from moderately sinuous and moderate-gradient reaches to broad, meandering rivers with wide floodplains or broad, braided channels. Many stands also occur within highly entrenched or eroding gullies.

Classification Comments: *Salix interior* Rowlee has been recently raised to species level and was formerly *Salix exigua* Nutt. subsp. *interior* (Rowlee) Cronquist. Stands west of the 100th meridian are included in the concept of this alliance, including those stands in eastern Wyoming, Montana, Colorado and New Mexico.

Internal Comments:
Other Comments:

Similar NVC Types:
- A3646 *Salix interior* Riverscour Shrubland Alliance: occurs in the Great Plains, midwestern and eastern U.S.

Diagnostic Characteristics: Greater than 5% relative cover of *Salix exigua, Salix interior, Salix irrorata*, and/or *Salix melanopsis*.

VEGETATION

Physiognomy and Structure: The canopy is dominated by a tall (2-5 m), broad-leaved deciduous shrub that is typically many-branched with continuous cover of 60-100%. The herbaceous stratum is sparse to moderate cover, including a variety of pioneer species.

Floristics: Plant associations within this alliance are characterized as temporarily flooded cold-deciduous shrublands dominated by *Salix exigua, Salix irrorata, Salix melanopsis*, and/or *Salix interior*. The tall-shrub layer has 15-90% cover, ranging in height between 2-5 m. Other shrubs can occur in the canopy, including *Salix eriocephala, Salix lasiolepis, Salix ligulifolia, Salix lutea*, and/or *Salix monticola*. Occasionally, taller *Acer negundo, Alnus rhombifolia, Juglans hindsii, Populus angustifolia, Populus deltoides, Populus balsamifera, Populus fremontii, Salix gooddingii, Salix laevigata, Salix lucida, Salix amygdaloides*, or *Tamarix* spp. occur within the tree subcanopy. The herbaceous layer varies greatly over the broad range of the alliance. It may have as much as 20-35% cover of various graminoid species, including *Carex nebrascensis, Carex pellita (= Carex lanuginosa), Equisetum arvense, Muhlenbergia rigens, Panicum bulbosum, Phalaris arundinacea*, and *Spartina pectinata*. Other common herbaceous species include *Artemisia ludoviciana, Epilobium* spp., *Equisetum* spp., *Fragaria virginiana ssp. glauca (= Fragaria ovalis), Geranium* spp., *Hackelia* spp., *Maianthemum stellatum, Mertensia ciliata, Osmorhiza occidentalis, Glycyrrhiza lepidota, Thalictrum fendleri*, and *Urtica dioica*. Non-native species can be abundant, such as *Medicago sativa, Agrostis gigantea, Agrostis stolonifera, Poa pratensis, Bromus inermis, Melilotus officinalis, Taraxacum officinale, Cirsium arvense*, and/or Trifolium repens. The understory can also have no herbaceous growth at all and be completely barren ground, gravels or other alluvium.

ENVIRONMENT & DYNAMICS

Environmental Description: Plant associations within this alliance are located on floodplains and gravel bars at an elevational range between 0 and 2950 m (0-9680 feet) in the western U.S. These shrublands are found on open sandbars without canopy shading on large or small streams and rivers with sandy or cobble substrates. They are associated with annual flooding and inundation and will grow well into the active river channel, where it is flooded even in drier years. Even though flooding is frequent, surface water is not present for much of the growing season, and the water table is well below the surface, especially in warmer and drier parts of the western U.S. Some stands form large, wide stands on mid-channel islands on larger rivers, or narrow stringer bands on small, rocky tributaries. Stream reaches range widely from moderately sinuous and moderate-gradient reaches to broad, meandering rivers with wide floodplains or broad, braided channels. Many stands also occur within highly entrenched or eroding gullies. It can be found along wet ditches as well.

Soils of this alliance are typically coarse alluvial deposits of sand, silt and cobbles that are highly stratified with depth from flooding scour and deposition. The stratified profiles consist of alternating layers of clay loam and organic material with coarser sand or thin layers of sandy loam over very coarse alluvium. Occasionally, stands may occur on deep pockets of sand. The pH of the substrate ranges from 6.0-6.8 (Johnston 1987).

Dynamics: This alliance represents an early-seral primary successional stage on newly deposited sediments that may persist under a regime of repeated fluvial disturbance. *Salix exigua, Salix interior*, and *Salix irrorata* are highly adapted to most forms of disturbance, are prolific sprouters, and will re-establish themselves on sites dominated by other disturbance-associated species, e.g., *Glycyrrhiza lepidota* and *Pascopyrum smithii*.

DISTRIBUTION

Geographic Range: This alliance is found throughout the lower elevations of the Interior West from Arizona to Alberta west to California and Washington.

Nations: CA, US
States/Provinces: AB, AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Salix* spp. Series (Johnston 1987)
- **?** Plains and Great Basin Riparian Wetlands (Brown 1982a)

LOWER LEVEL UNITS

Associations:
- CEGL001198 *Salix exigua / Elymus x pseudorepens* Wet Shrubland
- CEGL001214 *Salix irrorata* Wet Shrubland
- CEGL001197 *Salix exigua* Riparian Wet Shrubland
- CEGL002655 *Salix exigua - Salix ligulifolia* Wet Shrubland
- CEGL001202 *Salix exigua* / Mesic Forbs Wet Shrubland
- CEGL001204 *Salix exigua - Salix lucida ssp. caudata* Wet Shrubland
- CEGL005656 *Salix exigua* / Gravel Bar Wet Shrubland
- CEGL001201 *Salix exigua / Equisetum arvense* Wet Shrubland
- CEGL005986 *Salix irrorata / Carex rostrata* Wet Shrubland
- CEGL005987 *Salix irrorata / Eleocharis palustris* Wet Shrubland
- CEGL005984 *Salix irrorata - Salix exigua* Wet Shrubland
- CEGL005983 *Salix irrorata - Cornus sericea ssp. sericea* Wet Shrubland
- CEGL005985 *Salix irrorata - Salix lucida ssp. lasiandra* Wet Shrubland
- CEGL001203 *Salix exigua* / Mesic Graminoids Western Wet Shrubland

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2016/10/17

REFERENCES

References: Borchert et al. 2004, Brown 1982a, Brown et al. 1979, Christy 1973, Cooper and Cottrell 1990, Dale and Kuroda 1979, Dick-Peddie 1993, Dick-Peddie et al. 1984, Dorn 1997, Evenden 1990, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Hansen et al. 1989, Hansen et al. 1991, Hansen et al. 1995, Johnston 1987, Jones and Walford 1995, Kagan 1997, Kearney et al. 1969, Kittel 1994, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1995, Kittel et al. 1996, Kittel et al. 1999a, Kovalchik 1987, Martin and Hutchins 1980, Muldavin et al. 1993a, Muldavin et al. 1994a, Muldavin et al. 2000a, Myhre and Clements 1972, Padgett et al. 1988b, Padgett et al. 1989, Phillips 1977, Sawyer and Keeler-Wolf 1995, Shelford 1954, Szaro 1989, Thompson and Hansen 2002, Tuhy and Jensen 1982, Vaghti 2003, Weber 1990, Youngblood et al. 1985a

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
2.C.4.Nb.2.b. M075 Western North American Montane-Subalpine-Boreal Marsh, Wet Meadow & Shrubland

G521. Vancouverian-Rocky Mountain Montane Wet Meadow & Marsh

Type Concept Sentence: This group consists of wet meadows dominated by graminoids such as *Calamagrostis canadensis, Carex aquatilis, Carex utriculata*, and *Eleocharis palustris* or forbs such as *Camassia quamash, Cardamine cordifolia, Dodecatheon jeffreyi, Phippsia algida, Rorippa alpina, Senecio triangularis*, and *Veratrum californicum* found throughout low and high montane altitudes of the western U.S. and Canada.

OVERVIEW

Scientific Name: *Carex* spp. - *Calamagrostis* spp. Montane Wet Meadow & Marsh Group
Common Name (Translated Scientific Name): Sedge species - Reedgrass species Montane Wet Meadow & Marsh Group
Colloquial Name: Western Glaucous Bluegrass Wet Meadow

Type Concept: This group contains the wet meadows found in low and high montane and subalpine elevations, occasionally reaching into the lower edges of the alpine elevations (about 1000-3600 m), from California's Transverse and Peninsular ranges north to British Columbia's Coastal Mountains and from throughout the Rocky Mountains of Canada and the U.S. (including the Black Hills of South Dakota) and mountain ranges of the intermountain Interior West. Varying dominant herbaceous species include graminoids *Calamagrostis canadensis, Calamagrostis stricta, Carex bolanderi, Carex exsiccata, Carex illota, Carex microptera, Carex scopulorum, Carex utriculata, Carex vernacula, Deschampsia cespitosa, Eleocharis quinqueflora, Glyceria striata (= Glyceria elata), Juncus drummondii, Juncus nevadensis*, and *Scirpus* and/or *Schoenoplectus* spp. Forb species include *Camassia quamash, Cardamine cordifolia, Dodecatheon jeffreyi, Phippsia algida, Rorippa alpina, Senecio triangularis, Trifolium parryi*, and *Veratrum californicum*. Common but sparse shrubs may include *Betula glandulosa, Salix* spp., *Vaccinium macrocarpon*, and *Vaccinium uliginosum*. Wet meadows occur in open wet depressions, basins and flats with low-velocity surface and subsurface flows. They can be large meadows in montane or subalpine valleys, or occur as narrow strips bordering ponds, lakes and streams, and along toeslope seeps. They are typically found on flat areas or gentle slopes, but may also occur on subirrigated sites with slopes up to 10%. In alpine regions, sites typically are small depressions located below late-melting snow patches. Sites are usually seasonally wet, often drying by late summer, and many occur in a tension zone between perennial wetlands and uplands, where water tables fluctuate in response to long-term climatic cycles. They may have surface water for part of the year, but depths rarely exceed a few centimeters. Wet meadows can be tightly associated with snowmelt and typically are not subjected to high velocity disturbance, but can be flooded by slow-moving waters. Soils are mostly mineral and show typical hydric soil characteristics such as low chroma and redoximorphic features; some areas may have high organic content as inclusions or pockets. Vegetation of this group can manifest as a mosaic of several plant associations, or be a monotypic stand of a single association which is dominated by graminoids or forbs.

Classification Comments:

Similar NVC Types:

- G520 Vancouverian-Rocky Mountain Subalpine-Alpine Snowbed, Wet Meadow & Dwarf-shrubland: is more or less a strictly alpine group that occurs at higher elevations with different dominant species, and is restricted to alpine or upper subalpine environments; however, it may be adjacent to or even overlap with G521 in some areas.
- G517 Vancouverian Freshwater Wet Meadow & Marsh: occurs at lower elevations within 2 miles of coast.
- G524 Western North American Ruderal Marsh, Wet Meadow & Shrubland
- G531 Arid West Interior Freshwater Marsh
- G545 Colorado Plateau Hanging Garden Seep

Diagnostic Characteristics: Perennial herbaceous wet meadows found in the montane, subalpine and lower alpine elevations (about 1000-3600 m) of western mountain ranges. Sites are usually seasonally wet, often drying by late summer, and many occur in a tension zone between perennial wetlands and uplands, where water tables fluctuate in response to long-term climatic cycles.

VEGETATION

Physiognomy and Structure: Open wet meadows dominated by perennial cold-dormant graminoids or forbs, usually less than 1 m in height, often a pocket surrounded by forests. Wet meadows may be large and carpet an entire valley floor, or they can be very small patches or narrow linear strips. They can also occur in complex mosaics of meadows intermixed with patches of dwarf- or tall shrublands.

Floristics: Vegetation of this group can manifest as a mosaic of several plant associations, or be a monotypic stand of a single association which is dominated by graminoids or forbs. Varying dominant herbaceous species include graminoids *Calamagrostis canadensis, Calamagrostis stricta, Carex bolanderi, Carex utriculata, Carex illota, Carex exsiccata, Carex nigricans, Carex microptera, Carex scopulorum, Carex vernacula, Deschampsia cespitosa, Eleocharis quinqueflora, Glyceria striata (= Glyceria elata), Juncus drummondii, Juncus nevadensis*, and *Scirpus* and/or *Schoenoplectus* spp. Forb species may include *Camassia quamash, Cardamine cordifolia, Caltha leptosepala, Dodecatheon jeffreyi, Phippsia algida, Rorippa alpina, Senecio triangularis, Trifolium parryi*, *Trollius laxus*, and *Veratrum californicum*. Common but sparse shrubs may include *Salix* spp., *Vaccinium uliginosum, Betula glandulosa*, and *Vaccinium macrocarpon*. Floristic information compiled from Komarkova (1976, 1986), Nachlinger (1985), Kovalchik (1987, 1993), Barbour and Major (1988), Meidinger et al. (1988), Padgett et al. (1988a), Lloyd et al. (1990), Banner et al. (1993), DeLong et al. (1993), Manning and Padgett (1995), Sawyer and Keeler-Wolf (1995), Sanderson and Kettler (1996), Crowe and Clausnitzer (1997), Steen and Coupe (1997), Kittel et al. (1999b), and MacKenzie and Moran (2004).

ENVIRONMENT & DYNAMICS

Environmental Description: *Soil/substrate/hydrology:* Wet meadows are typically found on flat areas or gentle slopes, but may also occur on subirrigated sites with slopes up to 10%. In alpine regions, sites typically are small depressions located below late-melting snow patches. Sites are usually seasonally wet, often drying by late summer, and many occur in a tension zone between perennial wetlands and uplands, where water tables fluctuate in response to long-term climatic cycles. They may have surface water for part

of the year, but depths rarely exceed a few centimeters. Wet meadows can be tightly associated with snowmelt and typically are not subjected to high velocity disturbance, but can be flooded by slow-moving waters. Moisture for these wet meadow community types is acquired from groundwater, stream discharge, overland flow, overbank flow, and on-site precipitation. Salinity and alkalinity are generally low due to the frequent flushing of moisture through the meadow. Depending on the slope, topography, hydrology, soils and substrate, intermittent, ephemeral, or permanent pools may be present.

These areas may support species more representative of purely aquatic environments. Standing water may be present during some or all of the growing season, with water tables typically remaining at or near the soil surface. Fluctuations of the water table throughout the growing season are not uncommon, however. On drier sites supporting the less mesic types, the late-season water table may be 1 m or more below the surface.

Soils are mostly mineral and show typical hydric soil characteristics such as low chroma and redoximorphic features; some areas may have high organic content as inclusions or pockets. Soils may have organic soils inclusions. The presence and amount of organic matter may vary considerably depending on the frequency and magnitude of alluvial deposition (Kittel et. al. 1999b). Organic composition of the soil may include a thin layer near the soil surface or accumulations of highly sapric material of up to 120 cm thick. Soils may exhibit gleying and/or mottling throughout the profile. Wet meadows provide important water filtration, flow attenuation, and wildlife habitat functions. Environmental information compiled from Komarkova (1976, 1986), Nachlinger (1985), Kovalchik (1987, 1993), Barbour and Major (1988), Meidinger et al. (1988), Padgett et al. (1988a), Lloyd et al. (1990), Banner et al. (1993), DeLong et al. (1993), Manning and Padgett (1995), Sawyer and Keeler-Wolf (1995), Sanderson and Kettler (1996), Crowe and Clausnitzer (1997), Steen and Coupe (1997), Kittel et al. (1999b), and MacKenzie and Moran (2004).

Dynamics: This group has soils that may be flooded or saturated throughout the growing season. It may also occur on areas with soils that are only saturated early in the growing season, or intermittently. Typically these associations are tolerant of moderate-intensity surface fires and late-season livestock grazing (Kovalchik 1987). Most appear to be relatively stable types, although in some areas these may be impacted by intensive livestock grazing.

DISTRIBUTION

Geographic Range: This group occurs in the mountains in California's Transverse and Peninsular ranges north to British Columbia's coastal ranges and is found throughout the Rocky Mountains (including the Black Hills of South Dakota) of the U.S. and Canada as well as the intermountain ranges of the interior west, ranging in elevation from montane to alpine (1000-3600 m).

Spatial Scale & Pattern [optional]: Small patch
Nations: CA, MX?, US
States/Provinces: AB, AK?, AZ, BC, CA, CO, ID, MT, NM, NV, OR, SD, UT, WA, WY
TNC Ecoregions [optional]: 3:C, 4:C, 5:C, 7:C, 8:C, 9:C, 11:C, 12:C, 16:C, 18:C, 19:C, 20:C, 21:C, 22:P, 25:C, 68:C, 69:C, 81:C
USFS Ecoregions (2007): 262A:PP, 263A:PP, 313A:CP, 313B:CC, 313D:C?, 315A:C?, 315B:C?, 315H:CC, 321A:??, 322A:CC, 331A:CP, 331H:CP, 331I:CP, 331J:CC, 341A:CC, 341B:CC, 341C:CC, 341D:CC, 341F:CP, 341G:CP, 342B:CC, 342C:CC, 342D:C?, 342E:CC, 342F:CP, 342G:CC, 342H:CC, 342I:CP, 342J:CP, M242A:CC, M242B:CC, M242C:CC, M242D:CP, M261A:CC, M261B:CC, M261D:CC, M261E:CC, M261F:CC, M261G:CC, M313A:CC, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M334A:PP, M341A:CP, M341B:CC, M341C:CC, M341D:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Great Basin); USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: High.

SYNONYMY

- **<** Alpine Grassland (213) (Shiflet 1994) [SRM type 213 includes all alpine communities in Sierra, Klamath and California Cascades, both herbaceous and shrub-dominated, and wet meadows.]
- **><** Alpine Rangeland (410) (Shiflet 1994) [Alpine wet meadows are included in this SRM type.]
- **<** Montane Meadows (216) (Shiflet 1994)
- **><** Tall Forb (409) (Shiflet 1994) [Forb-dominated wet meadows are included in this group.]
- **><** Tufted Hairgrass - Sedge (313) (Shiflet 1994) [Wetter portions of this SRM type overlap with this group.]

LOWER LEVEL UNITS

Alliances:

- A2584 *Carex amplifolia - Carex interior - Carex sheldonii* Wet Meadow Alliance
- A2564 *Elymus glaucus - Carex pellita - Carex feta* Wet Meadow Alliance
- A3815 *Calamagrostis canadensis - Calamagrostis stricta - Poa palustris* Wet Meadow Alliance
- A3810 *Saxifraga odontoloma - Senecio triangularis - Mertensia ciliata* Wet Meadow Alliance
- A3806 *Carex praegracilis - Carex scopulorum - Eleocharis quinqueflora* Wet Meadow Alliance

- A3807 *Eleocharis palustris - Eleocharis acicularis* Marsh Alliance
- A3809 *Heracleum maximum - Veratrum californicum - Rorippa* spp. Wet Meadow Alliance
- A3812 *Mimulus* spp. - *Primula parryi - Dodecatheon redolens* Wet Meadow Alliance
- A3814 *Danthonia* spp. - *Camassia* spp. Wet Meadow Alliance
- A3813 *Carex densa* Wet Meadow Alliance
- A2642 *Argentina anserina* Wet Meadow Alliance
- A3539 *Equisetum arvense - Equisetum hyemale - Equisetum variegatum* Wet Meadow Alliance
- A3804 *Carex aquatilis - Carex utriculata - Deschampsia cespitosa* Wet Meadow Alliance
- A1374 *Juncus arcticus ssp. littoralis - Juncus mexicanus* Wet Meadow Alliance
- A1361 *Poa glauca* Wet Meadow Alliance
- A3805 *Carex nebrascensis - Carex vesicaria - Carex pellita* Wet Meadow Alliance
- A3808 *Glyceria grandis - Glyceria striata - Glyceria borealis* Wet Meadow Alliance

AUTHORSHIP

Primary Concept Source: P. Comer and G. Kittel, in Faber-Langendoen et al. (2011)
Author of Description: P. Comer, G. Kittel and C. Chappell
Acknowledgments:
Version Date: 12/02/2015
Classif Resp Region: West
Internal Author: GK 12-10, 12-15, 10-16

REFERENCES

References: Banner et al. 1993, Barbour and Major 1988, Cooper 1986b, Crowe and Clausnitzer 1997, DeLong 2003, DeLong et al. 1990, DeLong et al. 1993, Faber-Langendoen et al. 2017a, Holland and Keil 1995, Kittel et al. 1999b, Komarkova 1976, Komarkova 1986, Kovalchik 1987, Kovalchik 1993, Lloyd et al. 1990, MacKenzie and Moran 2004, MacKinnon et al. 1990, Manning and Padgett 1995, Meidinger and Pojar 1991, Meidinger et al. 1988, Nachlinger 1985, Padgett et al. 1988a, Reed 1988, Rodriguez et al. 2017, Sanderson and Kettler 1996, Sawyer and Keeler-Wolf 1995, Shiflet 1994, Steen and Coupé 1997, Stout et al. 2013

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G521. Vancouverian-Rocky Mountain Montane Wet Meadow & Marsh

G520. Vancouverian-Rocky Mountain Subalpine-Alpine Snowbed, Wet Meadow & Dwarf-shrubland

Type Concept Sentence: These alpine herbaceous and dwarf-shrub communities are found on wet sites throughout the western U.S. and Canada in high mountainous regions. They are dominated by graminoids such as *Carex illota, Carex lachenalii, Carex nigricans, Carex vernacula, Deschampsia cespitosa, Juncus drummondii*, or forbs *Caltha leptosepala, Trollius laxus, Phippsia algida, Rorippa alpina, Sibbaldia procumbens*, and *Trifolium parryi*, as well as dwarf-shrubs that may also be scattered to moderately dense, including *Dasiphora, Kalmia, Salix* or *Vaccinium* species.

OVERVIEW

Scientific Name: *Caltha leptosepala - Carex nigricans - Kalmia microphylla* Subalpine-Alpine Snowbed, Wet Meadow & Dwarf-shrubland Group
Common Name (Translated Scientific Name): White Marsh-marigold - Black Alpine Sedge - Alpine Laurel Subalpine-Alpine Snowbed, Wet Meadow & Dwarf-shrubland Group
Colloquial Name: Rocky Mountain Shrubby-cinquefoil Wet Shrubland

Type Concept: These are high-elevation communities found throughout the Rocky Mountains, Pacific Northwest and Intermountain West regions, dominated by herbaceous species found on wetter sites with very low-velocity surface and subsurface flows. They range in elevation from upper subalpine to alpine (1500-3600 m) depending on latitude. These types occur as large meadows in subalpine valleys, as narrow strips bordering ponds, lakes and streams, and along toeslope seeps. They are typically found on flat areas or gentle slopes, but may also occur on subirrigated sites with slopes up to 10%. In alpine regions, sites typically are small depressions located below late-melting snow patches or on snowbeds. Soils of this group are mineral or with a thin (<40 cm) organic layer over mineral layers (aka not peatland). Soils show hydric soil characteristics, including high organic content and/or low chroma and redoximorphic features. This group often occurs as a mosaic of several plant associations, often dominated by graminoids such as *Carex illota, Carex lachenalii, Carex nigricans, Carex vernacula, Deschampsia cespitosa, Juncus drummondii*, and forbs *Caltha leptosepala, Trollius laxus, Phippsia algida, Rorippa alpina, Sibbaldia procumbens*, and *Trifolium parryi*. Often scattered to moderately dense dwarf-shrubs are present, especially *Dasiphora, Kalmia, Salix* or *Vaccinium*, which when present form alpine dwarf-shrublands. Wet meadows are tightly associated with snowmelt and typically not subjected to high disturbance events such as flooding.

Classification Comments: This group includes sparsely vegetated alpine areas that nonetheless have lush wet meadows and dwarf-shrublands are included together in one group because the alpine mesic floristic composition is more diagnostic than vegetation structure. This might be confusing with Rocky Mountain-Sierran Alpine Dwarf-shrubland & Krummholz Group (G316) because it includes mesic dwarf-shrublands; however, this group includes the true wetland associations.

Similar NVC Types:
- G271 Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow
- G521 Vancouverian-Rocky Mountain Montane Wet Meadow & Marsh: is lower in elevation (montane to subalpine) and may overlap slightly but has a different suite of dominant species than G520.
- G320 North Pacific Alpine-Subalpine Tundra: is similar in structure but does not contain wetland associations.
- G316 Rocky Mountain-Sierran Alpine Dwarf-shrubland & Krummholz: is similar in structure but does not contain wetland associations.
- G317 North Pacific Alpine-Subalpine Dwarf-shrubland & Heath: is similar in structure but does not contain wetland associations.

Diagnostic Characteristics: This group includes open to closed-canopy herbaceous stands dominated by Rocky Mountain alpine wetland species as well as open to closed dwarf-shrublands. Wetland graminoids may include *Carex illota, Carex lachenalii, Carex nigricans, Carex vernacula, Deschampsia cespitosa, Juncus drummondii*, and *Juncus mertensianus*; forbs include *Caltha leptosepala, Trollius laxus, Parnassia fimbriata, Phippsia algida, Polygonum bistortoides, Rorippa alpina, Sibbaldia procumbens*, and *Trifolium parryi*. Scattered to moderately dense dwarf-shrubs may also be present, especially *Dasiphora fruticosa ssp. floribunda* and *Kalmia microphylla*, which form alpine dwarf-shrublands.

VEGETATION

Physiognomy and Structure: This group is variable structurally and includes open to closed-canopy, graminoid- and forb-dominated herbaceous stands as well as stands dominated by dwarf-shrublands. Sometimes rings of different plant communities form around a late-melting snowbed because of different soil moisture requirements (drier turf species on outside edges, wetland species near the middle and sometimes a sparsely vegetated center because of the extremely short growing season).

Floristics: This group often occurs as a mosaic of several plant associations, often dominated by graminoids, including *Carex illota, Carex lachenalii, Carex nigricans, Carex vernacula, Deschampsia cespitosa, Juncus drummondii, Juncus mertensianus*, and forbs *Caltha leptosepala, Trollius laxus, Parnassia fimbriata, Phippsia algida, Polygonum bistortoides, Rorippa alpina, Sibbaldia procumbens*, and *Trifolium parryi*. Often scattered to moderately dense dwarf-shrubs are present, especially *Dasiphora fruticosa ssp. floribunda, Kalmia microphylla*, or *Vaccinium uliginosum*, which form alpine dwarf-shrublands. Wet meadows are tightly associated with snowmelt and typically not subjected to high disturbance events such as flooding. Floristic information was compiled from Willard (1963), Komarkova (1976, 1986), Nachlinger (1985), Cooper (1986b), Kovalchik (1987, 1993), Padgett et al. (1988a), Reed (1988), Meidinger and Pojar (1991), Shiflet (1994), Manning and Padgett (1995), Sanderson and Kettler (1996), Zwinger and Willard (1996), Cooper et al. (1997), Crowe and Clausnitzer (1997), and Kittel et al. (1999b).

ENVIRONMENT & DYNAMICS

Environmental Description: These are high-elevation communities found throughout the Rocky Mountains, Pacific Northwest and Intermountain West regions, dominated by herbaceous species found on wetter sites with very low-velocity surface and subsurface flows. They range in elevation from upper subalpine to alpine (1500-3600 m) depending on latitude. These types occur as large meadows in subalpine valleys, as narrow strips bordering ponds, lakes and streams, and along toeslope seeps. They are typically found on flat areas or gentle slopes, but may also occur on subirrigated sites with slopes up to 10%. In alpine regions, sites typically are small depressions located below late-melting snow patches or on snowbeds. Soils of this group are mineral or with a thin (<40 cm) organic layer over mineral layers (aka not peatland).

Moisture for these wet meadow community types is acquired from groundwater, stream discharge, overland flow, overbank flow, and on-site precipitation. Salinity and alkalinity are generally low due to the frequent flushing of moisture through the meadow. Depending on the slope, topography, hydrology, soils and substrate, intermittent, ephemeral or permanent pools may be present. These areas may support species more representative of purely aquatic environments. Standing water may be present during some or all of the growing season, with water tables typically remaining at or near the soil surface. Fluctuations of the water table throughout the growing season are not uncommon, however. On drier sites supporting the less mesic types, the late-season water table may be 1 m or more below the surface.

Soil/substrate/hydrology: Soils typically possess a high proportion of organic matter, but this may vary considerably depending on the frequency and magnitude of alluvial deposition (Kittel et. al. 1999b). Organic composition of the soil may include a thin layer near the soil surface or accumulations of highly sapric material up to 30 cm thick (aka not peatland). Soils may exhibit gleying and/or mottling throughout the profile. Wet meadow ecological systems provide important water filtration, flow attenuation, and wildlife habitat functions. Environmental information was compiled from Willard (1963), Komarkova (1976, 1986),

Nachlinger (1985), Cooper (1986b), Kovalchik (1987, 1993), Padgett et al. (1988a), Reed (1988), Meidinger and Pojar (1991), Shiflet (1994), Manning and Padgett (1995), Sanderson and Kettler (1996), Zwinger and Willard (1996), Cooper et al. (1997), Crowe and Clausnitzer (1997), and Kittel et al. (1999b).

Dynamics: Associations in this group are adapted to soils that may be flooded or saturated throughout the growing season. They may also occur on areas with soils that are only saturated early in the growing season or intermittently. Typically these associations are tolerant of moderate-intensity surface fires and late-season livestock grazing (Kovalchik 1987). Most appear to be relatively stable types, although in some areas these may be impacted by intensive livestock grazing.

DISTRIBUTION

Geographic Range: This group is found throughout the Rocky Mountains, Pacific Northwest and Intermountain West regions, ranging in elevation from upper subalpine to alpine (1500-3600 m) depending on latitude.

Spatial Scale & Pattern [optional]: Small patch
Nations: CA, US
States/Provinces: AB, AZ, BC, CA, CO, ID, MT, NM, NV, OR, SD, UT, WA, WY
TNC Ecoregions [optional]: 7:C, 8:C, 9:C, 11:C, 18:C, 19:C, 20:C, 21:C, 22:P, 25:C, 68:C
USFS Ecoregions (2007): 313A:CP, 313B:CC, 313D:C?, 315A:C?, 315B:C?, 315H:CC, 321A:??, 322A:CC, 331H:CP, 331I:CP, 331J:CC, 341A:CC, 341B:CC, 341C:CC, 341F:CP, 341G:CP, 342B:CC, 342C:CC, 342D:C?, 342E:CC, 342F:CP, 342G:CC, 342H:CC, 342J:CP, M242D:PP, M313A:CC, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M334A:PP, M341A:CP, M341B:CC, M341C:CC, M341D:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: High.

SYNONYMY

- **><** Alpine Rangeland (410) (Shiflet 1994) [Alpine wet meadows are included in this SRM type.]
- **><** Tall Forb (409) (Shiflet 1994) [Forb-dominated wet meadows are included in this group.]
- **><** Tufted Hairgrass - Sedge (313) (Shiflet 1994) [Wetter portions of this SRM type overlap with this group.]

LOWER LEVEL UNITS

Alliances:

- A3831 *Kalmia microphylla - Cassiope mertensiana - Dryas drummondii* Wet Dwarf-shrubland Alliance
- A3832 *Carex nigricans - Sibbaldia procumbens - Trollius laxus* Wet Meadow Alliance
- A1309 *Carex vernacula - Phippsia algida - Ptilagrostis kingii* Wet Meadow Alliance
- A0958 *Dasiphora fruticosa ssp. floribunda* Wet Shrubland Alliance
- A1424 *Carex lachenalii - Carex capillaris - Carex illota* Wet Meadow Alliance
- A1698 *Caltha leptosepala - Rhodiola rhodantha* Wet Meadow Alliance

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2011)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 12/02/2015
Classif Resp Region: West
Internal Author: KAS 12-10, 3-11, mod. GK 9-13, 12-15

REFERENCES

References: Cooper 1986b, Cooper et al. 1997, Crowe and Clausnitzer 1997, Faber-Langendoen et al. 2017a, Kittel et al. 1999b, Komarkova 1976, Komarkova 1986, Kovalchik 1987, Kovalchik 1993, Manning and Padgett 1995, Meidinger and Pojar 1991, Nachlinger 1985, Padgett et al. 1988a, Reed 1988, Sanderson and Kettler 1996, Shiflet 1994, Willard 1963, Zwinger and Willard 1996

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G520. Vancouverian-Rocky Mountain Subalpine-Alpine Snowbed, Wet Meadow & Dwarf-shrubland

G527. Western Montane-Subalpine Riparian & Seep Shrubland

Type Concept Sentence: These are montane to subalpine riparian shrublands ranging from short to tall (0.5-15 m) that occur in steep and narrow to wide, low-gradient valley bottoms and floodplains as well as steep moist avalanche chutes. They are generally dominated by any or a mix of the following: *Alnus incana, Alnus oblongifolia, Alnus viridis, Betula occidentalis, Betula glandulosa, Betula occidentalis, Cornus sericea, Salix bebbiana, Salix boothii, Salix brachycarpa, Salix drummondiana, Salix eriocephala, Salix geyeriana, Salix monticola, Salix planifolia*, and/or *Salix wolfii*.

OVERVIEW

Scientific Name: *Salix* spp. - *Alnus* spp. - *Betula occidentalis* Riparian & Seep Shrubland Group
Common Name (Translated Scientific Name): Willow species - Alder species - Water Birch Riparian & Seep Shrubland Group
Colloquial Name: Western Alder Wet Shrubland

Type Concept: These are montane to subalpine riparian shrublands occurring as narrow bands or broad shrublands and are found throughout the Rocky Mountain cordillera from New Mexico north into Montana and northwestern Alberta. They also occur in mountainous areas of the interior Intermountain West and on the Colorado Plateau. This group often occurs as part of a mosaic of multiple communities that are shrub- and herb-dominated and includes above-treeline, willow-dominated, snowmelt-fed basins that feed into streams. Shrubs range from short to tall (0.5-15 m). The shrub species that can be dominant reflect the large elevational gradient of this group and include *Alnus incana, Alnus oblongifolia, Alnus viridis, Betula occidentalis, Betula glandulosa, Betula occidentalis, Cornus sericea, Salix bebbiana, Salix boothii, Salix brachycarpa, Salix drummondiana, Salix eriocephala, Salix geyeriana, Salix monticola, Salix planifolia*, and *Salix wolfii*. Generally the upland vegetation surrounding these wet shrublands is either conifer or aspen forest. Stands occur on streambanks, stream benches and alluvial terraces in steep narrow to wide, low-gradient valley bottoms and floodplains with sinuous stream channels, as well as steep moist avalanche chutes. This group is generally found at higher elevations, but can be found anywhere from 1500-3475 m, and may occur at even lower elevations in the Canadian Rockies. Occurrences can also be found around seeps, fens, and isolated springs on hillslopes away from valley bottoms. Many of the plant associations found within this group are associated with beaver activity.

Classification Comments:

Similar NVC Types:
- G507 North Pacific Montane Riparian Woodland
- G322 Vancouverian Wet Shrubland: occurs at lower elevations along the Pacific Northwest coast.
- G526 Rocky Mountain-Great Basin Lowland-Foothill Riparian Shrubland: occurs at lower elevations and may overlap with G527.

Diagnostic Characteristics: Montane wet shrublands of the Rocky Mountains of Canada and the U.S., and mountain ranges in the Intermountain West. These shrublands line streams and valley bottoms and are often associated with beaver activity.

VEGETATION

Physiognomy and Structure: Montane wetlands dominated by short to tall (0.5-15 m) cold-deciduous shrubs with multiple stems, occurring as narrow bands of shrubs lining streambanks and alluvial terraces in narrow to wide, low-gradient valley bottoms and floodplains with sinuous stream channels.

Floristics: The dominant shrubs reflect the large elevational gradient and include *Alnus incana, Betula glandulosa, Betula occidentalis, Cornus sericea, Salix bebbiana, Salix boothii, Salix brachycarpa, Salix drummondiana, Salix eriocephala, Salix geyeriana, Salix monticola, Salix planifolia*, and *Salix wolfii*. Generally the upland vegetation surrounding these riparian systems is either conifer or aspen forest. Floristic information was compiled from Padgett (1982), Kovalchik (1987, 1993, 2001), Baker (1988, 1989a, 1989b, 1990), Padgett et al. (1988a, 1988b), Kittel (1993, 1994), Manning and Padgett (1995), Kittel et al. (1996, 1999a, 1999b), Walford (1996), Crowe and Clausnitzer (1997), Steen and Coupe (1997), and Muldavin et al. (2000a).

ENVIRONMENT & DYNAMICS

Environmental Description: *Soil/substrate/hydrology:* These are montane to subalpine riparian shrublands occurring as narrow bands lining streambanks and alluvial terraces in narrow to wide, low-gradient valley bottoms and floodplains with sinuous stream channels. Generally, the group is found at higher elevations, but can be found anywhere from 1500-3475 m, and may occur at even lower elevations in the Canadian Rockies. Occurrences can also be found around seeps, fens, and isolated springs on hillslopes away from valley bottoms. They occur on mineral soils or, if on organic soil, these are not deep (not >30-40 cm). Environmental information was compiled from Padgett (1982), Kovalchik (1987, 1993, 2001), Baker (1988, 1989a, 1989b, 1990), Padgett et al. (1988a, 1988b), Kittel (1993, 1994), Manning and Padgett (1995), Kittel et al. (1996, 1999a, 1999b), Walford (1996), Crowe and Clausnitzer (1997), Steen and Coupe (1997), and Muldavin et al. (2000a).

Dynamics: These shrublands are very tolerant of soil saturation, flooding and flooding disturbance. They require moist to saturated soils throughout the growing season, and regrow quickly after damage to tissue from flood and debris flows or avalanches.

DISTRIBUTION

Geographic Range: This group is found throughout the Rocky Mountain cordillera from New Mexico north into Montana and the Canadian Rockies of Alberta and British Columbia (including the isolated "island" mountain ranges of central and eastern Montana), and in mountainous areas of the Intermountain West and on the Colorado Plateau.

Spatial Scale & Pattern [optional]: Linear, Small patch
Nations: CA, US
States/Provinces: AB, AZ, BC, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]: 6:P, 7:C, 8:C, 9:C, 11:C, 18:C, 19:C, 20:C, 21:C, 25:C, 26:C, 68:C
USFS Ecoregions (2007): 313A:CC, 313B:CC, 313D:CC, 315A:P?, 315H:PP, 321A:PP, 331A:C?, 331B:C?, 331J:CC, 341A:CP, 341B:CP, 341C:CP, 341D:CP, 341F:CC, 342A:CC, 342B:CP, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:CC, 342J:CC, M242C:CP, M242D:CC, M261E:CC, M313A:CC, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M341B:CC, M341C:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Great Basin)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: High.

SYNONYMY

- **<** Riparian (422) (Shiflet 1994)

LOWER LEVEL UNITS

Alliances:
- A0977 *Salix lasiolepis* Wet Shrubland Alliance
- A1003 *Salix commutata* Wet Shrubland Alliance
- A3774 *Salix eastwoodiae - Salix lemmonii* Wet Shrubland Alliance
- A0981 *Salix monticola* Wet Shrubland Alliance
- A3770 *Salix wolfii - Salix brachycarpa - Betula glandulosa* Wet Shrubland Alliance
- A2563 *Salix orestera* Wet Shrubland Alliance
- A3974 *Crataegus douglasii / Symphoricarpos albus* Wet Shrubland Alliance
- A3973 *Celtis laevigata var. reticulata / Philadelphus lewisii* Wet Scrub Alliance
- A3771 *Alnus incana - Alnus viridis* Wet Shrubland Alliance
- A3769 *Salix boothii - Salix geyeriana - Salix lutea* Montane Wet Shrubland Alliance
- A3773 *Cornus sericea - Dasiphora fruticosa ssp. floribunda - Ribes* spp. Wet Shrubland Alliance
- A3772 *Betula occidentalis* Wet Shrubland Alliance

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2011)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 12/02/2015
Classif Resp Region: West
Internal Author: GK 12-10, 9-13, 12-15

REFERENCES

References: Baker 1988, Baker 1989a, Baker 1989b, Baker 1990, Crowe and Clausnitzer 1997, Faber-Langendoen et al. 2017a, Kittel 1993, Kittel 1994, Kittel et al. 1996, Kittel et al. 1999a, Kittel et al. 1999b, Kovalchik 1987, Kovalchik 1993, Kovalchik 2001, Manning and Padgett 1995, Muldavin et al. 2000a, Padgett 1982, Padgett et al. 1988a, Padgett et al. 1988b, Shiflet 1994, Steen and Coupé 1997, Szaro 1989, Walford 1996, Willoughby 2007

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G527. Western Montane-Subalpine Riparian & Seep Shrubland

A3771. Alnus incana - Alnus viridis Wet Shrubland Alliance

Type Concept Sentence: Vegetation types within this riparian tall (>1.5 m) shrubland alliance typically occur adjacent to streams and in mountain meadows at moderate to high-elevation (1200-3000 m) riparian habitats of the northern Rocky Mountains and Cascade Range where deep snow accumulations are common. Landforms associated with this alliance are streambanks, alluvial bars, and floodplains. *Alnus incana* or *Alnus viridis ssp. sinuata* forms a dense canopy with at least 90% cover. *Acer circinatum* may be codominant in the tall-shrub layer in some stands.

OVERVIEW

Scientific Name: *Alnus incana - Alnus viridis* Wet Shrubland Alliance
Common Name (Translated Scientific Name): Gray Alder - Green Alder Wet Shrubland Alliance
Colloquial Name: Western Alder Wet Shrubland

Type Concept: *Alnus incana* or *Alnus viridis ssp. sinuata* forms a dense canopy with at least 90% cover. *Acer circinatum* may be codominant in the tall-shrub layer in some stands. The diverse understory shrub layer may include *Acer glabrum, Ribes lacustre*, and *Sorbus scopulina*. In the northern Rocky Mountains, *Abies lasiocarpa* colonizes these communities, and scattered seedlings or saplings may be present. Low cold-deciduous or ericaceous shrubs may be abundant, including *Betula occidentalis, Cornus sericea, Oplopanax horridus, Paxistima myrsinites, Ribes hudsonianum, Rubus parviflorus, Rubus spectabilis, Salix drummondiana, Sambucus racemosa, Symphoricarpos albus*, and *Vaccinium* spp. The forb layer is sparse and may include *Achillea millefolium, Aconitum columbianum, Canadanthus modestus (= Aster modestus), Galium triflorum, Heracleum maximum (= Heracleum lanatum), Osmorhiza berteroi (= Osmorhiza chilensis), Polystichum munitum, Senecio triangularis, Symphyotrichum spathulatum (= Aster occidentalis), Thalictrum occidentale, Urtica dioica*, and *Veratrum viride*. The graminoid layer is usually dominated by 1 or 2 species that include *Agrostis stolonifera* and *Calamagrostis canadensis*. The fern and fern allies layer is generally dense with at least 40% cover. The dominant species typically are *Gymnocarpium dryopteris* and *Athyrium filix-femina*. This alliance is found in the Rocky Mountains, the highlands of Arizona, intermountain ranges of Nevada, and montane areas of California. Stands occur adjacent to streams and in mountain meadows at moderate to high-elevation (1200-3000 m) riparian habitats. Landforms associated with this alliance are streambanks, alluvial bars, and floodplains. Soils are shallow, skeletal alluvium over water-worked cobbles and gravels.

Classification Comments: Alder- and maple-dominated riparian and wetland shrublands.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Tall (>1.5 m) shrublands dominated by *Alnus incana, Alnus viridis ssp. sinuata, Alnus oblongifolia*, and/or *Acer glabrum*.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance is dominated by a relatively dense tall-shrub layer that is 2-15 m tall, that may or may not have a short-shrub layer that is <2 m tall. The herbaceous layer is dominated by perennial forbs with some perennial graminoids.

Floristics: *Alnus incana, Alnus viridis ssp. sinuata, Alnus oblongifolia*, and/or *Acer glabrum* form a dense canopy layer. *Acer circinatum* may be codominant in the tall-shrub layer in some stands. The diverse understory shrub layer may include *Ribes lacustre*, and *Sorbus scopulina*. In the northern Rocky Mountains, *Abies lasiocarpa* may colonize these communities, and scattered seedlings or saplings may be present. Low cold-deciduous or ericaceous shrubs may be abundant, including *Cornus sericea, Betula occidentalis, Oplopanax horridus, Paxistima myrsinites, Ribes hudsonianum, Rubus parviflorus, Rubus spectabilis, Sambucus racemosa, Salix drummondiana, Symphoricarpos albus*, and *Vaccinium* spp. The forb layer is sparse and may include *Achillea millefolium, Aconitum columbianum, Canadanthus modestus (= Aster modestus), Galium triflorum, Heracleum maximum (= Heracleum lanatum), Osmorhiza berteroi (= Osmorhiza chilensis), Polystichum munitum, Senecio triangularis, Symphyotrichum spathulatum (= Aster occidentalis), Thalictrum occidentale, Urtica dioica*, and *Veratrum viride*. The graminoid layer is usually dominated by 1 or 2 species that include *Agrostis stolonifera* and *Calamagrostis canadensis*. The fern and fern allies layer is generally dense with at least 40% cover. The dominant species typically are *Gymnocarpium dryopteris* and *Athyrium filix-femina*.

ENVIRONMENT & DYNAMICS

Environmental Description: Vegetation types within this riparian tall (>1.5 m) shrubland alliance typically occur adjacent to streams and in mountain meadows at moderate to high-elevation (1200-3000 m) riparian habitats of the northern Rocky Mountains and Cascade Range where deep snow accumulations are common. Landforms associated with this alliance are streambanks, alluvial bars, and floodplains. Sites are young, active channel shelves that lie between active and flood-stage streambanks along second-order and

larger streams in moderately graded (3-5%) valleys. Soils are shallow, skeletal alluvium over water-worked cobbles and gravels. Active channel shelves have surface soil textures that are loamy sands, while older sites are silts and loam. Available water-holding capacity is low; surface water is present briefly during the growing season. The water table usually lies well below the ground surface.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is found in the Rocky Mountains of eastern Oregon, Washington, Idaho, Montana, British Columbia, Alberta, Wyoming, Colorado, Utah, and New Mexico, the highlands of Arizona, intermountain ranges of Nevada, and montane areas of California.

Nations: CA, US
States/Provinces: AB, AZ, BC, CA, CO, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Alnus incana* (Mountain alder thicket) Alliance (Sawyer et al. 2009) [63.210.00]
- **?** *Alnus viridis* (Sitka alder thickets) Provisional Alliance (Sawyer et al. 2009) [63.220.00]

LOWER LEVEL UNITS

Associations:

- CEGL001158 *Alnus* spp. Avalanche Chute Wet Shrubland
- CEGL002633 *Alnus viridis ssp. sinuata* / Mesic Forbs Wet Shrubland
- CEGL001146 *Alnus incana / Equisetum arvense* Wet Shrubland
- CEGL001156 *Alnus viridis ssp. sinuata / Athyrium filix-femina - Cinna latifolia* Wet Shrubland
- CEGL001153 *Alnus incana / Symphoricarpos albus* Wet Shrubland
- CEGL001144 *Alnus incana / Carex (aquatilis, lenticularis, luzulina, pellita)* Wet Shrubland
- CEGL002602 *Alnus viridis ssp. sinuata / Rubus (lasiococcus, parviflorus)* Wet Shrubland
- CEGL002628 *Alnus incana / Athyrium filix-femina* Wet Shrubland
- CEGL001141 *Alnus incana* Wet Shrubland
- CEGL000481 *Alnus incana / Scirpus microcarpus* Wet Shrubland
- CEGL001145 *Alnus incana / Cornus sericea* Wet Shrubland
- CEGL002652 *Alnus incana - Salix drummondiana* Wet Shrubland
- CEGL001142 *Alnus incana - Betula occidentalis* Wet Shrubland
- CEGL001148 *Alnus incana* / Mesic Graminoids Wet Shrubland
- CEGL000122 *Alnus incana / Carex scopulorum var. prionophylla* Wet Shrubland
- CEGL001152 *Alnus incana / Spiraea douglasii* Wet Shrubland
- CEGL001143 *Alnus incana / Calamagrostis canadensis* Wet Shrubland
- CEGL002629 *Alnus incana / Lysichiton americanus* Wet Shrubland
- CEGL002651 *Alnus incana - Salix (monticola, lucida, ligulifolia)* Wet Shrubland
- CEGL001151 *Alnus incana / Ribes (inerme, hudsonianum, lacustre)* Wet Shrubland
- CEGL001147 *Alnus incana* / Mesic Forbs Wet Shrubland
- CEGL000228 *Alnus incana / Glyceria striata* Wet Shrubland
- CEGL002687 *Alnus incana ssp. tenuifolia - Salix irrorata* Wet Shrubland

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Faber-Langendoen et al. 2017b, Sawyer et al. 2009

2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G527. Western Montane-Subalpine Riparian & Seep Shrubland

A3772. Betula occidentalis Wet Shrubland Alliance

Type Concept Sentence: This riparian shrubland alliance occurs on moderately wide stream benches and floodplains. It may also occur on hillside seeps in the mountains and foothills. Sites are relatively flat (1-5% slope) stream benches and often extend away from the channel edge. The substrate is usually exposed, but surface water can be present for variable periods without detectable seasonal periodicity. *Betula occidentalis* forms a dense, closed canopy with cover up to 95%. It occurs in the Rocky Mountains, intermountain ranges of Nevada and Sierra Nevada of California.

OVERVIEW

Scientific Name: *Betula occidentalis* Wet Shrubland Alliance
Common Name (Translated Scientific Name): Water Birch Wet Shrubland Alliance
Colloquial Name: Western Water Birch Wet Shrubland

Type Concept: In this alliance, *Betula occidentalis* forms a dense, closed canopy with cover up to 95%. The shrub layer may also include *Alnus incana, Artemisia tridentata ssp. vaseyana, Cornus sericea, Crataegus douglasii, Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda), Juniperus horizontalis, Purshia tridentata, Purshia tridentata, Rosa woodsii*, and *Salix* spp. Due to the dense shrub canopy, herbaceous undergrowth is usually limited. Forb species include *Aquilegia formosa, Maianthemum stellatum (= Smilacina stellata)*, and *Urtica dioica*. Graminoid cover is usually low and is typically composed of introduced hay grasses. This riparian shrubland alliance occurs in the Rocky Mountains, intermountain ranges of Nevada and Sierra Nevada of California on moderately wide stream benches and floodplains. It may also occur on hillside seeps in the mountains and foothills. Sites are relatively flat (1-5% slope) stream benches and often extend away from the channel edge. The substrate is usually exposed, but surface water can be present for variable periods without detectable seasonal periodicity. Inundation is not predictable to a given season and is dependent upon highly localized rainstorms (e.g., summer thunderstorms in eastern Oregon and Idaho). Soils are derived from alluvium and are fairly shallow, ranging from 30 cm to greater than 60 cm. Substrates are typically alluvial and range from fairly shallow, finer-textured soils to gravel and boulders. Soils usually have signs of saturation (mottles).

Classification Comments: Tall riparian shrublands may be mixed with other tall riparian shrubland alliances such as *Alnus*- and *Salix*-dominated communities.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Tall (>1.5 m) shrubland dominated by *Betula occidentalis*.

VEGETATION

Physiognomy and Structure: The tall-shrub layer is dominated by broad-leaved deciduous shrubs or small trees reaching heights of up to 8-9 m. The tree canopy is dominated by conifers of variable density. The tall-shrub stratum is dense with up to 98% cover. The short-shrub layer (1-2 m tall) is sparse to dense with 25-60% cover. The graminoid layer consists of mainly introduced hay grasses and constitutes up to 35% cover. The forb layer has 0-40% cover depending on the overstory canopy cover.

Floristics: Plant associations within this alliance are classified as intermittently flooded, cold-deciduous shrublands. *Betula occidentalis* forms a dense, closed canopy with cover up to 95%. The shrub layer may also include *Alnus incana, Artemisia tridentata ssp. vaseyana, Cornus sericea, Crataegus douglasii, Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda), Juniperus horizontalis, Purshia tridentata, Purshia tridentata, Rosa woodsii*, and *Salix* spp. The tree canopy has a moderate cover and includes any of the following species: *Abies lasiocarpa, Acer negundo, Alnus rhombifolia, Picea pungens, Populus angustifolia, Populus tremuloides, Pseudotsuga menziesii*, and *Thuja occidentalis*. Due to the dense shrub canopy, herbaceous undergrowth is usually limited. Forb species include *Aquilegia formosa, Maianthemum stellatum (= Smilacina stellata)*, and *Urtica dioica*. Graminoid cover is usually low and includes *Carex utriculata, Carex pellita (= Carex lanuginosa), Carex microptera, Carex nebrascensis, Glyceria* spp., *Juncus balticus*, and introduced hay grasses.

ENVIRONMENT & DYNAMICS

Environmental Description: Plant associations within this alliance occupy moderately wide stream benches and floodplains in moderately wide valleys and on hillside seeps in the mountains and foothills. Sites are relatively flat (1-5% slope) stream benches and often extend away from the channel edge. Elevation ranges up to 2700 m in Idaho. The substrate is usually exposed, but surface water can be present for variable periods without detectable seasonal periodicity. Inundation is not predictable to a given season

and is dependent upon highly localized rainstorms e.g., summer thunderstorms in eastern Oregon and Idaho. Soils derived from alluvium are fairly shallow, ranging from 30 to greater than 60 cm.

Dynamics: *Betula occidentalis* is highly adapted to most forms of disturbance. However, heavy grazing may eliminate the more palatable native graminoids, thereby replacing them with introduced species or nonpalatable native species in the understory (Hansen et al. 1995).

DISTRIBUTION

Geographic Range: This alliance is found in the Rocky Mountains of eastern Oregon and Washington, Idaho, British Columbia, Alberta, Montana, Wyoming, Colorado, New Mexico, and Utah, as well as intermountain ranges of Nevada and Sierra Nevada of California.

Nations: CA, US
States/Provinces: AB, BC, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Betula occidentalis* (Water birch thicket) Alliance (Sawyer et al. 2009) [63.610.00]

LOWER LEVEL UNITS

Associations:
- CEGL003450 *Betula occidentalis - Celtis laevigata var. reticulata* Wet Shrubland
- CEGL000489 *Betula occidentalis / Philadelphus lewisii - Symphoricarpos albus* Wet Shrubland
- CEGL001083 *Betula occidentalis - Dasiphora fruticosa ssp. floribunda* Wet Shrubland
- CEGL001080 *Betula occidentalis* Wet Shrubland
- CEGL002668 *Betula occidentalis / Philadelphus lewisii* Wet Shrubland
- CEGL001084 *Betula occidentalis / Purshia tridentata / Hesperostipa comata* Wet Shrubland
- CEGL001162 *Betula occidentalis / Maianthemum stellatum* Wet Shrubland
- CEGL001081 *Betula occidentalis / Crataegus douglasii* Wet Shrubland
- CEGL001161 *Betula occidentalis / Cornus sericea* Wet Shrubland
- CEPP009680 *Betula occidentalis* Desert Spring Shrubland
- CEGL002654 *Betula occidentalis* / Mesic Graminoids Wet Shrubland

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Faber-Langendoen et al. 2017b, Hansen et al. 1995, Sawyer et al. 2009

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G527. Western Montane-Subalpine Riparian & Seep Shrubland

A3973. Celtis laevigata var. reticulata / Philadelphus lewisii Wet Scrub Alliance

Type Concept Sentence: This *Celtis laevigata var. reticulata*- and/or *Philadelphus lewisii*-dominated scrub woodland and shrubland alliance is found in the lower montane and foothill regions around the Columbia Basin, and north and east into the Central Rockies in Idaho and northwestern Wyoming where it occurs as numerous relatively small stands, dispersed and clustered in valley bottoms along riparian margins, on lower slopes of river terraces near seepage lines, and on scree slopes.

OVERVIEW

Scientific Name: *Celtis laevigata var. reticulata / Philadelphus lewisii* Wet Scrub Alliance
Common Name (Translated Scientific Name): Netleaf Hackberry / Lewis' Mock Orange Wet Scrub Alliance
Colloquial Name: Valley Bottom Netleaf Hackberry / Lewis' Mock Orange Wet Scrub

Type Concept: The upper canopy of this scrub woodland and shrubland alliance is dominated by *Celtis laevigata var. reticulata* and/or *Philadelphus lewisii*, often forming dense thickets. *Celtis laevigata var. reticulata* occurs either as a short tree or tall shrub between 3-6 m in height. *Philadelphus lewisii* occurs as a tall shrub between 2-5 m in height. The short-shrub layer often contains *Rosa woodsii, Rosa nutkana*, or *Sambucus nigra ssp. cerulea* with other riparian shrubs such as *Holodiscus discolor* or occasionally *Symphoricarpos albus* and *Toxicodendron rydbergii* on moist sites. If present, the herbaceous layer may be dominated by the perennial bunchgrass *Pseudoroegneria spicata*. *Poa secunda* and *Aristida purpurea var. longiseta* are often present also. This alliance is found in the lower montane and foothill regions around the Columbia Basin, and north and east into the Central Rockies in Idaho and northwestern Wyoming, and south into canyons in the Colorado Plateau and in riparian areas in the southeastern Colorado plains. Stands occur as numerous relatively small stands, dispersed and clustered in valley bottoms along riparian margins, on lower slopes of river terraces near seepage lines, and on scree slopes. It can also occur in the active floodplain of intermittent streams and deep canyon bottoms of the Snake and Salmon rivers. Elevations range from 250-550 m in the Columbia Basin and 1400-1700 m in Colorado. Although sites are predominately on hot, dry southeastern to southwestern aspects, these trees access additional soil moisture that accumulates at the base of the colluvial slopes, or are riparian. Soils are poorly developed, well-drained alluvial or colluvial sands that often have a high percentage of rock fragments.

Classification Comments: Stands included in this alliance from riparian areas in the southeastern Colorado plains and canyons in the Colorado Plateau (Carsey et al. 2003a) need further review as they may be more appropriately placed in a plains riparian alliance or Colorado Plateau seep alliance.

Internal Comments: KAS 2-14: This is a messy alliance with some associations occurring as both upland seep associations and riparian stands in the PNW. More review is need to clarify if this is the appropriate group for some of this associations or if they need to be split into riparian and upland types. In addition, stands of *Celtis laevigata var. reticulata / Pseudoroegneria spicata* Woodland (CEGL001085) attributed to Colorado is a long way from the Columbia Basin. Carsey et al. (2003a) describe two occurrences in Colorado. The Colorado Plateau stands are likely *Celtis laevigata var. reticulata* Slickrock Canyon Woodland (CEGL002359) and possibly the one in a riparian area in the southeastern Colorado plains.
Other Comments:

Similar NVC Types: Western Interior Riparian Forest & Woodland Group (G797) is a western group that also has stands dominated by *Celtis laevigata var. reticulata* included in it and may be more appropriate for stands of this alliance described in Colorado.

Diagnostic Characteristics: This scrub woodland and shrubland alliance is dominated by diagnostic species *Celtis laevigata var. reticulata* and/or *Philadelphus lewisii*, often forming dense thickets. *Celtis laevigata var. reticulata* occurs either as a short tree or tall shrub between 3-6 m in height. *Philadelphus lewisii* occurs as a tall shrub between 2-5 m in height.

VEGETATION

Physiognomy and Structure: Vegetation in this alliance has an open to moderately dense layer of broad-leaved deciduous small trees or shrubs forming a scrub woodland or tall shrubland less than 6 m tall.

Floristics: This scrub woodland and shrubland alliance has an upper canopy dominated by *Celtis laevigata var. reticulata* and/or *Philadelphus lewisii*, often forming dense thickets. *Celtis laevigata var. reticulata* occurs either as a short tree or tall shrub between 3-6 m in height. *Philadelphus lewisii* occurs as a tall shrub between 2-5 m in height. The short-shrub layer often contains *Rosa woodsii, Rosa nutkana*, or *Sambucus nigra ssp. cerulea* with other riparian shrubs such as *Holodiscus discolor* or occasionally *Amelanchier alnifolia, Crataegus douglasii, Cornus sericea, Frangula purshiana (= Rhamnus purshiana), Prunus virginiana*, and *Symphoricarpos albus*. *Toxicodendron rydbergii* is more abundant on moist sites. If present, the herbaceous layer has sparse to moderate cover. It is dominated by the perennial bunchgrass *Pseudoroegneria spicata* with smaller amounts of *Aristida purpurea var. longiseta* and *Poa secunda*. Other species include forbs such as *Achillea millefolium, Erigeron pumilus, Galium aparine, Heterotheca villosa, Lotus unifoliolatus (= Lotus purshianus), Scutellaria angustifolia, Stellaria nitens*, and the cactus *Opuntia polyacantha*. Mosses and lichens are usually present and average about 20% cover. Litter cover is relatively high. Exotic species may dominate these often disturbed stands, particularly the annual grass *Bromus tectorum*, but also *Bromus arvensis (= Bromus japonicus), Hypericum perforatum, Melilotus officinalis, Verbascum* spp., and others.

ENVIRONMENT & DYNAMICS

Environmental Description: This scrub woodland and shrubland alliance is found in the lower montane and foothill regions around the Columbia Basin, and north and east into the Central Rockies in Idaho and northwestern Wyoming and south into canyons in the Colorado Plateau and in riparian areas in the southeastern Colorado plains. It can occur in the active floodplain of intermittent streams and deep canyon bottoms of the Snake and Salmon rivers. Elevations range from 250-550 m in the Columbia Basin (Tisdale 1986) and 1400-1700 m in Colorado (Carsey et al. 2003a). The climate is temperate, continental with a mean annual precipitation of approximately 25-30 cm. Precipitation primarily occurs in the winter as snow or rain. This moisture is stored in the soil and utilized

during the typically dry summers. Stands are typically found on moderately steep footslopes and toeslopes in canyons where gravel and boulder-sized colluvium accumulate; near the seepage lines on river terraces; on riparian margins and river bars; and forest openings in the mountains. Although sites are predominately on hot, dry southeastern to southwestern aspects, these trees access additional soil moisture that accumulates at the base of the colluvial slopes, or are riparian. Soils are poorly developed, well-drained alluvial or colluvial sands that often have a high percentage of rock fragments. There are reports of this alliance occurring on colluvial talus cones (Daubenmire 1970), but generally sites are more stable than adjacent *Rhus glabra* stands. On lowland sites surface water can be present for variable periods without detectable seasonal periodicity. Inundation is not predictable to a given season and is dependent upon highly localized rainstorms. Other adjacent stands may include other riparian vegetation and xeric grasslands dominated by *Pseudoroegneria spicata* or *Poa secunda* on the upper slopes.

Dynamics: *Celtis laevigata var. reticulata* tolerates fires. It is rarely killed when burned and sprouts vigorously from underground rhizomes following a fire (FEIS 1998). However, the sprouts and seedlings may not compete well with grassland vegetation, and frequent fire is thought to exclude *Celtis laevigata var. reticulata* from grasslands (Johnson and Simon 1987). These stands occur on rocky slopes that are likely to have few fires (Johnson and Simon 1987). The biggest threat is exotic plants that have invaded many stands. Common exotics include annual grasses such as *Bromus tectorum, Bromus arvensis*, and *Bromus briziformis*, and the perennial forbs *Hypericum perforatum* and *Conyza canadensis*.

DISTRIBUTION

Geographic Range: This scrub woodland and shrubland alliance is found in the lower montane and foothill regions around the Columbia Basin, and north and east into the Central Rockies in Idaho and northwestern Wyoming and south into canyons in the Colorado Plateau and in riparian areas in the southeastern Colorado plains.

Nations: US
States/Provinces: CA?, CO, ID, OR, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **><** *Celtis reticulata* Series (Tisdale 1986)

LOWER LEVEL UNITS

Associations:
- CEGL001085 *Celtis laevigata var. reticulata / Pseudoroegneria spicata* Wet Scrub
- CEGL000792 *Celtis laevigata var. reticulata / Philadelphus lewisii* Wet Scrub
- CEGL000875 *Philadelphus lewisii / Symphoricarpos albus* Wet Shrubland
- CEGL003451 *Celtis laevigata var. reticulata / Toxicodendron rydbergii* Wet Scrub
- CEGL001170 *Philadelphus lewisii* Wet Shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by D. Culver.
Version Date: 2014/03/14

REFERENCES

References: Carsey et al. 2003a, Daubenmire 1970, Evans 1989a, FEIS 1998, Faber-Langendoen et al. 2017b, Johnson and Simon 1987, Moseley 1987a, Tisdale 1986

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G527. Western Montane-Subalpine Riparian & Seep Shrubland

A3773. Cornus sericea - Dasiphora fruticosa ssp. floribunda - Ribes spp. Wet Shrubland Alliance

Type Concept Sentence: This western alliance comprises short-statured to medium-tall (usually <1.5 m, but can be up to 3 m) shrublands dominated by *Cornus sericea, Dasiphora fruticosa ssp. floribunda, Rosa woodsii, Ribes lacustre*, and/or *Ribes hudsonianum*. Understories are graminoid- or forb-dominated. Environments are riparian areas, wet valley bottoms and lower slopes that have seasonal subirrigation.

OVERVIEW

Scientific Name: *Cornus sericea - Dasiphora fruticosa ssp. floribunda - Ribes* spp. Wet Shrubland Alliance
Common Name (Translated Scientific Name): Red-osier Dogwood - Shrubby-cinquefoil - Currant species Wet Shrubland Alliance
Colloquial Name: Western Non-willow Wet Shrubland

Type Concept: This western alliance comprises short-statured to medium-tall (usually <1.5 m, but can be up to 3 m) shrublands dominated by *Cornus sericea, Dasiphora fruticosa ssp. floribunda, Rosa woodsii, Ribes lacustre*, and/or *Ribes hudsonianum*. Understories are graminoid- or forb-dominated. Environments are riparian areas, wet valley bottoms and lower slopes that have seasonal subirrigation.

Classification Comments: These are riparian shrublands that are not wet enough to support *Salix* or *Alnus* species.

Internal Comments: mjr 8-15: CA? added based on member distribution. mjr 2-15: NV added for MOJN.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Riparian shrublands dominated by *Cornus sericea, Dasiphora fruticosa ssp. floribunda, Rosa woodsii, Ribes lacustre*, and/or *Ribes hudsonianum*.

VEGETATION

Physiognomy and Structure: The short-shrub stratum is dominated by broad-leaved deciduous shrubs that typically are 1 m tall or less. The open canopy cover ranges from 10-90%. The herbaceous layer can be sparse with heavy overstory or dense graminoid cover formed by rhizomatous sedges and bunch grasses. The forb layer is usually dominated by perennial forbs and can be sparse to nonexistent in some stands.

Floristics: Plant associations within this alliance are classified as temporarily flooded, cold-deciduous shrublands. *Cornus sericea, Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda)*, or *Ribes lacustre* dominates the overstory. Other shrub species may include *Acer glabrum, Alnus incana, Artemisia cana, Artemisia tridentata ssp. vaseyana, Betula occidentalis, Cornus sericea (= Cornus stolonifera), Juniperus communis, Lonicera involucrata, Ribes inerme, Rosa woodsii, Rubus idaeus, Salix bebbiana*, and other *Salix* species. The herbaceous understory is sparse to moderate cover that may include graminoids *Andropogon gerardii, Bromus ciliatus, Carex aquatilis, Carex buxbaumii, Carex microptera, Carex pachystachya, Festuca campestris, Festuca idahoensis, Festuca rubra, Juncus arcticus ssp. littoralis (= Juncus balticus), Muhlenbergia filiformis, Phalaris arundinacea, Poa palustris, Poa secunda*, and/or *Schizachyrium scoparium*, and/or forbs such as *Galium triflorum, Heracleum maximum (= Heracleum lanatum), Maianthemum stellatum, Mertensia ciliata, Saxifraga odontoloma*, and/or *Trifolium longipes*. Exotic forage species such as *Phleum pratense, Poa pratensis*, and the annual forb *Taraxacum officinale* may be present in disturbed stands.

ENVIRONMENT & DYNAMICS

Environmental Description: Plant associations within this alliance occur adjacent to glacial depressions, terraces along meandering streams, slopes near springs and seeps, steep scree slopes, or broad mountain meadows. They may occur in foothill canyons, on intermittent streams with beds of limestone cobbles and boulders, or near springs at the base of limestone talus or limestone bedrock. They typically occur on alluvial terraces adjacent to stream channels and near seeps on moist toeslopes (slope 0-10%) of canyon walls. They also occur on narrow stream benches in ravines and on narrow terraces of wider valleys. They range in elevation from 860 to 3000 m. Surface water is present for brief periods during the growing season, but the water table usually lies well below the soil surface. Parent materials for sites supporting stands of this alliance are either alluvial-glacial or organic. The soils are typically sandy loams over sand and gravel layers.

Dynamics: Heavily grazed sites may support *Dasiphora*-dominated communities (Komarkova 1986, Padgett et. al. 1989). With continuous heavy grazing, *Dasiphora fruticosa ssp. floribunda* will increase in abundance because it is unpalatable to livestock. Other species that increase with grazing are *Poa pratensis, Juncus arcticus ssp. littoralis* and *Taraxacum officinale* (Padgett et al. 1989). Stands dominated by *Cornus sericea* forms a relatively stable community because of its strong rhizomes and stolons (Hansen et al. 1988b).

DISTRIBUTION

Geographic Range: This western alliance is found in eastern Oregon and Washington, Idaho, Montana, Wyoming, Colorado, Nevada and Utah.

Nations: CA?, US
States/Provinces: CO, ID, MT, NV, OR, UT, WA, WY
TNC Ecoregions [optional]: 11:C

USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** *Rosa woodsii* (Interior rose thickets) Provisional Alliance (Sawyer et al. 2009) [63.320.00]
- **>** *Rosa woodsii* Shrubland Alliance (Evens et al. 2014)

LOWER LEVEL UNITS

Associations:

- CEGL001107 *Dasiphora fruticosa ssp. floribunda / Deschampsia cespitosa* Wet Shrubland
- CEGL001167 *Cornus sericea / Heracleum maximum* Wet Shrubland
- CEGL001165 *Cornus sericea* Rocky Mountain Wet Shrubland
- CEGL001172 *Ribes lacustre / Mertensia ciliata* Wet Shrubland
- CEGL003445 *Ribes lacustre - Ribes hudsonianum / Cinna latifolia* Wet Shrubland
- CEGL001126 *Rosa woodsii* Wet Shrubland
- CEGL003446 *Ribes lacustre - Ribes hudsonianum / Glyceria striata* Wet Shrubland
- CEGL001166 *Cornus sericea / Galium triflorum* Wet Shrubland

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Evens et al. 2014, Faber-Langendoen et al. 2017b, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Komarkova 1986, Padgett et al. 1988b, Padgett et al. 1989, Sanderson and March 1996, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Tuhy and Jensen 1982, Welsh et al. 1987, Youngblood et al. 1985a, Youngblood et al. 1985b

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G527. Western Montane-Subalpine Riparian & Seep Shrubland

A3974. Crataegus douglasii / Symphoricarpos albus Wet Shrubland Alliance

Type Concept Sentence: This deciduous broad-leaved shrubland alliance is dominated by *Crataegus douglasii*, often forming dense thickets, and is found in the lower montane and foothill regions around the Columbia Basin, and north and east into the Central Rockies in Idaho and northwestern Wyoming.

OVERVIEW

Scientific Name: *Crataegus douglasii / Symphoricarpos albus* Wet Shrubland Alliance
Common Name (Translated Scientific Name): Black Hawthorn / Common Snowberry Wet Shrubland Alliance
Colloquial Name: Valley Bottom Black Hawthorn / Common Snowberry Wet Shrubland

Type Concept: The shrub canopy of this deciduous broad-leaved shrubland alliance is dominated by *Crataegus douglasii*, often forming dense thickets. Occasional the broad-leaved deciduous trees *Populus tremuloides* or *Populus balsamifera ssp. trichocarpa* may codominate the tree layer for a period of years before dying back from heart rot. Other trees are occasionally present with low cover. The understory is dominated by short shrubs or herbaceous species. Common shrubs include *Rosa nutkana, Rosa woodsii, Spiraea betulifolia*, and *Symphoricarpos albus*. The sparse to moderately dense herbaceous layer is composed of perennial graminoids, such as *Deschampsia cespitosa, Elymus glaucus*, and *Leymus cinereus (= Elymus cinereus)*, and diverse forbs The herbaceous layer is relatively depauperate if *Heracleum maximum* is abundant due to the extreme shading. Many weedy introduced grasses are common, such as the perennial forage species *Bromus inermis, Phleum pratense, Poa pratensis*, and invasive annual grass *Bromus tectorum*. This alliance is found in the lower montane and foothill regions around the Columbia Basin, and north and east into the Central Rockies in Idaho and northwestern Wyoming. Stands occur on relatively moist sites on deep soils within flat valleys on low-gradient streams with broad floodplains that flood seasonally. Elevations range between 400 and 850 m. Stands often extend up adjacent north-facing toeslopes where seepage provides constant moisture. Soils are typically deep and fine-textured.

Classification Comments: Associations within this alliance are often degraded and poorly described. Characteristics which differentiate this alliance from the moister *Crataegus douglasii* alliances are not clearly quantified.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: The alliance is characterized by dominance of diagnostic species *Crataegus douglasii*, often forming dense thickets 3-8 m tall. Broad-leaved deciduous trees *Populus tremuloides* and *Populus balsamifera ssp. trichocarpa* may codominate the tree layer for a period of years before dying back and *Crataegus douglasii* becoming dominant again. Occasional individuals of *Alnus incana, Betula occidentalis*, or *Celtis laevigata var. reticulata* may be present with low cover. The understory is dominated by short shrubs or herbaceous species. If present the shrub layer is composed of associated species *Amelanchier alnifolia, Cornus sericea, Rosa nutkana, Rosa woodsii, Salix exigua, Spiraea betulifolia*, or *Symphoricarpos albus*. A sparse to moderately dense herbaceous layer may be present, typically composed of mesic perennial graminoids and forbs. Associated species include grasses *Deschampsia cespitosa, Elymus glaucus, Leymus cinereus*, and many forbs such as *Geum macrophyllum, Heracleum maximum, Hydrophyllum fendleri, Iris missouriensis, Lithophragma parviflorum, Pteridium aquilinum*, and *Urtica dioica*.

VEGETATION

Physiognomy and Structure: Associations in this alliance generally support a dense thicket of tall (2-8 m) cold-deciduous woody shrubs with a secondary canopy of low shrubs. The herbaceous layer is usually well-developed and diverse, ranging from low-statured graminoids to coarse forbs approaching 2 m in height. A phase described by Daubenmire (1970) has an emergent open tree canopy of cold-deciduous trees, but this does not occur in all stands.

Floristics: The shrub canopy of this deciduous broad-leaved shrubland alliance is dominated by *Crataegus douglasii*, often forming dense thickets 3-7 m tall. Occasionally the broad-leaved deciduous trees *Populus tremuloides* or *Populus balsamifera ssp. trichocarpa* may codominate the tree layer for a period of years before dying back from heart rot (Daubenmire 1970). These *Populus*-codominated phases may repeat periodically when *Populus* stems sprout from roots. The process is described by Daubenmire (1970). Other trees occasionally present with low cover are *Alnus incana, Betula occidentalis*, or *Celtis laevigata var. reticulata*, but they never dominate the stand. The understory is dominated by short shrubs or herbaceous species. Shrubs may include *Amelanchier alnifolia, Cornus sericea, Rosa nutkana, Rosa woodsii, Salix exigua, Spiraea betulifolia*, and *Symphoricarpos albus*. The sparse to moderately dense herbaceous layer is composed of perennial graminoids, such as *Carex* spp., *Deschampsia cespitosa, Elymus glaucus*, and *Leymus cinereus (= Elymus cinereus)*, and forbs such as *Achillea millefolium, Besseya rubra, Galium boreale, Geranium viscosissimum, Geum macrophyllum, Heracleum maximum, Hydrophyllum fendleri, Iris missouriensis, Lithophragma parviflorum, Osmorhiza berteroi, Potentilla arguta, Potentilla gracilis, Pteridium aquilinum*, and *Urtica dioica*. The herbaceous layer is relatively depauperate if *Heracleum maximum* is abundant due to extreme shading. Many weedy introduced grasses are common in the understories of most *Crataegus* stands. These can include perennial forage species *Bromus inermis, Phleum pratense, Poa pratensis*, invasive annual grass *Bromus tectorum*, and many others.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance is found in the lower montane and foothill regions around the Columbia Basin, and north and east into the Central Rockies in Idaho and northwestern Wyoming. Elevations range between 400 and 850 m. The climate of the region is characterized by a mix of continental and maritime influences. It is in the rainshadow of the Cascades, with annual precipitation between 23 and 51 cm (9-20 inches). Between 55 and 75% of the precipitation falls as snow during October through March, and summers are typically dry. Summer temperatures can be hot, and winters are typically cold. Stands occur on relatively moist sites on deep soils within flat valleys on low-gradient streams with broad floodplains that flood seasonally. This alliance is typically found on aggraded valley floors which border intermittent or permanent streams and have dependable soil moisture through the growing season (Daubenmire 1970). These sites may be flooded seasonally, but due to the low gradients are rarely scoured. Soils are generally accumulated glacial outwash composed of fine silts and clays of moderate to deep depths. Stands of this alliance often extend up adjacent north-facing toeslopes where seepage provides constant moisture. Adjacent vegetation is usually *Artemisia* steppe or *Pseudoroegneria - Festuca* grassland.

Dynamics: Historically, fire appears to have been important in maintaining the open nature of *Crataegus* shrublands (Daubenmire 1970). Fire may also have been somewhat influential in maintaining the much branched morphology of the dominant shrubs. Most stands have been severely degraded by livestock grazing. Livestock browse all accessible parts of *Crataegus douglasii*, and can eliminate entire stands (Daubenmire 1970).A

DISTRIBUTION

Geographic Range: This deciduous broadleaf shrubland alliance is found in the lower montane and foothill regions around the Columbia Basin, and north and east into the Central Rockies in Idaho and northwestern Wyoming.

Nations: US

States/Provinces: CA?, ID, OR, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** *Crataegus douglasii / Heracleum lanatum* Association Habitat types (Daubenmire 1970)
- **>** *Crataegus douglasii / Symphoricarpos albus* Association Habitat types (Daubenmire 1970)
- **>** *Crataegus douglasii* Shrubland Alliance (Bourgeron and Engelking 1994)

LOWER LEVEL UNITS

Associations:

- CEGL001095 *Crataegus douglasii / Rosa woodsii* Wet Shrubland
- CEGL001096 *(Populus tremuloides) / Crataegus douglasii / Symphoricarpos albus* Wet Shrubland
- CEGL001094 *(Populus tremuloides) / Crataegus douglasii / Heracleum maximum* Wet Shrubland

AUTHORSHIP

Primary Concept Source: R.F. Daubenmire (1970)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by D. Sarr.
Version Date: 2014/03/14

REFERENCES

References: Bourgeron and Engelking 1994, Crowe and Clausnitzer 1997, Daubenmire 1970, Evans 1989a, Faber-Langendoen et al. 2017b, Kovalchik 1987, ORNHP unpubl. data, Reid et al. 1994

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G527. Western Montane-Subalpine Riparian & Seep Shrubland

A3769. Salix boothii - Salix geyeriana - Salix lutea Montane Wet Shrubland Alliance

Type Concept Sentence: This alliance contains tall (>1.5 m) *Salix*-dominated shrublands in riparian and wetland settings. It is dominated by single or multiple *Salix* species, including *Salix bebbiana, Salix boothii, Salix drummondiana, Salix eriocephala, Salix geyeriana, Salix ligulifolia, Salix lucida ssp. caudata, Salix lucida ssp. lasiandra, Salix lutea, Salix planifolia*, and *Salix prolixa*. These shrub species occur in the same broad geographic region, spreading from eastern Oregon and Washington, Idaho, Montana, Wyoming, Colorado, Utah, Nevada, New Mexico, and Arizona.

OVERVIEW

Scientific Name: *Salix boothii - Salix geyeriana - Salix lutea* Montane Wet Shrubland Alliance
Common Name (Translated Scientific Name): Booth's Willow - Geyer's Willow - Yellow Willow Montane Wet Shrubland Alliance
Colloquial Name: Western Montane Tall Willow Wet Shrubland

Type Concept: This alliance contains tall (>1.5 m) *Salix*-dominated shrublands in riparian and wetland settings. It is dominated by single or multiple *Salix* species including *Salix bebbiana, Salix boothii, Salix drummondiana, Salix eriocephala, Salix geyeriana, Salix ligulifolia, Salix lucida ssp. caudata, Salix lucida ssp. lasiandra, Salix lutea, Salix planifolia*, and *Salix prolixa*. *Salix monticola* may also be present but is not a dominant species. These shrub species occur in the same broad geographic region, spreading from eastern Oregon and Washington, Idaho, Montana, Wyoming, Colorado, Utah, Nevada, New Mexico, and Arizona. Understories range from thick graminoids or forbs to very sparse cover depending on the degree of overstory shading. Common dominant graminoid species include *Calamagrostis canadensis, Carex aquatilis, Carex utriculata, Carex nebrascensis*, and *Deschampsia cespitosa*. Forb species are often mixed. These are generally subirrigated soils that are mineral with some degree of organic layers, but not deep peat soils.

Classification Comments: This covers the tall willow shrublands in the heart of the Intermountain West and Rocky Mountains within the U.S. Some of the associations include stands on mineral soils and stands on peat soils, and these will need to be separated into organic and non-organic soil counterparts. Many of these species are codominant in varying combinations, making single-*Salix* species alliances problematic. Stands with codominance of *Salix monticola* belong to *Salix monticola* Wet Shrubland Alliance (A0981).

Internal Comments:

Other Comments:

Similar NVC Types:
- A0981 *Salix monticola* Wet Shrubland Alliance: may have some of the same codominant *Salix* species.

Diagnostic Characteristics: Dominance or codominance (>5% relative cover) of one or more of the following tall *Salix* species: *Salix bebbiana, Salix boothii, Salix drummondiana, Salix eriocephala, Salix geyeriana, Salix ligulifolia, Salix lucida ssp. caudata, Salix lucida ssp. lasiandra, Salix lutea, Salix planifolia*, and *Salix prolixa*.

VEGETATION

Physiognomy and Structure: This alliance is dominated by tall (1-4 m) broad-leaved deciduous shrublands. It is characterized by a dense to open canopy. The herbaceous layer can be dominated by graminoids or forbs and is often a mix.

Floristics: The tall-shrub layer is dominated by large stands of one or several willow species, including *Salix bebbiana, Salix boothii, Salix drummondiana, Salix eriocephala, Salix geyeriana, Salix ligulifolia, Salix lucida ssp. caudata, Salix lucida ssp. lasiandra, Salix lutea, Salix planifolia*, and *Salix prolixa*. *Salix monticola* may also be present but not dominant. Other shorter shrub species include *Dasiphora fruticosa ssp. floribunda (= Pentaphylloides fruticosa), Lonicera utahensis*, and *Ribes* spp. The herbaceous layer is characterized by a moderate forb layer or dense graminoids. When forbs dominate the herbaceous layer, rarely is one forb species dominant, but rather several species form a combined cover. Forb species include *Achillea millefolium, Epilobium ciliatum, Galium trifidum, Geum macrophyllum, Heracleum maximum (= Heracleum lanatum), Pedicularis groenlandica, Polygonum bistortoides, Pyrola asarifolia*, and *Swertia perennis*. Graminoids, when dominant, can be only one or two species and include *Carex aquatilis, Carex utriculata, Carex microptera, Calamagrostis canadensis, Calamagrostis stricta*, and *Poa palustris*.

ENVIRONMENT & DYNAMICS

Environmental Description: Vegetation types in this alliance occur in valley bottoms on swales, banks, and occasionally terraces of stream channels, areas which may have surface water in wet years. The ground surface is often uneven and hummocky. Soils are typically highly stratified with alternating layers of sandy loam and clay loam and are mottled within the top 10 cm. Other soils are finely textured, dark-colored, highly organic soils with silty clay loam. Lower profiles typically contain a gravel or cobble layer which may indicate that the soil section is a silted-in beaver pond (Kittel et al. 1999b).

Dynamics: Stands within this alliance are generally highly productive. Understory production varies, depending on the density of overstory shrubs. Characteristics of the herbaceous layer and soils suggest that many of the vegetation types within this alliance are stable (Youngblood et al. 1985b). However, livestock or wildlife grazing pressure will cause a decrease in the native graminoids (Hansen et al. 1995), and an opening of the overstory canopy, especially if browsing pressure is heavy. Beavers can increase the amount of surface water and decrease willow density.

DISTRIBUTION

Geographic Range: Montane elevations in eastern Oregon and Washington, Idaho, Montana, Wyoming, Colorado, Utah, Nevada, New Mexico, and Arizona.

Nations: CA, US
States/Provinces: AZ, CO, ID, MT, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Salix* spp. Series (Johnston 1987)

LOWER LEVEL UNITS

Associations:
- CEGL001173 *Salix bebbiana* Wet Shrubland
- CEGL001190 *Salix drummondiana* Wet Shrubland [Placeholder]
- CEGL001181 *Salix boothii* / Mesic Graminoids Wet Shrubland
- CEGL001233 *Salix eriocephala / Ribes aureum - Rosa woodsii* Wet Shrubland
- CEGL001180 *Salix boothii* / Mesic Forbs Wet Shrubland
- CEGL002621 *Salix lucida ssp. caudata / Rosa woodsii* Wet Shrubland

- CEGL001205 *Salix geyeriana / Calamagrostis canadensis* Wet Shrubland
- CEGL001208 *Salix geyeriana / Deschampsia cespitosa* Wet Shrubland
- CEGL002975 *Salix ligulifolia / Carex utriculata* Wet Shrubland
- CEGL002671 *Salix boothii / Equisetum arvense* Wet Shrubland
- CEGL001218 *Salix ligulifolia* Wet Shrubland
- CEGL002904 *Salix boothii / Deschampsia cespitosa - Geum rossii* Wet Shrubland
- CEGL001187 *Salix boothii / Maianthemum stellatum* Wet Shrubland
- CEGL001211 *Salix geyeriana / Poa palustris* Wet Shrubland
- CEGL001186 *Salix boothii - Salix lemmonii* Wet Shrubland
- CEGL002607 *Salix boothii - Salix eastwoodiae / Carex nigricans* Wet Shrubland
- CEGL001219 *Salix lutea / Calamagrostis canadensis* Wet Shrubland
- CEGL001220 *Salix lutea / Carex utriculata* Wet Shrubland
- CEGL001174 *Salix bebbiana* / Mesic Graminoids Wet Shrubland
- CEGL001184 *Salix boothii - Salix geyeriana* Wet Shrubland
- CEGL003452 *Salix prolixa / Rosa woodsii* Wet Shrubland
- CEGL001176 *Salix (boothii, geyeriana) / Carex aquatilis* Wet Shrubland
- CEGL001212 *Salix geyeriana - Salix lemmonii / Carex aquatilis var. dives* Wet Shrubland
- CEGL001584 *Salix drummondiana / Carex scopulorum var. prionophylla* Wet Shrubland
- CEGL002631 *Salix drummondiana / Carex utriculata* Wet Shrubland
- CEGL002667 *Salix drummondiana / Calamagrostis canadensis* Wet Shrubland
- CEGL001185 *Salix boothii - Salix geyeriana / Carex angustata* Wet Shrubland
- CEGL001192 *Salix drummondiana* / Mesic Forbs Wet Shrubland
- CEGL005937 *Salix planifolia / Carex utriculata* Wet Shrubland
- CEGL001247 *Salix geyeriana - Salix monticola / Calamagrostis canadensis* Wet Shrubland
- CEGL002624 *Salix lutea / Rosa woodsii* Wet Shrubland
- CEGL001177 *Salix boothii / Carex nebrascensis* Wet Shrubland
- CEGL001213 *Salix geyeriana - Salix eriocephala* Wet Shrubland
- CEGL002666 *Salix geyeriana* / Mesic Forbs Wet Shrubland
- CEGL001210 *Salix geyeriana* / Mesic Graminoids Wet Shrubland
- CEGL001183 *Salix boothii / Poa palustris* Wet Shrubland
- CEGL001178 *Salix boothii / Carex utriculata* Wet Shrubland
- CEGL001137 *Salix glauca / Deschampsia cespitosa* Wet Shrubland
- CEGL002774 *Salix lutea* / Mesic Forbs Wet Shrubland
- CEGL001175 *Salix boothii / Calamagrostis canadensis* Wet Shrubland
- CEGL001224 *Salix planifolia* Wet Shrubland
- CEGL002893 *Salix planifolia* / Mesic Forbs Wet Shrubland
- CEGL001206 *Salix geyeriana / Carex aquatilis* Wet Shrubland
- CEGL002073 *Salix lutea* / Mesic Graminoids Wet Shrubland
- CEGL001207 *Salix geyeriana / Carex utriculata* Wet Shrubland
- CEGL003780 *Salix lutea* Wet Shrubland
- CEGL005322 *Salix lutea / Leymus cinereus* Wet Shrubland
- CEGL005363 *Salix eriocephala* / Mesic Graminoids Wet Shrubland
- CEGL001215 *Salix lucida ssp. caudata* Wet Shrubland
- CEGL001223 *Salix geyeriana - Salix monticola* / Mesic Forbs Wet Shrubland

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Carsey et al. 2003a, Carsey et al. 2003b, Cooper and Cottrell 1990, Dorn 1997, Evenden 1990, Faber-Langendoen et al. 2017b, Girard et al. 1997, Hallock et al. 1986, Hansen et al. 1991, Hansen et al. 1995, Hess 1981, Jensen and Tuhy 1981, Johnston 1987, Jones 1992b, Kagan 1997, Kearney et al. 1969, Kettler and McMullen 1996, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1995, Kittel et al. 1999a, Kittel et al. 1999b, Kovalchik 1987, MTNHP unpubl. data, Manning and Padgett 1991, Manning and Padgett 1992, Manning and Padgett 1995, Mutz and Graham 1982, Mutz and Queiroz 1983, Norton et al. 1981, ORNHP unpubl. data, Padgett 1982, Padgett and Manning 1988, Padgett et al. 1988b, Padgett et al. 1989, Phillips 1977, Reid 1990, Sawyer and Keeler-Wolf 1995, Tuhy and Jensen 1982, Weixelman et al. 1996, Youngblood et al. 1985a, Youngblood et al. 1985b

2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G527. Western Montane-Subalpine Riparian & Seep Shrubland

A1003. Salix commutata Wet Shrubland Alliance

Type Concept Sentence: These are short-statured (<1.5 m) willow-dominated communities found at subalpine elevations. *Salix commutata* dominates the shrub canopy with cover of >25%. Stands are confined to narrow riparian zones along upper reaches of streams and to elongated openings in higher elevation forests. Stands are typically found at moderate to high elevations between 2065 and 2220 m in British Columbia, Oregon, Washington, Idaho, western Montana and just into northern California and possibly as far east as Wyoming.

OVERVIEW

Scientific Name: *Salix commutata* Wet Shrubland Alliance
Common Name (Translated Scientific Name): Undergreen Willow Wet Shrubland Alliance
Colloquial Name: Cascadian Undergreen Willow Wet Shrubland

Type Concept: These are short-statured (<1.5 m) willow-dominated communities found at subalpine elevations. Stands within this alliance are classified as seasonally flooded, cold-deciduous shrublands. *Salix commutata* dominates the shrub canopy with cover of >25%. *Salix planifolia* and *Lonicera caerulea* may also be present. *Carex scopulorum* dominates the herbaceous layer with *Calamagrostis canadensis*. *Galium trifidum* has high constancy, and some stands contain a complement of wet-site forbs such as *Aconitum columbianum* and *Caltha leptosepala ssp. howellii (= Caltha biflora)*. Adjacent communities may be herbaceous bogs dominated by *Eleocharis quinqueflora (= Eleocharis pauciflora)*. In some stands, a fringe of *Vaccinium uliginosum (= Vaccinium occidentale)* separates the bog from the willow stands. Stands are confined to narrow riparian zones along upper reaches of streams and to elongated openings in higher elevation forests. Stands are typically found at moderate to high elevations between 2065 and 2220 m in British Columbia, Oregon, Washington, Idaho, western Montana and just into northern California and possibly as far east as Wyoming. Microtopography is usually hummocky to undulating. Slopes range from 2-4%. Soils in Idaho stands are wet to saturated at the surface by flowing groundwater for most or all of the growing season. Soils are poorly to very poorly drained due to accumulation of organic material.

Classification Comments: This is the short shrub of higher elevations in the Cascades and Rocky Mountains that does not tend to overlap with other short-statured willows.

Internal Comments:
Other Comments:

Similar NVC Types:
- A3770 *Salix wolfii - Salix brachycarpa - Betula glandulosa* Wet Shrubland Alliance: occupies similar environments and has similar stature, with some shared species, but tends to be further west and north.

Diagnostic Characteristics: Greater than 5% relative cover of *Salix commutata*.

VEGETATION

Physiognomy and Structure: This alliance is dominated by short, 1- to 2-m tall, broad-leaved deciduous shrublands. Canopy cover is continuous with 60-100% cover. The herbaceous layer is dominated by graminoids (60-100% cover) and a sparse forb layer.

Floristics: Stands within this alliance are classified as seasonally flooded, cold-deciduous shrublands. *Salix commutata* dominates the shrub canopy with cover of >25%. *Salix planifolia* and *Lonicera caerulea* may also be present. *Carex scopulorum* dominates the herbaceous layer with *Calamagrostis canadensis*. *Galium trifidum* has high constancy, and some stands contain a complement of wet-site forbs such as *Aconitum columbianum* and *Caltha leptosepala ssp. howellii (= Caltha biflora)*.

ENVIRONMENT & DYNAMICS

Environmental Description: Communities found within this alliance are found in the subalpine zone. Stands are confined to narrow riparian zones along upper reaches of streams and to elongated openings in higher elevation forests. Stands are typically found at moderate to high elevations between 2065 and 2220 m. Microtopography is usually hummocky to undulating. Slopes range from 2-4%. Soils in Idaho stands are wet to saturated to the surface by flowing groundwater for most or all of the growing season. Soils are poorly to very poorly drained due to accumulation of organic material.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is found in British Columbia, Oregon, Washington, Idaho, western Montana and just into northern California and possibly as far east as Wyoming.

Nations: CA, US
States/Provinces: BC, CA, ID, MT, OR, WA, WY?
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL003497 *Salix commutata* / Mesic Graminoid Wet Shrubland
- CEGL001189 *Salix commutata / Carex scopulorum* Wet Shrubland

AUTHORSHIP

Primary Concept Source: D. Culver, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Dorn 1984, Faber-Langendoen et al. 2017b, Hickman 1993, Hitchcock et al. 1964, Tuhy and Jensen 1982

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G527. Western Montane-Subalpine Riparian & Seep Shrubland

A3774. Salix eastwoodiae - Salix lemmonii Wet Shrubland Alliance

Type Concept Sentence: These riparian shrublands, found scattered throughout high-elevation, late-snowmelt areas of the western U.S., are dominated by *Salix eastwoodiae* and/or *Salix lemmonii*. Other species such as *Salix planifolia, Salix boothii*, and *Betula glandulosa* may also occur in the shrub layer. They are found within glacial valley bottoms (e.g., seeps, toeslopes, benches, and stream benches), wet mountain meadows, and streambanks with gentle slopes (3%). Elevations range from 2300-3200 m. Sites that support these communities contain surface waters that collect in rivulets or are fed by seeps with water flowing at or near the surface.

OVERVIEW

Scientific Name: *Salix eastwoodiae - Salix lemmonii* Wet Shrubland Alliance
Common Name (Translated Scientific Name): Mountain Willow - Lemmon's Willow Wet Shrubland Alliance
Colloquial Name: Mountain Willow - Lemmon's Willow Wet Shrubland

Type Concept: These riparian shrublands, found scattered throughout high-elevation, late-snowmelt areas, are dominated by *Salix eastwoodiae* and/or *Salix lemmonii*. Other species such as *Salix planifolia, Salix boothii*, and *Betula glandulosa* may also occur in the shrub layer. Total shrub cover varies from 30 to over 75%. *Carex scopulorum, Carex aquatilis*, and *Carex utriculata* are usually dominant in the understory with at least 40% cover. *Carex cusickii (= Carex obovoidea)* and *Carex luzulina* are frequent and abundant. *Calamagrostis canadensis* is a dominant graminoid in Idaho stands. Forb cover is low with *Mertensia ciliata, Saxifraga odontoloma*, and *Thalictrum occidentale*. Adjacent upland communities are dominated by *Pinus monticola, Pinus contorta*, and *Abies concolor*. This alliance is found in the Rocky Mountains of western Wyoming and eastern Idaho, and the Sierra Nevada of western Nevada and California. These shrublands are found within glacial valley bottoms (e.g., seeps, toeslopes, benches, and stream benches), wet mountain meadows, and streambanks with gentle slopes (3%). Elevations range from 2300-3200 m. Sites that support these communities contain surface waters that collect in rivulets or are fed by seeps with water flowing at or near the surface. Soils are characterized by organic surface horizons. Textures of the underlying mineral horizons range from silty clay loam to loam sand.

Classification Comments: These *Salix* species do overlap somewhat with other Rocky Mountain tall willows, but are centered in their distribution further west and extend into California.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Riparian shrublands dominated by *Salix eastwoodiae* and/or *Salix lemmonii*.

VEGETATION

Physiognomy and Structure: This alliance is composed of tall (2-5 m), broad-leaved deciduous shrublands. They are characterized by intermittent shrub cover (30-75%). The herbaceous layer is dominated by 10-20% cover of graminoids. Forb cover is low to none.

Floristics: Vegetation types within this alliance are characterized as cold-deciduous, seasonally flooded shrublands. They are dominated by *Salix eastwoodiae* and/or *Salix lemmonii*. *Salix planifolia, Salix boothii*, and *Betula glandulosa* also occur in the shrub layer. Total shrub cover varies from 30 to over 75%. *Carex scopulorum, Carex aquatilis*, and *Carex utriculata* are usually dominant in the understory with at least 40% cover. *Carex cusickii (= Carex obovoidea)* and *Carex luzulina* are frequent and abundant (Mutz and Queiroz 1983). Tuhy and Jensen (1982) report *Calamagrostis canadensis* as a dominant graminoid in their Idaho stands. Forb cover is low with *Mertensia ciliata, Saxifraga odontoloma*, and *Thalictrum occidentale*.

ENVIRONMENT & DYNAMICS

Environmental Description: Communities within this shrubland alliance are scattered throughout the high-elevation, late-snowmelt areas. They are found within glacial valley bottoms (e.g., seeps, toeslopes, benches, and stream benches), wet mountain meadows, and streambanks with gentle slopes (3%). Elevations range from 2300-3200 m (Dorn 1997). Sites that support these communities contain surface waters that collect in rivulets or are fed by seeps with water flowing at or near the surface (Mutz and Queiroz 1983). Soils are characterized by organic surface horizons. Textures of the underlying mineral horizons range from silty clay loam to loam sand.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is found in the Rocky Mountains of western Wyoming and eastern Idaho, and the Sierra Nevada of western Nevada and California.

Nations: US
States/Provinces: CA, ID, NV, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** *Salix eastwoodiae* (Sierran willow thickets) Alliance (Sawyer et al. 2009) [61.112.00]
- **>** *Salix lemmonii* (Lemmon's willow thickets) Alliance (Sawyer et al. 2009) [61.113.00]

LOWER LEVEL UNITS

Associations:

- CEGL002772 *Salix lemmonii / Rosa woodsii* Wet Shrubland
- CEGL003128 *Salix eastwoodiae / Deschampsia cespitosa* Wet Shrubland
- CEGL008698 *Salix lemmonii* Sierran Wet Shrubland
- CEGL002069 *Salix lemmonii* / Mesic Graminoids Wet Shrubland
- CEGL002771 *Salix lemmonii* / Mesic-Tall Forbs Wet Shrubland
- CEGL001194 *Salix eastwoodiae* Wet Shrubland
- CEGL001196 *Salix eastwoodiae / Carex utriculata* Wet Shrubland
- CEGL001195 *Salix eastwoodiae / Carex aquatilis* Wet Shrubland

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Dorn 1997, Faber-Langendoen et al. 2017b, Mutz and Queiroz 1983, Padgett and Manning 1988, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Tuhy and Jensen 1982, Walford et al. 1997, Youngblood et al. 1985a

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G527. Western Montane-Subalpine Riparian & Seep Shrubland

A0977. Salix lasiolepis Wet Shrubland Alliance

Type Concept Sentence: Communities within this cold-deciduous, temporarily (or seasonally) flooded shrubland alliance occupy stream benches and occasionally seeps. They can form stringer communities along drainages with slopes ranging between 1-15%. Elevations range between 259 and 2490 m. Soils are xeric and developed on alluvium. The tall-shrub layer is dominated by *Salix lasiolepis* which forms a dense overstory ranging from 60-100% cover.

OVERVIEW

Scientific Name: *Salix lasiolepis* Wet Shrubland Alliance
Common Name (Translated Scientific Name): Arroyo Willow Wet Shrubland Alliance
Colloquial Name: Arroyo Willow Wet Shrubland

Type Concept: The tall-shrub layer of this alliance is dominated by *Salix lasiolepis* which forms a dense overstory ranging from 60-100% cover. Other shrubs that may be equally important include *Baccharis pilularis, Baccharis salicifolia, Cephalanthus occidentalis, Cornus sericea, Morella californica*, and *Toxicodendron diversilobum*. Emergent trees may include *Acer macrophyllum, Platanus racemosa, Populus balsamifera, Populus fremontii, Salix* spp., and *Sambucus nigra ssp. canadensis*. *Ribes aureum, Rosa californica*, or *Rosa woodsii* typically form a low-shrub layer near the base of the willows. The undergrowth is typically depauperate, with *Clematis ligusticifolia* and *Maianthemum stellatum (= Smilacina stellata)* present in minor amounts. Bare ground and/or leaf litter from the willow overstory are characteristic. This alliance occurs in California, Nevada, southwestern Utah, Oregon, and Idaho. Communities within this cold-deciduous, temporarily (or seasonally) flooded shrubland alliance occupy stream benches and occasionally seeps. They can form stringer communities along drainages with slopes ranging from 1-15%. Elevations range between 259 and 2490 m. Soils are xeric and developed on alluvium. Water tables were rarely reached by researchers within the depth of soil pits, and mottles were not evident because of the coarse soil texture.

Classification Comments: *Salix lasiolepis* mixes with other tall willows in the northern and eastern portions of its range in Oregon, Idaho, Nevada and Utah, but the only associations described to date are single willow-dominated types.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Riparian stands dominated by *Salix lasiolepis*.

VEGETATION

Physiognomy and Structure: The tall-shrub layer is dominated by broad-leaved, deciduous shrubs that can reach heights of 5 m. The canopy is dense with cover of over 90%. The understory forms a moderately dense, low-shrub stratum with a sparse graminoid/forb layer.

Floristics: Communities within this alliance are defined as cold-deciduous, temporarily (or seasonally) flooded shrublands. The tall-shrub layer is dominated by *Salix lasiolepis* which forms a dense overstory ranging from 60-100% cover. Other woody species in the shrub or emergent tree layer include *Acer macrophyllum, Baccharis pilularis, Baccharis salicifolia, Cephalanthus occidentalis, Cornus sericea, Morella californica, Platanus racemosa, Populus balsamifera, Populus fremontii, Salix* spp., and *Sambucus nigra ssp. canadensis*. *Ribes aureum, Rosa californica*, or *Rosa woodsii* typically form a low-shrub layer near the base of the willows. The undergrowth is typically depauperate, with *Artemisia douglasiana, Clematis ligusticifolia* or other *Clematis* sp., *Juncus* spp., and *Maianthemum stellatum (= Smilacina stellata)* present in minor amounts. Bare ground and/or leaf litter from the willow overstory are characteristic of stands within this alliance.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands occupy stream benches and occasionally seeps. They can form stringer communities along drainages with slopes ranging from 1-15% cover. Elevations range between 259 and 2490 m. Soils are xeric and developed on alluvium. Water tables were rarely reached within the depth of soil pits, and mottles were not evident because of the coarse soil

texture (Padgett et al. 1989, Manning and Padgett 1995). Adjacent uplands can be dominated by *Pinus edulis, Juniperus osteosperma, Quercus gambelii*, or *Artemisia tridentata ssp. vaseyana*.

Dynamics: These plant associations are disturbance-dependent with seasonal flooding and appear to be stable and long-lived in Nevada (Manning and Padgett 1995). The depauperate undergrowth is likely indicative of the xeric surface soil conditions or grazing pressures (Padgett et al. 1989). There were several weedy species within the understory, including *Bromus tectorum, Melilotus indicus, Poa pratensis, Rumex crispus*, and *Taraxacum officinale*.

DISTRIBUTION

Geographic Range: This alliance occurs in California, Nevada, southwestern Utah, Oregon, and Idaho.

Nations: US
States/Provinces: CA, ID, NV, OR, UT
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **<** *Salix lasiolepis* (Arroyo willow thickets) Alliance (Sawyer et al. 2009) [61.201.00]
- **=** *Salix lasiolepis* Alliance (Arroyo willow thickets) (Buck-Diaz et al. 2012)
- **=** *Salix lasiolepis* Temporarily Flooded Shrubland Alliance (Keeler-Wolf et al. 2012)
- **=** *Salix lasiolepis* Woodland/Forest Alliance (Keeler-Wolf and Evens 2006)

LOWER LEVEL UNITS

Associations:

- CEGL001216 *Salix lasiolepis* / Barren Ground Wet Shrubland
- CEGL003453 *Salix lasiolepis - Cornus sericea / Rosa woodsii* Wet Shrubland
- CEGL001217 *Salix lasiolepis / Rosa woodsii* / Mixed Herbs Wet Shrubland

AUTHORSHIP

Primary Concept Source: D. Culver, J. Evens and A. Klein, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Blackburn et al. 1968a, Buck-Diaz et al. 2012, Faber-Langendoen et al. 2017b, Hitchcock et al. 1964, Kearney et al. 1969, Keeler-Wolf and Evens 2006, Keeler-Wolf et al. 2012, Manning and Padgett 1992, Manning and Padgett 1995, Martin and Hutchins 1980, Moseley 1998, Moseley et al. 1998, Padgett et al. 1989, Sawyer et al. 2009, Sproul et al. 2011

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G527. Western Montane-Subalpine Riparian & Seep Shrubland

A0981. Salix monticola Wet Shrubland Alliance

Type Concept Sentence: This is a montane riparian shrubland alliance that is characterized by a tall, nearly closed canopy of *Salix monticola* often with one or more other willow species such as *Salix geyeriana, Salix drummondiana, Salix lucida ssp. lasiandra, Salix planifolia*, and *Salix wolfii*. It occurs in the Rocky Mountains along stream reaches in wide to narrow valleys (20-500 m) with broad, swift-moving streams and active, flat (3-8%) floodplains. Elevations range between 2310 and 3350 m.

OVERVIEW

Scientific Name: *Salix monticola* Wet Shrubland Alliance
Common Name (Translated Scientific Name): Park Willow Wet Shrubland Alliance
Colloquial Name: Park Willow Wet Shrubland

Type Concept: This is a montane riparian shrubland alliance that is characterized by a tall, nearly closed canopy of *Salix monticola* often with one or more other willow species such as *Salix geyeriana, Salix drummondiana, Salix lucida ssp. lasiandra (= Salix lasiandra), Salix planifolia* and *Salix wolfii*. Other shrubs may be present as well, such as *Cornus sericea, Betula glandulosa*, and

Lonicera involucrata. The forb layer is dense (up to 50%) and consists of *Angelica ampla, Galium boreale, Geum macrophyllum, Senecio bigelovii, Solidago canadensis*, and others. Graminoids can also be very abundant with species such as *Calamagrostis canadensis, Carex utriculata*, and *Carex aquatilis*. This alliance occurs in the Rocky Mountains along stream reaches in wide to narrow valleys (20-500 m) with broad, swift-moving streams and active, flat (3-8%) floodplains. Elevations range between 2310 and 3350 m. Large stands occur between meanders and at the edges of beaver ponds. The ground surface is usually undulating, from past flooding or beaver activity. These shrublands occur right at stream's edge, and up to 15 m from the channel, usually >0.5 m above the channel elevation. Soils are predominantly heavy silty clays with occasional to abundant mottling evident. Some stands occur on coarse, well-drained alluvium.

Classification Comments: This tall willow species does not range as widely as others in the Rocky Mountains, so it seems prudent to keep it as its own alliance. It could be included with *Salix boothii - Salix geyeriana - Salix lutea* Montane Wet Shrubland Alliance (A3769), as many of the willow species included there can co-occur with *Salix monticola*.

Internal Comments:
Other Comments:

Similar NVC Types:
- A3769 *Salix boothii - Salix geyeriana - Salix lutea* Montane Wet Shrubland Alliance

Diagnostic Characteristics: Riparian shrublands dominated by *Salix monticola*.

VEGETATION

Physiognomy and Structure: This alliance is dominated by a tall (2-5 m) broad-leaved deciduous shrub. It forms a thick, closed canopy (30-75%) with a short-shrub layer (25-35% cover). The graminoid and forb layer varies widely among associations, but percent cover averages 30%.

Floristics: Plant associations within this alliance are intermittent in the montane areas of the Rocky Mountains. They are temporarily flooded, cold-deciduous shrublands dominated by *Salix monticola*. The tall-shrub layer is characterized by a tall, nearly closed canopy of *Salix monticola* (8-70%), typically with *Salix geyeriana* (40-50%) or *Salix drummondiana* (10%). Other shrubs present include *Betula glandulosa, Salix lucida ssp. lasiandra (= Salix lasiandra), Salix planifolia*, and *Salix wolfii*. The short-shrub layer is dominated by *Cornus sericea* and *Lonicera involucrata*. The forb layer is dense (up to 50%) and consists of *Angelica ampla, Galium boreale, Geum macrophyllum, Senecio bigelovii, Solidago canadensis*, and others. *Calamagrostis canadensis* comprises a dense graminoid layer of 40-50% cover. *Carex utriculata* and *Carex aquatilis* also contribute to the graminoid understory in several associations.

ENVIRONMENT & DYNAMICS

Environmental Description: Plant associations occur in the mountains along stream reaches in moderately wide to narrow valleys (20-120 m) with broad, swift-moving streams and active, flat (3-8%) floodplains. Elevations range between 2310 and 3350 m. Large stands occur between meanders and at the edges of beaver ponds. The ground surface is usually undulating, from past flooding or beaver activity. Associations occur right at stream's edge, and up to 15 m from the channel, usually >0.5 m above the channel elevation. Adjacent riparian vegetation can include deciduous shrublands and woodlands with mesic meadows. Adjacent upslope vegetation is typically coniferous forests dominated by *Pinus contorta, Picea* spp., and *Populus tremuloides*. Soils are predominantly heavy silty clays with occasional to abundant mottling evident. Some stands occur on coarse, well-drained alluvium.

Dynamics: Several associations within this alliance are influenced by beaver activity. *Carex utriculata* usually forms monotypic stands at the edge of ponds, where a persistent high water table limits the occurrence of other species. *Carex* stands are slowly invaded by *Salix* spp. as the ground becomes less saturated (Hansen et al. 1988b). Presence of dying conifer trees may indicate an increase in the water table due to decreased transpiration rates, allowing for expansion of *Calamagrostis canadensis* and conversion from a conifer / *Calamagrostis canadensis* plant association to a *Salix monticola / Calamagrostis canadensis* association (Padgett et al. 1989).

DISTRIBUTION

Geographic Range: This alliance is intermittent in the montane areas of the Rocky Mountains of Wyoming, Colorado and New Mexico.

Nations: US
States/Provinces: CO, NM, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:

Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Associations:

- CEGL001139 *Salix monticola* Thicket Wet Shrubland
- CEGL001222 *Salix monticola / Calamagrostis canadensis* Wet Shrubland
- CEGL002656 *Salix monticola / Carex aquatilis* Wet Shrubland
- CEGL001221 *Salix monticola / Angelica ampla* Wet Shrubland
- CEGL002657 *Salix monticola / Carex utriculata* Wet Shrubland
- CEGL002659 *Salix monticola* / Mesic Graminoids Wet Shrubland
- CEGL002658 *Salix monticola* / Mesic Forbs Wet Shrubland

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Andrews 1983, Baker 1989b, Carsey et al. 2003a, Carsey et al. 2003b, Cooper and Cottrell 1990, Faber-Langendoen et al. 2017b, Hansen et al. 1988b, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1995, Kittel et al. 1996, Kittel et al. 1997a, Kittel et al. 1999a, Kittel et al. 1999b, Padgett et al. 1989, Richard et al. 1996, Sanderson and Kettler 1996

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G527. Western Montane-Subalpine Riparian & Seep Shrubland

A2563. Salix orestera Wet Shrubland Alliance

Type Concept Sentence: This vegetation forms a dense shrub canopy between 0.5 and 2 m in height, dominated by the tall willow *Salix orestera*. It grows on low-gradient basin floors, streamsides, and wet meadows around 3050-3200 m (10,000-10,500 feet) elevation in the Sierra Nevada of California and in Oregon and Nevada. Soils are silt or clay loams derived from metamorphic parent materials.

OVERVIEW

Scientific Name: *Salix orestera* Wet Shrubland Alliance
Common Name (Translated Scientific Name): Sierra Willow Wet Shrubland Alliance
Colloquial Name: Sierra Willow Wet Shrubland

Type Concept: This vegetation forms a dense shrub canopy between 0.5 and 2 m in height, dominated by the tall willow *Salix orestera*. Other shrub species that may be present to codominant include *Ribes montigenum, Vaccinium cespitosum*, and *Phyllodoce breweri*. The herbaceous understory tends to be light cover dominated by graminoids such as *Calamagrostis breweri, Carex exserta, Carex fissuricola, Carex spectabilis, Juncus parryi, Luzula subcongesta, Phleum alpinum, Poa secunda, Poa stebbinsii*, and *Ptilagrostis kingii*. Forbs present may include *Achillea millefolium, Allium validum, Antennaria media, Antennaria rosea, Arnica mollis, Castilleja lemmonii, Chamerion angustifolium (= Epilobium angustifolium), Cirsium* sp., *Lupinus lepidus, Mimulus primuloides, Montia chamissoi, Muhlenbergia filiformis, Oreostemma alpigenum var. alpigenum, Pedicularis attollens, Penstemon rydbergii, Potentilla drummondii, Potentilla gracilis, Senecio scorzonella, Senecio triangularis*, and/or *Symphyotrichum spathulatum var. spathulatum (= Aster occidentalis var. occidentalis)*. This vegetation grows on low-gradient basin floors, streamsides, and wet meadows around 3050-3200 m (10,000-10,500 feet) elevation in the Sierra Nevada of California and in Oregon and Nevada. Soils are silt or clay loams derived from metamorphic parent materials.

Classification Comments: Descriptive information is only from Yosemite National Park. Need to incorporate information from Sawyer et al. (2009).

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Riparian shrublands dominated by *Salix orestera* with >50% relative cover in the shrub layer (Manning and Padgett 1995, Keeler-Wolf et al. 2004, Potter 2005).

VEGETATION

Physiognomy and Structure: This vegetation forms a dense shrub canopy between 0.5 and 2 m in height, dominated by the tall willow *Salix orestera*.

Floristics: This vegetation forms a dense shrub canopy between 0.5 and 2 m in height, dominated by the tall willow *Salix orestera*. Other shrub species that may be present to codominant include *Ribes montigenum, Vaccinium cespitosum*, and *Phyllodoce breweri*. The herbaceous understory tends to be light cover dominated by graminoids such as *Calamagrostis breweri, Carex exserta, Carex fissuricola, Carex spectabilis, Juncus parryi, Luzula subcongesta, Phleum alpinum, Poa secunda, Poa stebbinsii*, and *Ptilagrostis kingii*. Forbs present may include *Achillea millefolium, Allium validum, Antennaria media, Antennaria rosea, Arnica mollis, Castilleja lemmonii, Chamerion angustifolium (= Epilobium angustifolium), Cirsium* sp., *Lupinus lepidus, Mimulus primuloides, Montia chamissoi, Muhlenbergia filiformis, Oreostemma alpigenum var. alpigenum, Pedicularis attollens, Penstemon rydbergii, Potentilla drummondii, Potentilla gracilis, Senecio scorzonella, Senecio triangularis*, and/or *Symphyotrichum spathulatum var. spathulatum (= Aster occidentalis var. occidentalis)*.

ENVIRONMENT & DYNAMICS

Environmental Description: This vegetation grows on low-gradient basin floors, streamsides, and wet meadows around 3050-3200 m (10,000-10,500 feet) elevation in the Sierra Nevada of California. Soils are silt or clay loams derived from metamorphic parent materials.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is found in the Sierra Nevada of California and in Oregon and Nevada.

Nations: US
States/Provinces: CA, NV, OR
TNC Ecoregions [optional]: 12:C
USFS Ecoregions (2007): M261E:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **=** *Salix orestera* (Sierra gray willow thickets) Alliance (Sawyer et al. 2009) [61.115.00]
- **=** *Salix orestera* Shrubland Alliance (CNPS 2017) [61.115.00]
- **<** Montane Riparian Scrub (#63500) (Holland 1986b)
- **><** Montane wetland shrub habitat (Sawyer and Keeler-Wolf 1995)
- **><** Subalpine wetland shrub habitat (Sawyer and Keeler-Wolf 1995)

LOWER LEVEL UNITS

Associations:

- CEGL008700 *Salix orestera / Senecio triangularis* Wet Shrubland
- CEGL008701 *Salix orestera / Allium validum* Wet Shrubland
- CEGL008702 *Salix orestera / Calamagrostis breweri* Wet Shrubland

AUTHORSHIP

Primary Concept Source: J.O. Sawyer et al. (2009)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: CNPS 2017, Cheng 2004, Faber-Langendoen et al. 2017b, Holland 1986b, Keeler-Wolf et al. 2003a, Keeler-Wolf et al. 2004, Klikoff 1965, Major and Taylor 1977, Manning and Padgett 1995, Potter 2005, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009

2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G527. Western Montane-Subalpine Riparian & Seep Shrubland

A3770. Salix wolfii - Salix brachycarpa - Betula glandulosa Wet Shrubland Alliance

Type Concept Sentence: These are short (<1.5 m) *Salix*- or *Betula*-dominated shrublands of Intermountain West and Rocky Mountain high subalpine altitudes dominated by *Betula nana, Salix brachycarpa, Salix farriae, Salix planifolia*, and/or *Salix wolfii*. Canopy can be closed to open. Understory is usually fairly dense, graminoid-dominated herbaceous cover and occasionally forb-dominated, including several *Carex* spp. (e.g., *Carex aquatilis, Carex microptera, Carex scopulorum, Carex utriculata*), *Deschampsia cespitosa*, and others. Forb species may include *Caltha leptosepala, Fragaria virginiana, Pedicularis groenlandica, Swertia perennis*, and others.

OVERVIEW

Scientific Name: *Salix wolfii - Salix brachycarpa - Betula glandulosa* Wet Shrubland Alliance
Common Name (Translated Scientific Name): Wolf's Willow - Short-fruit Willow - Resin Birch Wet Shrubland Alliance
Colloquial Name: Rocky Mountain Short Willow Wet Shrubland

Type Concept: These are short (<1.5 m) *Salix*- or *Betula*-dominated shrublands of Intermountain West and Rocky Mountain high subalpine altitudes dominated by *Betula nana, Salix brachycarpa, Salix farriae, Salix planifolia*, and/or *Salix wolfii*. Canopy can be closed to open. Understory is usually fairly dense, graminoid-dominated herbaceous cover and occasionally forb-dominated, including several *Carex* spp. (e.g., *Carex aquatilis, Carex microptera, Carex scopulorum, Carex utriculata*), *Deschampsia cespitosa*, and others. Forb species may include *Caltha leptosepala, Fragaria virginiana, Pedicularis groenlandica, Swertia perennis*, and others. Communities within this alliance occur in moderately narrow to wide valleys and glacial basins on floodplains with lateral seepage of groundwater. Valley slopes range from 3-7%, and stream channels that run through the valleys vary from deep, narrow, and sinuous to shallow, broad, and gently meandering. Beavers are often active within the stands. Some stands occur on sideslope seeps, which remain wet throughout the growing season. Elevation ranges from 1950-3350 m. Soils are mineral. Soil textures include silty clay loams, silty loams, and sandy clay loams with mottling. Some stands occur on deep sandy clays, often with a high organic content, while other stands occur on shallow silty clays over gravels and rocks.

Classification Comments: This alliance covers low-statured (short <1.5 m) shrublands of subalpine altitudes in the Intermountain West and Rocky Mountains. *Salix commutata* occupies similar habitats but are regionally limited to the Cascade Range and Coast Ranges.

Internal Comments:
Other Comments:

Similar NVC Types:
- A1003 *Salix commutata* Wet Shrubland Alliance: occupies similar habitats with overlapping ranges but generally does not mix with *Salix* species in this alliance.

Diagnostic Characteristics: Short (<1.5 m) willow- or birch-dominated shrublands of high subalpine altitudes dominated by *Betula nana, Salix brachycarpa, Salix farriae, Salix planifolia*, and/or *Salix wolfii*.

VEGETATION

Physiognomy and Structure: This alliance is characterized by broad-leaved deciduous shrubs. The canopy consists of short (1-2 m), rounded shrubs that form a dense canopy. The herbaceous layer is dense with graminoids, especially rhizomatous sedges, and has a sparse to moderately dense forb layer.

Floristics: These are cold-deciduous, short-statured shrublands. The shrub layer is typically dominated by *Betula nana, Salix brachycarpa, Salix farriae, Salix planifolia*, and/or *Salix wolfii*. Stands can be monotypic, but are more often a mix of at least 2 species. *Salix brachycarpa* occupies the drier margins or raised hummocks. The herbaceous undergrowth is generally dense and rich, dominated by graminoids such as *Carex aquatilis, Carex microptera, Carex nebrascensis, Carex utriculata*, or *Deschampsia cespitosa*, or by forbs that may include *Caltha leptosepala, Ligusticum tenuifolium, Pedicularis groenlandica, Swertia perennis*, or *Thalictrum alpinum*.

ENVIRONMENT & DYNAMICS

Environmental Description: Communities within this alliance occur in moderately narrow to wide valleys and glacial basins on floodplains with lateral seepage of groundwater. Valley slopes range from 3-7%, and stream channels that run through the valleys vary from deep, narrow, and sinuous to shallow, broad, and gently meandering. Beavers are often active within the stands. Some stands occur on sideslope seeps, which remain wet throughout the growing season. Elevation ranges from 1950-3350 m. Soils are

mineral. Soil textures include silty clay loams, silty loams, and sandy clay loams with mottling. Some stands occur on deep sandy clays, often with a high organic content, while other stands occur on shallow silty clays over gravels and rocks.

Dynamics: Browsing may weaken or eventually eliminate some willow species. With increasing levels of grazing, *Deschampsia cespitosa* will be replaced by *Juncus arcticus ssp. littoralis, Poa pratensis*, and *Taraxacum officinale*.

DISTRIBUTION

Geographic Range: This alliance is found in the Intermountain West and Rocky Mountains of Idaho, Montana, Wyoming, Colorado, Utah, and New Mexico, extending into eastern Oregon and Washington.

Nations: CA, US
States/Provinces: CO, ID, MT, NM, OR, UT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Salix* spp. Series (Johnston 1987)

LOWER LEVEL UNITS

Associations:
- CEGL002653 *Betula glandulosa* / Mesic Forbs - Mesic Graminoids Wet Shrubland
- CEGL002064 *Salix wolfii / Calamagrostis canadensis* Wet Shrubland
- CEGL001240 *Salix wolfii* / Mesic Forbs Wet Shrubland
- CEGL001241 *Salix wolfii / Poa palustris* Wet Shrubland
- CEGL001244 *Salix brachycarpa / Carex aquatilis* Wet Shrubland
- CEGL001236 *Salix wolfii / Carex nebrascensis* Wet Shrubland
- CEGL001242 *Salix wolfii / Swertia perennis - Pedicularis groenlandica* Wet Shrubland
- CEGL001225 *Salix planifolia / Calamagrostis canadensis* Wet Shrubland
- CEGL001135 *Salix brachycarpa* / Mesic Forbs Wet Shrubland
- CEGL002665 *Salix planifolia / Caltha leptosepala* Wet Shrubland
- CEGL001079 *Betula glandulosa / Carex utriculata* Wet Shrubland
- CEGL001235 *Salix wolfii / Carex microptera* Wet Shrubland
- CEGL001237 *Salix wolfii / Carex utriculata* Wet Shrubland
- CEGL001230 *Salix planifolia / Deschampsia cespitosa* Wet Shrubland
- CEGL005828 *Betula glandulosa / Salix brachycarpa* Wet Shrubland
- CEGL001229 *Salix planifolia / Carex scopulorum* Wet Shrubland
- CEGL001238 *Salix wolfii / Deschampsia cespitosa* Wet Shrubland
- CEGL001227 *Salix planifolia / Carex aquatilis* Wet Shrubland
- CEGL001136 *Salix glauca* Wet Shrubland
- CEGL001228 *Salix (farriae, planifolia) / Carex utriculata* Wet Shrubland
- CEGL001234 *Salix wolfii / Carex aquatilis* Wet Shrubland
- CEGL005887 *Betula glandulosa / Carex* spp. Wet Shrubland
- CEGL001239 *Salix wolfii / Fragaria virginiana* Wet Shrubland

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Cooper 1986a, Cooper and Cottrell 1990, Dorn 1997, Faber-Langendoen et al. 2017b, Girard et al. 1997, Hansen et al. 1991, Hansen et al. 1995, Heifner 1974, Hess 1981, Hess and Wasser 1982, Hitchcock et al. 1964, Jensen and Tuhy 1981, Johnston 1987, Jones 1992b, Kettler and McMullen 1996, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1995, Kittel et al. 1996, Kittel et al. 1999a, Kittel et al. 1999b, Komarkova 1986, Lewis 1970, Mattson 1984, Mutz and Graham 1982, Mutz and Queiroz 1983,

Norton et al. 1981, Olson and Gerhart 1982, Padgett et al. 1988b, Padgett et al. 1989, Phillips 1977, Sanderson and Kettler 1996, Tuhy 1981, Tuhy and Jensen 1982, Youngblood et al. 1985a, Youngblood et al. 1985b

2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
2.C.4.Nb.2.f. M075 Western North American Montane-Subalpine-Boreal Marsh, Wet Meadow & Shrubland

G528. Western North American Boreal Wet Meadow & Marsh

Type Concept Sentence: This wetland group occurs in boreal Alaska and Canada on mineral soils and is characterized by graminoid species such as *Calamagrostis canadensis, Carex aquatilis, Carex lasiocarpa, Carex utriculata, Equisetum palustre, Eriophorum angustifolium*, and others. It may include shrub cover (<25%) such as *Myrica gale, Alnus incana ssp. tenuifolia*, and *Salix* spp.

OVERVIEW

Scientific Name: *Carex aquatilis - Carex utriculata* Boreal Wet Meadow & Marsh Group
Common Name (Translated Scientific Name): Water Sedge - Northwest Territory Sedge Boreal Wet Meadow & Marsh Group
Colloquial Name: Boreal Sedge Wet Meadow

Type Concept: This group is widespread in the boreal and boreal transitional areas of Alaska and British Columbia, extending east into Alberta, Saskatchewan, and Manitoba and south into Idaho, Montana, North Dakota and Minnesota. Vegetation is largely graminoid-dominated. Common species include *Calamagrostis canadensis, Carex aquatilis, Carex lasiocarpa, Carex utriculata, Equisetum palustre*, and *Eriophorum angustifolium*. Shrubs may be a minor component of the canopy cover (less than 25%) and include *Myrica gale, Alnus incana ssp. tenuifolia*, and *Salix* spp. It occurs on floodplains, depressions, pond and lake margins, oxbows and abandoned channels. Frequent river channel migration and associated flooding and fluvial processes constitute the major disturbances. Wetland succession and species composition are variable due to diverse environmental conditions such as water depth, substrate, and nutrient input. Floodplain wetland vegetation includes freshwater marsh and wet low shrub. Patch size is small to large and often linear. Moisture regime varies from saturated to semipermanently flooded.

Classification Comments:

Similar NVC Types:

Diagnostic Characteristics: This group is characterized principally by hydrophytic herbaceous vegetation and less commonly low-shrub marshes that are saturated to semipermanently flooded on boreal and boreal transition areas.

VEGETATION

Physiognomy and Structure: This group is defined by hydrophytic graminoids.

Floristics: Freshwater marsh vegetation may be dominated by emergent sedges, forbs, or grasses. Species that often dominate or codominate include *Calamagrostis canadensis, Carex aquatilis, Carex lasiocarpa, Carex utriculata, Equisetum palustre*, and *Eriophorum angustifolium*. Shrubs may be a minor component of the canopy cover (less than 25% cover) and include *Myrica gale, Alnus incana ssp. tenuifolia*, and *Salix* spp.

ENVIRONMENT & DYNAMICS

Environmental Description: Freshwater marshes are found throughout the boreal transition and boreal regions of Alaska and British Columbia, extending east into Alberta, Saskatchewan, and Manitoba and south into Idaho, Montana, North Dakota and Minnesota. They are characterized by emergent herbaceous vegetation. Freshwater marshes typically occur with other wetland groups. They occur on the margins of abandoned channels, floodplains, ponds, lakes, and riparian systems and on inland deltas where rivers drain into large lakes. Inland marshes are mostly small-patch, confined to limited areas in suitable floodplain or basin topography. They are typically saturated or semipermanently flooded, but some marshes have seasonal flooding. Water is at or above the surface for most of the growing season (typically 10 cm above the surface). Soils are muck or mineral, and water is nutrient-rich. These systems are highly productive and have high rates of decomposition.

Dynamics: This group requires a source of freshwater. Seasonal flooding is characteristic of inland deltas. Marsh zonation is related to water depth and duration of flooding. A typical sequence progresses from open water to emergent deep marsh to shallow marsh to wet meadow or fen. Floating marsh mats may be seral to fens. River channel migration, flooding and other fluvial processes constitute the major disturbance in this group.

DISTRIBUTION

Geographic Range: This group occurs throughout the boreal transition and boreal regions of Alaska and British Columbia, extending east into Alberta, Saskatchewan, and Manitoba and south into Idaho, Montana, North Dakota and Minnesota.

Spatial Scale & Pattern [optional]: Large patch, Small patch, Linear
Nations: CA, US
States/Provinces: AB, AK, BC, ID, MB, MN, ND, SK, YT
TNC Ecoregions [optional]: 71:C, 72:C, 73:C, 74:C, 75:?, 76:C, 77:C, 78:C, 79:C, 134:P, 135:C, 139:C, 140:C, 141:C, 144:C
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: NPS (Katmai)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Alliances:
- A3824 *Typha* spp. - *Schoenoplectus* spp. Boreal Marsh Alliance
- A3825 *Myrica gale - Alnus incana ssp. tenuifolia - Salix* spp. Boreal Wet Shrubland Alliance
- A3823 *Carex aquatilis - Carex utriculata* Boreal Wet Meadow Alliance

AUTHORSHIP

Primary Concept Source: G. Kittel, K. Boggs, P. Comer, M. Reid, D. Faber-Langendoen, in Faber-Langendoen et al. (2011)
Author of Description: M.E. Hall, G. Kittel and T. Boucher
Acknowledgments:
Version Date: 01/19/2016
Classif Resp Region: West
Internal Author: MEH 10-11, mod. GK 10-11, 9-13, 11-15, mod. TB 1-16

REFERENCES

References: Boggs 2002, Boggs et al. 2003, Comer et al. 2003, Faber-Langendoen et al. 2017a, Fleming and Spencer 2007, Gracz et al. 2005, Jorgenson 1999, Lawrence et al. 2005, National Wetlands Working Group 1997, Shiflet 1994, Stone et al. 2007, Thompson and Hansen 2003, Viereck et al. 1992, Willoughby 2007, Willoughby et al. 2006

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G528. Western North American Boreal Wet Meadow & Marsh

M301. Western North American Ruderal Marsh, Wet Meadow & Shrubland

This macrogroup includes disturbed natural wetland habitats of temperate western North America that are now strongly dominated by non-native and sometimes weedy or generalist native species.

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
2.C.4.Nb.90.a. M301 Western North American Ruderal Marsh, Wet Meadow & Shrubland

G524. Western North American Ruderal Marsh, Wet Meadow & Shrubland

Type Concept Sentence: This group contains wet meadows dominated by non-native species such as *Agrostis gigantea, Agrostis stolonifera, Alopecurus pratensis, Conyza canadensis, Cirsium arvense, Sonchus* spp., *Lactuca serriola, Phalaris arundinacea, Phragmites australis ssp. australis, Poa palustris*, and/or *Poa pratensis* that occur in the same physical settings as native wet meadows found throughout the western U.S. and Canada.

OVERVIEW

Scientific Name: *Poa pratensis - Conyza canadensis - Cirsium arvense* Ruderal Marsh, Wet Meadow & Shrubland Group
Common Name (Translated Scientific Name): Kentucky Bluegrass - Canadian Horseweed - Canada Thistle Ruderal Marsh, Wet Meadow & Shrubland Group
Colloquial Name: Western Ruderal Forb Wet Meadow

Type Concept: This group contains disturbed wet meadows found in lowland, montane and subalpine elevations, occasionally reaching into the lower edges of the alpine elevations (sea level to 3600 m) throughout the western U.S. and Canada. Vegetation is dominated by non-native species such as *Agrostis gigantea, Agrostis stolonifera, Alopecurus pratensis, Bromus inermis, Conyza canadensis, Cirsium arvense, Sonchus* spp., *Lactuca serriola, Phalaris arundinacea, Phragmites australis ssp. australis, Poa bulbosa, Poa palustris*, and *Poa pratensis*. Native species may be present but are so low in abundance that the original native plant association is impossible to determine. These can be wet meadows, wet emergent marshes, coastal backwater dunes, sloughs, open wet depressions, basins and flats with low-velocity surface and subsurface flows. They can be large meadows in montane or subalpine valleys, or occur as narrow strips bordering ponds, lakes, and streams, and along toeslope seeps. They are typically found on flat areas or gentle slopes, but may also occur on subirrigated sites with slopes up to 10%. Sites are usually seasonally wet, often drying by late summer, and many occur in a tension zone between perennial wetlands and uplands, where water tables fluctuate in response to long-term climatic cycles. They may have surface water for part of the year, but depths rarely exceed a few centimeters. Soils are mostly mineral and show typical hydric soil characteristics such as low chroma and redoximorphic features; some areas may have high organic content as inclusions or pockets. Due to disturbance, soils may be compacted.

Classification Comments: This group may be difficult to tease apart from its native counterpart. The test is that the non-native species far outweigh native species in abundance and richness, such that a well-trained observer cannot tell what the native counterpart may have been or to do so is only speculation. This group does not include actively managed irrigated hay meadows that have been historically seeded. Those belong under 7 Agricultural & Developed Vegetation Class (CCL01).

Similar NVC Types:
- G517 Vancouverian Freshwater Wet Meadow & Marsh: is dominated by native species.
- G521 Vancouverian-Rocky Mountain Montane Wet Meadow & Marsh: is dominated by native species.
- G531 Arid West Interior Freshwater Marsh
- G819 North American Warm Desert Ruderal Scrub
- G677 North American Warm Desert Ruderal Grassland
- G600 Great Basin-Intermountain Ruderal Dry Shrubland & Grassland

Diagnostic Characteristics: Wet graminoid and forb meadow or marsh dominated by non-native species.

VEGETATION

Physiognomy and Structure: Herbaceous wet meadow dominated by perennial herbs introduced to North America.

Floristics: Vegetation of this group is dominated by non-native species such as *Agrostis gigantea, Agrostis stolonifera, Alopecurus pratensis, Bromus inermis, Conyza canadensis, Lactuca serriola, Cirsium arvense, Iris pseudacorus, Phalaris arundinacea, Phragmites australis, Poa bulbosa, Poa palustris, Poa pratensis, Poa trivialis*, and *Scirpus cyperinus*. Native species may be present but are so low in abundance that the original native plant association is impossible to determine. Floristic information was compiled from Whitson et al. (1996), Rondeau (2001), Faber-Langendoen et al. (2008), and Sawyer et al. (2009).

ENVIRONMENT & DYNAMICS

Environmental Description: *Soil/substrate/hydrology:* These wet meadows occur in open wet depressions, basins and flats with low-velocity surface and subsurface flows. They can be large meadows in montane or subalpine valleys, or occur as narrow strips bordering ponds, lakes, and streams, and along toeslope seeps. They are typically found on flat areas or gentle slopes, but may also occur on subirrigated sites with slopes up to 10%. Sites are usually seasonally wet, often drying by late summer, and many occur in a tension zone between perennial wetlands and uplands, where water tables fluctuate in response to long-term climatic cycles. Some sites occur under an agricultural management regime of seasonal sheet irrigation for grazing or haying purposes, and may bear no resemblance to historical types of the area. They may have surface water for part of the year, but depths rarely exceed a few centimeters. Soils are mostly mineral and show typical hydric soil characteristics such as low chroma and redoximorphic features; some areas may have high organic content as inclusions or pockets. Due to disturbance, soils may be compacted.

This group occurs in the same environmental settings as Vancouverian-Rocky Mountain Montane Wet Meadow & Marsh Group (G521), Vancouverian Freshwater Wet Meadow & Marsh Group (G517), and Arid West Interior Freshwater Marsh Group (G531).

Dynamics: This group is a product of disturbance such as continuous heavy grazing by domestic livestock, soil disturbance/compactions, significant change in hydrologic regime, invasion after natural disturbance such as fire, floods or landslides, and are a combination of infestation by non-native invasive plants, and by diminished or lack of competition by native plants.

DISTRIBUTION

Geographic Range: This group is found throughout the entire western U.S. and Canada.

Spatial Scale & Pattern [optional]: Small patch
Nations: CA, US
States/Provinces: AB, AK, BC, CA, CO, ID, MT, NM, NV, OR, SD, TX, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Alliances:
- A2020 *Sorghum halepense* Ruderal Desert Grassland Alliance
- A3848 *Poa pratensis - Agrostis gigantea - Agrostis stolonifera* Ruderal Marsh Alliance
- A4217 *Salix* spp. - *Artemisia cana* Ruderal Understory Wet Shrubland Alliance
- A3847 *Phragmites australis ssp. australis - Arundo donax - Typha angustifolia* Ruderal Marsh Alliance
- A3849 *Conyza canadensis - Cirsium arvense - Lactuca serriola* Ruderal Wet Meadow Alliance
- A3846 *Phalaris arundinacea* Western Ruderal Marsh Alliance

AUTHORSHIP

Primary Concept Source: D. Faber-Langendoen, in Faber-Langendoen et al. (2011)
Author of Description: G. Kittel
Acknowledgments: Associate Editor: F.J. Triepke. Peer review by J. Rocchio.
Version Date: 09/29/2016
Classif Resp Region: West
Internal Author: GK 12-10, 3-11, 6-12, 9-13, 12-15, 9-16, 10-16, 8-17

REFERENCES

References: Buck-Diaz et al. 2012, Faber-Langendoen et al. 2008a, Faber-Langendoen et al. 2017a, Rondeau 2001, Sawyer et al. 2009, Whitson et al. 2000

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G524. Western North American Ruderal Marsh, Wet Meadow & Shrubland

A3849. Conyza canadensis - Cirsium arvense - Lactuca serriola Ruderal Wet Meadow Alliance

Type Concept Sentence: This alliance covers those non-native forb-dominated waste and other disturbed places of the western U.S. dominated by such species as *Conyza canadensis, Cirsium arvense*, or *Lactuca serriola* (other species may be present to dominant).

OVERVIEW

Scientific Name: *Conyza canadensis - Cirsium arvense - Lactuca serriola* Ruderal Wet Meadow Alliance
Common Name (Translated Scientific Name): Canadian Horseweed - Canada Thistle - Prickly Lettuce Ruderal Wet Meadow Alliance
Colloquial Name: Western Ruderal Forb Wet Meadow

Type Concept: This alliance covers herbaceous areas dominated by non-native forb species such as *Conyza canadensis, Cirsium arvense*, or *Lactuca serriola*. Many other facultative wet forbs may be present or dominant, such as *Chenopodium album, Dipsacus fullonum, Lepidium perfoliatum, Rumex crispus, Sisymbrium altissimum, Sonchus arvensis*, and many others. These disturbed places are generally seasonally or intermittently flooded, usually drying completely between wet episodes. They are generally not alkaline but may be mildly so. It is found throughout the western U.S.

Classification Comments: This alliance covers western U.S. mesic to seasonally wet to moist areas, not dry upland areas.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Disturbed areas dominated by one or a mix of non-native wetland or facultative forb species such as *Chenopodium album, Cirsium arvense, Conyza canadensis, Dipsacus fullonum, Lactuca serriola, Lepidium perfoliatum, Rumex crispus, Sisymbrium altissimum*, or *Sonchus arvensis*.

VEGETATION

Physiognomy and Structure: Broad-leaved annual or perennial herbaceous stands <2 m in height.

Floristics: These stands are dominated by non-native forb species such as *Conyza canadensis, Cirsium arvense*, or *Lactuca serriola*. Many other facultative wet forbs may be present or dominant, such as *Chenopodium album, Cirsium arvense, Conyza canadensis, Dipsacus fullonum, Lactuca serriola, Lepidium perfoliatum, Rumex crispus, Sisymbrium altissimum, Sonchus arvensis*, and many others. Other commonly associated forbs present and contributing low to moderate cover include *Melilotus officinalis, Rorippa palustris ssp. hispida, Salsola tragus*, and *Verbascum thapsus*. Some graminoids such as *Hordeum jubatum* may also be present, but these tend to be not as abundant as the total forb cover.

ENVIRONMENT & DYNAMICS

Environmental Description: These alliance occur in mesic areas that are somehow disturbed, and are common throughout western North America. Stands occur in reservoir drawdown zones, disturbed areas near streams or old fields, and heavily damaged soils near open water.

Dynamics: This alliance is generally a product of serious soil disturbance in areas that are periodically wet, such as abandoned fields within flood zones or high water areas or drawn down reservoirs, or rings around stock ponds.

DISTRIBUTION

Geographic Range: This alliance is found throughout the western U.S.

Nations: US
States/Provinces: AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL002800 *Conyza canadensis* Ruderal Wet Meadow

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/01/07

REFERENCES

References: Faber-Langendoen et al. 2017b

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G524. Western North American Ruderal Marsh, Wet Meadow & Shrubland

A3846. Phalaris arundinacea Western Ruderal Marsh Alliance

Type Concept Sentence: Stands are dominated by *Phalaris arundinacea*, which tends to occur in monocultures and is known to occur in mesic to wet disturbed areas and along rivers that no longer flood throughout the western U.S.

OVERVIEW

Scientific Name: *Phalaris arundinacea* Western Ruderal Marsh Alliance
Common Name (Translated Scientific Name): Reed Canarygrass Western Ruderal Marsh Alliance
Colloquial Name: Western Ruderal Reed Canarygrass Marsh

Type Concept: This herbaceous alliance covers stands dominated by *Phalaris arundinacea*, which tends to occur in monocultures. Stands are found along riparian areas, pond and lake margins, wet meadows, and intermittent drainages, and is known from throughout the western U.S.

Classification Comments: This alliance covers non-native strains of the nominal species. Extensive planting as a forage crop has led to the spread of this semi-natural type (Hansen et al. 1995, Hall and Hansen 1997). *Phalaris arundinacea* is native and widespread in Alberta, although some introduced genotypes may be present. Further work is required to resolve the natural versus introduced nature of this type in western North America. Midwest and eastern North American stands are covered by groups and alliances for those geographic areas.

Internal Comments: mjr 2-15: CA added based on Buck-Diaz et al. (2012).
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Stands dominated by *Phalaris arundinacea*, which tends to occur in monocultures.

VEGETATION

Physiognomy and Structure: Tall herbaceous perennial graminoid that can reach heights >2 m tall.

Floristics: Stands are dominated by non-native strains of *Phalaris arundinacea*, which tends to occur in monocultures or associated with *Calamagrostis canadensis* in northern areas.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs in wet areas, primarily riparian, occurring along rivers and streams, as well as shallow lakeshores (MacKenzie and Moran 2004, Willoughby et al. 2004). Elevations range from near sea level to 2307 m. The poorly drained alluvial soils are commonly fine-textured (occasionally coarse-textured) and may be flooded for brief to extended periods.

Dynamics:

DISTRIBUTION

Geographic Range: This herbaceous alliance occurs throughout the western U.S. It also occurs in Canada, in the southern two-thirds of British Columbia, in areas with warm and relatively dry summers and in Alberta. Its distribution as a natural type is complicated because this native species is widely cultivated as a forage crop and has escaped and established in wetlands and riparian areas, displacing the local flora.

Nations: CA, US
States/Provinces: AB, BC, CA, CO, ID, MT, NM, NV, OR, UT, WA
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** *Phalaris arundinacea* Provisional Semi-Natural Stands (Reed canary grass grassland) (Buck-Diaz et al. 2012)

LOWER LEVEL UNITS

Associations:
- CEGL001474 *Phalaris arundinacea* Western Marsh

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Boggs et al. 1990, Buck-Diaz et al. 2012, Crawford 2001, Faber-Langendoen et al. 2017b, Hall and Hansen 1997, Hansen et al. 1991, Hansen et al. 1995, MacKenzie and Moran 2004, Muldavin et al. 2000a, Willoughby et al. 2004

2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G524. Western North American Ruderal Marsh, Wet Meadow & Shrubland

A3847. Phragmites australis ssp. australis - Arundo donax - Typha angustifolia Ruderal Marsh Alliance [Low - Poorly Documented]

Type Concept Sentence: This common reed marsh alliance is dominated by introduced *Phragmites australis ssp. australis, Arundo donax, Typha angustifolia* or other invasive wetland graminoid species, and is found across the west-temperate regions of the United States and Canada.

OVERVIEW

Scientific Name: *Phragmites australis ssp. australis - Arundo donax - Typha angustifolia* Ruderal Marsh Alliance
Common Name (Translated Scientific Name): European Common Reed - Giant Reed - Narrowleaf Cattail Ruderal Marsh Alliance
Colloquial Name: Western Ruderal Common Reed Marsh

Type Concept: This common reed-dominated marsh alliance is found across the west-temperate regions of the United States and Canada. *Phragmites australis ssp. australis, Arundo donax*, or *Typha angustifolia* will often invade into existing natural or semi-natural communities present on the site, and once established, this alliance is usually strongly dominated with few or no other vascular plants present. Stands occur in semipermanently flooded marshes, ditches, impoundments, etc. that have often been disturbed by human activity.

Classification Comments: This alliance is limited to the western U.S. and is intended to cover the non-native stands of introduced *Phragmites australis ssp. australis, Arundo donax*, or *Typha angustifolia*. Compare with similar monotypic stands in Great Plains and eastern U.S. alliances.

Internal Comments: DFL 8-17: AB added. mjr 8-15: MX added based on members.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Stands strongly dominated by non-native *Phragmites australis ssp. australis, Arundo donax*, or *Typha angustifolia*.

VEGETATION

Physiognomy and Structure: Tall perennial graminoid herbaceous that is <3 m in height.

Floristics: Stands are monocultures of introduced *Phragmites australis ssp. australis, Arundo donax*, or *Typha angustifolia*. Some stands may have minor cover of associates such as *Agrostis stolonifera, Carex* spp., *Conyza canadensis, Glycyrrhiza lepidota, Iva axillaris, Mentha arvensis, Schoenoplectus acutus (= Scirpus acutus)*, and *Typha* spp. Other species present may include *Ambrosia psilostachya, Anemopsis californica, Baccharis douglasii, Distichlis spicata, Juncus arcticus, Juncus cooperi, Lepidium latifolium, Schoenoplectus americanus, Schoenoplectus californicus*, and *Xanthium strumarium*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance is found in non-tidal marshes with semipermanently or, rarely, seasonally flooded hydrology, either in depressions or along rivers with seasonal fluctuation in water level throughout the western United States and adjacent Canada. This includes semipermanently flooded marshes, ditches, impoundments, etc.

Dynamics: Stands are generally a product of human-induced disturbance, either through direct habitat manipulation or through passive introduction of reproductive material to naturally disturbed substrates (Marks et al. 1994).

DISTRIBUTION

Geographic Range: West-temperate regions of the United States and Canada.

Nations: CA, MX, US
States/Provinces: AB, AZ, CA, CO, ID, MT, NM, NV, TX, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Lake Mead, Mojave); USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

- **>** *Arundo donax* (Giant reed breaks) Semi-natural Stands (Sawyer et al. 2009) [42.080.00]
- **>** *Arundo donax* Herbaceous Alliance (Keeler-Wolf and Evens 2006)
- **>** *Arundo donax* Semi-Natural Stands (Giant reed breaks) (Buck-Diaz et al. 2012)
- **>** *Phragmites australis* (Common reed marshes) Alliance (Sawyer et al. 2009) [41.061.00]
- **=** *Phragmites australis* Herbaceous Alliance (Evens et al. 2014)

LOWER LEVEL UNITS

Associations:

- CEGL001475 *Phragmites australis ssp. australis* Western Ruderal Wet Meadow
- CEGL004101 *Arundo donax* Riverbank Ruderal Wet Meadow

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2017/08/14

REFERENCES

References: Buck-Diaz et al. 2012, Evens et al. 2014, Faber-Langendoen et al. 2017b, Hickson and Keeler-Wolf 2007, Keeler-Wolf and Evens 2006, Keeler-Wolf and Vaghti 2000, Marks et al. 1994, Niering and Warren 1977, Overholt et al. 2015, Sawyer et al. 2009, Sproul et al. 2011, Swearingen and Saltonstall 2010, Swearingen and Saltonstall 2012, VegCAMP and AIS 2013

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G524. Western North American Ruderal Marsh, Wet Meadow & Shrubland

A3848. Poa pratensis - Agrostis gigantea - Agrostis stolonifera Ruderal Marsh Alliance

Type Concept Sentence: This alliance includes grasslands dominated by introduced grasses such as *Agrostis gigantea, Agrostis stolonifera, Alopecurus pratensis*, or *Poa pratensis*, and is a very common and widespread in the western U.S. where it has invaded natural meadows, wetlands and riparian areas.

OVERVIEW

Scientific Name: *Poa pratensis - Agrostis gigantea - Agrostis stolonifera* Ruderal Marsh Alliance
Common Name (Translated Scientific Name): Kentucky Bluegrass - Redtop - Creeping Bentgrass Ruderal Marsh Alliance
Colloquial Name: Ruderal Kentucky Bluegrass - Redtop - Creeping Bentgrass Marsh

Type Concept: This alliance includes mesic grasslands and wetlands dominated by introduced grasses such as Agrostis gigantea, Agrostis stolonifera, Alopecurus pratensis, or *Poa pratensis*. This semi-natural grassland is widespread in the western U.S. where it has invaded natural meadows, wetlands and riparian areas. *Agrostis stolonifera* and *Poa pratensis* have been widely planted for forage and have invaded native communities from hay fields, especially more mesic areas such as riparian floodplains and seasonally flooded wetlands in the semi-arid western U.S.

Classification Comments: This alliance covers areas invaded by these non-native grasses and does not include irrigated hay meadows or other actively managed areas.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Grasslands dominated by *Agrostis gigantea, Agrostis stolonifera, Alopecurus pratensis*, or *Poa pratensis*.

VEGETATION

Physiognomy and Structure: Low-statured perennial herbaceous graminoid, generally <1 m in height.

Floristics: This widespread, semi-natural alliance is characterized by a moderate to dense herbaceous canopy that is strongly dominated by *Agrostis gigantea, Agrostis stolonifera, Alopecurus pratensis*, or *Poa pratensis*. Associate species are often those early-seral and weedy species that tolerate historic heavy livestock grazing or other disturbance well, such as *Achillea millefolium, Cirsium*

arvense, Elymus repens, Equisetum spp., *Fragaria virginiana, Hordeum* spp., *Juncus balticus, Linaria vulgaris, Potentilla gracilis, Taraxacum officinale*, and introduced forage species such as *Agrostis stolonifera, Bromus inermis*, and *Phleum pratense*. Remnant native species present may include *Ambrosia psilostachya, Amorpha canescens, Andropogon gerardii, Artemisia ludoviciana, Carex* spp., *Deschampsia cespitosa, Pascopyrum smithii*, and *Psoralidium tenuiflorum*.

ENVIRONMENT & DYNAMICS

Environmental Description: Sites are generally flat to moderately sloping and occur on all aspects. Stands typically occur on pastures found in the plains, montane meadows, stream benches and terraces. In the semi-arid region it is restricted to relatively mesic sites. Stands with *Alopecurus pratensis* are the wettest of this alliance that tolerates very high water table throughout the growing season. Stands can also tolerate mildly alkaline and saline soils, and some drought (Kovalchik 1987, Padgett et al. 1989, Hansen et al. 1995, Manning and Padgett 1995, Hall and Hansen 1997).

Dynamics: *Poa pratensis* is tolerant of heavy grazing and increases at the expense of less tolerant native species (Volland 1978, Hansen et al. 1995). It is also adapted to burning and quickly resprouts after fire, except when burned during growing periods (Volland and Dell 1981).

DISTRIBUTION

Geographic Range: This alliance is found throughout western U.S.

Nations: US
States/Provinces: AZ, CA, CO, ID, MT, NV, OR, SD, UT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **>** *Agrostis (gigantea, stolonifera) - Festuca arundinacea* (Bent grass - tall fescue meadows) Semi-natural Stands (Sawyer et al. 2009) [45.106.00]
- **>** *Agrostis (gigantea, stolonifera)-Festuca arundinacea* Herbaceous Semi-Natural Alliance (CNPS 2017) [45.106.00]
- **>** *Poa pratensis* (Kentucky blue grass turf) Semi-natural Stands (Sawyer et al. 2009) [42.060.00]
- **>** *Poa pratensis* Herbaceous Semi-Natural Alliance (CNPS 2017) [42.060.00]

LOWER LEVEL UNITS

Associations:
- CEGL001558 *Agrostis (gigantea, stolonifera)* Ruderal Marsh
- CEGL005615 *Echinochloa crus-galli* Ruderal Wet Meadow
- CEGL005209 *Alopecurus pratensis* Western Ruderal Wet Meadow
- CEGL003081 *Poa pratensis* Ruderal Marsh

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: CNPS 2017, Carsey et al. 2003a, Faber-Langendoen et al. 2017b, Franklin and Dyrness 1973, Hall and Hansen 1997, Hansen et al. 1991, Hansen et al. 1995, Kauffman et al. 1983, Kauffman et al. 1985, Kittel et al. 1999b, Kovalchik 1987, Manning and Padgett 1995, Padgett et al. 1989, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Tuhy and Jensen 1982, Volland 1978, Volland and Dell 1981, Youngblood et al. 1985a

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G524. Western North American Ruderal Marsh, Wet Meadow & Shrubland

A4217. Salix spp. - Artemisia cana Ruderal Understory Wet Shrubland Alliance [Low - Poorly Documented]

Type Concept Sentence: Stands of native willows and/or native *Artemisia cana* sagebrush with non-native grasses and forbs dominant in the understory, found in western U.S. streams and floodplains.

OVERVIEW

Scientific Name: *Salix* spp. - *Artemisia cana* Ruderal Understory Wet Shrubland Alliance
Common Name (Translated Scientific Name): Willow species - Silver Sagebrush Ruderal Understory Wet Shrubland Alliance
Colloquial Name: Ruderal Willow - Silver Sagebrush Wet Shrubland

Type Concept: These riparian shrublands are dominated by native willows such as *Salix exigua, Salix monticola, Salix geyeriana, Salix drummondiana, Salix commutata*, and others, as well as shrublands dominated by *Artemisia cana* (*ssp. viscidula* and *ssp. bolanderi*) where the understory herbaceous layer has been completely replaced by non-native invasive species such as *Bromus tectorum, Poa pratensis, Dactylis glomerata, Bromus inermis, Elymus repens, Medicago sativa, Trifolium repens, Melilotus officinalis*, and *Phragmites australis*. This alliance occurs in relatively moist environments, including riparian areas and alkaline or saline playa lakes of the western U.S.

Classification Comments:

Internal Comments: GK 9-16: CO confirmed and AZ, CA, NV, WA added.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Stands lack an abundance of native herbaceous species such as *Danthonia intermedia, Deschampsia cespitosa, Eleocharis palustris, Elymus elymoides, Festuca idahoensis, Festuca ovina, Festuca thurberi, Leymus cinereus, Muhlenbergia richardsonis, Poa cusickii*, and *Poa secunda*.

VEGETATION

Physiognomy and Structure:

Floristics: These riparian shrublands are dominated by native willows such as *Salix exigua, Salix monticola, Salix geyeriana, Salix drummondiana, Salix commutata*, and others, as well as shrublands dominated by *Artemisia cana* (*ssp. viscidula* and *ssp. bolanderi*) where the understory herbaceous layer has been completely replaced by non-native invasive species such as *Bromus tectorum, Poa pratensis, Dactylis glomerata, Bromus inermis, Elymus repens, Medicago sativa, Trifolium repens, Melilotus officinalis*, and *Phragmites australis*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs in relatively moist environments, including riparian areas and alkaline or saline playa lakes.

Dynamics: Stands have been disturbed by chronic grazing (by native ungulates or livestock), recreational use, or other heavy use that disturbs the soil surface and makes it possible for invasive species to become dominant.

DISTRIBUTION

Geographic Range: This alliance is found throughout the western U.S. in riparian areas, especially near populated areas.

Nations: US
States/Provinces: AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL001199 *Salix exigua / Agrostis stolonifera* Ruderal Wet Shrubland
- CEGL005623 *Salix exigua / Phalaris arundinacea* Ruderal Wet Shrubland
- CEGL002988 *Artemisia cana (ssp. bolanderi, ssp. viscidula) / Poa pratensis* Ruderal Wet Shrubland

AUTHORSHIP

Primary Concept Source: M. Reid, in Faber-Langendoen et al. (2015)

Author of Description: G. Kittel
Acknowledgments:
Version Date: 2016/09/28

REFERENCES

References: Faber-Langendoen et al. 2017b, Manning and Padgett 1995, Padgett et al. 1989

2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G524. Western North American Ruderal Marsh, Wet Meadow & Shrubland

A2020. Sorghum halepense Ruderal Desert Grassland Alliance

Type Concept Sentence: This semi-natural alliance is dominated by the non-native grass *Sorghum halepense* and occurs in northern Mexico, Arizona and elsewhere in the desert southwestern U.S.

OVERVIEW

Scientific Name: *Sorghum halepense* Ruderal Desert Grassland Alliance
Common Name (Translated Scientific Name): Johnson Grass Ruderal Desert Grassland Alliance
Colloquial Name: Ruderal Johnson Grass Desert Grassland

Type Concept: The vegetation is characterized by a relatively sparse to dense herbaceous layer dominated or codominated by the exotic perennial forage grass *Sorghum halepense*. The native annual forb *Amaranthus palmeri* often codominates. Associated species are sometimes many and include scattered *Prosopis velutina* shrubs and grasses and forbs such as *Chenopodium berlandieri, Chloris virgata, Eragrostis cilianensis, Eragrostis pectinacea, Eriochloa acuminata, Ipomoea* spp., *Kallstroemia grandiflora, Leptochloa panicea ssp. brachiata (= Leptochloa filiformis), Salsola kali*, and *Solanum elaeagnifolium*. This semi-natural alliance occurs in northern Mexico, Arizona and elsewhere in the desert southwestern U.S. where disturbance by sorghum cultivation for forage production has converted what was likely natural desert grasslands. Sites are typically flat to gently sloping basins and flats that may be intermittently flooded. Soils are variable but typically finer-textured silt loam or clays.

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Edges of fields, roadsides, and disturbed or formerly cultivated areas dominated by *Sorghum halepense*.

VEGETATION

Physiognomy and Structure: This alliance is characterized by a relatively sparse to dense herbaceous layer dominated or codominated by an exotic perennial forage grass.

Floristics: The vegetation is characterized by a relatively sparse to dense herbaceous layer dominated or codominated by the exotic perennial forage grass *Sorghum halepense*. The native annual forb *Amaranthus palmeri* often codominates. Associated species are sometimes many and include scattered *Prosopis velutina* shrubs and grasses and forbs such as *Chenopodium berlandieri, Chloris virgata, Eragrostis cilianensis, Eragrostis pectinacea, Eriochloa acuminata, Ipomoea* spp., *Kallstroemia grandiflora, Leptochloa panicea ssp. brachiata (= Leptochloa filiformis), Salsola kali*, and *Solanum elaeagnifolium*.

ENVIRONMENT & DYNAMICS

Environmental Description: Sites are typically flat to gently sloping basins and flats that may be intermittently flooded. Soils are variable but typically finer-textured silt loam or clays.

Dynamics: This alliance occurs in old fields and along the edges of roads and fields. *Sorghum halepense* is kept out of agricultural fields with herbicides but can colonize after cultivation ceases. *Sorghum halepense* is considered to be one of the ten worst invasive weeds in the world (Holm et al. 1977).

DISTRIBUTION

Geographic Range: This alliance is described from Arizona and New Mexico and is presumably widespread in agricultural regions of the southeastern U.S.

Nations: MX?, US

States/Provinces: AZ, MXCH?, MXSO?, NM?, TX?
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL005327 *Amaranthus palmeri* Ruderal Grassland
- CEGL005328 *Sorghum halepense - (Amaranthus palmeri)* Ruderal Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Faber-Langendoen et al. 2017b, Holm et al. 1977

2.C.5. Salt Marsh

Salt Marsh is a wetland that has shallow water and levels that usually fluctuate due primarily to tides along the coast or changes in water depth in depressions. Coastal salt marshes are primarily intertidal; that is, they are found in areas at least occasionally inundated by high tide but not flooded during low tide, including estuaries, lagoons, and the lee side of barrier islands. The vegetation comprises emergent shrubs and herbs with at least 10% cover, especially saline or halophytic species. They occur at all latitudes around the globe, but are concentrated in the temperate mid-latitudes (23-70°N and S).

2.C.5.Nd. North American Western Interior Brackish Marsh, Playa & Shrubland

Interior saline-alkaline wetlands of North American interior west, including salt flats, marshes and seeps, whose species composition is driven by water chemistry and duration and seasonality of wetness. Stands range from sparse cover of shrubs and/or herbs to productive marshes dominated by tall emergent graminoids.

M082. Warm & Cool Desert Alkali-Saline Marsh, Playa & Shrubland

This macrogroup consists of alkaline and saline wetlands with salt-tolerant plant growth where dominant and characteristic plant species include *Atriplex* spp., *Distichlis spicata, Salicornia* spp., *Sarcobatus vermiculatus, Sesuvium verrucosum, Sporobolus* spp., *Suaeda moquinii*, and *Triglochin maritima*. These are located in playas, washes, mudflats and depressional wetlands where evaporation far exceeds precipitation and/or where bedrock and soil properties contribute to alkaline/saline conditions. Sites are found throughout the western U.S. and southwestern Canada.

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2. Shrub & Herb Vegetation
2.C.5.Nd. North American Western Interior Brackish Marsh, Playa & Shrubland
2.C.5.Nd.1.a. M082 Warm & Cool Desert Alkali-Saline Marsh, Playa & Shrubland

G538. North American Desert Alkaline-Saline Marsh & Playa

Type Concept Sentence: This group contains alkaline-saline marshes found in non-coastal and non-tidal areas of the Intermountain West. Marshes can be densely vegetated emergent or barren and sparsely vegetated playas where soils and water (if present) are alkaline. Characteristic species may include *Allenrolfea occidentalis, Atriplex* spp., *Distichlis spicata, Grayia spinosa, Leymus cinereus, Leymus triticoides, Muhlenbergia* spp., *Poa secunda, Puccinellia lemmonii, Salicornia* spp., *Sarcobatus vermiculatus*, and *Triglochin maritima*.

OVERVIEW

Scientific Name: *Distichlis spicata - Puccinellia lemmonii - Salicornia* spp. Alkaline-Saline Marsh & Playa Group
Common Name (Translated Scientific Name): Saltgrass - Lemmon's Alkali Grass - Saltwort species Alkaline-Saline Marsh & Playa Group

Colloquial Name: Saltgrass Alkaline Wet Meadow

Type Concept: This group is found in the intermountain western U.S. Associations are composed of densely vegetated seasonal wetlands, saltwater emergent marshes to barren and sparsely vegetated playas (generally <10% plant cover). Characteristic species may include *Allenrolfea occidentalis, Atriplex* spp., *Distichlis spicata, Grayia spinosa, Leymus cinereus, Leymus triticoides (= Elymus triticoides), Muhlenbergia* spp., *Poa secunda, Puccinellia lemmonii, Salicornia* spp., *Sarcobatus vermiculatus*, and *Triglochin maritima*. Soils and standing water (if present) are alkaline. Salt crusts are common where there are actively drying ponds, that can have saltgrass beds in depressions and sparse shrubs around the margins. Playa flats are intermittently, seasonally to semipermanently flooded, usually retaining water into the growing season and drying completely only in drought years. Many are associated with hot and cold springs, located in basins with internal drainage. Soils are alkaline to saline clays with hardpans. Seasonal drying exposes mudflats colonized by annual wetland vegetation. Water is prevented from percolating through the soil by an impermeable soil subhorizon and is left to evaporate. Soil salinity varies greatly with soil moisture and greatly affects species composition. During exceptionally wet years, increased precipitation can dilute soil salt concentrations which may allow less salt-tolerant species to become established or more abundant. Some stands occur on floodplains, along the margins of perennial lakes, and in alkaline closed basins, with extremely low-gradient shorelines.

Classification Comments:

Similar NVC Types:
- G531 Arid West Interior Freshwater Marsh
- G324 Great Plains Saline Wet Meadow & Marsh: also includes salt-tolerant herbaceous wetlands, but occurs east of the Continental Divide on the Great Plains.
- G537 North American Desert Alkaline-Saline Wet Scrub: also occurs in cold desert regions but is dominated by shrub species.

Diagnostic Characteristics: Salt-tolerant herbs that are seasonally or intermittently wet on barren to sparsely vegetated playas, lake margins, closed basins, and low-gradient shorelines.

VEGETATION

Physiognomy and Structure: Open shrub and/or herb vegetation.

Floristics: Characteristic species may include *Allenrolfea occidentalis, Atriplex* spp., *Distichlis spicata, Grayia spinosa, Leymus cinereus, Leymus triticoides (= Elymus triticoides), Muhlenbergia* spp., *Poa secunda, Puccinellia lemmonii, Salicornia* spp., *Schoenoplectus americanus, Bolboschoenus maritimus (= Schoenoplectus maritimus)*, and *Triglochin maritima*.

ENVIRONMENT & DYNAMICS

Environmental Description: *Climate:* Cold desert. *Soil/substrate/hydrology:* This group is found on barren and sparsely vegetated playas (generally <10% plant cover). Salt crusts are common throughout, with small saltgrass beds in depressions and sparse shrubs around the margins. The flats are intermittently, seasonally to semipermanently flooded, usually retaining water into the growing season and drying completely only in drought years. Many are associated with hot and cold springs, located in basins with internal drainage. Soils are alkaline to saline clays with hardpans. Seasonal drying exposes mudflats colonized by annual wetland vegetation. Water is prevented from percolating through the soil by an impermeable soil subhorizon and is left to evaporate. Soil salinity varies greatly with soil moisture and greatly affects species composition. During exceptionally wet years, increased precipitation can dilute soil salt concentrations which may allow less salt-tolerant species to become established or more abundant. Some stands occur on floodplains, along the margins of perennial lakes, and in alkaline closed basins, with extremely low-gradient shorelines. Environmental information compiled from individual associations and Knight (1994).

Dynamics: Playas are shallow, seasonal wetlands that lie in the lowest point of a closed watershed. Their basins are lined with clay soils, which collect and hold water from rainfall and runoff events. Water evaporates, leaving high salt concentrations in the soils. Some playas will only flood with water during years with high precipitation, sometimes only once or twice in a decade. Others will have standing water every spring, except in the driest of years. During flooded years, some salt-tolerant marsh plant species may grow, such as cattails (*Typha* spp.) or bulrush (*Scirpus* and/or *Schoenoplectus* spp.) (Knight 1994).

DISTRIBUTION

Geographic Range: This group is found throughout the intermountain western U.S.

Spatial Scale & Pattern [optional]: Large patch, Small patch
Nations: CA, MX, US
States/Provinces: CA, CO, ID, MT, NM, NV, OR, TX, UT, WA?, WY
TNC Ecoregions [optional]: 6:C, 10:C, 11:C, 19:C

USFS Ecoregions (2007): 313A:CP, 313B:CP, 313D:CC, 322A:??, 331J:CC, 341A:CC, 341B:CC, 341C:CC, 341D:CC, 341E:CC, 341F:CC, 341G:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CP, 342F:CC, 342G:CC, 342H:CC, 342I:C?, 342J:CC, M242C:CC, M261D:P?, M261G:PP, M313A:CC, M331D:??, M331E:??, M332G:CC, M341A:CC, M341B:C?, M341D:CC
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: High.

SYNONYMY

LOWER LEVEL UNITS

Alliances:
- A1334 *Sporobolus airoides - Muhlenbergia asperifolia - Spartina gracilis* Alkaline Wet Meadow Alliance
- A4241 *Frankenia salina* Salt Marsh & Playa Alliance
- A4164 *Cladium californicum* Alkaline Seep Alliance
- A3930 *Eleocharis palustris - Eleocharis rostellata* Alkaline-Saline Marsh Alliance
- A3932 *Hordeum jubatum* Alkaline Wet Meadow Alliance
- A1332 *Distichlis spicata* Alkaline Wet Meadow Alliance
- A1329 *Leymus cinereus - Leymus triticoides* Alkaline Wet Meadow Alliance
- A4247 *Anemopsis californica - Helianthus nuttallii - Solidago spectabilis* Alkaline Wet Meadow Alliance

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al.
Author of Description: G. Kittel
Acknowledgments: J. Kagan and P. Comer
Version Date: 12/02/2015
Classif Resp Region: West
Internal Author: GK 10-10, 9-13, 12-15

REFERENCES

References: Faber-Langendoen et al. 2017a, Knight 1994, Rodriguez et al. 2017, Shiflet 1994, Stout et al. 2013

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2. Shrub & Herb Vegetation
2.C.5.Nd. North American Western Interior Brackish Marsh, Playa & Shrubland
G538. North American Desert Alkaline-Saline Marsh & Playa

A1332. Distichlis spicata Alkaline Wet Meadow Alliance

Type Concept Sentence: This wetland herbaceous alliance consists of playas and ephemeral streams with sparse to dense herbaceous cover dominated by *Distichlis spicata* on deep, saline, alkaline and fine-textured soils. This alliance occurs throughout much of the semi-arid and arid western U.S. in lowland sites such as playas, swales and terraces along washes that are seasonally, temporarily or intermittently flooded.

OVERVIEW

Scientific Name: *Distichlis spicata* Alkaline Wet Meadow Alliance
Common Name (Translated Scientific Name): Saltgrass Alkaline Wet Meadow Alliance
Colloquial Name: Saltgrass Alkaline Wet Meadow

Type Concept: This alkaline or saline wetland herbaceous alliance covers grasslands of playas and ephemeral streams. Cover may be a sparse or dense herbaceous layer dominated by *Distichlis spicata*, sometimes occurring in nearly pure stands, or with any of the following as a codominant: *Carex filifolia, Hordeum jubatum, Juncus arcticus ssp. littoralis (= Juncus balticus), Pascopyrum smithii, Puccinellia nuttalliana*, and/or *Sporobolus airoides*. Forb cover is generally low and may include Asteraceae spp., *Helianthus* spp., *Salicornia rubra, Suaeda calceoliformis (= Suaeda depressa)*, and *Triglochin maritima*. Occasionally *Suaeda* may be the dominant species and *Distichlis* may be completely absent. This alliance occurs throughout much of the semi-arid and arid western U.S. on saline or alkaline soils in lowland sites such as playas, swales and terraces along washes that are seasonally, temporarily or intermittently flooded. Soils are deep, saline, alkaline and fine-textured. They generally have an impermeable layer and therefore are poorly drained. When the soil is dry, the surface usually has salt accumulations.

Classification Comments: These are highly alkaline or saline sites.

Internal Comments: mjr 1-17: CNPS recommends a rank of G5/S4.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Diagnostic of this alliance is the *Distichlis spicata*- or *Suaeda calceoliformis*-dominated herbaceous layer.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a sparse to moderately dense graminoid layer dominated by rhizomatous mid grasses less than 0.5 m tall.

Floristics: Cover is sparse to dense and is dominated by *Distichlis spicata*, occurring in nearly pure stands. Associates from sites with higher soil salinity may include the graminoid *Puccinellia nuttalliana* and the forbs *Salicornia rubra, Triglochin maritima*, and *Suaeda calceoliformis (= Suaeda depressa)*. Species from sites with lower salinity include the graminoids *Carex filifolia, Juncus balticus, Hordeum jubatum, Pascopyrum smithii*, and *Sporobolus airoides*, and the forbs *Helianthus* spp. and Asteraceae spp. (Ungar 1974c). Forb cover is generally low. Shrubs are rare but may include scattered *Atriplex canescens* and *Sarcobatus vermiculatus*.

ENVIRONMENT & DYNAMICS

Environmental Description: Grasslands in this western alliance occur in lowland habitats such as playas, swales and terraces along washes that are intermittently flooded. The flooding is usually the result of highly localized thunderstorms which can flood one basin and leave the next dry. It also occurs along California coastal areas, and the Channel Islands, where it is sometimes found in a tidal wetland or riparian situation. Climate is semi-arid to arid. Soil texture ranges from clay loam to sandy clay (Redmann 1972, Johnston 1987). These soils are deep, saline and alkaline. They generally have an impermeable layer and therefore are poorly drained. When the soil is dry, the surface usually has salt accumulations.

Dynamics: Stands have higher diversity and cover during wet years and near boundaries with other vegetation types. Higher soil salinity favors *Distichlis spicata* over less salt-tolerant species. However, very high salinity will dwarf the *Distichlis spicata* and reduce cover. Generally, vegetation height and cover and species diversity tend to vary inversely with salinity (Ungar 1967, Steinauer 1989). Associated species may be restricted by the level of salinity in the soil. This osmotic stress of growing in alkaline and saline soils is compensated by the accumulation of proline by some halophytic species including *Distichlis spicata*. This aids the plants' water uptake by increasing the osmotic potential of the plant (Shupe et al. 1986). Vegetation forms zones at some saline sites, where species abundance is stratified by salt tolerance (Ungar et al. 1969, Shupe et al. 1986). In playas, the soil salinity at field capacity generally increases from the edge to the center allowing for several different vegetation stands to co-occur (Ungar 1967, 1970, Ungar et al. 1969). Microtopography can also affect vegetation structure. Where soil accumulates to form hummocks, less salt- and alkali-tolerant plants can occur (Ungar 1972, Johnson 1987).

Distichlis spicata is rhizomatous and tolerant of moderate grazing and its roots resist trampling. Although relatively unpalatable, it can provide valuable winter forage for livestock if needed. If grazed heavily, *Distichlis spicata* will decline and may be replaced by less desirable warm-season grasses such as *Schedonnardus paniculatus* (Costello 1944b). Weeds are generally not a problem because few grow well in saline soils.

DISTRIBUTION

Geographic Range: This alliance occurs throughout much of the semi-arid and arid western U.S. It also occurs along California coastal areas, and the Channel Islands.

Nations: CA, MX?, US
States/Provinces: AZ, CA, CO, ID, MT, NM, NV, OR, SK, UT, WA, WY
TNC Ecoregions [optional]: 6:C, 8:C, 9:C, 10:C, 11:C, 15:C, 16:C, 17:C, 18:C, 19:C, 20:C, 23:C, 24:C, 26:C, 27:C, 28:C
USFS Ecoregions (2007): 261A:CC, 261B:CC, 321A:CC, 322Ab:CCC, 322Ai:CCC, 322B:CC, 341A:CC, 341B:CC, 341D:CC, 341E:CC, 341F:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Channel Islands, Death Valley); USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** *Distichlis spicata* (Salt grass flats) Alliance (Sawyer et al. 2009) [41.200.00]
- **=** *Distichlis spicata* Alkaline Flats Alliance (Rodriguez et al. 2017)
- **=** *Distichlis spicata* Alliance (Salt grass flats) (Buck-Diaz et al. 2012)
- **=** *Distichlis spicata* Herbaceous Alliance (Evens et al. 2014)
- **?** *Distichlis spicata* Series (Johnston 1987)
- **=** *Distichlis spicata* Herbaceous Alliance (CNPS 2017) [41.200.00]
- **><** Alkali Meadow (#45310) (Holland 1986b)

- **><** Northern Coastal Salt Marsh (#52110) (Holland 1986b)
- **?** Overland Flow # 36 (Soil Conservation Service n.d.)
- **?** Salt Flat # 34 (Soil Conservation Service n.d.)
- **=** Saltgrass Series (Sawyer and Keeler-Wolf 1995)
- **><** Southern Coastal Salt Marsh (#52120) (Holland 1986b)
- **?** Wet Meadow # 38 (Soil Conservation Service n.d.)

LOWER LEVEL UNITS

Associations:

- CEGL001771 *Distichlis spicata* - Mixed Herb Wet Meadow
- CEGL001770 *Distichlis spicata* Alkaline Wet Meadow
- CEGL001772 *Distichlis spicata - Lepidium perfoliatum* Wet Meadow
- CEPP006701 *Distichlis spicata - Juncus cooperi* Alkaline Wet Meadow
- CEPP005679 *Distichlis spicata - Bromus diandrus* Ruderal Saline/Alkaline Grassland
- CEPP006700 *Distichlis spicata - Juncus arcticus ssp. littoralis* Alkaline Wet Meadow
- CEPP005715 *Distichlis spicata - (Baccharis douglasii, Equisetum hyemale)* Wet Meadow
- CEPP005716 *Distichlis spicata - Leymus triticoides* Wet Meadow
- CEPP006712 *Juncus cooperi* Alkaline Wet Meadow
- CEGL003462 *Distichlis spicata - Frankenia salina - Jaumea carnosa* Salt Marsh
- CEGL001773 *Distichlis spicata - (Scirpus nevadensis)* Alkaline Wet Meadow
- CEGL005417 *Suaeda calceoliformis* Wet Meadow

AUTHORSHIP

Primary Concept Source: K.A. Schulz and J. Evens, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel, K.A. Schulz, J. Evens
Acknowledgments:
Version Date: 2016/11/10

REFERENCES

References: Baker 1984a, Beatley 1976, Bradley 1970, Brotherson 1987, Buck-Diaz et al. 2012, Bunin 1985, CNPS 2017, Copeland 1979, Costello 1944b, Crouch 1961a, Daniels 1911, Daubenmire 1970, Evens et al. 2014, Faber-Langendoen et al. 2017b, Ferren and Davis 1991, Franklin and Dyrness 1973, Graham 1937, Griffiths 1902, Hansen et al. 1991, Hansen et al. 1995, Henrickson 1974, Hickson and Keeler-Wolf 2007, Holland 1986b, Hyder et al. 1966, Johnston 1987, Jones and Walford 1995, Junak et al. 2007, Keeler-Wolf and Evens 2006, Keeler-Wolf and Vaghti 2000, Keeler-Wolf et al. 2003b, Keeler-Wolf et al. 2005, Kittel and Lederer 1993, Kittel et al. 1994, Klipple and Costello 1960, Macdonald 1977, Odion et al. 1992, Osborn 1974, Peinado et al. 1994b, Pickart 2006, Ralston 1969, Ramaley 1942, Redmann 1972, Rodriguez et al. 2017, Rogers 1953, Saul 1974, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Shanks 1977, Shupe et al. 1986, Soil Conservation Service 1978, Soil Conservation Service n.d., Solomeshch and Barbour 2006, Sproul et al. 2011, Stearns-Roger, Inc. 1978, Steinauer 1989, Thorne 1976, Tuhy and Jensen 1982, Ungar 1967, Ungar 1968, Ungar 1970, Ungar 1972, Ungar 1974b, Ungar 1974c, Ungar et al. 1969, VegCAMP and AIS 2013, Vestal 1914, Weaver and Albertson 1956, Zedler et al. 1992

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2. Shrub & Herb Vegetation
2.C.5.Nd. North American Western Interior Brackish Marsh, Playa & Shrubland
G538. North American Desert Alkaline-Saline Marsh & Playa

A3930. Eleocharis palustris - Eleocharis rostellata Alkaline-Saline Marsh Alliance

Type Concept Sentence: This alliance is characterized by a sparse to dense herbaceous layer that is dominated or codominated by *Eleocharis palustris*, a facultative wetland species, or *Eleocharis rostellata*. Other salt-tolerant species may also be present to codominant, such as *Carex aquatilis, Distichlis spicata, Glaux maritima, Juncus arcticus ssp. littoralis*, and *Muhlenbergia asperifolia*. Stands occur adjacent to salt waterbodies or on the margins of high-evaporation playas of central Intermountain West basins. Surface water, if present, is highly saline and may or may not be present during the entire growing season.

OVERVIEW

Scientific Name: *Eleocharis palustris - Eleocharis rostellata* Alkaline-Saline Marsh Alliance
Common Name (Translated Scientific Name): Common Spikerush - Beaked Spikerush Alkaline-Saline Marsh Alliance
Colloquial Name: Common Spikerush Alkaline-Saline Marsh

Type Concept: This herbaceous wetland alliance occurs in shallow, mostly still water. The vegetation is characterized by a sparse to dense herbaceous layer that is dominated or codominated by *Eleocharis palustris*, a facultative wetland species, or *Eleocharis rostellata*. Other salt-tolerant species may also be present to codominant, such as *Carex aquatilis, Distichlis spicata, Glaux maritima, Juncus arcticus ssp. littoralis (= Juncus balticus)*, and *Muhlenbergia asperifolia*. Stands occur adjacent to salt waterbodies or on the

margins of high-evaporation playas. Surface water, if present, is highly saline and may or may not be present during the entire growing season. Known locations are near the Great Salt Lake, playas, and springs of the central Intermountain West.

Classification Comments: These are very salty conditions, and much more than the mild alkalinity freshwater *Eleocharis palustris* associations experience near the end of the growing season as water sources dwindle.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Highly saline wetlands (perennial or ephemeral) dominated by *Eleocharis palustris*.

VEGETATION

Physiognomy and Structure: This alliance is characterized by a rhizomatous perennial that dominates the graminoid stratum (up to 70% cover). The forb layer is sparse (0-20%) and contains both aquatic and terrestrial species.

Floristics: *Eleocharis palustris* or *Eleocharis rostellata* dominates the graminoid stratum. Other salt-tolerant species may also be present to codominant, such as *Carex aquatilis, Distichlis spicata, Glaux maritima, Juncus arcticus ssp. littoralis (= Juncus balticus)*, and *Muhlenbergia asperifolia*. Cover ranges from sparse to quite dense (10-80%).

ENVIRONMENT & DYNAMICS

Environmental Description: These conspicuous, common emergent communities occur in shallow, mostly still water. Stands occur on a variety of landforms, including lake margins, stream terraces, floodplains, gravel bars, and wet basins (cienegas) or meadows. Soil reaction is alkaline (Hansen et al. 1988). All sites are saturated throughout much of the growing season.

Dynamics:

DISTRIBUTION

Geographic Range: This alliances is found in the central Intermountain West basins of Utah, Wyoming and possibly Nevada.

Nations: US
States/Provinces: NV?, UT, WY
TNC Ecoregions [optional]: 11:C, 17:C
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Carex* spp. Series (Johnston 1987)
- **=** *Eleocharis (palustris, rostellata)* Herbaceous Alliance (Evens et al. 2014)
- **>** *Eleocharis rostellata - Schoenus nigricans* community (Sada and Cooper 2012)
- **?** Montane, Plains, and Great Basin Marshlands (Brown 1982a)

LOWER LEVEL UNITS

Associations:
- CEGL001834 *Eleocharis palustris - Distichlis spicata* Marsh
- CEGL003428 *Eleocharis rostellata* Marsh
- CEGL001835 *Eleocharis palustris - Juncus arcticus ssp. littoralis* Marsh

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Baker and Kennedy 1985, Brotherson 1987, Brotherson and Barnes 1984, Brown 1982a, Cronquist et al. 1977, Evens et al. 2014, Faber-Langendoen et al. 2017b, Hendrickson and Minckley 1984, Johnston 1987, Kovalchik 1987, Manning and Padgett

1995, Mutel and Marr 1973, Padgett et al. 1988b, Padgett et al. 1989, Reid et al. 1994, Sada and Cooper 2012, Shupe et al. 1986, Sturges 1968, Youngblood et al. 1985a

2. Shrub & Herb Vegetation
2.C.5.Nd. North American Western Interior Brackish Marsh, Playa & Shrubland
G538. North American Desert Alkaline-Saline Marsh & Playa

A3932. Hordeum jubatum Alkaline Wet Meadow Alliance

Type Concept Sentence: This alliance consists of grasslands dominated by *Hordeum jubatum* found in lowlands with moderately to strongly saline or alkaline soils within the western U.S. and Canada.

OVERVIEW

Scientific Name: *Hordeum jubatum* Alkaline Wet Meadow Alliance
Common Name (Translated Scientific Name): Foxtail Barley Alkaline Wet Meadow Alliance
Colloquial Name: Foxtail Barley Alkaline Wet Meadow

Type Concept: This alkaline grassland alliance contains stands dominated by *Hordeum jubatum*. Vegetation is dominated by short and medium-tall graminoids with a total cover of nearly 100%. Shrubs are often absent, and forbs are present but not usually abundant. Other common species include *Distichlis spicata, Elymus trachycaulus, Pascopyrum smithii, Poa arida, Poa compressa, Rumex crispus*, and *Sonchus arvensis*. *Hordeum jubatum* is a native increaser species that responds to disturbance, and with time since disturbance, sites will grade into other alkaline alliances. This alliance is found throughout the interior western U.S., including California's Central Valley, and Alberta, Canada. Stands are located in lowlands with moderately to strongly saline or alkaline soils. The topography is flat and the soils are often briefly flooded or saturated in the spring.

Classification Comments: This combines temporarily and intermittently flooded alliances, and often grades into other alliances with time since disturbance, and therefore may be difficult to classify when *Hordeum jubatum* is codominant with other species. This alliance is limited to the western U.S. and Canada.

Internal Comments:
Other Comments:

Similar NVC Types:
- A1341 *Distichlis spicata - Hordeum jubatum* Wet Meadow Alliance: is restricted to the Great Plains.

Diagnostic Characteristics: Bottomland alkaline grasslands dominated by *Hordeum jubatum*. Stands are often monotypic, or with 1-3 dominants.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a sparse to dense graminoid layer dominated by perennial bunch grasses less than 0.5 m tall. Forbs are infrequent.

Floristics: Grasslands included in this alliance have vegetation that is a sparse to dense layer of short and medium-tall graminoids dominated by the cool-season, short-lived, perennial bunchgrass *Hordeum jubatum*. It often occurs in nearly pure stands. Ungar et al. (1969) described one stand that was dominated by *Hordeum jubatum* in the spring and early summer, which then became dominated by *Iva annua* in the late summer. Total vegetation cover is usually high but can range from 20% to nearly 100% (Barnes and Tieszen 1978, Hansen et al. 1995). Shrubs are often absent, and forbs are present but not usually abundant. Species diversity is typically low. Other species include *Chenopodium* spp., *Distichlis spicata, Eleocharis* spp., *Elymus trachycaulus, Iva annua, Pascopyrum smithii, Poa arida, Poa compressa, Puccinellia nuttalliana, Rumex crispus, Salicornia rubra*, and *Bolboschoenus maritimus (= Scirpus paludosus)*.

ENVIRONMENT & DYNAMICS

Environmental Description: The topography is flat, and the soils are often briefly flooded or saturated in the spring (Redmann 1972). It is also found in the drawdown zone of ponds with moderately saline water (Hansen et al. 1995). Soils are clay loam to clay and poor to very poorly drained. Soil salinity is somewhat variable. In the field with competition, this grass grows best in moderately saline conditions (up to 0.7% salinity) (Wilson 1967). The soil surface may be covered with white salt crusts with moderately to strongly saline soils (Wilson 1967, Ungar et al. 1969, Barnes and Tieszen 1978, Hansen et al. 1995).

Dynamics: *Hordeum jubatum* is a common, short-lived pioneer species of mesic habitats where permanent grass cover has been destroyed (Dodd and Coupland 1966). It may represent a seral stage that will be taken over by more permanent grasses (Hansen et al. 1995). It is moderately salt-tolerant and can densely colonize areas disturbed by flooding along drainages, around playas and

more permanent ponds. *Hordeum jubatum* is moderately tolerant of salinity. Often on playas, these grasslands occupy a zone of intermediate salinity between halophytic vegetation dominated by *Distichlis spicata, Puccinellia nuttalliana*, or *Salicornia rubra*, and non-saline, mesic prairie vegetation dominated by *Pascopyrum smithii, Poa* spp. or *Elymus* spp. Total vegetation cover (density and height), species composition and soil salinity depend on the amount and timing of precipitation and flooding. Growth-inhibiting salt concentrations are diluted when the soil is saturated, allowing the growth of less salt-tolerant species and more robust growth (Ungar 1967).

DISTRIBUTION

Geographic Range: This alliance is found in the interior west of California, Oregon, and Washington east to Colorado, Idaho, Montana, south into New Mexico, and north into Alberta.

Nations: CA, US
States/Provinces: AB, CA, CO, ID, MT, NM, NV, OR, WA
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Hordeum brachyantherum* (Meadow barley patches) Alliance (Sawyer et al. 2009) [42.052.00]
- **?** *Hordeum jubatum* Community Type (Hansen et al. 1995)
- **?** *Hordeum jubatum* Dominance Type (Hansen et al. 1988b)
- **?** *Hordeum jubatum* Plains Grassland (Baker 1984a)
- **?** *Hordeum brachyantherum* Herbaceous Alliance (CNPS 2017) [42.052.00]
- **><** *Hordeum* Type (Redmann 1972)

LOWER LEVEL UNITS

Associations:

- CEGL005285 *Hordeum jubatum* Great Basin Wet Meadow

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz, L. Allen, and G. Kittel
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Airphoto Analysis Associates 1979, Baker 1984a, Barnes and Tieszen 1978, Bunin 1985, CNPS 2017, Dodd and Coupland 1966, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Redmann 1972, Reid 1974, Sawyer et al. 2009, Thompson and Hansen 2002, Ungar 1967, Ungar et al. 1969, Vestal 1914, Wilson 1967

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2. Shrub & Herb Vegetation
2.C.5.Nd. North American Western Interior Brackish Marsh, Playa & Shrubland
G538. North American Desert Alkaline-Saline Marsh & Playa

A1329. Leymus cinereus - Leymus triticoides Alkaline Wet Meadow Alliance

Type Concept Sentence: This alliance is of *Leymus cinereus*- and *Leymus triticoides*-dominated grasslands of alkaline/saline wet meadows that occur throughout much of the Intermountain West, including the Great Basin and Columbia River Basin, as well as and California's Central Valley and coastal plains.

OVERVIEW

Scientific Name: *Leymus cinereus - Leymus triticoides* Alkaline Wet Meadow Alliance
Common Name (Translated Scientific Name): Basin Wildrye - Beardless Wildrye Alkaline Wet Meadow Alliance
Colloquial Name: Western Wildrye Alkaline Wet Meadow

Type Concept: This grassland alliance is of alkaline wetlands where tall bunchgrasses *Leymus cinereus* and/or *Leymus triticoides* are the dominant species. Other graminoids present may include *Achnatherum hymenoides (= Oryzopsis hymenoides), Achnatherum thurberianum (= Stipa thurberiana), Carex praegracilis, Distichlis spicata, Elymus elymoides, Hesperostipa comata (= Stipa comata),*

Hordeum brachyantherum ssp. californicum (= Hordeum californicum), Hordeum jubatum, Juncus arcticus ssp. littoralis (= Juncus balticus), Lolium perenne ssp. multiflorum (= Lolium multiflorum), Onopordum acanthium, Pascopyrum smithii, Poa secunda, Pseudoroegneria spicata, Schoenoplectus spp., and/or *Scirpus* spp. It is rarely without several introduced annual plants such as *Avena fatua, Brassica nigra, Bromus diandrus, Bromus hordeaceus, Carduus pycnocephalus, Lactuca serriola, Lolium perenne ssp. multiflorum (= Lolium multiflorum), Polypogon monspeliensis, Sonchus* spp., or *Vulpia myuros*. This alliance occurs throughout much of the Intermountain West, including the Great Basin and Columbia River Basin, as well as California's Central Valley and coastal plains. Elevations range from sea level to 3000 m. Stands are restricted to intermittently flooded habitats such as playas, intermittent streams, dry washes, poorly drained floodplains, margins of marshes, and historic lake basins. Soils are saline or alkaline with a shallow water table. Soils are typically moderately deep silts and clays, and the soil surface often has high cover of bare ground.

Classification Comments:

Internal Comments: mjr 1-17: CNPS recommends a rank of G4/S3.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Diagnostic of this alliance is the medium-tall grassland dominated by *Leymus cinereus* or *Leymus triticoides* that is restricted to lowland sites that are flooded intermittently.

VEGETATION

Physiognomy and Structure: Perennial bunch grasses less than 1.5 m tall.

Floristics: The tall bunchgrasses *Leymus cinereus* or *Leymus triticoides (= Elymus triticoides)* are the sole or dominant grasses. Other graminoids may include *Achnatherum hymenoides (= Oryzopsis hymenoides), Achnatherum thurberianum (= Stipa thurberiana), Carex praegracilis, Distichlis spicata, Elymus elymoides, Hesperostipa comata (= Stipa comata), Hordeum brachyantherum ssp. californicum (= Hordeum californicum), Hordeum jubatum, Juncus balticus, Lolium perenne ssp. multiflorum (= Lolium multiflorum), Pascopyrum smithii, Poa secunda, Pseudoroegneria spicata, Schoenoplectus* spp., and/or *Scirpus* spp. There is often sparse to moderate cover of forbs such as *Achillea millefolium, Agoseris glauca, Claytonia perfoliata (= Montia perfoliata), Crepis runcinata, Iris missouriensis, Lactuca serriola, Nitrophila occidentalis, Potentilla gracilis var. fastigiata (= Potentilla gracilis var. nuttallii), Sonchus* spp., *Suaeda* spp., and *Triglochin maritima*. Shrubs such as *Ericameria nauseosa (= Chrysothamnus nauseosus)* may be scattered within the stand.

ENVIRONMENT & DYNAMICS

Environmental Description: Elevations range from 0-3000 m. Sites are nearly level to gently sloping (to 18%) occurring on all aspects. Stands are restricted to intermittently flooded habitats such as playas, intermittent streams, drainage bottoms, poorly drained floodplains, margins of marshes, historic lake basins, and dry washes. Flooding is not predictable to a given season and is dependent upon localized rainstorms. Soils are typically poorly drained, alkaline, deep silts, clays, sandy loam to clay loam in texture. The soil surface often has high cover of bare ground. The water table is generally shallow.

Dynamics: *Leymus cinereus* is considered fire-adapted and generally resprouts after fire and recovers quite rapidly on most sites (FEIS 1998).

DISTRIBUTION

Geographic Range: This alliance is found in the Intermountain West of Montana, Wyoming, Idaho, Washington, southeastern Oregon; northwestern Nevada; and interior central Coast Ranges, southern coastal Transverse Ranges, Central Valley and Sierra Nevada foothills of California.

Nations: US
States/Provinces: CA, CO, ID, NV, OR, UT, WA, WY
TNC Ecoregions [optional]: 4:C, 6:C, 8:C, 9:C, 10:C, 11:C, 12:C, 13:C, 15:C, 16:C, 19:C, 20:C, 26:C
USFS Ecoregions (2007): 261A:CC, 261B:CC, 313A:CC, 331A:CC, 341F:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:CC, 342I:CC, M261F:CC, M261G:CC, M262A:CC, M262B:CC, M331D:CC, M331E:CC, M331G:CC, M331H:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M341A:CC, M341B:C?
Omernik Ecoregions:
Federal Lands [optional]: NPS (Channel Islands); USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** *Elymus cinereus - Elymus triticoides* Herbaceous Alliance (Rodriguez et al. 2017)
- **?** *Elymus cinereus/Distichlis stricta* habitat type (Daubenmire 1970)
- **>** *Leymus cinereus* (Ashy ryegrass meadows) Alliance (Sawyer et al. 2009) [41.020.00]
- **>** *Leymus cinereus* Alliance (Ashy rye grass meadows) (Buck-Diaz et al. 2012)
- **>** *Leymus triticoides* (Creeping rye grass turfs) Alliance (Sawyer et al. 2009) [41.080.00]
- **>** *Leymus triticoides* Alliance (Creeping rye grass turfs) (Buck-Diaz et al. 2012)
- **>** *Leymus triticoides* Herbaceous Alliance (Keeler-Wolf and Evens 2006)
- **><** Alkali Grassland and Wetlands (Chappell et al. 1997)
- **><** Ashy Ryegrass Series (Sawyer and Keeler-Wolf 1995)

LOWER LEVEL UNITS

Associations:

- CEGL001479 *Leymus cinereus* Alkaline Wet Meadow
- CEGL001480 *Leymus cinereus* Bottomland Wet Meadow
- CEGL001571 *Leymus triticoides* Wet Meadow
- CEPP005717 *Leymus triticoides - Bromus* spp. - *Avena* spp. Wet Meadow
- CEGL001481 *Leymus cinereus - Distichlis spicata* Alkaline Wet Meadow
- CEGL005306 *Muhlenbergia rigens* Wet Meadow
- CEGL001572 *Leymus triticoides - Poa secunda* Wet Meadow

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel , K.A. Schulz, and J. Evens
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: AIS 2007, Blackburn et al. 1969a, Blackburn et al. 1969d, Buck-Diaz et al. 2012, Chappell et al. 1997, Christensen 1963, Cooper et al. 1995, Copeland 1979, Daubenmire 1970, Daubenmire 1992, Easterday and Mamone 1980, Evens and San 2004, Evens et al. 2006, FEIS 1998, Faber-Langendoen et al. 2017b, Franklin and Dyrness 1973, Hamilton 1997, Holstein 2001, Hull and Hull 1974, Johnson and Simon 1985, Johnson and Simon 1987, Junak et al. 2007, Keeler-Wolf and Evens 2006, Keeler-Wolf and Vaghti 2000, Mueggler and Stewart 1980, Peterson pers. comm., Poulton 1955, Rodriguez et al. 2017, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Seyer 1984, Solomeshch and Barbour 2006, Sproul et al. 2011, Stoddart 1941, Stout et al. 2013, Walker and Brotherson 1982

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2. Shrub & Herb Vegetation
2.C.5.Nd. North American Western Interior Brackish Marsh, Playa & Shrubland
G538. North American Desert Alkaline-Saline Marsh & Playa

A1334. Sporobolus airoides - Muhlenbergia asperifolia - Spartina gracilis Alkaline Wet Meadow Alliance

Type Concept Sentence: This alliance is characterized by sparse to dense grasslands and meadows dominated by *Muhlenbergia asperifolia, Poa secunda, Puccinellia lemmonii, Puccinellia nuttalliana, Spartina gracilis*, and/or *Sporobolus airoides*, any of which may form nearly pure stands. It occurs in lowland habitats such as playas, swales, terraces along intermittently flooded washes, and flats that are alkaline or moderately saline. This alliance is found on plains, in mountain parks and valleys, and in canyons and plateaus of the western U.S.

OVERVIEW

Scientific Name: *Sporobolus airoides - Muhlenbergia asperifolia - Spartina gracilis* Alkaline Wet Meadow Alliance
Common Name (Translated Scientific Name): Alkali Sacaton - Scratchgrass - Alkali Cordgrass Alkaline Wet Meadow Alliance
Colloquial Name: Alkali Sacaton - Scratchgrass - Alkali Cordgrass Alkaline Wet Meadow

Type Concept: Vegetation included in this alliance is characterized by grasslands and meadows dominated by *Muhlenbergia asperifolia, Poa secunda, Puccinellia lemmonii, Puccinellia nuttalliana, Spartina gracilis*, and/or *Sporobolus airoides*, any of which may form monotypic stands. Other species that co-occur include *Carex microptera, Distichlis spicata, Elymus elymoides, Hordeum brachyantherum, Juncus arcticus ssp. littoralis (= Juncus balticus), Juncus ensifolius, Muhlenbergia richardsonis, Pascopyrum smithii*, and/or *Pseudoroegneria*. Forb cover is generally low with *Achillea millefolium, Arnica longifolia, Iris missouriensis, Stellaria longipes*, the annuals *Montia linearis* and *Trifolium cyathiferum*, and may include species of *Atriplex, Polygonum*, and *Rumex*. Shrubs are rare, but because of the patchy distribution of these stands, scattered *Atriplex canescens* and *Sarcobatus vermiculatus* may be present. Sites are found in lowland habitats such as playas, swales, terraces along intermittently flooded washes, and alkali flats. Any flooding that occurs tends to be the result of localized thunderstorms in the summer. Soils are variable, ranging from deep, fine-textured soil

to shallow sand deposits. They are alkaline and may be moderately saline and poorly drained due to an impermeable layer. Stands are documented from eastern Oregon, Washington, California, Nevada, Colorado, Utah, and New Mexico.

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:
- A3186 *Sporobolus airoides - Sporobolus wrightii - Panicum obtusum* Lowland Desert Grassland Alliance

Diagnostic Characteristics: Bottomland alkaline grasslands dominated by *Muhlenbergia asperifolia, Puccinellia lemmonii, Puccinellia nuttalliana, Spartina gracilis*, and/or *Sporobolus airoides*. Stands are often monotypic, or with 1-3 dominants, with any combination of these species.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a sparse to dense herbaceous layer dominated by medium-tall bunch grasses.

Floristics: Dominant graminoids include *Muhlenbergia asperifolia, Poa secunda, Puccinellia lemmonii, Puccinellia nuttalliana*, and/or *Sporobolus airoides*. Other graminoids present to codominant may include *Agrostis gigantea, Carex douglasii, Carex microptera, Distichlis spicata, Elymus elymoides, Hordeum brachyantherum, Juncus balticus, Juncus ensifolius, Muhlenbergia richardsonis, Pascopyrum smithii, Pseudoroegneria spicata, Bolboschoenus maritimus (= Scirpus paludosus)*, and *Spartina gracilis*. Forb cover is generally low but may include *Achillea millefolium, Arnica longifolia, Atriplex argentea, Iris missouriensis, Montia linearis, Plantago eriopoda, Polygonum* spp., *Rumex* spp., *Stellaria longipes*, and *Trifolium cyathiferum*. Shrubs may be present as well with very low cover (<3%) and include *Atriplex canescens* and *Sarcobatus vermiculatus*. Exotic annual grasses such as *Bromus tectorum* and *Polypogon monspeliensis* are often abundant on disturbed sites.

ENVIRONMENT & DYNAMICS

Environmental Description: Sites occur in lowland habitats such as playas, swales, terraces along intermittently flooded washes, and alkali flats. Soils are variable, ranging from deep, fine-textured soil to shallow sand deposits. They are alkaline and may be moderately saline and poorly drained due to an impermeable layer. When dry the soil may have salt accumulations on the soil surface. Stands are typically flooded in the spring and have a shallow water table that may drop below 1 m by the early summer. Elevation ranges from low interior valleys of eastern Oregon to high-elevation mountain parks of Colorado (Reid 1974).

Dynamics: Total vegetation abundance (density and height), species composition and soil salinity depend on the amount and timing of precipitation and flooding. Growth inhibiting salt concentrations are diluted when the soil is saturated allowing the growth of less salt-tolerant species. As the saturated soils dry, the salt concentrates until it precipitates out on the soil surface (Dodd and Coupland 1966, Ungar 1968). Higher salinity favors some species over others, and may influence changes in species composition from year to year. For example, higher soil salinity favors *Distichlis spicata, Hordeum jubatum*, and *Sporobolus airoides* over the less salt-tolerant *Muhlenbergia asperifolia*. Ungar (1965) lists *Muhlenbergia asperifolia* as significantly less salt-tolerant than *Sporobolus airoides* and much less tolerant than *Distichlis spicata*. The special configuration (often concentric rings) of salt-tolerant species may also change with microtopography and degree of ponded water (Ungar 1967, 1970, 1972, Ungar et al. 1969).

DISTRIBUTION

Geographic Range: This alliance is found in the interior west of California, Oregon, and Washington east to Colorado, south into New Mexico, and north into Alberta.

Nations: CA, US
States/Provinces: AB, AZ, CA, CO, NM, NV, OR, UT, WA
TNC Ecoregions [optional]: 17:C
USFS Ecoregions (2007): 322Ab:CCC, 322Al:CCC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Mojave)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Muhlenbergia asperifolia* salt marsh (Baker 1984a)
- **>** *Poa secunda* (Curly blue grass grassland) Alliance (Sawyer et al. 2009) [41.180.00]

- **>** *Poa secunda* Alliance (Curly blue grass grassland) (Buck-Diaz et al. 2012)
- **>** *Spartina gracilis* (Alkali cordgrass marsh) Alliance (Sawyer et al. 2009) [52.030.00]
- **>** *Sporobolus airoides* (Alkali sacaton grassland) Alliance (Sawyer et al. 2009) [41.010.00]
- **>** *Sporobolus airoides* Alliance (Alkali sacaton grassland) (Buck-Diaz et al. 2012)
- **>** *Sporobolus airoides* Herbaceous Alliance (Evens et al. 2014)
- **><** *Sporobolus cryptandrus - Aristida purpurea var. longiseta* Grasslands (Chambers et al. 1997)
- **><** One-sided Bluegrass Series (Sawyer and Keeler-Wolf 1995)

LOWER LEVEL UNITS

Associations:
- CEGL001688 *Sporobolus airoides* Monotype Wet Meadow
- CEGL001685 *Sporobolus airoides* Southern Plains Wet Meadow
- CEGL001658 *Puccinellia lemmonii - Poa secunda* Wet Meadow
- CEGL001588 *Spartina gracilis* Wet Meadow
- CEGL001779 *Muhlenbergia asperifolia* Wet Meadow
- CEGL001799 *Puccinellia nuttalliana* Salt Marsh
- CEGL001687 *Sporobolus airoides - Distichlis spicata* Wet Meadow
- CEGL005809 *Tiquilia latior / Sporobolus airoides* Dwarf-shrub Wet Meadow
- CEGL001476 *Spartina pectinata* Western Wet Meadow

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel and K.A. Schulz
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Baker 1984a, Blackburn et al. 1969b, Bolen 1964, Borgais unpubl. data 1990, Buck-Diaz et al. 2012, Chambers et al. 1997, Dodd and Coupland 1966, Evens et al. 2014, Faber-Langendoen et al. 2017b, Keeler-Wolf and Thomas 2000, Kittel and Lederer 1993, Manning 1988, Reid 1974, Reid et al. 1994, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Shupe et al. 1986, Stout et al. 2013, USBOR 1976, Ungar 1972, Ungar et al. 1969, VegCAMP and AIS 2013

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2. Shrub & Herb Vegetation
2.C.5.Nd. North American Western Interior Brackish Marsh, Playa & Shrubland
2.C.5.Nd.1.b. M082 Warm & Cool Desert Alkali-Saline Marsh, Playa & Shrubland

G537. North American Desert Alkaline-Saline Wet Scrub

Type Concept Sentence: This group consists of saline scrub wetlands of the Intermountain West. Characteristic species include *Atriplex* spp., *Allenrolfea occidentalis, Salicornia rubra, Sarcobatus vermiculatus, Sesuvium verrucosum*, and/or *Suaeda moquinii*.

OVERVIEW

Scientific Name: *Sarcobatus vermiculatus - Atriplex* spp. Alkaline-Saline Wet Scrub Group
Common Name (Translated Scientific Name): Greasewood - Saltbush species Alkaline-Saline Wet Scrub Group
Colloquial Name: Iodinebush Wet Shrubland

Type Concept: This group occurs throughout much of the western U.S. in intermountain basins. Stands typically occur near drainages on stream terraces and flats or may form rings around more sparsely vegetated playas. Sites typically have saline soils, a shallow water table and flood intermittently, but remain dry for most growing seasons. The water table remains high enough to maintain vegetation, despite salt accumulations. This group consists of open to moderately dense shrublands dominated by *Atriplex lentiformis, Atriplex parryi, Atriplex polycarpa, Atriplex spinifera, Allenrolfea occidentalis, Salicornia rubra, Sarcobatus vermiculatus, Sesuvium verrucosum*, and/or *Suaeda moquinii*. Stands may be monotypic or have lesser abundance of other shrubs such as *Atriplex canescens, Atriplex confertifolia, Atriplex gardneri, Artemisia tridentata ssp. wyomingensis, Artemisia tridentata ssp. tridentata, Artemisia cana ssp. cana, Baccharis* spp., *Krascheninnikovia lanata*, and others. The herbaceous layer, if present, is usually dominated by graminoids. There may be inclusions of *Calamovilfa longifolia, Distichlis spicata* (where water remains ponded the longest), *Eleocharis palustris, Pascopyrum smithii, Poa pratensis, Puccinellia nuttalliana*, or *Sporobolus airoides* herbaceous types.

Classification Comments:

Similar NVC Types:

- G534 Western Great Plains Saline Wet Meadow: occurs in the northern and western Great Plains and is also dominated by *Sarcobatus vermiculatus* with more Great Plains herbaceous species.
- G538 North American Desert Alkaline-Saline Marsh & Playa: includes salt communities in the cold desert that are dominated by herbaceous species.

Diagnostic Characteristics: Salt-tolerant shrublands with a shallow water table.

VEGETATION

Physiognomy and Structure: Shrubland.

Floristics: These shrublands are dominated by *Atriplex lentiformis, Atriplex parryi, Atriplex polycarpa, Atriplex spinifera, Allenrolfea occidentalis, Salicornia rubra, Sarcobatus vermiculatus, Sesuvium verrucosum*, and/or *Suaeda moquinii*. Codominant shrubs include *Ambrosia dumosa, Artemisia californica, Atriplex canescens, Baccharis pilularis, Baccharis salicifolia, Encelia californica, Eriogonum fasciculatum, Gutierrezia sarothrae, Hymenoclea salsola, Bassia americana (= Kochia americana), Larrea tridentata, Malosma laurina, Myoporum laetum, Pluchea sericea, Prosopis glandulosa, Rhus integrifolia*, and/or *Suaeda taxifolia* plus several others. The herbaceous layer, if present, is usually dominated by graminoids. There may be inclusions of *Calamovilfa longifolia, Distichlis spicata* (where water remains ponded the longest), *Eleocharis palustris, Pascopyrum smithii, Poa pratensis, Puccinellia nuttalliana*, or *Sporobolus airoides* herbaceous types (West 1983b, Knight 1994).

ENVIRONMENT & DYNAMICS

Environmental Description: *Climate:* Cold interior desert. *Soil/substrate/hydrology:* Sites are generally flat to gently sloping and moderately saline, but some sites do occur on rolling to hilly fans and slopes. Sites typically have saline soils, a shallow water table and flood intermittently, on margins of intermittently flooded desert playas, and usually remain dry for most growing seasons. The water table remains high enough to maintain vegetation, despite salt accumulations, often with fine soils such as clays (West 1983b, Knight 1994).

Dynamics:

DISTRIBUTION

Geographic Range: This group occurs throughout much of the western U.S. in intermountain basins.

Spatial Scale & Pattern [optional]: Large patch
Nations: US
States/Provinces: AZ, CA, CO, ID, MT, NM, NV, OR, TX, UT, WA, WY
TNC Ecoregions [optional]: 4:C, 6:C, 8:C, 9:C, 10:C, 11:C, 19:C, 20:C, 26:C
USFS Ecoregions (2007): 313A:CC, 313B:CC, 313D:CC, 315A:CC, 315H:CC, 321A:??, 322A:CC, 331B:CC, 331C:CP, 331D:CP, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 331J:CC, 331K:CP, 331L:C?, 341A:CC, 341B:CC, 341C:CC, 341D:CC, 341E:CC, 341F:CC, 341G:CC, 342A:CC, 342B:CC, 342C:CC, 342D:CC, 342F:CC, 342G:CC, 342H:CC, 342I:C?, 342J:CC, M242C:??, M261D:CC, M261E:CP, M261G:CC, M313A:CC, M313B:CC, M331A:C?, M331B:CP, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CP, M331J:C?, M332A:C?, M332D:CP, M332E:C?, M332G:CC, M341A:CC, M341B:CC, M341C:CC, M341D:CC
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **<** Salt Desert Shrub (414) (Shiflet 1994)
- **><** Saltbush - Greasewood (501) (Shiflet 1994)

LOWER LEVEL UNITS

Alliances:
- A0798 *Pluchea sericea* Wet Shrubland Alliance
- A3173 *Atriplex lentiformis* Wet Shrubland Alliance
- A1046 *Sarcobatus vermiculatus* Intermountain Wet Shrubland Alliance
- A0866 *Allenrolfea occidentalis* Wet Shrubland Alliance
- A3880 *Suaeda moquinii - Salicornia rubra - Isocoma acradenia* Alkaline Wet Scrub Alliance
- A2507 *Atriplex parryi* Wet Shrubland Alliance
- A0865 *Atriplex spinifera* Wet Shrubland Alliance
- A3879 *Sesuvium verrucosum* Desert Salt Mudflat Scrub Alliance

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2011)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 12/02/2015
Classif Resp Region: West
Internal Author: GK 10-10, 9-13, 5-15, 12-15

REFERENCES

References: Comer et al. 2003, Faber-Langendoen et al. 2017a, Knight 1994, Shiflet 1994, West 1983b

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2. Shrub & Herb Vegetation
2.C.5.Nd. North American Western Interior Brackish Marsh, Playa & Shrubland
G537. North American Desert Alkaline-Saline Wet Scrub

A0866. Allenrolfea occidentalis Wet Shrubland Alliance

Type Concept Sentence: This alliance consists of herbaceous flats dominated by *Allenrolfea occidentalis* known from saline habitats throughout the arid intermountain western United States, such as alkaline flats along the margins of salt lakes, in depressions among gypsum ridges, and along washes in saline overflow areas.

OVERVIEW

Scientific Name: *Allenrolfea occidentalis* Wet Shrubland Alliance
Common Name (Translated Scientific Name): Iodinebush Wet Shrubland Alliance
Colloquial Name: Iodinebush Wet Shrubland

Type Concept: This herbaceous alliance consists of vegetation dominated by *Allenrolfea occidentalis*. Associated species include *Atriplex canescens, Atriplex gardneri, Distichlis spicata, Suaeda suffrutescens, Sporobolus airoides*, and/or *Sporobolus wrightii*. Stands occur in alkaline flats along the margins of salt lakes, in depressions among gypsum ridges, and along washes in saline overflow areas. In all cases, it occurs at sites that are seasonally moist or flooded and where evaporation concentrates transported salts, leaving visible mineral crusts at the soil surface. The nominal species can cover large acreages, with little else except barren soil. This alliance occurs throughout the arid intermountain western United States.

Classification Comments: This alliance can form landscape mosaics with other saline communities in saline marshes or gyp-influenced habitats.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: *Allenrolfea occidentalis* >2% absolute cover in the shrub canopy, and no other species with greater or equal cover (Keeler-Wolf et al. 1998a, Thomas et al. 2004).

VEGETATION

Physiognomy and Structure: These are sparse to moderately dense (15-45% cover) xeromorphic, evergreen, succulent shrublands. Shrubs are generally less than 1 m in height. These stands are usually monotypic and harbor a depauperate understory and abundant bare ground. When present, the herbaceous layer consists of a sparse cover of mat-forming or cespitose graminoids and/or salt-tolerant annual forbs.

Floristics: Stands are usually strongly dominated by *Allenrolfea occidentalis* and may cover large areas of excessively salty soils. Stands of this alliance may be monotypic. Associated species are all halophytic, and other shrub species may occur. Such species include *Atriplex canescens, Atriplex gardneri, Atriplex lentiformis, Atriplex polycarpa, Frankenia salina*, and *Sarcobatus vermiculatus*. Common graminoid associates include *Distichlis spicata, Eleocharis palustris, Kalinia obtusiflora (= Eragrostis obtusiflora)*, and *Sporobolus airoides*. Succulent halophytic annuals, such as *Salicornia rubra, Salicornia bigelovii*, and *Suaeda* spp., are typical forb associates. Additional associated species from stands in western Texas include *Suaeda suffrutescens var. detonsa* and *Sporobolus wrightii*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs in topographic depressions usually without surface drainage (playas) and stream terraces from sea level to 1800 m (5900 feet) elevation. In all cases, it occurs at sites that are seasonally moist or flooded and where evaporation concentrates transported salts, leaving visible mineral crusts at the soil surface. *Allenrolfea occidentalis* is tolerant of

extreme salinities and heavy soils which tend to exclude other species, and usually forms the lowest ring of perennial vegetation around desert salt flats. This vegetation is also associated with hummocks scattered over barren salt flats. These hummocks are formed by eolian deposition of sands within the individual shrubs. Although *Allenrolfea* occurs at sites with up to 3% soil salinity, optimum growth occurs at about 1% (Mozingo 1987).

Dynamics: Fluvial proceses rather than fire primarily disturb stands. Plants sprout after fire and other disturbances, but information on fire characteristics is lacking. Because of the harsh environment and succulent nature of the plants, fire is unlikely in all but the densest and driest stands.

DISTRIBUTION

Geographic Range: Vegetation included in this widespread western alliance occurs in saline habitats in the deserts of the southwestern U.S. and northern Mexico, from the Chihuahuan Desert of western Texas and New Mexico, across the Sonoran and Mojave deserts to Baja California and north into the Central Valley of California. It also occurs in the Colorado Plateau, Great Basin and Columbia Plateau regions of Nevada, Oregon, and Utah from Death Valley to Petrified Forest national parks.

Nations: MX, US
States/Provinces: AZ, CA, MXBC, NM, NV, OR, TX, UT, WY
TNC Ecoregions [optional]: 11:C, 13:C, 15:C, 17:C, 23:C
USFS Ecoregions (2007): 262A:CC, 322Ab:CCC, 322Ai:CCC, 322B:CC, 322C:CC, 341D:CC, 341Fc:CCC, 341Ff:CCC, 342B:CC, M262A:CC
Omernik Ecoregions:
Federal Lands [optional]: BLM (Carrizo Plain); NPS (Death Valley, Mojave)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** *Allenrolfea occidentalis* (Iodine bush scrub) Alliance (Sawyer et al. 2009) [36.120.00]
- **=** *Allenrolfea occidentalis* Alliance (Iodine bush scrub) (Buck-Diaz et al. 2012)
- **=** *Allenrolfea occidentalis* Shrubland Alliance (Evens et al. 2014)
- **?** Iodine Bush Series (Sawyer and Keeler-Wolf 1995)

LOWER LEVEL UNITS

Associations:

- CEGL000988 *Allenrolfea occidentalis* Wet Shrubland
- CEPP005788 *Allenrolfea occidentalis / Distichlis spicata* Wet Shrubland
- CEPP005787 *Allenrolfea occidentalis - Suaeda moquinii* Wet Shrubland
- CEGL000989 *Allenrolfea occidentalis / Atriplex gardneri* Wet Shrubland

AUTHORSHIP

Primary Concept Source: D. Sarr and K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel, D. Sarr, K.A. Schulz
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Barbour and Major 1977, Bradley 1970, Buck-Diaz et al. 2012, Burgess and Klein n.d., Burgess and Northington 1977, Burk 1977, Diamond 1993, Dick-Peddie 1993, Evens and Hartman 2007, Evens et al. 2014, Faber-Langendoen et al. 2017b, Fautin 1946, Griffiths 1902, Henrickson 1974, Holland 1986b, Keeler-Wolf and Thomas 2000, MacMahon 1988, MacMahon and Wagner 1985, McHargue 1973, Mozingo 1987, Nelson 1976, ORNHP unpubl. data, Odion et al. 1992, Paysen et al. 1980, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Stout et al. 2013, Thomas et al. 2004, Thorne 1982, Vasek and Barbour 1988, VegCAMP and AIS 2013, Vest 1962b, Young et al. 1977

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2. Shrub & Herb Vegetation
2.C.5.Nd. North American Western Interior Brackish Marsh, Playa & Shrubland
G537. North American Desert Alkaline-Saline Wet Scrub

A1046. Sarcobatus vermiculatus Intermountain Wet Shrubland Alliance

Type Concept Sentence: Shrublands included in this alliance are dominated or codominated by *Sarcobatus vermiculatus*. They occur on lowland sites in plains, mountain valleys and intermountain basins throughout the arid and semi-arid western United States, on generally flat, poorly drained, seasonally, temporarily or intermittently flooded sites with a shallow or perched water table often within 1 m depth such as alkali flats around playas and floodplains along stream channels.

OVERVIEW

Scientific Name: *Sarcobatus vermiculatus* Intermountain Wet Shrubland Alliance
Common Name (Translated Scientific Name): Greasewood Intermountain Wet Shrubland Alliance
Colloquial Name: Intermountain Greasewood Wet Shrubland

Type Concept: Shrublands included in this alliance are dominated or codominated by *Sarcobatus vermiculatus*. Other shrubby codominants include *Artemisia cana, Artemisia tridentata, Atriplex confertifolia, Atriplex gardneri, Chrysothamnus* spp., *Collomia linearis, Grayia spinosa*, or *Picrothamnus desertorum (= Artemisia spinescens)*. In more saline environments, *Nitrophila occidentalis* and *Suaeda moquinii* may be present. If present, the sparse to moderate herbaceous layer is dominated by perennial grasses, such as *Achnatherum hymenoides (= Oryzopsis hymenoides), Bouteloua gracilis, Distichlis spicata, Elymus elymoides, Hordeum jubatum, Leymus cinereus, Nassella viridula, Pascopyrum smithii, Poa secunda (= Poa juncifolia)*, and *Sporobolus airoides*. Forbs are generally sparse except on disturbed weedy sites. The native perennial forbs include *Achillea millefolium, Artemisia ludoviciana, Astragalus* spp., *Chenopodium fremontii, Glycyrrhiza lepidota*, and *Opuntia polyacantha*. Perennial forbs are typically sparse and often include *Grindelia squarrosa, Iva axillaris*, and *Sphaeralcea coccinea*. Annual grasses, especially the exotic *Bromus* spp., may be present to abundant. Forbs are common on disturbed sites. Weedy annual forbs may include the exotics *Descurainia* spp., *Helianthus annuus, Halogeton glomeratus, Lactuca serriola*, and *Lepidium perfoliatum*. This alliance occurs throughout the arid and semi-arid western United States. Sites are generally flat, poorly drained, seasonally, temporarily or intermittently flooded with a shallow or perched water table often within 1 m depth such as alkali flats around playas and floodplains along stream channels. Substrates are generally shallow, calcareous, fine-textured soils derived from alluvium. Soils are alkaline and typically moderately saline.

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Diagnostic of this alliance is the *Sarcobatus vermiculatus*-dominated shrub layer in a shrubland that has a relatively shallow water table and may be flooded at any time.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a moderate to dense layer of microphyllous, deciduous xeromorphic shrubs 0.5-2 m tall. The herbaceous layer is sparse to moderately dense and dominated by tall to medium-tall bunch grasses or rhizomatous mid grasses. Perennial forbs are sparse. Scattered cacti and perennial forbs may be present. Annual grasses and forbs may be seasonally present to abundant.

Floristics: This alliance has shrublands dominated or codominated by the deciduous, facultative halophytic shrub *Sarcobatus vermiculatus*. Other shrubby codominants include *Artemisia cana, Artemisia tridentata, Atriplex confertifolia, Atriplex gardneri, Chrysothamnus* spp., *Collomia linearis, Grayia spinosa, Nitrophila occidentalis, Picrothamnus desertorum (= Artemisia spinescens)*, and/or *Suaeda moquinii*. Herbaceous layers range from absent to a moderately dense canopy of medium-tall to short bunchgrasses or sod grasses (0-25% cover) such as *Achnatherum hymenoides (= Oryzopsis hymenoides), Bouteloua gracilis, Distichlis spicata, Elymus elymoides, Hordeum jubatum, Leymus cinereus, Nassella viridula, Pascopyrum smithii, Poa secunda (= Poa juncifolia)*, and/or *Sporobolus airoides*. Perennial forbs are typically sparse and often include *Achillea millefolium, Artemisia ludoviciana, Astragalus* spp., *Chenopodium fremontii, Glycyrrhiza lepidota, Grindelia squarrosa, Iva axillaris, Opuntia polyacantha*, and/or *Sphaeralcea coccinea*. Exotic species can be abundant on disturbed weedy sites and include such species as *Bassia scoparia (= Kochia scoparia), Bromus arvensis (= Bromus japonicus), Bromus rubens, Bromus tectorum, Descurainia* spp., *Halogeton glomeratus, Helianthus annuus, Lactuca serriola*, and/or *Lepidium perfoliatum*.

ENVIRONMENT & DYNAMICS

Environmental Description: Elevations range from 100-2400 m. Sites are generally flat, poorly drained and intermittently flooded with a shallow or perched water table often within 1 m depth (West 1983b). Sites may receive overland flow during intense summer thunderstorms. Some sites are well-drained and do not have a shallow water table. Substrates are generally shallow, calcareous, fine-textured soils (clays to silt-loams), derived from alluvium. Soils are alkaline and typically moderately saline (West 1983b). Summers are hot. Winters are generally cold, but are mild in subtropical regions. Precipitation varies with geography but is generally low and infrequent.

Dynamics: *Sarcobatus vermiculatus* is often found on sites with high water tables that are intermittently flooded. Hansen et al. (1995) reported that it can tolerate saturated soil conditions for up to 40 days. Hansen et al. (1995) also reported browsing damage with heavy spring and summer grazing, but noted that *Sarcobatus vermiculatus* is moderately poisonous to livestock especially in the

fall, and supplemental feed is recommended to avoid livestock loss. Hanson (1929) states that *Sarcobatus vermiculatus* can form an important part of winter forage for sheep. Fire will top-kill *Sarcobatus vermiculatus*, but the shrub will promptly resprout from the root crown (Daubenmire 1970).

DISTRIBUTION

Geographic Range: This alliance is found throughout the interior arid west from California, eastern Oregon and Washington, Idaho, Montana, Wyoming, Colorado, Nevada, Utah, northern Arizona, and New Mexico, not dropping into the warm desert provinces.

Nations: US
States/Provinces: AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]: 4:C, 6:C, 11:C, 17:C
USFS Ecoregions (2007): 322Ai:CCC, 341D:CC, 341Fc:CCC, 342B:CC, M261G:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Mojave); USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** *Sarcobatus vermiculatus* (Greasewood scrub) Alliance (Sawyer et al. 2009) [36.400.00]
- **?** *Sarcobatus vermiculatus/Sporobolus airoides* plant association (Johnston 1987) [included within the *Sarcobatus vermiculatus* Series.]
- **?** *Sarcobatus vermiculatus* Association (152.171) (Brown 1982a) [included within Great Basin Desertscrub, Saltbush Series.]
- **><** *Sarcobatus vermiculatus* Series (Johnston 1987)
- **?** *Sarcobatus vermiculatus* Series (Mueggler and Stewart 1980) [includes both *Sarcobatus vermiculatus/Elymus cinereus* and *Sarcobatus vermiculatus/Agropyron smithii* habitat types.]
- **><** *Sarcobatus vermiculatus* Series (Francis 1986)
- **=** *Sarcobatus vermiculatus* Shrubland Alliance (Evens et al. 2014)
- **><** *Sarcobatus vermiculatus* habitat type (Daubenmire 1970)
- **=** *Sarcobatus vermiculatus* Shrubland Alliance (CNPS 2017) [36.400.00]
- **><** Desert Greasewood Scrub (#36130) (Holland 1986b)
- **><** Desert Sink Scrub (Holland 1986b)
- **><** Greasewood Series (Sawyer and Keeler-Wolf 1995)
- **?** Greasewood-Desert Shrub Series (Dick-Peddie 1993) [within the Arroyo Riparian Habitat Type.]
- **><** Northern Plains: Saline lowland (Soil Conservation Service n.d.)
- **?** Saltbush Series (Dick-Peddie 1993) [within the Great Basin Desert Scrub.]

LOWER LEVEL UNITS

Associations:

- CEGL001362 *Sarcobatus vermiculatus / Ericameria nauseosa* Wet Shrubland
- CEGL001368 *Sarcobatus vermiculatus / Sporobolus airoides* Wet Shrubland
- CEGL001369 *Sarcobatus vermiculatus / Nitrophila occidentalis - Suaeda moquinii* Wet Shrubland
- CEGL001370 *Sarcobatus vermiculatus / Suaeda moquinii* Wet Shrubland
- CEGL001373 *Sarcobatus vermiculatus / Achnatherum hymenoides* Wet Shrubland
- CEGL001371 *Sarcobatus vermiculatus / Atriplex confertifolia - (Picrothamnus desertorum, Suaeda moquinii)* Wet Shrubland
- CEGL002919 *Sarcobatus vermiculatus / Juncus arcticus ssp. littoralis* Sparse Vegetation
- CEGL001366 *Sarcobatus vermiculatus / Leymus cinereus* Wet Shrubland
- CEGL001360 *Sarcobatus vermiculatus / Atriplex gardneri* Wet Shrubland
- CEGL001359 *Sarcobatus vermiculatus / Artemisia tridentata* Wet Shrubland
- CEGL001365 *Sarcobatus vermiculatus / Elymus elymoides - Pascopyrum smithii* Wet Shrubland
- CEGL001357 *Sarcobatus vermiculatus* Disturbed Wet Shrubland
- CEGL002763 *Sarcobatus vermiculatus - Psorothamnus polydenius* Wet Shrubland
- CEGL001361 *Sarcobatus vermiculatus / Bouteloua gracilis* Wet Shrubland
- CEGL001372 *Sarcobatus vermiculatus / Elymus elymoides* Wet Shrubland
- CEGL002764 *Sarcobatus vermiculatus - Atriplex parryi / Distichlis spicata* Wet Shrubland
- CEGL001364 *Sarcobatus vermiculatus* Dune Wet Shrubland
- CEGL001363 *Sarcobatus vermiculatus / Distichlis spicata* Wet Shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz and G. Kittel

Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Anderson 2004b, Baker 1984a, Barbour and Major 1977, Blackburn et al. 1969b, Blackburn et al. 1969c, Blackburn et al. 1969d, Blackburn et al. 1971, Branson and Owen 1970, Branson et al. 1976, Brotherson et al. 1986, Brown 1982a, Bundy et al. 1996, Burk 1977, CNPS 2017, Chappell et al. 1997, Charlton 2000a, Copeland 1979, Copeland and Greene 1982, Dastrup 1963, Daubenmire 1970, DeVelice and Lesica 1993, DeVelice et al. 1991, DeVelice et al. 1995, Dick-Peddie 1993, Evens et al. 2014, Faber-Langendoen et al. 2017b, Fenemore 1970, Ferren and Davis 1991, Francis 1986, Franklin and Dyrness 1973, Graham 1937, Hamner 1964, Hansen et al. 1995, Hanson 1929, Holland 1986b, Johnston 1987, Jones and Walford 1995, Knight et al. 1987, Lesica and DeVelice 1992, MacMahon 1988, Medicine Bow Mine Application n.d., Mueggler and Stewart 1980, Paysen et al. 1980, Paysen et al. 2000, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Soil Conservation Service n.d., Sweetwater Uranium Project 1978, Terwilliger and Smith 1978, Terwilliger et al. 1979a, Terwilliger et al. 1979b, Thomas et al. 2004, Thorne 1982, Tueller 1994, Tweit and Houston 1980, Ungar et al. 1969, Vasek and Barbour 1988, VegCAMP and AIS 2013, West 1983b, West 1988, Young et al. 1977, Young et al. 1986, Young et al. 2007b

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2. Shrub & Herb Vegetation
2.C.5.Nd. North American Western Interior Brackish Marsh, Playa & Shrubland
G537. North American Desert Alkaline-Saline Wet Scrub

A3880. Suaeda moquinii - Salicornia rubra - Isocoma acradenia Alkaline Wet Scrub Alliance

Type Concept Sentence: This alliance is characterized by an open to dense canopy dominated by saline wet species *Suaeda moquinii* and/or *Salicornia rubra*. Sites include moist or seasonally dry flats, margins of intermittently flooded playas, and low coastal areas. Stands generally have low cover of vegetation and may be sparse (<10% total vegetation). It occurs in the Central Valley and San Joaquin Valley in California south into Baja California.

OVERVIEW

Scientific Name: *Suaeda moquinii - Salicornia rubra - Isocoma acradenia* Alkaline Wet Scrub Alliance
Common Name (Translated Scientific Name): Mojave Seablite - Red Swampfire - Alkali Goldenbush Alkaline Wet Scrub Alliance
Colloquial Name: Mojave Seablite - Red Swampfire Alkaline Wet Scrub

Type Concept: This alliance includes stands that are characterized by an open to dense canopy of *Suaeda moquinii* and/or *Salicornia rubra*. Other saline wetland species present may include *Anemopsis californica, Distichlis spicata, Eleocharis palustris, Juncus arcticus ssp. littoralis (= Juncus balticus), Schoenoplectus americanus (= Scirpus americanus), Tiquilia* spp., or *Triglochin maritima*. Stands generally have low cover of vegetation and may be sparse (<10% total vegetation). Sites are moist or seasonally dry flats, and margins of intermittently flooded desert playas and may extend to coast. This highly variable saline wet herbaceous vegetation alliance occurs across the warm deserts of North America, extending into the Central Valley and San Joaquin Valley in California south into Baja California.

Classification Comments:

Internal Comments: MSR 1-16: add CO, NM, NV, UT. mjr 1-15: AZ added for Lake Mead (MOJN). GK 4-14: Existing related alliances are included in G538.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: This alkaline, saline wet flats warm desert scrub is identified by an open scrub canopy characterized by saline wet species such as *Suaeda moquinii* and/or *Salicornia rubra*.

VEGETATION

Physiognomy and Structure:

Floristics: This alliance includes stands that are characterized by an open to dense canopy of *Suaeda moquinii* and/or *Salicornia rubra*. Other saline wetland species present may include *Anemopsis californica, Distichlis spicata, Eleocharis palustris, Juncus balticus, Schoenoplectus americanus (= Scirpus americanus), Tiquilia* spp., or *Triglochin maritima*. Stands generally have low cover of vegetation and may be sparse (<10% total vegetation).

ENVIRONMENT & DYNAMICS

Environmental Description: Sites are moist or seasonally dry flats, and margins of intermittently flooded desert playas and may extend to coast.

Dynamics:

DISTRIBUTION

Geographic Range: This saline wet scrub alliance is found in suitable sites across the warm deserts of North America, extending into the Central Valley and San Joaquin Valley in California south into Baja California.

Nations: MX, US
States/Provinces: AZ, CA, CO, MXBC, NM, NV, UT
TNC Ecoregions [optional]: 11:C, 17:C
USFS Ecoregions (2007): 322Ab:CCC, 322Ae:CCC, 322Ai:CCC, 322Ay:CCC, 341Fc:CCC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Lake Mead, Mojave)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** *Suaeda moquinii* (Bush seepweed scrub) Alliance (Sawyer et al. 2009) [36.200.00]
- **>** *Suaeda moquinii* Shrubland Alliance (Evens et al. 2014)
- **>** *Suaeda nigra* Alliance (Bush seepweed scrub) (Buck-Diaz et al. 2012)

LOWER LEVEL UNITS

Associations:

- CEGL001991 *Suaeda moquinii* Wet Shrubland
- CEPP006758 *Suaeda moquinii - Atriplex canescens* Alkaline Wet Shrubland
- CEGL005465 *Isocoma acradenia* Desert Scrub
- CEGL005395 *Isocoma acradenia* Wet Shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Buck-Diaz et al. 2012, Evens and Hartman 2007, Evens et al. 2014, Faber-Langendoen et al. 2017b, Keeler-Wolf and Thomas 2000, Sawyer et al. 2009, VegCAMP and AIS 2013

3. DESERT & SEMI-DESERT

Cool and warm semi-deserts dominated by xeromorphic growth forms, including *succulent* (e.g., cacti, euphorbias) and *small-leaved shrubs* and *trees*, desert grasses and other xeromorphic growth forms, with an irregular horizontal canopy spacing that is often open to very sparse (1%) cover.

3.B. Cool Semi-Desert Scrub & Grassland

Cool Semi-Desert Scrub & Grassland occurs in dry, cool-temperate climates, at mid-latitudes (35° to 50°N), typically in the interior of continents, and varies from low shrublands to very open grassland and shrub-steppe, including open rocky or sandy semi-desert vegetation.

3.B.1. Cool Semi-Desert Scrub & Grassland

Cool Semi-Desert Scrub & Grassland occurs in dry, cool-temperate climates, at mid-latitudes (35° to 50°N), typically in the interior of continents.

3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland

This division encompasses all upland shrub and grassland vegetation within the Western North American Cool Semi-desert region, from south-central Alberta through the Great Basin and western margins of the Great Plains to New Mexico, westward to dry-interior southern British Columbia and south through eastern Oregon and interior California, into the mountains of northwestern

Baja California, Mexico. It includes extensive shrublands dominated by *Artemisia tridentata*, ranging from mid to upper slopes and deep to shallow soils, and extensive *Atriplex* shrublands.

M171. Great Basin-Intermountain Dry Shrubland & Grassland

This diverse semi-arid macrogroup is found throughout the Intermountain West, including mid-elevation sites in eastern and central Mojave Desert, the Great Basin, Colorado Plateau, Columbia Plateau, and lower elevation sites in the central Rocky Mountains extending east across Wyoming Basins into the western Great Plains. It can occur as open shrubland, dwarf-shrub, shrub herbaceous, or grassland communities. Characteristic species include shrubs *Chrysothamnus viscidiflorus, Coleogyne ramosissima, Ephedra* spp., *Ericameria nauseosa, Gutierrezia sarothrae, Krascheninnikovia lanata*, and dry grasses such as *Achnatherum hymenoides, Achnatherum lettermanii, Aristida purpurea, Bouteloua gracilis, Hesperostipa comata, Leymus salinus ssp. salinus, Muhlenbergia pungens, Pleuraphis jamesii, Poa fendleriana, Poa secunda, Pseudoroegneria spicata, Sporobolus cryptandrus*, and *Sporobolus airoides*.

3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
3.B.1.Ne.1.c. M171 Great Basin-Intermountain Dry Shrubland & Grassland

G311. Intermountain Semi-Desert Grassland

Type Concept Sentence: This widespread semi-arid to arid grassland group occurs throughout the intermountain western U.S. that are composed of dominant drought-resistant perennial bunchgrasses such as *Achnatherum* spp., *Bouteloua gracilis, Hesperostipa comata, Pleuraphis jamesii, Poa cusickii, Poa secunda*, and *Pseudoroegneria spicata* often with scattered shrubs, especially *Artemisia tridentata, Atriplex* spp., *Coleogyne ramosissima, Ephedra* spp., *Gutierrezia sarothrae*, and *Krascheninnikovia lanata*.

OVERVIEW

Scientific Name: *Pleuraphis jamesii - Achnatherum hymenoides - Hesperostipa comata* Semi-Desert Grassland Group
Common Name (Translated Scientific Name): James' Galleta - Indian Ricegrass - Needle-and-Thread Semi-Desert Grassland Group
Colloquial Name: Indian Ricegrass - Bluebunch Wheatgrass - Sandhill Muhly Grassland

Type Concept: This widespread group includes semi-arid to arid grasslands found throughout the intermountain western U.S. The dominant perennial bunchgrasses and shrubs within this group are all drought-resistant plants. Dominant or codominant species are *Achnatherum hymenoides, Achnatherum lettermanii, Achnatherum nelsonii, Achnatherum speciosum, Bouteloua gracilis, Hesperostipa comata, Pleuraphis jamesii, Poa cusickii, Poa secunda, Pseudoroegneria spicata*, and *Sporobolus cryptandrus*. Scattered shrubs and dwarf-shrubs often are present, especially *Artemisia tridentata ssp. tridentata, Artemisia tridentata ssp. wyomingensis, Atriplex* spp., *Coleogyne ramosissima, Ephedra* spp., *Gutierrezia sarothrae*, and *Krascheninnikovia lanata*, which are the typical dominant species of adjacent shrublands. Stands occur on sites on a variety of landforms, including swales, playas, mesas, alluvial flats, and plains over an elevational range of approximately 1100 to 3290 m in most of its range and 350 to 425 m in the Columbia Basin. This group may constitute the matrix over large areas of intermountain basins, and also may occur as large patches in mosaics with semi-desert shrublands. Grasslands in areas of higher precipitation, at higher elevation, typically belong to other groups. Substrates are often well-drained sandy or loam soils derived from sedimentary parent materials but are quite variable and may include fine-textured soils derived from igneous and metamorphic rocks.

Classification Comments: This group was merged with former Columbia Basin Foothill & Canyon Dry Grassland Group (G274), which was very similar compositionally and a northern variant of this intermountain group. Communities dominated by *Achnatherum lettermanii, Achnatherum nelsonii*, and *Agrostis variabilis* are poorly understood and require further documentation. The only occurrence of a community dominated by *Agrostis variabilis* is known from Utah and may be the result of disturbance. *Achnatherum speciosum* is a southern Great Basin species, which extends in distribution into the Mojave and Colorado deserts, for now its communities are included here. Occurrences of this semi-desert grassland group in the relatively high-elevation basins of Wyoming and south-central Montana resemble in species composition the foothill grasslands that grow at slightly higher elevations and in the Columbia Plateau.

Similar NVC Types:
- G273 Central Rocky Mountain Lower Montane, Foothill & Valley Grassland

Diagnostic Characteristics: This group consists of semi-arid to arid grasslands often creating the matrix over large areas. Characteristic graminoids include *Achnatherum hymenoides, Bouteloua eriopoda, Bouteloua gracilis, Hesperostipa comata, Pleuraphis jamesii, Poa cusickii, Poa secunda*, and *Pseudoroegneria spicata*.

VEGETATION

Physiognomy and Structure: Medium to tall bunchgrass-dominated group occurring with scattered shrubs as a matrix community or interspersed among shrub-dominated communities. Cover within this group is variable from dense to less than 25% cover.

Floristics: The dominant perennial bunchgrasses and shrubs within this group are all drought-resistant plants. Dominant or codominant species are *Achnatherum hymenoides, Achnatherum lettermanii, Achnatherum nelsonii, Achnatherum speciosum, Bouteloua eriopoda, Bouteloua gracilis, Hesperostipa comata, Pleuraphis jamesii, Poa cusickii, Poa secunda*, and *Pseudoroegneria spicata*. Other graminoids may include *Aristida purpurea, Carex filifolia, Elymus elymoides, Koeleria macrantha, Leymus salinus*, or *Sporobolus cryptandrus*. Scattered shrubs and dwarf-shrubs often are present, especially *Artemisia tridentata ssp. tridentata, Artemisia tridentata ssp. wyomingensis, Atriplex* spp., *Coleogyne ramosissima, Ephedra* spp., *Gutierrezia sarothrae*, and *Krascheninnikovia lanata*. Forb cover is also sparse but can be relatively diverse. Common forbs are *Gaura coccinea, Balsamorhiza sagittata, Hymenopappus filifolius, Machaeranthera canescens, Sphaeralcea coccinea, Vicia americana, Lappula occidentalis (= Lappula redowskii), Lithophragma glabrum, Lupinus pusillus, Opuntia aurea (= Opuntia basilaris var. aurea), Opuntia polyacantha, Plantago patagonica, Pediomelum argophyllum, Artemisia campestris, Artemisia dracunculus, Artemisia ludoviciana*, and species of *Antennaria, Astragalus, Cryptantha, Eriogonum, Gilia*, and *Lappula*. Cryptogams are important in some stands with up to 40% ground cover on sites in the Colorado Plateau. Exotic species such as *Bromus tectorum, Draba verna, Lactuca serriola, Salsola tragus, Bassia scoparia (= Kochia scoparia), Onopordum acanthium, Poa pratensis, Sisymbrium altissimum*, and *Tragopogon dubius* are present in many of these stands.

ENVIRONMENT & DYNAMICS

Environmental Description: Low-elevation grasslands in the Intermountain West region occur in semi-arid to arid climates at approximately 1450 to 2320 m (4750-7610 feet) elevation, but can reach as low as 350 m in the Columbia Basin. These grasslands occur in lowland and upland areas and may occupy swales, playas, mesatops, plateau parks, alluvial flats, plains and extend into dry foothills. In the Columbia Plateau stands extend up into the Columbia and Snake river canyons on stream terraces and dry, rocky slopes. These grasslands typically occur on relatively xeric sites. This group experiences cold temperate conditions. Hot summers and cold winters with freezing temperatures and snow are common. Annual precipitation is usually from 20-40 cm (7.9-15.7 inches). A significant portion of the precipitation falls in July through October during the summer monsoon storms, with the rest falling as snow during the winter and early spring months. These grasslands occur on a variety of aspects and slopes. Sites may range from flat to moderately steep. Soils supporting this group also vary from deep to shallow, and from sandy to finer-textured. The substrate is typically derived from sandstone or shale. Some occurrences on sandy soils have a high cover of cryptogams on the soil surface. These cryptogams tend to increase the stability of the highly erodible sandy soils of these grasslands during torrential summer rains and heavy wind storms (Kleiner and Harper 1977).

Dynamics: *Achnatherum hymenoides* is one of the most drought-tolerant grasses in the western U.S. (USFS 1937). It is also a valuable forage grass in arid and semi-arid regions. Improperly managed livestock grazing could increase soil erosion, decrease cover of this palatable plant species and increase weedy species (USDA 1937). *Hesperostipa comata* is a deep-rooted grass that uses soil moisture below 0.5 m during the dry summers. Burning generally kills or severely damages *Hesperostipa comata* plants. After fire, regeneration of this non-rhizomatous bunchgrass is through seed and may take many years to reach prefire densities. *Pleuraphis jamesii* is both drought- and grazing-resistant (USFS 1937, Weaver and Albertson 1956, West et al. 1972). In parts of its range it increases under grazing, and in others parts it decreases. The grass is favored in mixedgrass stands because it is only moderately palatable to livestock, but decreases when heavily grazed during drought and in the more arid portions of its range where it is the dominant grass (West et al. 1972). This grass reproduces extensively from scaly rhizomes. These rhizomes make the plant resistant to trampling by livestock and have good soil binding properties (USFS 1937, Weaver and Albertson 1956, West et al. 1972). The cool-season annual grass *Bromus tectorum* can be an effective competitor for winter soil moisture because it can germinate in the fall, over-winter, then begin re-growing in the early spring before it is warm enough for many perennial grasses, completing its lifecycle and depleting soil moisture before the dry summer weather begins. This annual species also produces abundant fine fuels that carry fire well and increase the frequency of fires (FEIS 1998).

DISTRIBUTION

Geographic Range: This group occurs throughout the intermountain western U.S. on dry plains, foothills and mesas, at approximately 1450 to 2320 m (4750-7610 feet) elevation. Stands extend up into the Columbia and Snake river canyons on stream terraces and dry, rocky slopes. In the Bighorn Basin of north-central Wyoming, there may be some semi-desert grasslands, but this is uncertain.

Spatial Scale & Pattern [optional]: Large patch
Nations: MX?, US
States/Provinces: AZ, CA, CO, ID, MT?, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]: 4:C, 6:C, 8:C, 9:C, 10:C, 11:C, 18:C, 19:C, 20:C, 21:C

USFS Ecoregions (2007): 313A:CC, 313B:CC, 313C:CC, 313D:CC, 315A:CC, 315H:CC, 321A:CC, 322A:CC, 331A:CC, 331J:CC, 341A:CC, 341B:CC, 341C:CC, 341D:CC, 341E:CC, 341F:CC, 341G:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:CC, 342I:CC, 342J:CC, M242C:CC, M242D:CP, M261E:CC, M261G:CC, M313A:CC, M313B:CC, M331A:CC, M331B:C?, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CP, M331J:CP, M332G:CC, M333A:??, M341A:CC, M341B:CC, M341C:CC, M341D:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Arches); USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** Grama - Galleta (502) (Shiflet 1994)
- **=** Southeastern Utah galleta-threeawn shrub steppe (West 1983e)

LOWER LEVEL UNITS

Alliances:
- A1290 *Achnatherum speciosum* Grassland Alliance
- A3976 *Pseudoroegneria spicata - Opuntia polyacantha* Dry Canyon Slope Grassland Alliance
- A4216 *Sphaeralcea ambigua - Sphaeralcea coccinea - Sphaeralcea parvifolia* Dry Meadow Alliance
- A1262 *Achnatherum hymenoides - Pseudoroegneria spicata - Muhlenbergia pungens* Grassland Alliance
- A1287 *Pleuraphis jamesii* Grassland Alliance
- A1270 *Hesperostipa comata* Grassland Alliance
- A3977 *Sporobolus cryptandrus - Aristida purpurea var. longiseta - Poa secunda* Sandy Stream Terrace Grassland Alliance

AUTHORSHIP

Primary Concept Source: N.E. West (1983e)
Author of Description: M.E. Hall and M.S. Reid
Acknowledgments:
Version Date: 11/06/2015
Classif Resp Region: West
Internal Author: MEH/MSR 3-10, mod. KAS 4-15, 11-15, mod. GK 9-16

REFERENCES

References: Bowers 1982, Cable 1967, Cable 1969, Cable 1975b, Castle 1954, FEIS 1998, Faber-Langendoen et al. 2017a, Kleiner and Harper 1972, Kleiner and Harper 1977, McClaran and Van Devender 1995, Ramaley 1939b, Shiflet 1994, USFS 1937, Van Pelt 1978, Weaver and Albertson 1956, West 1983e, West et al. 1972

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G311. Intermountain Semi-Desert Grassland

A1262. Achnatherum hymenoides - Pseudoroegneria spicata - Muhlenbergia pungens Grassland Alliance

Type Concept Sentence: These grasslands are dominated by a variety of grasses, the most frequently occurring being *Achnatherum hymenoides, Muhlenbergia pungens*, and *Pseudoroegneria spicata*, and occur in the southern and middle Rocky Mountains and Colorado Plateau, into adjacent ecoregions.

OVERVIEW

Scientific Name: *Achnatherum hymenoides - Pseudoroegneria spicata - Muhlenbergia pungens* Grassland Alliance
Common Name (Translated Scientific Name): Indian Ricegrass - Bluebunch Wheatgrass - Sandhill Muhly Grassland Alliance
Colloquial Name: Indian Ricegrass - Bluebunch Wheatgrass - Sandhill Muhly Grassland

Type Concept: Vegetation of this alliance is characterized by a sparse to moderately dense herbaceous layer of graminoids, the most of common of which include *Achnatherum hymenoides, Muhlenbergia pungens*, and *Pseudoroegneria spicata*. Other common graminoid associates may include *Hesperostipa comata (= Stipa comata), Koeleria macrantha, Leucopoa kingii, Pascopyrum smithii, Pleuraphis jamesii (= Hilaria jamesii), Poa fendleriana, Poa secunda, Redfieldia flexuosa*, and *Schizachyrium scoparium*. Scattered shrubs may be found throughout stands. Forbs are rarely important, although cushion plants may be a prominent feature in some stands. These grasslands occur throughout the southern and middle Rocky Mountains and Colorado Plateau, into adjacent ecoregions. Habitats are variable and may include sand dunes and deposits, shale barrens, rocky or badland slopes, foothills, mesas, ridgetops, plateaus and saddles. Sites are flat to gently sloping between 1220 and 2700 m elevation.

Classification Comments: Some vegetation in this alliance may be too sparse in sandy sites to be classified as grassland. Renee Rondeau (CONHP pers. comm.) reported that *Ericameria nauseosa* is codominant in fire-suppressed stands in the San Luis Valley in

Colorado. *Sphaeralcea (coccinea, parvifolia)* Grassland (CEGL005366) has been included in this alliance tentatively despite being forb-dominated as these stands exhibit floristic overlap with associations included here and may represent forb-dominated inclusions within these communities.

Internal Comments: GK 9-16: ID added for Minidoka. mjr 12-14: CA added for MOJN.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: *Achnatherum hymenoides, Muhlenbergia pungens*, or *Pseudoroegneria spicata* have >50 % relative cover in the herbaceous layer. Forbs are rarely important. Occurrences of these grasslands are extremely widespread throughout their range, and habitats vary widely, therefore diagnostic characters are difficult to determine.

VEGETATION

Physiognomy and Structure: Vegetation in this alliance is characterized by a sparse to dense cover of graminoids that is dominated by perennial bunch grasses less than 1 m tall. There is also sparse to moderate cover of perennial forbs. Occasional scattered shrubs and dwarf-shrubs may be present. Annual forbs and grasses are seasonally present.

Floristics: Vegetation of this alliance is characterized by a sparse to moderately dense herbaceous layer of graminoids, the most of common of which include *Achnatherum hymenoides, Muhlenbergia pungens*, and *Pseudoroegneria spicata*. Other common graminoid associates may include *Festuca idahoensis, Hesperostipa comata (= Stipa comata), Koeleria macrantha, Leucopoa kingii, Pascopyrum smithii, Pleuraphis jamesii (= Hilaria jamesii), Poa fendleriana, Poa secunda, Redfieldia flexuosa*, and *Schizachyrium scoparium*. Scattered shrubs may be found throughout stands, but only occur at low cover and may include *Artemisia frigida, Artemisia nova, Artemisia tridentata, Cercocarpus montanus, Ericameria* spp., *Gutierrezia sarothrae, Krascheninnikovia lanata*, and *Tetradymia canescens*. A sparse layer of forbs is typically present. Cushion plants may be important in some stands and may include species of *Arenaria, Astragalus, Cryptantha, Heterotheca, Hymenoxys, Phlox*, and *Stenotus*.

ENVIRONMENT & DYNAMICS

Environmental Description: Climate is semi-arid with highly variable precipitation during the growing season. Mean annual precipitation ranges from 30-60 cm. Drought is not uncommon and contributes to the formation of blowouts. Habitats are variable and may include sand dunes and deposits, shale barrens, rocky or badland slopes, foothills, mesas, ridgetops, plateaus and saddles. Sites are flat to gently sloping between 1220 and 2700 m elevation. Stands occur on all aspects, but often on the drier southern and western slopes. Substrates are also variable and range from shallow, lithic soils with a rocky surface to moderately deep soils with little rock. Disturbance is usually a factor; upland sites often have blowing sand, and wash sites are subject to periodic flooding.

Dynamics: *Achnatherum hymenoides* is one of the most drought-tolerant grasses in the western U.S. and occurs on a variety of xeric sites (USFS 1937). It is also a valuable forage grass in arid and semi-arid regions. Improperly managed livestock grazing could increase soil erosion, decrease cover of this palatable plant species and increase weedy species (USFS 1937). Fire has variable effects on *Pseudoroegneria spicata*. Plants usually survive burning, and growth is often stimulated, except when fire occurs in the driest month when the crowns will burn because of low moisture in the vegetation, and the meristems are damaged (Johnson and Simon 1987). Grazing impacts are concentrated on the gentler slopes accessible to livestock. *Pseudoroegneria spicata* shows an inconsistent reaction to grazing, increasing on some grazed sites while decreasing on others. It seems to recover more quickly from overgrazing than *Festuca campestris* (Mueggler and Stewart 1980). It tolerates dormant-period grazing well, but is sensitive to defoliation during the growing season. Light spring use or fall grazing can help retain plant vigor. It is particularly sensitive to defoliation in late spring (Comer et al. 1999). The exotic species *Bromus tectorum* occurs in many stands of the alliance and contributes significant cover on sites disturbed by livestock.

DISTRIBUTION

Geographic Range: Stands of this grassland alliance occur in the Colorado Plateau, Wyoming Basins, Utah-Wyoming Mountains, southern and middle Rocky Mountains, in southern Idaho, and the Great Basin.

Nations: US
States/Provinces: CA, CO, ID, MT, UT, WY
TNC Ecoregions [optional]: 11:C, 17:C
USFS Ecoregions (2007): 322Ai:CCC, 341Fc:CCC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Mojave); USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **>** *Achnatherum hymenoides* (Indian rice grass grassland) Alliance (Sawyer et al. 2009) [41.120.00]
- **>** *Achnatherum hymenoides* Alliance (Indian rice grass grassland) (Buck-Diaz et al. 2012)
- **>** *Achnatherum hymenoides* Herbaceous Alliance (Evens et al. 2014)
- **>** *Pseudoroegneria spicata* (Bluebunch wheat grass grassland) Alliance (Sawyer et al. 2009) [41.040.00]

LOWER LEVEL UNITS

Associations:

- CEGL001674 *Pseudoroegneria spicata - Achnatherum hymenoides* Grassland
- CEGL001651 *Achnatherum hymenoides* Shale Barren Grassland
- CEGL001661 *Pseudoroegneria spicata ssp. inermis* Grassland
- CEPP006710 *Achnatherum hymenoides - Oenothera deltoides* Dune Grassland
- CEGL001666 *Pseudoroegneria spicata* - Cushion Plants Grassland
- CEGL002343 *Achnatherum hymenoides* Colorado Plateau Grassland
- CEGL002363 *Muhlenbergia pungens* Grassland
- CEGL005470 *Achnatherum thurberianum - Bromus tectorum* Ruderal Grassland
- CEGL003300 *Achnatherum hymenoides* Shrub Grassland
- CEGL001652 *Achnatherum hymenoides - Sporobolus contractus* Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz and J. Coles, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2016/09/29

REFERENCES

References: Buck-Diaz et al. 2012, Evens et al. 2014, Faber-Langendoen et al. 2017b, Keeler-Wolf and Thomas 2000, Sawyer et al. 2009, USFS 1937, VegCAMP and AIS 2013

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G311. Intermountain Semi-Desert Grassland

A1290. Achnatherum speciosum Grassland Alliance

Type Concept Sentence: This grassland is documented from the Mojave Desert and dominated by *Achnatherum speciosum*, which is the sole dominant or important plant in the herbaceous layer.

OVERVIEW

Scientific Name: *Achnatherum speciosum* Grassland Alliance
Common Name (Translated Scientific Name): Desert Needlegrass Grassland Alliance
Colloquial Name: Desert Needlegrass Grassland

Type Concept: Stands of this alliance are dominated by *Achnatherum speciosum (= Stipa speciosa)*, which is the sole dominant or important plant in the herbaceous layer. Species composition varies among stands, but *Achnatherum speciosum* is the unifying species. Other graminoids which may be present include *Achnatherum hymenoides (= Oryzopsis hymenoides), Elymus elymoides, Nassella cernua, Nassella lepida*, and *Poa secunda*. Scattered emergent shrubs such as *Hymenoclea salsola* may be present. This uncommon grassland is documented from the Mojave Desert. It grows in very xeric conditions with hot summers and occasional freezes in the winter. This alliance requires well-drained rocky or sandy soils. It was formerly widespread, but overgrazing has decimated stands. Remaining stands occur from 600-1000 m elevation on flat ridges, lower slopes, valleys, and washes.

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Vegetation appears to be endemic to the Mojave Desert and is characterized by dominance or codominance of the perennial grass *Achnatherum speciosum* having >50% of the total herbaceous cover.

VEGETATION

Physiognomy and Structure: This graminoid-dominated alliance typically is less than 1 m in height. The herbaceous layer can vary from open to fairly continuous. Scattered, emergent shrubs may be present.

Floristics: Stands of this alliance are dominated by *Achnatherum speciosum (= Stipa speciosa)* which is the sole dominant or important plant in the herbaceous layer. Species composition varies among stands, but *Achnatherum speciosum* is the unifying species. Other graminoids which may be present include *Achnatherum hymenoides (= Oryzopsis hymenoides), Elymus elymoides, Nassella cernua, Nassella lepida*, and *Poa secunda*. Scattered emergent shrubs such as *Hymenoclea salsola* may be present.

ENVIRONMENT & DYNAMICS

Environmental Description: This grassland of the Mojave Desert grows in very xeric conditions with hot summers and occasional freezes in the winter. This alliance requires well-drained rocky or sandy soils. It was formerly widespread, but overgrazing has decimated stands. Remaining stands occur from 600 to 1000 m elevation on flat ridges, lower slopes, valleys, and washes.

Dynamics: Plants of this alliance evolved in a very xeric environment with infrequent disturbance. Fires were not well-supported by the light plant cover, and grazing pressure was very light due to the low carrying capacity of the environment. The impact of cattle and sheep grazing and the consequent introduction of exotic plants such as *Bromus tectorum* have reduced stands of this alliance to a few dozen across its range.

DISTRIBUTION

Geographic Range: This alliance was once widespread throughout the Mojave Desert but has been reduced to scattered stands by overgrazing. It is reported from California and Utah.

Nations: US
States/Provinces: CA, UT
TNC Ecoregions [optional]: 11:C, 12:C, 17:C
USFS Ecoregions (2007): 322Ag:CCC, 341Fc:CCC, 341Ff:CCC, M261Er:CCC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Joshua Tree)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** *Achnatherum speciosum* (Desert needlegrass grassland) Alliance (Sawyer et al. 2009) [41.090.00]
- **=** *Achnatherum speciosum* Herbaceous Alliance (Evens et al. 2012)
- **=** *Achnatherum speciosum* Herbaceous Alliance (Evens et al. 2014)
- **=** *Achnatherum speciosum* Herbaceous Alliance (CNPS 2017) [41.090.00]
- **<** Desert needlegrass series (Sawyer and Keeler-Wolf 1995)
- **><** Valley Needlegrass Grassland (#42110) (Holland 1986b)

LOWER LEVEL UNITS

Associations:
- CEGL003112 *Achnatherum speciosum* Grassland
- CEGL003113 *Achnatherum speciosum* Shrub Grassland

AUTHORSHIP

Primary Concept Source: R. F. Holland (1986b); J.O. Sawyer and T. Keeler-Wolf (1995)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: CNPS 2017, Evens et al. 2012, Evens et al. 2014, Faber-Langendoen et al. 2017b, Holland 1986b, Humphrey 1974, Keeler-Wolf and Thomas 2000, Pavek 1993c, Reid et al. 1999, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Thomas et al. 2004, Tueller et al. 1991, Vasek and Thorne 1977, VegCAMP and AIS 2013

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G311. Intermountain Semi-Desert Grassland

A1270. Hesperostipa comata Grassland Alliance

Type Concept Sentence: This grassland alliance is dominated or codominated by *Aristida purpurea, Bouteloua gracilis, Hesperostipa comata*, or *Sporobolus cryptandrus* and is found primarily from Wyoming Basins, Colorado Plateau and Great Basin.

OVERVIEW

Scientific Name: *Hesperostipa comata* Grassland Alliance
Common Name (Translated Scientific Name): Needle-and-Thread Grassland Alliance
Colloquial Name: Needle-and-Thread Grassland

Type Concept: Grasslands included in this alliance are characterized by a sparse to moderately dense herbaceous layer dominated by *Aristida purpurea, Bouteloua gracilis, Hesperostipa comata*, or *Sporobolus cryptandrus*. Other common to codominant graminoids include *Achnatherum hymenoides (= Oryzopsis hymenoides), Carex filifolia, Koeleria macrantha, Pleuraphis jamesii (= Hilaria jamesii), Poa secunda, Sporobolus contractus*, and *Sporobolus giganteus*. The invasive species *Bromus tectorum* is common in disturbed stands. Forb cover is also sparse, but can be relatively diverse. Common forbs are *Gaura coccinea, Lappula occidentalis (= Lappula redowskii), Lithophragma glabrum, Lithophragma glabrum, Lupinus pusillus, Opuntia aurea (= Opuntia basilaris var. aurea), Opuntia polyacantha, Plantago patagonica*, or *Pediomelum argophyllum (= Psoralea argophylla)*. Cryptogams are important in some stands with up to 40% ground cover on sites in the Colorado Plateau. This grassland alliance is found primarily from Wyoming Basins, Colorado Plateau, and Great Basin. Sites are on flat to moderately steep, often south-facing slopes, but can occur on any aspect. Soils are shallow to moderately deep, well-drained, coarse-textured, and non-saline. Sites include intermountain basins, alluvial flats, alluvial terraces of large rivers, sandy upper stream terraces along intermittent washes, and on sand deposits on mesas and plains.

Classification Comments: More investigation is needed to clarify the concept of this alliance. Some stands described by Kleiner (1968) have less than 25% herbaceous cover and are better classified in a sparsely vegetated alliance. Stands containing a mix of *Bouteloua gracilis, Carex filifolia*, and moderate amounts of *Pascopyrum smithii* or *Hesperostipa comata* may present classification problems. *Bouteloua gracilis* increases with heavy grazing pressure as other species decline in many western plant communities, often resulting in difficulties in classification. *Sporobolus cryptandrus* is found throughout the western and northern U.S. where it usually occurs as a minor species in various grassland and shrubland vegetation types. It may be locally common in areas disturbed by drought and overgrazing in the plains (Weaver and Albertson 1956). Further survey may find other associations than are currently in the classification.

Internal Comments: GK 9-16: ID added for Minidoka.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Vegetation is characterized by dominance or codominance of the perennial bunch grasses *Aristida purpurea, Bouteloua gracilis, Hesperostipa comata*, or *Sporobolus cryptandrus* having >50% of the total herbaceous cover in association with other graminoids.

VEGETATION

Physiognomy and Structure: This vegetation has a sparse to dense herbaceous layer less than 1 m tall that is dominated by perennial mid- and shortgrass species. Sparse to scattered cover of shrubs may be present. Perennial forbs are common but are not abundant in most stands. Annual forbs and grasses are seasonally present.

Floristics: Grasslands included in this alliance are characterized by a sparse to moderately dense herbaceous layer dominated by the medium-tall, cool-season bunchgrasses *Aristida purpurea, Bouteloua gracilis, Hesperostipa comata*, or *Sporobolus cryptandrus*. Other common to codominant graminoids include *Achnatherum hymenoides (= Oryzopsis hymenoides), Carex filifolia, Koeleria macrantha, Pleuraphis jamesii (= Hilaria jamesii), Poa secunda, Sporobolus contractus*, and *Sporobolus giganteus*. The invasive species *Bromus tectorum* is common in disturbed stands. Shrubs and dwarf-shrubs are sparse and may include scattered *Artemisia cana, Artemisia frigida, Artemisia tridentata, Ericameria nauseosa (= Chrysothamnus nauseosus)*, or *Gutierrezia sarothrae*. Forb cover is also sparse, but can be relatively diverse. Common forbs are *Gaura coccinea, Lappula occidentalis (= Lappula redowskii), Lithophragma glabrum, Lithophragma glabrum, Lupinus pusillus, Opuntia aurea (= Opuntia basilaris var. aurea), Opuntia polyacantha, Plantago patagonica*, or *Pediomelum argophyllum (= Psoralea argophylla)*. Cryptogams are important in some stands with up to 40% ground cover on sites in the Colorado Plateau.

ENVIRONMENT & DYNAMICS

Environmental Description: Grasslands included in this alliance are found on sandy loam, loam, silty loam, or loamy clay soils (Weaver and Albertson 1956, Johnston 1987, Steinauer 1989) that are shallow to moderately deep, well-drained, coarse-textured, and non-saline. They are often derived of alluvium or eolian deposits. Climate is temperate, mostly continental and semi-arid to arid.

Mean annual precipitation ranges from 25-35 cm. The year-to-year variation of annual precipitation is great. Sites are on flat to moderately steep, often south-facing slopes, but can occur on any aspect. Sites include intermountain basins, alluvial flats, alluvial terraces of large rivers, sandy upper stream terraces along intermittent washes, and on sand deposits on mesas and plains. Elevations range from 1100-2300 m.

Dynamics: These grasslands are dominated by relatively deep-rooted grasses that use soil moisture below 0.5 m during the typically dry summers. The coarse-textured soils allow for rapid infiltration and storage of winter and summer precipitation (Kleiner 1968, Daubenmire 1970, Kleiner and Harper 1977, Thilenius et al. 1995). Burning generally kills or severely damages *Hesperostipa comata* plants. After fire, regeneration of this non-rhizomatous bunchgrass is through seed and may take many years to reach prefire densities (FEIS 1998). Exotic species such as *Bromus tectorum, Draba verna, Lactuca serriola, Tragopogon dubius* are present in some these stands (Daubenmire 1970). The cool-season annual grass *Bromus tectorum* can be an effective competitor for winter soil moisture because it can germinate in the fall, overwinter, then begin regrowing in the early spring before it is warm enough for many perennial grasses, completing its lifecycle and depleting soil moisture before the dry summer weather begins. This annual species also produces abundant fine fuels that carry fire well and increase the frequency of fires (FEIS 1998).*Bouteloua gracilis* is an extremely drought- and grazing-tolerant shortgrass species. It is one of the most widely distributed grasses in the western U.S. and is present in many different grassland, shrubland and woodland communities. It evolved with grazing by large herbivores and generally forms a short sod. However, in some stands ungrazed plants develop the upright physiognomy of a bunchgrass.

DISTRIBUTION

Geographic Range: Vegetation included in this grassland alliance is found in the central Wyoming Basins, Utah-Wyoming Mountains, Colorado Plateau, Great Basin, on the Snake River plain and foothills of the Rocky Mountains in Idaho, and east to the fringe of the Great Plains.

Nations: US
States/Provinces: AZ, CO, ID, NM, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL001703 *Hesperostipa comata - Achnatherum hymenoides* Grassland
- CEGL005800 *Aristida purpurea* Grassland
- CEGL002997 *Hesperostipa comata - (Bouteloua eriopoda, Pleuraphis jamesii)* Grassland
- CEGL001705 *Hesperostipa comata* Great Basin Grassland
- CEGL002932 *Bouteloua gracilis - Hesperostipa comata* Grassland
- CEGL002691 *Sporobolus cryptandrus* Great Basin Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2016/09/29

REFERENCES

References: Daubenmire 1970, FEIS 1998, Faber-Langendoen et al. 2017b, Kleiner 1968, Kleiner and Harper 1977, Thilenius et al. 1995

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G311. Intermountain Semi-Desert Grassland

A1287. Pleuraphis jamesii Grassland Alliance

Type Concept Sentence: This alliance is dominated or codominated by *Bouteloua eriopoda, Bouteloua gracilis, Pleuraphis jamesii*, or *Sporobolus airoides*. It occurs in arid and semi-arid regions in the southwestern Great Plains, Colorado Plateau, southern Rocky Mountains, Great Basin, and northern Chihuahuan Desert.

OVERVIEW

Scientific Name: *Pleuraphis jamesii* Grassland Alliance
Common Name (Translated Scientific Name): James' Galleta Grassland Alliance
Colloquial Name: James' Galleta Grassland

Type Concept: The vegetation is characterized by an herbaceous layer with sparse to moderately dense cover of perennial grasses that is usually dominated or codominated by *Bouteloua eriopoda, Bouteloua gracilis, Pleuraphis jamesii*, or *Sporobolus airoides*. Other common perennial grasses may include *Achnatherum hymenoides (= Oryzopsis hymenoides), Aristida purpurea, Bouteloua curtipendula, Bouteloua dactyloides (= Buchloe dactyloides), Elymus elymoides, Hesperostipa neomexicana (= Stipa neomexicana), Muhlenbergia porteri, Muhlenbergia torreyi, Pascopyrum smithii*, and *Sporobolus cryptandrus*. The sparse forb layer may include *Artemisia carruthii, Artemisia dracunculus, Astragalus* spp., *Chaenactis stevioides, Cryptantha* sp., *Cymopterus newberryi, Grindelia squarrosa, Lappula occidentalis, Machaeranthera pinnatifida, Plantago patagonica, Ratibida* spp., *Scleropogon brevifolius, Sphaeralcea coccinea*, and *Zinnia grandiflora*. This alliance occurs in arid and semi-arid regions in the southwestern Great Plains, Colorado Plateau, Great Basin, and northern Chihuahuan Desert. These grasslands occur on a variety of landforms, including plains, mesas, alluvial flats, floodplains, swales, hillslopes, dunes, badlands and bajadas. Soils are variable and range from sand to clay textures. Stands occur on all slopes and aspects. Substrates are variable and range from sand- to clay-textured soils. Parent materials include alluvium, colluvium and eolian deposits derived from igneous, metamorphic and, most commonly, sedimentary rocks, especially shale and sandstone. Elevation ranges from 1200-2800 m.

Classification Comments: Stands containing a mix of *Bouteloua gracilis, Carex filifolia*, and moderate amounts of *Pascopyrum smithii* or *Hesperostipa comata* may present classification problems. *Bouteloua gracilis* increases with heavy grazing pressure as other species decline in many western plant communities, often resulting in difficulties in classification.

Internal Comments: mjr 12-14: CA added for MOJN.
Other Comments:

Similar NVC Types:
- A3186 *Sporobolus airoides - Sporobolus wrightii - Panicum obtusum* Lowland Desert Grassland Alliance

Diagnostic Characteristics: Vegetation is characterized by dominance or codominance of the perennial grasses *Bouteloua eriopoda, Bouteloua gracilis, Pleuraphis jamesii*, and *Sporobolus airoides* having >50% of the total herbaceous cover. These grasslands have their main area of distribution in the Colorado Plateau and southern Rocky Mountains and have a broad ecological amplitude.

VEGETATION

Physiognomy and Structure: Vegetation in this alliance has a sparse to moderately dense herbaceous layer is dominated by perennial bunch grasses. A sparse to moderately dense forb layer is often present. Annuals may be seasonally abundant.

Floristics: The vegetation is characterized by an herbaceous layer with sparse to moderately dense cover of perennial grasses that is usually dominated or codominated by *Bouteloua eriopoda, Bouteloua gracilis, Pleuraphis jamesii*, or *Sporobolus airoides*. Other common perennial grasses may include *Achnatherum hymenoides (= Oryzopsis hymenoides), Aristida purpurea, Bouteloua curtipendula, Bouteloua dactyloides (= Buchloe dactyloides), Elymus elymoides, Hesperostipa neomexicana (= Stipa neomexicana), Muhlenbergia porteri, Muhlenbergia torreyi, Pascopyrum smithii*, and *Sporobolus cryptandrus*. The sparse forb layer may include *Artemisia carruthii, Artemisia dracunculus, Astragalus* spp., *Chaenactis stevioides, Cryptantha* sp., *Cymopterus newberryi, Grindelia squarrosa, Lappula occidentalis, Machaeranthera pinnatifida, Plantago patagonica, Ratibida* spp., *Scleropogon brevifolius, Sphaeralcea coccinea*, and *Zinnia grandiflora*. Occasional shrubs and dwarf-shrubs, such as *Artemisia bigelovii, Atriplex canescens, Atriplex confertifolia, Atriplex obovata, Ericameria nauseosa, Ephedra* spp., *Gutierrezia sarothrae, Krascheninnikovia lanata, Opuntia* spp., or *Yucca* spp., may occur with less than 10% total cover.

ENVIRONMENT & DYNAMICS

Environmental Description: These grasslands occur on a variety of landforms, including plains, mesas, alluvial flats, floodplains, swales, hillslopes, dunes, badlands and bajadas. Soils are variable and range from sand to clay textures. Stands occur on all slopes and aspects. Parent materials include alluvium, colluvium and eolian deposits derived from igneous, metamorphic and, most commonly, sedimentary rocks, especially shale and sandstone. Elevation ranges from 1200-2800 m. The climate is semi-arid with highly variable, bimodally distributed precipitation. Approximately two-thirds of the 20-40 cm mean annual precipitation occurs in the late summer and early fall, usually as localized high-intensity thunderstorms.

Dynamics: *Pleuraphis jamesii* is both drought- and grazing-resistant (USFS 1937, Weaver and Albertson 1956, West et al. 1972). In parts of its range it increases under grazing, and in others parts it decreases. The grass is favored in mixedgrass stands because it is only moderately palatable to livestock, but decreases when heavily grazed during drought and in the more arid portions of its range

where it is the dominant grass (West et al. 1972). This grass reproduces extensively from scaly rhizomes. These rhizomes make the plant resistant to trampling by livestock and have good soil-binding properties (USFS 1937, Weaver and Albertson 1956, West et al. 1972). The abundance of *Bouteloua eriopoda*-dominated grasslands has declined significantly in the last 50 years (Nelson 1934, Gardner 1950, Buffington and Herbel 1965, Herbel et al. 1972, Hennessy et al. 1983). These grasslands have been replaced largely by shrublands dominated by *Prosopis glandulosa* in Trans-Pecos Texas, southern New Mexico, and southeastern Arizona. Studies on the Jornada Experimental Range suggest that combinations of drought, overgrazing by livestock, wind and water erosion, seed dispersal by livestock, fire suppression, shifting dunes, and changes in the seasonal distribution of precipitation have caused this recent, dramatic shift in vegetation physiognomy (Buffington and Herbel 1965, Herbel et al. 1972, Humphrey 1974, McLaughlin and Bowers 1982, Gibbens et al. 1983, Hennessy et al. 1983, Schlesinger et al. 1990, McPherson 1995). *Prosopis* spp. and other shrubs have extensive root systems that allow them to exploit deep soil water that is unavailable to shallower-rooted grasses and cacti (Burgess 1995). This strategy works well, except on sites that have well-developed argillic or calcic soil horizons that limit infiltration and storage of winter moisture in the deeper soil layers (McAuliffe 1995). McAuliffe (1995) found *Prosopis* spp. invasion on these sites to be limited to a few small individuals. This has implications in plant geography and grassland revegetation work in the southwestern United States. *Bouteloua gracilis* is an extremely drought- and grazing-tolerant shortgrass species. It is one of the most widely distributed grasses in the western U.S. and is present in many different grassland, shrubland and woodland communities. It evolved with grazing by large herbivores and generally forms a short sod. However, in some stands ungrazed plants develop the upright physiognomy of a bunchgrass.

DISTRIBUTION

Geographic Range: The distribution of this southwestern alliance is centered in the Colorado Plateau region of Colorado, New Mexico, Arizona, and Utah. It is also found in the shortgrass steppe in eastern Colorado and New Mexico (and possibly the panhandles of Oklahoma and Texas), north to Wyoming, south to the northern Chihuahuan Desert and west to the Great Basin.

Nations: US
States/Provinces: AZ, CA, CO, NM, NV, OK?, TX?, UT, WY
TNC Ecoregions [optional]: 17:C
USFS Ecoregions (2007): 322Ai:CCC, 322Al:CCC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Mojave)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Hilaria jamesii - Sporobolus airoides* Plant Community (Francis 1986) [Plant community #37]
- **=** *Pleuraphis jamesii* (James' galleta shrub-steppe) Alliance (Sawyer et al. 2009) [41.610.00]
- **=** *Pleuraphis jamesii* Herbaceous Alliance (Evens et al. 2014)

LOWER LEVEL UNITS

Associations:
- CEGL001751 *Bouteloua eriopoda - Pleuraphis jamesii* Grassland
- CEGL001759 *Bouteloua gracilis - Pleuraphis jamesii* Grassland
- CEGL001760 *Bouteloua gracilis* Grassland
- CEGL006755 *Scleropogon brevifolius - Pleuraphis jamesii - Bouteloua eriopoda* Grassland
- CEGL001778 *Pleuraphis jamesii - Sporobolus airoides* Grassland
- CEGL001777 *Pleuraphis jamesii* Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, B. Hoagland, D. Diamond, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Evens et al. 2014, Faber-Langendoen et al. 2017b, Francis 1986, Francis and Aldon 1983, Keeler-Wolf and Thomas 2000, Sawyer et al. 2009, Thomas et al. 2004, USFS 1937, VegCAMP and AIS 2013, Weaver and Albertson 1956, West et al. 1972

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G311. Intermountain Semi-Desert Grassland

A3976. Pseudoroegneria spicata - Opuntia polyacantha Dry Canyon Slope Grassland Alliance

Type Concept Sentence: These dry grasslands occur in the canyons and valleys of the northern Great Basin and in the Columbia Basin and are characterized by a sparse to moderately dense graminoid layer of *Pseudoroegneria spicata* codominated by *Aristida purpurea var. longiseta* and/or *Poa secunda*. *Pseudoroegneria spicata* is sometimes absent or has low cover, and *Sporobolus cryptandrus* and *Opuntia polyacantha* may be especially abundant on disturbed or harsh windswept sites.

OVERVIEW

Scientific Name: *Pseudoroegneria spicata - Opuntia polyacantha* Dry Canyon Slope Grassland Alliance
Common Name (Translated Scientific Name): Bluebunch Wheatgrass - Plains Prickly-pear Dry Canyon Slope Grassland Alliance
Colloquial Name: Dry Canyon Slope Wheatgrass - Prickly-pear Grassland

Type Concept: The vegetation of this dry grassland alliance is characterized by a sparse to moderately dense graminoid layer of *Pseudoroegneria spicata* codominated by *Aristida purpurea var. longiseta* and/or *Poa secunda*. *Pseudoroegneria spicata* is sometimes absent or has low cover. *Sporobolus cryptandrus* and *Opuntia polyacantha* are especially abundant on disturbed sites or harsh windswept ridgetops and steep upper slopes. Important forbs include *Achillea millefolium, Allium acuminatum, Arnica sororia, Balsamorhiza sagittata, Castilleja* spp., *Calochortus* spp., *Crepis acuminata, Erigeron pumilus, Eriophyllum lanatum, Lupinus* spp., *Plantago patagonica*, and *Sedum stenopetalum*. Deciduous shrubs such as *Holodiscus discolor, Physocarpus malvaceus, Ribes* spp., *Rhus glabra*, and *Symphoricarpos* spp. are occasionally present and may increase in abundance with fire exclusion. These grasslands occur in the canyons and valleys of the northern Great Basin and in the Columbia Basin, particularly along the Snake River canyon, the lower foothill slopes of the Blue Mountains, Wallowa Mountains, Hells Canyon, Seven Devil Mountains, and Salmon River Mountains of eastern Oregon, Washington and Idaho and along the main stem of the Columbia River in eastern Washington. Stands occur on gentle to steep mid and upper slopes and ridgetops in highly dissected foothills and canyon slope terrain and on stream terraces, alluvial fans, and benchlands in lower canyons. Sites are as low as 240 m and up to 1130 m elevation. Soils are typically shallow with a high percentage of rock fragments.

Classification Comments: These grasslands are floristically similar to other lower montane and foothill grasslands of the Central Rockies, but are found in environmental settings that tend to be drier than the "matrix" grasslands. Some of the dominant species (*Aristida, Sporobolus*, and *Opuntia*) are not particularly common in other Central Rockies grasslands, and forb taxa are also different.

Internal Comments: KAS 2-14: *Aristida purpurea var. longiseta - Pseudoroegneria spicata - Sporobolus cryptandrus* Herbaceous Vegetation (CEGL001589) is included in this alliance because of codominance of Pseudoroegneria spicata, but is occurs is similar river terrace habitats and the grasslands in the *Sporobolus cryptandrus - Aristida purpurea var. longiseta - Poa secunda* Sandy Stream Terrace Grassland Alliance (A3977).
Other Comments:

Similar NVC Types: Alliances in Central Rocky Mountain Lower Montane, Foothill & Valley Grassland Group (G273) and Central Rocky Mountain Montane Grassland Group (G267) may share some of the widespread dominant grass species. This alliance typically occurs in drier, often lower elevation sites.

Diagnostic Characteristics: This alliance has a sparse to moderately dense graminoid layer characterized by diagnostic and often dominant species *Pseudoroegneria spicata* codominated by *Aristida purpurea var. longiseta* and/or *Poa secunda*. *Pseudoroegneria spicata* is sometimes absent or has low cover with *Aristida purpurea var. longiseta* and *Poa secunda* dominating. Indicator species *Sporobolus cryptandrus* and *Opuntia polyacantha* are especially abundant on disturbed sites or harsh windswept ridgetops and steep upper slopes.

VEGETATION

Physiognomy and Structure: Vegetation in this alliance is characterized by a sparse to dense cover of graminoids that is dominated by perennial bunch grasses less than 1 m tall. There is also sparse to moderate cover of perennial forbs. Occasional scattered shrubs and dwarf-shrubs may be present. Annual forbs and grasses are seasonally present. Nonvascular cover is important in some stands.

Floristics: The vegetation is characterized by a sparse to moderately dense graminoid layer of *Pseudoroegneria spicata* codominated by *Aristida purpurea var. longiseta* and/or *Poa secunda*. *Pseudoroegneria spicata* is sometimes absent or has low cover. *Sporobolus cryptandrus* and *Opuntia polyacantha* are especially abundant on disturbed sites or harsh windswept ridgetops and steep upper slopes. Other associated grasses include *Danthonia unispicata, Elymus elymoides*, and *Hesperostipa comata*. Important forbs include *Achillea millefolium, Allium acuminatum, Antennaria* spp., *Arnica sororia, Balsamorhiza sagittata, Castilleja* spp., *Calochortus* spp., *Crepis acuminata, Erigeron pumilus, Eriophyllum lanatum, Lomatium cous, Lupinus* spp., *Plantago patagonica, Scutellaria angustifolia*, and *Sedum stenopetalum*. Deciduous shrubs such as *Holodiscus discolor, Phlox longifolia, Physocarpus malvaceus, Ribes* spp., *Rhus glabra*, and *Symphoricarpos* spp. are occasionally present and may increase in abundance with fire exclusion. The shrub *Ericameria nauseosa (= Chrysothamnus nauseosus)* is present in some stands, and will increase with overgrazing and other

disturbance (Daubenmire 1970). The introduced annual grasses *Bromus tectorum, Bromus arvensis (= Bromus japonicus)*, and *Bromus briziformis* and diverse non-native forbs such as *Hypericum perforatum* and *Erodium cicutarium* are abundant in many stands.

ENVIRONMENT & DYNAMICS

Environmental Description: These dry grasslands occur in the canyons and valleys of the northern Great Basin and in the Columbia Basin, particularly along the Snake River canyon, the lower foothill slopes of the Blue Mountains, Wallowa Mountains, Hells Canyon, Seven Devil Mountains, and Salmon River Mountains of eastern Oregon, Washington and Idaho and along the main stem of the Columbia River in eastern Washington. Climate is temperate continental. Mean annual precipitation ranges from 33-60 cm. Precipitation primarily occurs in the winter as snow or rain. Stands occur on gentle to steep mid and upper slopes and ridgetops in highly dissected foothills and canyon slope terrain and on stream terraces, alluvial fans, and benchlands in lower canyons. Sites are as low as 240 m and up to 1130 m elevation. This moisture is stored in the soil profile and utilized during the typically dry summers. Sites include soil pockets between rocks on cliffs lining the sides of ravines. This grassland occurs on all aspects, but is more common on southern slopes. Soils are typically shallow with a high percentage of rock fragments and exposed rock (lithic), but also may be moderately deep on some sites. They are moderately to well-drained, non-calcareous, sandy to clay soils with pH of 5.8-7.2, and are derived from alluvium, colluvium, residuum or loess. Parent materials include basalt, andesite, rhyolite and tuff. Rock and moss cover significant amounts of the ground surface often with over 40% cover of each.

Dynamics: Fire has variable effects on *Pseudoroegneria spicata*. Plants usually survive burning, and growth is often stimulated, except when fire occurs in the driest month when the crowns will burn because of low moisture in the vegetation, and the meristems are damaged (Johnson and Simon 1987). Grazing impacts are concentrated on the gentler slopes accessible to livestock. *Pseudoroegneria spicata* shows an inconsistent reaction to grazing, increasing on some grazed sites while decreasing on others. It seems to recover more quickly from overgrazing than *Festuca campestris* (Mueggler and Stewart 1980). It tolerates dormant-period grazing well, but is sensitive to defoliation during the growing season. Light spring use or fall grazing can help retain plant vigor. It is particularly sensitive to defoliation in late spring (Comer et al. 1999).

Poa secunda-dominated grasslands usually have relatively shallow, rocky soils with limited water-holding capacity. The winter precipitation wets these soils, but they typically dry out completely to bedrock by midsummer (Ganskopp 1979). *Poa secunda* is well-adapted to these conditions because it starts growing early in the spring and completes its reproductive cycle early while there is still moisture in the soil (Daubenmire 1970). If there is late summer or fall precipitation, dominant *Poa secunda* can green up quickly again. Shrubs are uncommon. Daubenmire (1970) and Johnson and Simon (1987) suggest that bedrock present under these grasslands is not fractured enough to support deeper-rooted shrubs. In addition to drought tolerance, *Poa secunda* is also tolerant of grazing and trampling by livestock (Daubenmire 1970, Ganskopp 1979).

Stands in this alliance are generally considered to be late-seral with species composition controlled by the harsh edaphic conditions of the site (Daubenmire 1970, Johnson and Simon 1987). However, some stands, especially stands of *Aristida purpurea var. longiseta - Poa secunda* Grassland (CEGL001781) that occur on deeper soils, may be early-seral forms of a *Pseudoroegneria spicata* grassland, because *Poa secunda* increases under moderate grazing (Daubenmire 1970).

Sporobolus cryptandrus occurs throughout the western U.S. as a minor species, occasionally becoming locally dominant in disturbed or sandy sites in the midgrass prairie (Weaver and Albertson 1956). In the headwaters of the Columbia River basin these stands occur as climax grasslands in canyons on river bars and terraces, and on upland benches and terraces as grazing disclimax and edaphic climax grasslands (Daubenmire 1970, Johnson and Simon 1987, Tisdale 1986).

Many of these grasslands have been severely disturbed by grazing livestock and exotic weeds (Daubenmire 1970, Johnson and Simon 1987, Tisdale 1986). Early-season grazing reduces the abundance of the very palatable cool-season bunchgrass *Pseudoroegneria spicata* and favors the warm-season *Sporobolus cryptandrus* that greens up later in the season. Also, *Sporobolus cryptandrus* is a C4 plant that grows on sites that stay moist when it is hot, giving the C4 the advantage over the cool-season (C3) bunchgrasses. *Poa secunda*, another cool-season grass, is also affected by early grazing, but is better able to withstand it because of its short stature. *Aristida purpurea var. longiseta* is an unpalatable warm-season grass that increases as the palatable grasses decline. As native perennial grasses decline, exotic species fill the gaps (Tisdale 1986). Exotic annual grasses (*Bromus tectorum, Bromus arvensis*, and *Bromus briziformis*) and others may make up 20-50% of the vegetation cover. These annual grasses are especially abundant during wet years (Ganskopp 1979, Tisdale 1986).

Other disturbances such as frost heaving also favor exotic species invasion. Frost heaving causes local soil disturbance in the winter when these thin, saturated soils freeze and push soil and plants up out of the ground. Exotic forbs, both perennials such as *Hypericum perforatum*, and annuals such as *Arenaria serpyllifolia, Epilobium brachycarpum, Erodium cicutarium, Draba verna, Holosteum umbellatum, Lactuca serriola, Lepidium perfoliatum, Myosotis stricta, Tragopogon dubius*, and *Veronica arvensis* make up significant cover and diversity in many stands. The newest exotic threats are four species of *Centaurea* that are invading large areas in this region. Fire appears to have little effect on the species composition of these grasslands (Tisdale 1986).

DISTRIBUTION

Geographic Range: These dry grasslands occur in the canyons and valleys of the northern Great Basin and in the Columbia Basin, particularly along the Snake River canyon, the lower foothill slopes of the Blue Mountains, Wallowa Mountains, Hells Canyon, Seven

Devil Mountains, and Salmon River Mountains of eastern Oregon, Washington and Idaho and along the main stem of the Columbia River in eastern Washington.

Nations: US
States/Provinces: ID, NV, OR, WA
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** *Agropyron spicatum* Series (Johnson and Simon 1987)
- **><** *Agropyron spicatum* Series (Tisdale 1986)
- **><** *Pseudoroegneria spicata* Grasslands (Chappell et al. 1997)
- **><** *Sporobolus cryptandrus - Aristida purpurea var. longiseta* Grasslands (Chappell et al. 1997)
- **><** Bluebunch Wheatgrass - Sand Dropseed - Red Three Awn Plant Community Type - Sand (Johnson and Simon 1987)
- **=** Bluebunch Wheatgrass Series (Johnson and Simon 1987) [roughly includes types in this alliance.]
- **><** Bluegrass Scabland (Volland 1976)
- **><** Bluegrass Scabland (Hall 1973)
- **><** River Terrace Canyon Grasslands (Kagan 1997)
- **?** Sand Dropseed Plant Association (Johnson and Simon 1987)

LOWER LEVEL UNITS

Associations:

- CEGL001781 *Aristida purpurea var. longiseta - Poa secunda* Grassland
- CEGL001673 *Pseudoroegneria spicata - Opuntia polyacantha - (Poa secunda)* Grassland
- CEGL001589 *Aristida purpurea var. longiseta - Pseudoroegneria spicata - Sporobolus cryptandrus* Grassland

AUTHORSHIP

Primary Concept Source: C.G. Johnson and S.A. Simon (1987)
Author of Description: K.A. Schulz
Acknowledgments: This alliance is based in part on Columbia Basin Foothill and Canyon Dry Grassland (CES304.993), ecological system concept (authored by R. Crawford, J. Kagan, and M. Reid).
Version Date: 2015/09/21

REFERENCES

References: Anderson 1956, Chappell et al. 1997, Christensen 1963, Copeland 1980a, Daubenmire 1970, Daubenmire 1992, Faber-Langendoen et al. 2017b, Fisser et al. 1965, Francis 1983, Ganskopp 1979, Hall 1973, Johnson and Clausnitzer 1992, Johnson and Simon 1985, Johnson and Simon 1987, Kagan 1997, Manning and Padgett 1992, Poulton 1955, Reid et al. 1994, Tisdale 1979, Tisdale 1986, USFS 1937, Volland 1976, Winward and Youtie 1976

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G311. Intermountain Semi-Desert Grassland

A4216. Sphaeralcea ambigua - Sphaeralcea coccinea - Sphaeralcea parvifolia Dry Meadow Alliance [Low - Poorly Documented]

Type Concept Sentence:

OVERVIEW

Scientific Name: *Sphaeralcea ambigua - Sphaeralcea coccinea - Sphaeralcea parvifolia* Dry Meadow Alliance
Common Name (Translated Scientific Name): Desert Globemallow - Scarlet Globemallow - Small-leaf Globemallow Dry Meadow Alliance
Colloquial Name: Globemallow Dry Meadow

Type Concept:

Classification Comments:

Internal Comments: mjr 12-16: AZ & CA added based on child records (MOJN).
Other Comments:

Similar NVC Types:

Diagnostic Characteristics:

VEGETATION

Physiognomy and Structure:

Floristics:

ENVIRONMENT & DYNAMICS

Environmental Description:

Dynamics:

DISTRIBUTION

Geographic Range:

Nations: US
States/Provinces: AZ, CA, UT
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEPP009532 *Sphaeralcea ambigua* Dry Meadow
- CEGL005366 *Sphaeralcea (coccinea, parvifolia)* Grassland

AUTHORSHIP

Primary Concept Source: M. Reid, in Faber-Langendoen et al.
Author of Description:
Acknowledgments:

REFERENCES

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G311. Intermountain Semi-Desert Grassland

A3977. Sporobolus cryptandrus - Aristida purpurea var. longiseta - Poa secunda Sandy Stream Terrace Grassland Alliance

Type Concept Sentence: This dry grassland alliance is characterized by a moderately dense graminoid layer dominated by *Sporobolus cryptandrus*, often codominant with *Aristida purpurea var. longiseta* or *Poa secunda*. It occurs on gentle lower slopes, river terraces and alluvial bars on hot, dry sites in the Columbia Basin and lower Snake and Clearwater rivers in Oregon and Washington, and in the lowest elevations of Hells Canyon within the Blue Mountains in Idaho, and the Bighorn Basin in Montana.

OVERVIEW

Scientific Name: *Sporobolus cryptandrus - Aristida purpurea var. longiseta - Poa secunda* Sandy Stream Terrace Grassland Alliance
Common Name (Translated Scientific Name): Sand Dropseed - Red Three-awn - Sandberg Bluegrass Sandy Stream Terrace Grassland Alliance
Colloquial Name: Sandy Stream Terrace Sand Dropseed Grassland

Type Concept: The vegetation of this grassland alliance is characterized by a moderately dense graminoid layer dominated by *Sporobolus cryptandrus*. *Poa secunda* or *Aristida purpurea var. longiseta* often codominate the graminoid layer. *Hesperostipa comata (= Stipa comata)* may be present in low abundance; *Pseudoroegneria spicata* is generally absent. Forb cover is typically low, but *Astragalus inflexus, Calochortus macrocarpus*, and *Heterotheca villosa (= Chrysopsis villosa)* are often present. *Bromus tectorum* (and several other exotic species) is common. This grassland alliance is described for the Columbia Basin and lower Snake and Clearwater rivers in Oregon and Washington, and in the lowest elevations of Hells Canyon within the Blue Mountains in Idaho, and the Bighorn Basin in Montana. Stands occur on lower slopes, river terraces and alluvial bars on hot, dry sites. Sites are flat to gentle (to 30%) and occur on all aspects. Substrates are excessively drained soils with sand or sandy loam texture.

Classification Comments: *Sporobolus cryptandrus* is found throughout the western and northern U.S. where it usually occurs as a minor species in various grassland and shrubland vegetation types. It may be locally common in areas disturbed by drought and overgrazing in the plains (Weaver and Albertson 1956). Further survey may find other associations than are currently in the classification.

Johnson and Simon (1987) describe a similar community with *Sporobolus cryptandrus* dominant, but *Poa secunda* is not present in any of the stands they sampled. It is not certain if these stands represent distinct environmental conditions or if *Poa secunda* has simply been eliminated by grazing pressure. Most stands are in poor condition in canyons in eastern Washington. Overgrazed stands develop a significant shrub layer of *Ericameria nauseosa* and may be better classified in a shrubland alliance (Daubenmire 1970).

Internal Comments:
Other Comments:

Similar NVC Types: Alliances in Central Rocky Mountain Lower Montane, Foothill & Valley Grassland Group (G273) and Central Rocky Mountain Montane Grassland Group (G267) may share some of the widespread dominant grass species.

Diagnostic Characteristics: The vegetation is characterized by a moderately dense graminoid layer dominated by diagnostic species *Sporobolus cryptandrus*. *Poa secunda* or *Aristida purpurea var. longiseta* often codominate. *Hesperostipa comata* may be present in low abundance; *Pseudoroegneria spicata* is generally absent. Forb cover is typically low, but *Astragalus inflexus, Calochortus macrocarpus*, and *Heterotheca villosa* are often present. *Bromus tectorum* and several other exotic species are common.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a sparse to moderately dense layer of medium-tall graminoids, primarily perennial bunch grasses. Forbs are present but usually not abundant. Shrubs are rarely present except in livestock-grazed sites.

Floristics: Vegetation in this alliance is sparse to moderately dense grassland communities that are dominated or codominated by the perennial medium-tall, warm-season bunchgrasses *Sporobolus cryptandrus* and *Aristida purpurea var. longiseta* and cool-season bunchgrass *Poa secunda*. Cool-season bunchgrass *Hesperostipa comata* may be present in lesser amounts, especially on the more upland sites. *Pseudoroegneria spicata* is generally absent or has low cover. Associated perennial forbs include *Achillea millefolium, Astragalus inflexus, Calochortus macrocarpus, Erigeron pumilus, Heterotheca villosa*, and *Opuntia polyacantha*. Common annuals are the forbs *Epilobium brachycarpum (= Epilobium paniculatum)* and *Plantago patagonica*, and the grasses *Vulpia octoflora (= Festuca octoflora)* and *Vulpia microstachys var. pauciflora (= Festuca pacifica)*. The shrub *Ericameria nauseosa (= Chrysothamnus nauseosus)* is present in some stands, and will increase with overgrazing (Daubenmire 1970). The introduced annual grasses *Bromus tectorum, Bromus arvensis (= Bromus japonicus)*, and *Bromus briziformis* and diverse non-native forbs such as *Hypericum perforatum* and *Erodium cicutarium* are abundant in many stands. Diagnostic of this grassland alliance is the dominance or codominance of *Sporobolus cryptandrus*.

ENVIRONMENT & DYNAMICS

Environmental Description: Grasslands in this alliance are found in the lower Salmon and Snake river canyons of Idaho, Oregon and Washington, and the Columbia River in central Washington. Stands occur on dry alluvial bars, river terraces, footslopes of benches and alluvial fans. The elevation ranges from 240-1630 m. Sites are flat to gentle (to 30%) and occur on all aspects. Climate in the canyon bottoms is relatively hot and dry with as little as 25 cm mean annual precipitation. Substrates are derived from loess and alluvium-colluvium. Soils are moderately deep (0.75-1.5 m), and surface soil texture varies from sandy loam to silt loam. This alliance includes grasslands in two successional stages. The first is later seral and is found on river terraces and alluvial bars. *Celtis laevigata var. reticulata* communities are often adjacent. The second is a grazing disclimax and occurs on terraces, alluvial fans and benchlands within the more mesic *Pseudoroegneria spicata* zone. Daubenmire (1970) also described it as an edaphic climax where it occurs on sandy sites adjacent to *Pseudoroegneria spicata*-dominated grasslands. His research found these soils deficient in magnesium and possibly potassium. He hypothesized that the low levels prevented *Pseudoroegneria spicata* from becoming dominant.

Dynamics: *Sporobolus cryptandrus* occurs throughout the western U.S. as a minor species, occasionally becoming locally dominant in disturbed or sandy sites in the midgrass prairie (Weaver and Albertson 1956). In the headwaters of the Columbia River basin these stands occur as climax grasslands in canyons on river bars and terraces, and on upland benches and terraces as grazing disclimax and edaphic climax grasslands (Daubenmire 1970, Johnson and Simon 1987, Tisdale 1986). Many of these grasslands have been severely disturbed by grazing livestock and exotic weeds (Daubenmire 1970, Johnson and Simon 1987, Tisdale 1986). Early-season grazing reduces the abundance of the very palatable cool-season bunchgrass *Pseudoroegneria spicata* and favors the warm-season *Sporobolus cryptandrus* that greens up later in the season. Also, *Sporobolus cryptandrus* is a C4 plant that grows on sites that stay moist when it is hot giving the C4 the advantage over the cool-season (C3) bunch grasses. *Poa secunda*, another cool-season grass, is also affected by early grazing, but is better able to withstand it because of its short stature. *Aristida purpurea var. longiseta* is an unpalatable warm-season grass that increases as the palatable grasses decline. As native perennial grasses decline, exotic species fill the gaps (Tisdale 1986). Exotic annual grasses (*Bromus tectorum, Bromus arvensis*, and *Bromus briziformis*) and others may make up 20-50% of the vegetation cover. These annual grasses are especially abundant during wet years (Ganskopp 1979, Tisdale 1986). Exotic forbs, both perennials, such as *Hypericum perforatum*, and annuals, such as *Arenaria serpyllifolia, Epilobium brachycarpum, Erodium cicutarium, Draba verna, Holosteum umbellatum, Lactuca serriola, Lepidium perfoliatum, Myosotis stricta, Tragopogon dubius*, and *Veronica arvensis*, make up significant cover and diversity in many stands. The newest exotic threats are four species of *Centaurea* that are invading large areas in this region. Fire appears to have little effect on the species composition of these grasslands (Tisdale 1986).

DISTRIBUTION

Geographic Range: This dry grassland alliance is described for the Columbia Basin and lower Snake and Clearwater rivers in Oregon and Washington, and in the lowest elevations of Hells Canyon within the Blue Mountains in Idaho.

Nations: US
States/Provinces: ID, MT, OR, WA, WY?
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** River Terrace Canyon Grasslands (Kagan 1997)
- **=** Sand Dropseed Plant Association (Johnson and Simon 1987)

LOWER LEVEL UNITS

Associations:
- CEGL001514 *Sporobolus cryptandrus* Shrub Grassland
- CEGL001516 *Sporobolus cryptandrus - Poa secunda* Grassland
- CEGL001515 *Aristida purpurea var. longiseta - Sporobolus cryptandrus* Grassland

AUTHORSHIP

Primary Concept Source: C.G. Johnson and S.A. Simon (1987)
Author of Description: K.A. Schulz
Acknowledgments: This alliance is based in part on Columbia Basin Foothill and Canyon Dry Grassland (CES304.993), an ecological system concept (authored by R. Crawford, J. Kagan, and M. Reid).
Version Date: 2014/03/14

REFERENCES

References: Chappell et al. 1997, Daubenmire 1970, Faber-Langendoen et al. 2017b, Ganskopp 1979, Johnson and Simon 1985, Johnson and Simon 1987, Kagan 1997, Reid et al. 1994, Tisdale 1986, USFS 1937, Weaver and Albertson 1956

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
3.B.1.Ne.1.d. M171 Great Basin-Intermountain Dry Shrubland & Grassland

G310. Intermountain Semi-Desert Steppe & Shrubland

Type Concept Sentence: This widespread dwarf-shrubland, shrubland and shrub-steppe group occurs throughout the semi-arid western U.S. on a variety of sites and disturbance regimes and is characterized by an open to moderately dense woody layer composed of diverse woody species such as *Chamaebatiaria millefolium, Chrysothamnus albidus, Chrysothamnus viscidiflorus, Ericameria nauseosa, Ephedra viridis, Ephedra torreyana, Glossopetalon spinescens, Gutierrezia sarothrae, Gutierrezia microcephala, Ericameria nana, Ericameria parryi, Ericameria teretifolia, Krascheninnikovia lanata, Mahonia fremontii, Opuntia polyacantha*, and *Tetradymia canescens* with or without an herbaceous layer.

OVERVIEW

Scientific Name: *Chrysothamnus viscidiflorus - Ericameria nauseosa - Krascheninnikovia lanata* Steppe & Shrubland Group
Common Name (Translated Scientific Name): Yellow Rabbitbrush - Rubber Rabbitbrush - Winterfat Steppe & Shrubland Group
Colloquial Name: White-flower Rabbitbrush Shrubland

Type Concept: This group occurs throughout the semi-arid western U.S., including areas in the western Great Plains. This group can either be shrub-, dwarf-shrub-, or grass-dominated with an open (5-25% cover) woody layer. Stands dominated by *Chrysothamnus viscidiflorus, Ericameria nauseosa, Gutierrezia microcephala*, and *Gutierrezia sarothrae* are often associated with disturbance. Other common shrubs may include *Chamaebatiaria millefolium, Chrysothamnus albidus, Ephedra viridis, Ephedra torreyana, Glossopetalon spinescens, Ericameria nana, Ericameria parryi, Ericameria teretifolia, Krascheninnikovia lanata, Mahonia fremontii, Opuntia fragilis, Opuntia polyacantha, Opuntia phaeacantha*, and *Tetradymia canescens*. Herbaceous species include *Achnatherum hymenoides, Aristida purpurea, Hesperostipa comata*, and *Pleuraphis jamesii*. Scattered *Juniperus* spp. are common, but rarely attain more than 5% cover. Landforms include alluvial flats and fans, talus slopes, plateaus, and bluffs. Slopes range from gentle to steep, and substrates are variable and include sandstone talus, fine-textured alluvium, sand, clay, loams, cinder, cobbles, and coarse gravels. Disturbance and grazing have impacted many occurrences, and in some cases may be important in maintaining these communities.

Classification Comments: This group encompasses a somewhat broad range of semi-desert shrublands in the Intermountain West. Many of these communities are somewhat disturbance-maintained, early-seral types. Additional data and analysis are needed to clarify the associations that should be placed here. Shrub communities occurring over talus included in this group are part of a continuum and can be highly variable, and some dwarf-shrub communities can technically be defined as herbaceous types.

Similar NVC Types:

Diagnostic Characteristics: This group occurs as open shrub, dwarf-shrub, or shrub herbaceous communities. Shrub canopy ranges from 10-60% shrub cover with herbaceous layer usually sparse but ranging from dense to absent. Dominant/diagnostic shrubs in this group include *Chamaebatiaria millefolium, Chrysothamnus albidus, Chrysothamnus viscidiflorus, Ephedra viridis, Ephedra torreyana, Ericameria nauseosa, Ericameria nana, Ericameria parryi, Ericameria teretifolia, Glossopetalon spinescens, Gutierrezia sarothrae, Gutierrezia microcephala, Krascheninnikovia lanata, Mahonia fremontii, Opuntia fragilis, Opuntia phaeacantha, Opuntia polyacantha, Tetradymia canescens*, and *Tetradymia tetrameres*. Characteristic herbaceous species may include *Achnatherum hymenoides, Aristida purpurea, Bouteloua curtipendula, Bouteloua eriopoda, Bouteloua gracilis, Hesperostipa comata, Pleuraphis jamesii, Poa secunda, Sphaeralcea coccinea*, and *Sporobolus cryptandrus*. Scattered *Juniperus* spp. are common, but rarely attain more than 5% cover.

VEGETATION

Physiognomy and Structure: Open shrub, dwarf-shrub, or shrub herbaceous communities dominated by cold-deciduous, broad-leaved shrub, dwarf-shrub species, or perennial grasses with an open shrub layer.

Floristics: The most important, widespread shrubs in this group include *Chrysothamnus viscidiflorus, Ericameria nauseosa, Gutierrezia sarothrae, Gutierrezia microcephala, Krascheninnikovia lanata, Opuntia polyacantha*, and *Opuntia phaeacantha*. Other dominant/diagnostic shrubs with narrower ranges are *Chrysothamnus albidus, Chamaebatiaria millefolium, Ericameria nana, Ericameria parryi, Ericameria teretifolia, Glossopetalon spinescens, Mahonia fremontii, Opuntia phaeacantha*, and *Opuntia polyacantha*. Other commonly present to codominant species include *Artemisia* spp., *Ephedra torreyana, Ephedra viridis , Coleogyne ramosissima, Fallugia paradoxa, Isocoma drummondii, Eriogonum* spp., *Grayia spinosa, Holodiscus dumosus, Lycium pallidum, Opuntia* fragilis, *Purshia tridentata, Tetradymia canescens*, and *Tetradymia tetrameres*. Semi-desert grasses are common, including *Achnatherum hymenoides, Aristida purpurea, Aristida purpurea, Bouteloua curtipendula, Bouteloua eriopoda, Bouteloua gracilis, Elymus elymoides, Hesperostipa comata, Leymus salinus, Muhlenbergia pungens, Pascopyrum smithii, Pleuraphis jamesii, Poa secunda, Pseudoroegneria spicata, Sporobolus airoides*, and *Sporobolus cryptandrus*. Perennial forbs may include *Achillea millefolium, Astragalus purshii, Calochortus macrocarpus, Chamaesyce* spp., *Erigeron* spp., *Penstemon deustus, Phlox hoodii, Sphaeralcea coccinea*, and *Sphaeralcea munroana*. Annuals may be seasonally present to abundant depending on precipitation and disturbance. Exotic annuals such as *Bromus tectorum* or *Salsola kali* can be abundant.

ENVIRONMENT & DYNAMICS

Environmental Description: This group occurs throughout the Intermountain West from the western Great Basin to the Northern Rocky Mountains and Colorado Plateau at elevations ranging from 300 m up to 2500 m. The climate where this group occurs is generally hot in summers and cold in winters with low annual precipitation, ranging from 18-40 cm and high inter-annual variation. Much of the precipitation falls as snow, and growing-season drought is characteristic. Temperatures are continental with large annual and diurnal variations. Sites are generally alluvial fans and flats with moderate to deep soils. Some sites can be flat, poorly drained and intermittently flooded with a shallow or perched water table often within 1 m depth (West 1983e). Substrates are generally shallow, calcareous, fine-textured soils (clays to silt-loams), derived from alluvium; deep, fine to medium-textured alluvial soils with some source of subirrigation during the summer season, or sandstone talus over shale. Soils may be alkaline and typically moderately saline (West 1983e).

Dynamics:

DISTRIBUTION

Geographic Range: This group occurs throughout the semi-arid western U.S., including areas in the western Great Plains.

Spatial Scale & Pattern [optional]: Large patch
Nations: CA?, US
States/Provinces: AZ, CA, CO, ID, KS, MT, NM, NV, OR, SD, TX, UT, WY
TNC Ecoregions [optional]: 4:C, 6:C, 8:C, 9:C, 10:C, 11:C, 18:C, 19:C, 20:C, 21:C
USFS Ecoregions (2007): 313A:CC, 313B:CC, 313C:CC, 313D:CC, 315A:CC, 315B:CC, 315H:CC, 321A:CC, 322A:CC, 331B:CC, 331H:CC, 331I:CC, 331J:CC, 341A:CC, 341B:CC, 341C:CC, 341D:CC, 341E:CC, 341F:CC, 341G:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:CC, 342I:CP, 342J:CC, M242C:CC, M261E:CC, M261G:CC, M313A:CC, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332E:CP, M332G:CC, M333A:??, M341A:CC, M341B:CC, M341C:CC, M341D:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Arches); USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **=** Southeastern Utah galleta-threeawn shrub steppe (West 1983e)

LOWER LEVEL UNITS

Alliances:
- A2650 *Opuntia* spp. Colorado Plateau Shrubland Alliance
- A2540 *Ericameria teretifolia* Shrubland Alliance
- A3197 *Ericameria parryi* Shrubland Alliance
- A3196 *Ericameria nauseosa* Steppe & Shrubland Alliance
- A3203 *Gutierrezia sarothrae - Gutierrezia microcephala* Dwarf-shrubland Alliance
- A1032 *Glossopetalon spinescens* Shrubland Alliance
- A0834 *Chrysothamnus albidus* Shrubland Alliance
- A3202 *Krascheninnikovia lanata* Steppe & Dwarf-shrubland Alliance
- A3195 *Chrysothamnus viscidiflorus* Steppe & Shrubland Alliance

AUTHORSHIP

Primary Concept Source: N.E. West (1983e)
Author of Description: M.E. Hall, M.S. Reid, K.A. Schulz
Acknowledgments: P. Comer
Version Date: 11/06/2015
Classif Resp Region: West
Internal Author: MEH/MSR 3-10, mod. PC 4-13, mod. KAS 11-15

REFERENCES

References: Branson et al. 1976, Faber-Langendoen et al. 2017a, Hanson 1929, Shiflet 1994, Stout et al. 2013, Tuhy et al. 2002, West 1983e

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G310. Intermountain Semi-Desert Steppe & Shrubland

A0834. Chrysothamnus albidus Shrubland Alliance

Type Concept Sentence: Stands included in this shrubland alliance have a sparse woody layer dominated by the microphyllous evergreen shrub *Chrysothamnus albidus* and occur around seeps, saline meadows and flats, and around pluvial lakes in the Great Basin.

OVERVIEW

Scientific Name: *Chrysothamnus albidus* Shrubland Alliance
Common Name (Translated Scientific Name): White-flower Rabbitbrush Shrubland Alliance
Colloquial Name: White-flower Rabbitbrush Shrubland

Type Concept: Stands have a sparse woody layer dominated by the microphyllous evergreen shrub *Chrysothamnus albidus*. The herbaceous layer is sparse to possibly moderately dense, but no cover values are available. The most frequent species are the graminoids *Muhlenbergia richardsonis* and *Puccinellia nuttalliana*. Other scattered species include *Crepis runcinata, Distichlis spicata*, and *Nitrophila occidentalis*. Adjacent vegetation includes sparse shrublands dominated by *Atriplex confertifolia, Pyrrocoma uniflora var. uniflora*, and *Distichlis spicata* or *Sarcobatus vermiculatus*-dominated herbaceous community. Stands included in this shrubland alliance occur around seeps, saline meadows and flats, and around pluvial lakes in the Great Basin. The climate is arid; mean annual precipitation is generally less than 15 cm. Summers are hot and winters are cold. Elevations range from 1450-1900 m. Described stands occur on mesic sites on the nearly flat lakeplain where groundwater reaches the soil surface at some time during the growing season. Soils are generally deep, fine-textured (silty clay), poorly drained, calcareous, alkaline and saline.

Classification Comments: Stands described by Young et al. (1986) on the lakeplain had only 3% cover of the shrub canopy and would be better classified in a shrub herbaceous or a sparsely vegetated alliance. Data from other stands are not available.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Shrublands inhabiting saline environments of the Great Basin dominated by *Chrysothamnus albidus*. Total stand cover may be sparse to dense and is often composed of species adapted to saline conditions.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a sparse shrub layer dominated by microphyllous evergreen shrubs (0.3-1.5 m tall). A sparse to moderately dense herbaceous layer is dominated by perennial grasses. Scattered forbs may be present.

Floristics: Stands have a sparse woody layer dominated by the microphyllous evergreen shrub *Chrysothamnus albidus*. The herbaceous layer is sparse to possibly moderately dense, but no cover values are available. The most frequent species are the graminoids *Muhlenbergia richardsonis* and *Puccinellia nuttalliana*. Other scattered species include *Crepis runcinata, Distichlis spicata, Nitrophila occidentalis*, and *Pyrrocoma uniflora var. uniflora*.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands included in this shrubland alliance occur around seeps, saline meadows and flats, and around pluvial lakes in the Great Basin. Climate is arid; mean annual precipitation is generally less than 15 cm. Summers are hot and winters are cold. Elevations range from 1450-1900 m. Stands described by Young et al. (1986) occur on mesic sites on the nearly flat lakeplain where groundwater reaches the soil surface at some time during the growing season. Soils are generally deep, fine-textured (silty clay), poorly drained, calcareous, alkaline and saline.

Dynamics: Access to the water table is necessary for plants in this mesic vegetation type in the arid Great Basin. Where it occurs on playas, there is likely temporary flooding. *Puccinellia nuttalliana* is a valuable forage grass and may be depleted where heavy livestock grazing is allowed.

DISTRIBUTION

Geographic Range: Stands included in this minor shrubland alliance occur in the Great Basin. It has been reported from Utah and Nevada and likely occurs in eastern California.

Nations: US
States/Provinces: CA?, NV, UT
TNC Ecoregions [optional]:
USFS Ecoregions (2007):

Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Chrysothamnus albidus / Puccinellia* plant community (Young et al. 1986) [occurs on the lake plain of a pluvial lake in Nevada]
- **?** Saltgrass Series (Sawyer and Keeler-Wolf 1995) [*Chrysothamnus albidus* was mentioned in text.]

LOWER LEVEL UNITS

Associations:

- CEGL001328 *Chrysothamnus albidus / Puccinellia nuttalliana* Shrubland
- CEGL005596 *Ericameria nana - Holodiscus dumosus / Penstemon deustus* Shrubland
- CEGL005597 *Ericameria nana / Poa secunda - Penstemon deustus* Sparse Vegetation

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Faber-Langendoen et al. 2017b, Sawyer and Keeler-Wolf 1995, Young et al. 1986

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G310. Intermountain Semi-Desert Steppe & Shrubland

A3195. Chrysothamnus viscidiflorus Steppe & Shrubland Alliance

Type Concept Sentence: This alliance is characterized by a sparse to dense layer of *Chrysothamnus viscidiflorus* and sparse to dense layer of graminoids and is known from in the southern San Luis Valley of Colorado, the lower slopes of mountains in western Wyoming and northern Utah, and on mesas and high plateaus of the Colorado Plateau.

OVERVIEW

Scientific Name: *Chrysothamnus viscidiflorus* Steppe & Shrubland Alliance
Common Name (Translated Scientific Name): Yellow Rabbitbrush Steppe & Shrubland Alliance
Colloquial Name: Yellow Rabbitbrush Steppe & Shrubland

Type Concept: The vegetation is characterized by an open to moderate shrub layer dominated by *Chrysothamnus viscidiflorus* with 3-35% cover. Other shrub species may be present with low cover, such as *Amelanchier utahensis, Artemisia bigelovii, Artemisia tridentata, Atriplex canescens, Atriplex confertifolia, Eriogonum corymbosum, Ephedra viridis, Ericameria nauseosa, Gutierrezia sarothrae, Mahonia fremontii, Shepherdia rotundifolia, Symphoricarpos oreophilus, Tetradymia canescens*, and *Yucca baccata*. The herbaceous layer is variable and ranges from being moderately dense, diverse and bunchgrass-dominated to sparse and often depauperate. In some stands the herbaceous layer is dominant over shrubs. Dominant and common grasses may include *Achnatherum hymenoides (= Oryzopsis hymenoides), Bouteloua gracilis, Elymus elymoides, Hesperostipa comata, Koeleria macrantha, Leymus salinus ssp. salinus, Pascopyrum smithii, Poa fendleriana, Poa secunda, Pseudoroegneria spicata*, and the introduced annuals *Bromus briziformis* and *Bromus tectorum*. *Leymus cinereus* may be present in mesic gully bottoms in Utah. Scattered forbs are present, such as *Antennaria* spp., *Astragalus bisulcatus, Castilleja* spp., *Cirsium undulatum, Cryptantha humilis, Linanthus pungens (= Leptodactylon pungens)*, and *Linanthus watsonii (= Leptodactylon watsonii)*. Stands of the alliance occur in the southern San Luis Valley of Colorado, the lower slopes of mountains in western Wyoming and northern Utah, and on mesas and high plateaus of the Colorado Plateau. Stands occur on a variety of sites and range from level to moderately sloping, disturbed sites on ridges and in valleys. Elevations range from 1300 to 2440 m (4250-8000 feet). Substrates include eolian sands, alluvium, metamorphic rocks, granite or limestone, and the soil is likewise variable, with textures ranging from silt loam, sandy loam, loamy sand and silty clay loam.

Classification Comments: This alliance has one association that is based on the Van Pelt (1978) description of *Chrysothamnus viscidiflorus / Leymus salinus ssp. salinus* Plant Association on Bridger Jack Mesa. Information on other occurrences is needed to describe the full range of this alliance.

Internal Comments: mjr 12-14: CA added for MOJN.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Shrublands of the Colorado Plateau and southern Rocky Mountains where *Chrysothamnus viscidiflorus* is the dominant species ranging from 3-35% cover or some stands with <10% cover and graminoid layer with 5-25% cover.

VEGETATION

Physiognomy and Structure: The vegetation in this alliance has a sparse to dense graminoid layer dominated by medium-tall bunch grasses with a sparse to dense short xeromorphic shrub layer.

Floristics: Vegetation included in this shrub herbaceous alliance is characterized by a sparse to moderate shrub layer dominated by *Chrysothamnus viscidiflorus* with 3-20% cover. Other shrub species may be present with low cover, such as *Amelanchier utahensis, Artemisia tridentata, Artemisia bigelovii, Atriplex canescens, Atriplex confertifolia, Ephedra viridis, Ericameria nauseosa, Eriogonum corymbosum, Gutierrezia sarothrae, Mahonia fremontii, Shepherdia rotundifolia, Symphoricarpos oreophilus, Tetradymia canescens*, and *Yucca baccata*. Occasional *Pinus edulis* and *Juniperus osteosperma* trees or seedlings may be present in the stand. The herbaceous layer is variable and ranges from being moderately dense, diverse and bunchgrass-dominated to sparse and sometimes depauperate. Common dominant graminoid species include *Achnatherum hymenoides (= Oryzopsis hymenoides), Bouteloua gracilis, Elymus elymoides, Hesperostipa comata, Koeleria macrantha, Leymus salinus ssp. salinus, Pascopyrum smithii, Poa fendleriana, Poa secunda, Pseudoroegneria spicata*, and introduced annuals *Bromus briziformis* and *Bromus tectorum*. *Leymus cinereus* may be present in mesic gully bottoms in Utah. Forbs may be diverse but typically contribute very little cover. Associate species may include *Antennaria* spp., *Arenaria* sp., *Astragalus bisulcatus, Castilleja* spp., *Chenopodium leptophyllum, Cirsium undulatum, Crepis acuminata, Cryptantha cinerea var. jamesii, Cryptantha humilis, Erigeron* spp., *Eriogonum* sp., *Heterotheca villosa, Linanthus pungens (= Leptodactylon pungens), Linanthus watsonii (= Leptodactylon watsonii), Lupinus caudatus, Packera tridenticulata, Sedum lanceolatum, Schoenocrambe linifolia, Stenotus armerioides var. armerioides*, and cacti such as *Mammillaria* spp. and *Opuntia* spp.

ENVIRONMENT & DYNAMICS

Environmental Description: This shrubland alliance includes associations found in the Colorado Plateau extending east into the southern Rocky Mountains. Stands occur on a variety of sites and range from level to moderately sloping, disturbed sites on ridges and in valleys. Elevations range from 1300 to 2440 m (4250-8000 feet). Substrates include eolian sands, alluvium, metamorphic rocks, granite or limestone, and the soil is likewise variable, with textures ranging from silt loam to sandy loam to loamy sand. Ground surface is variable and has low to high cover of gravel, bare soil, litter and duff.

Dynamics: Disturbance by fire may be important in the creation and maintenance of these stands. Burned tree snags indicate these stands were created by fire that burned openings in the *Pinus edulis* and *Juniperus osteosperma* woodland (Van Pelt 1978). Van Pelt (1978) reported that young *Pinus edulis* are slowly invading the park and in time will convert it back to woodland unless fire reburns the site. Lightning likely starts these fires. With past fire suppression policies on some federal lands and livestock grazing which removes the necessary fine fuels needed to carry fire through woodlands, these parks may be disappearing. More information is needed to understand their current status and management needs.

DISTRIBUTION

Geographic Range: Stands of the alliance occur in the southern San Luis Valley of Colorado, the lower slopes of mountains in western Wyoming and northern Utah, and on mesas and high plateaus of the Colorado Plateau.

Nations: US
States/Provinces: CA, CO, ID, MT, NV, UT, WY
TNC Ecoregions [optional]: 11:C
USFS Ecoregions (2007): 341Fc:CCC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley); USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** *Chrysothamnus viscidiflorus* Shrubland Alliance (Evens et al. 2014)
- **?** Salina Wildrye/Douglas Rabbitbrush Community (Van Pelt 1978)

LOWER LEVEL UNITS

Associations:

- CEGL005594 *Chrysothamnus viscidiflorus / Pseudoroegneria spicata* Shrubland
- CEGL002781 *Chrysothamnus viscidiflorus - Ericameria parryi* Shrub Grassland

- CEGL001501 *Chrysothamnus viscidiflorus / Leymus salinus ssp. salinus* Shrub Grassland
- CEPP005695 *Chrysothamnus viscidiflorus* / Disturbed Understory Shrubland
- CEGL002530 *Chrysothamnus viscidiflorus* Shrub Grassland
- CEGL002799 *Chrysothamnus viscidiflorus / Hesperostipa comata* Shrubland
- CEGL005592 *Chrysothamnus viscidiflorus / Pascopyrum smithii* Shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments: M.E. Hall
Version Date: 2014/03/14

REFERENCES

References: Evens et al. 2014, Faber-Langendoen et al. 2017b, Van Pelt 1978

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G310. Intermountain Semi-Desert Steppe & Shrubland

A3196. Ericameria nauseosa Steppe & Shrubland Alliance

Type Concept Sentence: This alliance is characterized by shrub and shrub herbaceous vegetation where *Ericameria nauseosa* is dominant and includes both natural and semi-natural stands from localized areas across the northern Great Plains and throughout the western U.S.

OVERVIEW

Scientific Name: *Ericameria nauseosa* Steppe & Shrubland Alliance
Common Name (Translated Scientific Name): Rubber Rabbitbrush Steppe & Shrubland Alliance
Colloquial Name: Rubber Rabbitbrush Steppe & Shrubland

Type Concept: The vegetation is characterized by a sparse to moderately dense, short-shrub layer (5-60% cover) that is dominated by *Ericameria nauseosa*. Depending on geography, associated shrubs may include scattered *Artemisia filifolia, Artemisia tridentata, Chrysothamnus viscidiflorus, Gutierrezia sarothrae, Opuntia* spp., *Prunus virginiana, Rhus trilobata, Symphoricarpos occidentalis*, and *Yucca* spp. The herbaceous layer can vary from sparse moderately dense, being more prominent in some stands than shrubs, and dominated by graminoids. Common native grasses include *Achnatherum hymenoides (= Oryzopsis hymenoides), Bouteloua* spp., *Elymus trachycaulus ssp. trachycaulus, Leymus flavescens (= Elymus flavescens), Pascopyrum smithii, Pleuraphis jamesii, Pseudoroegneria spicata*, and *Sporobolus cryptandrus*. Native forbs generally have low cover. Disturbed stands typically have high cover of introduced annual *Bromus* species. This alliance includes both natural and semi-natural stands from localized areas across the northern Great Plains and throughout the western U.S. Elevations range from 1100 to 2200 m. Soils are variable but generally well-drained and coarse-textured. Sites are flat to gently sloping, occurring on all aspects. The semi-natural stands included in this alliance are seral shrubland communities resulting from overgrazing by livestock, road building, or other cultural disturbance of typically grass-dominated communities.

Classification Comments: Further study is needed on the effects of livestock grazing on vegetation structure in these stands and on the relationship between *Ericameria nauseosa* shrub herbaceous associations and shrubland associations. *Mahonia fremontii* Shrubland (CEGL003967) has been placed in this alliance tentatively until further studies can be completed on this association.

Internal Comments: GK 9-16: ID added for Minidoka.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Very widespread shrub and shrub herbaceous vegetation where *Ericameria nauseosa* ranges in cover from 15-60% cover and where herbaceous component is sparse or absent. Cover of *Ericameria nauseosa* is 5-25% in cover when graminoids are more abundant.

VEGETATION

Physiognomy and Structure: Vegetation in this alliance has a sparse to dense layer of microphyllous evergreen shrubs (<2 m tall) with a sparse to moderately dense herbaceous layer dominated by perennial medium-tall and short grasses. Perennial forbs are sparse. Annual forbs and grasses may be present seasonally.

Floristics: The vegetation is characterized by a sparse to moderately dense, short-shrub layer (5-60% cover) that is dominated by *Ericameria nauseosa*. Depending on geography, associated shrubs may include scattered *Artemisia filifolia, Artemisia tridentata, Chrysothamnus viscidiflorus, Gutierrezia sarothrae, Opuntia* spp., *Prunus virginiana, Rhus trilobata, Symphoricarpos occidentalis*, and *Yucca* spp. The herbaceous layer can vary from sparse to dense and is dominated by graminoids. In some stands, the herbaceous component may surpass that of shrubs. Common native grasses include *Achnatherum hymenoides (= Oryzopsis hymenoides), Aristida purpurea, Bouteloua* spp., *Elymus trachycaulus ssp. trachycaulus, Leymus flavescens (= Elymus flavescens), Pascopyrum smithii, Pleuraphis jamesii, Pseudoroegneria spicata*, and *Sporobolus cryptandrus*. Native forbs generally have low cover, but may include species such as *Lygodesmia grandiflora, Machaeranthera canescens (= Aster canescens), Phacelia hastata (= Phacelia leucophylla)*, and *Psoralidium lanceolatum (= Psoralea lanceolata)*. Disturbed stands typically have high cover of introduced annual *Bromus* species such as *Bromus tectorum, Bromus arvensis (= Bromus japonicus)*, and *Bromus rubens*. Introduced forbs may include *Bassia scoparia (= Kochia scoparia), Melilotus officinalis*, and *Salsola kali*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance includes both natural and semi-natural stands from localized areas across the northern Great Plains and throughout the western U.S. Stands occur in the a variety of habitats such as gentle or steep slopes, dunes, and washes. Elevations range from 1100 to 2200 m elevation. Substrates may be eolian, alluvial, or colluvial with soils that are generally well-drained and coarse-textured. The semi-natural stands included in this alliance are seral shrubland communities resulting from overgrazing by livestock, road building, or other cultural disturbance of typically grass-dominated communities.

Dynamics: Grazing has significantly impacted much of the vegetation in this region, which has had a long history of settlement and heavy livestock use. With proper livestock management and time, palatable species such as *Achnatherum hymenoides, Artemisia tridentata, Elymus elymoides, Pascopyrum smithii, Schedonnardus paniculatus*, and *Sporobolus cryptandrus* may increase, and *Gutierrezia sarothrae* and *Ericameria nauseosa* may decline in abundance (Francis 1986).

DISTRIBUTION

Geographic Range: This alliance includes shrublands from localized areas across the northern Great Plains and throughout much of the western U.S.

Nations: US
States/Provinces: AZ, CO, ID, MT, ND, NM, NV, SD, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **><** *Chrysothamnus* Subformation (Francis 1986)

LOWER LEVEL UNITS

Associations:
- CEGL002713 *Ericameria nauseosa* Shrubland
- CEGL002918 *Ericameria nauseosa / Sporobolus airoides* Shrubland
- CEGL002996 *Ericameria nauseosa / Pleuraphis jamesii - (Hesperostipa comata)* Shrub Grassland
- CEPP006725 *Lepidospartum latisquamum* Shrubland
- CEGL003495 *Ericameria nauseosa / Bouteloua gracilis* Shrub Grassland
- CEGL003967 *Mahonia fremontii* Shrubland
- CEGL001330 *Ericameria nauseosa / Pseudoroegneria spicata* Shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Faber-Langendoen et al. 2017b, Francis 1986

G310. Intermountain Semi-Desert Steppe & Shrubland

A3197. Ericameria parryi Shrubland Alliance

Type Concept Sentence: Vegetation included in this shrubland alliance is characterized by having a sparse to dense shrub layer dominated by *Ericameria parryi*. It occurs in the Great Basin, Arizona-New Mexico Mountains, Colorado Plateau and in isolated locations in the northern Coast Ranges of California.

OVERVIEW

Scientific Name: *Ericameria parryi* Shrubland Alliance
Common Name (Translated Scientific Name): Parry's Rabbitbrush Shrubland Alliance
Colloquial Name: Parry's Rabbitbrush Shrubland

Type Concept: Vegetation included in this shrubland alliance is characterized by having a sparse to dense shrub layer dominated by *Ericameria parryi (= Chrysothamnus parryi)*. Shrub associates include *Artemisia tridentata, Ephedra* spp., *Krascheninnikovia lanata*, and *Purshia tridentata*. The sparse to moderate herbaceous layer is dominated by graminoids such as *Achnatherum occidentale ssp. pubescens (= Stipa occidentalis var. pubescens), Bouteloua gracilis, Elymus elymoides, Pleuraphis jamesii (= Hilaria jamesii)*, and *Sporobolus airoides*. Perennial forbs are generally sparse. Some stands may have scattered *Juniperus* spp. and *Pinus* spp. trees. This alliance occurs in the Great Basin, Arizona-New Mexico Mountains, Colorado Plateau and in isolated locations in the northern Coast Ranges of California. These shrublands occur on bajadas, pediments and valleys, including pumice flats. Substrates and parent materials are variable. Soils are shallow, well-drained, calcareous, alkaline and often gravelly.

Classification Comments: This alliance includes all shrublands dominated by any of the 12 subspecies of *Ericameria parryi* that occur in the western U.S. Vegetation included in this alliance may be too sparse to be classified as a shrubland. Further study is needed throughout its range, especially to assess the effects of livestock grazing on vegetation structure and to describe stands of different subspecies.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Sparse to dense shrublands dominated by *Ericameria parryi* found in the Great Basin and Colorado Plateau. The sparse to moderate herbaceous layer is dominated by graminoids.

VEGETATION

Physiognomy and Structure: Vegetation in this alliance is dominated by sparse to moderately dense microphyllous evergreen shrubs and graminoids in the understory.

Floristics: These shrublands have a sparse to dense shrub layer with a sparse to moderate herbaceous layer dominated by grasses. Some stands have a sparse tree layer of scattered *Juniperus* spp. and *Pinus* spp. *Ericameria parryi* dominates the shrub layer. Associated species vary greatly with geography. Other shrubs present may include *Artemisia tridentata, Ephedra* spp., *Krascheninnikovia lanata*, and *Purshia tridentata*. Common perennial grasses include *Achnatherum occidentale ssp. pubescens (= Stipa occidentalis var. pubescens*), *Bouteloua gracilis, Elymus elymoides, Pleuraphis jamesii (= Hilaria jamesii)*, and *Sporobolus airoides*. Perennial forbs are generally sparse (Taylor 1980, Francis 1986, Sawyer and Keeler-Wolf 1990).

ENVIRONMENT & DYNAMICS

Environmental Description: The alliance is found on alluvial flats, on bajadas, pediments and valleys, including pumice flats from 1800-2400 m elevation. Substrates and parent materials are variable (Taylor 1980, Sawyer and Keeler-Wolf 1995). Soils are shallow, poorly developed, well-drained, calcareous, alkaline and often gravelly. They are typically derived from sedimentary rocks. Textures range from fine sandy loams to silty clay loams (Taylor 1980, Francis 1986, Sawyer and Keeler-Wolf 1995).

Dynamics: Grazing has significantly impacted much of the vegetation in this region with its long history of settlement and heavy livestock use (Griffiths 1902, Francis 1986). With proper livestock management and time, palatable species such as *Krascheninnikovia lanata* and *Sporobolus airoides* may increase in abundance (Francis 1986). This alliance may respond positively to disturbance because many species of *Chrysothamnus* in the Great Basin increase in abundance with excessive livestock grazing and accelerated fire frequencies (West 1988).

DISTRIBUTION

Geographic Range: This alliance occurs in the Great Basin, Arizona-New Mexico Mountains, Colorado Plateau and in isolated locations in the northern Coast Ranges of California.

Nations: US
States/Provinces: CA, CO, NM, NV?
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Ericameria parryi* (Parry's rabbitbrush scrub) Alliance (Sawyer et al. 2009) [35.340.00]
- **?** Parry Rabbitbrush Series (Sawyer and Keeler-Wolf 1995) [includes shrubland dominated by any of the 6 subspecies that occur in California.]
- **?** Rabbitbrush Scrub (#35400) (Holland 1986b) [includes all *Chrysothamnus*-dominated scrub in California.]

LOWER LEVEL UNITS

Associations:

- CEGL003040 *Ericameria parryi* Shrubland
- CEGL003751 *Ericameria parryi / Achnatherum hymenoides* Shrubland
- CEGL001331 *Ericameria parryi / Pleuraphis jamesii - Bouteloua gracilis* Shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Faber-Langendoen et al. 2017b, Francis 1986, Griffiths 1902, Holland 1986b, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Taylor 1990, West 1988

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G310. Intermountain Semi-Desert Steppe & Shrubland

A2540. Ericameria teretifolia Shrubland Alliance [Low - Poorly Documented]

Type Concept Sentence: This xeromorphic shrubland alliance is dominated by *Ericameria teretifolia* and occurs from southern California mountains and valleys to the Mojave Desert, north into the southeastern Great Basin.

OVERVIEW

Scientific Name: *Ericameria teretifolia* Shrubland Alliance
Common Name (Translated Scientific Name): Green Rabbitbrush Shrubland Alliance
Colloquial Name: Green Rabbitbrush Shrubland

Type Concept: The vegetation of this alliance is characterized by an open, xeromorphic, short-shrub layer (<2 m tall) that is dominated by *Ericameria teretifolia*. Other shrubs and dwarf-shrubs present may include *Ephedra viridis, Eriogonum fasciculatum, Grayia spinosa, Gutierrezia sarothrae, Cylindropuntia acanthocarpa (= Opuntia acanthocarpa), Opuntia chlorotica, Prunus fasciculata, Salazaria mexicana, Salvia dorrii, Sphaeralcea ambigua*, or *Stephanomeria pauciflora*. The generally sparse herbaceous layer is dominated by perennial graminoids. This xeromorphic shrubland alliance occurs from southern California mountains and valleys to the Mojave Desert, north into the southeastern Great Basin. Stands are found on ridges, slopes and valleys above *Larrea tridentata*- and *Ambrosia dumosa*-dominated desert scrub and below *Artemisia tridentata*-dominated shrublands and *Pinus monophylla* woodlands. Substrates are coarse-textured soils derived from bedrock or alluvium. Habitats include disturbed areas, including burns, washes, road cuts, and heavily grazed sites. Soils are variable in parent material and usually coarse, well-drained, and moderately acidic to slightly saline.

Classification Comments: This description is based on classification work done by Keeler-Wolf and Thomas (2000) on the Mojave Ecosystem Mapping Project. *Ericameria teretifolia* nearly always shares the shrub canopy with other shrub species. Stands occur above *Larrea tridentata* alliance and below *Pinus monophylla* and *Artemisia tridentata* alliances. Stands are adjacent to those of the *Atriplex confertifolia, Coleogyne ramosissima, Grayia spinosa, Juniperus californica,* and *Juniperus osteosperma* alliances.

Internal Comments:

Other Comments:

Similar NVC Types:

Diagnostic Characteristics: *Ericameria teretifolia* cover greater than or equal to other species (such as *Eriogonum fasciculatum, Gutierrezia sarothrae*, or *Opuntia chlorotica*) in relative cover in the shrub canopy (Keeler-Wolf et al. 1998, Thomas et al. 2004).

VEGETATION

Physiognomy and Structure:

Floristics: The vegetation is characterized by an open, xeromorphic, short-shrub layer (<2 m tall) that is dominated by *Ericameria teretifolia*. Other shrubs and dwarf-shrubs present may include *Ephedra viridis, Eriogonum fasciculatum, Grayia spinosa, Gutierrezia sarothrae, Cylindropuntia acanthocarpa (= Opuntia acanthocarpa), Opuntia chlorotica, Prunus fasciculata, Salazaria mexicana, Salvia dorrii, Sphaeralcea ambigua*, or *Stephanomeria pauciflora*. The generally sparse herbaceous layer is dominated by perennial graminoids such as *Achnatherum speciosum, Muhlenbergia porteri, Pleuraphis jamesii, Pleuraphis rigida*, and *Poa secunda* (Keeler-Wolf and Thomas 2000).

ENVIRONMENT & DYNAMICS

Environmental Description: This xeromorphic shrubland alliance occurs from southern California mountains and valleys to the Mojave Desert, north into the southeastern Great Basin. Elevation ranges from 800 to 1700 m. Stands are found on ridges, slopes and valleys above *Larrea tridentata*- and *Ambrosia dumosa*-dominated desert scrub and below *Artemisia tridentata*-dominated shrublands and *Pinus monophylla* woodlands. Habitats include disturbed areas, including burns, washes, road cuts, and heavily grazed sites. Soils are variable in parent material and usually coarse, well-drained, and moderately acidic to slightly saline. Substrates are coarse-textured soils derived from bedrock or alluvium (Keeler-Wolf and Thomas 2000).

Dynamics: Disturbance appears to be important to the maintenance of this seral shrubland as it is found in burned-over *Juniperus californica* stands, road cuts, and heavily grazed areas, and in intermittent washes (Keeler-Wolf and Thomas 2000).

DISTRIBUTION

Geographic Range: This alliance is found in the Mojave Desert and extends into the southern California mountains and southeastern Great Basin.

Nations: US
States/Provinces: CA
TNC Ecoregions [optional]: 11:C, 12:C, 16:C, 17:C
USFS Ecoregions (2007): 322Ab:CCC, 322Ad:CCC, 322Af:CCC, 322Al:CCC, 341D:CC, 341Ff:CCC, M261E:CC, M262B:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Joshua Tree, Mojave)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

- **=** *Ericameria teretifolia* (Needleleaf rabbitbrush scrub) Alliance (Sawyer et al. 2009) [35.330.00]
- **=** *Ericameria teretifolia* Shrubland Alliance (Evens et al. 2014)
- **=** *Ericameria teretifolia* Shrubland Alliance (Evens et al. 2012)
- **=** *Ericameria teretifolia* Shrubland Alliance (CNPS 2017) [35.330.00]
- **><** Blackbush Scrub (#34300) (Holland 1986b)
- **><** Mojave Mixed Woody Scrub (#34210) (Holland 1986b)
- **><** Mojave Mixed Woody and Succulent Scrub (#34240) (Holland 1986b)
- **><** Mojavean Juniper Woodland and Scrub (#72220) (Holland 1986b)
- **><** Peninsular Juniper Woodland and Scrub (#72320) (Holland 1986b)
- **><** Sonoran Mixed Woody and Succulent Scrub (#33220) (Holland 1986b)

LOWER LEVEL UNITS

Associations:
- CEGL002963 *Ericameria teretifolia* Shrubland

AUTHORSHIP

Primary Concept Source: M.S. Reid and K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:

Version Date: 2014/03/14

REFERENCES

References: CNPS 2017, Evens et al. 2012, Evens et al. 2014, Faber-Langendoen et al. 2017b, Holland 1986b, Keeler-Wolf and Thomas 2000, Keeler-Wolf et al. 1998a, Sawyer et al. 2009, Thomas et al. 2004, Thorne 1982, VegCAMP and AIS 2013

3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G310. Intermountain Semi-Desert Steppe & Shrubland

A1032. Glossopetalon spinescens Shrubland Alliance

Type Concept Sentence: These sparse shrublands are dominated by the xeromorphic shrub *Glossopetalon spinescens* and occur along the rims of the Snake River and Imnaha River canyons in Idaho and eastern Oregon.

OVERVIEW

Scientific Name: *Glossopetalon spinescens* Shrubland Alliance
Common Name (Translated Scientific Name): Spiny Greasebush Shrubland Alliance
Colloquial Name: Spiny Greasebush Shrubland

Type Concept: Vegetation included in this minor alliance has a sparse woody layer (usually less than 1 m tall) that is dominated by the xeromorphic shrub *Glossopetalon spinescens* (15-23% cover). The herbaceous layer is also relatively sparse (typically 10-20% cover). It is dominated by the perennial bunchgrass *Pseudoroegneria spicata*. Other characteristic species include the annual grass *Vulpia myuros* and forbs such as *Achillea millefolium, Cerastium arvense, Erigeron pumilus, Opuntia polyacantha*, and *Phacelia heterophylla*. Moss and lichen cover is moderate and averages 22% cover. Exotic species, namely *Bromus tectorum, Bromus arvensis (= Bromus japonicus)*, and *Bromus briziformis*, are often present. These sparse shrublands occur along the rims of the Snake River and Imnaha River canyons in Idaho and eastern Oregon. Elevations range from 550-900 m, and the climate is temperate continental. Mean annual precipitation is approximately 25-30 cm. Precipitation primarily occurs in the winter as snow or rain. This moisture is stored in the soil and in fractures in the highly weathered bedrock, and utilized during the usually dry summers. Stands are typically found on steep upper canyon slopes, but may occur on the lower canyon slopes. Sites are predominantly on hot, dry southwestern aspects, although the alliance may occur on all aspects. Soils are shallow, well-drained loams or sandy loams with a high percentage of rock fragments (greater than 35% by volume and 40% ground cover), and derived from loess and various bedrock types.

Classification Comments: Some stands in this alliance may be too sparse to be classified as dwarf-shrublands (Johnson and Simon 1987).

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Nearly dwarf-shrublands with low to open cover dominated by *Glossopetalon spinescens* in association with a sparse to open herbaceous layer composed of grasses.

VEGETATION

Physiognomy and Structure: Vegetation in this alliance has sparse to moderate cover of shrubs (usually less than 1 m tall). There is also a sparse herbaceous layer that is dominated by perennial bunch grasses with sparse scattered perennial forbs. Annual forbs and grasses are seasonally present in small amounts.

Floristics: Vegetation included in this minor alliance has a sparse woody layer (usually less than 1 m tall) that is dominated by the xeromorphic shrub *Glossopetalon spinescens* (15-23% cover). The herbaceous layer is also relatively sparse (typically 10-20% cover). It is dominated by the perennial bunchgrass *Pseudoroegneria spicata*. Other characteristic species include the annual grass *Vulpia myuros* and forbs such as *Achillea millefolium, Cerastium arvense, Erigeron pumilus, Opuntia polyacantha*, and *Phacelia heterophylla*. Moss and lichen cover is moderate and averages 22% cover. Exotic species, namely *Bromus tectorum, Bromus arvensis (= Bromus japonicus)*, and *Bromus briziformis* are often present.

ENVIRONMENT & DYNAMICS

Environmental Description: These sparse shrublands occur along the rims of the Snake and Imnaha River canyons in Idaho and eastern Oregon. Elevations range from 550-900 m, and the climate is temperate continental. Mean annual precipitation is approximately 25-30 cm. Precipitation primarily occurs in the winter as snow or rain. This moisture is stored in the soil and in fractures in the highly weathered bedrock, and utilized during the usually dry summers. Stands are typically found on steep upper canyon slopes, but may occur on the lower canyon slopes. Sites are predominantly on hot, dry southwest aspects, although the

alliance may occur on all aspects. Soils are shallow, well-drained loam or sandy loam with a high percentage of rock fragments (greater than 35% by volume and 40% ground cover), and derived from loess and various bedrock types.

Dynamics: Stands occur on steep hot, dry, canyon slopes. *Glossopetalon spinescens* appears restricted to these areas with weathered, fractured bedrock that provides deeper rooting for these shrubs and other plants. Fire is infrequent because stands are isolated on rims and rock outcrops (Johnson and Simon 1987). The biggest threat is exotic plants that have invaded many stands.

DISTRIBUTION

Geographic Range: This is a minor alliance found on rocky slopes in the Snake and Imnaha river canyons in Idaho and Oregon. It may also occur in Washington.

Nations: US
States/Provinces: ID, OR, WA?
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL001100 *Glossopetalon spinescens var. aridum / Pseudoroegneria spicata* Shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Faber-Langendoen et al. 2017b, Johnson and Simon 1987

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G310. Intermountain Semi-Desert Steppe & Shrubland

A3203. Gutierrezia sarothrae - Gutierrezia microcephala Dwarf-shrubland Alliance

Type Concept Sentence: This alliance represents shrub and shrub herbaceous vegetation of the Colorado Plateau and southern Rocky Mountains with shrub layers most often dominated by *Gutierrezia sarothrae* with an open to dense herbaceous layer composed of perennial graminoids.

OVERVIEW

Scientific Name: *Gutierrezia sarothrae - Gutierrezia microcephala* Dwarf-shrubland Alliance
Common Name (Translated Scientific Name): Broom Snakeweed - Threadleaf Snakeweed Dwarf-shrubland Alliance
Colloquial Name: Snakeweed Dwarf-shrubland

Type Concept: The vegetation is characterized by an open (10-30% cover) woody layer dominated by *Gutierrezia sarothrae* with a sparse to luxuriant perennial graminoid layer. *Atriplex canescens* and *Krascheninnikovia lanata* may codominate the shrub layer in some stands. Other shrub associates may include *Artemisia tridentata, Ephedra viridis, Eriogonum corymbosum, Ericameria nauseosa, Fallugia paradoxa, Isocoma drummondii*, and *Opuntia* spp. Trees are absent or represented by scattered individuals of *Juniperus monosperma* or *Pinus edulis*, mostly as seedlings or saplings. The most common dominant graminoids include *Bouteloua gracilis, Bouteloua eriopoda, Elymus elymoides, Pleuraphis jamesii*, and *Sporobolus airoides*. Other herbaceous associates include *Aristida purpurea, Hesperostipa comata, Muhlenbergia porteri, Pleuraphis rigida (= Hilaria rigida), Sphaeralcea coccinea*, and *Sporobolus cryptandrus*. Introduced species such as *Bromus tectorum* or *Salsola kali* may dominate the herbaceous layer of some disturbed stands. This alliance represents shrub and shrub herbaceous vegetation of the Colorado Plateau and southern Rocky Mountains. It most commonly occurs on level to gently sloping sites, including gently rolling mesatops, terraces, hillslopes, plateaus, sand deposits, bluffs and occasionally along canyon footslopes on sites with moderate solar exposure. Elevation ranges from 1300 to 2230 m.

Classification Comments:

Internal Comments: mjr 12-14: CA added for MOJN.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: *Gutierrezia sarothrae* or *Atriplex obovata* have 10-25% cover with an herbaceous layer composed of *Bouteloua gracilis, Pleuraphis jamesii, Sporobolus airoides*, or *Sporobolus cryptandrus*.

VEGETATION

Physiognomy and Structure: Vegetation in this alliance has a sparse to dense layer of microphyllous evergreen shrubs (<2 m tall) with a sparse to moderately dense herbaceous layer dominated by perennial medium-tall and short grasses. Perennial forbs are sparse. Annual forbs and grasses may be present seasonally.

Floristics: The vegetation is characterized by an open (10-30% cover) woody layer dominated by *Gutierrezia sarothrae* with a sparse to luxuriant perennial graminoid layer. *Atriplex canescens* and *Krascheninnikovia lanata* may codominate the shrub layer in some stands. Other shrub associates may include *Artemisia tridentata, Ephedra viridis, Eriogonum corymbosum, Ericameria nauseosa, Fallugia paradoxa, Isocoma drummondii*, and *Opuntia* spp. Trees are absent or represented by scattered individuals of *Juniperus monosperma* or *Pinus edulis*, mostly as seedlings or saplings. The most common dominant graminoids include *Bouteloua gracilis, Bouteloua eriopoda, Elymus elymoides, Pleuraphis jamesii*, and *Sporobolus airoides*. Other graminoids may include *Aristida purpurea, Hesperostipa comata, Muhlenbergia porteri, Pleuraphis rigida (= Hilaria rigida)*, and *Sporobolus cryptandrus*. Introduced species such as *Bromus tectorum* or *Salsola kali* may dominate the herbaceous layer of some disturbed stands. Other types of herbaceous species are not consistent, but may include *Chamaesyce* spp., *Opuntia phaeacantha, Opuntia polyacantha*, and *Sphaeralcea coccinea*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance most commonly occurs on level to gently sloping sites, including gently rolling mesatops, terraces, hillslopes, plateaus, sand deposits, bluffs and occasionally along canyon footslopes on sites with moderate solar exposure. Elevation ranges from 1300 to 2230 m. Aspects are reported from the southeast, south and southwest. Soils are variable and range from sandy to clayey texture and may occur over gravel, cinders and cobbles or talus.

Dynamics: Grazing has significantly impacted much of the vegetation in this region, which has had a long history of settlement and heavy livestock use. With proper livestock management and time, palatable species such as *Krascheninnikovia lanata* and *Sporobolus airoides* may increase, and *Gutierrezia sarothrae* and *Opuntia* spp. may decline in abundance (Francis 1986).

DISTRIBUTION

Geographic Range: This alliance is known from the Colorado Plateau and southern Rocky Mountains.

Nations: US
States/Provinces: AZ, CA, NM, UT
TNC Ecoregions [optional]: 17:C
USFS Ecoregions (2007): 322Af:CCC, 322Aj:CCC, 322Ak:CCC, 322Al:CCC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Mojave)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** *Gutierrezia (microcephala, sarothrae)* Shrubland Alliance (Evens et al. 2014)
- **=** *Gutierrezia sarothrae* (Broom snake weed scrub) Provisional Alliance (Sawyer et al. 2009) [32.043.00]
- **?** Grama Grass - Scrub Series (Warren et al. 1982)

LOWER LEVEL UNITS

Associations:

- CEGL001776 *Gutierrezia sarothrae / Sporobolus airoides - Pleuraphis jamesii* Shrub Grassland
- CEGL002690 *Gutierrezia sarothrae* - (*Opuntia* spp.) / *Pleuraphis jamesii* Dwarf-shrubland
- CEGL001733 *Gutierrezia sarothrae - Krascheninnikovia lanata - Atriplex canescens / Bouteloua eriopoda* Shrub Grassland
- CEGL001543 *Gutierrezia sarothrae / Pleuraphis rigida - Sphaeralcea ambigua* Shrub Grassland

- CEPP005693 *Gutierrezia (microcephala, sarothrae) - (Encelia frutescens, Brickellia microphylla) / Stephanomeria pauciflora* Dwarf-shrubland
- CEGL005382 *Gutierrezia sarothrae / Bouteloua gracilis* Dwarf-shrub Grassland
- CEPP009523 *Gutierrezia (microcephala, sarothrae)* Dwarf-shrubland
- CEGL005130 *Gutierrezia (sarothrae, microcephala) - Ephedra* spp. - *Agave utahensis* Dwarf-shrubland
- CEGL002787 *Bouteloua eriopoda* Coconino Plateau Shrub Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Evens et al. 2014, Faber-Langendoen et al. 2017b, Francis 1986, Sawyer et al. 2009, Warren et al. 1982

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G310. Intermountain Semi-Desert Steppe & Shrubland

A3202. Kraschenninnikovia lanata Steppe & Dwarf-shrubland Alliance

Type Concept Sentence: This alliance represents vegetation of the interior western U.S. characterized by a sparse to dense layer of *Kraschenninnikovia lanata*.

OVERVIEW

Scientific Name: *Kraschenninnikovia lanata* Steppe & Dwarf-shrubland Alliance
Common Name (Translated Scientific Name): Winterfat Steppe & Dwarf-shrubland Alliance
Colloquial Name: Winterfat Steppe & Dwarf-shrubland

Type Concept: This alliance includes dwarf-shrublands dwarf-shrub herbaceous vegetation scattered across the interior western U.S. Shrub layers are characterized by a sparse to moderately dense dwarf-shrub layer dominated by *Kraschenninnikovia lanata*. Other woody species may include scattered *Artemisia frigida, Artemisia nova, Artemisia tridentata, Chrysothamnus* spp., *Gutierrezia sarothrae, Opuntia polyacantha, Rhus trilobata*, and *Yucca glauca*. In the Mojave Desert, *Ambrosia dumosa, Atriplex polycarpa, Larrea tridentata*, and *Lycium andersonii* may also be present. The herbaceous layer has sparse to very dense cover dominated by graminoids with scattered perennial forbs which in some stands may take prominence over shrubs. Graminoids such as *Achnatherum hymenoides (= Oryzopsis hymenoides), Bouteloua gracilis, Hesperostipa comata (= Stipa comata), Pascopyrum smithii, Pleuraphis jamesii (= Hilaria jamesii), Poa secunda*, and *Pseudoroegneria spicata* are most abundant. Perennial forbs may include *Achillea millefolium, Astragalus purshii, Calochortus macrocarpus, Erigeron* spp., *Phlox hoodii, Sphaeralcea coccinea*, and *Sphaeralcea munroana*. Annuals may be seasonally present to abundant depending on precipitation and disturbance. Exotic annuals, such as *Bromus tectorum*, can be abundant. Elevations range from 100-2700 m. Stands occur on plateaus, plains, mesas, hillslopes, alkaline flats around playas and along drainages. Some habitats are intermittently flooded wetlands. Sites are typically flat to gently sloping, occurring on any aspect, but stands have also been reported from moderately steep slopes. Soils are calcareous, moderately alkaline and sometimes saline. Soil texture is typically stony, sandy loam, but may be coarser textured. The ground cover is mostly bare soil.

Classification Comments: The vegetation is sparse in many of these stands, and they would be better classified in a sparsely vegetated alliance. Only stands described by Daubenmire (1970) and DeVelice et al. (1991) have the necessary woody cover to be dwarf-shrublands.

Internal Comments: mjr 12-14: CA confirmed for MOJN.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Shrublands of the interior western U.S. where *Kraschenninnikovia lanata* is the dominant species ranging from 3-35% cover or some stands with <10% cover and graminoid layer with cover 5-25%.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance is dominated by a sparse to moderately dense evergreen, dwarf-shrub layer often with scattered shrubs. Also present is a sparse to moderately dense herbaceous layer dominated by perennial graminoids with scattered perennial forbs. Annual grasses and forbs are seasonally present to abundant.

Floristics: Vegetation included in this alliance has a sparse to moderately dense dwarf-shrub layer dominated by *Krascheninnikovia lanata*. Other woody species may include scattered *Artemisia frigida, Artemisia nova, Artemisia tridentata, Chrysothamnus* spp., *Gutierrezia sarothrae, Opuntia polyacantha, Rhus trilobata*, and *Yucca glauca*. In the Mojave Desert, *Ambrosia dumosa, Atriplex polycarpa, Larrea tridentata*, and *Lycium andersonii* may also be present. The herbaceous layer has sparse to moderately dense cover dominated by graminoids with scattered perennial forbs. In some stands, shrubs may be very widely spaced and graminoids take prominence over shrub cover. Graminoids such as *Achnatherum hymenoides (= Oryzopsis hymenoides), Bouteloua gracilis, Hesperostipa comata (= Stipa comata), Muhlenbergia torreyi, Pascopyrum smithii, Pleuraphis jamesii (= Hilaria jamesii), Poa secunda*, and *Pseudoroegneria spicata* are most abundant. Scattered *Carex filifolia, Koeleria macrantha, Nassella viridula*, and *Sporobolus airoides* are also often present. Perennial forbs may include *Achillea millefolium, Astragalus purshii, Calochortus macrocarpus, Erigeron* spp., *Phlox hoodii, Sphaeralcea coccinea*, and *Sphaeralcea munroana*. Annuals may be seasonally present to abundant depending on precipitation and disturbance. Common native annual are *Chenopodium* spp., *Descurainia pinnata, Lappula occidentalis (= Lappula redowskii)*, and *Plantago patagonica*. Exotic annuals may include *Bromus arvensis (= Bromus japonicus), Bromus tectorum, Halogeton glomeratus, Melilotus officinalis, Salsola kali*, and many others.

ENVIRONMENT & DYNAMICS

Environmental Description: Elevations range from 100-2700 m. Climate is semi-arid with about half the annual precipitation occurring in July to September often as high-intensity, convective storms. Sites include plains, alkaline flats, mesas and plateaus, hillslopes, alkaline flats around playas and along drainages. Sites are typically flat to gentle-sloped, but occasionally occur on moderate slopes up to 45%. Sites include all aspects. Soil textures are typically stony, sandy loams, but range to fine-textured silty clays and are typically shallow to moderate deep.

Dynamics: Stands dominated by *Krascheninnikovia lanata* occur locally. They often have sharp ecotones with other vegetation types and are thought to be an edaphic community type by Daubenmire (1970). However, edaphic factors separating these stands from adjacent stands have yet to be found. Soil characteristics, such as excessive amounts of calcium carbonate or lack of the nutrients N, P, K or S, have been studied and do not appear to control the occurrence of this alliance (Daubenmire 1970, DeVelice et al. 1995). *Krascheninnikovia lanata* is also important range forage. It is highly palatable in the winter and is tolerant of heavy browsing (Daubenmire 1970). Many stands have long histories of grazing impacts and are thought to be in a degraded state (Francis 1986, DeVelice et al. 1995). These stands often have low perennial herbaceous cover and many have high cover of the exotic annual grass *Bromus tectorum* (Daubenmire 1970, Francis 1986). DeVelice et al. (1995) described stands dominated by *Krascheninnikovia lanata* and *Hesperostipa comata*, which they considered to be a seral stage of a *Krascheninnikovia lanata / Pseudoroegneria spicata* community type that is not currently described in the National Vegetation Classification. Francis (1986) predicts that with protection from grazing, *Gutierrezia sarothrae* cover will decrease and *Krascheninnikovia lanata, Sporobolus airoides*, and *Achnatherum hymenoides* will increase in cover.

DISTRIBUTION

Geographic Range: Stands in this minor dwarf-shrubland alliance occur on the Columbia Plateau and Great Basin, and extend east to the northwestern Great Plains and south to the Mojave Desert, northern Chihuahuan Desert and Colorado Plateau. It is reported from eastern Washington and Oregon, Idaho, Montana, Nevada, New Mexico, Colorado and likely occurs in Utah, California, and Saskatchewan, Canada.

Nations: CA?, US
States/Provinces: AZ, CA, CO, ID, KS, MT, NM, NV, OR, SK?, TX, UT, WA, WY
TNC Ecoregions [optional]: 6:C, 11:C, 13:C, 15:C, 17:C
USFS Ecoregions (2007): 262A:CC, 322Al:CCC, 322Av:CCC, 341D:CC, 341Fa:CCC, 341Fb:CCC, 341Fc:CCC, 341Fe:CCC, 341Ff:CCC, 342B:CC, M262A:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Lake Mead, Mojave); USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Eurotia lanata - Poa secunda* habitat type (Daubenmire 1970)
- **?** *Eurotia lanata* Series (Johnston 1987) [includes the *Eurotia lanata/Hilaria jamesii* plant association.]
- **=** *Krascheninnikovia lanata* (Winterfat scrubland) Alliance (Sawyer et al. 2009) [36.500.00]
- **=** *Krascheninnikovia lanata* Shrubland Alliance (Evens et al. 2014)
- **=** *Krascheninnikovia lanata* Shrubland Alliance (CNPS 2017) [36.500.00]
- **><** Mixed Saltdesert Shrub - Playa (Chappell et al. 1997)
- **><** Shadscale Scrub (#36140) (Holland 1986b)

- **?** Winterfat Series (Sawyer and Keeler-Wolf 1995)

LOWER LEVEL UNITS

Associations:
- CEGL001321 *Krascheninnikovia lanata / Bouteloua gracilis* Dwarf-shrub Grassland
- CEGL001327 *Krascheninnikovia lanata / Hesperostipa comata* Dwarf-shrubland
- CEGL001325 *Krascheninnikovia lanata / Phlox* spp. Dwarf-shrubland
- CEGL001326 *Krascheninnikovia lanata / Poa secunda* Dwarf-shrubland
- CEGL001324 *Krascheninnikovia lanata / Pascopyrum smithii - Bouteloua gracilis* Dwarf-shrub Grassland
- CEGL001320 *Krascheninnikovia lanata* Dwarf-shrubland
- CEGL001323 *Krascheninnikovia lanata / Achnatherum hymenoides* Dwarf-shrubland
- CEGL001322 *Krascheninnikovia lanata / Pleuraphis jamesii* Dwarf-shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: CNPS 2017, Carey 1995, Chappell et al. 1997, Daubenmire 1970, DeVelice et al. 1991, DeVelice et al. 1995, Evens et al. 2014, Faber-Langendoen et al. 2017b, Francis 1986, Holland 1986b, Johnston 1987, Keeler-Wolf and Thomas 2000, MacMahon 1988, Reid et al. 1999, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Stout et al. 2013, Thomas et al. 2004, Turner 1982c, VegCAMP and AIS 2013, West 1988, Young et al. 1977, Young et al. 2007b

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G310. Intermountain Semi-Desert Steppe & Shrubland

A2650. Opuntia spp. Colorado Plateau Shrubland Alliance

Type Concept Sentence: This alliance is dominated by clumps of *Opuntia* cacti and occurs in disturbed or extremely xeric sites with coarse soils throughout the Colorado Plateau.

OVERVIEW

Scientific Name: *Opuntia* spp. Colorado Plateau Shrubland Alliance
Common Name (Translated Scientific Name): Prickly-pear species Colorado Plateau Shrubland Alliance
Colloquial Name: Colorado Plateau Prickly-pear Shrubland

Type Concept: Clumps of *Opuntia* cacti dominate the community, with sparse to moderate cover by grasses and forbs growing within and between clumps. *Bromus tectorum* is the most common and abundant herbaceous species in this community, but even disturbed examples generally include some cover of native grasses and forbs, including *Achnatherum hymenoides, Bouteloua gracilis, Hesperostipa comata, Pleuraphis jamesii*, and *Sphaeralcea* spp. Cryptobiotic soil crusts may be well-developed in undisturbed sites. This alliance occurs throughout the Colorado Plateau in disturbed or extremely xeric sites with coarse soils. Many stands occur on eolian or alluvial deposits on gentle to moderate slopes.

Classification Comments: This is a Colorado Plateau-centric alliance that is placed within an ecological group with alliances that span multiple ecoregions.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Low shrublands composed of one or more species of *Opuntia*, most typically in association with native and non-native grasses and disturbed sites of the Colorado Plateau.

VEGETATION

Physiognomy and Structure:

Floristics: This is often a somewhat sparse community, with total perennial vegetation cover rarely exceeding 30%. In wet years, weedy and native annual herbaceous species may provide more than 50% cover. *Opuntia polyacantha* and *Opuntia phaeacantha* are

the most common dominant cacti in this alliance, occurring in patches or clumps throughout the community. Scattered individuals of other shrub species may also occur in this community, particularly *Atriplex canescens*. Other shrubs present may include *Artemisia tridentata ssp. wyomingensis, Atriplex confertifolia, Chrysothamnus viscidiflorus, Ephedra* spp., *Gutierrezia sarothrae, Grayia spinosa*, and *Sarcobatus vermiculatus*. The exotic annual grass *Bromus tectorum* frequently dominates the herbaceous layer along with weedy and exotic forbs such as *Astragalus nuttallianus* and *Erodium cicutarium*; however, even in the most disturbed sites, some native forbs and grasses may persist, including *Achnatherum hymenoides, Bouteloua gracilis, Hesperostipa comata, Pleuraphis jamesii*, and *Sphaeralcea* spp.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs on alluvial terraces, slopes and ridges throughout the Colorado Plateau. Sites are often disturbed or, if undisturbed, are extremely xeric. Slopes range from gently sloping to moderately steep, and elevations range from 1450 to 1750 m (4757-5740 feet). Substrates include sandy alluvium, eolian sands, and coarse black migmatitic gravels. Soils are usually coarse-textured, either sandy or gravelly. At Canyon de Chelly, Arizona, this alliance often indicates the location of Anasazi ruins that have become buried by eolian sands.

Dynamics: In all but the most xeric habitats, dominance by *Opuntia* species generally indicates heavy, chronic disturbance, such as grazing by domestic livestock (Rice and Westoby 1978). However, in some extremely xeric habitats, such as sandsheets or coarse dark metamorphic gravels, *Opuntia* will dominate a community that otherwise shows few signs of disturbance and may have a well-developed cryptobiotic soil crust.

DISTRIBUTION

Geographic Range: This alliance is currently known from the Colorado Plateau of western Colorado, northern Arizona and southeastern Utah.

Nations: US
States/Provinces: AZ, CO, UT
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL002299 *Opuntia polyacantha / Pleuraphis jamesii* Shrubland
- CEGL004009 *Opuntia (fragilis, polyacantha, phaeacantha)* Shrubland

AUTHORSHIP

Primary Concept Source: J. Coles and K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Faber-Langendoen et al. 2017b, Rice and Westoby 1978

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
3.B.1.Ne.1.e. M171 Great Basin-Intermountain Dry Shrubland & Grassland

G775. Intermountain Sparsely Vegetated Dune Scrub & Grassland

Type Concept Sentence: This shrubby and herbaceous group occurs on sandy sites in the intermountain western U.S. and is characterized by a sparse to open vegetation layer composed of shrubs *Ericameria nauseosa, Eriogonum leptocladon*, or *Tetradymia tetrameres* and herbaceous species *Achnatherum hymenoides, Leymus flavescens, Psoralidium lanceolatum*, and *Redfieldia flexuosa*, which may dominate solely or in a combination on active and stable dunes and sandsheets.

OVERVIEW

Scientific Name: Intermountain Sparsely Vegetated Dune Scrub & Grassland Group

Common Name (Translated Scientific Name): Intermountain Sparsely Vegetated Dune Scrub & Grassland Group
Colloquial Name: Rubber Rabbitbrush - Sand Buckwheat - Four-part Horsebrush Sparse Scrub

Type Concept: This group occurs on sandy sites in the intermountain western U.S. from the Columbia Basin, Great Basin, and Centennial Valley in Montana, Wyoming Basins, Colorado Plateau and the San Luis Valley of southern Colorado. This group is characterized by open to sparse (<15% total cover) shrub and/or herbaceous vegetation. Characteristic shrubs include *Ericameria nauseosa, Eriogonum leptocladon*, or *Tetradymia tetrameres*. Diagnostic herbaceous species are *Achnatherum hymenoides, Leymus flavescens, Muhlenbergia pungens, Psoralidium lanceolatum*, and *Redfieldia flexuosa*, which may dominate solely or in a combination. There are several associated species, including graminoids such as *Calamovilfa gigantea, Hesperostipa comata (= Stipa comata), Schizachyrium scoparium*, and forbs *Heliotropium convolvulaceum, Machaeranthera canescens (= Aster canescens), Oxytheca dendroidea (= Eriogonum dendroideum), Polanisia dodecandra ssp. trachysperma, Polanisia jamesii, Reverchonia arenaria, Sophora stenophylla, Scabrethia scabra (= Wyethia scabra)*, and the annual forb *Eriogonum deflexum*. Stands occur on active and stable dunes and sandsheets. Elevations range from 1500-2400 m. All sites have cool, semi-arid continental climates. Substrates are eolian sand.

Classification Comments: The majority of this group occurs in the intermountain western U.S.; however, two of the associations may extend out into the shortgrass region of the western Great Plains. These associations need further review as far as floristic composition and range such as on "blowout" sites where sandy plains or stabilized dunes have been disturbed (Ramaley 1939b). Shrubby semi-arid dune communities in this group need further review.

Similar NVC Types:
- G675 North American Warm Semi-Desert Dune & Sand Flats: also occurs on dunes and sandsheets, but in warm, semi-arid climate.

Diagnostic Characteristics: This group is characterized by a sparse to open shrub and/or herbaceous layer composed of shrubs *Ericameria nauseosa, Eriogonum leptocladon, Tetradymia tetrameres*, and perennial grasses and forbs *Achnatherum hymenoides, Leymus flavescens, Psoralidium lanceolatum*, and *Redfieldia flexuosa*, which may dominate solely or in a combination on rapidly drained sands.

VEGETATION

Physiognomy and Structure: Vegetation has a sparse cover of xeromorphic shrubs and dwarf-shrubs less than 2 m tall and/or a short herbaceous layer that is typically sparse and is dominated by perennial graminoids, with ephemeral forbs and grasses present seasonally.

Floristics: This group occurs on sandy sites in the intermountain western U.S. from the Columbia Basin, Great Basin, and Centennial Valley in Montana, Wyoming Basins, Colorado Plateau and the San Luis Valley of southern Colorado. This group is characterized by open to sparse (<15% total cover) shrub and/or herbaceous vegetation. Dominant shrubs include *Ericameria nauseosa, Eriogonum leptocladon*, or *Tetradymia tetrameres*. Diagnostic herbaceous species are *Achnatherum hymenoides, Leymus flavescens, Muhlenbergia pungens, Psoralidium lanceolatum*, and *Redfieldia flexuosa*, which may dominate solely or in a combination. There are several associated species, including graminoids such as *Calamovilfa gigantea, Hesperostipa comata (= Stipa comata), Schizachyrium scoparium*, and forbs *Heliotropium convolvulaceum, Machaeranthera canescens (= Aster canescens), Oxytheca dendroidea (= Eriogonum dendroideum), Polanisia dodecandra ssp. trachysperma, Polanisia jamesii, Reverchonia arenaria, Sophora stenophylla, Scabrethia scabra (= Wyethia scabra)*, and the annual forb *Eriogonum deflexum*. On the Colorado Plateau, active dune sites have codominants such as *Calamovilfa gigantea, Psoralidium lanceolatum, Reverchonia arenaria, Sophora stenophylla*, and *Scabrethia scabra* (Castle 1954, Bowers 1982).

ENVIRONMENT & DYNAMICS

Environmental Description: This group occurs on sandy sites in the intermountain western U.S. from the Columbia Basin, Great Basin, and Centennial Valley in Montana, Wyoming Basins, Colorado Plateau and the San Luis Valley of southern Colorado. Elevations range from 1500-2400 m. Stands occur on active and stable dunes and sandsheets. In the San Luis Valley in Colorado, at approximately 2400 m elevation, stands occur on a sandsheet on the windward side of dunes (R. Rondeau, CONHP, pers. comm.). In semi-arid dune systems in the Colorado Plateau and Great Basin, stands occur in active dunes (Van Pelt 1978, Bowers 1982). They are early-seral communities that colonize bare sand in interdune valleys. The plants adapt to sand deposition by stem elongation but eventually will be buried or dug up as the dunes move. On dune margins, stabilization may occur as other sand-adapted species colonize, eventually succeeding into the adjacent desert scrub community. In the Colorado Plateau of southeastern Utah and western Colorado, this vegetation is often limited to small stands on sandy point bars, islands or terraces in the beds of intermittent streams. These stands are subject to periodic flooding but are usually isolated from the water table. A few Colorado Plateau stands

occupy unconsolidated sands in areas with active dunes. Additional review is needed to characterize the environments in its full range.

Climate: This group occurs in a cool, semi-arid continental climate. *Soil/substrate/hydrology:* Substrates are eolian sands.

Dynamics: *Achnatherum hymenoides* is one of the most drought-tolerant grasses in the western U.S. and occurs on a variety of xeric sites (USFS 1937). It is also a valuable forage grass in arid and semi-arid regions. Improperly managed livestock grazing could increase soil erosion, decrease cover of this palatable plant species and increase weedy species (USFS 1937).

Dunes gradually become smaller and reach a threshold of size, below which they become stabilized by vegetation. This vegetation occurs on recent sand deposits, but over time, if deposition slows, it will succeed to shrubland or grassland vegetation types.

DISTRIBUTION

Geographic Range: This group occurs on sandy sites in the intermountain western U.S. from the Columbia Basin, Great Basin, Centennial Valley in Montana, Wyoming Basins, Colorado Plateau and the San Luis Valley of southern Colorado.

Spatial Scale & Pattern [optional]:
Nations: US
States/Provinces: AZ, CO, ID, MT, NV, OR, UT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Alliances:
- A4011 *Redfieldia flexuosa - Leymus flavescens - Achnatherum hymenoides* Grassland Alliance
- A4149 *Ericameria nauseosa - Eriogonum leptocladon - Tetradymia tetrameres* Sparse Scrub Alliance

AUTHORSHIP

Primary Concept Source: Faber-Langendoen et al. (2015)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 04/16/2015
Classif Resp Region: West
Internal Author: MSR 8-13, mod. KAS 4-15

REFERENCES

References: Faber-Langendoen et al. 2017a

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G775. Intermountain Sparsely Vegetated Dune Scrub & Grassland

A4149. Ericameria nauseosa - Eriogonum leptocladon - Tetradymia tetrameres Sparse Scrub Alliance

Type Concept Sentence: Sparsely vegetated scrub of sand dunes, sandsheets and sand blowouts of the western U.S. dominated by *Ericameria nauseosa, Eriogonum leptocladon*, and/or *Tetradymia tetrameres*, with understory of herbaceous species such as *Achnatherum hymenoides, Leymus flavescens, Muhlenbergia pungens*, and/or *Psoralidium lanceolatum*.

OVERVIEW

Scientific Name: *Ericameria nauseosa - Eriogonum leptocladon - Tetradymia tetrameres* Sparse Scrub Alliance
Common Name (Translated Scientific Name): Rubber Rabbitbrush - Sand Buckwheat - Four-part Horsebrush Sparse Scrub Alliance
Colloquial Name: Rubber Rabbitbrush - Sand Buckwheat - Four-part Horsebrush Sparse Scrub

Type Concept: This sparse shrubland alliance of the western U.S. has open and low vegetative cover from 15 to 50%. Dominant diagnostic shrub species are *Ericameria nauseosa, Eriogonum leptocladon*, and/or *Tetradymia tetrameres*. Dominant and consistently present understory herbaceous species include *Achnatherum hymenoides, Leymus flavescens, Muhlenbergia pungens*, and/or *Psoralidium lanceolatum*. This sparse community is characteristic of flat to rolling areas of sandsheets, stabilized or moving

sand dunes, sand blowouts, or colluvial slopes, between 1220 and 2505 m (4000-8218 feet) elevation. Sites include valley floors, floodplains, and stream terraces, are gentle to moderately sloping, but range from flat to steep and may occur on any aspect. Soils are sands, loamy sands and sandy loams derived from local eroding sandstone or eolian sands. Most of the unvegetated surface is bare soil, although incipient biological soil crusts (consisting mostly of dark cyanobacteria) may cover up to 20% of the ground in more stable sites.

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics:

VEGETATION

Physiognomy and Structure: Open and sparse low shrubland (<2 m height).

Floristics: This sparse shrubland has open and low vegetative cover from 15 to 60%. Dominant diagnostic shrub species are *Ericameria nauseosa, Eriogonum leptocladon*, and/or *Tetradymia tetrameres*. Dominant and consistently present understory herbaceous species include *Achnatherum hymenoides, Leymus flavescens, Muhlenbergia pungens*, and *Psoralidium lanceolatum*. Other common shrub associates include *Chrysothamnus viscidiflorus, Ephedra torreyana, Artemisia bigelovii, Atriplex canescens, Eriogonum corymbosum, Gutierrezia sarothrae, Ipomopsis congesta, Opuntia polyacantha, Sarcobatus vermiculatus*, and *Yucca elata (= var. utahensis)*. Associated herbaceous species that have very low cover include graminoids such as *Aristida purpurea, Hesperostipa comata, Pleuraphis jamesii*, and *Sporobolus airoides*, and forbs such as *Abronia fragrans, Chamaesyce glyptosperma, Cirsium calcareum, Cirsium* spp., *Eriogonum cernuum, Gayophytum humile (= Gayophytum nuttallii), Heterotheca villosa, Lygodesmia grandiflora, Lygodesmia juncea, Machaeranthera canescens (= Aster canescens), Oenothera pallida, Oxytheca dendroidea (= Eriogonum dendroideum), Penstemon palmeri, Phacelia hastata var. hastata (= Phacelia leucophylla), Phacelia heterophylla, Salsola tragus, Sophora stenophylla, Sphaeralcea coccinea, Streptanthella longirostris*, and *Tragopogon dubius*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs on sandsheets, sand blowouts, and sand dunes both moving and stabilized. Soils are sands, loamy sands and sandy loams derived from local eroding sandstone or eolian sands.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is found on southeastern Idaho Snake River basalts, Great Sand Dunes of south-central Colorado, and on the Colorado Plateau of southern and eastern Utah, northeastern Arizona and western Colorado.

Nations: US
States/Provinces: AZ, CO, ID, NV, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: NPS (Canyonlands, Capitol Reef, Dinosaur, Glen Canyon, Great Sand Dunes, Navajo, Zion); USFWS (Minidoka, Ouray)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL002980 *Ericameria nauseosa* Sand Deposit Sparse Shrubland
- CEGL002759 *Tetradymia tetrameres* Dune Sparse Vegetation
- CEGL002821 *Eriogonum leptocladon / Muhlenbergia pungens* Dwarf-shrubland
- CEGL002921 *Ericameria nauseosa / Muhlenbergia pungens - Achnatherum hymenoides* Shrub Grassland
- CEGL002822 *Eriogonum leptocladon* Sparse Vegetation
- CEGL001329 *Ericameria nauseosa / Leymus flavescens / Psoralidium lanceolatum* Shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2014)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2016/09/27

REFERENCES

References: Faber-Langendoen et al. 2017b

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G775. Intermountain Sparsely Vegetated Dune Scrub & Grassland

A4011. Redfieldia flexuosa - Leymus flavescens - Achnatherum hymenoides Grassland Alliance

Type Concept Sentence: This herbaceous alliance occurs on sandy sites in the intermountain western U.S. and is characterized by a sparse to an open herbaceous layer composed of *Redfieldia flexuosa, Leymus flavescens, Achnatherum hymenoides*, and *Psoralidium lanceolatum*, which may dominate solely or in combination on active and stable dunes and sandsheets.

OVERVIEW

Scientific Name: *Redfieldia flexuosa - Leymus flavescens - Achnatherum hymenoides* Grassland Alliance
Common Name (Translated Scientific Name): Blowout Grass - Yellow Wildrye - Indian Ricegrass Grassland Alliance
Colloquial Name: Blowout Grass - Yellow Wildrye - Indian Ricegrass Grassland

Type Concept: This herbaceous alliance occurs on sandy sites in the intermountain western U.S. from the Columbia Basin, Great Basin, Centennial Valley in Montana, Wyoming Basins, Colorado Plateau and the San Luis Valley of southern Colorado. This herbaceous layer is characterized by a sparsely vegetated to open herbaceous layer composed of *Redfieldia flexuosa, Leymus flavescens, Achnatherum hymenoides*, and *Psoralidium lanceolatum*, which may dominate solely or in combination. There are several associated species, including graminoids *Muhlenbergia pungens, Hesperostipa comata (= Stipa comata), Schizachyrium scoparium, Calamovilfa gigantea*, forbs *Heliotropium convolvulaceum, Machaeranthera canescens (= Aster canescens), Oxytheca dendroidea (= Eriogonum dendroideum), Polanisia dodecandra ssp. trachysperma, Polanisia jamesii, Reverchonia arenaria, Sophora stenophylla, Scabrethia scabra (= Wyethia scabra)*, and the annual forb *Eriogonum deflexum*. Stands occur on active and stable dunes, sand blowouts and sandsheets. Elevations range from 1500-2400 m. All sites have semi-arid climates. Substrates are eolian sands.

Classification Comments: The majority of this alliance occurs in the intermountain western U.S.; however, two of the associations may extend out into the shortgrass region of the western Great Plains. These associations need further review of floristic composition and range, such as on "blowout" sites where sandy plains or stabilized dunes have been disturbed (Ramaley 1939b).

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: This alliance is characterized by a sparse to open herbaceous layer composed of *Redfieldia flexuosa, Leymus flavescens, Achnatherum hymenoides*, and *Psoralidium lanceolatum*, which may dominate solely or in combination on rapidly drained sands.

VEGETATION

Physiognomy and Structure: The vegetation in this alliance has a sparse to moderate graminoid cover dominated by medium-tall bunchgrasses. Forb cover is generally sparse.

Floristics: This intermountain western U.S. herbaceous alliance is characterized by a sparsely vegetated to open herbaceous layer composed of *Redfieldia flexuosa, Leymus flavescens, Achnatherum hymenoides*, and *Psoralidium lanceolatum*, which may dominate solely or in combination. There are several associated species, including graminoids *Muhlenbergia pungens, Hesperostipa comata (= Stipa comata), Schizachyrium scoparium, Calamovilfa gigantea*, forbs *Heliotropium convolvulaceum, Machaeranthera canescens (= Aster canescens), Oxytheca dendroidea (= Eriogonum dendroideum), Polanisia dodecandra ssp. trachysperma, Polanisia jamesii, Reverchonia arenaria, Sophora stenophylla, Scabrethia scabra (= Wyethia scabra)*, and the annual forb *Eriogonum deflexum*. On the Colorado Plateau, active dune sites have codominants such as *Calamovilfa gigantea, Psoralidium lanceolatum, Reverchonia arenaria, Sophora stenophylla*, and *Scabrethia scabra* (Castle 1954, Bowers 1982).

ENVIRONMENT & DYNAMICS

Environmental Description: Stands of this herbaceous alliance occur in the intermountain western U.S. on active and stable dunes, sandsheets, and small isolated sand blowouts. Elevations range from 1500-2400 m. All sites have semi-arid climates. Substrates are eolian sands. In the San Luis Valley in Colorado, at approximately 2400 m elevation, stands occur on a sandsheet on the windward side of dunes (R. Rondeau, CONHP, pers. comm.). In semi-arid dune systems in the Colorado Plateau and Great Basin, stands of this alliance occur in active dunes (Van Pelt 1978, Bowers 1982). They are early-seral communities that colonize bare sand in interdune valleys. The plants adapt to sand deposition by stem elongation but eventually will be buried or dug up as the dunes move. On dune margins, stabilization may occur as other sand-adapted species colonize, eventually succeeding into the adjacent desert scrub community. In the Colorado Plateau of southeastern Utah and western Colorado, this alliance is often limited to small stands on sandy point bars, islands or terraces in the beds of intermittent streams. These stands are subject to periodic flooding but are usually isolated from the water table. A few Colorado Plateau stands occupy unconsolidated sands in areas with active dunes. In the Snake River Valley, this community has been documented in sand blowouts in the rolling hills of sagebrush. Additional review is needed to characterize the environments of this alliance in its full range.

Dynamics: *Achnatherum hymenoides* is one of the most drought-tolerant grasses in the western U.S. and occurs on a variety of xeric sites (USFS 1937). It is also a valuable forage grass in arid and semi-arid regions. Improperly managed livestock grazing could increase soil erosion, decrease cover of this palatable plant species and increase weedy species (USFS 1937).

Dunes gradually become smaller and reach a threshold of size, below which they become stabilized by vegetation. This alliance occurs on recent sand deposits, but over time, if deposition slows, it will succeed to shrubby vegetation types.

DISTRIBUTION

Geographic Range: This alliance occurs on sandy sites in the intermountain western U.S. from the Columbia Basin, Great Basin, Centennial Valley in Montana, Wyoming Basins, Colorado Plateau and the San Luis Valley of southern Colorado.

Nations: CA?, US
States/Provinces: CO, ID, MT, NV, OR, UT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL001650 *Achnatherum hymenoides - Psoralidium lanceolatum* Grassland
- CEGL002917 *Redfieldia flexuosa - (Psoralidium lanceolatum)* Grassland
- CEGL001563 *Leymus flavescens* Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, Faber-Langendoen et al. (2014)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by M.S. Reid.
Version Date: 2016/10/17

REFERENCES

References: Bowers 1982, Bowers 1984, Burgess and Northington 1977, Castle 1954, Chadwick and Dalke 1965, Daubenmire 1970, Faber-Langendoen et al. 2017b, Franklin and Dyrness 1973, Ramaley 1937, Ramaley 1939b, Ramaley 1942, Reid 1980, Reid et al. 1994, Strong 1980, Terwilliger and Tiedemann 1978, Tiedemann et al. 1987, USFS 1937, Van Pelt 1978, WNDD unpubl. data

M170. Great Basin-Intermountain Dwarf Sagebrush Steppe & Shrubland

This semi-arid intermountain western U.S. macrogroup is characterized by short sagebrush taxa that form an open to moderately dense dwarf-shrub layer on shallow, rocky, calcareous or alkaline soils. Stands are dominated by one of several diagnostic *Artemisia* taxa depending on location and habitat, including *Artemisia arbuscula ssp. arbuscula, Artemisia arbuscula ssp. longiloba, Artemisia arbuscula ssp. longicaulis, Artemisia arbuscula ssp. thermopola, Artemisia bigelovii, Artemisia frigida, Artemisia nova, Artemisia rigida*, or *Artemisia tripartita ssp. rupicola*.

3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
3.B.1.Ne.2.a. M170 Great Basin-Intermountain Dwarf Sagebrush Steppe & Shrubland

G307. Columbia Plateau Scabland Dwarf-shrubland

Type Concept Sentence: This group is found in the Columbia Plateau region and forms extensive low shrublands dominated by diagnostic dwarf-shrub, *Artemisia rigida* along with other species, particularly diagnostic *Eriogonum* spp. such as *Eriogonum compositum, Eriogonum douglasii, Eriogonum microthecum, Eriogonum niveum, Eriogonum sphaerocephalum, Eriogonum strictum*, and *Eriogonum thymoides*, which sometimes dominate the dwarf-shrub layer without *Artemisia rigida*.

OVERVIEW

Scientific Name: *Artemisia rigida - Eriogonum* spp. Dwarf-shrubland & Steppe Group
Common Name (Translated Scientific Name): Scabland Sagebrush - Buckwheat species Dwarf-shrubland & Steppe Group
Colloquial Name: Purple Sage Dwarf-shrubland

Type Concept: This scabland group is found in the Columbia Plateau region and forms extensive low shrublands. Total vegetation cover is typically low, generally less than 50% and often much less than that. Vegetation is characterized by an open dwarf-shrub canopy dominated by *Artemisia rigida* or *Salvia dorrii* along with other dwarf-shrub and suffrutescent species, particularly diagnostic *Eriogonum* spp. such as *Eriogonum compositum, Eriogonum douglasii, Eriogonum microthecum, Eriogonum niveum, Eriogonum sphaerocephalum, Eriogonum strictum*, and *Eriogonum thymoides*, which sometimes dominate the dwarf-shrub layer without *Artemisia rigida* or *Salvia dorrii*. Other shrubs, especially shrubby *Artemisia* spp., are uncommon in this group. These stands are characterized by low cover of perennial bunchgrasses, primarily *Poa secunda*, but may include *Danthonia unispicata, Elymus elymoides, Festuca idahoensis*, or *Pseudoroegneria spicata*, as well as scattered forbs, including species of *Allium, Antennaria, Balsamorhiza, Lomatium, Phlox*, and *Sedum*. Individual sites can be dominated by grasses and semi-woody forbs, such as *Physaria oregona* or *Nestotus stenophyllus (= Stenotus stenophyllus)*. Annuals may be seasonally abundant, and cover of moss and lichen is often high in undisturbed areas (1-60% cover). These xeric shrublands occur under relatively extreme soil-moisture conditions. Substrates are typically shallow lithic soils with limited water-holding capacity over fractured basalt. Because of poor drainage through basalt, these soils are often saturated from fall to spring by winter precipitation but typically dry out completely to bedrock by midsummer.

Classification Comments:

Similar NVC Types:

Diagnostic Characteristics: This group is characterized by an open dwarf-shrub canopy dominated or codominated by diagnostic species *Artemisia rigida, Eriogonum compositum, Eriogonum douglasii, Eriogonum microthecum, Eriogonum niveum, Eriogonum sphaerocephalum, Eriogonum strictum, Eriogonum thymoides*, and/or *Salvia dorrii*. *Poa secunda* and other dry-site grasses and forbs may be present usually with low cover.

VEGETATION

Physiognomy and Structure: Vegetation structure is a sparse to moderately dense dwarf-shrub canopy (10-25% cover and <0.5 m tall). Occasionally, woody cover may exceed 25%. If present, the herbaceous layer typically has low cover.

Floristics: This group is found in the Columbia Plateau region and forms extensive low shrublands. These xeric shrublands occur under relatively extreme soil-moisture conditions. Vegetation is characterized by an open dwarf-shrub canopy dominated by *Artemisia rigida* or *Salvia dorrii* along with other dwarf-shrub species, particularly *Eriogonum* spp. which sometimes dominates the dwarf-shrub layer without *Artemisia rigida* or *Salvia dorrii*. Diagnostic species of *Eriogonum* include *Eriogonum compositum, Eriogonum douglasii, Eriogonum microthecum, Eriogonum niveum, Eriogonum sphaerocephalum, Eriogonum strictum*, and *Eriogonum thymoides*. Other shrubs are uncommon. This group does not include mixed stands codominated by *Artemisia rigida* and other *Artemisia* species such as *Artemisia tridentata*. Low cover of perennial bunchgrasses, such as *Danthonia unispicata, Elymus elymoides, Festuca idahoensis*, or primarily *Poa secunda*, as well as scattered forbs, including species of *Allium, Antennaria, Balsamorhiza, Lomatium, Phlox*, and *Sedum*, characterize these sites. Individual sites can be dominated by grasses and semi-woody forbs, such as *Nestotus stenophyllus (= Stenotus stenophyllus)*. Annuals may be seasonally abundant, and cover of moss and lichen is often high in undisturbed areas (1-60% cover).

ENVIRONMENT & DYNAMICS

Environmental Description: This scabland group is found in the Columbia Plateau region and forms extensive low shrublands. These xeric shrublands occur under relatively extreme soil-moisture conditions. Substrates are typically shallow lithic soils with limited

water-holding capacity over fractured basalt. Because of poor drainage through basalt, these soils are often saturated from fall to spring by winter precipitation but typically dry out completely to bedrock by midsummer. Total vegetation cover is typically low, generally less than 50% and often much less than that.

Dynamics:

DISTRIBUTION

Geographic Range: This group occurs in the Columbia Plateau region of southern Idaho, eastern Oregon and eastern Washington, and extreme northern Nevada.

Spatial Scale & Pattern [optional]: Matrix
Nations: US
States/Provinces: CA, ID, NV, OR, UT?, WA
TNC Ecoregions [optional]: 6:C, 7:C, 68:C
USFS Ecoregions (2007): 331A:CC, 341E:C?, 341G:CC, 342B:CC, 342C:CC, 342D:CC, 342H:CC, 342I:CC, 342J:CC, M242C:CC, M242D:CC, M261D:C?, M261G:CC, M332G:CC, M333A:PP, M341A:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate. USNVC Confidence from peer reviewer, not AE.

SYNONYMY

- **=** Edaphic Series - Lithosols (Daubenmire 1970)

LOWER LEVEL UNITS

Alliances:
- A1568 *Eriogonum* spp. / *Poa secunda* Dwarf-shrub Steppe Alliance
- A1129 *Salvia dorrii* Dwarf-shrubland Alliance
- A1574 *Artemisia rigida* Steppe & Shrubland Alliance
- A1107 *Eriogonum microthecum* Dwarf-shrubland Alliance

AUTHORSHIP

Primary Concept Source: R.F. Daubenmire (1970)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 11/06/2015
Classif Resp Region: West
Internal Author: KAS 3-10, 11-15

REFERENCES

References: Copeland 1980a, Daubenmire 1970, Faber-Langendoen et al. 2017a, Franklin and Dyrness 1973, Ganskopp 1979, Hall 1973, Johnson and Simon 1985, Poulton 1955, Shiflet 1994

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G307. Columbia Plateau Scabland Dwarf-shrubland

G308. Intermountain Low & Black Sagebrush Steppe & Shrubland

Type Concept Sentence: This broadly defined semi-arid sagebrush dwarf-shrubland and steppe occurs throughout much of the intermountain western U.S. and is characterized by an open to moderately dense shrub or dwarf-shrub layer that is typically dominated by one of the following: *Artemisia arbuscula ssp. arbuscula, Artemisia arbuscula ssp. longicaulis, Artemisia arbuscula ssp. longiloba, Artemisia arbuscula ssp. thermopola, Artemisia bigelovii, Artemisia frigida, Artemisia nova*, or *Artemisia tripartita ssp. rupicola* depending on environment and range of species.

OVERVIEW

Scientific Name: *Artemisia arbuscula - Artemisia bigelovii - Artemisia nova* Steppe & Shrubland Group
Common Name (Translated Scientific Name): Little Sagebrush - Bigelow's Sagebrush - Black Sagebrush Steppe & Shrubland Group
Colloquial Name: Little Sagebrush Steppe & Shrubland

Type Concept: This broadly defined semi-arid dwarf-shrubland and steppe occurs throughout much of the intermountain western U.S. The vegetation in this broadly defined shrubland and steppe group includes an open to moderately dense shrub or dwarf-shrub

layer with a sparse to dense herbaceous layer. Several different taxa of sagebrush may dominate depending on location and by habitat. *Artemisia nova* is most widespread, occurring throughout most of the region on mid- to low-elevation, gravelly, calcareous soils. *Artemisia arbuscula ssp. arbuscula* occurs on low- to high-elevation sites often on shallow, fine-textured soils with a dense clay layer that impedes drainage in spring. *Artemisia arbuscula ssp. longiloba* is widespread in the Columbia Basin and Great Basin into southwestern Wyoming and badlands in the western Great Plains. It occurs on shallow, alkaline, calcareous soils derived from shale. *Artemisia bigelovii* occurs throughout much of the Colorado Plateau and extends across northern New Mexico and southeastern Colorado on shallow soils on limestone hills and shale outcrops. Several other more restricted taxa include *Artemisia tripartita ssp. rupicola, Artemisia arbuscula ssp. longicaulis, Artemisia arbuscula ssp. thermopola*, and *Artemisia frigida*. Other shrubs present to codominant may include *Artemisia tridentata ssp. wyomingensis, Artemisia tridentata ssp. vaseyana, Ephedra torreyana, Ephedra viridis, Grayia spinosa*, or *Purshia tridentata*, depending on habitat. The herbaceous layer, if present, ranges from sparse cushion plants such as *Arenaria hookeri, Eriogonum brevicaule*, and *Phlox hoodii* to moderate to dense cover of perennial grasses. Characteristic grasses include *Achnatherum hymenoides, Bouteloua gracilis, Elymus lanceolatus, Festuca idahoensis, Hesperostipa comata, Pascopyrum smithii, Pleuraphis jamesii, Poa fendleriana, Poa secunda*, and *Pseudoroegneria spicata*. Some stands have significant biological crust formation on the soil surface. Sites are generally xeric and may be wind-blown ridges and benches, gravelly alluvial fans, hilltops, canyons, gravelly draws, and dry flats. Substrates are typically shallow, gravelly or finer-textured alkaline, calcareous soils. Most stands occur from 1000 to 3000 m elevation with some extending to 3800 m in subalpine and alpine habitats of the Sierra Nevada. Substrates are variable, but are typically alluvium derived from limestone, shale, basalt, rhyolite or volcanics.

Classification Comments: Alliances in this group are distinguished largely by the predominant species: *Artemisia nova, Artemisia bigelovii*, and the nominal subspecies of *Artemisia arbuscula*, and by the importance of the perennial graminoid layer (>20% cover) in the shrub herbaceous alliances. The *Artemisia arbuscula* subspecies are distinguished by the nominal subspecies taxonomically and by the different environments which they occupy. *Artemisia arbuscula ssp. longicaulis* Shrubland Alliance (A2548) occurs in more alkaline and less stony settings than *Artemisia arbuscula ssp. arbuscula* Steppe & Shrubland Alliance (A3219). *Artemisia arbuscula ssp. thermopola - Artemisia papposa / Festuca idahoensis* Steppe & Shrubland Alliance (A4122) occurs in more calcareous soils and has a restricted distribution. Beetle and Johnson (1982) report that *Artemisia arbuscula ssp. arbuscula* grows in soils with a high volume of gravel (even though soil may be in clay textural class, or contain a clay-rich layer that impedes drainage), and that *Artemisia arbuscula ssp. longiloba* grows in clay soils, often alkaline, that contain no gravels.

Similar NVC Types:

Diagnostic Characteristics: This group has an open to moderately dense shrub or dwarf-shrub layer with a sparse to dense herbaceous layer. Several different taxa of sagebrush are diagnostic depending on location and by habitat: *Artemisia nova, Artemisia arbuscula ssp. arbuscula, Artemisia arbuscula ssp. longiloba, Artemisia arbuscula ssp. longicaulis, Artemisia bigelovii, Artemisia tripartita ssp. rupicola, Artemisia arbuscula ssp. longicaulis, Artemisia arbuscula ssp. thermopola*, and *Artemisia frigida*. In all cases, these sagebrush taxa tend to occur in shallow, rocky, calcareous or alkaline soils, often fine-textured and sometimes with a claypan impeding drainage. Associated herbaceous taxa are semi-desert grasses and forbs.

VEGETATION

Physiognomy and Structure: The vegetation is this broadly defined shrubland and steppe group includes an open to moderately dense shrub or dwarf-shrub layer dominated by microphyllous evergreen shrubs with a sparse to dense herbaceous layer usually dominated by perennial graminoids (often bunch grasses).

Floristics: This broadly defined shrubland and steppe group includes an open to moderately dense shrub or dwarf-shrub layer with a sparse to dense herbaceous layer. Several different taxa of sagebrush may dominate depending on location and by habitat. *Artemisia nova* is most widespread, occurring throughout most of the region on mid- to low-elevation, gravelly, calcareous soils. *Artemisia arbuscula ssp. arbuscula* occurs on low- to high-elevation sites often on shallow, fine-textured soils with a dense clay layer that impedes drainage in spring. *Artemisia arbuscula ssp. longiloba* is widespread in the Columbia Basin and Great Basin into southwestern Wyoming and badlands in the western Great Plains. It occurs on shallow, alkaline, calcareous soils derived from shale. *Artemisia bigelovii* occurs throughout much of the Colorado Plateau and extends across northern New Mexico and southeastern Colorado on shallow soils on limestone hill and shale outcrops. Several other more restricted taxa may dominate, including *Artemisia tripartita ssp. rupicola* (central Wyoming), *Artemisia arbuscula ssp. longicaulis* (Lahontan Basin of northwestern Nevada, southeastern Oregon, and northeastern California), *Artemisia arbuscula ssp. thermopola* (ridgetops and benches in mountains at 1830 to 2690 m in southern Idaho), and *Artemisia frigida* (described from sites in the Rocky Mountains). Other shrubs present to codominant may include *Artemisia tridentata ssp. wyomingensis, Artemisia tridentata ssp. vaseyana, Ephedra torreyana, Ephedra viridis, Grayia spinosa*, or *Purshia tridentata*, depending on habitat. The herbaceous layer is variable. If present, it ranges from sparse cushion plants such as *Arenaria hookeri, Astragalus bisulcatus, Astragalus jejunus, Eriogonum brevicaule, Minuartia nuttallii (= Arenaria nuttallii), Phlox hoodii, Stenotus acaulis*, and *Trifolium gymnocarpon* to moderate to dense cover of perennial grasses.

Characteristic grasses may include *Achnatherum hymenoides, Achnatherum thurberianum, Bouteloua gracilis, Elymus elymoides, Elymus lanceolatus, Festuca idahoensis, Hesperostipa comata, Leymus salinus, Pascopyrum smithii, Pleuraphis jamesii, Poa fendleriana, Poa secunda*, and *Pseudoroegneria spicata*. Some stands have significant biological crust formation on soil surface.

ENVIRONMENT & DYNAMICS

Environmental Description: This broadly defined semi-arid dwarf-shrubland and steppe group occurs throughout much of the intermountain western U.S. Sites are generally xeric and may be on wind-blown, shallow, gravelly or finer-textured alkaline soils. Throughout eastern Oregon, northern Nevada, southern Idaho, western Montana, western Wyoming, and western Colorado, stands typically occur on mountain ridges and flanks and broad terraces, ranging from 1000 to 3000 m in elevation with stands extending to 3800 m elevation in subalpine and alpine habitats of the Sierra Nevada. Substrates are shallow, fine-textured soils, poorly drained clays, shallow-soiled areas, almost always very stony, characterized by recent rhyolite or basalt or are alkaline soils derived from shale (Zamora and Tueller 1973, Baker and Kennedy 1985). In central and southern Wyoming, typical sites are very windy, gently rolling hills and long, gently sloping pediments and fans with shallow, often rocky soils where this group forms the matrix vegetation and large patches on the margins of high-elevation basins. In higher elevation areas, it forms a mosaic with Intermountain Mountain Big Sagebrush Steppe & Shrubland Group (G304) and is restricted to wind-blown ridges. In the Colorado Plateau, Tavaputs Plateau and Uinta Basin, stands occur in canyons, gravelly draws, hilltops, and dry flats at elevations generally below 1800 m. Soils are often rocky, shallow, and alkaline. This group also extends across northern New Mexico and Wyoming into the western Great Plains on limestone hills and shale outcrops.

Dynamics: This broadly defined semi-arid dwarf-shrubland and steppe group occurs throughout much of the intermountain western U.S. Sites are generally xeric and may be on wind-blown, shallow, gravelly or finer-textured alkaline soils. Throughout eastern Oregon, northern Nevada, southern Idaho, western Montana, western Wyoming, and western Colorado, stands typically occur on mountain ridges and flanks and broad terraces, ranging from 1000 to 3000 m in elevation with stands extending to 3800 m elevation in subalpine and alpine habitats of the Sierra Nevada. Substrates are shallow, fine-textured soils, poorly drained clays, shallow-soiled areas, almost always very stony, characterized by recent rhyolite or basalt or are alkaline soils derived from shale (Zamora and Tueller 1973, Baker and Kennedy 1985). In central and southern Wyoming, typical sites are very windy, gently rolling hills and long, gently sloping pediments and fans with shallow, often rocky soils where this group forms the matrix vegetation and large patches on the margins of high-elevation basins. In higher elevation areas, it forms a mosaic with Intermountain Mountain Big Sagebrush Steppe & Shrubland Group (G304) and is restricted to wind-blown ridges. In the Colorado Plateau, Tavaputs Plateau and Uinta Basin, stands occur in canyons, gravelly draws, hilltops, and dry flats at elevations generally below 1800 m. Soils are often rocky, shallow, and alkaline. This group also extends across northern New Mexico and Wyoming into the western Great Plains on limestone hills and shale outcrops.

DISTRIBUTION

Geographic Range: This broadly defined semi-arid dwarf-shrubland and steppe group occurs throughout much of the intermountain western U.S.

Spatial Scale & Pattern [optional]: Large patch
Nations: US
States/Provinces: AZ, CA, CO, ID, MT, NM, NV, OR, UT, WY
TNC Ecoregions [optional]: 6:C, 8:C, 9:C, 10:C, 11:C, 12:P, 17:P, 18:C, 19:C, 20:C, 21:P, 26:C, 27:C, 28:C
USFS Ecoregions (2007): 313A:CC, 313B:CC, 313D:CC, 315A:C?, 315B:CC, 315H:CC, 321A:CC, 331A:CC, 331B:CC, 331F:CC, 331G:CC, 331K:CP, 331L:C?, 331N:CP, 341A:CC, 341B:CC, 341C:CC, 341E:CP, 341G:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CP, 342F:CC, 342G:CC, 342H:CC, 342I:CC, 342J:CC, M242C:CC, M242D:CC, M261D:CC, M261G:CC, M313A:CC, M313B:CC, M331A:C?, M331B:CC, M331D:CC, M331E:CC, M331F:CP, M331G:CC, M331H:CC, M331I:CC, M332A:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:??, M341A:CC, M341B:CC, M341C:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate. USNVC Confidence from peer reviewer, not AE. This is a very broad group and further review may suggest splitting into two or three groups.

SYNONYMY

- **=** Great Basin-Colorado Plateau sagebrush semi-desert (West 1983a)

LOWER LEVEL UNITS

Alliances:

- A3221 *Artemisia arbuscula ssp. longiloba* Steppe & Shrubland Alliance
- A3223 *Artemisia bigelovii* Steppe & Shrubland Alliance
- A3222 *Artemisia nova* Steppe & Shrubland Alliance

- A2548 *Artemisia arbuscula ssp. longicaulis* Shrubland Alliance
- A3219 *Artemisia arbuscula ssp. arbuscula* Steppe & Shrubland Alliance
- A2565 *Artemisia frigida* Dwarf-shrubland Alliance
- A4122 *Artemisia arbuscula ssp. thermopola - Artemisia papposa / Festuca idahoensis* Steppe & Shrubland Alliance

AUTHORSHIP

Primary Concept Source: N.E. West (1983a)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 11/06/2015
Classif Resp Region: West
Internal Author: KAS 3-10, 11-15

REFERENCES

References: Baker and Kennedy 1985, Beetle and Johnson 1982, Brown 1982a, Brown et al. 1979, Dick-Peddie 1993, Faber-Langendoen et al. 2017a, Francis 1986, Jones 1992b, Knight 1994, Knight et al. 1987, Shiflet 1994, West 1983a, West 1983c, Zamora and Tueller 1973

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G308. Intermountain Low & Black Sagebrush Steppe & Shrubland

A3219. Artemisia arbuscula ssp. arbuscula Steppe & Shrubland Alliance

Type Concept Sentence: Shrublands dominated by *Artemisia arbuscula ssp. arbuscula* often in association with *Artemisia tridentata*. This widespread alliance is known from cold, dry areas of the Intermountain West, as well as in dry alpine and subalpine habitats of the Sierra Nevada.

OVERVIEW

Scientific Name: *Artemisia arbuscula ssp. arbuscula* Steppe & Shrubland Alliance
Common Name (Translated Scientific Name): Little Sagebrush Steppe & Shrubland Alliance
Colloquial Name: Little Sagebrush Steppe & Shrubland

Type Concept: Structurally, this alliance may be shrub-herbaceous or shrub-dominated. The woody layer consists mainly of the low shrub *Artemisia arbuscula ssp. arbuscula*, although *Artemisia tridentata ssp. vaseyana* or *Artemisia tridentata ssp. wyomingensis* may codominate some stands. Other shrub associates may include *Artemisia nova, Chrysothamnus* spp., *Ephedra viridis, Gutierrezia sarothrae, Juniperus occidentalis, Juniperus osteosperma, Purshia tridentata*, and *Tetradymia canescens*. Perennial grasses dominate the understory which may be sparse to very dense. Dominant to common grass species include *Achnatherum thurberianum (= Stipa thurberiana), Festuca idahoensis, Leymus salinus ssp. salmonis, Pascopyrum smithii, Poa secunda, Pseudoroegneria spicata*, and *Elymus elymoides* (in areas in poor condition). *Agoseris glauca, Allium* spp., *Antennaria rosea, Balsamorhiza sagittata, Castilleja angustifolia, Phlox hoodii*, and *Phlox longifolia* are common forb species. This widespread alliance is known from cold, dry areas of the Intermountain West, as well as in dry alpine and subalpine habitats of the Sierra Nevada. Stands typically occur on shallow, rocky, poorly drained soils on a variety of landforms, from flats and depressions to slopes, ridges or alpine fell-fields. Soils are usually shallow, rocky clays, often with an impenetrable layer at less than 60 cm depth. Poor drainage often leads to perched water tables in the spring, which may control the distribution of the vegetation in this alliance and explain its patchy distribution.

Classification Comments: This widespread alliance is poorly documented in northern Nevada, and additional fieldwork is needed there.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: This alliance occurs throughout the Intermountain West. Diagnostic of this alliance is the *Artemisia arbuscula ssp. arbuscula*-dominated low-shrub layer (or codominated with >40% relative shrub cover). Graminoids dominate the understory and cover may be open to very dense.

VEGETATION

Physiognomy and Structure: This alliance is characterized by a sparse to moderate microphyllous evergreen dwarf-shrub canopy (0.1-0.4 m in height). Cespitose graminoids dominate the understory with cover ranging from 10-70% and 0.3-1.0 m tall.

Floristics: Structurally, these communities may be shrub- or shrub-herbaceous-dominated. The woody layer consists mainly of the low shrub *Artemisia arbuscula ssp. arbuscula*, although *Artemisia tridentata ssp. vaseyana* or *Artemisia tridentata ssp. wyomingensis* may codominate some stands. Other shrub associates may include *Artemisia nova, Chrysothamnus* spp., *Ephedra viridis, Gutierrezia sarothrae, Juniperus occidentalis, Juniperus osteosperma, Purshia tridentata*, and *Tetradymia canescens*. The understory vegetation is characterized by a moderate to dense herbaceous layer dominated by perennial graminoids with sparse to dense cover ranging from 10-70%. Dominant to common grass species include *Achnatherum thurberianum (= Stipa thurberiana), Danthonia californica, Festuca idahoensis, Leymus salinus ssp. salmonis, Pascopyrum smithii, Poa secunda, Pseudoroegneria spicata*, and *Elymus elymoides* (in areas in poor condition). Other grass species may include *Achnatherum hymenoides (= Oryzopsis hymenoides), Bromus carinatus, Danthonia unispicata, Hesperostipa comata (= Stipa comata), Koeleria macrantha*, and *Leymus ambiguus*. Forbs are generally much less important, but occasionally frequent. Common species include *Achillea millefolium, Agoseris glauca, Allium* spp., *Antennaria rosea, Balsamorhiza sagittata, Castilleja angustifolia, Lupinus caespitosus, Penstemon speciosus, Phlox hoodii, Phlox longifolia, Polygonum* spp., and *Stenotus acaulis (= Haplopappus acaulis)*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance is widespread in the Intermountain West, as well as in dry alpine habitats of the Sierra Nevada between 1500 and 3800 m in elevation. Precipitation ranges from 15-50(150) cm annually, with a large proportion falling as winter snow. Sawyer and Keeler-Wolf (1995) report *Artemisia arbuscula* shrublands to be associated with flats, depressions, slopes, and ridges, and that soils are either very shallow or quite poorly drained. Soils are usually shallow, rocky clays, often with an impenetrable layer at less than 60 cm depth. Beetle and Johnson (1982) report that *Artemisia arbuscula ssp. arbuscula* grows in soils with a high volume of gravel (even though soil may be in clay textural class, or contain a clay-rich layer that impedes drainage). Poor drainage often leads to elevated water tables in the spring, which may control the distribution of the vegetation in this alliance. Poor drainage may explain the occurrence of patches of *Artemisia arbuscula* shrublands in *Pinus ponderosa* woodlands or *Artemisia tridentata* shrublands. In alpine settings, the vegetation often occurs in xeric sites where snow cover is blown off or lost to sublimation.

Dynamics: Due to the low-shrub stature of *Artemisia arbuscula*, this dwarf-shrubland alliance is less susceptible to natural fire than taller *Artemisia* spp. shrublands. Grazing appears to have little effect on shrub densities, but tends to decrease the importance of tall bunch grasses and increase the cover of *Chrysothamnus* spp., forbs, and non-native grasses (*Poa bulbosa* and *Poa pratensis*). Heavy livestock grazing may deplete the perennial graminoid layer and convert stands that are shrub-herbaceous in structure to those which are strictly shrub-dominated.

DISTRIBUTION

Geographic Range: The vegetation in this alliance is presently reported from much of the Intermountain West as far west as California and Washington and south to Colorado.

Nations: US
States/Provinces: CA, CO, ID, MT, NM?, NV, OR, UT?, WA, WY
TNC Ecoregions [optional]: 4:C, 5:C, 6:C, 11:C, 12:C, 14:C
USFS Ecoregions (2007): 341D:CC, 341Fc:CCC, 341Ff:CCC, 342B:CC, M261A:CC, M261B:CC, M261D:CC, M261E:CC, M261G:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Great Basin)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** *Artemisia arbuscula ssp. arbuscula* (Little sagebrush scrub) Alliance (Sawyer et al. 2009) [35.120.00]
- **=** *Artemisia arbuscula ssp. arbuscula* Shrubland Alliance (Evens et al. 2014)
- **=** *Artemisia arbuscula* ssp. *arbuscula* Shrubland Alliance (CNPS 2017) [35.120.00]
- **><** Low Sagebrush Series (Sawyer and Keeler-Wolf 1995)
- **<** SRM Cover Type #406 - Low Sagebrush (Shiflet 1994)
- **><** Subalpine Sagebrush Scrub (#35220) (Holland 1986b)
- **><** White Mountain Fell-Field (#91140) (Holland 1986b)

LOWER LEVEL UNITS

Associations:

- CEGL002983 *Artemisia arbuscula ssp. arbuscula - Artemisia tridentata ssp. wyomingensis / Festuca idahoensis* Shrubland
- CEGL003482 *Artemisia arbuscula ssp. arbuscula / Linanthus pungens* Shrubland
- CEGL003483 *Artemisia arbuscula ssp. arbuscula / Eriogonum microthecum* Shrubland
- CEGL001412 *Artemisia arbuscula ssp. arbuscula / Pseudoroegneria spicata* Shrub Grassland
- CEGL001409 *Artemisia arbuscula ssp. arbuscula / Festuca idahoensis* Shrub Grassland

- CEGL001518 *Artemisia arbuscula ssp. arbuscula - Purshia tridentata / Pseudoroegneria spicata - Festuca idahoensis* Shrub Grassland
- CEGL001411 *Artemisia arbuscula ssp. arbuscula / Poa secunda* Shrub Grassland
- CEGL002982 *Artemisia arbuscula ssp. arbuscula - Artemisia tridentata ssp. vaseyana / Festuca idahoensis* Shrubland
- CEGL001413 *Artemisia arbuscula ssp. arbuscula / Achnatherum thurberianum* Shrub Grassland
- CEGL005473 *Artemisia arbuscula ssp. arbuscula / Hesperostipa comata* Shrubland
- CEGL001410 *Artemisia arbuscula ssp. arbuscula / Leymus salinus ssp. salmonis* Shrub Grassland

AUTHORSHIP

Primary Concept Source: D. Sarr, C. Jean, J. Kagan, P. Lyon, E. Peterson, K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Beetle and Johnson 1982, CNPS 2017, Cheng 2004, Evens et al. 2014, Faber-Langendoen et al. 2017b, Holland 1986b, Keeler-Wolf et al. 2003a, Major and Taylor 1977, Murray 1991, Sawyer and Keeler-Wolf 1995, Sawyer and Keeler-Wolf 2007, Sawyer et al. 2009, Shiflet 1994, Smith 1998b, Steinberg 2002a, Stillman 1980, Tisdale 1994b, West 1988, Young et al. 1977, Young et al. 2007b, Zamora and Tueller 1973

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G308. Intermountain Low & Black Sagebrush Steppe & Shrubland

A2548. Artemisia arbuscula ssp. longicaulis Shrubland Alliance

Type Concept Sentence: This shrubland alliance is dominated by a low-shrub layer of *Artemisia arbuscula ssp. longicaulis* and is known from cold, dry areas of the Intermountain West, in and around the Lahontan Basin of northwestern Nevada, southeastern Oregon, and northeastern California.

OVERVIEW

Scientific Name: *Artemisia arbuscula ssp. longicaulis* Shrubland Alliance
Common Name (Translated Scientific Name): Lahontan Sagebrush Shrubland Alliance
Colloquial Name: Lahontan Sagebrush Shrubland

Type Concept: The vegetation included in this shrubland alliance is dominated by a low-shrub layer that averages more than 5% cover of *Artemisia arbuscula ssp. longicaulis*. Little is known about this alliance, but shrub associates could presumably include *Artemisia arbuscula ssp. arbuscula, Artemisia tridentata ssp. wyomingensis, Atriplex confertifolia, Chrysothamnus* spp., *Ephedra* spp., *Ericameria* spp., *Grayia spinosa, Lycium shockleyi, Picrothamnus desertorum, Sarcobatus vermiculatus (= var. baileyi)*, and *Tetradymia* spp. The herbaceous layer is typically sparse, and perennial bunchgrasses may include *Achnatherum hymenoides, Achnatherum speciosum (= Stipa speciosa), Achnatherum thurberianum (= Stipa thurberiana), Elymus elymoides*, and *Poa secunda*. Forb cover is likely sparse. This alliance is known from cold, dry areas of the Intermountain West, in and around the Lahontan Basin of northwestern Nevada, southeastern Oregon, and northeastern California. Stands occur on alluvial fans, upland slopes and ridges. Soils are generally shallow and rocky.

Classification Comments: More survey and classification work are needed to fully describe this alliance. The information for this alliance comes entirely from the description of the subspecies (Winward and McArthur 1995) and is very brief. They provide the range of the subspecies, a number of frequent associates, and state that it often occurs in pure stands.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Diagnostic of this alliance is the *Artemisia arbuscula ssp. longicaulis*-dominated shrub layer that has over 5% cover of the nominal species that contributes at least 40% of the total shrub cover.

VEGETATION

Physiognomy and Structure: This alliance is characterized by a sparse to moderately dense microphyllous evergreen dwarf-shrub canopy (0.1-0.4 m in height). Cespitose graminoids dominate the sparse understory.

Floristics: The vegetation included in this alliance is dominated by a low-shrub layer that averages more than 5% cover of *Artemisia arbuscula ssp. longicaulis*. Shrub associates could presumably include *Artemisia arbuscula ssp. arbuscula, Artemisia tridentata ssp. wyomingensis, Atriplex confertifolia, Chrysothamnus* spp., *Ephedra* spp., *Ericameria* spp., *Grayia spinosa, Lycium shockleyi, Picrothamnus desertorum, Sarcobatus vermiculatus (= var. baileyi)*, and *Tetradymia* spp. The herbaceous layer is likely sparse, and the perennial bunchgrasses may include *Achnatherum hymenoides, Achnatherum speciosum (= Stipa speciosa), Achnatherum thurberianum (= Stipa thurberiana), Elymus elymoides*, and *Poa secunda*. Forb cover is typically sparse.

ENVIRONMENT & DYNAMICS

Environmental Description: This shrubland alliance is known from cold, dry areas of the Intermountain West. Stands typically occur on alluvial fans, upland slopes and ridges from 1000-2000 m elevation. Precipitation ranges from 17-35 cm annually, with a large proportion falling as winter snow. The range of the subspecies corresponds strongly to the pluvial Lake Lahontan. *Artemisia arbuscula ssp. longicaulis* occurs primarily on Aridisols and Mollisols that are generally shallow and rocky.

Dynamics: Heavy grazing by livestock and other ground disturbance may increase the abundance of introduced annual grasses. Burning may result in conversion to a *Bromus tectorum* annual grassland.

DISTRIBUTION

Geographic Range: The diagnostic taxon for this alliance is known to occur in and around the Lahontan Basin in northwestern Nevada, southeastern Oregon, and northeastern California. The subspecies likely dominates the vegetation, forming this alliance, in all three states.

Nations: US
States/Provinces: CA, NV, OR
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Artemisia arbuscula ssp. longicaulis* (Lahontan sagebrush scrub) Provisional Alliance (Sawyer et al. 2009) [35.121.00]
- **<** SRM Cover Type #406 - Low Sagebrush (Shiflet 1994)

LOWER LEVEL UNITS

Associations:

- CEGL002986 *Artemisia arbuscula ssp. longicaulis / Elymus elymoides* Shrubland
- CEGL002984 *Artemisia arbuscula ssp. longicaulis - Grayia spinosa* Shrubland

AUTHORSHIP

Primary Concept Source: A.H. Winward and E.D. McArthur (1995)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Faber-Langendoen et al. 2017b, Sawyer et al. 2009, Shiflet 1994, Winward and McArthur 1995

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G308. Intermountain Low & Black Sagebrush Steppe & Shrubland

A3221. Artemisia arbuscula ssp. longiloba Steppe & Shrubland Alliance

Type Concept Sentence: *Artemisia arbuscula ssp. longiloba* is dominant in the shrub canopy and is widespread in the Intermountain West, the southern Rocky Mountains, and in the western Great Plains.

OVERVIEW

Scientific Name: *Artemisia arbuscula ssp. longiloba* Steppe & Shrubland Alliance
Common Name (Translated Scientific Name): Alkali Sagebrush Steppe & Shrubland Alliance
Colloquial Name: Alkali Sagebrush Steppe & Shrubland

Type Concept: This shrub-herbaceous alliance occurs in the Intermountain West, into the southern Rocky Mountains and in the western Great Plains. The structure of these stands may be shrub-herbaceous or shrub-dominated. The shrub layer may be sparse to open and dominated by the low shrub *Artemisia arbuscula ssp. longiloba*. Shrub associates include *Artemisia nova, Artemisia tridentata ssp. vaseyana, Artemisia tridentata ssp. wyomingensis, Artemisia tripartita, Chrysothamnus viscidiflorus, Gutierrezia sarothrae*, and *Purshia tridentata*. Perennial grasses are dominant in the understory and may have sparse to very dense cover where they are more prominent than shrubs. Dominant to common grass species include *Danthonia parryi, Elymus lanceolatus, Festuca idahoensis, Festuca thurberi, Pascopyrum smithii, Poa secunda*, and *Pseudoroegneria spicata*. Other perennial grasses that may be present include *Achnatherum hymenoides (= Oryzopsis hymenoides), Elymus elymoides, Hesperostipa comata (= Stipa comata)*, and *Koeleria macrantha*. Forb cover is typically minor. Stands occur on a variety of landforms, from flats and depressions to slopes and ridges. Soils are generally characterized by a heavy clay subsoil occurring within 25 cm of the soil surface, which restricts rooting depth. Soils are also alkaline and calcareous. Diagnostic of this alliance is a moderate (>20% cover) perennial graminoid layer with an *Artemisia arbuscula ssp. longiloba*-dominated low-shrub layer that has 10-40% cover. At least 40% of the total shrub cover is *Artemisia arbuscula ssp. arbuscula*.

Classification Comments: Stands included in this alliance occur in environments (climate or substrates) that limit the growth of perennial graminoids or may be the result of heavy livestock grazing depleting the perennial graminoid layer of stands of shrub-herbaceous vegetation. The range of this association is currently restricted to Nevada. More survey and classification work are needed to fully describe the range of this alliance.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Diagnostic of this alliance is the *Artemisia arbuscula ssp. longiloba*-dominated low-shrub layer (or codominated with >40% relative shrub cover of the nominal species).

VEGETATION

Physiognomy and Structure: This alliance is characterized by a sparse to moderate microphyllous evergreen dwarf-shrub canopy (0.1-0.4 m in height). Cespitose graminoids dominate the understory with cover ranging from 10-70% and 0.3-1.0 m tall.

Floristics: The structure of these stands may be shrub-herbaceous or shrub-dominated. The shrub layer may be sparse to open (10-40% cover) and dominated by the low shrub *Artemisia arbuscula ssp. longiloba*. Shrub associates include *Artemisia nova, Artemisia tridentata ssp. vaseyana, Artemisia tridentata ssp. wyomingensis, Artemisia tripartita, Chrysothamnus viscidiflorus, Gutierrezia sarothrae*, and *Purshia tridentata*. Perennial grasses are dominant in the understory and may have sparse to very dense cover where they are more prominent than shrubs. Dominant to common grass species include *Danthonia parryi, Elymus lanceolatus, Festuca idahoensis, Festuca thurberi, Pascopyrum smithii, Poa secunda*, and *Pseudoroegneria spicata*. Other perennial grasses that may be present include *Achnatherum hymenoides (= Oryzopsis hymenoides), Elymus elymoides, Hesperostipa comata (= Stipa comata)*, and *Koeleria macrantha*. Forb cover is typically minor.

ENVIRONMENT & DYNAMICS

Environmental Description: This shrub-herbaceous alliance occurs in the Intermountain West, into the southern Rocky Mountains and in the western Great Plains from 1600-3200 m (5500-10,600 feet) elevation. Stands occur on a variety of landforms, from flats and depressions to slopes and ridges. Soils are generally characterized by a heavy clay subsoil occurring within 25 cm of the soil surface, which restricts rooting depth. Soils are also alkaline and calcareous. Beetle and Johnson (1982) report that *Artemisia arbuscula ssp. arbuscula* grows in soils with a high volume of gravel (even though soil may be in clay textural class, or contain a clay-rich layer that impedes drainage), and that *Artemisia arbuscula ssp. longiloba* grows in clay soils, often alkaline, that contain no gravels.

Dynamics: Due to the low-shrub stature of *Artemisia arbuscula ssp. longiloba*, this shrubland alliance is less susceptible to natural fire than taller *Artemisia* spp. shrublands. Grazing appears to have little effect on shrub densities, but tends to decrease the importance of tall bunch grasses and increase the cover of *Arenaria congesta* (Johnston 2001). Heavy livestock grazing may deplete the perennial graminoid layer and convert stands that are shrub-herbaceous in structure to those that are strictly shrub-dominated.

DISTRIBUTION

Geographic Range: This alliance is widespread in the western United States, occurring from the Intermountain West, into the southern Rocky Mountains and the western Great Plains.

Nations: US
States/Provinces: CO, ID, MT, NV, OR, UT, WY

TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **<** SRM Cover Type #406 - Low Sagebrush (Shiflet 1994)

LOWER LEVEL UNITS

Associations:

- CEGL001416 *Artemisia arbuscula ssp. longiloba / Pseudoroegneria spicata* Shrub Grassland
- CEGL001415 *Artemisia arbuscula ssp. longiloba / Pascopyrum smithii* Shrub Grassland
- CEGL001414 *Artemisia arbuscula ssp. longiloba* Shrubland
- CEGL005997 *Artemisia arbuscula ssp. longiloba / Poa fendleriana* Shrubland
- CEGL001522 *Artemisia arbuscula ssp. longiloba / Festuca idahoensis* Shrub Grassland
- CEGL002585 *Artemisia arbuscula ssp. longiloba / Elymus lanceolatus* Shrubland
- CEGL005996 *Artemisia arbuscula ssp. longiloba* / Cushion Plants Shrubland
- CEGL001523 *Artemisia arbuscula ssp. longiloba / Poa secunda* Shrub Grassland

AUTHORSHIP

Primary Concept Source: C. Jean, J. Kagan, P. Lyon, E. Peterson, K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Beetle and Johnson 1982, Faber-Langendoen et al. 2017b, Johnston 2001, Shiflet 1994

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G308. Intermountain Low & Black Sagebrush Steppe & Shrubland

A4122. Artemisia arbuscula ssp. thermopola - Artemisia papposa / Festuca idahoensis Steppe & Shrubland Alliance [Low - Poorly Documented]

Type Concept Sentence:

OVERVIEW

Scientific Name: *Artemisia arbuscula ssp. thermopola - Artemisia papposa / Festuca idahoensis* Steppe & Shrubland Alliance
Common Name (Translated Scientific Name): Thermopola Little Sagebrush - Owyhee Sage / Idaho Fescue Steppe & Shrubland Alliance
Colloquial Name: Thermopola Little Sagebrush - Owyhee Sage / Idaho Fescue Steppe & Shrubland

Type Concept:

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics:

VEGETATION

Physiognomy and Structure:

Floristics:

ENVIRONMENT & DYNAMICS

Environmental Description:

Dynamics:

DISTRIBUTION

Geographic Range:

Nations: US
States/Provinces: ID, NV?, OR, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

LOWER LEVEL UNITS

Associations:

- CEGL002991 *Artemisia papposa / Danthonia californica - Festuca idahoensis* Shrubland
- CEGL001540 *Artemisia tripartita ssp. rupicola / Festuca idahoensis* Shrub Grassland
- CEGL001519 *Artemisia arbuscula ssp. thermopola / Festuca idahoensis* Shrub Grassland

AUTHORSHIP

Primary Concept Source: M.S. Reid
Author of Description:
Acknowledgments:

REFERENCES

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G308. Intermountain Low & Black Sagebrush Steppe & Shrubland

A3223. Artemisia bigelovii Steppe & Shrubland Alliance

Type Concept Sentence: Shrub and shrub-herbaceous vegetation dominated by *Artemisia bigelovii* occurring in the Tularosa Basin of southern New Mexico and the Colorado Plateau in southwestern Utah and northern Arizona and near canyon rims and along escarpments in southeastern Colorado.

OVERVIEW

Scientific Name: *Artemisia bigelovii* Steppe & Shrubland Alliance
Common Name (Translated Scientific Name): Bigelow's Sagebrush Steppe & Shrubland Alliance
Colloquial Name: Bigelow's Sagebrush Steppe & Shrubland

Type Concept: The structure of this vegetation may be shrub-herbaceous or shrub-dominated. The shrub layer is characterized by a sparse to moderately dense dwarf-shrub layer that is dominated or codominated by *Artemisia bigelovii*. Dwarf-shrub associates from the shortgrass steppe include *Frankenia jamesii, Glossopetalon spinescens var. meionandrum, Krascheninnikovia lanata*, and *Yucca glauca*, which may be present to codominant. On the Colorado Plateau, stands may be codominated by *Ephedra* spp., *Eriogonum corymbosum, Parryella filifolia*, or *Purshia stansburiana*. *Gutierrezia sarothrae* and species of *Atriplex* are common in most stands. Scattered *Juniperus* spp. and *Pinus edulis* trees are occasionally present. A sparse to dense graminoid layer is usually present. Dominant grasses include *Aristida purpurea, Achnatherum hymenoides (= Oryzopsis hymenoides), Bouteloua gracilis, Hesperostipa neomexicana (= Stipa neomexicana), Pleuraphis jamesii (= Hilaria jamesii), Sporobolus cryptandrus*, or less commonly *Pascopyrum smithii*. On the Colorado Plateau, forbs are generally sparse. However, cushion plants are common on shortgrass steppe slopes. Other forbs, such as *Astragalus missouriensis, Heterotheca villosa, Melampodium cinereum, Picradeniopsis oppositifolia, Stanleya pinnata*, and *Zinnia grandiflora*, may be present. Exotic annuals, such as *Bromus arvensis (= Bromus japonicus), Bromus tectorum, Descurainia sophia*, and *Salsola kali*, may be present to common depending on disturbance and the amount of seasonal precipitation. This alliance is reported from the Tularosa Basin of southern New Mexico and the Colorado Plateau in southwestern Utah and northern Arizona and near canyon rims and along escarpments in southeastern Colorado. Sites include gentle to moderately steep shale hillslopes and mesas in Arizona and Utah and escarpment and canyon breaks and shaly plains in the

shortgrass steppe west to the foothills near the Colorado Front Range. Soils are typically shallow, well-drained, calcareous loams, clay loams, and clays derived from limestone, sandstone, shale and alluvium. The soil surface has high cover of bare soil and rock.

Classification Comments: The vegetation in some stands included in this alliance may be too sparse to be classified as dwarf-shrubland.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics:

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has sparse to moderately dense cover of microphyllous evergreen dwarf-shrubs less than 0.5 m tall. A sparse to dense graminoid layer dominated by perennial medium-tall bunch grasses and short grasses is also present and may be more prominent than the shrubs. Forb cover is generally sparse. Scattered scale-leaved and needle-leaved evergreen trees may be present.

Floristics: The vegetation is characterized by a sparse to moderately dense dwarf-shrub layer that is dominated or codominated by *Artemisia bigelovii*. Dwarf-shrub associates for the shortgrass steppe include *Frankenia jamesii, Glossopetalon spinescens var. meionandrum, Krascheninnikovia lanata*, and *Yucca glauca*, which may be present to codominant. Scattered shrubs such as *Atriplex canescens, Cercocarpus montanus, Ericameria nauseosa (= Chrysothamnus nauseosus), Lycium pallidum*, and *Rhus trilobata* are occasionally present. On the Colorado Plateau, stands may be codominated by *Atriplex confertifolia, Ephedra* spp., *Eriogonum corymbosum, Opuntia polyacantha var. polyacantha, Cylindropuntia whipplei (= Opuntia whipplei), Parryella filifolia*, or *Purshia stansburiana*. *Gutierrezia sarothrae* and species of *Atriplex* and *Yucca* are common in most stands. Scattered *Juniperus* spp. and *Pinus edulis* trees are occasionally present. A sparse to dense graminoid layer is usually present and may take prominence over shrubs. Dominant grasses include *Achnatherum hymenoides (= Oryzopsis hymenoides), Aristida purpurea, Bouteloua gracilis, Hesperostipa neomexicana (= Stipa neomexicana), Muhlenbergia torreyi, Pascopyrum smithii, Pleuraphis jamesii (= Hilaria jamesii), Poa fendleriana, Sporobolus airoides*, and *Sporobolus cryptandrus*. On the Colorado Plateau, forbs are generally sparse. However, on shortgrass steppe slopes, cushion plants such as *Arenaria hookeri, Eriogonum lachnogynum, Tetraneuris acaulis (= Hymenoxys acaulis)*, and *Paronychia sessiliflora* are common. Other forbs, such as *Astragalus missouriensis, Heterotheca villosa, Melampodium cinereum, Picradeniopsis oppositifolia, Stanleya pinnata*, and *Zinnia grandiflora*, are usually present. Exotic annuals, such as *Bromus arvensis (= Bromus japonicus), Bromus tectorum, Salsola kali*, and *Descurainia sophia*, may be present to common depending on disturbance, and amount and season of precipitation.

ENVIRONMENT & DYNAMICS

Environmental Description: Elevation ranges from 1350-1890 m. Climate is semi-arid with 22-35 cm of mean annual precipitation occurring during the growing season. Sites are nearly flat to moderate and include shale hillslopes and mesas in Arizona and breaks and shale plains in the shortgrass steppe west to the foothills near the Colorado Front Range. Soils are typically shallow, well-drained, calcareous loams, clay loams, and clays derived from limestone, sandstone, shale and alluvium. The soil surface has high cover of bare soil and rock.

Dynamics: Livestock grazing must be managed carefully to prevent the loss of highly palatable grasses such as *Schizachyrium scoparium, Bouteloua curtipendula, Hesperostipa neomexicana*, and *Achnatherum hymenoides*. The effects of fire on this vegetation are unknown. However, the vegetation is usually too sparse to carry a fire under most circumstances.

DISTRIBUTION

Geographic Range: Stands included in this shrubland alliance are found in Arizona, western Colorado and Utah on the Colorado Plateau and in southeastern Colorado.

Nations: US
States/Provinces: AZ, CO, NM, UT
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **><** *Artemisia bigelovii/Bouteloua gracilis* Plant Community (Shaw et al. 1989)
- **><** Limestone Breaks SCS Range Site #58 (Soil Conservation Service n.d.)
- **<** SRM Cover Type #408 - Other Sagebrush Types (Shiflet 1994)
- **><** Sandstone Breaks SCS Range Site #53 (Soil Conservation Service n.d.)
- **><** Shaley Plains SCS Range Site (Soil Conservation Service n.d.)

LOWER LEVEL UNITS

Associations:

- CEGL000276 *Artemisia bigelovii* Shrubland
- CEGL000990 *Artemisia bigelovii / Achnatherum hymenoides* Shrubland
- CEGL001742 *Artemisia bigelovii / Bouteloua gracilis* Dwarf-shrub Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Faber-Langendoen et al. 2017b, Shaw et al. 1989, Shiflet 1994, Soil Conservation Service 1978, Soil Conservation Service n.d.

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G308. Intermountain Low & Black Sagebrush Steppe & Shrubland

A2565. Artemisia frigida Dwarf-shrubland Alliance

Type Concept Sentence: This shrubland alliance is dominated by the dwarf-shrub *Artemisia frigida* and is described from the Colorado Plateau and western slope of the southern Rocky Mountains.

OVERVIEW

Scientific Name: *Artemisia frigida* Dwarf-shrubland Alliance
Common Name (Translated Scientific Name): Prairie Sagewort Dwarf-shrubland Alliance
Colloquial Name: Prairie Sagewort Dwarf-shrubland

Type Concept: This shrubland alliance is dominated by the dwarf-shrub *Artemisia frigida*. Total shrub cover ranges from 5-85%. Other common shrubs and dwarf-shrubs include *Artemisia nova, Chrysothamnus viscidiflorus, Gutierrezia sarothrae, Krascheninnikovia lanata, Tetradymia canescens*, and the cactus *Pediocactus simpsonii*. The understory is dominated by perennial graminoids, including *Achnatherum hymenoides, Bouteloua gracilis*, and *Poa secunda*. Other herbaceous species often include low-growing cushion plants. Other herbaceous associates may include *Festuca brachyphylla, Hymenoxys richardsonii, Paronychia sessiliflora, Penstemon strictus, Poa fendleriana, Stenotus armerioides, Pleiacanthus spinosus (= Lygodesmia spinosa)*, and *Tetraneuris torreyana*. Cryptogamic cover varies from low to moderate and is occasionally as high as 55%, mostly composed of crustose and foliose lichens. This alliance is described from the Colorado Plateau and western slope of the southern Rocky Mountains. Stands occur on mid to upper slopes and tops of mesas, hills and ridges, but also midslopes of mountains, active slopes and on valley terraces. Site are flat to moderately steep (to 53% slope) on all aspects between 2315 and 2965 m elevation.

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Shrublands of the Colorado Plateau and western slope of the southern Rocky Mountains in which *Artemisia frigida* is dominant and has >50% of the total shrub cover, typically found on exposed, wind-blown sites. The other characteristic species are perennial graminoids.

VEGETATION

Physiognomy and Structure: This alliance is characterized by a sparse to moderate cover of a suffrutescent plant that occurs as both a dwarf-shrub and forb. Cespitose graminoids dominate the understory.

Floristics: Vegetation is dominated by the suffrutescent dwarf-shrub *Artemisia frigida*. Total shrub cover ranges from 5-85%. Other common shrubs and dwarf-shrubs include *Artemisia nova, Chrysothamnus viscidiflorus, Gutierrezia sarothrae, Krascheninnikovia lanata, Tetradymia canescens*, and the cactus *Pediocactus simpsonii*. The understory is dominated by perennial graminoids, including *Achnatherum hymenoides, Bouteloua gracilis*, and *Poa secunda*. Other herbaceous species often include low-growing cushion plants. Other herbaceous associates may include *Festuca brachyphylla, Hymenoxys richardsonii, Paronychia sessiliflora, Penstemon strictus, Poa fendleriana, Stenotus armerioides, Pleiacanthus spinosus (= Lygodesmia spinosa)*, and *Tetraneuris torreyana*. Cryptogamic cover varies from low to moderate and is occasionally as high as 55%, mostly composed of crustose and foliose lichens.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands occur on mid to upper slopes and tops of mesas, hills and ridges, but also midslopes of mountains, active slopes and on valley terraces. Site are flat to moderately steep (to 53% slope) on all aspects between 2315 and 2965 m elevation. Various amounts of bedrock, large and small rocks, and bare soil compose the majority of the ground surface, with sparse to low cover of litter. Parent materials are frequently volcanic (basalt) rocks that are present as bedrock, boulders and gravel, Mesozoic shale, and Quaternary landslide deposits. Soils are shallow, rapidly drained and range from coarse sand and sandy loam to sandy clay loam and sandy clay.

Dynamics: Dry, windswept conditions appear to be important for this alliance.

DISTRIBUTION

Geographic Range: This shrubland is described from the Colorado Plateau and western slope of the southern Rocky Mountains.

Nations: US
States/Provinces: CO, UT
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Associations:

- CEGL002344 *Artemisia frigida - (Bouteloua gracilis, Achnatherum hymenoides, Poa secunda)* - Lichens Rocky Mesa Dwarf-shrubland

AUTHORSHIP

Primary Concept Source: G. Kittel and K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Faber-Langendoen et al. 2017b

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G308. Intermountain Low & Black Sagebrush Steppe & Shrubland

A3222. Artemisia nova Steppe & Shrubland Alliance

Type Concept Sentence: Associations within this alliance are dominated by *Artemisia nova* and occur at intermediate elevations (1400-2500 m) in the Intermountain West and Rocky Mountains.

OVERVIEW

Scientific Name: *Artemisia nova* Steppe & Shrubland Alliance
Common Name (Translated Scientific Name): Black Sagebrush Steppe & Shrubland Alliance
Colloquial Name: Black Sagebrush Steppe & Shrubland

Type Concept: Structurally, this alliance may occur as shrub-herbaceous or shrub-dominated vegetation. The shrub layer is characterized by the dominance of the dwarf-shrub *Artemisia nova*, which may have sparse to moderate cover of 10-60%.

Associated shrub species that occur in stands of this alliance include *Artemisia arbuscula, Artemisia cana, Artemisia tridentata, Atriplex confertifolia, Chrysothamnus viscidiflorus, Grayia spinosa, Gutierrezia sarothrae, Krascheninnikovia lanata, Purshia tridentata*, and *Symphoricarpos oreophilus*. The ground layer is dominated by perennial bunchgrasses which may exceed the height and cover of shrubs, ranging from sparse to dense cover. Recurrent species include *Achnatherum hymenoides (= Oryzopsis hymenoides), Achnatherum speciosum (= Stipa speciosa), Achnatherum thurberianum (= Stipa thurberiana), Elymus elymoides, Hesperostipa comata (= Stipa comata), Koeleria macrantha, Poa secunda*, and *Pseudoroegneria spicata*. In southern stands, *Bouteloua gracilis* and *Pleuraphis jamesii (= Hilaria jamesii)* may also be important. Common forbs include *Balsamorhiza sagittata, Castilleja angustifolia, Heterotheca villosa, Packera multilobata (= Senecio multilobatus), Phlox hoodii, Senecio integerrimus, Sphaeralcea coccinea*, and *Stenotus armerioides*. Associations within this alliance occur at intermediate elevations (1400-2500 m) in the Intermountain West and Rocky Mountains, a region of semi-arid, continental climate regime. Soils are typically young, shallow, coarse-textured, and often derived from calcareous parent materials. *Artemisia nova* associations occur on well-drained slopes and ridges and often grow with other *Artemisia* associations on deeper soils. In the Columbia River Basin, the vegetation in this alliance occupies the driest habitats of all the *Artemisia*-dominated alliances.

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Shrublands of the Intermountain West and Rocky Mountains where *Artemisia nova* has <50% of the total shrub cover. Structurally, this alliance may occur as shrub-herbaceous or shrub-dominated vegetation. The herbaceous layer is graminoid-dominated and may be dominant over shrubs in some stands.

VEGETATION

Physiognomy and Structure: This shrubland alliance is characterized by sparse to moderate cover (10-60%) of a low-statured, microphyllous evergreen shrub, and a sparse to well-developed graminoid layer. The graminoids often exceed the shrubs in height, and ungrazed stands may have the appearance of perennial grasslands (Baker and Kennedy 1985). The shrubs may be pruned by livestock and native ungulate browsing into low, spreading cushion-like shrubs. Prostrate and, occasionally, upright forbs are present, but with very low cover.

Floristics: Associations within this alliance are characterized by the dominance of the dwarf-shrub *Artemisia nova*, which must contribute at least 40% of the total shrub cover in any stand. Structurally, this alliance may occur as shrub-herbaceous or shrub-dominated vegetation. Associated shrub species that occur in stands of this alliance include *Artemisia arbuscula, Artemisia cana, Artemisia tridentata, Atriplex confertifolia, Chrysothamnus viscidiflorus, Grayia spinosa, Gutierrezia sarothrae, Krascheninnikovia lanata, Purshia tridentata*, and *Symphoricarpos oreophilus*. The ground layer is dominated by perennial bunchgrasses which may exceed the height and cover of the shrubs, but typically may be sparse to very dense. Recurrent species include *Achnatherum hymenoides (= Oryzopsis hymenoides), Achnatherum speciosum (= Stipa speciosa), Achnatherum thurberianum (= Stipa thurberiana), Elymus elymoides, Festuca idahoensis, Hesperostipa comata (= Stipa comata), Koeleria macrantha, Poa secunda*, and *Pseudoroegneria spicata*. In southern stands, *Bouteloua gracilis* and *Pleuraphis jamesii (= Hilaria jamesii)* may also be important. Common forbs include *Balsamorhiza sagittata, Castilleja angustifolia, Heterotheca villosa, Packera multilobata (= Senecio multilobatus), Phlox hoodii, Senecio integerrimus, Sphaeralcea coccinea*, and *Stenotus armerioides*.

ENVIRONMENT & DYNAMICS

Environmental Description: Associations within this alliance occur at intermediate elevations (1400-2500 m) in the Intermountain West and Rocky Mountains. The climate is semi-arid with 20-30 cm of annual precipitation. The temperature regime is continental, with cold winters, warm summers, a large diurnal temperature range, and a short frost-free season. Soils are typically young, shallow, coarse-textured, and often derived from calcareous parent materials. *Artemisia nova* associations occur on well-drained slopes and ridges and often grow with other *Artemisia* associations on deeper soils. In the Columbia River Basin, the vegetation in this alliance occupies the driest habitats of all the *Artemisia*-dominated alliances. At the edges of intermountain basins, this alliance is usually contiguous with *Atriplex confertifolia* shrublands (Hironaka 1978).

Dynamics: This shrubland alliance is associated with shallow, rocky soils which experience extreme drought in summer. The plants are low and widely spaced, which tends to decrease the risk of fire (Chappell et al. 1997). Barbour and Major (1977) report that *Artemisia nova* is utilized by livestock to a much greater degree than other species of *Artemisia*, resulting in low, pruned plants. *Artemisia nova* dwarf-shrublands grow in more xeric sites than other *Artemisia* shrublands. Blackburn and Tueller (1970) noted rapid invasion of these communities by *Juniperus osteosperma* and *Pinus monophylla* in Nevada, citing overgrazing coupled with fire suppression, and possibly climate change as causative variables.

DISTRIBUTION

Geographic Range: Associations in this alliance occur in the mountains of the Mojave Desert, throughout the Great Basin, and east into western and central Wyoming, Montana, Colorado, Utah, and northwestern New Mexico. It also occurs in the upper Columbia River Basin of southeastern Idaho.

Nations: US
States/Provinces: CA, CO, ID, MT, NM, NV, OR, UT, WY
TNC Ecoregions [optional]: 11:C, 16:C, 17:C
USFS Ecoregions (2007): 322A:CC, 341D:CC, 341Fc:CCC, M262B:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Great Basin)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **=** *Artemisia nova* (Black sagebrush scrub) Alliance (Sawyer et al. 2009) [35.130.00]
- **=** *Artemisia nova* Shrubland Alliance (Evens et al. 2014)
- **=** *Artemisia nova* Shrubland Alliance (CNPS 2017) [35.130.00]
- **><** Big Sagebrush Series (Sawyer and Keeler-Wolf 1995)
- **><** Black Sagebrush Series (Sawyer and Keeler-Wolf 1995)
- **><** Pebble Plain Community (Holland 1986b)
- **>** SRM Cover Type #320 - Black Sagebrush-Bluebunch Wheatgrass (Shiflet 1994)
- **>** SRM Cover Type #321 - Black Sagebrush-Idaho Fescue (Shiflet 1994)
- **>** SRM Cover Type #322 - Black Sagebrush-Rough Fescue (Shiflet 1994)
- **=** SRM Cover Type #405 - Black Sagebrush (Shiflet 1994)
- **><** Subalpine Sagebrush Scrub (#35220) (Holland 1986b)

LOWER LEVEL UNITS

Associations:

- CEGL001417 *Artemisia nova* Shrubland
- CEGL002773 *Artemisia nova - Ericameria nana* Shrubland
- CEGL001425 *Artemisia nova / Hesperostipa comata* Shrubland
- CEGL002698 *Artemisia nova / Poa fendleriana* Shrubland
- CEGL001422 *Artemisia nova / Achnatherum hymenoides* Shrubland
- CEGL001423 *Artemisia nova / Poa secunda* Shrubland
- CEGL001524 *Artemisia nova / Festuca idahoensis* Shrub Grassland
- CEGL001419 *Artemisia nova - Gutierrezia sarothrae / Bouteloua gracilis - Pleuraphis jamesii* Shrubland
- CEGL001420 *Artemisia nova / Pleuraphis jamesii* Shrubland
- CEGL001424 *Artemisia nova / Pseudoroegneria spicata* Shrubland
- CEGL001421 *Artemisia nova / Leymus salinus* Shrub Grassland
- CEGL001418 *Artemisia nova / Elymus elymoides* Shrubland

AUTHORSHIP

Primary Concept Source: D. Sarr, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Baker 1983c, Baker 1983d, Baker and Kennedy 1985, Barbour and Major 1977, Blackburn and Tueller 1970, CNPS 2017, Chappell et al. 1997, Cheatham and Haller 1975, Derby and Wilson 1978, Derby and Wilson 1979, Evens et al. 2014, Faber-Langendoen et al. 2017b, Hironaka 1978, Holland 1986b, Krantz 1988, Krantz 1993, Milton and Purdy 1983, Paysen et al. 1980, Peterson 1984a, Peterson 1984b, Rickard and Beatley 1965, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Shiflet 1994, Thomas et al. 2004, Thorne 1976, Tisdale 1994a, Turner 1982c, West 1988, Young et al. 1977, Young et al. 2007b, Zamora and Tueller 1973

M169. Great Basin-Intermountain Tall Sagebrush Steppe & Shrubland

This macrogroup includes the big sagebrush shrubland and shrub-steppe that is a matrix and large-patch type throughout much of the intermountain western U.S. and that is dominated by *Artemisia tridentata, Purshia tridentata*, and several local dominants such as *Artemisia cana* and *Artemisia tripartita ssp. tripartita*.

3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
3.B.1.Ne.3.a. M169 Great Basin-Intermountain Tall Sagebrush Steppe & Shrubland

G303. Intermountain Dry Tall Sagebrush Steppe & Shrubland

Type Concept Sentence: This widely distributed, matrix-forming shrubland group is concentrated in the drier, more southerly portions of the interior western U.S., but extends into more xeric portions of the Columbia Plateau, Rocky Mountains, across Wyoming, then northeast into the northwestern Great Plains. Vegetation is typically dominated by *Artemisia tridentata ssp. wyomingensis* and *Artemisia tridentata ssp. tridentata*, sometimes codominated by xeric shrubs such as *Atriplex* spp., with a typically sparse to open herbaceous layer dominated by dry-site graminoids.

OVERVIEW

Scientific Name: *Artemisia tridentata ssp. wyomingensis - Artemisia tridentata ssp. tridentata* Steppe & Shrubland Group
Common Name (Translated Scientific Name): Wyoming Big Sagebrush - Basin Big Sagebrush Steppe & Shrubland Group
Colloquial Name: Big Sagebrush - Mixed Shrub Dry Steppe & Shrubland

Type Concept: This widely distributed, matrix-forming shrubland group is concentrated in the drier, more southerly portions of the interior western U.S., especially in the Great Basin and Colorado Plateau, but extends into more xeric portions of the Columbia Plateau, Wyoming steppe, Rocky Mountains, and northeast into the northwestern Great Plains. Stands are dominated by *Artemisia tridentata ssp. wyomingensis* and *Artemisia tridentata ssp. tridentata* and, in some cases, codominated by xeric shrubs such as *Atriplex canescens, Atriplex confertifolia, Ephedra nevadensis, Ephedra viridis, Ericameria nauseosa, Grayia spinosa*, or *Sarcobatus vermiculatus*. Other common shrubs include *Amelanchier utahensis, Artemisia frigida, Atriplex gardneri, Chrysothamnus* spp., *Ericameria* spp., *Peraphyllum ramosissimum, Purshia tridentata*, and *Tetradymia* spp. If present, the herbaceous layer ranges from sparse and patchy to moderately dense and is typically dominated by dry-site graminoids with low cover of forbs. Characteristic graminoids include *Achnatherum hymenoides, Achnatherum lettermanii (= Stipa lettermanii), Achnatherum pinetorum, Achnatherum thurberianum, Bouteloua gracilis, Bromus tectorum, Carex filifolia, Distichlis spicata, Elymus albicans, Elymus elymoides, Hesperostipa comata (= Stipa comata), Leymus ambiguus, Leymus salinus, Pleuraphis jamesii, Poa fendleriana, Poa secunda, Pseudoroegneria spicata, Sporobolus airoides*, and *Sporobolus cryptandrus*. A sparse layer of cold-deciduous needle-leaved or scale-leaved evergreen trees may occasionally be emergent over the shrubs. This group occurs on flat to steeply sloping upland slopes on alluvial fans and terraces, toeslopes, lower and middle slopes, draws, badlands, and foothills. Stands are found at elevations as low as 500 m in the northwestern Great Plains to 2500 m in the Rocky Mountains and Colorado Plateau. Sites with little slope tend to have deep soils, while those with steeper slopes have shallow to moderately deep soils. Climate is mostly semi-arid but ranges from semi-arid in the western Great Basin to subhumid in the northern Great Plains and Rocky Mountains with much of the precipitation falling primarily as snow. The amount and reliability of growing-season moisture increase eastward and with increasing elevation.

Classification Comments: This group tends to occur in drier biophysical settings than the two similar tall sagebrush groups (G302, G304). Hence, it tends to have a less abundant herbaceous component, with the predominant grasses being more adapted to drier conditions. In addition, the co-occurring shrub taxa will include more desert species as well as cacti. This is a slid group in concept, but the specific associations included in it need to be reviewed and will require some adjustment.

Similar NVC Types:
- G302 Intermountain Mesic Tall Sagebrush Steppe & Shrubland
- G304 Intermountain Mountain Big Sagebrush Steppe & Shrubland

Diagnostic Characteristics: Stands are dominated by *Artemisia tridentata ssp. wyomingensis* or *Artemisia tridentata ssp. tridentata* and, in some cases, codominated by dry-site shrubs such as *Atriplex canescens, Ephedra nevadensis, Ephedra viridis, Ericameria nauseosa*, or *Sarcobatus vermiculatus*. If present, the herbaceous component layer ranges from sparse and patchy to moderately dense and is typically dominated by dry-site graminoids with low cover of forbs. Characteristic graminoids include *Achnatherum hymenoides, Achnatherum lettermanii, Achnatherum pinetorum, Achnatherum thurberianum, Bouteloua gracilis, Bromus tectorum, Carex filifolia, Distichlis spicata, Elymus albicans, Elymus elymoides, Hesperostipa comata, Leymus ambiguus, Leymus salinus, Pleuraphis jamesii, Poa fendleriana, Poa secunda, Pseudoroegneria spicata, Sporobolus airoides*, and *Sporobolus cryptandrus*. Associated species tend to include more semi-desert taxa with core distribution in the Great Basin and Colorado Plateau regions. Warm-season grasses are common in the southern and eastern portions of its range.

VEGETATION

Physiognomy and Structure: This deciduous scrub and grassland group is structurally characterized by open to dense sagebrush with associated shrubs interspersed and/or a moderately dense understory of perennial grasses.

Floristics: Stands are dominated by *Artemisia tridentata ssp. wyomingensis* and *Artemisia tridentata ssp. tridentata* and, in some cases, codominated by *Atriplex canescens, Atriplex confertifolia, Ephedra nevadensis, Ephedra viridis, Ericameria nauseosa, Grayia spinosa*, or *Sarcobatus vermiculatus*. Other common shrubs include *Artemisia frigida, Atriplex gardneri, Chrysothamnus* spp., *Ericameria* spp., *Krascheninnikovia lanata, Peraphyllum ramosissimum, Prunus virginiana, Purshia tridentata, Symphoricarpos longiflorus*, and *Tetradymia* spp. A sparse layer of cold-deciduous needle-leaved or scale-leaved evergreen trees may occasionally be emergent over the shrubs. The herbaceous layer may be sparse to strongly dominated by graminoids, including *Achnatherum hymenoides, Achnatherum lettermanii (= Stipa lettermanii), Achnatherum pinetorum, Achnatherum thurberianum, Bouteloua gracilis, Bromus tectorum, Carex filifolia, Elymus albicans, Elymus elymoides, Elymus lanceolatus, Festuca idahoensis, Hesperostipa comata (= Stipa comata), Leymus ambiguus, Pleuraphis jamesii, Poa fendleriana, Poa secunda, Pseudoroegneria spicata, Sporobolus airoides*, and *Sporobolus cryptandrus*. Trees found across the range include *Cercocarpus ledifolius, Juniperus monosperma, Juniperus occidentalis, Juniperus osteosperma, Juniperus scopulorum, Pinus edulis, Pinus flexilis, Pinus jeffreyi, Pinus monophylla, Pinus ponderosa, Populus tremuloides, Quercus gambelii, Quercus garryana*, and *Yucca brevifolia*.

ENVIRONMENT & DYNAMICS

Environmental Description: This shrubland group is widely distributed in the western U.S., at elevations as low as 500 m in the northwestern Great Plains to 2500 m in the Rocky Mountains and Colorado Plateau. This group occurs on flat to steeply sloping upland slopes on alluvial fans and terraces, toeslopes, lower and middle slopes, draws, badlands, and foothills. *Climate:* Climate ranges from arid in the western Great Basin to subhumid in the northern plains and Rocky Mountains with much of the precipitation falling primarily as snow. The amount and reliability of growing-season moisture increase eastward and with increasing elevation. *Soil/substrate/hydrology:* Sites with little slope tend to have deep soils while those with steeper slopes have shallow to moderately deep soils. Soil texture is loamy sand, loam, sandy loam, or clay loam (Hansen and Hoffman 1988), and there is often a significant amount of coarse fragments in the soil profile.

Dynamics: The natural fire regime of this group likely maintains patchy distribution of shrubs, so the general aspect of the vegetation is that of a grassland. Shrubs may increase following heavy grazing and/or with fire suppression, particularly in moist portions of the northern Columbia Plateau where it forms a landscape mosaic pattern with shallow-soil scabland shrublands. Response to grazing can be variable depending on the type of grazer and the season in which grazing occurs. *Hesperostipa comata* can increase in abundance in response to either grazing or fire. Microphytic crust is very important in this group.

DISTRIBUTION

Geographic Range: This widely distributed, matrix-forming shrubland group is concentrated in the drier, more southerly portions of the interior western U.S., especially in the Great Basin and Colorado Plateau, but extends into more xeric portions of the Columbia Plateau, Wyoming steppe, Rocky Mountains, and northeast into the northwestern Great Plains.

Spatial Scale & Pattern [optional]: Matrix, Large patch
Nations: CA, US
States/Provinces: BC, CA, CO, ID, MT, ND, NV, OR, SD?, UT, WY
TNC Ecoregions [optional]: 4:C, 6:C, 8:C, 9:C, 10:C, 11:C, 12:C, 18:C, 19:C, 20:C, 26:C, 27:C
USFS Ecoregions (2007): 313A:CC, 313B:CC, 322A:CC, 331A:CP, 331D:CC, 331F:CC, 331G:CC, 331H:CC, 331J:C?, 341A:CC, 341B:CC, 341C:CC, 342A:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:CC, 342I:CC, M242C:CC, M261G:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333D:CC, M334A:CC, M341A:CC, M341B:CC, M341C:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Arches, Bighorn Canyon, Black Canyon of the Gunnison?, Bryce Canyon, Canyon de Chelly, Canyonlands, Capitol Reef, Colorado, Curecanti, Death Valley, Dinosaur, Fossil Butte, Glen Canyon, Golden Spike, Grand Canyon, Hovenweep, John Day Fossil Beds, Mesa Verde, Natural Bridges, Theodore Roosevelt, Zion); USFS (Arapaho-Roosevelt, Custer, Medicine Bow, Shoshone, Thunder Basin); USFWS (Ouray)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate. USNVC Confidence from peer reviewer, not AE.

SYNONYMY

- **><** Basin Big Sagebrush (401) (Shiflet 1994)
- **=** Great Basin-Colorado Plateau sagebrush semi-desert (West 1983a)
- **><** Wyoming Big Sagebrush (403) (Shiflet 1994)

LOWER LEVEL UNITS

Alliances:
- A3194 *Artemisia tridentata ssp. tridentata - Artemisia tridentata ssp. xericensis* Dry Steppe & Shrubland Alliance
- A3198 *Artemisia tridentata* - Mixed Shrub Dry Steppe & Shrubland Alliance
- A3184 *Artemisia tridentata ssp. wyomingensis* Dry Steppe & Shrubland Alliance

AUTHORSHIP

Primary Concept Source: N.E. West (1983a)
Author of Description: M.E. Hall and K.A. Schulz
Acknowledgments:
Version Date: 11/06/2015
Classif Resp Region: West
Internal Author: MEH/KAS 3-10, mod. GK 8-15, mod. KAS 11-15

REFERENCES

References: Baker and Kennedy 1985, Barbour and Billings 1988, Barbour and Major 1988, Blackburn and Tueller 1970, Brown 1982a, Brown et al. 1979, Chappell et al. 1997, Daubenmire 1970, Ecosystems Working Group 1998, Faber-Langendoen et al. 2017a, Hansen and Hoffman 1988, Hironaka et al. 1983, Holland and Keil 1995, Knight 1994, Mueggler and Stewart 1980, Shiflet 1994, West 1983a, West 1983c

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G303. Intermountain Dry Tall Sagebrush Steppe & Shrubland

A3198. Artemisia tridentata - Mixed Shrub Dry Steppe & Shrubland Alliance

Type Concept Sentence: Stands in this alliance have a mixed shrub canopy codominated by *Artemisia tridentata* with dry-site shrub species such as *Atriplex canescens, Atriplex confertifolia, Ephedra aspera, Ephedra viridis, Ephedra nevadensis, Grayia spinosa, Sarcobatus vermiculatus*, or *Tetradymia canescens* present to codominant. The sparse to moderately dense herbaceous layer is dominated by perennial graminoids with lower cover of sometimes diverse forbs characteristic of semi-arid upland sites.

OVERVIEW

Scientific Name: *Artemisia tridentata* - Mixed Shrub Dry Steppe & Shrubland Alliance
Common Name (Translated Scientific Name): Big Sagebrush - Mixed Shrub Dry Steppe & Shrubland Alliance
Colloquial Name: Big Sagebrush - Mixed Shrub Dry Steppe & Shrubland

Type Concept: Stands in this alliance have a mixed shrub canopy codominated by *Artemisia tridentata* with dry-site shrub species such as *Atriplex canescens, Atriplex confertifolia, Ephedra aspera (= Ephedra fasciculata), Ephedra viridis, Ephedra nevadensis, Grayia spinosa, Sarcobatus vermiculatus*, or *Tetradymia canescens* present to codominant. The sparse to moderately dense herbaceous layer is dominated by perennial graminoids with lower cover of sometimes diverse forbs characteristic of semi-arid upland sites. Characteristic dry-site understory species include *Achnatherum hymenoides, Achnatherum speciosum, Bouteloua gracilis, Bromus tectorum, Elymus elymoides, Elymus lanceolatus, Hesperostipa comata (= Stipa comata), Leymus cinereus, Opuntia polyacantha, Phlox hoodii, Pleuraphis jamesii, Poa fendleriana, Poa secunda, Sphaeralcea coccinea*, and *Sporobolus cryptandrus*. This dry-site shrubland alliance is distributed throughout the central and southern interior western U.S., especially in the Great Basin and Colorado Plateau regions. Stands occur on flat to steeply sloping upland sites, on a wide variety of landform positions such as alluvial fans and plains, plateaus, mesas and foothills. Soil texture is loamy sand, loam, sandy loam, or clay loam, and there is often a significant amount of coarse fragments in the soil profile.

Classification Comments: This is a weak artificial alliance. It would be better to further develop this alliance using more biogeographic or environmental (stabilized dunes) information, but the analysis is not done. Big sagebrush subspecies include *Artemisia tridentata ssp. tridentata, Artemisia tridentata ssp. xericensis*, and *Artemisia tridentata ssp. wyomingensis*.

Internal Comments:
Other Comments:

Similar NVC Types:

- A3194 *Artemisia tridentata ssp. tridentata - Artemisia tridentata ssp. xericensis* Dry Steppe & Shrubland Alliance: is not codominated by non-sagebrush shrubs.

Diagnostic Characteristics: Stands in this dry shrubland alliance have a mixed shrub canopy codominated by *Artemisia tridentata* with dry-site shrub species such as *Atriplex canescens, Atriplex confertifolia, Ephedra aspera, Ephedra viridis, Ephedra nevadensis, Grayia spinosa, Peraphyllum ramosissimum, Purshia tridentata, Sarcobatus vermiculatus*, or *Tetradymia canescens*. Characteristic dry shrubland understory species include *Achnatherum hymenoides, Achnatherum speciosum, Bouteloua gracilis, Elymus elymoides, Elymus lanceolatus, Hesperostipa comata, Leymus cinereus, Phlox hoodii, Pleuraphis jamesii, Poa fendleriana, Poa secunda, Sphaeralcea coccinea*, and *Sporobolus cryptandrus*.

VEGETATION

Physiognomy and Structure: The vegetation in this alliance is characterized by a moderate to dense (25-70%) cover of microphyllous evergreen shrubs, usually 0.5-1 m in height. Cespitose graminoids are usually prominent, often matching the shrubs in height and cover. Forb species may be frequent, but usually contribute little canopy cover. With increasing summer rain in the eastern portion of the range, there is a corresponding increase in the abundance of sod-forming grasses as compared to bunchgrasses. There may be significant cover on the ground surface by mosses and lichens, or a cryptogamic soil crust.

Floristics: Stands in this alliance have a mixed shrub canopy codominated by *Artemisia tridentata* with dry-site shrub species such as *Atriplex canescens, Atriplex confertifolia, Ephedra aspera (= Ephedra fasciculata), Ephedra viridis, Ephedra nevadensis, Grayia spinosa, Sarcobatus vermiculatus*, or *Tetradymia canescens* present to codominant. The sparse to moderately dense herbaceous layer is dominated by perennial graminoids with lower cover of sometimes diverse forbs characteristic of semi-arid upland sites. Characteristic dry-site understory species include *Achnatherum hymenoides, Achnatherum speciosum, Bouteloua gracilis, Bromus tectorum, Elymus elymoides, Elymus lanceolatus, Hesperostipa comata (= Stipa comata), Leymus cinereus, Opuntia polyacantha, Phlox hoodii, Pleuraphis jamesii, Poa fendleriana, Poa secunda, Sphaeralcea coccinea*, and *Sporobolus cryptandrus*.

ENVIRONMENT & DYNAMICS

Environmental Description: This dry-site shrubland alliance is distributed throughout the central and southern interior western U.S., especially in the Great Basin and Colorado Plateau regions. Climate is semi-arid with the amount and reliability of growing-season moisture increasing eastward and with increasing elevation. Stands occur on flat to steeply sloping upland sites, on a wide variety of landform positions. These include alluvial fans and terraces, toeslopes, lower and middle slopes, draws, badly eroded badland slopes, and foothills. Sites with little slope tend to have deep soils, while those with steeper slopes have shallow to moderately deep soils. Sloping sites tend to have southerly aspects. Soil texture is loamy sand, loam, sandy loam, or clay loam, and there is often a significant amount of coarse fragments in the soil profile.

Dynamics: Complex ecological interactions between fire regimes, grazing history, and climate patterns result in equally complex patterns of species structure and composition in *Artemisia tridentata*. These present corresponding difficulties in the classification of these shrublands, which have been compounded by the influence of human settlement and agricultural patterns. What follows is a summary of some of the influences of altered fire regimes and grazing history on *Artemisia tridentata* shrublands and shrub-herbaceous vegetation.

Artemisia tridentata ssp. wyomingensis shrublands may represent either drier or more disturbed examples of the *Artemisia tridentata ssp. wyomingensis* shrubland and shrub-herbaceous alliances. Shrub densities typically increase with overgrazing of the bunchgrass component or with increasing summer drought (West 1983c). There is considerable debate over whether present shrub-dominated stands are actually degraded "steppe" (e.g., shrub-herbaceous physiognomy), and if the stands will return to steppe with changes in grazing and fire management. *Artemisia tridentata* is inhibited by fire, and excessive grazing may decrease fire frequency due to consumption of herbaceous forage, resulting in increased shrub density. Conversely, invasion by non-native annual grasses (e.g., *Bromus tectorum* or *Bromus arvensis*) may increase fire frequency sufficiently to eliminate the shrubs from the stands (Hironaka et al. 1983). With a change in fire frequency, species composition will be altered as well (West 1983c). With a high fire frequency (every 2-5 years), perennial grasses and shrubs are eliminated and non-native annual grasses dominate. At fire-return intervals of 10-30 years, short-lived resprouting shrubs such as *Chrysothamnus* or *Tetradymia* spp. dominate. At fire intervals of 30-70 years, a mixture of perennial bunchgrasses and shrubs is maintained. Finally, in the complete absence of fire, deep-rooted shrubs such as *Artemisia tridentata* become the theoretical dominants.

DISTRIBUTION

Geographic Range: This broadly distributed alliance is found in the western United States on dry steppes with core distribution in the Great Basin and Colorado Plateau regions.

Nations: US
States/Provinces: AZ, CA, CO, ID, MT, NV, OR, UT, WY
TNC Ecoregions [optional]: 4:C, 5:C, 11:C, 12:C, 13:C, 15:C, 16:C, 17:C
USFS Ecoregions (2007): 262A:CC, 322A:CC, 341D:CC, 341F:CC, 342B:CC, M261A:CC, M261D:CC, M261E:CC, M261G:CC, M262A:CC, M262B:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Great Basin, Mojave)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** *Artemisia tridentata* (Big sagebrush) Alliance (Sawyer et al. 2009) [35.110.00]
- **=** *Artemisia tridentata* Shrubland Alliance (Evens et al. 2014)

- **=** *Artemisia tridentata* Shrubland Alliance (CNPS 2017) [35.110.00]
- **><** Big Sagebrush Scrub (#35210) (Holland 1986b)
- **<** Big Sagebrush Series (Sawyer and Keeler-Wolf 1995)
- **><** Great Basin Mixed Scrub (#35100) (Holland 1986b)
- **><** Sagebrush Steppe (#35300) (Holland 1986b)

LOWER LEVEL UNITS

Associations:
- CEGL001040 *Artemisia tridentata ssp. wyomingensis - Atriplex confertifolia* Shrubland
- CEGL000993 *Artemisia tridentata - Atriplex confertifolia* Shrubland
- CEGL001054 *Purshia tridentata - Artemisia tridentata ssp. tridentata* Shrubland
- CEGL001004 *Artemisia tridentata ssp. tridentata - Grayia spinosa* Shrubland
- CEPP005793 *Artemisia tridentata - Ericameria teretifolia* Shrubland
- CEGL001355 *Artemisia tridentata - Atriplex canescens - Sarcobatus vermiculatus / (Achnatherum hymenoides)* Shrubland
- CEGL005430 *Peraphyllum ramosissimum - Artemisia tridentata* Shrubland
- CEGL001002 *Artemisia tridentata - Ephedra nevadensis* Shrubland
- CEGL001056 *Purshia tridentata - Ericameria nauseosa* Shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Blackburn 1967, Blackburn et al. 1968a, Blackburn et al. 1968b, Blackburn et al. 1969a, Blackburn et al. 1969b, Blackburn et al. 1969c, Blackburn et al. 1969d, Blackburn et al. 1971, Brown 1971, CNPS 2017, Cheng 2004, Evens et al. 2014, Faber-Langendoen et al. 2017b, Ferren and Davis 1991, Francis 1983, Gordon and White 1994, Hanes 1976, Hironaka et al. 1983, Holland 1986b, Johnson 2000b, Keeler-Wolf et al. 2003a, Klein and Evens 2006, Paysen et al. 1980, Peterson 1984a, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Thomas et al. 2004, Tirmenstein 1999c, West 1983c, Wolfram and Martin 1965, Young et al. 1977, Young et al. 2007b

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G303. Intermountain Dry Tall Sagebrush Steppe & Shrubland

A3194. Artemisia tridentata ssp. tridentata - Artemisia tridentata ssp. xericensis Dry Steppe & Shrubland Alliance

Type Concept Sentence: Stands in this semi-arid shrubland alliance have a shrub canopy dominated by *Artemisia tridentata ssp. tridentata* or *Artemisia tridentata ssp. xericensis*. Other shrubs have low cover, except species that increase with disturbance such as *Gutierrezia sarothrae, Chrysothamnus viscidiflorus*, and *Ericameria nauseosa*. The understory, if present, is characterized by dry-site grass species.

OVERVIEW

Scientific Name: *Artemisia tridentata ssp. tridentata - Artemisia tridentata ssp. xericensis* Dry Steppe & Shrubland Alliance
Common Name (Translated Scientific Name): Basin Big Sagebrush - Foothill Big Sagebrush Dry Steppe & Shrubland Alliance
Colloquial Name: Basin Big Sagebrush - Foothill Big Sagebrush Dry Steppe & Shrubland

Type Concept: This semi-arid alliance occurs throughout much of the Intermountain West, especially in the Great Basin and Colorado Plateau. Stands in have a mixed shrub canopy dominated by *Artemisia tridentata ssp. tridentata* or *Artemisia tridentata ssp. xericensis*. Other shrubs have low cover, except species that increase with disturbance such as *Gutierrezia sarothrae, Chrysothamnus viscidiflorus*, and *Ericameria nauseosa*. Characteristic dry shrubland understory species include *Achnatherum hymenoides, Achnatherum lettermanii, Bouteloua gracilis, Distichlis spicata, Pascopyrum smithii, Pleuraphis jamesii, Poa secunda, Sporobolus airoides*, and *Sporobolus cryptandrus*. The non-native, invasive annual grass *Bromus tectorum* may be present and dominant in disturbed stands. Sites supporting this alliance include sloping fans, footslopes, rolling hills, swales, draws, and deep, well-drained alluvial bottomlands. Soils are deep, fine- to medium-textured alluvial soils with some source of subirrigation during the summer season, but moderately deep upland soils with ample moisture storage also support these shrublands. Some stands occur on deep, sandy soils, or soils that are highly calcareous.

Classification Comments: Associations with undetermined subspecies of *Artemisia tridentata* from former *Artemisia tridentata* Shrubland Alliance (A.829) were reviewed and placed into either *Artemisia tridentata ssp. wyomingensis* Dry Steppe & Shrubland Alliance (A3184) or *Artemisia tridentata ssp. tridentata - Artemisia tridentata ssp. xericensis* Dry Steppe & Shrubland Alliance (A3194). More review would increase confidence of placement. *Artemisia tridentata / Ericameria nauseosa* Shrubland (CEGL000998) is currently a broadly defined association that may need to be split into an *Artemisia tridentata ssp. wyomingensis / Ericameria nauseosa* shrubland association and an *Artemisia tridentata ssp. tridentata / Ericameria nauseosa* shrubland association after more data are available.

Internal Comments:
Other Comments:

Similar NVC Types:
- A3198 *Artemisia tridentata* - Mixed Shrub Dry Steppe & Shrubland Alliance: is codominated by non-sagebrush shrubs.

Diagnostic Characteristics: Stands in this semi-arid shrubland alliance are dominated by *Artemisia tridentata ssp. tridentata* or *Artemisia tridentata ssp. xericensis*. Characteristic herbaceous species include *Achnatherum hymenoides, Achnatherum lettermanii, Bouteloua gracilis, Distichlis spicata, Pascopyrum smithii, Pleuraphis jamesii, Poa secunda, Sporobolus airoides*, and *Sporobolus cryptandrus*.

VEGETATION

Physiognomy and Structure: The shrublands in this alliance are characterized by a open to dense (10-75%) cover of microphyllous evergreen shrubs, usually 1-2 m in height. Cespitose graminoids are scattered in the shrub matrix and can occasionally match the shrubs in height. A sparse, emergent layer of scale-leaved or needle-leaved evergreen trees may also be present, but in many areas no trees are present. Forb species may be frequent, but are usually of low cover. With increasing summer rain in the southeastern edge of the range, there is an increase in the importance of sod-forming grasses in comparison to bunchgrasses. In many areas, undisturbed stands in this alliance will have a cryptogamic soil crust composed of a mix of lichens, tiny mosses, and bacteria.

Floristics: Stands in this semi-arid shrubland alliance have a mixed shrub canopy dominated by *Artemisia tridentata ssp. tridentata* or *Artemisia tridentata ssp. xericensis*. Other shrubs have low cover, except species that increase with disturbance such as *Gutierrezia sarothrae, Chrysothamnus viscidiflorus*, and *Ericameria nauseosa*. Characteristic dry shrubland understory species include *Achnatherum hymenoides, Achnatherum lettermanii, Bouteloua gracilis, Distichlis spicata, Pascopyrum smithii, Pleuraphis jamesii, Poa secunda, Sporobolus airoides*, and *Sporobolus cryptandrus*. The non-native, invasive annual grass *Bromus tectorum* may be present and dominant in disturbed stand. Forbs are generally of low importance and are highly variable across the range, but may be diverse in some stands. Common forbs include species of *Astragalus, Oenothera, Eriogonum*, and *Erigeron*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs throughout the Intermountain West from the western Great Basin to the Columbia Basin and Colorado Plateau at elevations ranging from 240 m in the Columbia Basin up to 2500 m. The climate where this alliance occurs is semi-arid with annual precipitation ranging from 18-40 cm and high inter-annual variation. Much of the precipitation falls as snow, and growing-season drought is characteristic. Temperatures are continental with large annual and diurnal variation. In drier regions, these shrublands are usually associated with perennial or ephemeral stream drainages with water tables less than 3 m from the soil surface. Sites supporting this alliance include sloping fans, footslopes, rolling hills, swales, draws, and deep, well-drained alluvial bottomlands. Soils are deep, fine- to medium-textured alluvial soils with some source of subirrigation during the summer season, but moderately deep upland soils with ample moisture storage also support these shrublands. Some stands occur on deep, sandy soils, or soils that are highly calcareous (Hironaka et al. 1983). Although this alliance may grade into sites with alkaline soils at the edge of internally drained basins, *Artemisia tridentata* is a non-halophyte and requires low salinity for optimum growth. The importance of perennial bunchgrasses, the most typical herbaceous associates, is favored with greater spring and summer rain, which increases northward and eastward. Because of the deep alluvial soils, stands have been converted to agriculture in much of the range of the alliance. Adjacent vegetation is highly variable, but some common adjacent communities include *Juniperus occidentalis-*, *Pinus ponderosa-*, and *Cercocarpus ledifolius*-dominated woodlands, as well as shrublands dominated by *Artemisia tridentata ssp. vaseyana*.

Dynamics: Complex ecological interactions between fire regimes, grazing history, and climate patterns result in equally complex patterns of species structure and composition in *Artemisia tridentata* stands. These present corresponding difficulties in the classification of these shrublands, which have been compounded by the influence of human settlement and agricultural patterns. What follows is a summary of some of the influences of altered fire regimes and grazing history on *Artemisia tridentata* shrublands and shrub-herbaceous vegetation.

Artemisia tridentata is inhibited by fire, and excessive grazing may decrease fire frequency due to consumption of herbaceous forage, resulting in increased shrub density. Conversely, invasion by non-native annual grasses (e.g., *Bromus tectorum*) may increase

fire frequency sufficiently to eliminate the shrubs from the stands (Daubenmire 1970). With a change in fire frequency, species composition will be altered as well (West 1983c). With a high fire frequency (every 2-5 years), perennial grasses and shrubs are eliminated and non-native annual grasses dominate. At fire-return intervals of 10-30 years, short-lived resprouting shrubs such as *Chrysothamnus* or *Tetradymia* spp. dominate. At fire intervals of 30-70 years, a mixture of perennial bunchgrasses and shrubs is maintained. Finally, in the complete absence of fire, deep-rooted shrubs such as *Artemisia tridentata* become the dominant shrubs.

This alliance is often found in seasonal or intermittent stream drainages. Currently, it can often be found on the benches of perennial steams which have become restricted to a downcut channel, although these are generally in poor condition with a *Bromus tectorum* understory. It is likely that these habitats are a result of livestock grazing impacts.

DISTRIBUTION

Geographic Range: This broadly distributed alliance is found in the western United States on dry steppes with core distribution in the Great Basin and Colorado Plateau regions.

Nations: US
States/Provinces: AZ, CA, CO, ID, NM, NV, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **>** *Artemisia tridentata / Sporobolus cryptandrus - Oryzopsis hymenoides* Plant Community (Francis 1986)
- **><** Big Sagebrush Scrub (#35210) (Holland 1986b)
- **><** Big Sagebrush Series (Sawyer and Keeler-Wolf 1995)
- **<** SRM Cover Type #401 - Basin Big Sagebrush (Shiflet 1994)
- **><** Western Shrub: 38: Great Basin Sagebrush (*Artemisia*) (Küchler 1964)

LOWER LEVEL UNITS

Associations:

- CEGL001545 *Artemisia tridentata / Sporobolus cryptandrus - Achnatherum hymenoides* Shrub Grassland
- CEGL000999 *Artemisia tridentata / Chrysothamnus viscidiflorus / (Poa secunda)* Shrubland
- CEGL001000 *Artemisia tridentata ssp. tridentata / Distichlis spicata* Shrubland
- CEGL001008 *Artemisia tridentata ssp. tridentata / Poa secunda* Shrubland
- CEGL000996 *Artemisia tridentata / Bouteloua gracilis - Pleuraphis jamesii* Shrubland
- CEGL001006 *Artemisia tridentata / Achnatherum hymenoides* Shrubland
- CEGL000995 *Artemisia tridentata / Bouteloua gracilis* Shrubland
- CEGL000997 *Artemisia tridentata / Bouteloua gracilis - Pascopyrum smithii* Shrubland
- CEGL001011 *Artemisia tridentata / Achnatherum lettermanii* Shrubland
- CEGL000998 *Artemisia tridentata / Ericameria nauseosa* Shrubland
- CEGL001013 *Artemisia tridentata* Upperzone Community Shrubland
- CEGL000991 *Artemisia tridentata* Shrubland
- CEGL002200 *Artemisia tridentata ssp. tridentata / Sporobolus airoides* Shrubland
- CEGL003826 *Artemisia tridentata ssp. tridentata / Sporobolus cryptandrus* Shrubland
- CEGL001015 *Artemisia tridentata ssp. tridentata / Pleuraphis jamesii* Shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Baker 1982b, Baker 1983b, Baker 1984a, Barbour and Major 1988, Barrows et al. 1977, Blackburn 1967, Blackburn et al. 1968a, Blackburn et al. 1968c, Blackburn et al. 1969a, Blackburn et al. 1969b, Blackburn et al. 1969c, Blackburn et al. 1969d, Blackburn et al. 1971, Branson et al. 1976, Britton et al. 1981, Caicco and Wellner 1983f, Caicco and Wellner 1983k, Chappell et al. 1997, Daubenmire 1970, DeVelice and Lesica 1993, Donart et al. 1978b, Eddleman and Jaindl 1994, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Fenemore 1970, Francis 1983, Francis 1986, Francis and Aldon 1983, Franklin and Dyrness 1973, Hansen et al. 1984, Harper and Jaynes 1986, Heinze et al. 1962, Hess 1981, Hironaka 1978, Hironaka et al. 1983, Holecheck and

Stephenson 1983, Holland 1986b, Jameson et al. 1962, Jensen et al. 1988a, Johnson and Payne 1968, Johnson and Simon 1987, Jorgensen 1979, Keammerer 1977, Kittel et al. 1994, Kittel et al. 1999a, Kurzius 1981, Küchler 1964, Leary and Peterson 1984, Lesica and DeVelice 1992, Loope 1969, McArthur and Welch 1986, McLean 1970, Mooney 1985, Moretti 1979, Moretti and Brotherson 1982, Mueggler and Stewart 1980, Northcutt 1978, ORNHP unpubl. data, Poulton 1955, Ralston 1969, Reid et al. 1994, Rickard and Beatley 1965, Robertson 1971, Savage 1968, Sawyer and Keeler-Wolf 1995, Sheehy and Winward 1981, Shiflet 1994, Strong 1980, Tiedemann et al. 1987, Tisdale 1986, Tisdale and Hironaka 1981, Tueller and Blackburn 1974, Tueller et al. 1966, Tweit and Houston 1980, USFS 1992, Warren et al. 1982, West 1983a, West 1983c

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G303. Intermountain Dry Tall Sagebrush Steppe & Shrubland

A3184. Artemisia tridentata ssp. wyomingensis Dry Steppe & Shrubland Alliance

Type Concept Sentence: This semi-arid shrubland alliance is found in the western United States on dry steppes with core distribution in the Great Basin, Colorado Plateau and Wyoming and is characterized by an open to moderately dense shrub canopy dominated by *Artemisia tridentata ssp. wyomingensis*. Other shrubs have low cover, except species that increase with disturbance such as *Gutierrezia sarothrae, Chrysothamnus viscidiflorus*, and *Ericameria nauseosa*. This understory is a sparse to moderately dense herbaceous layer characterized by dry-site perennial graminoids such as *Achnatherum hymenoides, Bouteloua gracilis, Carex filifolia, Distichlis spicata, Elymus elymoides, Hesperostipa comata, Pleuraphis jamesii*, and *Poa fendleriana*.

OVERVIEW

Scientific Name: *Artemisia tridentata ssp. wyomingensis* Dry Steppe & Shrubland Alliance
Common Name (Translated Scientific Name): Wyoming Big Sagebrush Dry Steppe & Shrubland Alliance
Colloquial Name: Wyoming Big Sagebrush Dry Steppe & Shrubland

Type Concept: This broadly distributed semi-arid shrubland alliance is found in the western United States on dry sites with core distribution in the Great Basin, Colorado Plateau and Wyoming. Stands have open to moderately dense shrub canopy dominated by *Artemisia tridentata ssp. wyomingensis*. *Artemisia tridentata ssp. tridentata* may be present in some stands. Other shrubs have low cover, except species that increase with disturbance such as *Gutierrezia sarothrae, Chrysothamnus viscidiflorus*, and *Ericameria nauseosa*. This understory is a sparse to moderately dense herbaceous layer characterized by dry-site graminoids such as *Achnatherum hymenoides, Achnatherum pinetorum, Achnatherum thurberianum, Bouteloua gracilis, Carex filifolia, Distichlis spicata, Elymus albicans, Elymus elymoides, Elymus lanceolatus, Hesperostipa comata, Leymus ambiguus, Leymus salinus, Pleuraphis jamesii*, and *Poa fendleriana*. The non-native, invasive species *Agropyron cristatum, Bromus tectorum*, and *Psathyrostachys juncea* may be present and dominant in disturbed stands. This alliance occurs on flat to steeply sloping sites with southerly aspects. Sites with little slope tend to have deep soils, while those with steeper slopes have shallow to moderately deep soils. Soil texture is loamy sand, loam, sandy loam, or clay loam.

Classification Comments: Associations with undetermined subspecies of *Artemisia tridentata* from former *Artemisia tridentata* Shrubland Alliance (A.829) were reviewed and placed into either *Artemisia tridentata ssp. wyomingensis* Dry Steppe & Shrubland Alliance (A3184) or *Artemisia tridentata ssp. tridentata - Artemisia tridentata ssp. xericensis* Dry Steppe & Shrubland Alliance (A3194). More review would increase confidence of placement.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Stands in this dry-site alliance are dominated by *Artemisia tridentata ssp. wyomingensis*. Characteristic herbaceous species include *Achnatherum hymenoides, Achnatherum pinetorum, Achnatherum thurberianum, Bouteloua gracilis, Carex filifolia, Distichlis spicata, Elymus albicans, Elymus elymoides, Elymus lanceolatus, Hesperostipa comata, Leymus ambiguus, Leymus salinus, Pleuraphis jamesii*, and *Poa fendleriana*.

VEGETATION

Physiognomy and Structure: The vegetation in this alliance is characterized by a moderate to dense (25-70%) cover of microphyllous evergreen shrubs, usually 0.5-1 m in height. Cespitose graminoids are usually prominent, often matching the shrubs in height and cover. Forb species may be frequent, but usually contribute little canopy cover. With increasing summer rain in the eastern portion of the range, there is a corresponding increase in the abundance of sod-forming grasses as compared to bunchgrasses. There may be significant cover on the ground surface by mosses and lichens, or a cryptogamic soil crust.

Floristics: Stands in this dry-site shrublands alliance have an open to moderately dense shrub canopy dominated by *Artemisia tridentata ssp. wyomingensis*. *Artemisia tridentata ssp. tridentata* may be present in some stands. Other shrubs have low cover, except species that increase with disturbance such as *Gutierrezia sarothrae, Chrysothamnus viscidiflorus*, and *Ericameria nauseosa*. Characteristic dry shrubland understory species include *Achnatherum hymenoides, Achnatherum pinetorum, Achnatherum thurberianum, Bouteloua gracilis, Carex filifolia, Distichlis spicata, Elymus albicans, Elymus elymoides, Elymus lanceolatus, Hesperostipa comata, Leymus ambiguus, Leymus salinus, Pleuraphis jamesii*, and *Poa fendleriana*. The non-native, invasive species *Agropyron cristatum, Bromus tectorum*, and *Psathyrostachys juncea* may be present and dominant in disturbed stands. Forbs form a minor and highly variable portion of this vegetation. Recurrent species include *Achillea millefolium, Balsamorhiza sagittata, Camelina microcarpa, Erigeron* spp., *Opuntia* spp., *Phlox* spp., and *Sphaeralcea coccinea*. Mosses and lichens, such as *Selaginella densa* and *Tortula ruralis*, may occur on bare ground, and in Washington and Idaho stands may cover up to 50% of the ground surface. Diagnostic of this dry-site shrubland alliance is the *Artemisia tridentata ssp. wyomingensis*-dominated shrub layer typically lacking a significant perennial graminoid layer (<20% cover).

ENVIRONMENT & DYNAMICS

Environmental Description: This broadly distributed alliance is found in the western United States on dry steppes with core distribution in the Great Basin, Colorado Plateau and Wyoming. Climate ranges from semi-arid in the western Great Basin and Colorado Plateau to subhumid in the northern plains. The amount and reliability of growing-season moisture increase eastward and with increasing elevation. These shrublands occur from less than 1000 m elevation in the Columbia Basin and northern Great Plains to over 2500 m in the Rocky Mountains and Great Basin ranges. The alliance occurs on flat to steeply sloping upland sites, on a wide variety of landform positions. These include alluvial fans and terraces, toeslopes, lower and middle slopes, draws, badly eroded badland slopes, and foothills. Sites with little slope tend to have deep soils, while those with steeper slopes have shallow to moderately deep soils (USFS 1992). Sloping sites tend to have southerly aspects. Soil texture is loamy sand, loam, sandy loam, or clay loam (Hansen and Hoffman 1988), and there is often a significant amount of coarse fragments in the soil profile. Hironaka et al. (1983) reported that most of their *Artemisia tridentata ssp. wyomingensis* habitat types occurred on calcareous soils, often with some form of a cemented duripan or silica-hardpan at about 1 m in depth.

In eastern Idaho and western Wyoming, *Artemisia tridentata ssp. wyomingensis* occupies somewhat dry, low-elevation sites, while *Artemisia tridentata ssp. tridentata* or *Artemisia cana* occupy deep alluvial soils of drainage bottoms at low elevation, and *Artemisia tridentata ssp. vaseyana* occupies cooler, moister upland sites at higher elevation. In addition to *Artemisia tridentata* and *Artemisia cana*, other associated vegetation types include *Atriplex confertifolia, Ericameria* spp., or *Chrysothamnus* spp. shrublands, *Populus tremuloides, Pinus ponderosa, Pinus contorta, Abies grandis*, or *Pseudotsuga menziesii* forests, *Pinus - Juniperus* woodlands, or mesic herbaceous communities.

Dynamics: Complex ecological interactions between fire regimes, grazing history, and climate patterns result in equally complex patterns of species structure and composition in *Artemisia tridentata*. These present corresponding difficulties in the classification of these shrublands, which have been compounded by the influence of human settlement and agricultural patterns. What follows is a summary of some of the influences of altered fire regimes, and grazing history on *Artemisia tridentata* shrublands and shrub-herbaceous vegetation.

Artemisia tridentata ssp. wyomingensis shrublands may represent either drier or more disturbed examples of the *Artemisia tridentata ssp. wyomingensis* shrubland and shrub herbaceous alliances. Shrub densities typically increase with overgrazing of the bunchgrass component or with increasing summer drought (West 1983c). There is considerable debate over whether present shrub-dominated stands are actually degraded "steppe" (e.g., shrub-herbaceous physiognomy), and if the stands will return to steppe with changes in grazing and fire management. *Artemisia tridentata* is inhibited by fire, and excessive grazing may decrease fire frequency due to consumption of herbaceous forage, resulting in increased shrub density. Conversely, invasion by non-native annual grasses (e.g., *Bromus tectorum* or *Bromus arvensis*) may increase fire frequency sufficiently to eliminate the shrubs from the stands (Hironaka et al. 1983). With a change in fire frequency, species composition will be altered as well (West 1983c). With a high fire frequency (every 2-5 years), perennial grasses and shrubs are eliminated and non-native annual grasses dominate. At fire-return intervals of 10-30 years, short-lived resprouting shrubs such as *Chrysothamnus* or *Tetradymia* spp. dominate. At fire intervals of 30-70 years, a mixture of perennial bunchgrasses and shrubs is maintained. Finally, in the complete absence of fire, deep-rooted shrubs such as *Artemisia tridentata* become the theoretical dominants.

DISTRIBUTION

Geographic Range: This broadly distributed alliance is found in the western United States on dry steppes with core distribution in the Great Basin, Colorado Plateau and Wyoming.

Nations: US
States/Provinces: AZ, CA, CO, ID, MT, ND, NM, NV, OR, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:

Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **><** Big Sagebrush Scrub (#35210) (Holland 1986b)
- **><** Big Sagebrush Series (Sawyer and Keeler-Wolf 1995)
- **><** SRM Cover Type #314 - Big Sagebrush-Bluebunch Wheatgrass (Shiflet 1994)
- **<** SRM Cover Type #403 - Wyoming Big Sagebrush (Shiflet 1994)
- **<** SRM Cover Type #612 - Sagebrush - Grass (Shiflet 1994)
- **><** Western Shrub and Grasslands Combinations: 55: Sagebrush-Steppe (*Artemisia-Agropyron*) (Küchler 1964)
- **><** Western Shrub: 38: Great Basin Sagebrush (*Artemisia*) (Küchler 1964)

LOWER LEVEL UNITS

Associations:

- CEGL001534 *Artemisia tridentata ssp. wyomingensis* / Mixed Grasses Shrub Grassland
- CEGL002761 *Artemisia tridentata ssp. wyomingensis / Hesperostipa comata* Colorado Plateau Shrubland
- CEGL001041 *Artemisia tridentata ssp. wyomingensis / Bouteloua gracilis* Shrubland
- CEGL001001 *Artemisia tridentata / Elymus elymoides* Shrubland
- CEGL001005 *Artemisia tridentata / Pleuraphis jamesii* Shrubland
- CEGL001042 *Artemisia tridentata ssp. wyomingensis / Carex filifolia* Shrubland
- CEGL002810 *Artemisia tridentata ssp. wyomingensis / Achnatherum pinetorum* Shrubland
- CEGL001045 *Artemisia tridentata ssp. wyomingensis / Leymus ambiguus* Shrubland
- CEGL001046 *Artemisia tridentata ssp. wyomingensis / Achnatherum hymenoides* Shrubland
- CEGL001052 *Artemisia tridentata ssp. wyomingensis / Achnatherum thurberianum* Shrubland
- CEGL002084 *Artemisia tridentata ssp. wyomingensis / Pleuraphis jamesii* Shrubland
- CEGL002768 *Artemisia tridentata ssp. wyomingensis* / Sparse Understory Shrubland
- CEGL002775 *Artemisia tridentata ssp. wyomingensis / Poa fendleriana* Shrubland
- CEGL002813 *Artemisia tridentata ssp. wyomingensis / Leymus salinus* Shrubland
- CEGL001043 *Artemisia tridentata ssp. wyomingensis / Elymus elymoides* Shrubland
- CEGL001044 *Artemisia tridentata ssp. wyomingensis / Elymus albicans* Shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by D. Sarr.
Version Date: 2014/12/18

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References: Baker 1982b, Baker 1983c, Baker and Kennedy 1985, Bear Creek Uranium Mine Application n.d., Bighorn Coal Mine n.d., Blackburn 1967, Blackburn et al. 1968a, Blackburn et al. 1968b, Blackburn et al. 1968c, Blackburn et al. 1969a, Blackburn et al. 1969b, Blackburn et al. 1969c, Blackburn et al. 1969d, Blackburn et al. 1971, Britton et al. 1981, Brotherson and Brotherson 1981, Brown 1971, Caicco and Wellner 1983f, Caicco and Wellner 1983i, Caicco and Wellner 1983j, Caicco and Wellner 1983k, Caicco and Wellner 1983l, Chappell et al. 1997, Comer 1999, Cotter-Ferguson Project n.d., Daubenmire 1970, Day and Wright 1985, DeVelice and Lesica 1993, DeVelice et al. 1991, Doescher et al. 1986, Driese et al. 1997, Earth Resource Technology n.d., Eddleman and Jaindl 1994, Ellis and Hackney 1981, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Fenemore 1970, Ferchau 1973, Fisser 1964, Fisser 1970, Francis 1983, Francis 1986, Franklin and Dyrness 1973, Giese 1975, Gross 1955, Hall 1973, Hansen and Hoffman 1988, Hansen et al. 1984, Harper and Jaynes 1986, Heinze et al. 1962, Hess 1981, Hess and Wasser 1982, Hironaka 1978, Hironaka et al. 1983, Holecheck and Stephenson 1983, Holland 1986b, Jameson et al. 1962, Jensen et al. 1988a, Johnson and Payne 1968, Johnson and Simon 1987, Johnston 1987, Jorgensen 1979, Keammerer 1987, Knight 1994, Knight et al. 1987, Komarkova 1986, Kurzius 1981, Küchler 1964, Leary and Peterson 1984, Lesica and DeVelice 1992, Leucite Hills Mine Application n.d., Lewis 1975a, Loope 1969, Lucky McMine Application n.d., Lundberg 1977, Marr et al. 1979, McArthur and Welch 1986, McLean 1970, Moretti 1979, Moretti and Brotherson 1982, Mueggler and Stewart 1980, Nichols 1964a, Nichols 1964b, Northwest Resources Co. 1981, ORNHP unpubl. data, Poulton 1955, Ralston 1969, Rickard and Beatley 1965, Robertson 1971, Savage 1968, Sawyer and Keeler-Wolf 1995, Seminoe I Mine Application n.d., Sheehy and Winward 1981, Shiflet 1994, Skull Point Mine Application n.d., Skull Point Mine Permit Renewal n.d., Smith n.d.b, Steger 1970, Stoecker-Keammerer Consultants n.d.a, Strong 1980, Sweetwater Uranium Project 1978, Sweetwater Uranium Project n.d., Terwilliger et al. 1979a, Thorne Ecological Institute 1973a, Thorne Ecological Institute 1973b, Tiedemann et al. 1987, Tisdale 1947, Tisdale and Hironaka 1981, Tueller and Blackburn 1974, Tueller et al. 1966, Tweit and Houston 1980, USFS 1992, Van Pelt 1978, Warren et al. 1982, West 1983c, West et al. 1984, Winward 1970

3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
3.B.1.Ne.3.b. M169 Great Basin-Intermountain Tall Sagebrush Steppe & Shrubland

G302. Intermountain Mesic Tall Sagebrush Steppe & Shrubland

Type Concept Sentence: This widespread matrix-forming sagebrush steppe and shrubland group occurs throughout the interior western U.S., Wyoming and the northwestern Great Plains and is characterized by an open to sparse shrub layer of *Artemisia tridentata* (*ssp. tridentata, ssp. xericensis*) or *Artemisia tripartita ssp. tripartita* with an often dense herbaceous layer dominated by perennial bunchgrasses such as *Achnatherum occidentale, Festuca campestris, Festuca idahoensis, Leymus cinereus, Poa secunda*, and *Pseudoroegneria spicata*.

OVERVIEW

Scientific Name: *Artemisia tridentata - Artemisia tripartita - Purshia tridentata* Big Sagebrush Steppe & Shrubland Group
Common Name (Translated Scientific Name): Basin Big Sagebrush - Threetip Sagebrush - Antelope Bitterbrush Big Sagebrush Steppe & Shrubland Group
Colloquial Name: Basin Big Sagebrush - Foothill Big Sagebrush Mesic Steppe & Shrubland

Type Concept: This widespread matrix-forming sagebrush steppe group occurs throughout much of the western U.S. in the Great Basin, Columbia Plateau, northwestern Great Plains, eastern Sierra Nevada, Wyoming Basins, Rocky Mountains, and Colorado Plateau between elevations of 1200 and 2400 m. Stands are characterized by open to sparse shrublands dominated by *Artemisia tridentata* (*ssp. tridentata, ssp. xericensis*) or *Artemisia tripartita ssp. tripartita* which tend to occupy more mesic sites with well-developed soil, and *Purshia tridentata* which tends to occupy drier, rockier soils and positions, as well as sandy dune areas. Some *Artemisia tridentata ssp. wyomingensis* associations are included here, where they occur in biophysical settings conducive to an abundant herbaceous layer, and more mesic-indicator species. Herbaceous layers are often dense and dominated by perennial bunchgrasses, especially as *Festuca idahoensis* and *Pseudoroegneria spicata*. Other common graminoids include *Achnatherum hymenoides, Achnatherum occidentale, Carex pensylvanica, Festuca campestris, Hesperostipa comata, Leymus cinereus, Pascopyrum smithii*, and *Poa secunda*. In some cases scattered trees may form an emergent layer of individual trees; species include *Cercocarpus ledifolius, Juniperus occidentalis, Juniperus osteosperma, Juniperus scopulorum*, or *Pinus ponderosa*. Many perennial forb species are important in these shrublands, and microphytic crust is very important in this group. This group may occur on stream terraces, point bars, valley floors, alluvial fans, floodplains, washes, gullies, stabilized dunes, swales, and rocky slopes. Soils vary from deep and well-developed to shallow, rocky and poorly developed sandy loams, loamy sands, sand, silt loams, and clay loams derived from alluvium, loess, shale, and sandstone.

Classification Comments: This group is a solid concept at its core, although the associations considered "mesic tall sagebrush" probably need adjustment. These communities tend to occur in the northern Great Basin and Northern Rockies, or on somewhat more mesic settings than the dry tall sagebrush group. Slightly higher precipitation and less evapotranspiration stress combined with deeper soils allow for the significant bunchgrass and perennial forb component of the shrublands in this group.

Similar NVC Types:
- G303 Intermountain Dry Tall Sagebrush Steppe & Shrubland
- G304 Intermountain Mountain Big Sagebrush Steppe & Shrubland

Diagnostic Characteristics: Stands are characterized by open to sparse shrublands dominated by *Artemisia tridentata (ssp. tridentata, ssp. xericensis)* or *Artemisia tripartita ssp. tripartita* which tend to occupy more mesic sites with well-developed soil, and *Purshia tridentata* which tends to occupy drier, rockier soils and positions, as well as sandy dune areas. Herbaceous layers are often dense and dominated by perennial bunchgrasses and a significant perennial graminoid layer is diagnostic of this group. Common graminoids include *Achnatherum hymenoides, Achnatherum occidentale, Achnatherum thurberianum, Carex pensylvanica, Elymus lanceolatus, Festuca campestris, Festuca idahoensis, Hesperostipa comata, Koeleria macrantha, Leymus cinereus, Pascopyrum smithii, Poa secunda*, and *Pseudoroegneria spicata*.

VEGETATION

Physiognomy and Structure: These are microphyllous evergreen or deciduous scrublands, with a significant component of perennial grasses. The group is structurally characterized by open to dense sagebrush or bitterbrush with associated shrubs interspersed and/or a dense understory of perennial bunch grasses.

Floristics: This shrub and shrub herbaceous group is characterized by communities dominated by *Artemisia tridentata ssp. tridentata, Artemisia tridentata ssp. xericensis, Artemisia tridentata ssp. wyomingensis, Artemisia tripartita ssp. tripartita*, and *Purshia tridentata*. Other associated shrubs and dwarf-shrubs may include *Arctostaphylos uva-ursi, Artemisia frigida, Chrysothamnus*

viscidiflorus, Ericameria spp., *Peraphyllum ramosissimum, Philadelphus lewisii, Prunus virginiana, Ribes cereum, Symphoricarpos longiflorus*, and *Symphoricarpos rotundifolius*. Herbaceous layers are often dense and dominated by perennial bunchgrasses. Common graminoids include *Achnatherum hymenoides, Achnatherum nelsonii, Achnatherum occidentale, Achnatherum thurberianum, Carex pensylvanica, Elymus lanceolatus, Festuca campestris, Festuca idahoensis, Hesperostipa comata, Koeleria macrantha, Leymus cinereus, Muhlenbergia montana, Pascopyrum smithii, Poa secunda*, and *Pseudoroegneria spicata*. Forbs are often diverse and have moderate to low cover. Species may include *Balsamorhiza sagittata, Eriogonum umbellatum*, or *Penstemon deustus*. In some cases scattered trees may form an emergent layer of individual trees; species include *Cercocarpus ledifolius, Juniperus occidentalis, Juniperus osteosperma, Juniperus scopulorum*, or *Pinus ponderosa*.

ENVIRONMENT & DYNAMICS

Environmental Description: This widespread matrix-forming group occurs throughout much of the western U.S. between elevations of 600 m in the northern extents to 2500 m in southern range limits. This group may occur on stream terraces, point bars, valley floors, alluvial fans, floodplains, washes, gullies, stabilized dunes, mesic uplands, swales, and rocky slopes. Slopes are variable from gentle to very steep. *Climate:* The climate where this group occurs is semi-arid with annual precipitation ranging from 18-40 cm and high inter-annual variation. Much of the precipitation falls as snow, and growing-season drought is characteristic. Temperatures are continental with large annual and diurnal variations. *Soil/substrate/hydrology:* Soils vary from deep and well-developed to rocky and poorly developed sandy loams, loamy sands, sand, silt loams, and clay loams derived from alluvium, loess, shale, and sandstone. In drier regions, these shrublands are usually associated with perennial or ephemeral stream drainages with water tables less than 3 m from the soil surface.

Dynamics: The natural fire regime of this group likely maintains a patchy distribution of shrubs so that the general aspect of the vegetation is a grassland. Shrubs may increase following heavy grazing and/or with fire suppression, particularly in moist portions in the northern Columbia Plateau where it forms a landscape mosaic pattern with shallow-soil scabland shrublands. Response to grazing can be variable depending on the type of grazer and the season in which grazing occurs. *Hesperostipa comata* can increase in abundance in response to either grazing or fire. In central and eastern Montana (and possibly elsewhere), complexes of prairie dog towns are common in this group. Microphytic crust is very important in this group.

DISTRIBUTION

Geographic Range: This widespread matrix-forming sagebrush steppe group occurs throughout much of the western U.S. in the Columbia Plateau, Great Basin, eastern Sierra Nevada, Colorado Plateau, Wyoming Basins, Rocky Mountains, and northwestern Great Plains.

Spatial Scale & Pattern [optional]: Matrix, Large patch
Nations: CA, US
States/Provinces: BC, CA, CO, ID, MT, ND, NV, OR, SD?, UT, WA, WY
TNC Ecoregions [optional]: 4:P, 6:C, 8:C, 9:C, 10:C, 11:C, 18:C, 19:C, 20:C, 26:C, 68:C
USFS Ecoregions (2007): 313A:CC, 331D:CC, 331G:CC, 341A:CC, 341B:CC, 342A:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:C?, 342I:CC, M242C:CC, M261G:CC, M331A:CC, M331D:CC, M331E:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:C?, M332D:CC, M332E:CC, M332F:CC, M332G:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Arches, Curecanti, Dinosaur, Fossil Butte, Golden Spike, Grand Teton?, John Day Fossil Beds, Mesa Verde, Natural Bridges, Zion); USFS (Arapaho-Roosevelt, Bridger-Teton, Shoshone); USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low. USNVC Confidence from peer reviewer, not AE.

SYNONYMY

- **=** Western Intermountain sagebrush steppe (West 1983c)

LOWER LEVEL UNITS

Alliances:

- A3179 *Purshia tridentata - Artemisia tridentata* Mesic Steppe & Shrubland Alliance
- A3183 *Artemisia tridentata ssp. tridentata - Artemisia tridentata ssp. xericensis* Mesic Steppe & Shrubland Alliance
- A1528 *Artemisia tripartita ssp. tripartita - Artemisia tridentata* Mesic Steppe & Shrubland Alliance
- A3182 *Artemisia tridentata ssp. wyomingensis* Mesic Steppe & Shrubland Alliance

AUTHORSHIP

Primary Concept Source: N.E. West (1983c)
Author of Description: M.E. Hall and K.A. Schulz
Acknowledgments:
Version Date: 11/06/2015

Classif Resp Region: West
Internal Author: MEH/KAS 3-10, mod. KAS 11-15

REFERENCES

References: Barbour and Billings 1988, Barbour and Major 1977, Barbour and Major 1988, Brown 1982a, Brown et al. 1979, Daubenmire 1970, Faber-Langendoen et al. 2017a, Hironaka et al. 1983, Holland and Keil 1995, Knight 1994, Mueggler and Stewart 1980, Shiflet 1994, West 1983a, West 1983c

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G302. Intermountain Mesic Tall Sagebrush Steppe & Shrubland

A3183. Artemisia tridentata ssp. tridentata - Artemisia tridentata ssp. xericensis Mesic Steppe & Shrubland Alliance

Type Concept Sentence: This mesic shrubland and steppe alliance occurs throughout the Intermountain West on sloping fans, footslopes, rolling hills, and especially deep, well-drained alluvial bottomlands with vegetation characterized by an open to moderately dense (10-70% cover) shrub layer of *Artemisia tridentata ssp. tridentata* or *Artemisia tridentata ssp. xericensis* and a sparse to dense herbaceous layer dominated by perennial bunchgrasses, especially *Elymus lanceolatus, Festuca idahoensis, Hesperostipa comata, Leymus cinereus, Pascopyrum smithii*, and *Pseudoroegneria spicata*.

OVERVIEW

Scientific Name: *Artemisia tridentata ssp. tridentata - Artemisia tridentata ssp. xericensis* Mesic Steppe & Shrubland Alliance
Common Name (Translated Scientific Name): Basin Big Sagebrush - Foothill Big Sagebrush Mesic Steppe & Shrubland Alliance
Colloquial Name: Basin Big Sagebrush - Foothill Big Sagebrush Mesic Steppe & Shrubland

Type Concept: This mesic shrubland and steppe alliance occur throughout the Intermountain West from the western Great Basin to the northern Rocky Mountains, the Columbian Basin and Colorado Plateau. The vegetation included in this alliance is characterized by a somewhat sparse to moderately dense (10-70% cover) shrub layer of *Artemisia tridentata ssp. tridentata* or *Artemisia tridentata ssp. xericensis*. Shrub associates include *Ericameria nauseosa (= Chrysothamnus nauseosus)* or *Chrysothamnus viscidiflorus* which increase with disturbance. Other shrubs occasionally present include *Atriplex* spp., *Gutierrezia sarothrae*, and *Symphoricarpos longiflorus*. Occasionally individual trees are present in some stands. The sparse to dense herbaceous layer is dominated by bunchgrasses that occupy patches in the shrub matrix. The most widespread species is *Pseudoroegneria spicata*, which occurs from the Columbia Basin to the Northern Rockies. Other locally dominant or important species include *Elymus elymoides, Elymus lanceolatus, Festuca idahoensis, Hesperostipa comata (= Stipa comata), Koeleria macrantha, Leymus cinereus, Muhlenbergia richardsonis, Pascopyrum smithii, Pleuraphis jamesii (= Hilaria jamesii)*, and *Poa secunda*. Forbs are generally of low importance and are highly variable across the range. Mosses and lichens are important ground cover in some stands. This mesic shrubland and steppe alliance occurs on sloping fans, footslopes, rolling hills, and especially deep, well-drained alluvial bottomlands.

Classification Comments: This mesic shrubland and steppe alliance occurs as large patch/matrix stands in relatively mesic northern latitudes. However, in semi-arid landscapes in more southern latitudes, it frequently occurs in smaller patch stands restricted to relatively mesic sites, such as swales and basins, that receive additional moisture from surrounding slopes, and at higher elevations.

The subspecies of *Artemisia tridentata* occurring in some associations included in this alliance are not determined, inconsistent or may be mixed. As the subspecies in stands in this alliance are determined, some associations can be moved or split and placed into these other alliances. Further study is needed to re-apportion communities within this alliance or justify the current classification. Mueggler and Stewart (1980) describe two *Artemisia tridentata* habitat types, one with *Festuca campestris* diagnostic and the other with *Festuca idahoensis*. The first one includes both *ssp. vaseyana* and *ssp. wyomingensis* depending on elevation. They cite an *Artemisia tridentata ssp. tridentata / Festuca idahoensis* Habitat Type from eastern Washington (Daubenmire 1970). Dick-Peddie (1993) described several vegetation types that may be classified in this alliance from four shrub-grass series in New Mexico. More complete descriptions of both alliances are needed to distinguish them.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: This mesic shrubland and steppe alliance is characterized by a somewhat sparse to moderately dense (10-70% cover) shrub layer of *Artemisia tridentata ssp. tridentata* or *Artemisia tridentata ssp. xericensis*. The open to moderately dense herbaceous layer is dominated by bunchgrasses. Characteristic species are *Elymus lanceolatus, Festuca idahoensis, Hesperostipa comata, Leymus cinereus, Pascopyrum smithii, Poa secunda*, and *Pseudoroegneria spicata*.

VEGETATION

Physiognomy and Structure: The vegetation is characterized by a sparse cover of microphyllous evergreen shrubs, usually 1-2 m in height. Shrub cover can be variable, but on average is less than 25% for steppe sites and 10-70% cover for shrubland sites. Perennial cespitose graminoids form a matrix surrounding the shrubs in steppe, occasionally matching them in height, or form a sparse to moderately dense graminoid layer in shrublands. Forb species may be frequent, but are usually of low canopy cover. The ground surface is covered with mosses and lichens in good condition stands, except for fluvial sites.

Floristics: The vegetation included in this alliance is characterized by a somewhat sparse to moderately dense (10-70% cover) shrub layer of *Artemisia tridentata ssp. tridentata* or *Artemisia tridentata ssp. xericensis*. Shrub associates include *Ericameria nauseosa (= Chrysothamnus nauseosus)* or *Chrysothamnus viscidiflorus* which increase with disturbance. Other shrubs occasionally present include *Atriplex* spp., *Gutierrezia sarothrae*, and *Symphoricarpos longiflorus*. Occasionally individual trees are present in some stands. The open to dense herbaceous layer is dominated by bunchgrasses that occupy patches in the shrub matrix. The most widespread species is *Pseudoroegneria spicata*, which occurs from the Columbia Basin to the Northern Rockies. Other locally dominant or important species include *Achnatherum hymenoides (= Oryzopsis hymenoides), Elymus elymoides, Elymus lanceolatus, Festuca idahoensis, Hesperostipa comata (= Stipa comata), Koeleria macrantha, Leymus cinereus, Muhlenbergia richardsonis, Pascopyrum smithii, Pleuraphis jamesii (= Hilaria jamesii)*, and *Poa secunda*. Forbs are generally of low importance and are highly variable across the range. Mosses and lichens are important ground cover in some stands. Diagnostic of this alliance is the *Artemisia tridentata ssp. tridentata*- or *Artemisia tridentata ssp. xericensis*-dominated shrub layer. The graminoid layer typically has >20% cover perennial graminoids or has over 40% total cover of shrubs.

ENVIRONMENT & DYNAMICS

Environmental Description: This mesic shrubland and steppe alliance occurs throughout the Intermountain West from the western Great Basin to the Colorado Plateau, northern Rocky Mountains and northwestern Great Plains. Elevation is mostly 1200-2500 m, but extends down to 240 m in the Columbia Basin. Mean annual precipitation ranges from 20-50 cm. Precipitation primarily occurs in the winter as snow or rain in the western portion of its range; however, spring and summer precipitation becomes important in the eastern portion of its range. This moisture is stored in the soil profile and utilized during the typically dry summers. Sites supporting this alliance include sloping fans, footslopes, rolling hills, and deep, well-drained alluvial bottomlands and swales. Soils are deep, fine- to medium-textured alluvial soils with some source of subirrigation during the summer season, but moderately deep upland soils with ample moisture storage also support these shrublands. Some stands occur on deep, sandy soils, or soils that are highly calcareous.

Dynamics: Complex ecological interactions between fire regimes, grazing history, and climate patterns result in equally complex patterns of species structure and composition in *Artemisia tridentata*. These present corresponding difficulties in the classification of these shrublands, which have been compounded by the influence of human settlement and agricultural patterns. What follows is a summary of some of the influences of altered fire regimes and grazing history on *Artemisia tridentata* shrublands and shrub-herbaceous vegetation that can result in the conversion of stands of this alliance into stands of exotic annual grassland. Exotic plants have invaded many stands, especially where disturbed (Daubenmire 1970). Common exotics may include annual grasses such as *Bromus tectorum, Bromus arvensis*, and *Bromus briziformis* which may be abundant during wet years; and annual forbs such as *Epilobium brachycarpum, Erodium cicutarium, Lactuca serriola, Tragopogon dubius*, and the perennial forb *Hypericum perforatum*. The winter precipitation recharges soil moisture, and the typically dry summers favor shrubs and deep-rooted grasses (West 1983c, 1988). The exotic annual grass *Bromus tectorum* competes favorably with these cool-season, perennial bunchgrasses in these stands by geminating in the fall, establishing a root system during the winter, then utilizing and depleting soil moisture early in the spring while the bunchgrasses are still mostly dormant (West 1983c).

Artemisia tridentata (ssp. tridentata, ssp. xericensis) shrub-herbaceous communities may represent either moister or less disturbed examples of the *Artemisia tridentata (ssp. tridentata, ssp. xericensis)* shrubland complex. Shrub densities typically increase with overgrazing of the bunchgrass component or with increasing summer drought (West 1983c). *Artemisia tridentata* is inhibited by fire, and excessive grazing may decrease fire frequency due to consumption of herbaceous forage, resulting in increased shrub density. Conversely, invasion by non-native annual grasses (e.g., *Bromus tectorum*) may increase fire frequency sufficiently to eliminate the shrubs from the stands (Daubenmire 1970). With a change in fire frequency, species composition will be altered as well (West 1983c). With a high fire frequency (every 2-5 years), perennial grasses and shrubs are eliminated and non-native annual grasses dominate. At fire-return intervals of 10-30 years, short-lived resprouting shrubs, such as *Chrysothamnus* or *Tetradymia* spp. dominate. At fire intervals of 30-70 years, a mixture of perennial bunchgrasses and shrubs is maintained. Finally, in the complete absence of fire, deep-rooted shrubs such as *Artemisia tridentata* become the dominant shrubs.

DISTRIBUTION

Geographic Range: This shrubland and steppe alliance occurs throughout the Intermountain West from the western Great Basin to the Colorado Plateau, northern Rocky Mountains and northwestern Great Plains.

Nations: CA, US

States/Provinces: BC?, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Artemisia tridentata ssp. tridentata / Festuca idahoensis* habitat type (Daubenmire 1970)
- **><** *Artemisia tridentata ssp. tridentata* and *ssp. wyomingensis* Shrub Steppe (Chappell et al. 1997)
- **>** *Artemisia tridentata-Agropyron spicatum* habitat type (Daubenmire 1970)
- **>** *Artemisia tridentata/Agropyron spicatum* Habitat Type (Hironaka et al. 1983)
- **<** *Artemisia tridentata* Series (Mueggler and Stewart 1980)
- **><** Big Sagebrush Scrub (#35210) (Holland 1986b)
- **<** Big Sagebrush Series (Sawyer and Keeler-Wolf 1995)
- **<** Great Basin Sagebrush (*Artemisia*), #32 (Küchler 1964)
- **>** SRM Cover Type #314 - Big Sagebrush-Bluebunch Wheatgrass (Shiflet 1994)
- **<** Sagebrush Steppe (*Artemisia-Agropyron*) (Küchler 1964)

LOWER LEVEL UNITS

Associations:

- CEGL001530 *Artemisia tridentata / Festuca idahoensis* Shrub Grassland
- CEGL001017 *Artemisia tridentata ssp. tridentata / Pascopyrum smithii - (Elymus lanceolatus)* Shrubland
- CEGL001019 *Artemisia tridentata (ssp. tridentata, ssp. xericensis) / Pseudoroegneria spicata - Poa secunda* Shrub Grassland
- CEGL001016 *Artemisia tridentata ssp. tridentata / Leymus cinereus* Shrubland
- CEGL001012 *Artemisia tridentata / Symphoricarpos longiflorus* Shrubland
- CEGL001014 *Artemisia tridentata ssp. tridentata / Festuca idahoensis* Shrubland
- CEGL002966 *Artemisia tridentata ssp. tridentata / Hesperostipa comata* Shrubland
- CEGL001458 *Artemisia tridentata / Leymus cinereus* Shrub Grassland
- CEGL001018 *Artemisia tridentata (ssp. tridentata, ssp. xericensis) / Pseudoroegneria spicata* Shrub Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Blackburn et al. 1968a, Blackburn et al. 1968c, Blackhawk Coal Company 1981, Brotherson and Brotherson 1979, Caicco and Wellner 1983k, Chappell et al. 1997, Dastrup 1963, Daubenmire 1970, Daubenmire 1992, Dick-Peddie 1993, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Graham 1937, Hall 1973, Hansen 1985, Hansen et al. 1984, Hironaka 1978, Hironaka et al. 1983, Hirsch 1985, Holland 1986b, Jensen et al. 1988a, Küchler 1964, Mariah Associates 1981, McArthur and Welch 1986, McLean 1970, Mooney 1985, Mueggler and Stewart 1980, ORNHP unpubl. data, Poulton 1955, Ralston 1969, Sawyer and Keeler-Wolf 1995, Shiflet 1994, Thilenius et al. 1995, Tisdale 1947, Tweit and Houston 1980, USFS 1992, Van Pelt 1978, West 1983c, West 1988

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G302. Intermountain Mesic Tall Sagebrush Steppe & Shrubland

A3182. Artemisia tridentata ssp. wyomingensis Mesic Steppe & Shrubland Alliance

Type Concept Sentence: This mesic shrubland and steppe alliance is found in the western United States and southwestern Canada and is characterized by an open to dense (10-70% cover) shrub layer that is dominated (or codominated with at least 40% relative cover in mixed stands) by *Artemisia tridentata ssp. wyomingensis*. Common associates include *Atriplex confertifolia, Artemisia frigida, Krascheninnikovia lanata, Purshia tridentata*, and *Symphoricarpos longiflorus*.

OVERVIEW

Scientific Name: *Artemisia tridentata ssp. wyomingensis* Mesic Steppe & Shrubland Alliance
Common Name (Translated Scientific Name): Wyoming Big Sagebrush Mesic Steppe & Shrubland Alliance
Colloquial Name: Wyoming Big Sagebrush Mesic Steppe & Shrubland

Type Concept: This mesic shrubland and steppe alliance is found in the western United States and southwestern Canada and is characterized by an open to dense (10-70% cover) shrub layer that is dominated (or codominated with at least 40% relative cover in mixed stands) by *Artemisia tridentata ssp. wyomingensis*. Common associates include *Atriplex confertifolia, Artemisia frigida, Krascheninnikovia lanata, Purshia tridentata*, and *Symphoricarpos longiflorus*. The herbaceous stratum can be diverse and have open to dense cover, but perennial graminoids typically total >20% cover. Characteristic dominant species are *Balsamorhiza sagittata, Hesperostipa comata, Pascopyrum smithii, Poa secunda*, and *Pseudoroegneria spicata*. Stands occur on flat to steeply sloping upland sites. Sites with little slope tend to have deep soils, while those with steeper slopes have shallow to moderately deep soils. Soil texture is loam, sandy loam, or clay loam with coarse fragments common in the soil profile.

Classification Comments: This mesic shrubland and steppe alliance occurs as large patch/matrix stands in relatively mesic northern latitudes. However, in semi-arid landscapes in more southern latitudes, it frequently occurs in smaller patch stands restricted to relatively mesic sites, such as swales and basins, that receive additional moisture from surrounding slopes and at higher elevations.

Associations with undetermined subspecies of *Artemisia tridentata* from old alliances *Artemisia tridentata* Shrubland Alliance (A.829) and *Artemisia tridentata* Shrub Herbaceous Alliance (A.1521) were reviewed and placed into either *Artemisia tridentata ssp. wyomingensis* Mesic Steppe & Shrubland Alliance (A3182) or *Artemisia tridentata ssp. tridentata - Artemisia tridentata ssp. xericensis* Mesic Steppe & Shrubland Alliance (A3183). More review would increase confidence of placement. *Artemisia tridentata ssp. wyomingensis - Peraphyllum ramosissimum / Festuca idahoensis* Shrubland (CEGL001048) was placed in this alliance (A3182) instead of *Artemisia tridentata* - Mixed Shrub Dry Shrubland Alliance (A3198) because it is a relatively mesic shrubland, and the current concept of the association only requires *Peraphyllum ramosissimum* be present to codominant (1-20% cover), so it is not a reliable *Artemisia tridentata* - mixed shrub stand. Currently, this alliance includes stands in North Dakota In the northwestern Great Plains.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: This mesic steppe and shrubland alliance has an open to moderately dense conspicuous shrub layer dominated by diagnostic shrub *Artemisia tridentata ssp. wyomingensis*. Associated shrubs include *Atriplex confertifolia, Artemisia frigida, Purshia tridentata*, and *Krascheninnikovia lanata*. The herbaceous layer ranges from open to moderate cover, but perennial graminoids typically total >20% cover. Characteristic dominant species are *Balsamorhiza sagittata, Hesperostipa comata, Pascopyrum smithii, Poa secunda*, and *Pseudoroegneria spicata*.

VEGETATION

Physiognomy and Structure: This alliance is characterized by an open to dense (10-70%) cover of microphyllous evergreen shrubs, usually 0.3-1 m in height, although in Washington the shrubs may be up to 2 m tall. Cespitose graminoids are usually dominant, often matching, and sometimes exceeding, the shrubs in height or cover. Forb species may be frequent, but are usually of low canopy cover. With increasing summer rain in the eastern portion of the range, there is a corresponding increase in the proportion of sod-forming grasses as compared to bunchgrasses. Undisturbed stands in Washington and Oregon may have a nearly continuous cryptogamic soil crust of mosses and lichens.

Floristics: Shrubs are conspicuous in this alliance, but herbaceous species usually have equal or greater cover. The vegetation included in this alliance is characterized by an open to moderately dense (10-70% cover) shrub layer that is dominated (or codominated with at least 40% relative cover in mixed stands) by *Artemisia tridentata ssp. wyomingensis*. Common associated shrubs are *Artemisia frigida, Chrysothamnus* spp., *Ericameria* spp., *Gutierrezia sarothrae, Krascheninnikovia lanata, Peraphyllum ramosissimum*, and *Symphoricarpos longiflorus*. The herbaceous stratum can be diverse and have open to moderate cover, but perennial graminoids typically total <20% cover. The most widespread and common species are *Pseudoroegneria spicata*, which occurs from the Columbia Basin to the Northern Rockies, and *Pascopyrum smithii*, which is more common in the northwestern Great Plains. Other locally abundant grass associates include *Achnatherum thurberianum (= Stipa thurberiana)* (in the western portion of the range), *Achnatherum hymenoides (= Oryzopsis hymenoides), Bouteloua curtipendula, Bouteloua gracilis, Carex filifolia, Elymus lanceolatus, Hesperostipa comata (= Stipa comata), Koeleria macrantha, Leymus ambiguus*, and *Poa secunda*. Forbs form a minor and highly variable portion of this vegetation. Recurrent species include *Achillea millefolium, Balsamorhiza sagittata, Camelina microcarpa, Erigeron* spp., *Opuntia* spp., *Phlox* spp., and *Sphaeralcea coccinea*. Mosses and lichens, such as *Selaginella densa* and *Tortula ruralis*, may occur on bare ground. Where there is supplemental moisture or where the vegetation grades into forest, emergent needle-leaved evergreen or cold-deciduous trees may be scattered through these shrub-steppe communities. Recurrent tree associates include *Juniperus occidentalis, Juniperus osteosperma, Juniperus scopulorum, Pinus contorta, Pinus edulis, Pinus flexilis, Pinus ponderosa*, and *Populus tremuloides*.

ENVIRONMENT & DYNAMICS

Environmental Description: This mesic steppe and shrubland alliance is found in the western United States and southwestern Canada from the Columbia River Basin south and east across the Great Basin to the northern Rocky Mountains and northwestern Great Plains. Climates range from semi-arid in the western Great Basin to subhumid in the Rocky Mountains and northern plains. The amount and reliability of growing-season moisture increase eastward and with increasing elevation. The associations in this alliance occur in somewhat wetter areas of the range of *Artemisia tridentata ssp. wyomingensis*, generally with over 25 cm annual precipitation or with a significant proportion falling in the growing season. These communities occur at elevations of less than 1000 m in the Columbia Basin and northern Great Plains to over 2500 m in the Rocky Mountains and Great Basin ranges. The alliance occurs on flat to steeply sloping upland sites. Sites with little slope tend to have deep soils, while those with steeper slopes have shallow to moderately deep soils (USFS 1992). Soil texture is loam, sandy loam, or clay loam (Hansen and Hoffman 1988), which allows ample shallow rainfall storage and percolation of snowmelt. Coarse fragments are common in the soil profile. Hironaka et al. (1983) reported that most of their *Artemisia tridentata ssp. wyomingensis* habitat types occurred on calcareous soils, often with some form of a cemented duripan or silica-hardpan at about 1 m in depth.

In eastern Idaho and western Wyoming, *Artemisia tridentata ssp. wyomingensis* occupies somewhat dry, low-elevation sites, while *Artemisia tridentata ssp. tridentata* or *Artemisia cana* occupy deep alluvial soils of drainage bottoms at low elevation, and *Artemisia tridentata ssp. vaseyana* occupies cooler, moister upland sites at higher elevation. In addition to *Artemisia tridentata* and *Artemisia cana*, other associated vegetation types include *Atriplex confertifolia, Ericameria* spp., or *Chrysothamnus* spp. shrublands, *Abies grandis, Pinus contorta, Pinus ponderosa, Populus tremuloides*, or *Pseudotsuga menziesii* forests, *Pinus - Juniperus* woodlands, or mesic herbaceous communities.

Dynamics: Stands in this alliance represent the moister communities of the *Artemisia tridentata ssp. wyomingensis*-dominated communities in Great Basin-Intermountain Tall Sagebrush Steppe & Shrubland Macrogroup (M169). Shrub densities typically increase with overgrazing of the bunchgrass component or with increasing summer drought (West 1983c). *Artemisia tridentata* is inhibited by fire, and excessive grazing may decrease fire frequency due to consumption of herbaceous forage, resulting in increased shrub density. Conversely, invasion by non-native annual grasses (e.g., *Bromus tectorum, Bromus arvensis*) may increase fire frequency sufficiently to eliminate the shrubs from the stands (Daubenmire 1970). With a change in fire frequency, species composition will be altered as well (West 1983c). With a high fire frequency (every 2-5 years), perennial grasses and shrubs are eliminated and non-native annual grasses dominate. At fire-return intervals of 10-30 years, short-lived resprouting shrubs such as *Chrysothamnus* or *Tetradymia* spp. dominate. At fire intervals of 30-70 years, a mixture of perennial bunchgrasses and shrubs is maintained. Finally, in the complete absence of fire, deep-rooted shrubs such as *Artemisia tridentata* become the theoretical dominants.

DISTRIBUTION

Geographic Range: This mesic alliance occurs from northeastern California and eastern Oregon across the Great Basin, Utah and habitats of the Rocky Mountains to the northern Great Plains of Montana, Wyoming, and into western North and South Dakota. Associations are also reported from the intermountain parks of Colorado, and from British Columbia, Canada. The alliance has not been reported from either Arizona or New Mexico but may occur there.

Nations: CA, US
States/Provinces: AZ?, BC?, CA, CO, ID, MT, ND, NM?, NV, OR, SD, UT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** Big Sagebrush Series (Sawyer and Keeler-Wolf 1995)
- **><** SRM Cover Type #314 - Big Sagebrush-Bluebunch Wheatgrass (Shiflet 1994)
- **><** SRM Cover Type #315 - Big Sagebrush-Idaho Fescue (Shiflet 1994)
- **=** SRM Cover Type #403 - Wyoming Big Sagebrush (Shiflet 1994)
- **<** SRM Cover Type #612 - Sagebrush - Grass (Shiflet 1994)
- **><** Western Shrub and Grasslands Combinations: 55: Sagebrush-Steppe (*Artemisia-Agropyron*) (Küchler 1964)
- **><** Western Shrub: 38: Great Basin Sagebrush (*Artemisia*) (Küchler 1964)

LOWER LEVEL UNITS

Associations:

- CEGL001535 *Artemisia tridentata ssp. wyomingensis / Pseudoroegneria spicata* Shrub Grassland

- CEGL001050 *Artemisia tridentata ssp. wyomingensis - Purshia tridentata / Pseudoroegneria spicata* Shrubland
- CEGL001051 *Artemisia tridentata ssp. wyomingensis / Hesperostipa comata* Shrubland
- CEGL005479 *Artemisia tripartita ssp. tripartita / Achnatherum thurberianum* Shrubland
- CEGL000994 *Artemisia tridentata ssp. wyomingensis / Balsamorhiza sagittata* Shrubland
- CEGL001009 *Artemisia tridentata ssp. wyomingensis / Pseudoroegneria spicata* Shrubland
- CEGL001048 *Artemisia tridentata ssp. wyomingensis - Peraphyllum ramosissimum / Festuca idahoensis* Shrubland
- CEGL005478 *Artemisia tridentata ssp. wyomingensis / Festuca idahoensis* Shrubland
- CEGL001049 *Artemisia tridentata ssp. wyomingensis / Poa secunda* Shrubland
- CEGL001047 *Artemisia tridentata ssp. wyomingensis / Pascopyrum smithii* Shrub Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by D. Sarr.
Version Date: 2014/12/18

REFERENCES

References: Baker 1982b, Baker 1983c, Baker and Kennedy 1985, Bear Creek Uranium Mine Application n.d., Bighorn Coal Mine n.d., Blackburn 1967, Blackburn et al. 1968a, Blackburn et al. 1968b, Blackburn et al. 1969a, Blackburn et al. 1969b, Blackburn et al. 1969c, Blackburn et al. 1969d, Blackburn et al. 1971, Brotherson and Brotherson 1981, Brown 1971, Caicco and Wellner 1983i, Caicco and Wellner 1983j, Caicco and Wellner 1983k, Caicco and Wellner 1983l, Chappell et al. 1997, Comer 1999, Cotter-Ferguson Project n.d., Daubenmire 1970, Day and Wright 1985, DeVelice and Lesica 1993, DeVelice et al. 1991, Doescher et al. 1986, Driese et al. 1997, Earth Resource Technology n.d., Ellis and Hackney 1981, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Ferchau 1973, Fisser 1964, Fisser 1970, Francis 1983, Giese 1975, Gross 1955, Hall 1973, Hansen and Hoffman 1988, Heinze et al. 1962, Hess 1981, Hess and Wasser 1982, Hironaka 1978, Hironaka et al. 1983, Jensen et al. 1988a, Johnson and Simon 1987, Johnston 1987, Keammerer 1987, Knight 1994, Knight et al. 1987, Komarkova 1986, Küchler 1964, Leucite Hills Mine Application n.d., Lewis 1975a, Lucky McMine Application n.d., Lundberg 1977, Marr et al. 1979, McArthur and Welch 1986, McLean 1970, Moretti 1979, Moretti and Brotherson 1982, Mueggler and Stewart 1980, Nichols 1964a, Nichols 1964b, Northwest Resources Co. 1981, ORNHP unpubl. data, Poulton 1955, Sawyer and Keeler-Wolf 1995, Seminoe I Mine Application n.d., Shiflet 1994, Skull Point Mine Application n.d., Skull Point Mine Permit Renewal n.d., Smith n.d.b, Steger 1970, Stoecker-Keammerer Consultants n.d.a, Strong 1980, Sweetwater Uranium Project 1978, Sweetwater Uranium Project n.d., Terwilliger et al. 1979a, Thorne Ecological Institute 1973a, Thorne Ecological Institute 1973b, Tiedemann et al. 1987, Tisdale 1947, Tweit and Houston 1980, USFS 1992, Van Pelt 1978, West 1983c, West et al. 1984, Winward 1970

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G302. Intermountain Mesic Tall Sagebrush Steppe & Shrubland

A1528. Artemisia tripartita ssp. tripartita - Artemisia tridentata Mesic Steppe & Shrubland Alliance

Type Concept Sentence: This mesic alliance is distributed from the Columbia Basin east to the northern Rocky Mountains and is characterized by an open to moderately dense shrub layer dominated or codominated by *Artemisia tripartita* with10-25% cover and with herbaceous species having equal or greater coverage than shrubs.

OVERVIEW

Scientific Name: *Artemisia tripartita ssp. tripartita - Artemisia tridentata* Mesic Steppe & Shrubland Alliance
Common Name (Translated Scientific Name): Threetip Sagebrush - Big Sagebrush Mesic Steppe & Shrubland Alliance
Colloquial Name: Threetip Sagebrush - Big Sagebrush Mesic Steppe & Shrubland

Type Concept: This mesic shrubland and steppe alliance is distributed from the Columbia Basin east to the northern Rocky Mountains and is characterized by an open to moderately dense shrub layer dominated or codominated by *Artemisia tripartita* with10-25% cover and with herbaceous species having equal or greater coverage than shrubs. Common shrub associates include *Artemisia frigida, Artemisia tridentata ssp. tridentata, Artemisia tridentata ssp. vaseyana, Chrysothamnus viscidiflorus, Krascheninnikovia lanata, Purshia tridentata*, or *Tetradymia canescens*. The herbaceous stratum is typically dominated by graminoids and of moderate to moderately high cover (20-70%). *Pseudoroegneria spicata* and *Festuca idahoensis* are the most common associates. Other locally abundant graminoid species include *Bouteloua curtipendula, Bouteloua gracilis, Carex filifolia, Festuca campestris, Hesperostipa comata (= Stipa comata)*, and *Koeleria macrantha*. Forbs form a minor and highly variable portion of this vegetation. Recurrent species include *Achillea millefolium, Balsamorhiza sagittata, Camelina microcarpa, Erigeron* spp., *Opuntia* spp., *Phlox* spp., and *Sphaeralcea coccinea*. Climate ranges from semi-arid in intermountain basins to subhumid in higher elevations of the Rocky Mountains. Stands occur on flat to steeply sloping upland sites. Soil texture is loam, sandy loam, or clay loam, but is highly variable.

Classification Comments: This mesic shrubland and steppe alliance occurs as large patch/matrix stands in relatively mesic northern latitudes. However, in semi-arid landscapes in more southern latitudes, it frequently occurs in smaller patch stands restricted to relatively mesic sites, such as swales and basins, that receive additional moisture from surrounding slopes and at higher elevations.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Vegetation in this mesic shrubland and steppe is characterized by an open, conspicuous shrub layer with herbaceous species having equal or greater coverage with diagnostic species *Artemisia tripartita* dominant to codominant with 10-25% cover. Other characteristics shrubs include *Artemisia frigida, Artemisia tridentata ssp. tridentata, Artemisia tridentata ssp. vaseyana, Chrysothamnus viscidiflorus, Krascheninnikovia lanata, Purshia tridentata*, or *Tetradymia canescens*. The herbaceous layer is dominated by graminoids with moderate to moderately high cover (25-70%). Characteristic and often dominant grasses are *Festuca campestris, Festuca idahoensis, Hesperostipa comata, Leymus cinereus*, and *Pseudoroegneria spicata*.

VEGETATION

Physiognomy and Structure: This alliance is characterized by an open to moderately dense (10-25%) cover of microphyllous evergreen shrubs, usually 0.3-1 m in height. Cespitose graminoids are usually prominent, and exceed the shrubs in height and/or cover. Forb species may be frequent or not, but are usually of low canopy cover.

Floristics: This mesic shrubland and steppe alliance is characterized by an open to moderately dense shrub layer dominated or codominated by *Artemisia tripartita* with10-25% cover and with herbaceous species having equal or greater coverage than shrubs. Common shrub associates include *Artemisia frigida, Artemisia tridentata ssp. tridentata, Artemisia tridentata ssp. vaseyana, Chrysothamnus viscidiflorus, Krascheninnikovia lanata, Purshia tridentata*, or *Tetradymia canescens*. The herbaceous stratum is typically dominated by graminoids of moderate to moderately high cover (20-70%). *Pseudoroegneria spicata* and *Festuca idahoensis* are the most common associates. Other locally abundant graminoid species include *Bouteloua curtipendula, Bouteloua gracilis, Carex filifolia, Festuca campestris, Hesperostipa comata (= Stipa comata)*, and *Koeleria macrantha*. Forbs form a minor and highly variable portion of this vegetation. Recurrent species include Achillea millefolium, Balsamorhiza sagittata, Camelina microcarpa, Erigeron spp., *Opuntia* spp., *Phlox* spp., and *Sphaeralcea coccinea*.

ENVIRONMENT & DYNAMICS

Environmental Description: This mesic shrubland and steppe alliance is distributed from the Columbia Basin east to the northern Rocky Mountains. Climate ranges from semi-arid in intermountain basins to subhumid in higher elevations of the Rocky Mountains. The amount and reliability of growing-season moisture increase eastward and with increasing altitude, generally averaging 25-35 cm annually. These communities occur from elevations of less than 1000 m in the Columbia Basin to over 2500 m in the Rocky Mountains. The alliance occurs on flat to steeply sloping upland sites. Sites with little slope tend to have deeper soils, while those with steeper slopes have shallow to moderately deep soils. Soil texture is loam, sandy loam, or clay loam, but is highly variable (Hironaka et al. 1983). *Artemisia cana*- or *Artemisia tridentata ssp. wyomingensis*-dominated communities often occupy lower elevations, and *Artemisia tridentata ssp. vaseyana*-dominated communities occupy cooler, moister upland sites at higher elevation. Other adjacent vegetation types across the range of this alliance include *Atriplex confertifolia, Chrysothamnus* spp., or *Artemisia nova* shrublands, *Populus tremuloides, Pinus ponderosa, Pinus contorta, Abies grandis*, or *Pseudotsuga menziesii* forests, *Pinus - Juniperus* woodlands, shortgrass and mixed-grass prairie, or mesic montane meadow communities.

Dynamics: *Artemisia tripartita* is able to resprout following fire, and dominance by the shrub is favored in overgrazed ranges (Hironaka et al. 1983). Populations may have variation in this ability (Hironaka et al. 1983). *Artemisia tripartita ssp. tripartita* occurs from the Continental Divide of Wyoming to the Columbia Basin of Washington. This subspecies has an erect growth form and may reach 2 m in height. *Artemisia tripartita ssp. rupicola* occurs east of the Continental Divide in Wyoming and forms low, layered shrubs less than 0.3 m in height (Fisser 1962). Growth trials of the two subspecies under similar conditions have shown that these morphological characteristics are genetic rather than environmentally controlled (Fisser 1962).

DISTRIBUTION

Geographic Range: This alliance occurs from eastern Washington and British Columbia, across the upper Columbia Basin to various habitats in the Rocky Mountains of Montana, Wyoming, and Colorado.

Nations: CA, US
States/Provinces: BC, CO, ID, MT, OR, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):

Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** SRM Cover Type #404 - Threetip Sagebrush (Shiflet 1994)

LOWER LEVEL UNITS

Associations:

- CEGL001538 *Artemisia tripartita ssp. tripartita / Pseudoroegneria spicata* Shrub Grassland
- CEGL005482 *Artemisia tripartita ssp. tripartita / Pascopyrum smithii* Shrubland
- CEGL002994 *Artemisia tripartita ssp. tripartita / Leymus cinereus* Shrub Grassland
- CEGL001536 *Artemisia tripartita ssp. tripartita / Festuca idahoensis* Shrub Grassland
- CEGL005483 *Artemisia tripartita ssp. tripartita / Poa secunda* Shrubland
- CEGL001537 *Artemisia tripartita ssp. tripartita / Festuca campestris* Shrub Grassland
- CEGL001539 *Artemisia tripartita ssp. tripartita / Hesperostipa comata* Shrub Grassland
- CEGL005481 *Artemisia tripartita ssp. tripartita / Koeleria macrantha* Shrubland

AUTHORSHIP

Primary Concept Source: D. Sarr and M.S. Reid, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by D. Sarr and M.S. Reid.
Version Date: 2014/12/18

REFERENCES

References: Caicco and Wellner 1983h, Caicco and Wellner 1983i, Caicco and Wellner 1983j, Chappell et al. 1997, Daubenmire 1970, Faber-Langendoen et al. 2017b, Fisser 1962, Hess 1981, Hironaka et al. 1983, Johnston 1987, McLean 1970, Mueggler and Stewart 1980, Shiflet 1994, Tweit and Houston 1980, WNHP unpubl. data

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G302. Intermountain Mesic Tall Sagebrush Steppe & Shrubland

A3179. Purshia tridentata - Artemisia tridentata Mesic Steppe & Shrubland Alliance

Type Concept Sentence: This mesic alliance occurs throughout the Intermountain West and is characterized by an open to moderately dense short-shrub layer dominated or codominated by *Purshia tridentata* with *Artemisia tridentata* and sometimes *Prunus virginiana* present to codominant. The understory is sparse to dense and typically dominated by perennial bunchgrasses such as *Achnatherum hymenoides, Achnatherum nelsonii, Achnatherum occidentale, Festuca campestris, Festuca idahoensis, Hesperostipa comata, Leymus cinereus, Poa secunda*, and *Pseudoroegneria spicata*.

OVERVIEW

Scientific Name: *Purshia tridentata - Artemisia tridentata* Mesic Steppe & Shrubland Alliance
Common Name (Translated Scientific Name): Antelope Bitterbrush - Big Sagebrush Mesic Steppe & Shrubland Alliance
Colloquial Name: Antelope Bitterbrush - Big Sagebrush Mesic Steppe & Shrubland

Type Concept: This mesic shrubland and steppe alliance occurs throughout the Intermountain West and occurs over a broad range of landforms and microhabitats. Stands are characterized by an open to moderately dense short-shrub layer dominated or codominated by *Purshia tridentata* with *Artemisia tridentata* and sometimes *Prunus virginiana* present to codominant. Other important shrubs include *Ericameria nauseosa (= Chrysothamnus nauseosus), Eriogonum heracleoides, Ribes cereum*, and *Symphoricarpos oreophilus*. The understory is sparse to dense and typically dominated by perennial bunchgrasses such as *Achnatherum hymenoides, Achnatherum nelsonii, Achnatherum occidentale, Festuca campestris, Festuca idahoensis, Hesperostipa comata, Leymus cinereus, Poa secunda*, and *Pseudoroegneria spicata*. Some stands may have a well-developed forb component composed of *Arabis holboellii, Achillea millefolium, Balsamorhiza sagittata, Brodiaea* spp., *Eriogonum ovalifolium, Eriogonum umbellatum, Lithospermum ruderale*, and *Pteryxia terebinthina (= Cymopterus terebinthinus)*. Mosses and lichens are important in some stands. Scattered trees may form an emergent layer of individual trees. Stands occur on flats to moderate slopes in foothills, on slopes of lakebeds with ash or pumice soils, and on drier sites within lower forest zones as shrub-steppe inclusions in forest. In Idaho, the alliance is reported from stabilized dunes. In general, it is an upland type associated with coarse, well-drained soils without high salinity or pH. Adjacent vegetation is typically *Artemisia* steppe, *Pseudoroegneria - Poa - Festuca* grasslands, or *Pinus flexilis* woodlands.

Classification Comments: This mesic shrubland and steppe alliance occurs as large patch/matrix stands in relatively mesic northern latitudes. However, in semi-arid landscapes in more southern latitudes, it frequently occurs in smaller patch stands restricted to relatively mesic sites, such as swales and basins, that receive additional moisture from surrounding slopes and at higher elevations.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Stands in this mesic shrubland and steppe alliance are dominated or codominated by *Purshia tridentata* with *Artemisia tridentata* and sometimes *Prunus virginiana* present to codominant. Characteristic herbaceous species are *Achnatherum hymenoides, Achnatherum nelsonii, Achnatherum occidentale, Carex pensylvanica, Eriogonum umbellatum, Festuca campestris, Festuca idahoensis, Hesperostipa comata, Leymus cinereus, Poa secunda*, and *Pseudoroegneria spicata*.

VEGETATION

Physiognomy and Structure: This alliance has a moderately dense to open (20-60% cover) microphyllous evergreen (or late cold-deciduous) shrublands with the dominant shrubs varying from 0.5-3 m in height. Maximum shrub height generally decreases with latitude and altitude, reaching a minimum in subalpine stands. A second tier of microphyllous evergreen or cold-deciduous shrubs may be present. Cespitose graminoids are typical herbaceous associates and may strongly dominate the ground layer. Some regional variants may have a substantial forb component as well. Lichens and mosses may cover the ground surface in good condition stands.

Floristics: This mesic shrubland and steppe alliance is characterized by an open to moderately dense short-shrub layer dominated or codominated by *Purshia tridentata* with *Artemisia tridentata* and sometimes *Prunus virginiana* present to codominant. Other important or occasional shrubs include *Artemisia frigida, Ceanothus velutinus, Chrysothamnus viscidiflorus, Ericameria nauseosa (= Chrysothamnus nauseosus), Eriogonum heracleoides, Ribes cereum*, and *Symphoricarpos oreophilus*. Scattered trees may form an emergent layer of individual trees; species include *Cercocarpus ledifolius, Juniperus occidentalis, Juniperus osteosperma, Juniperus scopulorum, Pinus ponderosa, Pinus jeffreyi, Pinus ponderosa var. washoensis (= Pinus washoensis), Quercus garryana*, or *Yucca brevifolia*. The understory is sparse to dense and typically dominated by perennial bunchgrasses such as *Achnatherum hymenoides, Achnatherum nelsonii, Achnatherum occidentale, Elymus lanceolatus, Festuca campestris, Festuca idahoensis, Hesperostipa comata, Koeleria macrantha, Leymus cinereus, , Poa secunda*, and *Pseudoroegneria spicata*. Other graminoids include *Carex geyeri, Carex pensylvanica*, and *Muhlenbergia montana*. Some stands may have a well-developed forb component composed of *Arabis holboellii, Achillea millefolium, Balsamorhiza sagittata, Brodiaea* spp., *Eriogonum ovalifolium, Eriogonum umbellatum, Lithospermum ruderale*, and *Pteryxia terebinthina (= Cymopterus terebinthinus)*. Mosses and lichens are important in some stands. Diagnostic of this alliance is the dominance of *Purshia tridentata* in a shrub layer that is greater than 25% on average.

ENVIRONMENT & DYNAMICS

Environmental Description: This mesic shrubland and steppe alliance occurs throughout the Intermountain West over a broad range of landforms and microhabitats at elevations from 500-3000 m. Stands are often found on the margins of *Pinus ponderosa* woodlands or forests, forming the transition into sagebrush vegetation. Most of the region is arid to semi-arid with annual precipitation ranging from 15-75 cm. The entire range is under a continental temperature regime of cold winters, cool to warm summers and large diurnal variation. In the western portions of the alliance's range, summers are dry. Growing-season precipitation increases eastward and is the greatest in the Rocky Mountains. They also occur on flats to moderate slopes in foothills, on slopes of lakebeds with ash or pumice soils, and on drier sites within lower forest zones as shrub-steppe inclusions in forest. In Idaho, the alliance is reported from stabilized dunes (Chadwick and Dalke 1965). In Colorado, the alliance is found on exposed, steep (45-60% slope) mountain slopes with southerly aspects on the eastern slopes of the Front Range (Hess 1981). These sites are typically too xeric to support extensions of the surrounding coniferous forests. Parent materials are colluvial and residual metamorphic rocks which have developed into soils classified as Entisols. These soils are poorly developed and rocky, with loamy and sandy textures, and shallow A horizons over rocky C horizons. The soil surface is also moderately rocky. In general, it is an upland type associated with coarse, well-drained soils without high salinity or pH. Adjacent vegetation is typically *Artemisia* steppe, *Pseudoroegneria - Poa - Festuca* grasslands, or *Pinus flexilis* woodlands.

Dynamics: *Purshia tridentata* displays considerable plasticity in growth across its range. The variation in height and form of different populations appears to be related to ecotypic variation (Mozingo 1987). Although mycorrhizae are considered important in establishment and growth of individual plants, *Purshia tridentata* is one of the first species to colonize barren volcanic substrates following eruption. The species is valuable as winter browse for native ungulates and livestock and is used extensively. Moderate livestock utilization (<60% of the year's current growth) has been reported to stimulate twig growth the following spring (Mueggler and Stewart 1980). Sawyer and Keeler-Wolf (1995) report that stands of *Purshia tridentata* can reach 125 years of age on deep, well-drained sites, but more commonly become decadent at 30 years, and die at 40-50 years of age. Stands appear to result from either a

disturbance event (such as fire), or from rare years when many seedlings survive. This results in even-aged stands (Sawyer and Keeler-Wolf 1995).

DISTRIBUTION

Geographic Range: This alliance is found in many western U.S. states and Canada, from California north and east into Oregon, Washington, Idaho, Colorado and British Columbia. The core of its range is the Columbia Basin and Columbia Plateau, Owyhee Uplands, Snake River Plain, and the Colorado Rockies. *Purshia tridentata* is one of the most widespread shrubs in the western United States.

Nations: CA, US
States/Provinces: BC, CA, ID, MT, NV, OR, UT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** *Purshia tridentata* (Bitter brush scrub) Alliance (Sawyer et al. 2009) [35.200.00]
- **><** Bitterbrush Series (Sawyer and Keeler-Wolf 1995)

LOWER LEVEL UNITS

Associations:

- CEGL001494 *Purshia tridentata / Festuca campestris* Shrub Grassland
- CEPP006746 *Purshia glandulosa - Artemisia tridentata* Shrubland
- CEGL001497 *Purshia tridentata / Pseudoroegneria spicata - Leymus cinereus* Shrub Grassland
- CEGL002674 *Purshia tridentata / Festuca idahoensis* Shrub Grassland
- CEGL001058 *Purshia tridentata / Achnatherum hymenoides* Shrubland
- CEGL001498 *Purshia tridentata / Hesperostipa comata* Shrub Grassland
- CEGL001059 *Purshia tridentata / Poa secunda* Shrubland
- CEGL001060 *Purshia tridentata / Prunus virginiana* Shrubland
- CEGL003124 *Purshia tridentata* Shrubland [Placeholder]
- CEGL001495 *Purshia tridentata / Pseudoroegneria spicata* Shrub Grassland
- CEGL003477 *Purshia tridentata - Artemisia tridentata / Eriogonum umbellatum* Shrubland
- CEGL003478 *Purshia tridentata - Artemisia tridentata / Achnatherum hymenoides* Shrubland
- CEGL005610 *Purshia tridentata - Ericameria nana / Penstemon deustus* Shrubland
- CEGL003479 *Purshia tridentata - Artemisia tridentata / Achnatherum nelsonii* Shrubland
- CEGL003480 *Purshia tridentata - Artemisia tridentata - Symphoricarpos rotundifolius* Shrubland
- CEGL003481 *Purshia tridentata - Artemisia tridentata - Tetradymia canescens* Shrubland
- CEGL001492 *Purshia tridentata / Carex pensylvanica - Achnatherum occidentale* Shrub Grassland
- CEGL005612 *Purshia tridentata / Achnatherum thurberianum* Shrubland
- CEGL005613 *Purshia tridentata / Leymus cinereus* Shrub Grassland
- CEPP006747 *Purshia glandulosa* Shrubland
- CEGL005611 *Purshia tridentata - Philadelphus lewisii / Poa secunda* Shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by D. Sarr.
Version Date: 2014/12/18

REFERENCES

References: Buttery 1955, Caicco and Wellner 1983e, Chadwick and Dalke 1965, Chappell et al. 1997, Copeland 1978, Daubenmire 1970, Daubenmire 1975, Day 1985, Day and Wright 1985, Evens et al. 2014, Faber-Langendoen et al. 2017b, Franklin and Dyrness 1973, Hall 1973, Hess 1981, Hess and Wasser 1982, Hironaka et al. 1983, Johnson and Clausnitzer 1992, Johnson and Simon 1987, Johnston 1987, Lewis 1975a, Marr et al. 1980, Moseley 1987c, Mozingo 1987, Mueggler and Stewart 1980, Poulton 1955, Reid et al. 1994, Roughton 1966, Roughton 1972, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Tisdale 1947, Tweit and Houston 1980, Volland 1976, WNHP unpubl. data, Wasser and Hess 1982

3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
3.B.1.Ne.3.c. M169 Great Basin-Intermountain Tall Sagebrush Steppe & Shrubland

G304. Intermountain Mountain Big Sagebrush Steppe & Shrubland

Type Concept Sentence: This sagebrush shrubland and shrub-steppe group is found at montane and subalpine elevations across the western U.S. where the open to dense shrub layer is composed primarily of *Artemisia tridentata ssp. vaseyana, Artemisia cana ssp. bolanderi, Artemisia cana ssp. viscidula*, and related taxa such as *Artemisia tridentata ssp. spiciformis* and *Artemisia rothrockii* with *Symphoricarpos* spp. often codominant and there is usually an abundant perennial herbaceous layer (over 25% cover).

OVERVIEW

Scientific Name: *Artemisia tridentata ssp. spiciformis - Artemisia tridentata ssp. vaseyana - Artemisia cana ssp. viscidula* Steppe & Shrubland Group
Common Name (Translated Scientific Name): Spiked Big Sagebrush - Mountain Big Sagebrush - Mountain Silver Sagebrush Steppe & Shrubland Group
Colloquial Name: Silver Sagebrush Steppe & Shrubland

Type Concept: This group includes sagebrush communities occurring at foothills (in Wyoming) to montane and subalpine elevations across the western U.S. from 1000 m in eastern Oregon and Washington to over 3000 m in the Southern Rockies. In Montana, it occurs on mountain "islands" in the north-central portion of the state and possibly along the Boulder River south of Absarokee and at higher elevations. In British Columbia, it occurs between 450 and 1650 m in the southern Fraser Plateau and the Thompson and Okanagan basins. Across its range of distribution, this is a compositionally diverse group. It is composed primarily of *Artemisia tridentata ssp. vaseyana*, and related taxon *Artemisia tridentata ssp. spiciformis* often with *Symphoricarpos* spp. present to codominant. Also included, but less common, are stands dominated by *Artemisia cana ssp. bolanderi, Artemisia cana ssp. viscidula*, and *Artemisia rothrockii* (a California endemic). Additionally there are mixed shrub stands codominated by *Amelanchier* spp., *Chamaebatiaria millefolium, Chrysothamnus viscidiflorus, Ericameria nauseosa, Peraphyllum ramosissimum, Purshia tridentata*, and *Ribes cereum*. *Artemisia tridentata ssp. wyomingensis* may be present to codominant if the stand is clearly montane as indicated by montane indicator species such as *Artemisia tridentata ssp. vaseyana, Danthonia intermedia, Festuca thurberi*, or *Leucopoa kingii*.

Most stands have an abundant perennial herbaceous layer (over 25% cover, and in many cases over 50% cover), but this group also includes *Artemisia tridentata ssp. vaseyana* shrublands that lack a significant herbaceous layer. Other common graminoids include *Achnatherum lettermanii, Achnatherum occidentale, Achnatherum pinetorum, Bromus carinatus, Calamagrostis rubescens*, Carex geyeri, *Elymus trachycaulus, Festuca arizonica, Festuca campestris, Festuca idahoensis, Hesperostipa comata, Leucopoa kingii, Muhlenbergia montana, Pascopyrum smithii, Poa fendleriana, Poa secunda*, and *Pseudoroegneria spicata*. In many areas, wildfires can maintain an open herbaceous-rich steppe condition, although at most sites, shrub cover can be unusually high for a steppe system (>40%), with the moisture providing equally high grass and forb cover.

Classification Comments: *Artemisia cana* is often found in mesic to wet swales and toeslopes. Some *Artemisia cana ssp. viscidula* communities are included in this group, when they are not composed of more obligate wetland taxa, such as *Juncus*, wetland Carices, and such.

Similar NVC Types:
- G303 Intermountain Dry Tall Sagebrush Steppe & Shrubland
- G302 Intermountain Mesic Tall Sagebrush Steppe & Shrubland

Diagnostic Characteristics: This montane and subalpine sagebrush shrubland and shrub-steppe group is dominated by diagnostic shrub species *Artemisia tridentata ssp. vaseyana, Artemisia cana ssp. bolanderi, Artemisia cana ssp. viscidula*, and related taxa such as *Artemisia tridentata ssp. spiciformis* and *Artemisia rothrockii* (a California endemic). *Symphoricarpos* spp. are often codominant, but other shrubs may be present, forming a mixed canopy. There is usually an abundant perennial herbaceous layer (over 25% cover). Characteristic montane and subalpine herbaceous species include *Achnatherum lettermanii, Achnatherum occidentale, Achnatherum pinetorum, Bromus carinatus, Calamagrostis rubescens, Carex geyeri, Carex exserta, Danthonia intermedia, Danthonia parryi, Elymus trachycaulus, Festuca arizonica, Festuca campestris, Festuca idahoensis, Festuca thurberi, Leucopoa kingii*, and *Muhlenbergia montana*.

VEGETATION

Physiognomy and Structure: Microphyllous-leaved evergreen and broad-leaved, cold-deciduous shrub-steppe group with open to dense cover of sagebrush species and an abundant perennial herbaceous layer of graminoid and forb species.

Floristics: Vegetation types within this group are usually less than 1.5 m tall and dominated by *Artemisia tridentata ssp. vaseyana, Artemisia tridentata ssp. spiciformis*, or *Artemisia cana ssp. viscidula*, often with *Symphoricarpos* spp. present to codominant. Also included, but less common, are stands dominated by *Artemisia cana ssp. bolanderi, Artemisia cana ssp. viscidula*, and *Artemisia rothrockii* (a California endemic). Additionally, there are mixed shrub stands codominated by *Amelanchier* spp., *Chamaebatiaria millefolium, Peraphyllum ramosissimum*, and *Purshia tridentata*. A variety of other shrubs can be found in some occurrences, but these are seldom dominant. They include *Amelanchier alnifolia, Artemisia arbuscula, Ceanothus velutinus, Chrysothamnus viscidiflorus, Ericameria nauseosa, Ribes cereum*, and *Rosa woodsii*. *Artemisia tridentata ssp. wyomingensis* may be present to codominant if the stand is clearly montane to subalpine as indicated by montane indicator species such as *Artemisia tridentata ssp. vaseyana, Danthonia intermedia, Festuca thurberi*, or *Leucopoa kingii*. The shrub canopy cover ranges from 10 to 80%. The herbaceous layer is usually well-represented (over 25% cover, and in many cases over 50% cover), but bare ground may be common in particularly arid or disturbed occurrences. Additional characteristic graminoids may include *Achnatherum lettermanii, Achnatherum occidentale, Achnatherum pinetorum, Bromus carinatus, Calamagrostis rubescens, Carex geyeri, Carex exserta, Danthonia parryi, Elymus trachycaulus, Festuca arizonica, Festuca campestris, Festuca idahoensis, Hesperostipa comata, Muhlenbergia montana, Pascopyrum smithii, Poa fendleriana, Poa secunda*, and *Pseudoroegneria spicata*. Forbs are often numerous and an important indicator of health. Common forbs include *Achillea millefolium, Antennaria rosea, Artemisia ludoviciana, Balsamorhiza sagittata, Eriogonum umbellatum, Fragaria virginiana, Hymenoxys hoopesii (= Helenium hoopesii)*, and several species of *Astragalus, Castilleja, Erigeron, Geum, Lupinus, Penstemon, Phlox*, and *Potentilla*.

ENVIRONMENT & DYNAMICS

Environmental Description: This group occurs in many of the western United States, usually at middle elevations (1000-2500 m). The climate regime is cool, semi-arid to subhumid, with yearly precipitation ranging from 25 to 90 cm/year. Much of this precipitation falls as snow. Temperatures are continental with large annual and diurnal variation. In general, this group shows an affinity for mild topography, fine soils, and some source of subsurface moisture. Soils generally are moderately deep to deep, well-drained, and of loam, sandy loam, clay loam, or gravelly loam textural classes; soils often have a substantial volume of coarse fragments, and are derived from a variety of parent materials. This group primarily occurs on deep-soiled to stony flats, ridges, nearly flat ridgetops, and mountain slopes. All aspects are represented, but the higher elevation occurrences may be restricted to south- or west-facing slopes.

Dynamics: Healthy sagebrush shrublands are very productive, are often grazed by domestic livestock, and are strongly preferred during the growing season (Padgett et al. 1989). Prolonged livestock use can cause a decrease in the abundance of native bunch grasses and increase in the cover of shrubs and non-native grass species such as *Poa pratensis*. *Artemisia cana* resprouts vigorously following spring fire, and prescribed burning may increase shrub cover. Conversely, fire in the fall may decrease shrub abundance (Hansen et al. 1995). *Artemisia tridentata* is generally killed by fires and may take over ten years to form occurrences of some 20% cover or more. The condition of most sagebrush steppe has been degraded due to fire suppression and heavy livestock grazing. It is unclear how long restoration will take to restore degraded occurrences.

DISTRIBUTION

Geographic Range: This group is found at montane and subalpine elevations across the western U.S. from 1000 m in eastern Oregon and Washington to over 3000 m in the Southern Rockies. In British Columbia, it occurs in the southern Fraser Plateau and the Thompson and Okanagan basins. This group also occurs in central Montana in the Rocky Mountain island ranges

Spatial Scale & Pattern [optional]: Matrix
Nations: CA, US
States/Provinces: AZ?, BC, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]: 6:C, 7:C, 8:C, 9:C, 12:C, 18:C, 19:C, 20:C, 26:C, 68:C
USFS Ecoregions (2007): 313A:CC, 313B:CP, 315A:CC, 315H:CC, 321A:??, 322A:CC, 331B:C?, 331F:CC, 331G:CC, 331J:CC, 331M:C?, 331N:CP, 341A:CC, 341B:CC, 341C:CC, 341D:CC, 341E:CC, 341F:CC, 341G:CC, 342A:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:CC, 342I:CC, 342J:CC, M242C:CC, M242D:CC, M261A:CC, M261D:CC, M261E:CC, M261F:C?, M261G:CC, M313A:CP, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M341A:CC, M341B:CC, M341C:CC, M341D:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate. USNVC Confidence from peer reviewer, not AE.

SYNONYMY

- **=** Mountain Big Sagebrush (402) (Shiflet 1994)
- **=** Western Intermountain sagebrush steppe (West 1983c)

LOWER LEVEL UNITS

Alliances:

- A3208 *Artemisia tridentata ssp. vaseyana* - Mixed Steppe & Shrubland Alliance
- A1098 *Artemisia rothrockii* Shrubland Alliance
- A3200 *Artemisia cana ssp. bolanderi - Artemisia cana ssp. viscidula* Steppe & Shrubland Alliance
- A3207 *Artemisia tridentata ssp. spiciformis - Artemisia tridentata ssp. vaseyana* Steppe & Shrubland Alliance

AUTHORSHIP

Primary Concept Source: N.E. West (1983c)
Author of Description: M.E. Hall and K.A. Schulz
Acknowledgments:
Version Date: 11/06/2015
Classif Resp Region: West
Internal Author: MEH 2-10, mod. KAS 11-15

REFERENCES

References: Faber-Langendoen et al. 2017a, Hansen et al. 1995, Hironaka et al. 1983, Johnston 2001, Mueggler and Stewart 1980, Padgett et al. 1989, Shiflet 1994, West 1983c

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G304. Intermountain Mountain Big Sagebrush Steppe & Shrubland

A3200. Artemisia cana ssp. bolanderi - Artemisia cana ssp. viscidula Steppe & Shrubland Alliance

Type Concept Sentence: This alliance occurs throughout the northern half of the Intermountain West and is characterized by an open to closed, medium-tall shrub canopy of *Artemisia cana ssp. viscidula* or *Artemisia cana ssp. bolanderi* with dry graminoids in the understory. Stands occur in relatively moist environments, including mesic alkaline or saline basins, but not wetland or riparian sites.

OVERVIEW

Scientific Name: *Artemisia cana ssp. bolanderi - Artemisia cana ssp. viscidula* Steppe & Shrubland Alliance
Common Name (Translated Scientific Name): Bolander's Silver Sagebrush - Mountain Silver Sagebrush Steppe & Shrubland Alliance
Colloquial Name: Silver Sagebrush Steppe & Shrubland

Type Concept: This shrubland and steppe alliance occurs throughout the northern half of the Intermountain West. The shrub layer ranges from 0.5-1.5 m tall, and shrub canopy cover ranges from 10-60%. In most stands, *Artemisia cana ssp. viscidula* or *Artemisia cana ssp. bolanderi* is the only dominant shrub, although other shrubs such as *Purshia tridentata* can be present. The understory is variable, ranging from a sparse to dense herbaceous layer that is typically dominated by dry to mesic, perennial graminoids with 20% cover. Species include *Elymus elymoides, Festuca thurberi, Poa cusickii, Poa fendleriana, Poa pratensis*, and *Poa secunda (= Poa nevadensis)*. Wetland indicators such as species of *Eleocharis, Deschampsia, Juncus*, or *Salix* are absent or restricted to local microsites. This alliance occupies seasonally moist sites in broad meadows. Although it occurs in relatively moist environments and may be marginally riparian, including alkaline or saline basins, it is not a true riparian or wetland type. Soils are mostly well-developed with thick mollic epipedons and lack indicators of seasonally high water tables. Soil texture is variable and includes clayey, clayey skeletal, coarse-loamy and loamy skeletal. Depth to water table is over 75 to 100+ cm.

Classification Comments: There may be alliance range/taxonomic problems with the subspecies of *Artemisia cana*. For example, according to Kartesz (1999), *ssp. bolanderi* is not reported to occur in Oregon, but is reported to occur there by the Oregon Natural Heritage Program. Thus the distribution of this alliance is subject to change as updated information becomes available. Although there may be taxonomic issues with the subspecies, there are two other *Artemisia cana* alliances: (1) *Artemisia cana* Wet Shrubland Alliance (A2557) in Rocky Mountain-Great Basin Lowland-Foothill Riparian Shrubland Group (G526) that is dominated by the same two subspecies of *Artemisia cana* (*ssp. bolanderi, ssp. viscidula*), but is riparian, and (2) *Artemisia cana ssp. cana* Wet Shrubland Alliance (A3586) in Great Plains Riparian Wet Meadow & Shrubland Group (G337) that is dominated by *Artemisia cana ssp. cana* and occurs in riparian habitats (not upland) in the Great Plains. The subspecies will remain for now as more taxonomic and classification review is done.

Manning and Padgett (1995) include *Artemisia cana / Festuca ovina* c.t. (Padgett et al. 1989) and *Artemisia cana / Festuca idahoensis* c.t. (Youngblood et al. 1985) in the *Artemisia cana*/Dry Graminoid c.t. These community types are currently included in *Artemisia cana* Wet Shrubland Alliance (A2557) in Rocky Mountain-Great Basin Lowland-Foothill Riparian Shrubland Group (G526) so additional review is warranted.

Internal Comments: KAS 12-14: Mike Jennings in the alliance review recommended that "references to the subspecies, for example but not limited to the title, should be minimized. The two subspecies (ssp. bolanderi and viscidula) are the only two subspecies of the species. While ssp. viscidula is more of the Great Basin/Rocky Mtn region and ssp. Bolanderi is more of the Sierra/Cascades region, the compositions of the underlying associations are distinct regardless of the dominant subspecies. Relying on subspecific taxonomic differences as diagnostics at the alliance level is not good practice (though there are cases where this is unavoidable, like *A. tridentata* types). The name and description of this alliance should be revised accordingly. This is not to say that the biogeography of the dominant species should not be acknowledged and discussed in the comments section and elsewhere as appropriate, but the description as written reflects too much of a kluge" I decided to leave as is for now because the subspecies is important to distinguish between A3586. "Mesic-Riparian" was added to names of similar riparian *Artemisia cana* alliances: Artemisia cana Shrubland Alliance (A2557) in the Rocky Mountain & Great Basin Lowland & Foothill Riparian Shrubland (G526) group and Artemisia cana ssp. cana Shrub Herbaceous Alliance (A3586) in the Great Plains Shrub & Herb Riparian (G337) group to distinguish between this non-riparian *Artemisia cana* alliance.
Other Comments:

Similar NVC Types:
- A2557 *Artemisia cana* Wet Shrubland Alliance: is dominated by the same two subspecies of *Artemisia cana* (*ssp. bolanderi, ssp. viscidula*), but occurs in riparian situation not upland.
- A3586 *Artemisia cana ssp. cana* Wet Shrubland Alliance: is dominated by *Artemisia cana ssp. cana* and occurs in riparian situation (not upland) in the Great Plains.

Diagnostic Characteristics: Stands in this mesic alliance are characterized by an open to closed, medium-tall shrub canopy of *Artemisia cana ssp. viscidula* or *Artemisia cana ssp. bolanderi*. *Purshia tridentata* may be present to codominant. The shrub layer ranges from 0.5-1.5 m tall, and shrub canopy cover ranges from 10-60%. In most stands, herbaceous cover can be abundant to very sparse, but perennial graminoids generally total less than 20% cover. Characteristic herbaceous species include *Festuca idahoensis, Festuca thurberi, Poa secunda, Poa cusickii*, and *Poa fendleriana ssp. fendleriana*. Wetland indicators such as species of *Eleocharis, Deschampsia, Juncus*, and Salix are absent.

VEGETATION

Physiognomy and Structure: These are mesic shrubland and steppe communities characterized by moderately to widely spaced microphyllous evergreen shrubs. Widely spaced, often robust bunchgrasses usually dominate the understory, although rhizomatous species occasionally occur. The graminoids may exceed the shrubs in height and total cover. Prostrate and, occasionally, upright forbs may be present.

Floristics: The shrub layer ranges from 0.5-1.5 m tall, and shrub canopy cover ranges from 10-60%. In most stands, *Artemisia cana ssp. viscidula* or *Artemisia cana ssp. bolanderi* is the only dominant shrub, although other shrubs such as *Purshia tridentata, Rosa woodsii*, or *Symphoricarpos oreophilus* can be present. The understory is variable, ranging from a sparse to dense herbaceous layer that is typically dominated by dry to mesic, perennial graminoids with 20% cover. Species include *Bromus anomalus, Bromus porteri, Carex douglasii, Carex geyeri, Danthonia intermedia, Elymus elymoides, Elymus trachycaulus, Festuca idahoensis, Festuca thurberi, Poa cusickii, Poa fendleriana, Poa pratensis* (exotic), and *Poa secunda (= Poa nevadensis)* (Hess 1981, Francis 1983, Johnston 1987, Tiedemann et al. 1987, Manning and Padgett 1995). Forb associates include *Achillea millefolium, Eriogonum umbellatum, Geranium richardsonii, Potentilla gracilis*, and *Wyethia amplexicaulis*. Obligate and facultative wetland indicators such as species of *Eleocharis, Deschampsia, Juncus*, or *Salix* are generally absent or restricted to local microsites. One exception is the wide-ranging *Juncus arcticus*, a facultative wetland plant (usually occurs in wetlands, but may occur in non-wetlands) is often present but not dominant.

ENVIRONMENT & DYNAMICS

Environmental Description: This shrubland and steppe alliance occurs throughout the northern half of the Intermountain West in high mountain valleys, on broad flats and gently sloping to undulating alluvial outwash fans usually at middle elevations (1000-2500 m) and occasionally high elevations (to 3000 m) (Hess 1981, Francis 1983, Johnston 1987, Tiedemann et al. 1987, Manning and Padgett 1995). Climate is temperate. Precipitation varies across the range, from less than 25 cm in semi-arid basins of the western Great Basin, to over 90 cm in moister meadow habitats of the Sierra Nevada and central Rocky Mountains. Stands occupy seasonally moist sites in broad meadows that are flooded during snowmelt, but dry out by mid-late summer. Although it occurs in relatively moist environments and may be marginally riparian, including alkaline or saline basins, it is not a true riparian or wetland type. Substrates are mostly well-developed soils with thick mollic epipedons that lack indicators of seasonally high water tables. Soil texture is variable and includes clayey, clayey skeletal, coarse-loamy and loamy skeletal (Manning and Padgett 1995). Depth to water table us over 75 to 100+ cm.

Dynamics: *Artemisia cana ssp. viscidula* and *Artemisia cana ssp. bolanderi* both resprout vigorously after fire, and prescribed burning may increase shrub cover. Conversely, fire in the fall may decrease shrub abundance (Hansen et al. 1995). These highly productive sites often attract heavy livestock use. Livestock grazing may shift the understory composition to increased abundance of early-seral

species such as *Achillea millefolium, Potentilla gracilis*, or *Taraxacum officinale* and result in reduced abundance of native bunchgrass species such as *Festuca thurberi, Poa cusickii, Poa fendleriana*, or *Poa secunda*.

DISTRIBUTION

Geographic Range: This alliance is found west of the Continental Divide from the Rocky Mountains across the Great Basin to the Sierra Nevada and Cascade Range. Associations dominated by *Artemisia cana ssp. viscidula* occur mostly along streams or in areas with heavy snowpack. Associations dominated by *Artemisia cana ssp. bolanderi* occur mainly in the Sierra Nevada and Cascade Range, commonly in internally drained basins with poor drainage and/or alkaline conditions.

Nations: US
States/Provinces: CA, CO, ID, MT, NV?, OR, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **<** *Artemisia cana / Festuca thurberi* Plant Association (Johnston 1987)
- **<** *Artemisia cana* (Silver sagebrush scrub) Alliance (Sawyer et al. 2009) [35.150.00]
- **>** *Artemisia cana* / Dry Graminoid Community Type (Manning and Padgett 1995)
- **<** SRM Cover Type #408 - Other Sagebrush Types (Shiflet 1994)

LOWER LEVEL UNITS

Associations:

- CEGL001549 *Artemisia cana (ssp. bolanderi, ssp. viscidula) - Artemisia tridentata ssp. vaseyana / Poa cusickii* Shrub Grassland
- CEGL001071 *Artemisia cana ssp. viscidula / Festuca thurberi* Shrubland
- CEGL001073 *Artemisia cana ssp. viscidula / Purshia tridentata* Shrubland
- CEGL001551 *Artemisia cana (ssp. bolanderi, ssp. viscidula) / Poa fendleriana ssp. fendleriana* Shrub Grassland

AUTHORSHIP

Primary Concept Source: M.E. Manning and W.G. Padgett (1995)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Bramble-Brodahl 1978, Chappell et al. 1997, Comer et al. 1999, Cunningham 1971, Daubenmire 1970, Dealy 1971, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Francis 1983, Franklin and Dyrness 1973, Hansen et al. 1995, Hess 1981, Hironaka et al. 1983, Jankovsky-Jones et al. 2001, Johnston 1987, Kartesz 1999, Kovalchik 1987, Manning and Padgett 1995, Mueggler and Stewart 1980, Mutz and Graham 1982, Mutz and Queiroz 1983, ORNHP unpubl. data, Padgett 1982, Padgett et al. 1988b, Padgett et al. 1989, Reid et al. 1994, Sarr 1995, Sawyer et al. 2009, Schlatterer 1972, Shiflet 1994, Soil Conservation Service 1978, Tiedemann et al. 1987, Tuhy 1981, Tuhy and Jensen 1982, Turner 1969, USFS 1992, Winward 1980b, Youngblood et al. 1985a

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G304. Intermountain Mountain Big Sagebrush Steppe & Shrubland

A1098. Artemisia rothrockii Shrubland Alliance

Type Concept Sentence: This dwarf-shrubland is heavily dominated by *Artemisia rothrockii*. The only shrubs which co-occur are *Symphoricarpos rotundifolius, Ribes montigenum*, and *Holodiscus discolor*. Graminoids dominate the open herbaceous layer. Stands occur on slopes and ridges in the subalpine regions of California.

OVERVIEW

Scientific Name: *Artemisia rothrockii* Shrubland Alliance
Common Name (Translated Scientific Name): Rothrock's Sagebrush Shrubland Alliance
Colloquial Name: Rothrock's Sagebrush Shrubland

Type Concept: This dwarf-shrubland is heavily dominated by *Artemisia rothrockii*. The only shrubs which co-occur in this association are *Symphoricarpos rotundifolius, Ribes montigenum*, and *Holodiscus discolor*. Emergent conifers, such as *Pinus balfouriana, Pinus*

contorta var. murrayana, and *Pinus albicaulis*, may be present. Graminoids dominate the open herbaceous layer, and species composition may be highly variable among stands. *Carex filifolia, Danthonia intermedia*, and/or *Poa wheeleri* are the most common graminoid associates. Forbs only total a small amount of cover, typified by the diagnostic forb *Monardella odoratissima*. Other forbs which are often present at very low cover values may include *Antennaria rosea, Penstemon rydbergii, Juncus* sp., and/or *Horkelia fusca*. This dwarf-shrubland occurs on slopes and ridges in the subalpine regions of California. It is generally present in the zone between meadow and forest, growing on gravelly, carbonate-rich soils. Elevations range from 2000-3100 m. The nominal species' growth occurs mainly in early to mid summer, with flowering in late summer. The species is dormant in the fall, winter, and early spring due to cold.

Classification Comments: *Artemisia rothrockii* is a California endemic and grows on lower slopes and aprons between forests and valley bottom meadows (Benedict 1982, Ratliff 1985). Soils developed from granitic grus in the Sierra Nevada (Keeler-Wolf et al. 2003a) and from carbonate-rich dolomite and limestone in the Inyo and White mountains (Major and Taylor 1977) are droughty.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: This dwarf-shrubland is heavily dominated by diagnostic *Artemisia rothrockii*. Associated shrubs are *Symphoricarpos rotundifolius, Ribes montigenum*, and *Holodiscus discolor*. Graminoids dominate the open herbaceous layer. Characteristic herbaceous species include graminoids, *Carex filifolia, Danthonia intermedia*, and/or *Poa wheeleri*., and diagnostic forb *Monardella odoratissima*. Other forbs which are often present at very low cover values may include *Antennaria rosea, Penstemon rydbergii, Juncus* sp., and/or *Horkelia fusca*.

VEGETATION

Physiognomy and Structure: This extremely xeromorphic, subdesert dwarf-shrubland has an intermittent canopy of *Artemisia rothrockii* less than 1 m in height. Emergent conifers may be present. The herbaceous layer is sparse.

Floristics: In this California subalpine dwarf-shrubland *Artemisia rothrockii* is the sole or dominant shrub in the canopy. Other shrubs present may include *Ericameria discoidea, Ericameria suffruticosa, Penstemon heterodoxus*, and *Monardella odoratissima* (Sawyer et al. 2009). Emergent conifers such as *Pinus balfouriana, Pinus contorta var. murrayana*, and *Pinus albicaulis* may be present. Graminoids dominate the open herbaceous layer, and species composition may be highly variable among stands. *Carex filifolia, Danthonia intermedia*, and/or *Poa wheeleri* are the most common graminoid associates. Forbs only total a small amount of cover, typified by the diagnostic forb *Monardella odoratissima*. Other forbs which are often present at very low cover values may include *Antennaria rosea, Penstemon rydbergii, Juncus* sp., and/or *Horkelia fusca*. Twenty-five other species have been recorded on sampled plots, but none achieve more than 30% constancy. The forb *Castilleja miniata* and the graminoid *Poa wheeleri* each achieve 5% cover in 30% of plots. All other recorded species (mostly graminoids) only contribute a trace to the overall cover.

ENVIRONMENT & DYNAMICS

Environmental Description: This dwarf-shrubland occurs on slopes and ridges in the subalpine regions of California. It is generally present in the zone between meadow and forest, growing on gravelly, carbonate-rich soils. Elevations range from 2000 to 3500 m (Sawyer et al. 2009). The nominal species' growth occurs mainly early to mid-summer, with flowering in late summer. The species is dormant in the fall, winter, and early spring due to cold.

Dynamics: The soils that support this alliance are often carbonate-rich. These carbonates can form a hardpan 20-40 cm below the surface. Water runs downslope along this hardpan, reducing the amount of water available to plants, and making these sites droughty.

DISTRIBUTION

Geographic Range: This alliance occurs in California's Sierra Nevada at Yosemite National Park, and the Transverse and Peninsular ranges.

Nations: US
States/Provinces: CA
TNC Ecoregions [optional]: 11:C, 12:C, 16:C
USFS Ecoregions (2007): 341D:CC, M261E:CC, M262B:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** *Artemisia rothrockii* (Rothrock's sagebrush) Alliance (Sawyer et al. 2009) [35.140.00]
- **=** *Artemisia rothrockii* Shrubland Alliance (CNPS 2017) [35.140.00]
- **=** Rothrock sagebrush series (Sawyer and Keeler-Wolf 1995)
- **?** Subalpine Sagebrush (Cheatham and Haller 1975)
- **><** Subalpine Sagebrush Scrub (#35220) (Holland 1986b)

LOWER LEVEL UNITS

Associations:

- CEGL008652 *Artemisia rothrockii / Monardella odoratissima* Shrubland
- CEGL003014 *Artemisia rothrockii* Shrubland

AUTHORSHIP

Primary Concept Source: J.O. Sawyer, T. Keeler-Wolf, and J. Evens (2009)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by M. Schindel.
Version Date: 2014/12/18

REFERENCES

References: Bauer et al. 2002, Benedict 1982, Benedict 1983, CNPS 2017, Cheatham and Haller 1975, Faber-Langendoen et al. 2017b, Holland 1986b, Keeler-Wolf et al. 2003a, Major and Taylor 1977, Ratliff 1985, Reynolds and Berlow 2002, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Taylor 1984, West 1988

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G304. Intermountain Mountain Big Sagebrush Steppe & Shrubland

A3207. Artemisia tridentata ssp. spiciformis - Artemisia tridentata ssp. vaseyana Steppe & Shrubland Alliance

Type Concept Sentence: This alliance is widespread in mountainous areas across the western U.S. and is characterized by a moderate to dense shrub layer in which *Artemisia tridentata ssp. vaseyana* or *Artemisia tridentata ssp. spiciformis* dominates. If other shrubs are present, they have low cover and do not codominate. Stands form large, continuous stands on mid-elevation mountain slopes and foothills, and can extend above the lower treeline as patches within montane or subalpine coniferous forests.

OVERVIEW

Scientific Name: *Artemisia tridentata ssp. spiciformis - Artemisia tridentata ssp. vaseyana* Steppe & Shrubland Alliance
Common Name (Translated Scientific Name): Spiked Big Sagebrush - Mountain Big Sagebrush Steppe & Shrubland Alliance
Colloquial Name: Spiked Big Sagebrush - Mountain Big Sagebrush Steppe & Shrubland

Type Concept: This alliance is widespread in mountainous areas across the western U.S. and is characterized by a moderate to dense shrub layer in which *Artemisia tridentata ssp. vaseyana* or *Artemisia tridentata ssp. spiciformis* dominates. If other shrubs are present, they have low cover and do not codominate. Perennial graminoids typically dominate the open to dense herbaceous layer. The most widespread species are *Pseudoroegneria spicata* and *Festuca idahoensis*, which occur from the Columbia Basin to the Northern Rockies, although they may not be the most abundant species in individual stands. Other locally important species may include *Achnatherum occidentale (= Stipa occidentalis), Bouteloua gracilis, Bromus carinatus, Elymus trachycaulus, Festuca thurberi, Festuca viridula, Koeleria macrantha, Leucopoa kingii (= Festuca kingii), Leymus cinereus, Pascopyrum smithii, Poa fendleriana*, and *Poa secunda*. The forb layer is variable and can be very diverse. Species of *Castilleja, Potentilla, Erigeron, Phlox, Astragalus, Geum, Lupinus*, and *Eriogonum* are characteristic. Non-native grasses *Poa pratensis* and *Poa compressa* may be abundant. The alliance forms large, continuous stands on mid-elevation mountain slopes and foothills, and can extend above the lower treeline as patches within montane or subalpine coniferous forests. Sites are variable and range from flats to steep slopes to ridgetops with deep to shallow rocky soil.

Classification Comments: Diagnostic components of this alliance are phenotypically and genetically quite plastic species dominating a massive region spanning two floristic provinces, subspecies notwithstanding. There is enormous floristic variation within this alliance. Much work is needed to clarify the distribution and floristic characteristics of this alliance that will distinguish it clearly. *Artemisia tridentata ssp. spiciformis* as described by Shultz (1984) and Goodrich et al. (1985) includes *Artemisia rothrockii* as used by Bramble-Brodahl (1978) and described by Beetle and Johnson (1982). It does not include *Artemisia tridentata ssp. vaseyana* form.

spiciformis as used by numerous authors, including Bramble-Brodahl (1978), Winward (1980b), Beetle and Johnson (1982), and Hironaka et al. (1983). Goodrich et al. (1985) reassign form. *spiciformis* to variety *vaseyana* of *Artemisia tridentata ssp. vaseyana*.

Internal Comments: KAS 12-24: comment from M. Jennings AE review: Users of this description might benefit from the insight that this is a case of a phenotypically and genetically quite plastic species dominating a massive region spanning two floristic provinces, subspecies notwithstanding. There is enormous floristic variation within this alliance.
Other Comments:

Similar NVC Types:
- A3208 *Artemisia tridentata ssp. vaseyana* - Mixed Steppe & Shrubland Alliance: is codominated by non-sagebrush shrubs.

Diagnostic Characteristics: Vegetation included in this alliance is characterized by a moderate to dense shrub layer in which diagnostic species *Artemisia tridentata ssp. vaseyana* or *Artemisia tridentata ssp. spiciformis* dominate. If other shrubs are present, then they have low cover and do not codominate. A variety of perennial graminoids typically dominate the open to dense herbaceous layer. Characteristic herbaceous species are *Achnatherum lettermanii, Achnatherum occidentale, Achnatherum pinetorum, Balsamorhiza sagittata, Bromus carinatus, Carex exserta, Carex geyeri, Elymus lanceolatus, Festuca campestris, Festuca idahoensis, Festuca thurberi, Hesperostipa comata, Koeleria macrantha, Leucopoa kingii, Leymus cinereus, Monardella odoratissima, Pascopyrum smithii, Phlox condensata, Poa fendleriana, Poa glauca, Poa secunda*, and *Pseudoroegneria spicata*.

VEGETATION

Physiognomy and Structure: The vegetation in this alliance is characterized by a sparse (<25%) cover of microphyllous evergreen shrubs, usually 0.5-1 m in height. In one association, bunchgrasses form a matrix surrounding the shrubs, occasionally matching or exceeding the shrubs in height. In another association, a sod-forming short graminoid is dominant in the herbaceous layer. Forb species are often frequent and diverse, and can be prominent in some stands.

Floristics: This alliance is characterized by a moderate to dense shrub layer in which *Artemisia tridentata ssp. vaseyana* or *Artemisia tridentata ssp. spiciformis* dominates. If other shrubs are present, they have low cover and do not codominate. Perennial graminoids typically dominate the open to dense herbaceous layer. The most widespread species are *Pseudoroegneria spicata* and *Festuca idahoensis*, which occur from the Columbia Basin to the Northern Rockies, although they may not be the most abundant species in individual stands. Other locally important species may include *Achnatherum occidentale (= Stipa occidentalis), Bouteloua gracilis, Bromus carinatus, Elymus trachycaulus, Festuca thurberi, Festuca viridula, Koeleria macrantha, Leucopoa kingii (= Festuca kingii), Leymus cinereus, Pascopyrum smithii, Poa fendleriana*, and *Poa secunda*. The forb layer is variable and can be very diverse. *Balsamorhiza sagittata, Monardella odoratissima*, and *Phlox condensata* are often prominent. Species of *Astragalus, Castilleja, Erigeron, Eriogonum, Geum, Lupinus, Phlox*, and *Potentilla* are characteristic. Non-native grasses *Poa pratensis* and *Poa compressa* may be abundant. Trees are uncommon in stands of this alliance, but *Abies lasiocarpa, Cercocarpus ledifolius, Juniperus occidentalis, Juniperus scopulorum, Pinus albicaulis, Pinus ponderosa*, and *Populus tremuloides* may occasionally occur.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance is widespread in mountainous areas across the western U.S. and forms large, continuous stands on mid-elevation mountain slopes and foothills, and can extend above the lower treeline as patches within montane or subalpine coniferous forests. The climate regime is cool, semi-arid to subhumid, with yearly precipitation ranging from 18-90 cm. Much of the yearly precipitation falls as snow, which may cover the ground for long periods in winter. Temperatures are continental with large annual and diurnal variation. The elevation range for this alliance is large, from about 1060 m in eastern Oregon and Washington, to well over 3200 m in the mountains of northern Nevada, Idaho, and Colorado. Landscape positions are variable as well, but primarily are deep-soiled to stony flats, ridges, nearly flat ridgetops, and mountain slopes. All aspects are represented, and slopes range from nearly flat to very steep. Soils generally are moderately deep to deep, somewhat well-drained, and of loam, sandy loam, clay loam, or gravelly loam textural classes, often having a substantial volume of coarse fragments. The soils are derived from a variety of parent materials (although sandstones, limestones, basalts, and crystalline rocks are common). In some cases, soils supporting stands of this alliance are unstable and prone to mass movement (Bramble-Brodahl 1978, Hironaka et al. 1983). In subalpine environments, these shrub-herbaceous communities are found on deeper soils than *Artemisia arbuscula* subalpine shrublands.

Dynamics: Complex ecological interactions between fire regimes, grazing history, and climate patterns result in equally complex patterns of species structure and composition in *Artemisia tridentata* shrublands. These present corresponding difficulties in the classification of these shrublands, which have been compounded by the influence of human settlement and agricultural patterns. What follows is a summary of some of the influences of altered fire regimes and grazing history on *Artemisia tridentata* shrublands and shrub herbaceous vegetation.

Artemisia tridentata ssp. vaseyana shrub-herbaceous plant associations may represent either more moist or less disturbed communities within the complex of *Artemisia tridentata ssp. vaseyana* shrublands and shrub-steppe. Shrub densities typically

increase with overgrazing of the bunchgrass component or with increasing summer drought (West 1983c). There is considerable debate over whether present shrub-dominated stands are actually degraded "steppe" (e.g., shrub-herbaceous physiognomy), and if the stands will return to steppe with changes in grazing and fire management. *Artemisia tridentata* is inhibited by fire, and excessive grazing may decrease fire frequency due to consumption of herbaceous forage, resulting in increased shrub density. Conversely, invasion by non-native annual grasses (e.g., *Bromus tectorum* at lower elevations) may increase fire frequency sufficiently to eliminate the shrubs from the stands (Hironaka et al. 1983). With a change in fire frequency, species composition will be altered as well (West 1983c). With a high fire frequency (every 2-5 years), perennial grasses and shrubs are eliminated and non-native annual grasses dominate. At fire-return intervals of 10-30 years, short-lived resprouting shrubs such as *Chrysothamnus* or *Tetradymia* spp. dominate. At fire intervals of 30-70 years, a mixture of perennial bunchgrasses and shrubs is maintained. Finally, in the complete absence of fire, deep-rooted shrubs such as *Artemisia tridentata* may become dominant.

Artemisia tridentata ssp. spiciformis communities have a natural fire frequency averaging between 20 and 40 years. Presettlement fires burned unevenly, resulting in an ever-changing mosaic of different densities and ages of sagebrush plants (Winward 1991). However, *Artemisia tridentata ssp. spiciformis* resprouts vigorously after fire (Goodrich et al. 1985) and can return to pre-burn canopy cover very quickly (Winward 1991).

DISTRIBUTION

Geographic Range: This shrubland alliance occurs in mountainous regions from eastern California, Oregon and Washington, across the Great Basin in Nevada, the northern Rocky Mountain foothills of Idaho, and in Colorado, Wyoming and Montana. It has not been reported from Utah, Arizona or New Mexico, but it is very likely to occur in these states at high elevations. In addition, the alliance probably extends north into Alberta, Canada.

Nations: CA?, US
States/Provinces: AB?, CA, CO, ID, MT, NV, OR, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **<** *Artemisia tridentata ssp. vaseyana* (Mountain big sagebrush) Alliance (Sawyer et al. 2009) [35.111.00]
- **><** Big Sagebrush Series (Sawyer and Keeler-Wolf 1995)
- **><** SRM Cover Type #314 - Big Sagebrush-Bluebunch Wheatgrass (Shiflet 1994)
- **><** SRM Cover Type #315 - Big Sagebrush-Idaho Fescue (Shiflet 1994)
- **><** SRM Cover Type #316 - Big Sagebrush-Rough Fescue (Shiflet 1994)
- **<** SRM Cover Type #402 - Mountain Big Sagebrush (Shiflet 1994)
- **<** SRM Cover Type #408 - Other Sagebrush Types (Shiflet 1994)
- **<** SRM Cover Type #612 - Sagebrush - Grass (Shiflet 1994)
- **><** Western Shrub and Grasslands Combinations: 55: Sagebrush-Steppe (*Artemisia-Agropyron*) (Küchler 1964)
- **><** Western Shrub: 38: Great Basin Sagebrush (*Artemisia*) (Küchler 1964)

LOWER LEVEL UNITS

Associations:

- CEGL001531 *Artemisia tridentata ssp. vaseyana / Festuca campestris* Shrub Grassland
- CEGL005423 *Artemisia tridentata ssp. vaseyana / Poa (glauca, secunda)* Shrubland
- CEGL002990 *Artemisia tridentata ssp. spiciformis / Carex geyeri* Shrubland
- CEGL002931 *Artemisia tridentata ssp. vaseyana / Hesperostipa comata* Shrubland
- CEGL001033 *Artemisia tridentata ssp. vaseyana / Achnatherum occidentale* Shrubland
- CEGL008651 *Artemisia tridentata ssp. vaseyana / Carex exserta* Shrubland
- CEGL001023 *Artemisia tridentata ssp. vaseyana / Festuca idahoensis - Bromus carinatus* Shrubland
- CEGL002993 *Artemisia tridentata ssp. spiciformis* Shrub Grassland
- CEGL001026 *Artemisia tridentata ssp. vaseyana / Leucopoa kingii - Koeleria macrantha* Shrubland
- CEGL001024 *Artemisia tridentata ssp. vaseyana / Festuca thurberi* Shrubland
- CEGL001029 *Artemisia tridentata ssp. vaseyana / Poa secunda* Shrubland
- CEGL001030 *Artemisia tridentata ssp. vaseyana / Pseudoroegneria spicata* Shrubland
- CEGL001532 *Artemisia tridentata ssp. vaseyana / Carex geyeri* Shrub Grassland
- CEGL001028 *Artemisia tridentata ssp. vaseyana / Pascopyrum smithii* Shrubland
- CEGL001020 *Artemisia tridentata ssp. vaseyana / Balsamorhiza sagittata* Shrubland

- CEGL003476 *Artemisia tridentata ssp. vaseyana / Monardella odoratissima* Shrubland
- CEGL001021 *Artemisia tridentata ssp. vaseyana / Bromus carinatus* Shrubland
- CEGL001027 *Artemisia tridentata ssp. vaseyana / Leymus cinereus* Shrubland
- CEGL002770 *Artemisia tridentata ssp. vaseyana / Phlox condensata* Shrubland
- CEGL001533 *Artemisia tridentata ssp. vaseyana / Festuca idahoensis* Shrub Grassland
- CEGL001031 *Artemisia tridentata ssp. vaseyana / Pseudoroegneria spicata - Poa fendleriana* Shrubland
- CEGL002812 *Artemisia tridentata ssp. vaseyana / Poa fendleriana* Shrubland
- CEGL002806 *Artemisia tridentata ssp. vaseyana / Achnatherum pinetorum* Shrubland
- CEGL002811 *Artemisia tridentata ssp. vaseyana / Achnatherum lettermanii* Shrubland
- CEGL005318 *Artemisia tridentata ssp. vaseyana / Elymus lanceolatus* Shrubland
- CEGL001025 *Artemisia tridentata ssp. vaseyana / Leucopoa kingii* Shrubland
- CEGL002989 *Artemisia tridentata ssp. spiciformis / Bromus carinatus* Shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by D. Tart and D. Sarr.
Version Date: 2014/12/18

REFERENCES

References: Beetle and Johnson 1982, Bramble-Brodahl 1978, Despain 1973a, Faber-Langendoen et al. 2017b, Francis 1983, Goodrich et al. 1985, Hess 1981, Hess and Wasser 1982, Hironaka et al. 1983, Hurd 1961, Jensen et al. 1988a, Johnson and Clausnitzer 1992, Johnston 1987, Komarkova 1986, Küchler 1964, Lewis 1971, Lewis 1975a, Mooney 1985, Mueggler and Stewart 1980, Sabinske 1978, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Shiflet 1994, Smith 1966, Strong 1980, Tart 1996, Terwilliger and Smith 1978, Tiedemann et al. 1987, Tweit and Houston 1980, West 1983c, Winward 1980b, Winward 1991

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G304. Intermountain Mountain Big Sagebrush Steppe & Shrubland

A3208. Artemisia tridentata ssp. vaseyana - Mixed Steppe & Shrubland Alliance

Type Concept Sentence: This alliance is widespread in mountainous areas across the western U.S. The vegetation is characterized by a moderate to dense shrub layer in which *Artemisia tridentata ssp. vaseyana* is codominant with non-sagebrush shrub species *Amelanchier utahensis, Holodiscus dumosus, Purshia tridentata*, or *Symphoricarpos oreophilus*. Perennial graminoids typically dominate the open to moderately dense herbaceous layer. This alliance forms large, continuous stands on mid-elevation mountain slopes and foothills, and can extend above the lower treeline as patches within montane or subalpine coniferous forests.

OVERVIEW

Scientific Name: *Artemisia tridentata ssp. vaseyana* - Mixed Steppe & Shrubland Alliance
Common Name (Translated Scientific Name): Mountain Big Sagebrush - Mixed Steppe & Shrubland Alliance
Colloquial Name: Mountain Big Sagebrush - Mixed Steppe & Shrubland

Type Concept: This alliance is widespread in mountainous areas across the western U.S. The vegetation included in this alliance is characterized by an open to dense (10-70% cover) shrub layer in which *Artemisia tridentata ssp. vaseyana* is codominant, usually with 40-60% relative cover with non-sagebrush shrub species such as *Amelanchier utahensis, Holodiscus dumosus, Purshia tridentata*, or *Symphoricarpos oreophilus*. Perennial graminoids typically dominate the open to moderately dense herbaceous layer. The most widespread species are *Pseudoroegneria spicata* and *Festuca idahoensis*, which occur from the Columbia Basin to the northern Rockies, although they may not be the most abundant species in individual stands. Other locally important species may include *Achnatherum occidentale (= Stipa occidentalis), Bouteloua gracilis, Bromus carinatus, Elymus trachycaulus, Festuca thurberi, Festuca viridula, Koeleria macrantha, Leucopoa kingii (= Festuca kingii), Leymus cinereus, Pascopyrum smithii, Poa fendleriana*, and *Poa secunda*. The forb layer is variable and can be very diverse. Species of *Castilleja, Potentilla, Erigeron, Phlox, Astragalus, Geum, Lupinus*, and *Eriogonum* are characteristic. The alliance forms large, continuous stands on mid-elevation mountain slopes and foothills, and can extend above the lower treeline as patches within montane or subalpine coniferous forests. Sites are variable and range from flats to steep slopes to ridgetops with deep to shallow rocky soil.

Classification Comments: Although the dominant species is shared with the different *Artemisia tridentata ssp. spiciformis - Artemisia tridentata ssp. vaseyana* Steppe & Shrubland Alliance (A3207), Young et al. (2007) show that there are substantial compositional and environmental differences which warrant separation into two different alliances. Much of the area occupied by this widespread alliance has been moderately to severely degraded by livestock grazing and subsequent invasion by *Bromus*

tectorum with a consequent alteration of its fire regime. Individuals of the dominant species do not usually survive fire and usually take a decade or more to reestablish (Tirmenstein 1999c).

Internal Comments:
Other Comments:

Similar NVC Types:

- A3207 *Artemisia tridentata ssp. spiciformis - Artemisia tridentata ssp. vaseyana* Steppe & Shrubland Alliance: is not codominated by non-sagebrush shrubs.

Diagnostic Characteristics: This sagebrush mixed shrub alliance is widespread in mountainous areas across the western U.S. The vegetation included in this alliance is characterized by a moderate to dense shrub layer in which *Artemisia tridentata ssp. vaseyana* is codominant with non-sagebrush shrub species *Amelanchier utahensis, Holodiscus dumosus, Purshia tridentata*, or *Symphoricarpos oreophilus*. Perennial graminoids typically dominate the open to moderately dense herbaceous layer. Characteristic grasses are *Bromus carinatus, Elymus trachycaulus ssp. trachycaulus, Festuca idahoensis, Hesperostipa comata, Muhlenbergia montana, Poa secunda*, and *Pseudoroegneria spicata*.

VEGETATION

Physiognomy and Structure: The shrublands in this alliance are characterized by a open to dense (10-75%) cover of microphyllous evergreen shrubs, usually 1-2 m in height. Cespitose graminoids are scattered in the shrub matrix and can occasionally match the shrubs in height. A sparse, emergent layer of scale-leaved or needle-leaved evergreen trees may also be present, but in many areas no trees are present. Forb species may be frequent, but are usually of low cover. With increasing summer rain in the southeastern edge of the range, there is an increase in the importance of sod-forming grasses in comparison to bunchgrasses. In many areas, undisturbed stands in this alliance will have a cryptogamic soil crust composed of a mix of lichens, tiny mosses, and bacteria.

Floristics: The vegetation included in this alliance is characterized by a open to dense (10-70% cover) short-shrub layer in which *Artemisia tridentata ssp. vaseyana* is codominant, usually with 40-60% relative cover, with non-sagebrush shrub species such as *Amelanchier utahensis, Holodiscus dumosus, Purshia tridentata*, or *Symphoricarpos oreophilus*. Perennial graminoids typically dominate the open to moderately dense herbaceous layer. The most widespread species are *Pseudoroegneria spicata* and *Festuca idahoensis*, which occur from the Great Basin to the Rocky Mountains, although they may not be the most abundant species in individual stands. Other locally important species may include *Bromus carinatus, Elymus trachycaulus, Hesperostipa comata, Koeleria macrantha, Muhlenbergia montana, Poa fendleriana*, and *Poa secunda*. The forb layer is variable and can be very diverse. Species of *Castilleja, Potentilla, Erigeron, Phlox, Astragalus, Geum, Lupinus*, and *Eriogonum* are characteristic.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance is widespread in mountainous areas across the western U.S. and forms large, continuous stands on mid-elevation mountain slopes and foothills, and can extend above the lower treeline as patches within montane or subalpine coniferous forests. The climate regime is cool, semi-arid to subhumid, with yearly precipitation ranging from 18-60 cm. Much of the yearly precipitation falls as snow, which may cover the ground for long periods in winter. Temperatures are continental with large annual and diurnal variation. The elevation range for this alliance is large, from about 1060 m in eastern Oregon and Washington, to well over 3500 m in the mountains of northern Nevada, Idaho, and Colorado. Landscape positions are variable as well, but primarily are deep-soiled to stony flats, ridges, nearly flat ridgetops, and mountain slopes. All aspects are represented, but the higher elevation occurrences may be mainly on south- or west-facing slopes. Soils generally are moderately deep to deep, well-drained, and of loam, sandy loam, clay loam, or gravelly loam textural classes; they often have a substantial volume of coarse fragments. The soils are derived from a variety of parent materials (although sandstones, limestones, and crystalline rocks are common). In some cases, soils supporting stands of this alliance are unstable and prone to mass movement (Bramble-Brodahl 1978, Hironaka et al. 1983). In subalpine environments, these shrublands are found on deeper soils than *Artemisia arbuscula* subalpine shrublands. Although the vegetation may grow in alkaline soils at the edge of internally drained basins, *Artemisia tridentata* is a non-halophyte and requires low salinity for optimum growth.

Dynamics: Complex ecological interactions between fire regimes, grazing history, and climate patterns result in equally complex patterns of species structure and composition in *Artemisia tridentata*. These present corresponding difficulties in the classification of these shrublands, which have been compounded by the influence of human settlement and agricultural patterns. What follows is a summary of some of the influences of altered fire regimes, and grazing history on *Artemisia tridentata* shrublands and shrub herbaceous vegetation.

Artemisia tridentata ssp. vaseyana shrublands may represent either drier or more disturbed examples of the *Artemisia tridentata ssp. vaseyana* shrubland complex. Shrub densities typically increase with overgrazing of the bunchgrass component or with increasing summer drought (West 1983c). There is considerable debate over whether present shrub-dominated stands are actually degraded "steppe" (e.g., shrub-herbaceous physiognomy), and if the stands will return to steppe with changes in grazing

and fire management. *Artemisia tridentata* is inhibited by fire, and excessive grazing may decrease fire frequency due to consumption of herbaceous forage, resulting in increased shrub density. Conversely, invasion by non-native annual grasses (e.g., *Bromus tectorum* at lower elevations) may increase fire frequency sufficiently to eliminate the shrubs from the stands (Hironaka et al. 1983). With a change in fire frequency, species composition will be altered as well (West 1983c). With a high fire frequency (every 2-5 years), perennial grasses and shrubs are eliminated and non-native annual grasses dominate. At fire-return intervals of 10-30 years, short-lived resprouting shrubs such as *Chrysothamnus* or *Tetradymia* spp. dominate. At fire intervals of 30-70 years, a mixture of perennial bunchgrasses and shrubs is maintained. Finally, in the complete absence of fire, deep-rooted shrubs such as *Artemisia tridentata* become the theoretical dominants.

DISTRIBUTION

Geographic Range: This shrubland alliance occurs in mountainous regions from eastern California, Oregon, and Washington, across the Great Basin in Nevada, the northern Rocky Mountain foothills of Idaho, and in Colorado, Wyoming, and Montana. It has not been reported from Utah, Arizona, or New Mexico, but it is very likely to occur in these states at high elevations. In addition, the alliance probably extends north into Alberta, Canada.

Nations: CA?, US
States/Provinces: AB?, CA, CO, ID, MT, NV, OR, UT, WY
TNC Ecoregions [optional]: 11:C, 17:C
USFS Ecoregions (2007): 322Ac:CCC, 322Ad:CCC, 341Fa:CCC, 341Fb:CCC, 341Fc:CCC, 341Fd:CCC, 341Ff:CCC, 341Fg:CCC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Great Basin)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **<** *Artemisia tridentata ssp. vaseyana* (Mountain big sagebrush) Alliance (Sawyer et al. 2009) [35.111.00]
- **=** *Artemisia tridentata ssp. vaseyana* Shrubland Alliance (Evens et al. 2014) [probably equivalent]
- **><** Big Sagebrush Scrub (#35210) (Holland 1986b)
- **><** Big Sagebrush Series (Sawyer and Keeler-Wolf 1995)
- **<** SRM Cover Type #402 - Mountain Big Sagebrush (Shiflet 1994)
- **><** Western Shrub and Grasslands Combinations: 55: Sagebrush-Steppe (*Artemisia-Agropyron*) (Küchler 1964)
- **><** Western Shrub: 38: Great Basin Sagebrush (*Artemisia*) (Küchler 1964)

LOWER LEVEL UNITS

Associations:

- CEGL002820 *Amelanchier utahensis - Artemisia tridentata (ssp. vaseyana, ssp. wyomingensis)* Shrubland
- CEPP006855 *Artemisia tridentata ssp. vaseyana - Ephedra viridis* Shrubland
- CEGL002951 *Symphoricarpos oreophilus* Shrubland
- CEGL005484 *Chamaebatiaria millefolium / Penstemon deustus* Sparse Vegetation
- CEGL001034 *Artemisia tridentata ssp. vaseyana - Symphoricarpos oreophilus / Elymus trachycaulus ssp. trachycaulus* Shrubland
- CEGL001036 *Artemisia tridentata ssp. vaseyana - Symphoricarpos oreophilus / Festuca idahoensis* Shrubland
- CEGL005474 *Artemisia tridentata ssp. vaseyana - Chamaebatiaria millefolium / Penstemon deustus* Shrubland
- CEGL001035 *Artemisia tridentata ssp. vaseyana - Symphoricarpos oreophilus / Bromus carinatus* Shrubland
- CEGL001038 *Artemisia tridentata ssp. vaseyana - Symphoricarpos oreophilus / Pseudoroegneria spicata* Shrubland
- CEGL005827 *Artemisia tridentata ssp. vaseyana - (Purshia tridentata) / Muhlenbergia montana - (Hesperostipa comata ssp. comata)* Shrubland
- CEGL001037 *Artemisia tridentata ssp. vaseyana - Symphoricarpos oreophilus / Poa secunda* Shrubland
- CEGL001039 *Artemisia tridentata ssp. vaseyana - Symphoricarpos oreophilus / Hesperostipa comata* Shrubland
- CEGL002807 *Artemisia tridentata ssp. vaseyana - Holodiscus dumosus* Shrubland
- CEPP005794 *Artemisia tridentata ssp. vaseyana* Shrubland
- CEGL001003 *Artemisia tridentata - Ephedra* spp. Shrubland
- CEGL001032 *Artemisia tridentata ssp. vaseyana - Purshia tridentata / Pseudoroegneria spicata* Shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by D. Sarr.
Version Date: 2014/12/18

REFERENCES

References: Baker 1983c, Baker and Kennedy 1985, Blackburn 1967, Blackburn et al. 1968a, Blackburn et al. 1968c, Blackburn et al. 1969a, Blackburn et al. 1969b, Blackburn et al. 1969c, Blackburn et al. 1969d, Blackburn et al. 1971, Boyce 1977, Bramble-Brodahl 1978, Britton et al. 1981, Caicco and Wellner 1983a, Caicco and Wellner 1983f, Caicco and Wellner 1983k, Chappell et al. 1997, Cheng 2004, Cooper et al. 1999, Current 1984, Daubenmire 1970, Eddleman and Jaindl 1994, Evens et al. 2014, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Fenemore 1970, Francis 1983, Francis 1986, Franklin and Dyrness 1973, Giese 1975, Hansen et al. 1984, Harper and Jaynes 1986, Heinze et al. 1962, Hess 1981, Hess and Wasser 1982, Hironaka et al. 1983, Holecheck and Stephenson 1983, Holland 1986b, Jameson et al. 1962, Jensen et al. 1988a, Johnson and Clausnitzer 1992, Johnson and Payne 1968, Johnson and Simon 1987, Johnston 1987, Jorgensen 1979, Komarkova 1986, Kurzius 1981, Küchler 1964, Leary and Peterson 1984, Lesica and DeVelice 1992, Lewis 1971, Lewis 1975a, Loope 1969, McArthur and Welch 1986, McLean 1970, Mooney 1985, Moretti 1979, Moretti and Brotherson 1982, Nelson and Jensen 1987, ORNHP unpubl. data, Poulton 1955, Ralston 1969, Rickard and Beatley 1965, Robertson 1971, Rzedowski 1981, Savage 1968, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Sheehy and Winward 1981, Shiflet 1994, Smith 1966, Tart 1996, Terwilliger and Smith 1978, Terwilliger and Tiedemann 1978, Tiedemann et al. 1987, Tirmenstein 1999c, Tisdale and Hironaka 1981, Tueller and Blackburn 1974, Tueller and Eckert 1987, Tueller et al. 1966, Tweit and Houston 1980, USFS 1992, Warren et al. 1982, West 1983c, Winward 1970

M095. Great Basin-Intermountain Xeric-Riparian Scrub

This macrogroup covers shrublands along dry washes and valley floors dominated by *Atriplex canescens, Ericameria nauseosa, Artemisia tridentata ssp. tridentata*, and other species within the cool temperate desert of western North America.

3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
3.B.1.Ne.4.a. M095 Great Basin-Intermountain Xeric-Riparian Scrub

G559. Great Basin-Intermountain Shrub & Herb Wash-Arroyo

Type Concept Sentence: This group includes sparsely to densely vegetated shrublands that occur along dry watercourses that experience periodic flash flooding, and is dominated by *Atriplex canescens, Atriplex confertifolia, Brickellia* spp., *Ephedra* spp., *Ericameria nauseosa*, and/or *Fraxinus anomala*, found throughout interior western deserts.

OVERVIEW

Scientific Name: *Atriplex canescens - Ericameria nauseosa* Shrub & Herb Wash-Arroyo Group
Common Name (Translated Scientific Name): Fourwing Saltbush - Rubber Rabbitbrush Shrub & Herb Wash-Arroyo Group
Colloquial Name: Fourwing Saltbush - Rubber Rabbitbrush Desert Wash

Type Concept: This is a sparsely to densely vegetated group that occurs along dry watercourses that experience periodic flash flooding. These are shrublands dominated by *Atriplex canescens, Atriplex confertifolia, Brickellia* spp., *Ephedra* spp., *Ericameria nauseosa*, and/or *Fraxinus anomala*. Other associated shrubs include *Artemisia filifolia, Artemisia tridentata, Atriplex gardneri, Gutierrezia sarothrae, Lycium andersonii, Purshia stansburiana, Quercus havardii, Rhus trilobata, Sarcobatus vermiculatus*, and/or *Suaeda moquinii (= Suaeda torreyana)*. Herbaceous cover is sparse (<10% cover) with a variety of grasses and forbs; non-native annuals can be abundant. This group is known from eastern Washington, eastern Oregon, the Columbia Basin, and throughout the Great Basin. Elevations range from 500-2500 m. Stands occur along the banks or edges of, in or near temporary watercourses (aka washes, dry streambeds, gullies and the like). Surfaces occupied include sandy terraces, wash bottoms, point bars, as well as basin floors that are flat or gently sloping. Substrates are rapidly drained and coarse, such as sandy or gravelly soils derived from alluvium, gneiss, shale, cinder and sandstone, that are often very rocky as well.

Classification Comments: These associations can be difficult to differentiate from surrounding upland communities.

Similar NVC Types:
- G541 Warm Semi-Desert Shrub & Herb Dry Wash & Colluvial Slope: occurs in warmer regions of the West.

Diagnostic Characteristics: This shrubland group is characterized by a sparse to dense (1-65% cover) shrub layer dominated by *Atriplex canescens, Atriplex confertifolia, Brickellia* spp., *Ephedra* spp., *Ericameria nauseosa*, and/or *Fraxinus anomala*. Stands occur in or near temporary watercourses on sandy terraces, wash bottoms, point bars, and basin floors that are flat or gently sloping.

VEGETATION

Physiognomy and Structure: This group is defined as a broadleaf deciduous shrubland with 1-65% cover. Herbaceous cover is generally low to sparse and characterized by a mixed composition of graminoids.

Floristics: Stands are sparse to dense (1-65% cover) and dominated by *Atriplex canescens, Atriplex confertifolia, Brickellia* spp., *Ephedra* spp., *Ericameria nauseosa*, and/or *Fraxinus anomala*. Associated shrubs include *Artemisia filifolia, Artemisia tridentata, Atriplex gardneri, Gutierrezia sarothrae, Lycium andersonii, Purshia stansburiana, Quercus havardii, Rhus trilobata, Sarcobatus vermiculatus*, and/or *Suaeda moquinii (= Suaeda torreyana)*. Herbaceous cover is sparse (<10% cover) with a variety of grasses and forbs such as *Achnatherum hymenoides, Artemisia dracunculus, Descurainia pinnata, Elymus elymoides, Glycyrrhiza lepidota, Hesperostipa comata, Hordeum jubatum, Muhlenbergia porteri, Pleuraphis jamesii, Sphaeralcea parvifolia, Sporobolus contractus, Sporobolus cryptandrus, Stanleya pinnata*, and *Scabrethia scabra (= Wyethia scabra)*. Non-native annuals such as *Bromus tectorum* and *Salsola tragus* are sometimes present to abundant.

ENVIRONMENT & DYNAMICS

Environmental Description: *Soil/substrate/hydrology:* Substrates are rapidly drained, sandy or gravelly soils derived from alluvium, gneiss, shale, cinder and sandstone. Scattered large rocks, gravel and bare ground cover most of the unvegetated surface, although some litter is typically present.

Dynamics: This group is often associated with a combination of dry conditions, coarse-textured substrates and intermittent severe disturbance by flash floods. The vegetation is usually scattered, occurring in parts of the channel protected from the worst flooding, and shrubs have extensive root systems to allow them to resprout quickly when damaged or partially uprooted by flooding.

DISTRIBUTION

Geographic Range: This group is known from eastern Washington, eastern Oregon, the Columbia Basin, and throughout the Great Basin.

Spatial Scale & Pattern [optional]: Linear
Nations: US
States/Provinces: AZ, CA, CO, ID, MT, NV, OR, UT, WA, WY
TNC Ecoregions [optional]: 4:C, 6:C, 8:C, 9:C, 10:C, 11:C, 19:C, 20:C, 26:C
USFS Ecoregions (2007): 313A:CC, 313B:CC, 313D:CC, 315H:PP, 331B:CC, 331H:C?, 331I:CC, 331J:CC, 341A:CC, 341B:CC, 341C:CC, 341D:CC, 341E:CC, 341F:CC, 341G:CC, 342A:CC, 342E:CC, 342F:CC, 342G:CC, M313A:CC, M313B:CP, M331I:??, M341A:CC, M341B:CC, M341C:CC, M341D:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Alliances:
- A3266 *Atriplex canescens - Ericameria nauseosa* Desert Wash Alliance

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2011)
Author of Description: K.A. Schulz and G. Kittel
Acknowledgments:
Version Date: 11/06/2015
Classif Resp Region: West
Internal Author: MEH 10-10, mod. GK 8-15, mod. KAS 11-15

REFERENCES

References: Comer et al. 2003, Faber-Langendoen et al. 2017a, Knight 1994, Shiflet 1994, West 1983b

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G559. Great Basin-Intermountain Shrub & Herb Wash-Arroyo

A3266. Atriplex canescens - Ericameria nauseosa Desert Wash Alliance

Type Concept Sentence: This alliance consists of shrublands, generally dominated by *Atriplex canescens* and/or *Ericameria nauseosa*. Several other shrub species may appear in the stand. These are shrublands of cold desert washes of Arizona, Colorado, Nevada and Utah with low cover of mixes of short shrubs.

OVERVIEW

Scientific Name: *Atriplex canescens - Ericameria nauseosa* Desert Wash Alliance

Common Name (Translated Scientific Name): Fourwing Saltbush - Rubber Rabbitbrush Desert Wash Alliance
Colloquial Name: Fourwing Saltbush - Rubber Rabbitbrush Desert Wash

Type Concept: This alliance covers desert wash shrublands dominated by *Atriplex canescens* and/or *Ericameria nauseosa*. Associated shrubs include *Artemisia filifolia, Artemisia tridentata, Atriplex confertifolia, Atriplex gardneri, Brickellia longifolia, Ephedra torreyana, Ephedra viridis, Fraxinus anomala, Gutierrezia sarothrae, Lycium andersonii, Purshia stansburiana, Rhus trilobata, Sarcobatus vermiculatus*, and *Suaeda moquinii (= Suaeda torreyana)*. The herbaceous stratum has sparse to moderate cover of *Achnatherum hymenoides, Artemisia dracunculus, Descurainia pinnata, Elymus elymoides, Glycyrrhiza lepidota, Hesperostipa comata, Hordeum jubatum, Sphaeralcea parvifolia, Sporobolus contractus*, and *Sporobolus cryptandrus*. These shrubland are short-statured (<2 m in height), mixed species with fairly open canopy coverage. They can be found in cold desert washes of northern Arizona, Colorado, Nevada and Utah.

Classification Comments: Alliance of cold desert washes with sparsely scattered cover of either of the three shrub species.

Internal Comments: MSR 1-16: this alliance does not hold up; should be archived. mjr 12-14: CA added for MOJN.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Open to scattered cover (1-25%) of short shrubs lining arroyos and intermittent drainages.

VEGETATION

Physiognomy and Structure: Shrublands of facultatively deciduous, extremely xeromorphic shrubs with open to moderately dense canopy that is less than 2 m tall. The herbaceous layer is relatively sparse (20-30% cover) and is usually less than 0.5 m tall. It is codominated by perennial grasses and forbs. Annual graminoids and forbs are seasonally present.

Floristics: These shrublands lining desert washes are dominated by *Atriplex canescens* and/or *Ericameria nauseosa*. Associated shrubs may include scattered *Chrysothamnus viscidiflorus, Ephedra viridis, Gutierrezia sarothrae, Krascheninnikovia lanata, Parthenium confertum, Prunus virginiana, Purshia stansburiana (= Purshia mexicana var. stansburiana), Rhus trilobata, Sarcobatus vermiculatus, Symphoricarpos occidentalis, Tetradymia glabrata*, and occasional *Artemisia tridentata*. The herbaceous layer can vary from moderately dense and dominated by graminoids to absent. Common native grasses include *Achnatherum hymenoides (= Oryzopsis hymenoides), Distichlis spicata, Elymus elymoides, Elymus trachycaulus ssp. trachycaulus, Leymus flavescens (= Elymus flavescens), Pseudoroegneria spicata, Sporobolus airoides, Sporobolus cryptandrus, Sporobolus flexuosus, Sporobolus nealleyi*, and *Sporobolus wrightii*. Native forbs generally have low cover, but may include species such as *Abronia fragrans, Cleome lutea, Gayophytum ramosissimum, Lygodesmia grandiflora, Machaeranthera canescens (= Aster canescens), Mentzelia multiflora, Navarretia* sp., *Phacelia hastata (= Phacelia leucophylla), Phacelia* spp., *Psoralidium lanceolatum (= Psoralea lanceolata)*, and *Sphaeralcea coccinea*. Disturbed stands typically have high cover of introduced annual *Bromus* species such as *Bromus tectorum, Bromus arvensis (= Bromus japonicus)*, and *Bromus rubens*. Introduced forbs may include *Melilotus officinalis, Salsola kali*, and *Bassia scoparia (= Kochia scoparia)*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs in areas of high natural disturbance such as on steep colluvial slopes, along drainages or in floodplains and washes. The soils are well-drained, moderately deep and coarse-textured with a sandy surface over sandy loams. Soils are derived from sandy/gravelly alluvium. Elevations range from 670-2250 m (2198-7381 feet). Substrates may be eolian, alluvial, colluvial or derived from sandstone residuum. Soils are variable but are generally well-drained and coarse-textured.

Shrublands included in this alliance occur on lowland and upland sites throughout much of the arid and semi-arid western U.S. with elevations ranging from 75 m below sea level to 2400 m. Lowland sites include alluvial flats, drainage terraces, playas, washes and interdunal basins. The lowland sites may be moderately saline or alkaline. Bare ground usually dominates the ground surface.

Dynamics: This alliance occurs in washes and therefore experiences flash floods from time to time. Shrubs generally resprout after severe flood scour.

DISTRIBUTION

Geographic Range: This alliance is found in Arizona, Colorado, Nevada and Utah.

Nations: US
States/Provinces: AZ, CA, CO, NV, UT
TNC Ecoregions [optional]: 11:C, 17:C
USFS Ecoregions (2007): 322Av:CCC, 322Ay:CCC, 322Az:CCC, 341Fc:CCC

Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Joshua Tree, Mojave)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Atriplex canescens* Association (153.272) (Brown 1982a) [included within Chihuahuan Desertscrub, Saltbush Series.]
- **>** *Ericameria nauseosa* (Rubber rabbitbrush scrub) Alliance (Sawyer et al. 2009) [35.310.00]
- **>** *Ericameria nauseosa* Shrubland Alliance (Evens et al. 2014)
- **>** *Lepidospartum squamatum* (Scale broom scrub) Alliance (Sawyer et al. 2009) [32.070.00]
- **>** *Lepidospartum squamatum* Alliance (Scale broom scrub) (Buck-Diaz et al. 2012)

LOWER LEVEL UNITS

Associations:

- CEGL002261 *Ericameria nauseosa* Desert Wash Shrubland
- CEGL003470 *Atriplex canescens* Desert Wash Shrubland

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2015/12/19

REFERENCES

References: Aldous and Shantz 1924, BIA 1979, Brown 1982a, Buck-Diaz et al. 2012, Culver et al. 1996, Evens et al. 2012, Evens et al. 2014, Faber-Langendoen et al. 2017b, Hyder et al. 1966, Maxwell 1975, Miller et al. 1977, Peterson 2008, Reid et al. 1994, Roberts et al. 1992, Sawyer et al. 2009, Shaw et al. 1989, Shute and West 1978, Soil Conservation Service 1978, Soil Conservation Service n.d., Stout et al. 2013, USBOR 1976, USFS 1937, VegCAMP and AIS 2013, Vest 1962a, Warren et al. 1982

M093. Great Basin Saltbush Scrub

This widespread cool semi-desert macrogroup centers in the Intermountain West of the U.S. and is typically composed of saltbush shrublands. Dominants include *Atriplex canescens, Atriplex confertifolia, Atriplex corrugata, Atriplex cuneata, Atriplex gardneri, Atriplex lentiformis, Atriplex obovata, Atriplex polycarpa*, and *Atriplex spinifera*, either singly or mixed, sometimes codominated by other associated species. Substrates are typically saline, alkaline, fine-textured soils developed from shale or alluvium.

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
3.B.1.Ne.5.a. M093 Great Basin Saltbush Scrub

G301. Intermountain Dwarf Saltbush - Sagebrush Scrub

Type Concept Sentence: This dwarf-shrub scrub group occurs on gentle slopes and rolling plains in the Colorado Plateau and Uinta Basin on Mancos shale and arid, windswept basins and plains across parts of Wyoming and Montana. It is characterized by an open canopy of dwarf-shrubs composed of relatively pure stands of *Artemisia pedatifida, Atriplex corrugata*, or *Atriplex gardneri* sometimes with *Artemisia longifolia, Artemisia pygmaea*, or *Picrothamnus desertorum* dominant or codominant.

OVERVIEW

Scientific Name: *Atriplex corrugata - Atriplex gardneri - Artemisia pedatifida* Dwarf-Scrub Group
Common Name (Translated Scientific Name): Mat Saltbush - Gardner's Saltbush - Birdfoot Sagebrush Dwarf-Scrub Group
Colloquial Name: Birdfoot Sagebrush Low Scrub

Type Concept: This semi-arid dwarf-shrub scrub group occurs in the interior western U.S. and is found on windswept basins and plains, often on marine shales. The vegetation is characterized by an open canopy of dwarf-shrubs composed of relatively pure stands of *Artemisia pedatifida* (important in Wyoming), *Atriplex corrugata* (western Colorado and Utah), or *Atriplex gardneri* (Wyoming and Montana into Canada). Other dominant or codominant dwarf-shrubs may include *Artemisia longifolia, Artemisia pygmaea*, or *Picrothamnus desertorum*, sometimes with a mix of other low shrubs, such as *Krascheninnikovia lanata* or *Tetradymia spinosa*. Occasional individuals or small clumps of *Atriplex confertifolia, Atriplex canescens*, or *Artemisia tridentata ssp. wyomingensis* may be present in some stands within this group but do not codominate. The herbaceous layer is typically sparse. Scattered perennial forbs occur, such as *Xylorhiza glabriuscula* and *Sphaeralcea grossulariifolia*; perennial grasses *Achnatherum hymenoides, Bouteloua gracilis* (not in Wyoming), *Elymus elymoides, Elymus lanceolatus ssp. lanceolatus, Pascopyrum smithii, Poa secunda*, or *Sporobolus airoides* may dominate the herbaceous layer. In less saline areas, there may be inclusions of grasslands

dominated by *Hesperostipa comata, Leymus salinus, Pascopyrum smithii*, or *Pseudoroegneria spicata*. Stands occur on gentle slopes and rolling plains. Substrates are shallow, typically saline, alkaline, fine-textured soils developed from shale or alluvium that may be associated with shale badlands. Infiltration rate is typically low. In Wyoming and possibly elsewhere, inclusions of non-saline, gravelly barrens or rock outcrops dominated by cushion plants such as *Arenaria hookeri* and *Phlox hoodii* without dwarf-shrubs may be present (these are not restricted to this group and larger patches would likely be classified in a sparse vegetation group).

Classification Comments: This group is more broadly defined than just low, mat-forming saltbush on shaly sites (*Atriplex corrugata, Atriplex gardneri*), but includes few dwarf sagebrush species that occur with similar habits and in similar habitats. Generally, it does not include stands mixed with taller species of saltbush or sagebrush. Stands in this group may grade into sparse vegetation groups on shale barrens/badlands. Welsh (1957) observed that *Atriplex corrugata* stands were restricted to north and east aspects on Mancos shale, with south and west aspects nearly barren. In Montana, *Atriplex gardneri* also occurs associated with badlands, and determining which group it falls into may be difficult. Scrub stands dominated by *Picrothamnus desertorum* are placed in Intermountain Shadscale - Saltbush Scrub Group (G300) because they often codominant with the widespread shrub *Atriplex confertifolia*. However, *Picrothamnus desertorum* is often short (10-25 cm tall) so it could also be classified as a dwarf-shrubland.

Similar NVC Types:

Diagnostic Characteristics: This open dwarf-shrubland is typically dominated by relatively pure stands of *Atriplex corrugata* (in Colorado and Utah) or *Atriplex gardneri* (Wyoming and Montana into Canada). Other dominant or codominant dwarf-shrubs may include *Artemisia longifolia, Artemisia pedatifida* (very important in Wyoming, rare in Colorado stands), or *Artemisia pygmaea*, sometimes with a mix of other low shrubs, such as *Krascheninnikovia lanata* or *Tetradymia spinosa*. Occasional individuals or small clumps of *Atriplex confertifolia, Atriplex canescens*, or *Artemisia tridentata ssp. wyomingensis* may be present in some stands within this group but do not codominate.

VEGETATION

Physiognomy and Structure: This group is a facultatively deciduous, subdesert dwarf-shrubland. It typically has an open woody canopy of clumps of low, mat-forming dwarf-shrubs and a sparse herbaceous layer.

Floristics: This dwarf-shrubland group is characterized by an open canopy of dwarf-shrubs typically composed of relatively pure stands of *Atriplex* spp., such as *Atriplex corrugata* (in Colorado and Utah), *Atriplex gardneri* (Wyoming and Montana into Canada), or *Artemisia pedatifida* (very important in Wyoming, rare in Colorado stands). Other dominant or codominant dwarf-shrubs may include *Artemisia longifolia, Artemisia pygmaea*, or *Picrothamnus desertorum*, sometimes with a mix of other low shrubs, such as *Krascheninnikovia lanata* or *Tetradymia spinosa*. Occasional individuals or small clumps of *Atriplex confertifolia, Atriplex canescens*, or *Artemisia tridentata ssp. wyomingensis* may be present in some stands within this group but do not codominate. The herbaceous layer is typically sparse. Scattered perennial forbs occur, such as *Xylorhiza glabriuscula* and *Sphaeralcea grossulariifolia*; perennial grasses *Achnatherum hymenoides, Bouteloua gracilis* (not in Wyoming), *Elymus elymoides, Elymus lanceolatus ssp. lanceolatus, Pascopyrum smithii, Poa secunda*, or *Sporobolus airoides* may dominate the herbaceous layer. In less saline areas, there may be inclusions of grasslands dominated by *Hesperostipa comata, Leymus salinus, Pascopyrum smithii*, or *Pseudoroegneria spicata*. In Wyoming and possibly elsewhere, inclusions of non-saline, gravelly barrens or rock outcrops dominated by cushion plants such as *Arenaria hookeri* and *Phlox hoodii* without dwarf-shrubs may be present (these are not restricted to this group and larger patches would likely be classified in a sparse vegetation group). Annuals are seasonally present and may include *Eriogonum inflatum, Plantago tweedyi, Monolepis nuttalliana*, and the introduced annual grass *Bromus tectorum*.

ENVIRONMENT & DYNAMICS

Environmental Description: This group occurs on gentle slopes and rolling plains in the northern Colorado Plateau and Uinta Basin on Mancos shale and arid, windswept plains and basins across parts of Wyoming. On Mancos shale (and possibly other saline marine shales), stands may be restricted to gentler slopes and cooler north and east aspects, with steeper south and west aspects nearly barren (Welsh 1957). *Climate:* Climate is temperate and semi-arid. Summers are generally hot, and freezing temperatures are common in the winter. Mean annual precipitation ranges from 13-33 cm. In Montana and Wyoming, approximately two-thirds of the annual precipitation falls in spring and early summer. In Colorado and Utah, over half the precipitation occurs in the late-summer monsoons as high-intensity thunderstorms. *Soil/substrate/hydrology:* Substrates are typically saline, alkaline, fine-textured soils developed from shale or alluvium and may be associated with shale badlands. Infiltration rate is typically low. In Wyoming and possibly elsewhere, inclusions of non-saline, gravelly barrens or rock outcrops may be present.

Dynamics: *Atriplex corrugata*-dominated shrublands are the most saline-tolerant of the Mancos shale plant communities studied by Branson et al. (1976). *Atriplex corrugata* can completely dominate these extremely saline sites (Branson et al. 1976). It is a true evergreen dwarf-shrub retaining leaves for several years, and branches are capable of rooting at the nodes. This plant utilizes winter soil moisture, beginning new growth in March when the soils are relatively warm and moist. It flowers in April, and by mid-July fruits

are shattered (Branson et al. 1976). If the soils dry out in mid-summer, it can go dormant until the late-summer monsoon rains begin. Large areas of *Atriplex corrugata* died during the extreme drought of 2002 in the Four Corners area. By 2004, new seedlings were established and spreading; shrub cover recovered to approximately 50% of what it was before the drought. *Atriplex gardneri*-dominated vegetation is another saline/drought-tolerant example of the Mancos Shale plant communities studied by Branson et al. (1976). Although very slow-growing, it can completely dominate these extremely saline sites (Branson et al. 1976).

DISTRIBUTION

Geographic Range: This group occurs on gentle slopes and rolling plains in the Colorado Plateau and Uinta Basin on Mancos shale and arid, windswept basins and plains across parts of Wyoming and Montana, and into Canada.

Spatial Scale & Pattern [optional]: Matrix
Nations: CA, US
States/Provinces: AZ, CO, MT, NM, NV, UT, WY
TNC Ecoregions [optional]: 10:C, 11:P, 19:C, 20:P, 26:C
USFS Ecoregions (2007): 313A:CC, 313B:CC, 341B:CC, 341C:CC, 342E:C?, 342F:C?, 342G:CC, 342J:C?, M331B:CC, M331D:C?, M331E:CC, M331G:CC, M331H:CC, M331J:C?, M341B:CC, M341C:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate. The distinction between this group and Intermountain Basins Cliff, Scree & Badland Sparse Vegetation Group (G570) is unclear, as both occur on shale "badlands" and are floristically quite similar. The differences possibly relate more to total biomass, as opposed to floristic shifts.

SYNONYMY

- **=** Mat-*Atriplex* Association (Graham 1937)
- **><** Other Sagebrush Types (408) (Shiflet 1994)
- **><** Saltbush - Greasewood (501) (Shiflet 1994)
- **=** Vegetation on Manco Shale (Welsh 1957)

LOWER LEVEL UNITS

Alliances:
- A1127 *Artemisia pedatifida* Low Scrub Alliance
- A1110 *Atriplex gardneri* Low Scrub Alliance
- A1109 *Atriplex corrugata* Low Scrub Alliance
- A1106 *Artemisia pygmaea* Low Scrub Alliance

AUTHORSHIP

Primary Concept Source: S.L. Welsh (1957)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 11/06/2015
Classif Resp Region: West
Internal Author: KAS 2-10, 11-15

REFERENCES

References: Branson et al. 1976, Faber-Langendoen et al. 2017a, Graham 1937, Knight 1994, Knight et al. 1987, Potter et al. 1985, Shiflet 1994, Welsh 1957

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G301. Intermountain Dwarf Saltbush - Sagebrush Scrub

A1127. Artemisia pedatifida Low Scrub Alliance

Type Concept Sentence: This dwarf-shrub alliance is dominated by *Artemisia pedatifida* and is reported from the Pryor Mountains in the northern portion of the Bighorn Basin of south-central Montana.

OVERVIEW

Scientific Name: *Artemisia pedatifida* Low Scrub Alliance
Common Name (Translated Scientific Name): Birdfoot Sagebrush Low Scrub Alliance
Colloquial Name: Birdfoot Sagebrush Low Scrub

Type Concept: The vegetation of this alliance is characterized by a moderately dense dwarf-shrub layer that is dominated by *Artemisia pedatifida*. *Atriplex gardneri* may codominate in some stands. Other woody species may include scattered *Artemisia tridentata, Atriplex confertifolia, Ericameria nauseosa (= Chrysothamnus nauseosus), Eriogonum pauciflorum, Gutierrezia sarothrae, Krascheninnikovia lanata*, or *Suaeda moquinii (= Suaeda nigra)*. The moderately sparse herbaceous layer is often dominated by cool-season graminoids such as *Pascopyrum smithii* or *Elymus elymoides* with lesser amounts of *Bouteloua gracilis, Carex filifolia, Elymus lanceolatus ssp. lanceolatus, Poa secunda (= Poa juncifolia)*, or *Pseudoroegneria spicata*. Forbs are generally sparse and may include scattered *Allium textile, Astragalus* spp., *Comandra umbellata, Machaeranthera tanacetifolia, Musineon divaricatum, Phlox hoodii, Platyschkuhria integrifolia, Vicia americana, Xylorhiza glabriuscula*, or the cactus *Opuntia polyacantha*. Annual grasses and forbs are seasonally present. This dwarf-shrub alliance is reported from the Pryor Mountains in the northern portion of the Bighorn Basin of south-central Montana and dissected uplands of the Cheyenne River Basin in northeastern Wyoming. Stands typically occur in slight depressions on alluvial fans and terraces, dissected outwash or rolling plains, lower foothills, and badlands. Sites are flat to moderately steep, often highly eroded slopes with southern or western aspects. Soils are deep, poorly drained, and typically alkaline and saline with silt-loam to clay texture. The soil surface is mostly bare ground. Substrate is derived from shale or sandstone interbedded with shale, claystone or clay.

Classification Comments: This description is based on stands in northeastern Wyoming (Thilenius et al. 1995) and south-central Montana (Kratz 1988, DeVelice and Lesica 1993). The other Wyoming references were not available. Similar habitats in Wyoming in the Bighorn Canyon National Recreation Area were surveyed by Knight et al. (1987), but these shrublands were not described there. Some stands have very sparse vegetation cover and may be better classified in a sparsely vegetated alliance (Kratz 1988).

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Dwarf-shrublands found on shale breaks in dissected alluvial fans and terraces, outwash and rolling plains, and foothills in Montana and Wyoming with mixed species where *Artemisia pedatifida* is the most consistent dominant.

VEGETATION

Physiognomy and Structure: Vegetation in this alliance has a moderately dense, deciduous dwarf-shrub layer (<0.5 m). There is also a sparse to moderately dense herbaceous layer dominated by perennial graminoids with scattered perennial forbs. Annual forbs and grasses may be seasonally present.

Floristics: Stands have a moderately dense dwarf-shrub layer that is dominated by *Artemisia pedatifida*. *Atriplex gardneri* codominates in some stands. Other woody species may include scattered *Artemisia tridentata, Atriplex confertifolia, Ericameria nauseosa (= Chrysothamnus nauseosus), Eriogonum pauciflorum, Gutierrezia sarothrae, Krascheninnikovia lanata*, or *Suaeda moquinii (= Suaeda nigra)*. The moderately sparse herbaceous layer is often dominated by cool-season graminoids such as *Elymus elymoides* or *Pascopyrum smithii* with lesser amounts of *Bouteloua gracilis, Carex filifolia, Elymus lanceolatus ssp. lanceolatus, Poa secunda (= Poa juncifolia)*, or *Pseudoroegneria spicata*. Forbs are typically sparse and may include scattered *Allium textile, Astragalus* spp., *Comandra umbellata, Machaeranthera tanacetifolia, Musineon divaricatum, Phlox hoodii, Platyschkuhria integrifolia, Vicia americana, Xylorhiza glabriuscula*, or the cactus *Opuntia polyacantha*. Annual grasses and forbs are present seasonally.

ENVIRONMENT & DYNAMICS

Environmental Description: Vegetation included in this alliance is reported from the Pryor Mountains in the northern portion of the Bighorn Basin of south-central Montana (1250-1525 m elevation), and dissected uplands of the Cheyenne River Basin in northeastern Wyoming (1830-1600 m elevation). The climate is temperate and semi-arid, with hot and dry summers. Mean annual precipitation ranges from 25-35 cm with two-thirds occurring in the spring and early summer. Stands typically occur in slight depressions on alluvial fans and terraces, dissected outwash or rolling plains, lower foothills, and badlands. Sites are generally flat to gently sloping, or moderately steep, and often highly eroded with southern or western aspects. Soils are deep, poorly drained, and typically alkaline and saline with silt-loam to clay texture. The soil surface is mostly bare ground. Substrate is derived from shale or sandstone interbedded with shale, claystone or clay.

Dynamics: Harsh environmental conditions limit the abundance and species diversity of plants. Because of the poor subsurface soil drainage, the upper horizons are saturated and then completely dry out between summer rainstorms. The alternating soil-moisture extremes help create these distinctive plant communities (Thilenius et al. 1995).

DISTRIBUTION

Geographic Range: Stands in this alliance are restricted to shale breaks and badlands terrain in south-central Montana and northeastern Wyoming.

Nations: US
States/Provinces: MT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** *Artemisia pedatifida-Atriplex nuttallii* Community Type (DeVelice and Lesica 1993)
- **?** *Artemisia pedatifida/Agropyron spicatum* plant community type (Kratz 1988)
- **?** *Artemisia pedatifida* Vegetation Type (Thilenius et al. 1995)

LOWER LEVEL UNITS

Associations:

- CEGL001527 *Artemisia pedatifida / Pseudoroegneria spicata* Shrubland
- CEGL001451 *Artemisia pedatifida / Pascopyrum smithii* Shrubland
- CEGL001525 *Artemisia pedatifida - Atriplex gardneri* Shrubland
- CEGL001526 *Artemisia pedatifida / Festuca idahoensis* Shrubland
- CEGL001450 *Artemisia pedatifida / Elymus elymoides* Shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: DeVelice and Lesica 1993, Faber-Langendoen et al. 2017b, Knight et al. 1987, Kratz 1988, Thilenius et al. 1995

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G301. Intermountain Dwarf Saltbush - Sagebrush Scrub

A1106. Artemisia pygmaea Low Scrub Alliance

Type Concept Sentence: These communities are characterized by a sparse dwarf-shrub layer of *Artemisia pygmaea* and occur in relatively dry areas of the sagebrush desert of Nevada and Utah, from 1200-1800 m in elevation.

OVERVIEW

Scientific Name: *Artemisia pygmaea* Low Scrub Alliance
Common Name (Translated Scientific Name): Pygmy Sagebrush Low Scrub Alliance
Colloquial Name: Pygmy Sagebrush Low Scrub

Type Concept: This alliance is characterized by a sparse dwarf-shrub layer of *Artemisia pygmaea*, with other shrubs scattered through the stands. Only one association from central Nevada is presently described for this alliance. In addition to *Artemisia pygmaea*, that association included *Artemisia nova, Atriplex confertifolia, Chrysothamnus viscidiflorus*, and *Ephedra nevadensis* in the shrub layer. According to the authors, none of these associated shrubs is constant or characteristic of these communities. A sparse graminoid layer is usually present, including *Achnatherum hymenoides (= Oryzopsis hymenoides)* and *Elymus elymoides*. Forbs include *Astragalus* spp., *Eriogonum caespitosum*, and *Sphaeralcea coccinea*. Adjacent vegetation types are most often dominated by *Artemisia nova*, which often forms the vegetation matrix surrounding these unique communities. These communities often harbor regionally rare plant species. They occur in relatively dry areas of the sagebrush desert of Nevada and Utah, from 1200-1800 m in elevation. Precipitation averages 15-20 cm annually, with a significant proportion arriving as snow. Growing-season drought is characteristic. Soils are usually shallow and often unique, including Green River shale, heavy clays, or calcareous outcrops or gravels.

Classification Comments: Although these communities are classified as dwarf-shrublands, examination of stand data for the one association linked to this alliance indicates this vegetation may be better classified as sparsely vegetated. Total shrub cover is less than 15% and total vegetation cover is less than 25% for all species. Further inventory and classification work are needed to document this alliance.

Internal Comments:

Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Nearly sparsely vegetated low shrublands of the Nevada and Utah deserts where *Artemisia pygmaea* has <15% total cover, but remains the dominant shrub species.

VEGETATION

Physiognomy and Structure: These are sparse dwarf-shrublands dominated by a microphyllous evergreen shrub from 0.05-0.2 m in height. Larger shrubs are often scattered through these communities, but are of low cover and constancy. Scattered cespitose graminoids are also usually present, but of low cover (<10%).

Floristics: This alliance is characterized by a sparse dwarf-shrub layer of *Artemisia pygmaea*, with other shrubs scattered through the stands. Only one association from central Nevada is presently described for this alliance (Blackburn et al. 1968c). In addition to *Artemisia pygmaea*, that association includes *Artemisia nova, Atriplex confertifolia, Chrysothamnus viscidiflorus*, and *Ephedra nevadensis* in the shrub layer. According to the authors, none of these associated shrubs is constant or characteristic of these communities. A sparse graminoid layer is usually present, including *Achnatherum hymenoides (= Oryzopsis hymenoides)* and *Elymus elymoides*. Forbs include *Astragalus* spp., *Eriogonum caespitosum*, and *Sphaeralcea coccinea*.

ENVIRONMENT & DYNAMICS

Environmental Description: These communities occur in relatively dry areas of the sagebrush desert of Nevada and Utah, from 1200-1800 m in elevation. Precipitation averages 15-20 cm annually, with a significant proportion arriving as snow. Growing-season drought is characteristic. Soils are usually shallow and often unique, including Green River shale, heavy clays, or calcareous outcrops or gravels.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance has been quantitatively described from Nevada and also occurs in Utah (Welsh et al. 1993).

Nations: US
States/Provinces: NV, UT
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **<** SRM Cover Type #408 - Other Sagebrush Types (Shiflet 1994)

LOWER LEVEL UNITS

Associations:

- CEGL001436 *Artemisia pygmaea / Elymus elymoides - Achnatherum hymenoides* Shrubland

AUTHORSHIP

Primary Concept Source: D. Sarr, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Blackburn et al. 1968c, Faber-Langendoen et al. 2017b, Shiflet 1994, Welsh et al. 1987, Welsh et al. 1993

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G301. Intermountain Dwarf Saltbush - Sagebrush Scrub

A1109. Atriplex corrugata Low Scrub Alliance

Type Concept Sentence: Shrublands in this alliance are dominated by the halophytic, evergreen dwarf-shrub *Atriplex corrugata* and found on lower hillslopes and alkaline flats on the Colorado Plateau portions of northwestern New Mexico, western Colorado and Utah.

OVERVIEW

Scientific Name: *Atriplex corrugata* Low Scrub Alliance
Common Name (Translated Scientific Name): Mat Saltbush Low Scrub Alliance
Colloquial Name: Mat Saltbush Low Scrub

Type Concept: Stands have very sparse to moderate cover (5-30%) of woody vegetation that is dominated by the halophytic, evergreen dwarf-shrub *Atriplex corrugata*. Sparse stands are often completely dominated by this plant. Stands typically have very low species diversity. Depending on soil salinity and moisture, other plants may be present, including the shrubs *Krascheninnikovia lanata, Picrothamnus desertorum (= Artemisia spinescens)*, and *Tetradymia spinosa*. The herbaceous layer is very sparse. Scattered perennial forbs, such as *Sphaeralcea grossulariifolia* and *Xylorhiza glabriuscula*, and the perennial grass *Achnatherum hymenoides (= Oryzopsis hymenoides)* have been reported. Annuals are seasonally present and may include *Eriogonum inflatum, Plantago tweedyi*, and the exotics *Bromus tectorum, Malcolmia africana*, and *Salsola kali*. Shrublands in this alliance are found on lower hillslopes and alkaline flats on the Colorado Plateau portions of northwestern New Mexico, western Colorado and Utah. Climate is semi-arid with most of the highly variable precipitation falling in July and August as high-intensity thunderstorms. Mean annual precipitation is approximately 23 cm. Elevation ranges from 1300-1820 m. Sites are nearly flat to moderately steep, and have soils typically derived from Mancos shale. Soils are moderately deep, strongly saline, moderately alkaline, fine-textured (clayey), poorly developed and typically have high erosion rates.

Classification Comments: Vegetation cover in this alliance may vary greatly depending on soil chemistry and slope. Some stands should be classified as shrublands with 25-30% shrub cover (Branson et al. 1976, Potter et al. 1985). Most stands are in the 3-20% shrub cover range and should be classified in a sparsely vegetated alliance (West and Ibrahim 1968, Ibrahim et al. 1972, Harper and Jaynes 1986). Further investigation is needed throughout its range.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Sparse to open dwarf-shrublands (5-30%) of alkaline flats in the Colorado Plateau portions of northwestern New Mexico, western Colorado and Utah dominated by *Atriplex corrugata* occupying substrates typically derived from Mancos shale.

VEGETATION

Physiognomy and Structure: Vegetation in this alliance is characterized by sparse to moderate cover of xeromorphic evergreen dwarf-shrubs (<0.3 m tall). A sparse herbaceous layer may be present that is dominated by perennial graminoids with scattered perennial forbs. Annual forbs and grasses are seasonally present.

Floristics: Stands have very sparse to moderate cover (5-30%) of woody vegetation that is dominated by the halophytic evergreen dwarf-shrub *Atriplex corrugata*. Sparse stands are often completely dominated by this plant. Stands typically have very low species diversity. Depending on soil salinity and moisture, other plants may be present, including the shrubs *Krascheninnikovia lanata, Picrothamnus desertorum (= Artemisia spinescens)*, and *Tetradymia spinosa*. The herbaceous layer is very sparse. Scattered perennial forbs, such as *Xylorhiza glabriuscula* and *Sphaeralcea grossulariifolia*, and the perennial grass *Achnatherum hymenoides (= Oryzopsis hymenoides)* have been reported. Annuals are seasonally present and may include *Eriogonum inflatum, Plantago tweedyi*, and the exotics *Bromus tectorum, Malcolmia africana*, and *Salsola kali*.

ENVIRONMENT & DYNAMICS

Environmental Description: Shrublands included in this alliance are found on the lower slopes of shale outcrops and alkaline flats on the Colorado Plateau portions of northwestern New Mexico, western Colorado and Utah. Climate is semi-arid with most of the highly variable precipitation falling in July and August as high-intensity thunderstorms. Mean annual precipitation is approximately 23 cm. Elevation ranges from 1300-1700 m. Sites are nearly flat to moderately steep. Soils are typically derived from Mancos shale. They are moderately deep, strongly saline, moderately alkaline, fine-textured (clayey), poorly developed and typically have high erosion rates. The soil surface is mostly barren.

Dynamics: *Atriplex corrugata*-dominated shrublands are the most saline-tolerant of the Mancos shale plant communities studied by Branson et al. (1976). Although very slow-growing, *Atriplex corrugata* can completely dominate these extremely saline sites (Branson et al. 1976). It is a true evergreen dwarf-shrub retaining leaves for several years. This plant utilizes winter soil moisture, beginning new growth in March when the soils are relatively warm and moist. It flowers in April and by mid-July fruits are shattered (Branson et al. 1976). If the soils dry out in mid-summer, it can go dormant until the late-summer monsoon rains begin.

DISTRIBUTION

Geographic Range: Dwarf-shrublands included in this alliance occur on lower slopes and in basins in western Colorado, northwestern New Mexico and Utah, on Mancos shale.

Nations: US
States/Provinces: CO, NM, UT
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Atriplex corrugata* Shrub Association (Baker 1984b) [*Atriplex corrugata* Shale Barren is listed as a synonym.]
- **?** Badlands (Dastrup 1963) [*Atriplex corrugata* can be found on the "buckskin" knolls in the Uinta Basin of Utah.]
- **?** Mat *Atriplex-Hilaria* Community (Dastrup 1963) [includes two other species of *Atriplex* plus significant *Artemisia nova* cover]
- **?** Mat *Atriplex* Association (Graham 1937)
- **?** Mat saltbush association (Shantz 1925)

LOWER LEVEL UNITS

Associations:
- CEGL001437 *Atriplex corrugata* Dwarf-shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Baker 1984b, Branson et al. 1976, Dastrup 1963, Faber-Langendoen et al. 2017b, Graham 1937, Harper and Jaynes 1986, Ibrahim et al. 1972, Potter et al. 1985, Shantz 1925, West and Ibrahim 1968

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G301. Intermountain Dwarf Saltbush - Sagebrush Scrub

A1110. Atriplex gardneri Low Scrub Alliance

Type Concept Sentence: This dwarf-shrubland alliance has a very sparse to moderately dense cover of dwarf-shrubs that is dominated by *Atriplex gardneri* and occurs in western Colorado and eastern Utah, Wyoming and Montana on mesas, plateaus, plains, low hills and eroded "badlands."

OVERVIEW

Scientific Name: *Atriplex gardneri* Low Scrub Alliance
Common Name (Translated Scientific Name): Gardner's Saltbush Low Scrub Alliance
Colloquial Name: Gardner's Saltbush Low Scrub

Type Concept: Stands of this alliance have a very sparse to moderately dense cover of dwarf-shrubs that is dominated by *Atriplex gardneri*. *Artemisia tridentata* and *Picrothamnus desertorum (= Artemisia spinescens)* are codominants in some stands. Many other shrubs and dwarf-shrubs may be present, including *Atriplex* spp., *Krascheninnikovia lanata, Sarcobatus vermiculatus, Suaeda* spp., and *Tetradymia spinosa*. The herbaceous layer, if present, may be dominated by graminoids or forbs. Common species include *Achnatherum hymenoides (= Oryzopsis hymenoides), Eriogonum pauciflorum, Leymus salinus, Monolepis nuttalliana, Pascopyrum smithii, Pleuraphis jamesii (= Hilaria jamesii)*, or *Xylorhiza venusta*. This dwarf-shrubland alliance occurs in western Colorado and eastern Utah, Wyoming and Montana. Stands occur on mesas, plateaus, plains, low hills and eroded "badlands." Sites are nearly flat

to moderately steep with moderately deep to deep, usually saline, alkaline soils. Soils are typically fine-textured and often have high erosion rates because of poor infiltration and high runoff. The soil surface is often mostly barren.

Classification Comments: Vegetation cover in this alliance may vary greatly depending on soil chemistry and slope. Some stands could be classified as dwarf-shrublands with 25-60% dwarf-shrub cover (Branson et al. 1976, DeVelice and Lesica 1993, DeVelice et al. 1995). Other stands are in the 3-20% shrub cover range and could be classified in a sparsely vegetated or dwarf-shrub herbaceous alliance (West and Ibrahim 1968, Ibrahim et al. 1972, Baker and Kennedy 1985, Knight et al. 1987, DeVelice and Lesica 1993, DeVelice et al. 1995). In addition, heavy grazing by livestock has impacted some of these stands by nearly eliminating herbaceous species.

There is taxonomic confusion in some of the research done on these vegetation types. Some of the studies report the name *Atriplex nuttallii* to describe the taxon that is now called *Atriplex gardneri*, and yet *Atriplex nuttallii* is still a valid name (Kartesz 1999). Also, Welsh et al. (1987) described six varieties of *Atriplex gardneri*, most of which are now separate species of *Atriplex*. Further investigation is needed throughout the range of these taxa to clarify these taxonomic questions. New associations may need to be described or perhaps the concepts of these associations and the alliance need to be broadened to include the other species. DeVelice et al. (1995) have described two new *Atriplex gardneri*-dominated plant associations that have not yet been included in the U.S. National Vegetation Classification (named by DeVelice et al. (1995) as *Atriplex nuttallii* / perennial grass and *Atriplex nuttallii / Eriogonum pauciflorum*). The first plant association is very similar to current plant associations with the herbaceous layer dominated by either *Pascopyrum smithii, Pseudoroegneria spicata*, or *Sporobolus airoides*.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Diagnostic of this dwarf-shrubland alliance is the dominance or codominance of *Atriplex gardneri* in western Colorado and eastern Utah, Wyoming and Montana on mesas, plateaus, plains, low hills and eroded "badlands."

VEGETATION

Physiognomy and Structure: Vegetation in this alliance is dominated by sparse to moderate cover of xeromorphic evergreen dwarf-shrubs (<0.3 m tall). A sparse to moderately dense herbaceous layer that is dominated by perennial graminoids or forbs may be present. Annual forbs and grasses are seasonally present.

Floristics: Stands have a very sparse to moderately dense cover of woody species that is dominated by the halophytic evergreen dwarf-shrub *Atriplex gardneri*. Some stands are completely dominated by this plant and have very low species diversity. Depending on soil salinity and moisture, other plants may be present. *Artemisia tridentata* and *Picrothamnus desertorum (= Artemisia spinescens)* are codominants in some stands. Other shrubs and dwarf-shrubs may include *Atriplex* spp., *Krascheninnikovia lanata, Sarcobatus vermiculatus, Suaeda* spp. and *Tetradymia spinosa*. The herbaceous layer is very sparse to moderately dense. It may be dominated by graminoids such as *Achnatherum hymenoides (= Oryzopsis hymenoides), Leymus salinus, Pascopyrum smithii, Pleuraphis jamesii (= Hilaria jamesii)*, or the by forbs *Eriogonum pauciflorum, Monolepis nuttalliana* (an annual), or *Xylorhiza venusta*. Other frequent plants include *Allium textile, Aristida* spp., *Elymus elymoides, Eriogonum inflatum, Lappula* spp., *Opuntia polyacantha, Plantago patagonica, Poa secunda, Sphaeralcea coccinea*, and *Sporobolus* spp.

ENVIRONMENT & DYNAMICS

Environmental Description: Dwarf-shrublands in this alliance are found on mesas, plateaus, plains, low hills and eroded "badlands" in western Colorado and eastern Utah, Wyoming and Montana. Elevation ranges from 1150-2200 m. Climate is temperate and semi-arid. Summers are generally hot and freezing temperatures are common in the winter. Mean annual precipitation ranges from 13-33 cm. In Montana and Wyoming, approximately two-thirds of the annual precipitation falls in spring and early summer. In Colorado and Utah, over half the precipitation occurs in the late-summer monsoons as high-intensity thunderstorms. Sites are nearly flat to moderately steep. Soils are moderately deep to deep, usually saline, moderately alkaline, poorly developed and typically have high erosion rates because of poor infiltration and high runoff. Soil texture is typically fine, but ranges from sandy loam to clay and may be gravelly. Parent material is typically shale, alluvium and bentonite. The soil surface is often mostly barren. In the Badger Wash basin in Colorado, the soil surface has 74% bare ground and 6% litter (Branson et al. 1976).

Dynamics: *Atriplex gardneri*-dominated vegetation is the most saline/drought-tolerant of the Mancos shale plant communities studied by Branson et al. (1976). Although very slow-growing, it can completely dominate these extremely saline sites (Branson et al. 1976). This plant utilizes winter soil moisture, beginning new growth in March when the soils are relatively warm and moist. It flowers in April and by mid-July fruits are shattered (Branson et al. 1976).

DISTRIBUTION

Geographic Range: Dwarf-shrublands included in this alliance occur on mostly alkaline and barren plains and hills in western Colorado, eastern Utah, Wyoming and Montana.

Nations: US
States/Provinces: CO, MT, OR?, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Atriplex gardnerae* association (Ibrahim et al. 1972)
- **?** *Atriplex nuttallii* Community Type (Cooper et al. 1995)
- **?** *Atriplex nuttallii* plant community (Branson et al. 1976)
- **?** *Atriplex* spp. Series (Johnston 1987) [includes *Atriplex gardneri/Elytrigia smithii* plant association.]
- **><** Saltbush Desert Shrubland (Knight et al. 1987)

LOWER LEVEL UNITS

Associations:

- CEGL001441 *Atriplex gardneri / Pleuraphis jamesii* Dwarf-shrubland
- CEGL001443 *Atriplex gardneri / Monolepis nuttalliana* Dwarf-shrubland
- CEGL001439 *Atriplex gardneri - Picrothamnus desertorum* Dwarf-shrubland
- CEGL001440 *Atriplex gardneri / Artemisia tridentata* Dwarf-shrubland
- CEGL001446 *Atriplex gardneri / Xylorhiza venusta* Dwarf-shrubland
- CEGL001438 *Atriplex gardneri* Dwarf-shrubland
- CEGL001445 *Atriplex gardneri / Pascopyrum smithii* Dwarf-shrubland
- CEGL001442 *Atriplex gardneri / Leymus salinus* Dwarf-shrubland
- CEGL001444 *Atriplex gardneri / Achnatherum hymenoides* Dwarf-shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/03/14

REFERENCES

References: Baker and Kennedy 1985, Branson et al. 1976, Cooper et al. 1995, DeVelice and Lesica 1993, DeVelice et al. 1995, Faber-Langendoen et al. 2017b, Ibrahim et al. 1972, Johnston 1987, Kartesz 1999, Knight et al. 1987, Welsh et al. 1987, West and Ibrahim 1968

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
3.B.1.Ne.5.b. M093 Great Basin Saltbush Scrub

G300. Intermountain Shadscale - Saltbush Scrub

Type Concept Sentence: This widespread semi-arid scrub group is found in basins, plains, alluvial flats and slopes in the intermountain western U.S. and western Great Plains and is characterized by a typically open to moderately dense shrub layer dominated or codominated by *Atriplex canescens, Atriplex confertifolia, Atriplex cuneata, Atriplex hymenelytra, Atriplex obovata, Atriplex polycarpa, Grayia spinosa*, and/or *Picrothamnus desertorum* often with other shrubs present to codominant.

OVERVIEW

Scientific Name: *Atriplex confertifolia - Atriplex canescens - Grayia spinosa* Scrub Group
Common Name (Translated Scientific Name): Shadscale Saltbush - Fourwing Saltbush - Spiny Hopsage Scrub Group
Colloquial Name: Fourwing Saltbush Scrub

Type Concept: This extensive group includes open-canopied shrublands of typically saline basins, alluvial slopes and plains across the intermountain western U.S. and western Great Plains. The vegetation is characterized by a typically open to moderately dense

shrubland composed of one or more *Atriplex* species, such as *Atriplex canescens, Atriplex confertifolia, Atriplex cuneata, Atriplex hymenelytra, Atriplex obovata*, or *Atriplex polycarpa*. Other shrubs present to codominant may include *Artemisia tridentata ssp. wyomingensis, Chrysothamnus viscidiflorus, Ericameria nauseosa, Ephedra nevadensis, Krascheninnikovia lanata, Grayia spinosa, Lycium* spp., *Picrothamnus desertorum*, or *Tetradymia* spp. Northern occurrences lack *Atriplex* species and are typically dominated by *Grayia spinosa*. In Wyoming, occurrences are typically a mix of *Artemisia tridentata ssp. wyomingensis, Atriplex confertifolia, Grayia spinosa, Krascheninnikovia lanata, Sarcobatus vermiculatus*, and various *Ericameria* or *Chrysothamnus* species. Some places are a mix of *Atriplex confertifolia* and *Artemisia tridentata ssp. wyomingensis*. In the Great Basin, *Sarcobatus vermiculatus* is generally absent but, if present, does not codominate. The herbaceous layer varies from sparse to moderately dense and is dominated by perennial graminoids such as *Achnatherum hymenoides, Bouteloua gracilis, Elymus lanceolatus ssp. lanceolatus, Pascopyrum smithii, Pleuraphis jamesii, Pleuraphis rigida, Poa secunda*, or *Sporobolus airoides*. Various forbs are also present. Substrates are often saline and calcareous, medium- to fine-textured, alkaline soils, but include some coarser-textured soils.

Classification Comments: Some *Grayia spinosa*-dominated stands tends to occur on coppice dunes that have a silty component to them. If they occur on deep sand or dunes, then consider a dune group. Scrub stands dominated by *Picrothamnus desertorum* are placed in this group because *Picrothamnus desertorum* is frequently present to codominant with the widespread shrub *Atriplex confertifolia* in the Great Basin (Mozingo 1987). However, *Picrothamnus desertorum* is often short (10-25 cm tall) so could also be classified as Intermountain Dwarf Saltbush - Sagebrush Scrub Group (G301).

Similar NVC Types:
- G299 Chihuahuan Desert Lowland Basin Scrub

Diagnostic Characteristics: The vegetation is characterized by a typically open to moderately dense shrubland composed of one or more shrub species, such as *Atriplex canescens, Atriplex confertifolia, Atriplex cuneata, Atriplex hymenelytra, Atriplex obovata, Atriplex polycarpa, Grayia spinosa*, and/or *Picrothamnus desertorum*.

VEGETATION

Physiognomy and Structure: This group is a facultatively deciduous, extremely xeromorphic, subdesert short shrubland with a typically open shrub canopy and sparse to moderately dense herbaceous layer dominated by perennial graminoids.

Floristics: This widespread cool semi-desert scrub group is highly variable and ranges from almost pure occurrences of a single species to fairly complex mixtures. The characteristic mix of low shrubs and grasses is sparse, with large open spaces between the plants (Blaisdell and Holmgren 1984). Occurrences have a sparse to moderately dense cover of woody species that is often dominated by one of several shrubs such as *Atriplex canescens* (also codominated by *Artemisia tridentata, Ephedra viridis*, or *Krascheninnikovia lanata*), *Atriplex confertifolia* (also codominated by several species of *Lycium* and *Ephedra, Picrothamnus desertorum*, or *Sarcobatus vermiculatus*), *Atriplex cuneata, Atriplex obovata, Atriplex hymenelytra, Atriplex polycarpa, Grayia spinosa*, or *Picrothamnus desertorum (= Artemisia spinescens)*. Other shrubs may be present, especially in transition areas with desert or montane scrub. Species include *Acacia greggii, Artemisia frigida, Chrysothamnus* spp., *Encelia frutescens, Ericameria nauseosa, Ephedra nevadensis, Frankenia salina, Larrea tridentata, Lycium andersonii, Lycium pallidum, Parthenium confertum, Psorothamnus polydenius, Purshia stansburiana, Suaeda* spp., *Tetradymia glabrata, Tetradymia spinosa, Tiquilia latior*, and *Yucca glauca*. Dwarf-shrubs include *Gutierrezia sarothrae* and several species of *Eriogonum*, but generally do not form a distinct layer as the main shrub layer is often >0.5 m tall.

Warm-season medium-tall and short perennial grasses dominate in the sparse to moderately dense graminoid layer. The species present depend on the geographic range of the grasses, soil alkalinity/salinity, and past land use. Species may include *Achnatherum hymenoides, Bouteloua gracilis, Distichlis spicata, Elymus elymoides, Hesperostipa comata, Leymus ambiguus, Leymus salinus, Muhlenbergia torreyi, Pascopyrum smithii, Pleuraphis jamesii, Poa secunda, Pseudoroegneria spicata, Sporobolus airoides*, and *Sporobolus cryptandrus*. A number of annual species may also grow in association with the shrubs and grasses, although they are usually rare and confined to areas of recent disturbance (Blaisdell and Holmgren 1984). Forb cover is generally sparse. Perennial forbs that might occur include *Chaetopappa ericoides, Descurainia* spp., *Mentzelia* spp., *Sphaeralcea coccinea*, and *Xylorhiza venusta*. Annual natives include *Monolepis nuttalliana, Plantago* spp., or *Vulpia octoflora*. Associated halophytic annuals include *Salicornia bigelovii, Salicornia rubra*, and *Suaeda* species. Exotic annuals that may occur include *Salsola kali, Bromus rubens*, and *Bromus tectorum*. Cacti such as species of *Opuntia* and *Echinocereus* may be present in some occurrences. Trees are not usually present but some scattered *Juniperus* spp. may be found.

ENVIRONMENT & DYNAMICS

Environmental Description: This salt-desert shrubland group is matrix-forming in the Intermountain West. This group composes arid to semi-arid shrublands on lowland and upland sites usually at elevations between 1520 and 2200 m (4987-7218 feet). Sites can be found on all aspects and include valley bottoms, alluvial and alkaline flats, mesas and plateaus, playas, drainage terraces, washes and interdune basins, bluffs, and gentle to moderately steep sandy or rocky slopes. Slopes are typically gentle to moderately steep

but are sometimes unstable and prone to surface movement. Many areas within this group are degraded due to erosion and may resemble "badlands." Soil surface is often very barren and interspaces between the characteristic plant clusters are commonly covered by a microphytic crust (West 1982).

Climate: This is typically a vegetation group of extreme climatic conditions, with warm to hot summers and freezing winters. Annual precipitation ranges from approximately 13-33 cm. In much of the group, the period of greatest moisture will be mid to late summer, although in the more northern areas, a moist period is to be expected in the cold part of the year. However, plotted seasonality of occurrence is probably of less importance on this desert vegetation than in other types because desert precipitation comes with an extreme irregularity that does not appear in graphs of long-term seasonal or monthly averages (Blaisdell and Holmgren 1984). *Soil/substrate/hydrology:* Soils are shallow to moderately deep, poorly developed, and a product of an arid climate and little precipitation. Soils are often alkaline or saline. Vegetation within this group is tolerant of these soil conditions but not restricted to it. The shallow soils of much of the area are poorly developed Entisols. Vegetation within this group can occur on level pediment remnants where coarse-textured and well-developed soil profiles have been derived from sandstone gravel and are alkaline, or on Mancos shale badlands, where soil profiles are typically fine-textured and non-alkaline throughout (West and Ibrahim 1968). They can also occur in alluvial basins where parent materials from the other habitats have been deposited over Mancos shale and the soils are heavy-textured and saline-alkaline throughout the profile (West and Ibrahim 1968).

Dynamics: West (1982) stated that "salt desert shrub vegetation occurs mostly in two kinds of situations that promote soil salinity, alkalinity, or both. These are either at the bottom of drainages in enclosed basins or where marine shales outcrop." However, salt-desert shrub vegetation may be an indication of climatically dry as well as physiologically dry soils (Blaisdell and Holmgren 1984). Not all salt-desert shrub soils are salty, and their hydrologic characteristics may often be responsible for the associated vegetation (Naphan 1966). Species of the salt-desert shrub complex have different degrees of tolerance to salinity and aridity, and they tend to sort themselves out along a moisture/salinity gradient (West 1982). Species and communities are apparently sorted out along physical, chemical, moisture, and topographic gradients through complex relations that are not understood and are in need of further study (Blaisdell and Holmgren 1984).

The winter months are a good time for soil moisture accumulation and storage within stands in this group. There is generally at least one good snowstorm per season that will provide sufficient moisture to the vegetation. The winter moisture accumulation amounts will affect spring plant growth. Plants may grow as little as a few inches to 1 m. Unless more rains come in the spring, the soil moisture will be depleted in a few weeks, growth will slow and ultimately cease, and the perennial plants will assume their various forms of dormancy (Blaisdell and Holmgren 1984). If effective rain comes later in the warm season, some of the species will renew their growth from the stage at which it had stopped. Others, having died back, will start over as if emerging from winter dormancy (Blaisdell and Holmgren 1984). *Atriplex confertifolia* shrubs often develop large leaves in the spring, which increase the rate of photosynthesis. As soil moisture decreases, the leaves are lost, and the plant takes on a dead appearance. During late fall, very small overwintering leaves appear which provide some photosynthetic capability through the remainder of the year. Other communities are maintained by intra- or inter-annual cycles of flooding followed by extended drought, which favor accumulation of transported salts. The moisture supporting these intermittently flooded wetlands is usually derived off-site, and they are dependent upon natural watershed function for persistence (Reid et al. 1999).

In summary, desert communities of perennial plants are dynamic and changing. The composition within this group may change dramatically and may be both cyclic and unidirectional. Superimposed on the compositional change is great variation from year to year in growth of all the vegetation, the sum of varying growth responses of individual species to specific conditions of different years (Blaisdell and Holmgren 1984). Desert plants grow when temperature is satisfactory, but only if soil moisture is available at the same time. Because the amount of moisture is variable from year to year and because different species flourish under different seasons of soil moisture, seldom do all components of the vegetation thrive in the same year (Blaisdell and Holmgren 1984).

DISTRIBUTION

Geographic Range: The distribution of this widespread group centers in the Intermountain West of the U.S., and extends in limited distribution across northern New Mexico into the southern Great Plains. In Wyoming, this group occurs in the Great Divide and Bighorn basins.

Spatial Scale & Pattern [optional]: Large patch
Nations: MX?, US
States/Provinces: AZ, CA, CO, ID, KS, MT, NM, NV, OR, TX, UT, WA, WY
TNC Ecoregions [optional]: 4:?, 6:C, 8:?, 9:C, 10:C, 11:C, 18:C, 19:C, 20:C, 21:C, 26:C, 27:C, 28:C
USFS Ecoregions (2007): 313A:CC, 313B:CC, 313D:CC, 315A:CC, 315B:CP, 315H:CC, 321A:CC, 322A:CC, 331A:CP, 331B:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 331J:CC, 341A:CC, 341B:CC, 341C:CC, 341D:CC, 341E:CC, 341F:CC, 341G:CC, 342A:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:CC, 342I:CC, 342J:CC, M242C:PP, M261D:CP, M261E:CP, M261G:CC, M313A:CC, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:C?, M332A:CP, M332E:CC, M332F:CC, M332G:CP, M341A:CC, M341B:CC, M341C:CC, M341D:CC
Omernik Ecoregions:

Federal Lands [optional]: NPS (Arches)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **<** Biotic Matrix of the Shadscale and Associated Communities (Fautin 1946)
- **=** Intermountain salt desert shrublands (West 1983b)
- **<** Salt Desert Shrub (414) (Shiflet 1994)

LOWER LEVEL UNITS

Alliances:

- A3174 *Atriplex polycarpa* Scrub Alliance
- A0869 *Atriplex canescens* Scrub Alliance
- A3180 *Atriplex obovata - Atriplex cuneata* Scrub Alliance
- A0870 *Atriplex confertifolia* Scrub Alliance
- A3171 *Grayia spinosa* Scrub Alliance

AUTHORSHIP

Primary Concept Source: N.E. West (1983b)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 11/06/2015
Classif Resp Region: West
Internal Author: KAS 2-10, 11-15

REFERENCES

References: Barbour and Major 1988, Blaisdell and Holmgren 1984, Branson et al. 1967, Branson et al. 1976, Brown 1982a, Brown et al. 1979, Campbell 1977, Faber-Langendoen et al. 2017a, Fautin 1946, Francis 1986, Holland and Keil 1995, Knight 1994, Knight et al. 1987, Mozingo 1987, Naphan 1966, Reid et al. 1999, Shiflet 1994, Stout et al. 2013, West 1979, West 1982, West 1983b, West and Ibrahim 1968

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G300. Intermountain Shadscale - Saltbush Scrub

A0869. Atriplex canescens Scrub Alliance

Type Concept Sentence: Stands typically have a sparse to moderately dense (10-60% cover) short-shrub canopy (approximately 1.5 m tall) that is dominated by the facultative deciduous, xeromorphic shrub *Atriplex canescens*.

OVERVIEW

Scientific Name: *Atriplex canescens* Scrub Alliance
Common Name (Translated Scientific Name): Fourwing Saltbush Scrub Alliance
Colloquial Name: Fourwing Saltbush Scrub

Type Concept: This alliance occurs primarily in arid and semi-arid areas of the southwestern U.S. from western Texas to southern and eastern California and into Chihuahua, Mexico. It is also found in the western Great Plains to the Great Basin from western Kansas, Colorado, and Wyoming to Utah, Nevada and eastern Oregon. Stands typically have a sparse to moderately dense short-shrub canopy that is dominated by *Atriplex canescens*. Associated shrubs may include *Artemisia bigelovii, Artemisia tridentata, Ephedra viridis, Krascheninnikovia lanata, Purshia stansburiana (= Purshia mexicana var. stansburiana), Psorothamnus polydenius, Parthenium confertum, Sarcobatus vermiculatus*, and species of *Chrysothamnus, Ericameria*, and *Lycium*. The herbaceous layer is sparse to moderately dense and dominated by warm-season, medium-tall and short grasses depending on geographic range of the grasses. Species may include *Bouteloua gracilis, Distichlis spicata, Elymus elymoides, Hesperostipa comata, Pleuraphis jamesii (= Hilaria jamesii), Achnatherum hymenoides (= Oryzopsis hymenoides), Muhlenbergia porteri, Scleropogon brevifolius, Pascopyrum smithii*, and *Sporobolus* spp. Overall, shrublands in this alliance occur on lowland and upland sites with elevation ranging from 75 m below sea level to 2400 m. Lowland sites include alluvial flats, drainage terraces, playas, washes and interdune basins. Upland sites include bluffs and gentle to moderately steep, sandy or rocky slopes. Stands occur on all aspects. Soils are variable with depths ranging from shallow to moderately deep, and texture ranging from sand to loam to clay.

Classification Comments: Shrublands in this alliance can grade into grasslands dominated by *Sporobolus airoides* or *Pleuraphis mutica*, or occur within a matrix of other desert shrublands. Further review of this alliance is necessary before comparisons can be

made with other vegetation types. Some of the stands referenced, such as in Francis (1986), may not have enough vegetation cover to be classified as shrublands.

Given the geographic extent of this alliance, it may be warranted to split this into two alliances that reflect ecoregional variation.

Internal Comments:
Other Comments:

Similar NVC Types:
- A3151 *Atriplex canescens* Lowland Basin Desert Scrub Alliance

Diagnostic Characteristics: Nearly sparse to moderately dense stands of short shrubs dominated by *Atriplex canescens*. Due to the wide geographic range of this alliance, associated species composition is highly variable.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a sparse to moderately dense layer of facultatively deciduous, extremely xeromorphic shrubs up to 2 m in height. A sparse to dense graminoid layer of warm-season grasses may be present.

Floristics: Stands have a sparse to moderately dense (10-60% cover) short-shrub canopy (to approximately 1.5 m tall) that is dominated by the facultatively deciduous, xeromorphic shrub *Atriplex canescens*. Associated shrubs may include *Artemisia tridentata, Artemisia bigelovii, Krascheninnikovia lanata, Purshia stansburiana (= Purshia mexicana var. stansburiana), Psorothamnus polydenius, Ephedra viridis, Parthenium confertum, Sarcobatus vermiculatus*, and species of *Chrysothamnus* and *Lycium*. Dwarf-shrubs such as *Gutierrezia sarothrae* or *Eriogonum* spp. may be common in some stands. Warm-season, medium-tall and short grasses typically dominate the sparse to moderately dense (1-60% cover) graminoid layer. The species present depend on geographic range of the grasses, alkalinity/salinity and past land use. Species may include *Bouteloua gracilis, Distichlis spicata, Elymus elymoides, Hesperostipa comata, Pleuraphis jamesii (= Hilaria jamesii), Achnatherum hymenoides (= Oryzopsis hymenoides), Pascopyrum smithii, Muhlenbergia porteri, Scleropogon brevifolius, Sporobolus airoides, Sporobolus cryptandrus, Sporobolus flexuosus, Sporobolus nealleyi*, and *Sporobolus wrightii*. Forb cover is generally sparse, but annual forbs such as *Calycoseris parryi* may be abundant in wet years. Common forbs include species of *Sphaeralcea, Dalea, Cymopterus, Chenopodium, Bassia (= Kochia), Iva, Picradeniopsis*, and *Ratibida*. Cacti from the genus *Opuntia* are associated species in some stands. Trees are typically not present, but occasionally scattered *Juniperus* spp. may occur.

ENVIRONMENT & DYNAMICS

Environmental Description: Shrublands included in this alliance occur on lowland and upland sites throughout much of the arid and semi-arid western U.S. with elevations ranging from 75 m below sea level to 2400 m. Lowland sites include alluvial flats, drainage terraces, playas, washes and interdune basins. Upland sites include bluffs and gentle to moderately steep, sandy or rocky slopes. Stands occur on all aspects. Soils are variable with depths ranging from shallow to moderately deep, and textures ranging from sands to loams to clay. The lowland sites may be moderately saline or alkaline. Bare ground usually dominates the ground surface. Francis (1986) described stands in northwestern New Mexico with approximately 80% bare soil and 15% litter.

Dynamics: *Atriplex canescens* is tolerant of saline or alkaline soils, but is not restricted to those soils. Therefore, it is not a reliable indicator of those conditions (USFS 1937). This shrub is considered good forage for deer and many classes of livestock because it is highly nutritious and palatable (USFS 1937).

DISTRIBUTION

Geographic Range: Shrublands included in this alliance occur primarily in arid and semi-arid areas of the southwestern U.S. from west Texas to southern and eastern California and into Chihuahua, Mexico. They also are found in the western Great Plains to the Great Basin, from western Kansas, Colorado, and Wyoming to Utah, Nevada and eastern Oregon.

Nations: MX, US
States/Provinces: AZ, CA, CO, ID, KS, MXCH, NM, NV, OR, TX, UT, WY
TNC Ecoregions [optional]: 6:C, 11:C, 13:C, 15:C, 17:C, 23:C
USFS Ecoregions (2007): 262A:CC, 322Ab:CCC, 322Ai:CCC, 322Aj:CCC, 322Az:CCC, 322B:CC, 322C:CC, 341Fb:CCC, 341Fc:CCC, 341Fe:CCC, 341Ff:CCC, 342B:CC, M262A:CC, M262B:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Joshua Tree, Lake Mead, Mojave); USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- = *Atriplex canescens* (Fourwing saltbush scrub) Alliance (Sawyer et al. 2009) [36.310.00]
- = *Atriplex canescens* Shrubland Alliance (Evens et al. 2014)
- = *Atriplex canescens* Shrubland Alliance (Evens et al. 2012)
- = *Atriplex canescens* Shrubland Alliance (CNPS 2017) [36.310.00]
- >< Desert Saltbush Scrub (#36110) (Holland 1986b)
- = Fourwing saltbush series (Sawyer and Keeler-Wolf 1995)
- >< Interior Coast Range Saltbush Scrub (#36320) (Holland 1986b)
- >< Relictual Interior Dunes (#23200) (Holland 1986b)
- >< Sierra-Tehachapi Saltbush Scrub (#36310) (Holland 1986b)
- >< Valley Saltbush Scrub (#36220) (Holland 1986b)

LOWER LEVEL UNITS

Associations:

- CEGL001283 *Atriplex canescens / Bouteloua gracilis* Shrubland
- CEGL001285 *Atriplex canescens - Krascheninnikovia lanata* Shrubland
- CEGL001286 *Atriplex canescens / Purshia stansburiana* Shrubland
- CEGL001284 *Atriplex canescens / Calycoseris parryi* Shrubland
- CEGL001291 *Atriplex canescens / Sporobolus airoides* Shrubland
- CEGL005385 *Atriplex canescens / Muhlenbergia porteri* Shrubland
- CEGL001289 *Atriplex canescens / Achnatherum hymenoides* Shrubland
- CEGL001288 *Atriplex canescens / Pleuraphis jamesii* Shrubland
- CEGL001281 *Atriplex canescens* Shrubland
- CEGL003828 *Atriplex canescens - Ephedra viridis* Shrubland
- CEGL001282 *Atriplex canescens - Artemisia tridentata* Shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz after Sawyer et al. (2009)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Aldous and Shantz 1924, BIA 1979, BLM 1979a, BLM 1979b, Baker 1984a, Beatley 1976, Beatley 1993, Betancourt and Van Devender 1981, Brown 1982a, Burk 1977, CNPS 2017, Chappell et al. 1997, Culver et al. 1996, Diamond 1993, Dick-Peddie 1993, Donart et al. 1978a, Evens and Hartman 2007, Evens et al. 2012, Evens et al. 2014, Faber-Langendoen et al. 2017b, Francis 1986, Holland 1986b, Howard 2003, Hyder et al. 1966, Johnson 1976, Johnston 1987, Keeler-Wolf and Thomas 2000, Keeler-Wolf et al. 1998a, Klipple and Costello 1960, MacMahon 1988, MacMahon and Wagner 1985, Maxwell 1975, McHargue 1973, Miller et al. 1977, Muldavin and Mehlhop 1992, Muldavin et al. 2000b, Paysen et al. 1980, Peterson 1984a, Peterson 1984b, Price et al. 1981, Roberts et al. 1992, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Shaw et al. 1989, Shute and West 1978, Soil Conservation Service 1978, Soil Conservation Service n.d., Stout et al. 2013, Thomas et al. 2004, USBOR 1976, USFS 1937, Vasek and Barbour 1988, VegCAMP and AIS 2013, Vest 1962a, Warren et al. 1982

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G300. Intermountain Shadscale - Saltbush Scrub

A0870. Atriplex confertifolia Scrub Alliance

Type Concept Sentence: Shrublands occurring across the western U.S. characterized by a sparse to moderately dense shrub layer dominated or codominated by *Atriplex confertifolia* and/or *Picrothamnus desertorum*.

OVERVIEW

Scientific Name: *Atriplex confertifolia* Scrub Alliance
Common Name (Translated Scientific Name): Shadscale Saltbush Scrub Alliance
Colloquial Name: Shadscale Saltbush Scrub

Type Concept: This shrubland alliance occurs across the western U.S. from the eastern Mojave Desert and Great Basin east to the western Great Plains and north to Montana. The vegetation included in this alliance is characterized by a sparse to moderately dense shrub layer dominated or codominated by *Atriplex confertifolia* and/or *Picrothamnus desertorum*. Shrub associates may include *Atriplex polycarpa, Ephedra nevadensis, Chrysothamnus* spp., *Krascheninnikovia lanata, Lycium* spp., *Sarcobatus vermiculatus*, and *Tetradymia* spp. The usually sparse herbaceous layer is dominated by graminoids such as *Elymus elymoides,*

Pleuraphis jamesii (= Hilaria jamesii), Pleuraphis rigida (= Hilaria rigida), Leymus salinus, Achnatherum hymenoides (= Oryzopsis hymenoides), Pseudoroegneria spicata, Hesperostipa spp., and other perennial bunchgrasses. These shrublands are usually associated with margins of large playas, valley bottoms or alluvial slopes with medium- to fine-textured soils but may occur on coarser soils of erosional slopes with calcareous substrates. In most cases, the soils are alkaline and may have substantial salt accumulation.

Classification Comments: One of the associations in this alliance, *Picrothamnus desertorum* Shrubland (CEGL001452), is very poorly documented. There is only one reference source presently known for this association, Montana Natural Heritage Program, Data on File (n.d.). The Montana Heritage Program ecologist was consulted and could find no data for this association in the files. The alliance is also reported from Oregon, as described above, but further data collection and inventory efforts are needed to confirm this alliance and its characteristics as described here.

Some associations currently placed in this alliance are likely to be sparsely vegetated and would be better placed into the sparse vegetation class.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Nearly sparse to moderately dense stands of short shrubs dominated by *Atriplex confertifolia* or codominated by *Picrothamnus desertorum*. Due to the wide geographic range of this alliance, associated species composition is highly variable.

VEGETATION

Physiognomy and Structure: These are broad-leaved deciduous shrublands of somewhat sparse to moderate cover (15-60%). The deciduous character is as much drought-related as cold-related. The interstices between the shrubs may be very sparsely vegetated (<10% cover) in low desert or highly alkaline habitats or moderately vegetated (20-40%) with cespitose graminoids and forbs. In addition, these communities often harbor an ephemeral ground layer of short-lived annual forbs and graminoids which vary in abundance with local precipitation.

Floristics: *Atriplex confertifolia* and/or *Picrothamnus desertorum (= Artemisia spinescens)* are the dominant shrubs. Other codominant or associate shrub species may include *Atriplex canescens, Atriplex polycarpa, Ephedra nevadensis, Ericameria nauseosa (= Chrysothamnus nauseosus), Grayia spinosa, Krascheninnikovia lanata, Lycium* sp., *Tetradymia glabrata*, and *Tetradymia axillaris*. There is typically a depauperate understory of perennial bunchgrasses, including *Achnatherum hymenoides (= Oryzopsis hymenoides), Elymus elymoides, Hesperostipa* spp., *Pleuraphis jamesii (= Hilaria jamesii), Pleuraphis rigida (= Hilaria rigida), Pseudoroegneria spicata*, and *Psorothamnus polydenius*. *Yucca brevifolia* may form a scattered emergent tree layer in these stands.

ENVIRONMENT & DYNAMICS

Environmental Description: Extensive stands of the vegetation types in this alliance occur in the transition between the Mojave and Great Basin deserts of North America. Outlying stands also occur northward and eastward in valley bottom sites that have substantial salt accumulation. This alliance occurs at middle elevations (1000-1950 m [3300-6400 feet]) with annual precipitation averaging 10-25 cm. These shrublands are usually associated with margins of large playas, valley bottoms or alluvial slopes with medium- to fine-textured soils but may occur on coarser soils of erosional slopes with calcareous substrates. In most cases, the soils are alkaline (pH 7.5-8.5).

Dynamics: Many of the plant species commonly present in stands of this alliance grow from late winter to late spring or early summer, when soil moisture becomes depleted. *Atriplex confertifolia* shrubs often develop large leaves in the spring which increase the rate of photosynthesis. As soil moisture decreases, the leaves are lost, and the plant takes on a dead appearance. During late fall, very small overwintering leaves appear which provide some photosynthetic capability through the remainder of the year. The species is valued as winter range for native herbivores and livestock. During winter or drought periods, minor defoliation from herbivory may actually increase drought tolerance by lowering leaf area and transpiration losses.

DISTRIBUTION

Geographic Range: The plant associations in this alliance occur throughout the eastern Mojave and Great Basin deserts, northward to southern Idaho, north-central Wyoming, and south-central Montana. Stands have also been reported from the Colorado Plateau of western Colorado, Arizona, New Mexico and Utah.

Nations: US
States/Provinces: AZ, CA, CO, ID, MT, NM, NV, OR, UT, WY
TNC Ecoregions [optional]: 6:C, 11:C, 12:C, 13:C, 15:C, 17:C

USFS Ecoregions (2007): 262A:CC, 322Ab:CCC, 322Ad:CCC, 322Ae:CCC, 322Az:CCC, 341D:CC, 341Fa:CCC, 341Fb:CCC, 341Fc:CCC, 341Fd:CCC, 341Fe:CCC, 341Ff:CCC, 341Fg:CCC, 342B:CC, M261E:CC, M262A:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Lake Mead)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** *Atriplex confertifolia* (Shadscale scrub) Alliance (Sawyer et al. 2009) [36.320.00]
- **=** *Atriplex confertifolia* Shrubland Alliance (Evens et al. 2014)
- **=** *Atriplex confertifolia* Shrubland Alliance (CNPS 2017) [36.320.00]
- **<** Shadscale Scrub (#36140) (Holland 1986b)
- **=** Shadscale series (Sawyer and Keeler-Wolf 1995)

LOWER LEVEL UNITS

Associations:

- CEGL001294 *Atriplex confertifolia* Great Basin Shrubland
- CEPP005797 *Atriplex confertifolia - Suaeda moquinii* Shrubland
- CEGL001313 *Atriplex confertifolia - Sarcobatus vermiculatus* Shrubland
- CEGL001299 *Atriplex confertifolia - Atriplex polycarpa* Shrubland
- CEGL001309 *Atriplex confertifolia - Lycium pallidum / Mirabilis pudica* Shrubland
- CEGL001310 *Atriplex confertifolia - Lycium shockleyi* Shrubland
- CEGL001302 *Atriplex confertifolia / Elymus elymoides* Shrubland
- CEGL001311 *Atriplex confertifolia / Achnatherum hymenoides* Shrubland
- CEGL001307 *Atriplex confertifolia / Leymus salinus* Shrubland
- CEGL001297 *Atriplex confertifolia - Picrothamnus desertorum / Achnatherum hymenoides* Shrubland
- CEGL001301 *Atriplex confertifolia - Krascheninnikovia lanata* Shrubland
- CEGL001314 *Atriplex confertifolia / Hesperostipa comata* Shrubland
- CEGL001296 *Atriplex confertifolia - Picrothamnus desertorum / Krascheninnikovia lanata* Shrubland
- CEGL001306 *Atriplex confertifolia / Leymus salinus ssp. salmonis* Shrubland
- CEGL001300 *Atriplex confertifolia / Ericameria nauseosa* Shrubland
- CEGL001452 *Picrothamnus desertorum* Shrubland
- CEGL001312 *Atriplex confertifolia / Pseudoroegneria spicata* Shrubland
- CEGL001315 *Atriplex confertifolia / Tetradymia glabrata* Shrubland
- CEGL001295 *Atriplex confertifolia - Picrothamnus desertorum* Shrubland
- CEGL001305 *Atriplex confertifolia / Bassia americana* Shrubland
- CEGL001298 *Atriplex confertifolia - Picrothamnus desertorum / Sarcobatus vermiculatus* Shrubland
- CEGL001308 *Atriplex confertifolia - Lycium andersonii* Shrubland
- CEGL001304 *Atriplex confertifolia / Pleuraphis jamesii* Shrubland
- CEGL002992 *Picrothamnus desertorum / Elymus elymoides* Shrubland
- CEGL003762 *Atriplex confertifolia / Sporobolus cryptandrus* Shrubland
- CEGL003830 *Atriplex confertifolia* Sparse Shrubland
- CEPP005685 *Atriplex confertifolia - (Acamptopappus sphaerocephalus, Picrothamnus desertorum) / (Pleuraphis jamesii)* Scrub
- CEPP005795 *Atriplex confertifolia - Atriplex canescens* Shrubland
- CEGL005739 *Atriplex confertifolia - Ambrosia dumosa* Shrubland
- CEPP005796 *Atriplex confertifolia - Lepidium fremontii* Shrubland
- CEGL001293 *Atriplex confertifolia* Wyoming Basins Shrubland
- CEGL001303 *Atriplex confertifolia - Ephedra nevadensis* Shrubland

AUTHORSHIP

Primary Concept Source: D. Sarr, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Annable 1985, BLM 1979a, Baker 1982b, Baker 1983b, Baker 1983c, Baker and Kennedy 1985, Barbour and Major 1977, Beatley 1975, Beatley 1976, Billings 1949, Blackburn et al. 1968a, Blackburn et al. 1969b, Blackburn et al. 1969d, Bradley 1964, Branson and Owen 1970, Branson et al. 1976, Brotherson and Brotherson 1979, Burk 1977, CNPS 2017, Caicco and Wellner 1983c, Caicco and Wellner 1983g, Campbell 1977, Charlton 2000a, Dastrup 1963, Empire Engineering and Land Surveying 1986, Evens et al.

2014, Faber-Langendoen et al. 2017b, Faden 1977, Fautin 1946, Fenemore 1970, Graham 1937, Harper and Jaynes 1986, Holland 1986b, Ibrahim et al. 1972, Keammerer 1974b, Keammerer 1977, Keeler-Wolf and Thomas 2000, Leary and Peterson 1984, Lesica and DeVelice 1992, Lusby et al. 1963, MTNHP unpubl. data, MacMahon 1988, MacMahon and Wagner 1985, McHargue 1973, Miller et al. 1977, ORNHP unpubl. data, Paysen et al. 1980, Peterson 1984a, Potter et al. 1985, Rickard and Beatley 1965, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Schramm 1982, Simonin 2001a, Singh and West 1971, Soil Conservation Service 1978, Thomas et al. 2004, Thorne 1982, Tuhy and MacMahon 1988, Turner 1982b, USBOR 1976, Vasek and Barbour 1988, VegCAMP and AIS 2013, Vest 1962b, Ward et al. 1974, Warren et al. 1982, West 1983b, West and Ibrahim 1968, Young et al. 1977, Young et al. 1986

3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G300. Intermountain Shadscale - Saltbush Scrub

A3180. Atriplex obovata - Atriplex cuneata Scrub Alliance

Type Concept Sentence: This alliance occurs in the northern Chihuahuan Desert and Colorado Plateau from western Texas, south-central and northwestern New Mexico, and northeastern Arizona and is dominated or codominated by *Atriplex obovata*.

OVERVIEW

Scientific Name: *Atriplex obovata - Atriplex cuneata* Scrub Alliance
Common Name (Translated Scientific Name): Mound Saltbush - Valley Saltbush Scrub Alliance
Colloquial Name: Mound Saltbush - Valley Saltbush Scrub

Type Concept: This alliance occurs in the northern Chihuahuan Desert and Colorado Plateau from western Texas, south-central and northwestern New Mexico, and northeastern Arizona. The vegetation is characterized by a sparse to moderately dense dwarf-shrub layer that is dominated or codominated by *Atriplex obovata*. Some occurrences may have a dense understory of perennial grasses. Shrub associates may include scattered *Atriplex confertifolia, Ericameria nauseosa, Isocoma drummondii, Gutierrezia sarothrae, Prosopis glandulosa var. torreyana, Opuntia* spp., or *Suaeda* spp. The herbaceous layer ranges from moderately dense to absent, and is usually dominated by perennial grasses such as *Sporobolus airoides* and *Pleuraphis jamesii*. Other associated species may include *Achnatherum hymenoides, Bouteloua gracilis, Elymus elymoides*, and *Sporobolus cryptandrus*. Stands are known from mesas, plains, floodplains, valley bottoms, alluvial flats, lower to upper hillslopes, often in a "badlands" landscape. Soils are generally shallow, poorly developed, and alkaline.

Classification Comments: This alliance includes associations which are considered shrub-dominated, as well as one that is considered shrub-herbaceous which was previous attributed to former *Sporobolus airoides - (Pleuraphis jamesii)* Shrub Herbaceous Alliance (A.1532).

This alliance often occurs in "badlands" landscapes adjacent to barren and sparsely vegetated areas and may include vegetation that may be too sparse to be classified as a dwarf-shrubland. Further study is needed throughout its range, especially to assess the effects of livestock grazing on vegetation structure.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Shrub and shrub-herbaceous scrub vegetation where *Atriplex obovata* is the principal shrub with cover of 10-60%. *Pleuraphis jamesii* and *Sporobolus airoides* typically form an open to dense herbaceous layer.

VEGETATION

Physiognomy and Structure: Vegetation in this alliance is dominated by sparse to moderate cover of facultatively deciduous dwarf-shrubs with a sparse to dense perennial graminoid layer.

Floristics: The vegetation is characterized by a sparse to locally moderately dense dwarf-shrub layer (10-60% cover) that is dominated or codominated by *Atriplex obovata* (3-40% cover). Shrub associates may include scattered *Atriplex confertifolia, Atriplex canescens, Artemisia bigelovii, Ericameria nauseosa, Gutierrezia sarothrae, Isocoma drummondii, Opuntia* spp., *Prosopis glandulosa var. torreyana*, or *Suaeda* spp. The herbaceous layer ranges from moderately dense to absent (0-50% cover) and is usually dominated by perennial grasses such as *Sporobolus airoides* and *Pleuraphis jamesii*. Other associated species may include *Achnatherum hymenoides, Bouteloua gracilis, Elymus elymoides*, and *Muhlenbergia torreyi*. Forb cover is sparse and typically includes *Astragalus* spp. and *Sphaeralcea coccinea*.

ENVIRONMENT & DYNAMICS

Environmental Description: Elevation ranges from 1500-1850 m. Stands are known from mesas, plains, floodplains, valley bottoms, alluvial flats, lower to upper hillslopes, often in a "badlands" landscape. Soils are generally shallow, poorly developed, and alkaline. Textures range from fine sandy loam to silty clay loam and clay (Henrickson 1974, Francis 1986, TNC 1997b) which are often saline or gypseous. Parent materials include alluvium and colluvium derived from igneous or sedimentary materials such as basalt, shale, and clay. There is high cover of bare soil. Typically, areas have been severely degraded by erosion.

Dynamics: Grazing has significantly impacted much of the vegetation in the Rio Puerco basin of northwestern New Mexico, which has had a long history of settlement and heavy livestock use. With proper livestock management and time, palatable species such as *Sporobolus airoides* may increase and *Opuntia* spp. may decline (Francis 1986).

DISTRIBUTION

Geographic Range: Communities in this alliance are described from the southeastern part of the Colorado Plateau in the upper Rio Puerco watershed in northwestern New Mexico and Arizona; the Trans-Pecos region in Brewster County, western Texas; and in south-central New Mexico. The alliance probably also occurs in Utah and Chihuahua and Coahuila, Mexico.

Nations: MX?, US
States/Provinces: AZ, MXCH?, MXCO?, NM, TX, UT?
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL001789 *Atriplex obovata* Talus Dwarf-shrubland
- CEGL001316 *Atriplex cuneata - Frankenia jamesii / Sporobolus airoides* Shrubland
- CEGL001775 *Atriplex obovata / Sporobolus airoides - Pleuraphis jamesii* Shrub Grassland
- CEGL002928 *Atriplex obovata* Badland Sparse Vegetation
- CEGL001447 *Atriplex obovata / Sporobolus airoides - Sporobolus cryptandrus* Dwarf-shrubland

AUTHORSHIP

Primary Concept Source: M. Hall, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Faber-Langendoen et al. 2017b, Francis 1986, Henrickson 1974, Reid et al. 1994, TNC 1997b, Thomas et al. 2003b, Welsh et al. 1987, West et al. 1972

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G300. Intermountain Shadscale - Saltbush Scrub

A3174. Atriplex polycarpa Scrub Alliance

Type Concept Sentence: Shrublands in this alliance occur in desert valleys, basins, playas, bajadas, foothills and plains characterized by a sparse to moderately dense shrub layer dominated or codominated by *Atriplex polycarpa*.

OVERVIEW

Scientific Name: *Atriplex polycarpa* Scrub Alliance
Common Name (Translated Scientific Name): Cattle Saltbush Scrub Alliance
Colloquial Name: Cattle Saltbush Scrub

Type Concept: Shrublands in this alliance occur in desert valleys, basins, playas, bajadas, foothills and plains in southern New Mexico, Nevada and southern California. The vegetation included in this alliance is characterized by a sparse to moderately dense shrub layer dominated or codominated by *Atriplex polycarpa*. Shrub associates may include *Larrea tridentata, Ambrosia dumosa,*

Eriogonum fasciculatum, Hymenoclea salsola, Atriplex canescens, Atriplex confertifolia, Gutierrezia sarothrae, and *Suaeda moquinii*. Perennial graminoids are present to abundant in some habitats and may include *Distichlis spicata, Pleuraphis mutica (= Hilaria mutica)*, and *Sporobolus* spp. Sites are generally flat to gently sloping and moderately saline, but the alliance also occurs on rolling to hilly fans and slopes.

Classification Comments: This alliance has been segregated from the previously defined *Atriplex lentiformis-A. polycarpa* alliance (Sawyer and Keeler-Wolf 1995). Based on plot data collected over the past 10 years, both of these species apparently segregate and form their own alliances with frequently different environmental and species characteristics.

Brown (1982a) describes stands in the Saltbush Series that are dominated by *Atriplex polycarpa*. No *Atriplex polycarpa* associations have yet been described in Arizona by ecologists. The stands described by Peterson (1984a) are too sparse to be classified as shrublands. Little other quantitative data were available.

Whitfield and Anderson (1938) describe *Atriplex polycarpa*-dominated stands in the Chihuahuan Desert where other characteristic shrubs include *Atriplex canescens, Atriplex confertifolia, Ambrosia dumosa, Larrea tridentata, Gutierrezia sarothrae*, the phreatophyte *Suaeda moquinii*, and perennial grasses such as *Sporobolus airoides, Pleuraphis mutica, Sporobolus cryptandrus*, and *Muhlenbergia porteri*. The perennial grass cover is possible because of the late summer rains. In the Mojave Desert, grass cover is sparse. In Death Valley (Peterson 1984a) described stands with 10% aerial cover of *Atriplex polycarpa* and 1% or less of *Ambrosia dumosa, Larrea tridentata*, and *Hymenoclea salsola*. Total shrubs cover was 13%. In addition to *Atriplex polycarpa*, stands in the California Central Valley include a variety of dune, playa or uplands species such as *Distichlis spicata, Ephedra californica, Eriogonum fasciculatum, Hymenoclea salsola, Cleome isomeris (= Isomeris arborea), Isocoma acradenia*, and *Prosopis glandulosa* (Sawyer and Keeler-Wolf 1995).

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: *Atriplex polycarpa* >2% absolute cover in the shrub canopy; >50% relative cover in the shrub canopy (Keeler-Wolf et al. 1998, Thomas et al. 2004).

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a sparse to moderately dense woody layer dominated by facultative deciduous and microphyllous evergreen shrubs. The usually sparse herbaceous layer has a few perennial species of grasses and forbs with sometimes abundant cover of seasonally present annual grasses and forbs.

Floristics: The vegetation has a sparse to moderately dense woody layer usually less than 1 m tall, but occasionally over 2 m tall in mixed-shrub stands. *Atriplex polycarpa*, a facultative deciduous xeromorphic shrub, is the dominant species and may occur in nearly pure stands. Other characteristic shrubs may include *Larrea tridentata, Ambrosia dumosa*, and *Hymenoclea salsola*. Perennial graminoids such as *Distichlis spicata, Pleuraphis mutica (= Hilaria mutica)*, and *Sporobolus* spp. may be present and abundant in some habitats. Exotic annual grasses may dominate the understory in stands in California. Secondary species vary widely depending on site characteristics and geographic location.

ENVIRONMENT & DYNAMICS

Environmental Description: Shrublands in this alliance occur in desert valleys, basins, playas, bajadas, foothills and plains in southern New Mexico, Nevada and southern California. Climate is arid to semi-arid with hot summers. Sites are generally flat to gently sloping and moderately saline, but the alliance also occurs on rolling to hilly fans and slopes. Other characteristics vary by site and region. In the Chihuahuan Desert (1200-1500 m elevation), annual precipitation has a bimodal distribution with about half the precipitation occurring during the late summer months. Sites occur on lower foothills and plains. Soils are fine-textured, alkaline and typically saline.

Dynamics: *Atriplex polycarpa* is a facultative phreatophyte and occurs on moderately saline soil (<2%) just above the water table or xeric non-saline upland sites (Barbour and Major 1977). It has limited salt tolerance and is very drought-tolerant (Barbour and Major 1977). These two factors interact to control water stress in plants and define habitat boundaries.

DISTRIBUTION

Geographic Range: This alliance includes shrublands from valleys and basins in the Chihuahuan, Mojave and Sonoran deserts, and in the southern part of the Great Central Valley of California.

Nations: US
States/Provinces: CA, NM, NV
TNC Ecoregions [optional]: 11:C, 17:C

USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Lake Mead, Mojave)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- = *Atriplex polycarpa* (Allscale scrub) Alliance (Sawyer et al. 2009) [36.340.00]
- = *Atriplex polycarpa* Alliance (Allscale scrub) (Buck-Diaz et al. 2012)
- = *Atriplex polycarpa* Shrubland Alliance (Evens et al. 2014)

LOWER LEVEL UNITS

Associations:

- CEGL001319 *Atriplex polycarpa / Pleuraphis mutica* Shrubland
- CEGL001318 *Atriplex polycarpa* Shrubland

AUTHORSHIP

Primary Concept Source: M.E. Hall, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Barbour and Major 1977, Beatley 1976, Brown 1982a, Buck-Diaz et al. 2012, Evens et al. 2014, Faber-Langendoen et al. 2017b, Faden 1977, Holland 1986b, Keeler-Wolf and Thomas 2000, Keeler-Wolf et al. 1998a, Peterson 1984a, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Stout et al. 2013, Thomas et al. 2004, VegCAMP and AIS 2013, Whitfield and Anderson 1938

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G300. Intermountain Shadscale - Saltbush Scrub

A3171. Grayia spinosa Scrub Alliance

Type Concept Sentence: This alliance occurs in the Great Basin and the eastern Mojave Desert, and is characterized by a sparse to moderately dense shrub layer of *Grayia spinosa*. Other shrubs are species of Mojavean or Great Basin affinities.

OVERVIEW

Scientific Name: *Grayia spinosa* Scrub Alliance
Common Name (Translated Scientific Name): Spiny Hopsage Scrub Alliance
Colloquial Name: Spiny Hopsage Scrub

Type Concept: Vegetation in this alliance occurs throughout the lower to middle elevations (600-1600 m) of the Great Basin and the eastern Mojave Desert. The vegetation is more drought-tolerant than *Artemisia tridentata*-dominated communities and typically occurs where local climate or salty soils create high moisture stress. This alliance is characterized by a sparse to moderately dense shrub layer of *Grayia spinosa*. Shrub associates include *Artemisia nova, Artemisia tridentata, Atriplex confertifolia, Atriplex canescens, Chrysothamnus* spp., *Coleogyne ramosissima, Ephedra nevadensis, Ephedra viridis, Larrea tridentata, Picrothamnus desertorum (= Artemisia spinescens)*, and *Prunus andersonii*. The herbaceous layer is typically sparse with *Achnatherum hymenoides (= Oryzopsis hymenoides), Achnatherum speciosum (= Stipa speciosa), Elymus elymoides, Navarretia* spp., *Pleuraphis jamesii (= Hilaria jamesii)*, and *Poa secunda* being common associates. Stands usually occur on mountain slopes or alluvial fans bordering intermountain basins. Soils are highly variable, but are generally coarse-textured and well-drained, and often alkaline.

Classification Comments: During the ecological group revision, all *Grayia spinosa* associations were placed across several groups. The associations within this alliance had been split across Intermountain Shadscale - Saltbush Scrub Group (G300) and Mojave Mid-Elevation Mixed Desert Scrub Group (G296). They have been combined within G300 and this alliance as they appear to represent inclusions within the greater matrix-forming communities of the shadscale - saltbush communities.

Currently there are no associations placed in this alliance from California. Sawyer and Keeler-Wolf (1995) do report a Hopsage Series that is included as part of this alliance. Further classification and inventory work are needed to develop the association-level classification of this alliance.

Internal Comments: KAS 11-16: CEGL001349 *Grayia spinosa - Menodora spinescens* Shrubland Association was moved from A3171 *Grayia spinosa* Scrub Alliance to A2515 *Menodora spinescens* Scrub Alliance because *Menodora spinescens* is considered to be more

diagnostic than the ubiquitous *Grayia spinosa* and reference citation for CEGL001349 is from the Grapevine Mountains in Death Valley NP.

Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Vegetation in this alliance can be differentiated from other alliances by the strong dominance of *Grayia spinosa* in the shrub layer, and its broad distribution in non-wetland locations.

VEGETATION

Physiognomy and Structure: These communities are characterized by somewhat low to moderate cover (15-40%) of cold-deciduous or evergreen shrubs. The herbaceous layer is typically sparse (<20% cover) and dominated by cespitose perennial grasses or annual forbs and grasses. Scattered trees may form a sparse (0-10%) emergent layer in some stands, especially at the upper elevation margin and in the southwestern part of the range.

Floristics: Species found in southern stands include *Atriplex canescens, Atriplex confertifolia, Coleogyne ramosissima, Ephedra nevadensis, Larrea tridentata*, and *Picrothamnus desertorum (= Artemisia spinescens)*. Occasionally, scattered individuals of *Yucca brevifolia* may be emergent through the shrub layer. The herbaceous layer in these xeric southern stands is typically sparse with *Achnatherum hymenoides (= Oryzopsis hymenoides), Achnatherum speciosum (= Stipa speciosa), Eriogonum* spp., *Navarretia* spp., and *Pleuraphis jamesii (= Hilaria jamesii)* being common associates. Northward, and at higher elevations, the Mojavean element drops out and common shrub associates include *Artemisia nova, Artemisia tridentata, Chrysothamnus* spp., *Ephedra viridis*, and *Prunus andersonii*. Herbaceous associates include *Elymus elymoides, Festuca* spp., and *Poa secunda*.

ENVIRONMENT & DYNAMICS

Environmental Description: Vegetation in this alliance occurs throughout the lower to middle elevations (600-1600 m) of the Great Basin and the eastern Mojave Desert, usually on mountain slopes or alluvial fans bordering intermountain basins. The climate is arid to semi-arid with precipitation ranging from 15-30 cm annually. Winter precipitation dominates in the western area, with summer rain becoming more important eastward. Temperatures are continental, with large annual and diurnal ranges. Soils are highly variable, but are generally coarse-textured and well-drained, and often alkaline.

Dynamics: *Grayia spinosa* shrubs concentrate chemical elements in their leaves and fruits, and soils beneath the shrubs often show high levels of magnesium and potassium. Seeds remain viable for long periods (4 years or more) before germination (Mozingo 1987). Due to its wide geographic range, the species may demonstrate considerable ecotypic variation. For example, seeds from Mojave Desert individuals can germinate at 40°C, but seeds from Great Basin plants can not germinate at that high temperature (Mozingo 1987).

DISTRIBUTION

Geographic Range: This alliance occurs throughout the Great Basin, Columbia Plateau, and eastern Mojave regions of Colorado, Utah, Nevada, Oregon, Washington, and eastern California. It is most extensive in the southwestern portion of the Great Basin.

Nations: US
States/Provinces: CA, CO, NV, OR, UT, WA
TNC Ecoregions [optional]: 4:C, 6:C, 11:C, 12:C, 17:C
USFS Ecoregions (2007): 322Ad:CCC, 322Af:CCC, 322Aj:CCC, 322Al:CCC, 341D:CC, 341Fa:CCC, 341Fb:CCC, 341Fc:CCC, 341Fe:CCC, 341Ff:CCC, 341Fg:CCC, 342B:CC, M261E:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Joshua Tree, Mojave)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** *Grayia spinosa* (Spiny hop sage scrub) Alliance (Sawyer et al. 2009) [33.180.00]
- **=** *Grayia spinosa* Shrubland Alliance (Evens et al. 2014)
- **=** *Grayia spinosa* Shrubland Alliance (Evens et al. 2012)
- **=** *Grayia spinosa* Shrubland Alliance (CNPS 2017) [33.180.00]
- **=** Hop-sage series (Sawyer and Keeler-Wolf 1995)
- **<** Shadscale Scrub (#36140) (Holland 1986b)

LOWER LEVEL UNITS

Associations:

- CEGL002681 *Grayia spinosa / Achnatherum thurberianum* Shrubland
- CEGL001345 *Grayia spinosa / Picrothamnus desertorum* Shrubland
- CEGL001350 *Grayia spinosa / Achnatherum hymenoides* Shrubland
- CEGL001352 *Grayia spinosa - Prunus andersonii* Shrubland
- CEGL001351 *Grayia spinosa / Poa secunda* Shrubland
- CEGL002358 *Grayia spinosa* Shrubland
- CEGL001344 *Grayia spinosa / Artemisia nova / Achnatherum speciosum* Shrubland

AUTHORSHIP

Primary Concept Source: M.S. Reid, D. Sarr, G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2016/11/11

REFERENCES

References: Beatley 1975, Blackburn et al. 1968a, Blackburn et al. 1968c, Blackburn et al. 1969d, Blaisdell and Holmgren 1984, CNPS 2017, Daubenmire 1970, Evens et al. 2012, Evens et al. 2014, Faber-Langendoen et al. 2017b, Holland 1986b, Keeler-Wolf 2007, Keeler-Wolf and Thomas 2000, Kurzius 1981, Mozingo 1987, Paysen et al. 1980, Peterson 1984a, Ralston 1969, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Shaw et al. 2002, Shiflet 1994, Thomas et al. 2004, Thorne 1976, Thorne 1982, VegCAMP and AIS 2013, Webb et al. 1987, Young et al. 1977, Young et al. 2007b

M118. Intermountain Basins Cliff, Scree & Badland Sparse Vegetation

This sparsely vegetated macrogroup occurs in a variety of landscapes and a variety of exposed rock and badland substrates the interior western U.S. from the Columbia Plateau south to the Great Basin and Colorado Plateau, and east into Wyoming basins. Characteristic species are variable depending on substrate and other environmental condition and most of the species also occur in non-sparse vegetation macrogroups, although some of the sites with harsh soil properties may have of endemic species.

3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
3.B.1.Ne.6.a. M118 Intermountain Basins Cliff, Scree & Badland Sparse Vegetation

G570. Intermountain Basins Cliff, Scree & Badland Sparse Vegetation

Type Concept Sentence: This group consists of barren and sparsely vegetated cliffs, scree slopes, badlands and other similar harsh habitats from low to high elevations, with a wide variety of trees or shrubs, such as species of *Artemisia, Atriplex, Cercocarpus, Eriogonum, Fallugia, Grayia, Juniperus, Pinus, Purshia*, and others, distributed throughout the interior western U.S.

OVERVIEW

Scientific Name: *Atriplex* spp. - *Cercocarpus* spp. - *Ephedra* spp. Intermountain Basins Sparse Vegetation Group
Common Name (Translated Scientific Name): Saltbush species - Mountain-mahogany species - Joint-fir species Intermountain Basins Sparse Vegetation Group
Colloquial Name: Intermountain Shale Badlands Cold Desert Sparse Vegetation

Type Concept: This group consists of barren and sparsely vegetated cliffs, scree slopes, badlands and other similar areas from a variety of landscapes in the interior western U.S. from eastern Washington and Oregon, the Columbia Plateau south to the Great Basin and Colorado Plateau, east into Wyoming basins and plains. Characteristic shrub species in lower elevation semi-desert, lava field, and badland areas include *Artemisia pedatifida, Artemisia tridentata, Atriplex canescens, Atriplex confertifolia, Atriplex corrugata, Atriplex gardneri, Ephedra* spp., *Eriogonum corymbosum, Eriogonum heermannii, Eriogonum ovalifolium, Fallugia paradoxa, Grayia spinosa, Purshia tridentata, Salvia dorrii*, and *Sarcobatus vermiculatus*. Characteristic herbs include species of *Achnatherum, Camissonia, Cleome, Eriogonum*, and *Mentzelia*. Foothill sites include *Pinus edulis* and *Pinus ponderosa* (Colorado Plateau), *Pinus monophylla, Pinus longaeva* (Great Basin), *Juniperus osteosperma, Cercocarpus intricatus*, and *Cercocarpus ledifolius*. At montane and subalpine elevations, scattered trees may be present, such as *Abies concolor, Picea engelmannii, Pinus flexilis, Pinus ponderosa*, and *Pseudotsuga menziesii*. Shrubs may include *Arctostaphylos patula, Artemisia tridentata, Cercocarpus ledifolius, Ephedra* spp., *Holodiscus* spp., *Ivesia* sp., and *Purshia tridentata*. Landforms include cliffs and canyon sides, mesas and plateaus, and mountains. Sparse vegetation also occurs on special substrates such as shale outcrops, badlands and volcanic deposits such as lava, cinder, ash, tuff and basalt dikes. Rock substrates include bedrock, slickrock, and unstable talus and scree slopes. Some substrates, such as marine shales, are strongly alkaline and/or saline which chemically limits plant growth. Active substrates such as scree slopes are difficult sites for plants to grow. Physical properties of substrates may also limit plant growth. Some massive rock substrates lack cracks where vascular plants can root. Badland sites often have heavy clay soils that reduce water infiltration increasing erosion rates and reducing soil moisture for plants. Vegetation is variable depending on environmental variables of the sites, which range

from relatively low-elevation semi-desert to subalpine cliffs and rock outcrops. Lower elevation sites often have herbaceous or shrub species present, whereas foothill, montane and subalpine sites may also include trees. Most of the species also occur in non-sparse vegetation groups. However, some of the sites with harsh soil properties have a high number of endemic perennial species.

Classification Comments: This group is very diverse floristically and so it is difficult to determine indicator species. More diagnostic is the sparse cover of vascular plants and/or presence and sometimes dominance of nonvascular (lichen) species. This broadly defined lithomorphic group was developed by NatureServe. M. Reid (9-13): I am removing dune communities from this group; they are now placed in Intermountain Sparsely Vegetated Dune Scrub & Grassland Group (G775). We need to revisit and get clear on criteria for differentiating this group from other vegetated groups. Generally this group is conceived of as sparsely vegetated associations occurring on rocky or badland substrates.

Similar NVC Types:
- G569 North American Warm Semi-Desert Cliff, Scree & Pavement Sparse Vegetation
- G567 Great Plains Cliff, Scree & Rock Vegetation
- G565 Rocky Mountain Cliff, Scree & Rock Vegetation

Diagnostic Characteristics: Diagnostic characteristics of this lithomorphic group are barren to sparsely vegetation substrates and its geographic location, which is the intermountain western U.S. However, it is often composed of a mix of woody vegetation, especially shrubs and herbs (particularly cushion plants), although either may be absent on a given site.

VEGETATION

Physiognomy and Structure: This lithomorphic group may be composed of woody plants, including both trees and shrubs, herbaceous plants, and/or nonvascular plants. Shrubs are especially common and were chosen as indicator species, however, herbs, especially cushion plants, and nonvasculars such as mosses or lichens may be more common.

Floristics: This group consists of sparsely vegetated substrates which are variable depending on environmental factors of the sites. Sites range from relatively low-elevation semi-desert to subalpine cliffs and rock outcrops. Lower elevation sites often have herbaceous or shrub species present, whereas foothill, montane and subalpine sites may also include trees. Most of the species also occur in non-sparse vegetation groups. However, some of the sites with harsh soil properties have a high number of endemic perennial species (Welsh 1979, Welsh and Chatterly 1985). Characteristic shrub species in lower elevation semi-desert, lava field, and badland areas include *Artemisia pedatifida, Artemisia tridentata, Atriplex canescens, Atriplex confertifolia, Atriplex corrugata, Atriplex gardneri, Ephedra* spp., *Eriogonum corymbosum, Eriogonum heermannii, Eriogonum ovalifolium, Fallugia paradoxa, Grayia spinosa, Purshia tridentata, Salvia dorrii*, and *Sarcobatus vermiculatus*. Characteristic herbs include species of *Achnatherum, Camissonia, Cleome, Eriogonum*, and *Mentzelia*. Foothill sites include *Pinus edulis* and *Pinus ponderosa* (Colorado Plateau), *Pinus monophylla, Pinus longaeva* (Great Basin), *Juniperus osteosperma, Cercocarpus intricatus, Cercocarpus ledifolius*, and *Ephedra* spp. At montane and subalpine elevations, scattered trees may be present, such as *Pinus ponderosa, Pinus flexilis, Abies concolor, Pseudotsuga menziesii*, and *Picea engelmannii*. Shrubs may include *Arctostaphylos patula, Artemisia tridentata, Cercocarpus ledifolius, Ephedra* spp., *Holodiscus* spp., and *Purshia tridentata*.

ENVIRONMENT & DYNAMICS

Environmental Description: This group consists of barren and sparsely vegetated substrates from a variety of landscapes in the interior western U.S. from the Columbia Plateau south to the Great Basin and Colorado Plateau, east into Wyoming basins and plains. Landforms include cliffs and canyon sides, mesas and plateaus, and mountains. Sparse vegetation also occurs on special substrates such as shale outcrops, active sand dunes, badlands and volcanic deposits such as lava, cinder, ash, tuff and basalt dikes. Rock substrates include bedrock and unstable talus and scree slopes. Some substrates, such as marine shales, are strongly alkaline and/or saline which chemically limits plant growth. Active substrates such as scree slopes are difficult sites for plants to grow. Physical properties of substrates may also limit plant growth. Some massive rock substrates lack cracks where vascular plants can root. Badland sites often have heavy clay soils that reduce water infiltration increasing erosion rates and reducing soil moisture for plants.

Dynamics: Following wildfire, various associations which are typically woodland and shrubland will have transitional stages that are sparsely vegetated. *Populus tremuloides* will slowly re-colonize steep, unstable talus and scree slopes following ten-year-old forest fires in Great Basin National Park, although the seral community is transitional.

DISTRIBUTION

Geographic Range: This sparsely vegetated group occurs in the interior western U.S. from the Columbia Plateau south to the Great Basin and Colorado Plateau, east into Wyoming basins and plains.

Spatial Scale & Pattern [optional]: Large patch

Nations: US
States/Provinces: AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]: 4:C, 6:C, 8:C, 9:C, 10:C, 11:C, 12:?, 18:C, 19:C, 20:C, 21:C
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: BLM (Grand Staircase-Escalante); NPS (Arches, Canyonlands, Capitol Reef, Glen Canyon, Great Basin, Petrified Forest); USFS (Spring Mountains)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** Littleleaf Mountain-Mahogany (417) (Shiflet 1994)
- **><** Pinyon - Juniper: 239 (Eyre 1980)

LOWER LEVEL UNITS

Alliances:
- A4053 *Eriogonum ovalifolium - Fallugia paradoxa - Andropogon hallii* Lava & Cinder Sparse Vegetation Alliance
- A4051 *Pinus ponderosa - Cercocarpus intricatus* Bedrock Cliff & Canyon Wooded Scrub Alliance
- A4052 *Ephedra* spp. - *Leymus salinus - Eriogonum corymbosum* Badlands Cold Desert Sparse Vegetation Alliance
- A4050 *Ephedra viridis - Chrysothamnus viscidiflorus - Rhus trilobata* Talus Sparse Scrub Alliance

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al.
Author of Description: K.A. Schulz, M.S. Reid and G. Kittel
Acknowledgments:
Version Date: 11/06/2015
Classif Resp Region: West
Internal Author: KAS 12-10, 11-15, mod. MSR 9-13, mod. GK 8-15

REFERENCES

References: Barbour and Billings 2000, Brodo et al. 2001, Day and Wright 1985, ENTRIX, Inc. 2007, Eyre 1980, Faber-Langendoen et al. 2017a, Graybosch and Buchanan 1983, Hansen et al. 2004c, Logan Simpson Design 2011, Nachlinger and Reese 1996, Shiflet 1994, Tisdale et al. 1965, Welsh 1979, Welsh and Chatterly 1985

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G570. Intermountain Basins Cliff, Scree & Badland Sparse Vegetation

A4052. Ephedra spp. - Leymus salinus - Eriogonum corymbosum Badlands Cold Desert Sparse Vegetation Alliance

Type Concept Sentence: This alliance consists of sparsely vegetated (<10% vascular cover) areas with varied characteristic species such as *Enceliopsis nudicaulis, Eriogonum brevicaule, Leymus salinus ssp. salinus, Leymus salinus ssp. salmonis, Lupinus argenteus, Pseudoroegneria spicata*, and/or *Zuckia brandegeei*. This alliance occurs throughout the Intermountain West on badlands of shales, siltstones or mudstones on typically rounded hills and plains that form a rolling topography that can be steep and highly eroded.

OVERVIEW

Scientific Name: *Ephedra* spp. - *Leymus salinus - Eriogonum corymbosum* Badlands Cold Desert Sparse Vegetation Alliance
Common Name (Translated Scientific Name): Joint-fir species - Saline Wildrye - Crispleaf Buckwheat Badlands Cold Desert Sparse Vegetation Alliance
Colloquial Name: Intermountain Shale Badlands Cold Desert Sparse Vegetation

Type Concept: This alliance consists of sparsely vegetated (<10% vascular cover) areas with varied characteristic species such as *Enceliopsis nudicaulis, Eriogonum brevicaule, Leymus salinus ssp. salinus, Leymus salinus ssp. salmonis, Lupinus argenteus, Pseudoroegneria spicata*, and/or *Zuckia brandegeei*. Other species include dwarf-shrubs such as *Atriplex confertifolia, Gutierrezia* spp., and *Chrysothamnus viscidiflorus var. stenophyllus*. Characteristic forbs and grasses include *Achnatherum hymenoides, Arenaria hookeri, Astragalus* spp., *Cryptantha* spp., *Eriogonum pauciflorum, Machaeranthera grindelioides, Pleuraphis jamesii, Platyschkuhria integrifolia, Poa secunda*, and/or *Xylorhiza venusta*. This alliance occurs throughout the Intermountain West. Habitats are badlands of marine shales, siltstones and mudstones (clay). Landforms are typically rounded hills and plains that form a rolling topography, but at time can be steep and highly eroded. The harsh soil properties and high rate of erosion and deposition are driving environmental variables.

Classification Comments: Exactly where this transitions to ecological system Western Great Plains Badlands (CES303.663) in central Wyoming needs to be clarified.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics:

VEGETATION

Physiognomy and Structure: Vegetation in this alliance has a sparse herbaceous layer codominated by perennial bunchgrasses and forbs. There are also sparsely scattered short shrubs and scale-leaved trees. Annual forbs and grasses are seasonally present.

Floristics: This alliance consists of sparsely vegetated (<10% vascular cover) areas with varied characteristic species such as *Enceliopsis nudicaulis, Eriogonum brevicaule, Leymus salinus ssp. salinus, Leymus salinus ssp. salmonis, Lupinus argenteus, Pseudoroegneria spicata* and/or *Zuckia brandegeei*. Other species include dwarf-shrubs such as *Atriplex confertifolia, Gutierrezia* spp., and *Chrysothamnus viscidiflorus var. stenophyllus*. Characteristic forbs and grasses include *Achnatherum hymenoides, Arenaria hookeri, Astragalus* spp., *Cryptantha* spp., *Eriogonum pauciflorum, Machaeranthera grindelioides, Pleuraphis jamesii, Platyschkuhria integrifolia, Poa secunda*, and/or *Xylorhiza venusta*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs on steep slopes composed of fine volcanic tuffs or clays at low elevations, from roughly 1280 to 1890 m. This substrate is typically unstable, with constant downslope movement of soil surface layers, and a high shrink-swell ratio. Chronic soil disturbance is therefore a major factor in the species composition of the alliance. Soil textures range from sandy clay, clay to clay loam, and may be alkaline. The effects of shrink-swell action and sheet erosion in these soils are evident in the high percentage of bare ground.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is found in the cool semi-desert region of the intermountain western U.S., from Arizona and New Mexico north to Idaho and Montana. It is confirmed by Oregon and Washington reviewers to not occur in either of those states.

Nations: US
States/Provinces: AZ, CA, CO, ID, MT, NM, NV, UT, WY
TNC Ecoregions [optional]: 6:P, 9:C, 10:C, 11:C, 12:?, 18:C, 19:C, 20:C, 21:C
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: NPS (Lake Mead)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** *Chrysothamnus nauseosus/Eriogonum brevicaule* Community Type (DeVelice and Lesica 1993) [synonym for the sole association in this alliance.]
- **?** *Ephedra torreyana-Psorothamnus fremontii* Sparsely Vegetated Alliance (Evens et al. 2014)
- **?** Mixed Desert Shrubland (Knight et al. 1987) [This alliance may correspond to this general type if *Eriogonum brevicaule* is substituted for *Eriogonum pauciflorum*.]

LOWER LEVEL UNITS

Associations:

- CEGL002745 *Leymus salinus* Shale Sparse Vegetation
- CEPP006743 *Psorothamnus fremontii* / Cryptogamic Crust (Gypsum) Sparse Vegetation
- CEGL001643 *Leymus salinus ssp. salmonis - Lupinus argenteus* Sparse Vegetation
- CEGL002979 *Eriogonum corymbosum* Badlands Sparse Vegetation
- CEGL001642 *Leymus salinus ssp. salmonis - Enceliopsis nudicaulis* Sparse Vegetation
- CEGL001343 *Eriogonum corymbosum / Leymus salinus* Dwarf-shrubland
- CEGL002493 *Zuckia brandegeei* Sparse Vegetation

- CEGL002349 *Ephedra torreyana* - (*Atriplex* spp.) / Nonvascular Gypsum Sparse Vegetation
- CEGL002350 *Ephedra torreyana - Artemisia bigelovii* Sparse Vegetation
- CEGL002353 *Ephedra torreyana* Sparse Vegetation
- CEGL004013 *Eriogonum leptophyllum* Sparse Vegetation
- CEGL005319 *Eriogonum brevicaule* - Cushion Plants Sparse Vegetation
- CEGL005116 *Ephedra trifurca* Badlands Shrubland
- CEGL001667 *Pseudoroegneria spicata - Eriogonum brevicaule* Sparse Vegetation
- CEGL002976 *Ephedra nevadensis* / Lichens Sparse Vegetation

AUTHORSHIP

Primary Concept Source: M.S. Reid, in Faber-Langendoen et al. (2013)
Author of Description: M.S. Reid
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: DeVelice and Lesica 1993, Evens et al. 2014, Faber-Langendoen et al. 2017b, Knight et al. 1987, Lesica and DeVelice 1992, Moseley 1987b, Tiedemann et al. 1987

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G570. Intermountain Basins Cliff, Scree & Badland Sparse Vegetation

A4050. Ephedra viridis - Chrysothamnus viscidiflorus - Rhus trilobata Talus Sparse Scrub Alliance

Type Concept Sentence: This alliance consists of very open to sparse shrubs; typical species include *Artemisia bigelovii, Atriplex canescens, Brickellia* spp., *Chrysothamnus viscidiflorus, Ephedra viridis, Ericameria nauseosa, Fallugia paradoxa*, and/or *Rhus trilobata*. It occupies sparsely vegetated (<10% vascular plant cover) talus and colluvial slopes in the intermountain western U.S.

OVERVIEW

Scientific Name: *Ephedra viridis - Chrysothamnus viscidiflorus - Rhus trilobata* Talus Sparse Scrub Alliance
Common Name (Translated Scientific Name): Mormon-tea - Yellow Rabbitbrush - Skunkbush Sumac Talus Sparse Scrub Alliance
Colloquial Name: Intermountain Talus Sparse Scrub

Type Concept: This alliance consists of very open to sparse shrubs (<10% vascular plant cover); typical species include *Artemisia bigelovii, Atriplex canescens, Brickellia* spp., *Chrysothamnus viscidiflorus, Ephedra viridis, Ericameria nauseosa, Fallugia paradoxa*, and/or *Rhus trilobata*. It occupies sparsely vegetated talus and colluvial slopes. Sites range from dry and warm through some cooler aspects. Many types occur on tablelands and cliffs with talus and colluvial slopes below them. Substrates are predominantly sedimentary rocks, such as sandstone, shale, and limestone. These species are utilizing moisture from cracks and pockets where soil accumulates, and can tolerate rock-fall and movement since generally these are unstable substrates. These alliance occurs throughout the intermountain western U.S.

Classification Comments: Other associations in the west occur on talus and scree slopes from subalpine into the intermountain basins or low-elevation canyons. Most of these are currently placed into other groups. For now this alliance is constrained to generally sparsely vegetated talus, scree and colluvial slopes, but this treatment will need further review.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics:

VEGETATION

Physiognomy and Structure: Sparsely vegetated with <10% vascular plant cover of evergreen and deciduous shrubs, generally <2 m in height.

Floristics: This alliance consists of very open to sparse shrubs (<10% vascular plant cover); typical species include *Artemisia bigelovii, Atriplex canescens, Brickellia* spp., *Chrysothamnus viscidiflorus, Ephedra viridis, Ericameria nauseosa, Fallugia paradoxa*, and/or *Rhus trilobata*.

ENVIRONMENT & DYNAMICS

Environmental Description: Sites occur predominantly on talus and colluvial slopes. Aspects are mostly dry and warm but range to cool. Many types occur on tablelands and cliffs with talus and colluvial slopes below them. Substrates are predominantly sedimentary rocks, such as sandstone, shale, and limestone. Plants are utilizing moisture from cracks and pockets where soil accumulates, and can tolerate rockfall and movement, since generally these are unstable substrates.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance occurs on the Colorado Plateau and extends west throughout the Great Basin and northeast into Wyoming.

Nations: US
States/Provinces: AZ, CO, ID, NM, NV, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL001287 *Atriplex canescens - Ephedra viridis* Talus Shrubland
- CEGL003496 *Fallugia paradoxa - Brickellia* spp. - (*Holodiscus dumosus*) Scree Shrubland
- CEGL002927 *Atriplex canescens - (Ephedra viridis) / (Muhlenbergia porteri)* Sandstone Sparse Vegetation
- CEPP006704 *Ericameria cuneata var. spathulata* Shrubland
- CEGL003755 *Artemisia bigelovii - Ephedra (viridis, torreyana)* Talus Shrubland
- CEGL003961 *Ericameria nauseosa - (Xylorhiza tortifolia)* Talus Sparse Shrubland
- CEGL003776 *Rhus trilobata - Ephedra (viridis, torreyana)* Talus and Slickrock Shrubland
- CEGL002347 *Chrysothamnus viscidiflorus* Talus Shrubland

AUTHORSHIP

Primary Concept Source: M.S. Reid, in Faber-Langendoen et al. (2013)
Author of Description: M.S. Reid
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Faber-Langendoen et al. 2017b, Hansen et al. 2004b

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G570. Intermountain Basins Cliff, Scree & Badland Sparse Vegetation

A4053. Eriogonum ovalifolium - Fallugia paradoxa - Andropogon hallii Lava & Cinder Sparse Vegetation Alliance

Type Concept Sentence: This alliance consists of woody, scrub and subshrub-dominated sparse vegetation (<10% cover) with species such as *Artemisia filifolia, Atriplex canescens, Ephedra* spp., *Eriogonum corymbosum, Eriogonum ovalifolium*, and/or *Fallugia paradoxa*. This alliance occurs in the intermountain western U.S. on lava flows, cinder fields, and sand dunes.

OVERVIEW

Scientific Name: *Eriogonum ovalifolium - Fallugia paradoxa - Andropogon hallii* Lava & Cinder Sparse Vegetation Alliance
Common Name (Translated Scientific Name): Cushion Buckwheat - Apache Plume - Sand Bluestem Lava & Cinder Sparse Vegetation Alliance
Colloquial Name: Intermountain Basins Lava & Cinder Sparse Vegetation

Type Concept: This alliance consists of woody, scrub and subshrub-dominated sparse vegetation (<10% cover) with either trees such as *Pinus ponderosa, Pinus flexilis*, or *Juniperus* spp. or shrubs such as *Artemisia filifolia, Atriplex canescens, Ephedra* spp., *Eriogonum*

corymbosum, Eriogonum ovalifolium, and/or *Fallugia paradoxa*. The grass *Andropogon hallii* may be dominant (yet sparse) on some sites. Other forbs present may include *Chaenactis douglasii, Cryptantha interrupta, Machaeranthera canescens, Phacelia hastata, Stephanomeria minor (= Stephanomeria tenuifolia)*, and *Pleiacanthus spinosus (= Stephanomeria spinosa)*. *Allium simillimum, Lewisia rediviva, Mimulus nanus*, and *Mimulus suksdorfii* may be present in the spring. This alliance occurs in the intermountain western U.S. Sites are lava flows, cinder fields and sand dunes. Volcanic substrates include basalt lava and dikes with associated colluvium, basalt cliff faces and uplifted "backbones," tuff, and cinder cones or cinder fields. It may occur as large-patch, small-patch and linear (dikes) spatial patterns.

Classification Comments: Other associations occur on volcanic substrates throughout the western U.S., and are placed into other groups and alliances. This alliance is restricted to sparsely vegetated situations, but distinguishing it from others where the vegetation is more dense may be difficult. Rules will need to be determined.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics:

VEGETATION

Physiognomy and Structure: This alliance has sparsely vegetated (<10%) vascular cover and includes conifer trees, evergreen and deciduous shrubs, subshrubs, and graminoids.

Floristics: Stands have either trees such as *Pinus ponderosa, Pinus flexilis*, or *Juniperus* spp. or shrubs such as *Artemisia filifolia, Atriplex canescens, Ephedra* spp., *Eriogonum corymbosum, Eriogonum ovalifolium*, and/or *Fallugia paradoxa*. The grass *Andropogon hallii* may be dominant (yet sparse) on some sites. Other forbs present may include *Chaenactis douglasii, Cryptantha interrupta, Machaeranthera canescens, Phacelia hastata, Stephanomeria minor (= Stephanomeria tenuifolia)*, and *Pleiacanthus spinosus (= Stephanomeria spinosa)*. *Allium simillimum, Lewisia rediviva, Mimulus nanus*, and *Mimulus suksdorfii* may be present in the spring.

ENVIRONMENT & DYNAMICS

Environmental Description:

Dynamics:

DISTRIBUTION

Geographic Range: This alliance occurs in the intermountain western U.S. and is limited to barren and sparsely vegetated volcanic substrates. It occurs in Montana along the Rocky Mountain Front (east of the Continental Divide).

Nations: US
States/Provinces: AZ, ID, MT, NM, NV, OR, UT, WY
TNC Ecoregions [optional]: 4:C, 6:C, 8:C, 9:C, 11:C, 18:C, 19:C, 20:C, 21:C
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL001401 *Eriogonum ovalifolium var. depressum* Dwarf-shrubland
- CEGL005803 *Eriogonum corymbosum* Cinder Sparse Vegetation
- CEGL002785 *Andropogon hallii* Colorado Plateau Open Rock Vegetation
- CEGL005807 *Juniperus monosperma* Cinder Open Scrub Rock Vegetation
- CEGL002929 *Pinus ponderosa - (Populus tremuloides) / Fallugia paradoxa - (Holodiscus dumosus)* Lava Bed Sparse Vegetation
- CEGL005806 *Fallugia paradoxa - (Atriplex canescens, Ephedra torreyana)* Cinder Shrubland

AUTHORSHIP

Primary Concept Source: M.S. Reid, in Faber-Langendoen et al. (2013)
Author of Description: M.S. Reid

Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Day 1985, Day and Wright 1985, Faber-Langendoen et al. 2017b, Hansen et al. 2004c, Reid et al. 1994

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G570. Intermountain Basins Cliff, Scree & Badland Sparse Vegetation

A4051. Pinus ponderosa - Cercocarpus intricatus Bedrock Cliff & Canyon Wooded Scrub Alliance [Low - Poorly Documented]

Type Concept Sentence: This alliance consists of widely scattered trees and shrubs (with <10% vascular plant cover), including *Atriplex* spp., *Cercocarpus intricatus, Cercocarpus montanus, Coleogyne ramosissima, Juniperus* spp., and *Pinus ponderosa*. It ranges from Wyoming and Utah west across the intermountain western U.S., is found from foothill to lower montane elevations and includes steep cliff faces, narrow canyons, and smaller rock outcrops of various igneous, sedimentary, and metamorphic bedrock types.

OVERVIEW

Scientific Name: *Pinus ponderosa - Cercocarpus intricatus* Bedrock Cliff & Canyon Wooded Scrub Alliance
Common Name (Translated Scientific Name): Ponderosa Pine - Littleleaf Mountain-mahogany Bedrock Cliff & Canyon Wooded Scrub Alliance
Colloquial Name: Intermountain Bedrock Cliff & Canyon Wooded Scrub

Type Concept: This alliance consists of widely scattered trees and shrubs (with <10% vascular plant cover), including *Atriplex* spp., *Cercocarpus intricatus, Cercocarpus montanus, Coleogyne ramosissima, Juniperus* spp., and *Pinus ponderosa*. Other shrubs present may include *Amelanchier utahensis, Arctostaphylos patula, Artemisia bigelovii, Cercocarpus montanus, Glossopetalon spinescens var. meionandrum (= Forsellesia meionandra)*, or *Ephedra viridis*. The herbaceous layer is diverse, variable and low in cover. Occasional dwarfed individuals (often only 1-1.5 m tall) of *Pinus edulis* or *Juniperus osteosperma* may occur. Colorful lichens may cover much of the surface of the exposed bedrock. This alliance ranges from Wyoming and Utah west across the intermountain western U.S. Sites are found from foothill to lower montane elevations and include steep cliff faces, narrow canyons, and smaller rock outcrops of various igneous, sedimentary, and metamorphic bedrock types.

Classification Comments: Needs to be reviewed and additional floristics added. Other associations from different groups may belong in this alliance.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics:

VEGETATION

Physiognomy and Structure:

Floristics: This alliance consists of widely scattered trees and shrubs (with <10% vascular plant cover), including *Atriplex* spp., *Cercocarpus intricatus, Cercocarpus montanus, Coleogyne ramosissima, Juniperus* spp., and *Pinus ponderosa*. Other shrubs present may include *Amelanchier utahensis, Arctostaphylos patula, Artemisia bigelovii, Cercocarpus montanus, Glossopetalon spinescens var. meionandrum (= Forsellesia meionandra)*, or *Ephedra viridis*. The herbaceous layer is diverse, variable and low in cover. Occasional dwarfed individuals (often only 1-1.5 m tall) of *Pinus edulis* or *Juniperus osteosperma* may occur. Colorful lichens may cover much of the surface of the exposed bedrock.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands occur on a variety of exposed parent materials, rocky exposed sites, and massive sandstones, such as the Navajo, Weber, Cedar Mesa, White Rim, Kayenta and Wingate formations on the Colorado Plateau. Elevations range between 1412 and 2348 m (4630-7700 feet). Slopes range from level to vertical, and all aspects are possible. The vegetation roots in crevices where sandy soil collects.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance ranges from Colorado and Utah west but occurs predominantly in the Colorado Plateau region.

Nations: US
States/Provinces: AZ, CO, NM, NV, UT
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL002741 *Pinus (ponderosa, jeffreyi)* Sparse Vegetation
- CEGL003767 *Atriplex* spp. Desert Pavement Sparse Vegetation
- CEGL002977 *Cercocarpus intricatus* Slickrock Sparse Vegetation
- CEGL003834 *Coleogyne ramosissima* Sparse Shrubland
- CEGL002978 *Cercocarpus montanus* Rock Pavement Sparse Vegetation
- CEGL002972 *Pinus ponderosa* Slickrock Sparse Vegetation

AUTHORSHIP

Primary Concept Source: M.S. Reid, in Faber-Langendoen et al. (2013)
Author of Description: M.S. Reid
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Faber-Langendoen et al. 2017b

M499. Western North American Cool Semi-Desert Ruderal Scrub & Grassland

This upland cool semi-desert scrub and grassland macrogroup contains disturbed dry grasslands and shrublands dominated by non-native species or ruderal native species and is found from low-elevation basins to foothills throughout the western U.S. and Canada.

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
3.B.1.Ne.90.a. M499 Western North American Cool Semi-Desert Ruderal Scrub & Grassland

G600. Great Basin-Intermountain Ruderal Dry Shrubland & Grassland

Type Concept Sentence: This semi-desert interior western U.S. ruderal shrubland and grassland group includes shrubland, shrub-steppe and grassland stands that are strongly dominated (>90% relative canopy cover) by invasive, exotic species. Additionally, this group contains shrubland and shrub-steppe that are dominated or codominated by native shrub species (>10% relative cover) with a significant herbaceous understory (>10% absolute cover) that is strongly dominated (>90% relative canopy cover) by exotic herbaceous species.

OVERVIEW

Scientific Name: Great Basin-Intermountain Ruderal Dry Shrubland & Grassland Group
Common Name (Translated Scientific Name): Great Basin-Intermountain Ruderal Dry Shrubland & Grassland Group
Colloquial Name: Western Ruderal Crested Wheatgrass Grassland

Type Concept: This semi-desert interior western U.S. ruderal shrubland and grassland group includes shrubland, shrub-steppe and grassland stands that are strongly dominated (>90% relative canopy cover) by invasive, exotic species. Diagnostic invasive shrubs include *Alhagi maurorum, Cytisus striatus, Zygophyllum fabago*, or other exotic shrubs. Herbaceous stands include open to dense grasslands and forblands composed of either exotic annual or biennial grasses or forbs with low cover of perennial species (<10% absolute cover) or stands with a significant perennial herbaceous layer (>10% absolute cover) strongly dominated by exotics (>90% relative cover) with or without annuals and biennials present to dominant. There are relatively few cool, semi-arid invasive perennial graminoids such as *Agropyron cristatum*. Relatively mesic, invasive perennial hay grasses such as *Bromus inermis, Dactylis glomerata*, and *Phleum pratense* are typically absent or have low cover and are restricted to mesic microsites as they are more

common in higher elevation or higher latitude, temperate climates or relatively mesic sites. Numerous exotic perennial herbaceous species may compose these stands, such as *Acroptilon repens, Cardaria draba, Centaurea calcitrapa, Centaurea diffusa, Centaurea iberica, Centaurea stoebe ssp. micranthos, Centaurea virgata, Euphorbia esula, Hypericum perforatum, Lepidium latifolium, Peganum harmala*, or a mixture of other exotic forbs and graminoids. Stands dominated by annuals may be composed of annual grasses such as *Bromus arvensis (= Bromus japonicus), Bromus hordeaceus, Bromus madritensis, Bromus tectorum, Taeniatherum caput-medusae*, or annual forbs, including *Bassia scoparia (= Kochia scoparia), Brassica nigra, Centaurea melitensis, Centaurea solstitialis, Crupina vulgaris, Cynoglossum officinale, Descurainia sophia, Erodium cicutarium, Hyoscyamus niger, Isatis tinctoria, Salsola tragus, Sisymbrium altissimum, Taraxacum officinale*, or a mixture of other exotic annual forbs and grasses. Additionally, this group contains semi-desert shrublands and shrub-steppe that are dominated or codominated by native shrub species such as *Artemisia tridentata* with a significant herbaceous understory (>10% absolute cover) that is strongly dominated (>90% relative canopy cover) by exotic herbaceous species such as *Agropyron cristatum* or *Bromus tectorum*. Stands occur in disturbed dry to mesic basins, alluvial fans, and foothills elevations up to 2200 m and are restricted to areas with the cool, semi-arid climate found in the intermountain western U.S. region. Stands can be large areas or narrow strips adjacent to roadsides or under powerlines and other disturbed areas. Soils are mostly mineral and well-drained. Due to disturbance, soils may be compacted. It is an early-successional type that may occur in areas disturbed by fire, grazing or mining. This group may grade into wetter areas and may have transition zones where mesic forbs intermix with wetter forbs and graminoids found in Western North American Ruderal Marsh, Wet Meadow & Shrubland Group (G524). This group does not include the mesic introduced hay grasses such as *Bromus inermis, Dactylis glomerata*, and *Phleum pratense* that have escaped from improved pasture and irrigated meadow to invade montane grasslands. These grasslands are classified in the more temperate Western North American Interior Ruderal Grassland & Shrubland Group (G624).

Classification Comments: This group may be difficult to determine from native degraded shrublands and grasslands when non-native species codominate. The test is that the non-native species, especially invasive species, far outweigh (>90% relative cover) native species in abundance and richness, such that a well-trained observer cannot tell what the native counterpart may have been or to do so is only speculation. Dominant and diagnostic semi-arid exotic species *Agropyron cristatum* can be present to codominant in Western North American Interior Ruderal Grassland & Shrubland Group (G624) when codominated by relatively mesic species such as *Bromus inermis* or exotic forage grasses such as *Agrostis stolonifera, Dactylis glomerata, Phleum pratense*, and *Poa pratensis* that are characteristic of more temperate climates.

This group may grade into wetter areas and may have transition zones where mesic forbs intermix with wetter forbs and graminoids found in Western North American Ruderal Marsh, Wet Meadow & Shrubland Group (G524). This group does not include the mesic introduced hay grasses such as *Bromus inermis, Dactylis glomerata*, and *Phleum pratense* that have escaped from improved pasture and irrigated meadow to invade montane grasslands. These grasslands are classified in the more temperate Western North American Interior Ruderal Grassland & Shrubland Group (G624).

Similar NVC Types:

- G648 Southern Vancouverian Lowland Ruderal Grassland & Shrubland: may include similar alliances, but is restricted to lowlands west of the Cascade Range.
- G624 Western North American Interior Ruderal Grassland & Shrubland: has similar ruderal alliances but rather than occurring in cool, semi-arid sites, stands occur in cool, temperate regions and include montane, subalpine and alpine areas. Vegetation lacks obligate wetland species and is not dominated by facultative wetland species.
- G524 Western North American Ruderal Marsh, Wet Meadow & Shrubland: has similar ruderal alliances but occurs on mesic to wet sites and vegetation either includes obligate wetland species or is dominated by facultative wetland species.
- G819 North American Warm Desert Ruderal Scrub
- G677 North American Warm Desert Ruderal Grassland: may include similar alliances, but is restricted warm, semi-arid desert regions.

Diagnostic Characteristics: This ruderal shrubland and grassland group occurs in the semi-arid interior western U.S. and includes shrubland, shrub-steppe and grassland stands that are strongly dominated (>90% relative canopy cover) by invasive, exotic species. Additionally, this group contains shrubland and shrub-steppe that is dominated or codominated by native shrub species (>10% relative cover) with a significant herbaceous understory (>10% absolute cover) that is strongly dominated (>90% relative canopy cover) by exotic herbaceous species.

VEGETATION

Physiognomy and Structure: This group includes shrubland and shrub-steppe stands that have an open to dense shrub canopy, and annual and perennial grasslands and forblands with an open to dense herbaceous layer.

Floristics: This ruderal shrubland and grassland group includes shrubland and shrub-steppe stands that have an open to dense shrub canopy (>10% absolute cover) that is strongly dominated (>90% relative canopy cover) by invasive, introduced shrub species such as *Alhagi maurorum, Cytisus striatus, Zygophyllum fabago*, or other exotic shrubs. Additionally, this group includes shrubland and

shrub-steppe that is dominated or codominated by native shrub species (>10% relative cover) with a significant herbaceous understory (>10% absolute cover) that is strongly dominated (>90% relative canopy cover) by exotic herbaceous species. Herbaceous layers are composed of either exotic annuals with low cover of perennial species, or high cover of exotic perennials. Also included in this group are open to dense ruderal herbaceous stands without a shrub layer (<10% absolute cover). The herbaceous understory (>10% absolute cover) is strongly dominated (>90% relative canopy cover) by exotic herbaceous species. Herbaceous layers are composed of either exotic annuals with low cover of perennial species (<5% absolute cover), or moderate perennial cover (>10% absolute cover) dominated by of exotic perennials, either graminoids or forbs or a combination. There are relatively few cool, semi-arid perennial graminoids such as *Agropyron cristatum* (which has frequently been purposefully seeded to prevent soil erosion or provide livestock forage). The relatively mesic, invasive perennial hay grasses such as *Bromus inermis, Dactylis glomerata*, and *Phleum pratense* are typically absent or have low cover and are restricted to mesic microsites as they are more common in higher elevation or higher latitude, temperate climates or relatively mesic sites. Numerous exotic perennial herbaceous species may compose these stands such as *Acroptilon repens, Cardaria draba, Centaurea calcitrapa, Centaurea diffusa, Centaurea iberica, Centaurea stoebe ssp. micranthos, Centaurea virgata, Hypericum perforatum, Lepidium latifolium, Peganum harmala*, or a mixture of other exotic forbs and graminoids. Stands dominated by annuals may be composed of annual grasses such as *Bromus arvensis (= Bromus japonicus), Bromus hordeaceus, Bromus madritensis, Bromus tectorum, Taeniatherum caput-medusae*, or annual forbs, including *Bassia scoparia (= Kochia scoparia), Brassica nigra, Centaurea melitensis, Centaurea solstitialis, Crupina vulgaris, Cynoglossum officinale, Descurainia sophia, Erodium cicutarium, Hyoscyamus niger, Isatis tinctoria, Lepidium perfoliatum, Salsola tragus, Sisymbrium altissimum, Taraxacum officinale*, or a mixture of other exotic annual forbs and grasses.

ENVIRONMENT & DYNAMICS

Environmental Description: This interior western U.S. ruderal shrubland and grassland group is found on disturbed dry to mesic, basins, alluvial fans, and foothills elevations (up to 2200 m). Stands can be large areas or narrow strips adjacent to roadsides or under powerlines, in waste places such as abandoned agricultural fields that are no longer irrigated, oil and gas development areas, and other disturbed areas. *Climate:* This group occurs in the cool, semi-arid, continental, climate found intermountain western U.S. region. *Soil/substrate/hydrology:* Soils are mostly mineral and well-drained. Due to disturbance, soils may be compacted. It is an early-successional type that may occur in areas disturbed by fire, grazing or mining. However, it also occurs over vast acres of heavily overgrazed lands in the arid west, where livestock such as cows and horses have broken soil biotic crust, compacted soil and reduced native plant vigor.

Dynamics: Most of the invasive diagnostic species are cool-season (C3) plants such as *Agropyron cristatum* and *Bromus tectorum*. Cheatgrass expansion has radically changed fire regimes and vegetation over large areas in the Intermountain West. Cheatgrass invades native vegetation such as big sagebrush shrubland, then produces large amounts of fine fuels that readily carry fire, increasing the number, size and frequency of burns (fire-return interval = 3-5 year) which reduces cover of perennial vegetation and favors dominance by annual grasses (Young and Evans 1978, Zouhar 2003). Crested wheatgrass burns quickly and is therefore less susceptible to damage by fire than some native bunchgrass species that have a thick cespitose growth form. The fire may stay longer in the culms, resulting in heat transfer to the ground and the death of the plant (DePuit 1986). In crested wheatgrass, there is usually little heat transfer into the soil, so the tillers and root system are usually undamaged (DePuit 1986). Thus the more frequent fire regime caused by the introduction of *Bromus tectorum* also favors the maintenance of *Agropyron cristatum* over the establishment or survival of native bunchgrasses (S. Rust pers. comm. 2014).

DISTRIBUTION

Geographic Range: This ruderal group contains disturbed semi-arid grasslands, meadows, shrublands and shrub-steppe found in the interior western U.S. on disturbed dry to mesic, basins, alluvial fans, and foothills elevations (up to 2200 m). Stands do not extend up into the cool, temperate zone in included mountain ranges. This group does not extend south to the warm deserts or east into the Great Plains or west into cismontane California or the west side of the Cascades.

Spatial Scale & Pattern [optional]:
Nations: CA, US
States/Provinces: AZ, CA, CO, ID, MT, ND, NV, OR, SD, SK, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Alliances:

- A4213 *Artemisia* spp. - Mixed Shrub Ruderal Understory Shrubland Alliance
- A3257 *Centaurea solstitialis - Isatis tinctoria - Salsola tragus* Ruderal Annual Forb Alliance
- A3253 *Alhagi maurorum - Zygophyllum fabago* Ruderal Shrubland Alliance
- A1814 *Bromus tectorum - Taeniatherum caput-medusae* Ruderal Annual Grassland Alliance
- A3255 *Cardaria draba - Centaurea* spp. - *Lepidium latifolium* Ruderal Perennial Forb Alliance
- A4148 *Agropyron cristatum* Western Ruderal Perennial Grassland Alliance

AUTHORSHIP

Primary Concept Source: Faber-Langendoen et al. (2015)
Author of Description: G. Kittel and K.A. Schulz
Acknowledgments:
Version Date: 04/16/2015
Classif Resp Region: West
Internal Author: GK 5-12, mod. KAS 4-13, 4-15

REFERENCES

References: DePuit 1986, Faber-Langendoen et al. 2017a, Johnson and O'Neil 2000, Maser et al. 1984, Rust pers. comm., Young and Evans 1978, Zouhar 2003

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G600. Great Basin-Intermountain Ruderal Dry Shrubland & Grassland

A4148. Agropyron cristatum Western Ruderal Perennial Grassland Alliance

Type Concept Sentence: This semi-arid interior western U.S. ruderal perennial grassland alliance is strongly dominated (>90% relative canopy cover) by invasive, exotic perennial grasses, especially *Agropyron cristatum*, which can occur as a near-monoculture or mixed grassland with other exotic perennial grasses such as *Poa pratensis* and exotic perennial forbs and annuals.

OVERVIEW

Scientific Name: *Agropyron cristatum* Western Ruderal Perennial Grassland Alliance
Common Name (Translated Scientific Name): Crested Wheatgrass Western Ruderal Perennial Grassland Alliance
Colloquial Name: Western Ruderal Crested Wheatgrass Grassland

Type Concept: This ruderal perennial grassland alliance occurs in the interior western U.S. The vegetation is strongly dominated (>90% relative canopy cover) by invasive, exotic perennial grasses, especially *Agropyron cristatum*, which can occur as a near-monoculture or mixed grassland with other exotic perennial species such as *Poa pratensis*, and exotic perennial forbs and annuals. *Agropyron cristatum* has been purposefully seeded to prevent soil erosion and provide livestock forage in many areas and has naturalized outside these plantings. Scattered shrubs may be present but have low cover (<10% absolute cover). Native perennial graminoid species may be present but cover is low (<10% relative cover). Highly invasive and wind- and animal-distributed exotic forb and annual grass species may be present, including *Sisymbrium altissimum, Descurainia sophia, Halogeton glomeratus*, and *Salsola tragus*. Although exotic forbs and annual grasses may be abundant in the herbaceous layer and contribute to its ruderal nature, exotic perennial graminoids characterize the site. Stands occur in disturbed dry to mesic basins, alluvial fans, and foothills at elevations up to 2200 m throughout the cool, semi-arid interior western U.S. Vegetation dominated by relatively mesic, invasive perennial hay grasses such as *Bromus inermis, Dactylis glomerata, Phleum pratense*, and *Poa pratensis* generally occurs at higher elevations, higher latitudes or mesic microsites such as north slopes and generally has a more temperate climate and relatively mesic site conditions.

Classification Comments: *Agropyron cristatum* is an Old World introduction that grows in many alliances, especially on disturbed sites. Ranchers have planted thousands of hectares in the arid and semi-arid West to improve forage for use by livestock; it is palatable to wildlife, including antelope, deer, elk, birds, and small rodents. It naturalizes and dominates large areas, especially from northern parts of transmontane California east to the northwestern Great Plains (Ogle 2001, Kittel et al. 2012a). In conjunction with plantings, grazing pressures and changes in fire regime have caused shifts in native sagebrush stands with native understories of *Achnatherum hymenoides, Elymus elymoides, Festuca idahoensis, Leymus cinereus*, and *Poa secunda* into non-native understories or stands of *Agropyron cristatum* and/or *Bromus tectorum*.

Internal Comments:
Other Comments:

Similar NVC Types: Western North American Interior Ruderal Grassland & Shrubland Group (G624) has similar ruderal alliances but rather than occurring in cool, semi-arid sites, stands occur in cool, temperate regions and includes montane, subalpine and alpine

areas. Vegetation lacks obligate wetland species and is not dominated by facultative wetland species. Western North American Ruderal Marsh, Wet Meadow & Shrubland Group (G524) has similar ruderal alliances but occurs on mesic to wet sites and vegetation either includes obligate wetland species or is dominated by facultative wetland species. Southern Vancouverian Lowland Ruderal Grassland & Shrubland Group (G648) may include similar alliances, but is restricted to lowlands west of the Cascade Range. North American Warm Desert Ruderal Grassland Group (G677) may include similar alliances, but is restricted warm, semi-arid desert regions.

- A3254 *Agropyron cristatum - Bromus inermis - Poa pratensis* Ruderal Grassland Alliance: is very similar floristically, but is restricted to the western Great Plains.

Diagnostic Characteristics: Dominant diagnostic species for this alliance are invasive, perennial grass species such as *Agropyron cristatum*. There are relatively few cool, semi-arid perennial exotic grasses, but there are usually abundant annual exotic species present, seasonally.

VEGETATION

Physiognomy and Structure: This ruderal alliance is characterized by sparse to dense herbaceous layer dominated by perennial grasses with low cover of shrubs or annual graminoids and forbs (<5% absolute cover).

Floristics: The vegetation is strongly dominated (>90% relative canopy cover) by invasive, exotic perennial grasses, especially *Agropyron cristatum*, which can occur as a near-monoculture or mixed grassland with other exotic perennial species such as *Poa pratensis*, and exotic perennial forbs and annuals. *Agropyron cristatum* has been purposefully seeded to prevent soil erosion and provide livestock forage in many areas and has naturalized outside these plantings. Scattered shrubs may be present but have low cover (<10% absolute cover). Native perennial graminoid species such as *Hesperostipa comata* may be present but cover is low (<10% relative cover). Highly invasive and wind- and animal-distributed exotic forb and annual grass species may be present, including *Sisymbrium altissimum, Descurainia sophia, Halogeton glomeratus*, and *Salsola tragus*. Although exotic forbs and annual grasses may abundant in the herbaceous layer and contribute to its ruderal nature, exotic perennial graminoids characterize the site. Relatively mesic, invasive perennial hay grasses such as *Bromus inermis, Dactylis glomerata*, and *Phleum pratense* are absent or have low cover as they are more common in at higher elevations, higher latitudes or mesic microsites and generally occur in more temperate climates or relatively mesic sites.

ENVIRONMENT & DYNAMICS

Environmental Description: This ruderal perennial grassland alliance occurs in the interior western U.S. Stands occur in disturbed dry to mesic basins, alluvial fans, and foothills at elevations up to approximately 2200 m throughout the cool, semi-arid interior western U.S. Vegetation dominated by relatively mesic, invasive perennial hay grasses generally occurs at higher elevations, higher latitudes or mesic microsites such as north slopes and generally has a more temperate climate and relatively mesic site conditions. Stands can occur in a wide variety of human-disturbed habitats, including highway rights-of-way, revegetation projects, etc.

Dynamics: *Agropyron cristatum* burns quickly and is less susceptible to fire damage than native bunchgrasses. Its heat transfer is minimal into the soil, so the tillers and root system are usually undamaged. Tracks of *Agropyron cristatum* carry fires easily; they may promote the expansion and persistence of the type (Johnson 1986c). Managers plant *Agropyron cristatum* extensively in the Great Basin after burns and for erosion control. Its persistence following plantings involves shifts in the ecological function. Established plants replace natives; some plantings have resulted in pure stands (Johnson 1986c). Bakker et al. (2003) found that the control of *Agropyron cristatum* was possible without suppressing native bunchgrasses by both annual and early spring spraying with a generalist herbicide (glyphosate). This herbicide selectively killed the cool-season *Agropyron cristatum*. Bakker et al. (2003) found *Agropyron cristatum* persisting over 4 years in spite of annual herbicide application, and cover in control plots particularly increased with increased summer precipitation. They suggested that management focus on controlling *Agropyron cristatum* during dry years and on establishing native species during wet years.

DISTRIBUTION

Geographic Range: This alliance occurs at plains, basins, and foothill elevations (up to 2200 m) throughout the cool, semi-arid interior western U.S.

Nations: US
States/Provinces: AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]: 4:C, 11:C
USFS Ecoregions (2007): 341D:CC, 341F:CC, 342B:CC, M261G:CC
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** *Agropyron cristatum* (Crested wheatgrass rangelands) Semi-natural Stands (Sawyer et al. 2009) [42.030.00]
- **=** *Agropyron cristatum* Herbaceous Semi-Natural Alliance (CNPS 2017) [42.030.00]
- **<** Crested wheatgrass series (Sawyer and Keeler-Wolf 1995)
- **<** Great Basin Grassland (#43000) (Holland 1986b)

LOWER LEVEL UNITS

Associations:

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2014)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Allen-Diaz and Bartolome 1998, Asay and Knowles 1985, Bakker et al. 2003, CNPS 2017, Coffin et al. 1996, Dillman 1946, Eckert et al. 1961, Faber-Langendoen et al. 2017b, Garrison et al. 1977, Holland 1986b, Johnson 1986c, Kittel et al. 2012a, Ogle 2001, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, USFS 1937, Whitson et al. 2000, Zlatnik 1999d

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G600. Great Basin-Intermountain Ruderal Dry Shrubland & Grassland

A3253. Alhagi maurorum - Zygophyllum fabago Ruderal Shrubland Alliance

Type Concept Sentence: This cool, semi-arid interior western U.S. ruderal shrubland alliance is strongly dominated (>90% relative canopy cover) by invasive, exotic shrub species such as *Alhagi maurorum, Cytisus striatus*, or *Zygophyllum fabago* and occurs in disturbed dry to mesic basins, alluvial fans, and foothills at elevations up to 2200 m.

OVERVIEW

Scientific Name: *Alhagi maurorum - Zygophyllum fabago* Ruderal Shrubland Alliance
Common Name (Translated Scientific Name): Camelthorn - Syrian Bean-caper Ruderal Shrubland Alliance
Colloquial Name: Ruderal Camelthorn - Syrian Bean-caper Shrubland

Type Concept: This interior western U.S. ruderal shrubland alliance has an open to dense shrub canopy (>10% absolute cover) that is strongly dominated (>90% relative canopy cover) by invasive, introduced shrub species such as *Alhagi maurorum, Cytisus striatus*, or *Zygophyllum fabago*. Additionally, this alliance includes shrublands dominated or codominated by native shrub species (>10% relative cover) with a significant herbaceous understory (>10% absolute cover) that is strongly dominated (>90% relative canopy cover) by exotic herbaceous species. Herbaceous layers are composed of either exotic annuals with low cover of perennial species, or high cover of exotic perennials. Numerous exotic herbaceous species may compose the introduced herbaceous layer such as *Bromus tectorum, Brassica nigra*, and *Agropyron cristatum* Stands occur in disturbed dry to mesic basins, alluvial fans, and foothills from sea level to 2200 m elevation throughout the cool, semi-arid intermountain western U.S. region. It is an early-successional type that may occur in areas disturbed by fire, grazing or mining.

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types: Western North American Interior Ruderal Grassland & Shrubland Group (G624) has similar ruderal alliances but rather than occurring in cool, semi-arid sites, stands occur in cool, temperate regions and includes montane, subalpine and alpine areas. Vegetation lacks obligate wetland species and is not dominated by facultative wetland species. Western North American Ruderal Marsh, Wet Meadow & Shrubland Group (G524) has similar ruderal alliances but occurs on mesic to wet sites and vegetation either includes obligate wetland species or is dominated by facultative wetland species. Southern Vancouverian Lowland Ruderal Grassland & Shrubland Group (G648) may include similar alliances, but is restricted to lowlands west of the Cascade Range. North American Warm Desert Ruderal Grassland Group (G677) may include similar alliances, but is restricted warm, semi-arid desert regions.

Diagnostic Characteristics: Dominant diagnostic species for this alliance are invasive shrubs such as *Alhagi maurorum, Cytisus striatus*, or *Zygophyllum fabago*. Additionally, this alliance includes shrublands dominated or codominated by native shrub species

(>10% absolute shrub cover) with a significant herbaceous understory (>10% absolute cover) that is strongly dominated (>90% relative canopy cover) by exotic herbaceous species.

VEGETATION

Physiognomy and Structure: This ruderal alliance is characterized by an open to dense shrub canopy (>10% absolute cover) that is strongly dominated (>90% relative canopy cover) by invasive, introduced shrub and sparse to dense herbaceous layer dominated by perennial forbs with low cover of shrubs or annual graminoids and forbs (<5% absolute cover).

Floristics: This interior western U.S. ruderal shrubland alliance has an open to dense shrub canopy (>10% absolute cover) that is strongly dominated (>90% relative canopy cover) by invasive, introduced shrub species such as *Alhagi maurorum, Cytisus striatus*, or *Zygophyllum fabago*. Additionally, this alliance includes shrublands dominated or co-dominated by native shrub species (>10% relative cover) with a significant herbaceous understory (>10% absolute cover) that is strongly dominated (>90% relative canopy cover) by exotic herbaceous species. Herbaceous layers are composed of either exotic annuals with low cover of perennial species, or high cover of exotic perennials. Numerous exotic herbaceous species may compose the introduced herbaceous layer such as *Agropyron cristatum, Bromus tectorum, Cardaria draba*, or *Centaurea solstitialis*.

ENVIRONMENT & DYNAMICS

Environmental Description: This ruderal shrubland alliance occurs in the cool, semi-arid interior western U.S. Elevations range from sea level up to 2200 m. Stands occur in disturbed dry to mesic basins, alluvial fans, and foothills. Substrates are variable. Disturbance is important to initiating and maintaining many of these stands.

Dynamics:

DISTRIBUTION

Geographic Range: This ruderal shrubland alliance occurs in the cool, semi-arid interior western U.S.

Nations: US
States/Provinces: AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL002784 *Alhagi maurorum* Ruderal Scrub

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Faber-Langendoen et al. 2017b, USFS 1937, Whitson et al. 2000

3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G600. Great Basin-Intermountain Ruderal Dry Shrubland & Grassland

A4213. Artemisia spp. - Mixed Shrub Ruderal Understory Shrubland Alliance [Low - Poorly Documented]

Type Concept Sentence: Sagebrush shrublands with native shrubs in the overstory canopy and non-native herbaceous species in the understory; a wide spread example is *Artemisia tridentata / Bromus tectorum* shrubland.

OVERVIEW

Scientific Name: *Artemisia* spp. - Mixed Shrub Ruderal Understory Shrubland Alliance
Common Name (Translated Scientific Name): Sagebrush species - Mixed Shrub Ruderal Understory Shrubland Alliance
Colloquial Name: Great Basin-Intermountain Ruderal Understory Shrubland

Type Concept: This alliance covers those native shrublands that have had their herbaceous component completely replaced by non-native, invasive herbaceous species. Overstory shrubs include *Artemisia tridentata* (all subspecies), *Artemisia tridentata ssp. spiciformis (= Artemisia spiciformis), Artemisia arbuscula*, and *Artemisia tripartita*. Understory dominant herbaceous non-native species include graminoids *Bromus tectorum, Agropyron cristatum, Agrostis stolonifera, Taeniatherum caput-medusae, Poa bulbosa, Bromus diandrus*, and forbs *Sisymbrium altissimum, Descurainia pinnata, Onopordum acanthium, Cirsium* spp., *Centaurea* spp., *Lepidium* spp., and many others. Native herbaceous species may be present, but occur in very low abundance, less than 10% relative cover of all herbaceous cover. These stands occur in all areas where native sagebrush stands occur throughout the western US.

Classification Comments:

Internal Comments: GK 9-16: CA & OR confirmed and MT & NM added.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Stands are dominated in the understory layer by non-natives, such that the native association cannot be determined.

VEGETATION

Physiognomy and Structure:

Floristics:

ENVIRONMENT & DYNAMICS

Environmental Description:

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is found throughout the western U.S.

Nations: US
States/Provinces: AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL005480 *Artemisia tripartita ssp. tripartita / Bromus tectorum* Ruderal Shrubland
- CEGL002528 *Artemisia tridentata ssp. vaseyana / Poa pratensis* Ruderal Shrubland
- CEGL005593 *Chrysothamnus viscidiflorus / Poa secunda - Bromus tectorum* Ruderal Shrubland
- CEGL005591 *Chrysothamnus viscidiflorus / Bromus tectorum* Ruderal Shrubland
- CEGL002985 *Artemisia arbuscula ssp. longicaulis / Bromus tectorum* Ruderal Shrubland
- CEGL002699 *Artemisia tridentata - (Ericameria nauseosa) / Bromus tectorum* Ruderal Shrubland
- CEGL002937 *Ericameria nauseosa / Bromus tectorum* Ruderal Shrubland
- CEGL005472 *Artemisia arbuscula ssp. arbuscula / Bromus tectorum* Ruderal Shrubland
- CEGL005475 *Artemisia tridentata ssp. vaseyana / Bromus tectorum* Ruderal Shrubland
- CEGL005590 *Chrysothamnus viscidiflorus / Agropyron cristatum* Ruderal Shrubland
- CEGL005477 *Artemisia tridentata ssp. wyomingensis / Bromus tectorum* Ruderal Shrubland
- CEGL002083 *Artemisia tridentata ssp. wyomingensis* / Disturbed Understory Ruderal Shrubland
- CEGL002339 *Artemisia tridentata ssp. vaseyana / Poa (pratensis, compressa)* Ruderal Shrub Grassland
- CEGL002355 *Ephedra viridis / Bromus tectorum* Ruderal Shrubland

- CEGL002185 *Artemisia tridentata ssp. wyomingensis / (Agropyron cristatum, Psathyrostachys juncea)* Seeded Grasses Ruderal Shrubland
- CEGL002933 *Chrysothamnus viscidiflorus / Poa pratensis* Ruderal Shrub Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2015)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2016/09/28

REFERENCES

References: Faber-Langendoen et al. 2017b, Hickman 1993, Sawyer et al. 2009

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G600. Great Basin-Intermountain Ruderal Dry Shrubland & Grassland

A1814. Bromus tectorum - Taeniatherum caput-medusae Ruderal Annual Grassland Alliance

Type Concept Sentence: This cool, semi-arid interior western U.S. ruderal annual grassland alliance is strongly dominated (>90% relative canopy cover) by invasive, exotic annual grass species such as *Bromus tectorum*, and less commonly *Bromus arvensis, Bromus hordeaceus, Bromus madritensis*, or *Taeniatherum caput-medusae*. It occurs in disturbed dry to mesic basins, alluvial fans, and foothills at elevations up to 2200 m.

OVERVIEW

Scientific Name: *Bromus tectorum - Taeniatherum caput-medusae* Ruderal Annual Grassland Alliance
Common Name (Translated Scientific Name): Cheatgrass - Medusa-head Ruderal Annual Grassland Alliance
Colloquial Name: Ruderal Cheatgrass - Medusa-head Annual Grassland

Type Concept: This interior western U.S. ruderal annual grassland alliance is strongly dominated (>90% relative canopy cover) by invasive, exotic annual grass species such as *Bromus tectorum*, and less commonly *Bromus arvensis (= Bromus japonicus), Bromus hordeaceus, Bromus madritensis, Onopordum acanthium, Taeniatherum caput-medusae*, or a mixture of other exotic annual grasses. Cover of perennials is low (<5% absolute cover). Stands occur in disturbed dry to mesic basins, alluvial fans, and foothills at elevations up to 2200 m throughout the cool, semi-arid interior western U.S. region. It is an early-successional type that may occur in areas disturbed by fire, grazing or mining.

Classification Comments: This alliance includes grasslands dominated by other Eurasian introduced annual *Bromus* species. It is distinct from the annual *Bromus* communities found along the Pacific coast with Mediterranean or maritime climates because it does not have the introduced annual oatgrass (*Avena barbata* and *Avena fatua*), or other species typical of the California annual grassland (Sawyer and Keeler-Wolf 1995).

Internal Comments:
Other Comments:

Similar NVC Types: Western North American Interior Ruderal Grassland & Shrubland Group (G624) has similar ruderal alliances but rather than occurring in cool, semi-arid sites, stands occur in cool, temperate regions and includes montane, subalpine and alpine areas. Vegetation lacks obligate wetland species and is not dominated by facultative wetland species. Western North American Ruderal Marsh, Wet Meadow & Shrubland Group (G524) has similar ruderal alliances but occurs on mesic to wet sites and vegetation either includes obligate wetland species or is dominated by facultative wetland species. Southern Vancouverian Lowland Ruderal Grassland & Shrubland Group (G648) may include similar alliances, but is restricted to lowlands west of the Cascade Range. North American Warm Desert Ruderal Grassland Group (G677) may include similar alliances, but is restricted warm, semi-arid desert regions.

Diagnostic Characteristics: This disturbed grassland alliance is strongly dominated (>90% relative canopy cover) by invasive, exotic annual grass species such as *Bromus tectorum*, and less commonly *Bromus arvensis, Bromus hordeaceus, Bromus madritensis, Taeniatherum caput-medusae*, or a mixture of other exotic annual grasses. Cover of perennials is low (<5% absolute cover). Stands are restricted lower elevation sites (up to 2200 m) throughout the cool, semi-arid interior western U.S.

VEGETATION

Physiognomy and Structure: This alliance is characterized by sparse to dense annual grasslands with low cover of shrub or perennial graminoids or forbs (<5% absolute cover).

Floristics: This interior western U.S. ruderal annual grassland alliance is strongly dominated (>90% relative canopy cover) by invasive, exotic annual grass species such as *Bromus tectorum*, and less commonly *Bromus arvensis (= Bromus japonicus), Bromus hordeaceus, Bromus madritensis, Taeniatherum caput-medusae*, or a mixture of other exotic annual grasses. Cover of perennials is low (<5% absolute cover).

ENVIRONMENT & DYNAMICS

Environmental Description: Stands occur in disturbed dry to mesic basins, alluvial fans, and foothills at elevations up to 2200 m. Climate is cool, semi-arid. Substrates are variable.

Dynamics: *Bromus tectorum* is an annual grass and is able to complete its lifecycle in the spring before drying out mid-summer. Its fine structure makes it extremely flammable when dry, and it will increase the fire frequency of a site (FEIS 2001). Frequent fires favor *Bromus tectorum* because they eliminate competing perennial vegetation and increase soil nitrogen, but do not kill all the *Bromus tectorum* seeds, which survive in the unburned organic material (FEIS 2001). This altered ecological process has promoted the spread of *Bromus tectorum* and other exotic annual bromes at the expense of sagebrush shrublands in large parts of the western U.S. (Young and Evans 1973, 1978, Daubenmire 1975).

T. Naumann (pers. comm. 2005) reported successful restoration of cheatgrass-invaded systems by the use of prescribed fire, timed and controlled so as to destroy the seeds of *Bromus tectorum* while stimulating growth in remnant native warm-season grasses. She also reported that prescribed fire was least successful in areas of shallow soils, presumably because native grasses cannot develop sufficient root mass to compete with cheatgrass. Work by Redente and others (e.g., Redente et al. 1992) indicates that, under some circumstances, native grass and shrub species can regain competitive advantage over annuals such as *Bromus tectorum* if a source of carbon, such as sugar or sawdust, is added to the system. Amending the soil with carbon increases the activity of soil microbes and results in the reduction of plant-available nitrogen.

This type is most common where disturbances have eliminated or largely set back the native vegetation. Where the brome grasses are invading native vegetation, the types may still be tracked as native types, since the native species may still persist. A recent study (Karl et al. 1999) found that, despite strong seed and seedling production by the exotic brome grasses (*Bromus arvensis, Bromus tectorum*), the large amount of herbaceous biomass produced by the two vegetatively propagating native grasses *Bouteloua gracilis* and *Pascopyrum smithii* suggests that these native grasses may well maintain their ecological importance in the stands.

Evans et al. (2001) studied the invasion by cheatgrass of an undisturbed native grassland in Canyonlands National Park (Virginia Park). Their study showed that *Bromus* may cause a short-term decrease in nitrogen loss by decreasing substrate availability and denitrification enzyme activity, but in the long term, nitrogen loss is likely to be greater in invaded sites because of increased fire frequency and greater nitrogen volatilization during fire. A study by Englund (2004) at the same site showed decreasing levels of soil organic carbon as *Bromus tectorum*, with its shallow root systems, replaced perennial grasses with their more massive root systems.

In Nevada, Beatley (1976) found dense stands of the introduced winter annual grass *Bromus tectorum* growing in disturbed *Artemisia* shrublands. *Bromus rubens* is more common in lower elevation sites and *Bromus tectorum* is most common in higher elevation sagebrush and pinyon-juniper communities.

DISTRIBUTION

Geographic Range: This exotic annual grassland is restricted to the cool, semi-arid interior western U.S.

Nations: CA?, US
States/Provinces: AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]: 11:C
USFS Ecoregions (2007): 341Fd:CCC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Joshua Tree); USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **>** *Bromus tectorum* (Cheatgrass grassland) Semi-natural Stands (Sawyer et al. 2009) [42.020.00]
- **>** *Bromus tectorum* Semi-Natural Herbaceous Stands (Evens et al. 2012)
- **>** *Bromus tectorum* Semi-natural Herbaceous Alliance (Evens et al. 2014)

LOWER LEVEL UNITS

Associations:

- CEGL003019 *Bromus tectorum* Ruderal Grassland
- CEGL005614 *Sisymbrium altissimum - Bromus tectorum* Ruderal Grassland
- CEGL005604 *Poa secunda - Bromus tectorum* Ruderal Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Beatley 1976, Daubenmire 1975, Englund 2004, Evans et al. 2001, Evens and San 2006, Evens et al. 2012, Evens et al. 2014, FEIS 2001, Faber-Langendoen et al. 2017b, Karl et al. 1999, Naumann pers. comm., Redente et al. 1992, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Thompson 2001, USFS 1937, VegCAMP and AIS 2013, Von Loh 2000, Whitson et al. 2000, Young and Evans 1973, Young and Evans 1978

3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G600. Great Basin-Intermountain Ruderal Dry Shrubland & Grassland

A3255. Cardaria draba - Centaurea spp. - Lepidium latifolium Ruderal Perennial Forb Alliance

Type Concept Sentence: This cool, semi-arid interior western U.S. ruderal herbaceous alliance is strongly dominated (>90% relative canopy cover) by invasive, exotic perennial forbs such as *Acroptilon repens, Cardaria draba, Centaurea calcitrapa, Centaurea diffusa, Centaurea iberica, Centaurea stoebe ssp. micranthos, Centaurea virgata, Euphorbia esula, Hypericum perforatum, Lepidium latifolium, Linaria dalmatica, Linaria vulgaris*, or *Peganum harmala* and occurs in disturbed dry to mesic basins, alluvial fans, and foothills at elevations up to 2200 m.

OVERVIEW

Scientific Name: *Cardaria draba - Centaurea* spp. - *Lepidium latifolium* Ruderal Perennial Forb Alliance
Common Name (Translated Scientific Name): Whitetop - Knapweed species - Broadleaf Pepperweed Ruderal Perennial Forb Alliance
Colloquial Name: Ruderal Perennial Forb Meadow & Grassland

Type Concept: This interior western U.S. ruderal perennial herbaceous alliance is strongly dominated (>90% relative canopy cover) by invasive, exotic perennial forbs such as *Acroptilon repens, Cardaria draba, Centaurea calcitrapa, Centaurea diffusa, Centaurea iberica, Centaurea stoebe ssp. micranthos, Centaurea virgata, Euphorbia esula, Hypericum perforatum, Lepidium latifolium, Linaria dalmatica, Linaria vulgaris, Peganum harmala*, or a mixture of other exotic perennial forbs. Stands occur in disturbed dry to mesic basins, alluvial fans, and foothills at elevations up to 2200 m throughout the cool, semi-arid intermountain western U.S. region. It is an early-successional type that may occur in areas disturbed by fire, grazing or mining.

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types: Western North American Interior Ruderal Grassland & Shrubland Group (G624) has similar ruderal alliances but rather than occurring in cool, semi-arid sites, stands occur in cool, temperate regions and includes montane, subalpine and alpine areas. Vegetation lacks obligate wetland species and is not dominated by facultative wetland species. Western North American Ruderal Marsh, Wet Meadow & Shrubland Group (G524) has similar ruderal alliances but occurs on mesic to wet sites and vegetation either includes obligate wetland species or is dominated by facultative wetland species. Southern Vancouverian Lowland Ruderal Grassland & Shrubland Group (G648) may include similar alliances, but is restricted to lowlands west of the Cascade Range. North American Warm Desert Ruderal Grassland Group (G677) may include similar alliances, but is restricted warm, semi-arid desert regions.

Diagnostic Characteristics: This disturbed ruderal herbaceous alliance is strongly dominated (>90% relative canopy cover) by invasive, exotic perennial forb species such as *Acroptilon repens, Cardaria draba, Centaurea calcitrapa, Centaurea diffusa, Centaurea iberica, Centaurea stoebe ssp. micranthos, Centaurea virgata, Euphorbia esula, Hypericum perforatum, Lepidium latifolium, Linaria dalmatica, Linaria vulgaris, Peganum harmala*, or a mixture of other exotic perennial forbs.

VEGETATION

Physiognomy and Structure: This ruderal alliance is characterized by sparse to dense herbaceous layer dominated by annual forbs with low cover of shrubs or perennial graminoids and forbs (<5% absolute cover).

Floristics: This interior western U.S. ruderal perennial herbaceous alliance is strongly dominated (>90% relative canopy cover) by invasive, exotic perennial forbs such as *Acroptilon repens, Cardaria draba, Centaurea calcitrapa, Centaurea diffusa, Centaurea iberica, Centaurea stoebe ssp. micranthos, Centaurea virgata, Euphorbia esula, Hypericum perforatum, Lepidium latifolium, Linaria dalmatica, Linaria vulgaris, Peganum harmala*, or a mixture of other exotic perennial forbs.

ENVIRONMENT & DYNAMICS

Environmental Description: This ruderal perennial herbaceous alliance occurs in the interior western U.S. Stands occur in disturbed dry to mesic basins, alluvial fans, and foothills at elevations up to 2200 m throughout the cool, semi-arid intermountain western U.S. region. It is an early-successional type that may occur in areas disturbed by fire, grazing or mining.

Dynamics:

DISTRIBUTION

Geographic Range: This ruderal herbaceous alliance occurs in lowland and foothill sites throughout the cool, interior western U.S.

Nations: CA, US
States/Provinces: AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **>** *Lepidium latifolium* (Perennial pepper weed patches) Semi-natural Stands (Sawyer et al. 2009) [52.205.00]
- **>** *Lepidium latifolium* Semi-Natural Stands (Perennial pepper weed patches) (Buck-Diaz et al. 2012)

LOWER LEVEL UNITS

Associations:

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Buck-Diaz et al. 2012, Faber-Langendoen et al. 2017b, Sawyer et al. 2009, Sproul et al. 2011, USFS 1937, Whitson et al. 2000

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G600. Great Basin-Intermountain Ruderal Dry Shrubland & Grassland

A3257. Centaurea solstitialis - Isatis tinctoria - Salsola tragus Ruderal Annual Forb Alliance

Type Concept Sentence: This cool, semi-arid interior western U.S. ruderal annual herbaceous alliance is strongly dominated (>90% relative canopy cover) by invasive, exotic annual forb species such as *Brassica nigra, Centaurea melitensis, Centaurea solstitialis, Crupina vulgaris, Cynoglossum officinale, Hyoscyamus niger, Isatis tinctoria*, or *Salsola tragus* and occurs in disturbed dry to mesic basins, alluvial fans, and foothills at elevations up to 2200 m.

OVERVIEW

Scientific Name: *Centaurea solstitialis - Isatis tinctoria - Salsola tragus* Ruderal Annual Forb Alliance
Common Name (Translated Scientific Name): Yellow Star-thistle - Dyer's Woad - Prickly Russian-thistle Ruderal Annual Forb Alliance
Colloquial Name: Ruderal Annual Forb Meadow & Grassland

Type Concept: This ruderal herbaceous alliance occurs in the interior western U.S. Vegetation is strongly dominated (>90% relative canopy cover) by invasive, exotic annual forb species such as *Brassica nigra, Centaurea melitensis, Centaurea solstitialis, Crupina vulgaris, Cynoglossum officinale, Hyoscyamus niger, Isatis tinctoria, Salsola tragus* or a mixture of other exotic annual forbs. Other exotic annual forbs are often present to dominant in disturbed stands, including *Bassia scoparia (= Kochia scoparia), Descurainia sophia, Erodium cicutarium, Lepidium perfoliatum, Onopordum acanthium, Sisymbrium altissimum*, and *Taraxacum officinale*. Cover of perennials is low (<5% absolute cover). Stands occur in disturbed dry to mesic basins, alluvial fans, and foothills at elevations up to

2200 m throughout the cool, semi-arid intermountain western U.S. region. It is an early-successional type that may occur in areas disturbed by fire, grazing or mining.

Classification Comments: The aggressive invasive species are an obvious problem resulting from conversion of native vegetation types. However, the less aggressive species such as *Salsola tragus* can be disruptive ecological processes when they flush after large precipitation events, stabilizing active dunes or providing fine fuels that can carry fire through fire-sensitive vegetation types similar to the annual bromes.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Dominant diagnostic species for this alliance are invasive species such as *Brassica nigra, Centaurea melitensis, Centaurea solstitialis, Crupina vulgaris, Cynoglossum officinale, Hyoscyamus niger, Isatis tinctoria, Salsola tragus*, or a mixture of other exotic annual forbs. Other less aggressive non-native herbaceous species often present in these disturbed stands include *Erodium cicutarium, Bassia scoparia*, and *Taraxacum officinale*.

VEGETATION

Physiognomy and Structure: This ruderal alliance is characterized by sparse to dense herbaceous layer dominated by annual grasses with low cover of shrubs or perennial graminoids and forbs (<5% absolute cover).

Floristics: Vegetation in this alliance is strongly dominated (>90% relative canopy cover) by invasive, exotic annual forb species such as *Brassica nigra, Centaurea melitensis, Centaurea solstitialis, Crupina vulgaris, Cynoglossum officinale, Hyoscyamus niger, Isatis tinctoria, Salsola tragus*, or a mixture of other exotic annual forbs. Other exotic annual forbs are often present to dominant in disturbed stands, including *Bassia scoparia (= Kochia scoparia), Descurainia sophia, Erodium cicutarium, Lepidium perfoliatum, Sisymbrium altissimum*, and *Taraxacum officinale*. Cover of perennials is low (<5% absolute cover).

ENVIRONMENT & DYNAMICS

Environmental Description: This ruderal herbaceous alliance occurs in the interior western U.S. Stands occur in disturbed dry to mesic basins, alluvial fans, and foothills at elevations up to 2200 m. Climate is cool, semi-arid. Substrates are variable. It is an early-successional type that may occur in areas disturbed by fire, grazing or mining.

Dynamics:

DISTRIBUTION

Geographic Range: This ruderal herbaceous alliance occurs in lowland and foothill sites throughout the cool, interior western U.S. and Canada.

Nations: CA, US
States/Provinces: AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **<** *Centaurea (solstitialis, meletensis)* (Yellow star-thistle fields) Semi-natural Stands (Sawyer et al. 2009) [42.042.00]

LOWER LEVEL UNITS

Associations:
- CEGL004004 *Salsola* spp. Ruderal Grassland
- CEGL002085 *Erodium cicutarium* Ruderal Annual Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Bentley and Talbot 1948, Faber-Langendoen et al. 2017b, Sawyer et al. 2009, USFS 1937, Wagner et al. 1978, Whitson et al. 2000

6. OPEN ROCK VEGETATION

Tropical, temperate, and boreal habitats are characterized or dominated by plant growth forms, such as *lichen, bryophyte, alga*, or *fern*, that have structural adaptations for living on stable rock surfaces or on unstable rocky substrates, such as cliffs, talus, scree, pavement, cobble, lava or boulderfields, and with associated mesomorphic grass, shrub and tree growth forms.

6.B. Temperate & Boreal Open Rock Vegetation

Rocky habitats (such as cliffs, talus, scree, pavement, cobbles, recent lava flows, or large rock outcrops) characterized by temperate, including Mediterranean, and boreal lithomorphic and lithophilic growth forms, including saxicolous *lichens, bryophytes, algae*, and/or *ferns* and other pteridophytes. Tree growth forms typically have <10% cover, are very sparse; woody growth forms, when present, include cold-deciduous broad-leaved and needle-leaved trees and shrubs. Vegetation found on temperate and boreal rocky habitats (such as cliffs, talus, recent lava flows, or rock outcrops) at low to moderate elevations at mid-latitudes from 23°to 70°N or S latitude around the globe that are characterized by nonvascular plant growth forms that have structural adaptations for living on these habitats.

6.B.1. Temperate & Boreal Cliff, Scree & Other Rock Vegetation

Vegetation in temperate and boreal habitats found in rocky or rocklike habitats (such as cliffs, talus, scree, pavement, cobbles, lava, boulderfields, or badlands) at low elevations at mid-latitudes around the globe characterized by nonvascular plant growth forms that have structural adaptations for living on stable rock surfaces or in unstable rocky substrates. A sparse cover of vascular mesomorphic growth forms, including needle-leaved and cold-deciduous broad-leaved woody plants, may be present.

6.B.1.Na. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation

This type encompasses vegetation of eastern and boreal North America found on somewhat to strongly vertical cliffs, talus slopes, and erosional bluffs and characterized by sparse and patchy vascular vegetation and often high nonvascular and fern cover.

M116. Great Plains Cliff, Scree & Rock Vegetation

This macrogroup is found throughout the Great Plains on cliffs, bluffs, and rock outcrops, with vegetation comprised of sparse, rocky vegetation and sparse to abundant lichens.

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6. Open Rock Vegetation
6.B.1.Na. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation
6.B.1.Na.2.b. M116 Great Plains Cliff, Scree & Rock Vegetation

G567. Great Plains Cliff, Scree & Rock Vegetation

Type Concept Sentence: This group is composed of cliffs, bluffs, and rock outcrops in the Great Plains from the U.S.-Canadian border area south to Texas where vascular vegetation cover is sparse or nonexistent.

OVERVIEW

Scientific Name: *Rhus trilobata / Bouteloua gracilis - Opuntia* spp. Great Plains Cliff, Scree & Rock Vegetation Group
Common Name (Translated Scientific Name): Skunkbush Sumac / Blue Grama - Prickly-pear species Cliff, Scree & Rock Vegetation Group
Colloquial Name: Great Plains Acidic Cliff

Type Concept: This group is composed of cliffs, bluffs, and rock outcrops in the Great Plains from the U.S.-Canadian border area south to Texas. It is defined by having sparse vegetation and the abundance of exposed bedrock. The bedrock exposure can be vertical, sloping, or horizontal along rivers, at the tops of buttes, in dry canyons, or, rarely, large, low bedrock outcrops. The bedrock is usually sedimentary (sandstone, limestone, shale, gypsum, siltstone), but an area of quartzite outcrops in southwestern Minnesota is included in this group. Vegetation is generally sparse except where soil accumulates in pockets or ledges. Dominant species vary greatly depending on geology of the bedrock, climate, aspect, slope, and slope position. Common species are able to

tolerate the dry to xeric conditions and poor soil development found in this group. These include *Bouteloua eriopoda* (in the southwest), *Bouteloua gracilis, Cercocarpus montanus, Juniperus* spp., *Opuntia* spp., and *Rhus trilobata*.

Classification Comments: The concept of this group is fairly distinct within the Great Plains though individual sites may have enough vegetation to be confused with dry prairie or dry woodland groups. At the edges of the distribution of this group, there could be confusion with the sparse vegetation bedrock groups in the East, i.e., Laurentian-Acadian-Great Lakes Cliff & Rock Vegetation Group (G839), Appalachian Cliff & Rock Vegetation Group (G840), Central Midwest-Interior Cliff & Rock Vegetation Group (G841), and Southeast Coastal Plain Cliff & Rock Vegetation Group (G842), and the West, i.e., Rocky Mountain Cliff, Scree & Rock Vegetation Group (G565). Characteristics of this group may overlap with that of Comanchian Barrens & Glade Group (G598), and review is needed to clarify the limits of the two concepts.

Similar NVC Types:
- G598 Comanchian Barrens & Glade
- G569 North American Warm Semi-Desert Cliff, Scree & Pavement Sparse Vegetation
- G570 Intermountain Basins Cliff, Scree & Badland Sparse Vegetation
- G841 Central Midwest-Interior Cliff & Rock Vegetation
- G840 Appalachian Cliff & Rock Vegetation
- G839 Laurentian-Acadian-Great Lakes Cliff & Rock Vegetation
- G842 Southeast Coastal Plain Cliff & Rock Vegetation
- G565 Rocky Mountain Cliff, Scree & Rock Vegetation

Diagnostic Characteristics: This group is characterized by sparse vegetation (generally less than 10% cover) on rock outcrops in the Great Plains.

VEGETATION

Physiognomy and Structure: Examples of this group have sparse vegetation. The most abundant species at a site tend to be small trees, shrubs, or grasses but can be forbs in a few cases. Trees and shrubs are typically short, and mixedgrass species dominate the herbaceous stratum.

Floristics: This group has scattered vascular species found in cracks, depressions, or ledges in the bedrock where some soil can accumulate. Dominant species vary greatly depending on geology of the bedrock, climate, aspect, slope, and slope position. Common trees and shrubs are *Juniperus monosperma* (in the southwest), *Juniperus scopulorum* (in the west), *Juniperus virginiana* (in the east and north), *Artemisia longifolia, Cercocarpus montanus*, and *Rhus trilobata*. Common grasses include *Bouteloua eriopoda* (in the southwest), *Bouteloua gracilis, Calamovilfa longifolia*, and *Schizachyrium scoparium*. Forbs tend not to be as abundant as woody vegetation and grasses but are scattered. *Eriogonum* spp., *Gutierrezia sarothrae*, and *Opuntia* spp. are typical. Nonvascular species, especially lichens, can be very common on exposed rock.

ENVIRONMENT & DYNAMICS

Environmental Description: Sites in this group have significant exposure of bedrock. The bedrock can be vertical, sloping, or horizontal along rivers, at the tops of buttes, in dry canyons, or, rarely, large, low bedrock outcrops. The bedrock is usually sedimentary (sandstone, limestone, shale, gypsum, siltstone), but an area of quartzite outcrops in southwestern Minnesota is included in this group. Soil development is usually limited to cracks, ledges, or depressions in the bedrock.

Dynamics: Drought and erosion, both from wind and water, are important in maintaining sites in this group.

DISTRIBUTION

Geographic Range: This group is found in the Great Plains from near the U.S.-Canadian border south to northern Texas and from the Rocky Mountain foothills to southwestern Minnesota, eastern Kansas and possibly northwestern Iowa and Missouri. The granitic, igneous, and metamorphic formations in the Black Hills and nearby are not included in this group.

Spatial Scale & Pattern [optional]: Small patch
Nations: CA, US
States/Provinces: CO, IA?, KS, MB, MN, MO?, MT, ND, NE, NM, OK, SD, TX, WY
TNC Ecoregions [optional]: 26:C, 27:C, 28:C, 33:C, 34:C, 35:C, 36:C, 37:P, 66:P, 67:P
USFS Ecoregions (2007): 251B:CC, 251C:C?, 251E:CP, 251F:CC, 251H:CC, 315A:CC, 315B:CC, 315F:CC, 331B:CC, 331C:CC, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 331K:CP, 331L:CC, 331M:CC, 331N:CC, 332A:CP, 332B:CC, 332C:CC, 332D:CC, 332E:CP, 332F:CC, 342F:PP, M313B:PP, M331B:PP, M331F:PP, M331I:PP
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Alliances:
- A3981 Great Plains Acidic Cliff Alliance
- A3982 Great Plains Acidic Rock Outcrop Alliance
- A3980 Great Plains Alkaline Cliff Alliance

AUTHORSHIP

Primary Concept Source: S. Menard and K. Kindscher, in Faber-Langendoen et al. (2011)
Author of Description: J. Drake
Acknowledgments:
Version Date: 05/08/2015
Classif Resp Region: Midwest
Internal Author: JD 12-10, 5-15

REFERENCES

References: Comer et al. 2003, Faber-Langendoen et al. 2017a, MNNHP 1993

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6. Open Rock Vegetation
6.B.1.Na. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation
G567. Great Plains Cliff, Scree & Rock Vegetation

A3981. Great Plains Acidic Cliff Alliance

Type Concept Sentence: This alliance consists of sparsely vegetated bluffs and cliffs of sandstone or siltstone in the central and northern Great Plains.

OVERVIEW

Scientific Name: Great Plains Acidic Cliff Alliance
Common Name (Translated Scientific Name): Great Plains Acidic Cliff Alliance
Colloquial Name: Great Plains Acidic Cliff

Type Concept: This alliance consists of sparsely vegetated bluffs and cliffs of sandstone or siltstone in the central and northern Great Plains. Vascular floristic diversity is low. Forbs such as *Mentzelia decapetala* and *Penstemon glaber* tend to be more abundant than other lifeforms. Scattered shrubs, such as *Rhus trilobata* and *Cercocarpus montanus*, and grasses, such as *Pseudoroegneria spicata* and *Bouteloua gracilis*, which are more common in the surrounding grasslands and shrub communities can also occur. In general, slopes in this alliance are steep to vertical but small areas with gentle slopes or flat ledges can occur. Soils are absent or poorly developed and limited to cracks or ledges.

Classification Comments: This alliance is defined more by substrate and environmental condition (steep, acidic, rocky slopes) than by floristics. The vegetation of these sites is not well-described. Information on nonvascular species would probably be important in characterizing this alliance.

Internal Comments:
Other Comments:

Similar NVC Types:
- A3982 Great Plains Acidic Rock Outcrop Alliance: has less steep slopes and often has more pockets of soil development and plants.

Diagnostic Characteristics: This alliance consists of sparsely vegetated (generally <10% vascular plant cover) bluffs and cliffs of sandstone or siltstone in the central and northern Great Plains.

VEGETATION

Physiognomy and Structure: Vascular plant cover is <10% in examples of this alliance, though plants often have >10% cover in small, localized ledges and cliffs where soil has accumulated. Short shrubs and grasses can be present but forbs are typically the most abundant vascular lifeform.

Floristics: Vascular floristic diversity is low. Forbs such as *Mentzelia decapetala* and *Penstemon glaber* tend to be more abundant than other lifeforms. Scattered shrubs, such as *Rhus trilobata* and *Cercocarpus montanus*, and grasses, such as *Pseudoroegneria spicata* and *Bouteloua gracilis*, which are more common in the surrounding grasslands and shrub communities can also occur.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs where acidic bedrock is exposed in cliffs and bluffs. The substrate is usually sandstone but can be siltstone. Slopes are steep to vertical and there is little to no soil development. Soil that does develop or accumulate is on gently sloping or flat ledges and in cracks. These are small and localized.

Dynamics: The general lack of soil and steep slopes create very harsh conditions for plant growth and maintain stands of this alliance. Fire does not carry through this alliance, so shrubs and trees can persist, if they can find pockets of soil and survive the generally xeric conditions.

DISTRIBUTION

Geographic Range: This alliance occurs largely in the western Great Plains from western Kansas to western North Dakota and possibly southeastern Montana. Scattered occurrences may be found into eastern Kansas and Nebraska.

Nations: US
States/Provinces: CO?, KS, MT?, ND, NE, SD, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL005257 Sandstone Great Plains Dry Cliff Sparse Vegetation
- CEGL002297 Sandstone Butte Sparse Vegetation
- CEGL002290 Sandstone Great Plains Xeric Butte - Bluff Sparse Vegetation

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Faber-Langendoen et al. 2017b, Rolfsmeier and Steinauer 2010

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6. Open Rock Vegetation
6.B.1.Na. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation
G567. Great Plains Cliff, Scree & Rock Vegetation

A3982. Great Plains Acidic Rock Outcrop Alliance

Type Concept Sentence: This alliance consists of sparsely vegetated, flat to moderately sloping outcrops of acidic bedrock in the central and northern Great Plains with one disjunct site in central Wisconsin.

OVERVIEW

Scientific Name: Great Plains Acidic Rock Outcrop Alliance
Common Name (Translated Scientific Name): Great Plains Acidic Rock Outcrop Alliance
Colloquial Name: Great Plains Acidic Rock Outcrop

Type Concept: This alliance consists of outcrops of acidic bedrock in the central and northern Great Plains with one disjunct site in central Wisconsin. Species vary widely across the range of this alliance but typically consist of Great Plains taxa that can tolerate the shallow, dry soils. Total vegetation cover is sparse across the outcrops but can be moderate or even dense in small pockets where soil accumulates. Substrate varies from granite and quartzite (in Minnesota and Wisconsin) to siltstone, sandstone, shale, and even pockets of gypsum. The outcrops are generally flat to moderately sloping but soil development is limited to cracks or depressions.

Classification Comments: This alliance is defined more by substrate and environmental condition (relatively flat, acidic, rocky slopes) than by floristics. The vegetation of these sites is not well-described, with the exception of Quartzite - Granite Rock Outcrop Sparse Vegetation (CEGL002298) in Minnesota and Wisconsin. The Wisconsin stands lack many of the Great Plains species and, although on a similar substrate, may warrant being placed in a separate association.

Internal Comments:
Other Comments:

Similar NVC Types:
- A3981 Great Plains Acidic Cliff Alliance: has steeper slopes and fewer areas of soil development and plants.

Diagnostic Characteristics: This alliance consists of outcrops of acidic bedrock in the central and northern Great Plains with one disjunct site in central Wisconsin. Occurrences may contain areas of steep slopes but are not characterized by the steep slopes of cliffs and bluffs.

VEGETATION

Physiognomy and Structure: There is little vegetation on most examples of this alliance. Scattered short shrubs <1 m tall and short grasses and forbs generally <0.5 m tall occur where pockets of soil have accumulated.

Floristics: This alliance has little vegetation cover but a variety of species can be found, depending on the surrounding vegetation. Species of the nearby tallgrass or mixedgrass prairies can be found in cracks and depressions where soil has collected. Forbs can include *Oenothera caespitosa, Opuntia* spp., *Selaginella rupestris*, and *Phemeranthus parviflorus (= Talinum parviflorum)*. In Nebraska, Astragalus spatulatus, Cryptantha cana, Ericameria parryi var. howardii, Paronychia jamesii, Paronychia sessiliflora, Penstemon eriantherus, Penstemon glaber, Phlox hoodii, Stephanomeria runcinata, and *Tetraneuris acaulis* are considered diagnostic of this alliance.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs where acidic bedrock is exposed in flat to moderately sloping outcrops. This can be irregularly eroded escarpments or ravines or even ridgetops. The substrate is usually sandstone but can be siltstone. Slopes are not steep over entire stands but there is little to no soil development. Soil that does develop or accumulate is on gently sloping or flat ledges and in cracks. These are small and localized.

Dynamics: The general lack of soil and sloping nature of many sites create very harsh conditions for plant growth and maintain stands of this alliance. Fire does not carry through this alliance, so shrubs and trees can persist, if they can find pockets of soil and survive the generally xeric conditions. In Minnesota and Wisconsin, where precipitation is higher and evaporation lower, rain can collect in small depressions on generally flat outcrops and may allow the formation of ephemeral wetlands (Minnesota DNR 2010).

DISTRIBUTION

Geographic Range: This alliance is found from the central Great Plains in Kansas and Nebraska to southwestern Minnesota, southern Manitoba, and eastern Wyoming. There is one disjunct area in central Wisconsin currently grouped with this alliance but with somewhat different floristics.

Nations: CA, US
States/Provinces: KS, MB, MN, ND, NE, SD, WI, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **=** Crystalline Bedrock Outcrop (Prairie) Type [ROs12a] (Minnesota DNR 2010b)

LOWER LEVEL UNITS

Associations:
- CEGL002298 Quartzite - Granite Rock Outcrop Sparse Vegetation
- CEGL005261 Redbeds (Siltstone, Sandstone, Gypsum) Sparse Vegetation
- CEGL002294 Shale Barren Slopes Sparse Vegetation
- CEGL002047 Siltstone - Sandstone Rock Outcrop Sparse Vegetation

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Anderson 1999b, Faber-Langendoen et al. 2017b, Minnesota DNR 2010b, Rolfsmeier and Steinauer 2010, Younkin 1970

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6. Open Rock Vegetation
6.B.1.Na. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation
G567. Great Plains Cliff, Scree & Rock Vegetation

A3980. Great Plains Alkaline Cliff Alliance

Type Concept Sentence: This alliance consists of sparsely vegetated bluffs and cliffs of limestone or dolostone in the central and northern Great Plains.

OVERVIEW

Scientific Name: Great Plains Alkaline Cliff Alliance
Common Name (Translated Scientific Name): Great Plains Alkaline Cliff Alliance
Colloquial Name: Great Plains Alkaline Cliff

Type Concept: This alliance consists of sparsely vegetated bluffs and cliffs of limestone or dolostone in the central and northern Great Plains. Species vary from site to site but may include the shrubs *Rhus trilobata* and *Rosa arkansana*, the forbs *Mentzelia decapetala, Eriogonum pauciflorum, Gutierrezia sarothrae*, and the grasses *Schizachyrium scoparium* and *Achnatherum hymenoides*. Soils are generally absent or poorly developed or limited to cracks and ledges.

Classification Comments: This alliance is defined more by substrate and environmental condition (steep, alkaline, rocky slopes) than by floristics. The vegetation of these sites is not well-described.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: This alliance consists of sparsely vegetated bluffs and cliffs of limestone or dolostone in the central and northern Great Plains.

VEGETATION

Physiognomy and Structure: Vascular plant cover is <10% in examples of this alliance, though plants often have >10% cover in small, localized ledges and cliffs where soil has accumulated. Short shrubs and grasses can be present but forbs are typically the most abundant vascular lifeform.

Floristics: Species vary from site to site but may include the shrubs *Rhus trilobata* and *Rosa arkansana*, the forbs *Mentzelia decapetala, Eriogonum pauciflorum, Gutierrezia sarothrae*, and the grasses *Schizachyrium scoparium* and *Achnatherum hymenoides*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs where alkaline bedrock is exposed in cliffs and bluffs. The substrate is limestone or dolostones. Slopes are steep to vertical and there is little to no soil development. Soil that does develop or accumulate is on gently sloping or flat ledges and in cracks. These are small and localized.

Dynamics: The general lack of soil and steep slopes create very harsh conditions for plant growth and maintain stands of this alliance. Fire does not carry through this alliance, so shrubs and trees can persist, if they can find pockets of soil and survive the generally xeric conditions.

DISTRIBUTION

Geographic Range: This alliance occurs in the central and northern Great Plains from Kansas and eastern Nebraska to eastern Wyoming and western North Dakota.

Nations: US
States/Provinces: KS, ND, NE, SD, WY

TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL002296 Limestone Butte Sparse Vegetation
- CEGL002046 Limestone - Dolostone Great Plains Xeric Cliff Sparse Vegetation

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Faber-Langendoen et al. 2017b

M115. Great Plains Badlands Vegetation

This badlands macrogroup is found in the northern Great Plains where erodible parent material is dissected into dry, sparsely vegetated, generally steep slopes, usually above rivers or perennial or intermittent streams. The dominant vegetation is a mix of shrubs, forbs, and grasses with each dominating some areas.

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6. Open Rock Vegetation
6.B.1.Na. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation
6.B.1.Na.3.a. M115 Great Plains Badlands Vegetation

G566. Great Plains Badlands Vegetation

Type Concept Sentence: This group is relatively distinct from others due to the sparse vegetation and unique substrate within the Northern Great Plains. Sites with vegetation cover near the cut-off between sparse vegetation and vegetated types could be confusing as could patches with higher vegetation cover within a badlands area.

OVERVIEW

Scientific Name: *Sarcobatus vermiculatus / Eriogonum pauciflorum - Gutierrezia sarothrae* Badlands Group
Common Name (Translated Scientific Name): Greasewood / Few-flower Buckwheat - Broom Snakeweed Badlands Group
Colloquial Name: Hooker's Sandwort Barrens

Type Concept: This group includes badlands vegetation in the Northern Great Plains of the United States and Canada. Examples are found on slopes of easily erodible clay and poorly consolidated shale interspersed with sandstone, lignite lenses, and occasional scoria outcrops. Vegetation cover is typically sparse but can be moderate in small areas with shallower slopes. The dominant vegetation is a mix of shrubs, forbs and grasses with each dominating some areas. There is typically zonation of vegetation from the top of a slope to the bottom with different groups of species most common in certain zones. Typical species found in Great Plains badlands are *Sarcobatus vermiculatus, Atriplex* spp., *Artemisia longifolia, Artemisia tridentata, Gutierrezia sarothrae, Eriogonum pauciflorum*, and *Pseudoroegneria spicata*.

Classification Comments: This group is relatively distinct from others due to the sparse vegetation and unique substrate within the Northern Great Plains. Sites with vegetation cover near the cut-off between sparse vegetation and vegetated types could be confusing.

Similar NVC Types:

Diagnostic Characteristics: Examples are found on relatively unique sites with sparse vegetation, badlands topography, and badlands parent material.

VEGETATION

Physiognomy and Structure: Great Plains Badlands are typically sparsely vegetated (<10% total vegetation cover). The sloping, eroding sites, lack of soil development, and lack of available moisture for plants limits the species that can grow. Small areas with shallower slopes, including step-in-slopes, toeslopes, etc., may have moderate vegetation cover. Dominant plants are usually shrubs and forbs, though grasses can dominate some areas. Dominant plants rarely grow more than about 1 m tall.

Floristics: Dominant species can be shrubs, grasses or forbs. Common shrubs include *Sarcobatus vermiculatus, Artemisia tridentata, Atriplex confertifolia*, and *Ericameria nauseosa*; common grasses include *Achnatherum hymenoides, Pseudoroegneria spicata*, and *Pascopyrum smithii* (on more mesic sites); common forbs include *Arenaria hookeri, Artemisia longifolia, Eriogonum pauciflorum, Gutierrezia sarothrae*, and *Grindelia squarrosa*.

ENVIRONMENT & DYNAMICS

Environmental Description: A combination of factors, such as elevation, rainfall, carving action of streams and parent material, can contribute to the development of this group. Sites that harbor it are primarily a type of mature dissection with finely textured drainage patterns and steep slopes. This group contains extremely dry and easily erodible, consolidated clayey soils with bands of sandstone or isolated consolidates. This group is found within an arid to semi-arid climate with infrequent, but torrential, rains that cause erosion.

Dynamics: Examples of this group are affected by erosion and drought.

DISTRIBUTION

Geographic Range: This group is found in the Northern Great Plains region of the United States and Canada with some of the best developed examples in western North Dakota, southwestern South Dakota, and southeastern Montana.

Spatial Scale & Pattern [optional]: Large patch
Nations: CA, US
States/Provinces: AB, CO, MB?, MT, ND, NE, SD, SK, WY
TNC Ecoregions [optional]: 26:C
USFS Ecoregions (2007): 331E:CP, 331F:CC, 331G:CC, 331K:CC, 331L:CC, 331M:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Badlands, Theodore Roosevelt)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Alliances:
- A3979 *Eriogonum pauciflorum - Gutierrezia sarothrae* Badlands Alliance
- A3978 *Sarcobatus vermiculatus* Great Plains Badlands Alliance
- A1642 *Arenaria hookeri* Rock Alliance
- A1874 *Artemisia longifolia* Badlands Alliance

AUTHORSHIP

Primary Concept Source: S. Menard and K. Kindscher, in Faber-Langendoen et al. (2011)
Author of Description: J. Drake
Acknowledgments:
Version Date: 01/03/2011
Classif Resp Region: Midwest
Internal Author: JD 12-10, 5-15

REFERENCES

References: Brown 1971, Comer et al. 2003, Faber-Langendoen et al. 2017a

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6. Open Rock Vegetation
6.B.1.Na. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation
G566. Great Plains Badlands Vegetation

A1642. Arenaria hookeri Rock Alliance

Type Concept Sentence: This alliance is known from northeastern Colorado on hot, dry sites such as exposed siltstone barrens and ravines on convex slopes where erosion is active and moisture penetration is minimal. Stands have a sparse, short herbaceous layer of mostly perennial, mat-forming cushion plants, particularly *Arenaria hookeri*, and a few grasses.

OVERVIEW

Scientific Name: *Arenaria hookeri* Rock Alliance
Common Name (Translated Scientific Name): Hooker's Sandwort Rock Alliance
Colloquial Name: Hooker's Sandwort Barrens

Type Concept: Stands of this alliance have a sparse, short herbaceous layer of mostly perennial, mat-forming cushion plants and a few grasses. These vegetation mats are surrounded by bare ground. These perennials are very drought-tolerant. The diagnostic cushion plant is the perennial forb *Arenaria hookeri*. Other characteristic plants include *Astragalus gilviflorus, Astragalus sericoleucus, Astragalus spatulatus, Comandra umbellata, Ipomopsis spicata, Oenothera flava, Penstemon* spp., and *Phlox hoodii*. The characteristic graminoid is the medium-tall bunchgrass *Achnatherum hymenoides (= Oryzopsis hymenoides)*. Wet springs bring an abundance of cool-season annuals. Common annuals include *Vulpia octoflora* and *Plantago patagonica*. Vegetation in this alliance has been described from the Pawnee National Grasslands in northeastern Colorado at elevations between 1300 and 1935 m. Stands are restricted to hot, dry sites such as exposed siltstone barrens and ravines on convex slopes where erosion is active and moisture penetration is minimal. Soils are shallow with little development, fine-textured and often gravelly.

Classification Comments: These stands likely have less than 25% canopy cover and may be better classified in a sparsely vegetated herbaceous alliance. Little stand cover data are available to describe this alliance. More survey and sampling is needed.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Sparsely vegetated slopes on siltstone or clay with cushion plants, particularly *Arenaria hookeri*, dominant.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a very sparse to sparse perennial forb layer of low cushion plants. Sparse perennial grasses may be present. Annual grasses and forbs are seasonally present to abundant.

Floristics: Stands have a sparse herbaceous layer less than 0.5 m tall that is vegetated mostly with perennial, mat-forming cushion plants and a few grasses. These vegetation mats are surrounded by bare ground. These perennials are very drought-tolerant. The diagnostic cushion plant is the perennial forb *Arenaria hookeri*. Other characteristic plants include *Astragalus gilviflorus, Astragalus sericoleucus, Astragalus spatulatus, Comandra umbellata, Ipomopsis spicata, Oenothera flava, Penstemon* spp., and *Phlox hoodii*. The characteristic graminoid is the medium-tall bunchgrass *Achnatherum hymenoides (= Oryzopsis hymenoides)*. Wet springs bring an abundance of cool-season annuals. Common annuals include *Vulpia octoflora* and *Plantago patagonica*.

ENVIRONMENT & DYNAMICS

Environmental Description: Vegetation included in this alliance occurs on barren clay and siltstone outcrops in the shortgrass steppe of northeastern Colorado at elevations between 1300 and 1935 m. Climate is semi-arid, continental with mean annual precipitation between 25 and 35 cm. Stands are restricted to hot, dry sites such as exposed siltstone barrens and ravines (Hazlett 1998). Soils are shallow with little development, fine-textured and often gravelly. Badaracco (1971) described stands on exposed Brule clays especially on convex slopes where erosion is active and moisture penetration is minimal. In Nebraska, a similar community is found in the badlands where substrates "are largely clays and marls, which absorb little storm water, and are subject to excessive erosion" (Pound and Clements 1900). Adjacent vegetation is shortgrass steppe dominated by *Bouteloua gracilis* and *Bouteloua dactyloides*, or possibly a more mesic midgrass stand dominated by *Schizachyrium scoparium, Pascopyrum smithii*, or *Bouteloua gracilis* at the foot of the slope.

Dynamics: The harsh environmental conditions allow only drought-tolerant perennials and annual plants to survive. Most perennials are low, deep tap-rooted cushion plants.

DISTRIBUTION

Geographic Range: This alliance occurs on siltstone and clay breaks in the shortgrass steppe of northeastern Colorado and possibly the badlands of Nebraska. It likely occurs in other neighboring states where geologic substrates are similar.

Nations: US
States/Provinces: CO, NE?, WY?
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** Clay barrens (Badaracco 1971)
- **?** Mat formation of buttes and cliffs (Pound and Clements 1900)
- **?** Siltstone barren (Hazlett 1998)

LOWER LEVEL UNITS

Associations:
- CEGL001951 *Arenaria hookeri* Barrens Vegetation

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Badaracco 1971, Faber-Langendoen et al. 2017b, Hazlett 1998, Moran 1981a, Pound and Clements 1900

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6. Open Rock Vegetation
6.B.1.Na. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation
G566. Great Plains Badlands Vegetation

A1874. Artemisia longifolia Badlands Alliance

Type Concept Sentence: This vegetation is known from badlands in the northwestern Great Plains on moderately to steeply sloping acid-shale barrens and clay with sparse to moderate cover by forbs, especially *Artemisia longifolia* with *Eriogonum pauciflorum* sometimes codominating.

OVERVIEW

Scientific Name: *Artemisia longifolia* Badlands Alliance
Common Name (Translated Scientific Name): Longleaf Wormwood Badlands Alliance
Colloquial Name: Longleaf Wormwood Badlands

Type Concept: This vegetation is known from badlands in the northwestern Great Plains on acid-shale barrens and clay slopes. The vegetation layer is usually sparse (<10% cover) but may range up to 20%. It is less than 1 m tall and is dominated by the perennial forb *Artemisia longifolia* with *Eriogonum pauciflorum* sometimes codominating. Scattered graminoids and other forbs are also typically present and may include *Achnatherum hymenoides (= Oryzopsis hymenoides), Calamagrostis montanensis, Calamovilfa longifolia, Gutierrezia sarothrae, Schizachyrium scoparium, Solidago missouriensis, Stellaria media*, and *Thermopsis rhombifolia*. Scattered *Rosa arkansana* shrubs are often present. Stands occur on dry scree slopes, as well as acid-shale barrens. Sites are common on moderate to steep, highly eroded slopes with southern and western aspects. Substrates may be deep but are poorly developed, fine-textured soils.

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:
- A3979 *Eriogonum pauciflorum - Gutierrezia sarothrae* Badlands Alliance

Diagnostic Characteristics: This alliance is characterized by sparse to open vegetation on badland slopes dominated by *Artemisia longifolia*.

VEGETATION

Physiognomy and Structure: Stands have a sparse layer of perennial forbs to 0.8 m tall. Scattered perennial graminoids and occasional shrubs may also be present.

Floristics: The sparse vegetation layer is less than 1 m tall and is dominated by the perennial forb *Artemisia longifolia* with *Eriogonum pauciflorum* sometimes codominating. Scattered graminoids and other forbs are also typically present and may include *Achnatherum hymenoides (= Oryzopsis hymenoides), Calamagrostis montanensis, Calamovilfa longifolia, Schizachyrium scoparium, Solidago missouriensis, Stellaria media*, and *Thermopsis rhombifolia*. Occasional *Rosa arkansana* shrubs are often present.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands included in this minor alliance are found in the northwestern Great Plains on acid-shale barrens. This vegetation is known from badlands in the northwestern Great Plains. Elevation in Montana is approximately 1000 m. The climate is semi-arid, temperate continental. Mean annual precipitation is approximately 32 cm. Two-thirds of the annual precipitation occurs in the spring and early summer. Stands occur on dry scree slopes and acid-shale barrens. Sites are common on moderate to steep, highly eroded slopes with southern and western aspects. Substrate may be deep, but are poorly develop, fine-textured soils derived from acidic marine shales (pH <5). Because of a large coarse fraction of shale fragments, these soils may be better drained than expected (DeVelice et al. 1995).

Dynamics:

DISTRIBUTION

Geographic Range: Stands in this sparsely vegetated alliance occur in badlands in the northwestern Great Plains in Montana, Wyoming, North Dakota, and South Dakota, and adjacent Canada.

Nations: CA, US
States/Provinces: AB, MT, ND, SD, SK?, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Artemisia longifolia / Oryzopsis hymenoides* Community Type (DeVelice et al. 1995)
- **?** shale barren communities (Harvey 1982)
- **?** shale barren communities (Jorgensen 1979)

LOWER LEVEL UNITS

Associations:

- CEGL002195 *Artemisia longifolia* Badlands Sparse Vegetation
- CEGL001521 *Artemisia longifolia - Calamovilfa longifolia* Sparse Vegetation

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: DeVelice et al. 1995, Faber-Langendoen et al. 2017b, Harvey 1982, Jorgensen 1979

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6. Open Rock Vegetation
6.B.1.Na. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation
G566. Great Plains Badlands Vegetation

A3979. Eriogonum pauciflorum - Gutierrezia sarothrae Badlands Alliance

Type Concept Sentence: This alliance contains sparsely vegetated, forb-dominated communities on badland landscapes in the northwestern Great Plains on clays, shales, and poorly consolidated sandstones or conglomerates or on the colluvial slopes at the base of such slopes. Rapid erosion prevents the development of soils and this along with the arid climate limit vegetation development to 1-10% cover. Consistent species in this alliance are *Eriogonum pauciflorum* and *Gutierrezia sarothrae*.

OVERVIEW

Scientific Name: *Eriogonum pauciflorum - Gutierrezia sarothrae* Badlands Alliance
Common Name (Translated Scientific Name): Few-flower Buckwheat - Broom Snakeweed Badlands Alliance
Colloquial Name: Few-flower Buckwheat - Broom Snakeweed Badlands

Type Concept: This alliance contains sparsely vegetated, forb-dominated communities on badland landscapes in the northwestern Great Plains. Total vegetation cover is generally nearly absent to sparse (1-10% cover). Consistent species in this alliance are *Eriogonum pauciflorum* and *Gutierrezia sarothrae*. Other species possible are *Atriplex argentea, Cryptantha thyrsiflora, Opuntia polyacantha*, and the forb *Grindelia squarrosa*. *Atriplex canescens* dwarf-shrubs may be observed throughout the type but are typically short-statured and scattered in distribution. These communities occur on clays, shales, and poorly consolidated sandstones or conglomerates or on the colluvial slopes at the base of such slopes, all of which are easily eroded by wind and water. The rapid erosion prevents the development of soils and this along with the arid climate limit vegetation development.

Classification Comments:

Internal Comments: MSR 1-16: CO? added.
Other Comments:

Similar NVC Types: This alliance has some similarities to *Artemisia longifolia* Badlands Alliance (A1874). While there is species overlap between the two, this alliance lacks significant *Artemisia longifolia* and tends to occur on less steep sites.
- A1874 *Artemisia longifolia* Badlands Alliance: is usually dominated by *Artemisia longifolia* and tends to occur on steeper slopes.

Diagnostic Characteristics: Stands in this alliance occur on badlands formed from easily erodible clays, shales, and poorly consolidated sedimentary rocks. Vegetation is sparse and typically dominated by *Eriogonum pauciflorum* and *Gutierrezia sarothrae*.

VEGETATION

Physiognomy and Structure: Vegetation in this alliance is sparse (1-10% cover) and composed chiefly of short to medium-tall forbs.

Floristics: Total vegetation cover is generally nearly absent to sparse (1-10% cover). Consistent species in this alliance are *Eriogonum pauciflorum* and *Gutierrezia sarothrae*. Other species possible are *Atriplex argentea, Cryptantha thyrsiflora, Opuntia polyacantha*, and the forb *Grindelia squarrosa*. *Atriplex canescens* dwarf-shrubs may be observed throughout the type but are typically short-statured and scattered in distribution.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands of this alliance occur on clays, shales, and poorly consolidated sandstones or conglomerates or on the colluvial slopes at the base of such slopes, all of which are easily eroded by wind and water. The rapid erosion prevents the development of soils and this along with the arid climate limit vegetation development. Slopes are usually moderate.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is found in the northwestern Great Plains of the United States and adjacent Canada.

Nations: CA, US
States/Provinces: CO?, MT, ND, NE, SD, SK, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL002050 Eroding Great Plains Badlands Sparse Vegetation
- CEGL005270 *Eriogonum pauciflorum - Gutierrezia sarothrae* Badlands Sparse Vegetation

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)

Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Faber-Langendoen et al. 2017b

6. Open Rock Vegetation
6.B.1.Na. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation
G566. Great Plains Badlands Vegetation

A3978. Sarcobatus vermiculatus Great Plains Badlands Alliance

Type Concept Sentence: This greasewood alliance is found in the Badlands regions of the northwestern Great Plains on weakly consolidated sedimentary rocks, where eroded slopes contain interbedded clay and silt shales. Stands have a sparse to moderate woody layer (15-40% cover) dominated by the deciduous, facultative halophytic shrub *Sarcobatus vermiculatus*.

OVERVIEW

Scientific Name: *Sarcobatus vermiculatus* Great Plains Badlands Alliance
Common Name (Translated Scientific Name): Greasewood Great Plains Badlands Alliance
Colloquial Name: Great Plains Greasewood Badlands

Type Concept: This greasewood alliance is found in the Badlands regions of the northwestern Great Plains. Stands have a sparse to moderate woody layer (15-40% cover) dominated by the deciduous, facultative halophytic shrub *Sarcobatus vermiculatus*. Other characteristic shrubs and dwarf-shrubs include *Artemisia tridentata, Atriplex canescens, Ericameria nauseosa (= Chrysothamnus nauseosus)*, and *Gutierrezia sarothrae*. The herbaceous layer ranges from absent to moderately sparse cover (<25%) of scattered tall and medium-tall bunchgrasses, such as *Pseudoroegneria spicata, Achnatherum hymenoides (= Oryzopsis hymenoides)*, and the sod grass *Bouteloua gracilis*. Annual grasses, especially the exotic *Bromus tectorum* and *Bromus arvensis (= Bromus japonicus)*, may be present. Forbs are sparse, except on disturbed, weedy sites. Forb species may include *Eriogonum pauciflorum, Suaeda calceoliformis*, or *Sphaeralcea coccinea*. Occasionally, cacti such as *Opuntia fragilis* or *Opuntia polyacantha* may also be present. Stands are found on weakly consolidated sedimentary rocks, where eroded slopes contain interbedded clay and silt shales. Slopes range from 0-80%, and average about 35-40%, with a southwest- to southeast-facing aspect. A thin, highly saline crust 1-5 cm in depth may form on the surface. Soil pH is around 8.0.

Classification Comments: This alliance contains just one association (CEGL001367) at present. Other *Sarcobatus vermiculatus*-dominated communities that occur near CEGL001367 are associated with intermittent wetlands/riparian zones. The boundary between the lower parts of this alliance and the higher parts of those communities needs better delineation.

Internal Comments: MSR 1-16: CO? added.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Shrub-dominated stands on eroded badlands habitat in the western Great Plains. Total vegetation cover ranges from sparse to moderate and *Sarcobatus vermiculatus* is the dominant shrub.

VEGETATION

Physiognomy and Structure: Vegetation in this alliance in composed of a sparse to moderate (15-40% cover) woody layer dominated by deciduous shrubs 0.5-1.5 m tall. The herbaceous layer ranges from absent to moderately sparse (0-25%) and is largely medium-tall bunch grasses.

Floristics: Stands have a sparse to moderate woody layer (15-40% cover) dominated by the deciduous, facultative halophytic shrub *Sarcobatus vermiculatus*. Other characteristic shrubs and dwarf-shrubs include *Artemisia tridentata, Atriplex canescens, Ericameria nauseosa (= Chrysothamnus nauseosus)*, and *Gutierrezia sarothrae*. The herbaceous layer ranges from absent to moderately sparse cover (<25%) of scattered tall and medium-tall bunchgrasses, such as *Pseudoroegneria spicata, Achnatherum hymenoides (= Oryzopsis hymenoides)*, and the sod grass *Bouteloua gracilis*. Annual grasses, especially the exotic *Bromus tectorum* and *Bromus arvensis (= Bromus japonicus)*, may be present. Forbs are sparse, except on disturbed, weedy sites. Forb species may include *Eriogonum pauciflorum, Suaeda calceoliformis*, or *Sphaeralcea coccinea*. Occasionally, cacti such as *Opuntia fragilis* or *Opuntia polyacantha* may also be present.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands are found on weakly consolidated sedimentary rocks, where eroded slopes contain interbedded clay and silt shales. Slopes range from 0-80%, and average about 35-40%, with a southwest- to southeast-facing aspect. A thin, highly saline crust 1-5 cm in depth may form on the surface (Brown 1971). Soil pH is around 8.0.

Dynamics:

DISTRIBUTION

Geographic Range: This community is found in the badlands regions of southeastern Montana and western South Dakota, and possibly in northeastern Wyoming and western North Dakota.

Nations: US
States/Provinces: CO?, MT, ND, SD, WY?
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** *Sarcobatus vermiculatus/Agropyron spicatum* Habitat Type (Hansen et al. 1988a)
- **><** *Sarcobatus vermiculatus* Series (Johnston 1987)

LOWER LEVEL UNITS

Associations:
- CEGL001367 *Sarcobatus vermiculatus / Pseudoroegneria spicata* Shrubland

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Brown 1971, Faber-Langendoen et al. 2017b, Hansen 1985, Hansen and Hoffman 1988, Hansen et al. 1988a, Johnston 1987

6.B.1.Nb. Western North American Temperate & Boreal Cliff, Scree & Rock Vegetation

This division is characterized by the vegetation of rocky or rock-like habitats, including outcrops, cliffs, talus, or scree, in low- to mid-elevation, temperate and boreal climatic areas of western North America. Cryptogam vegetation tends to dominate, with vascular plants species of low cover.

M887. Western North American Cliff, Scree & Rock Vegetation

This sparsely vegetated rock outcrop and cliff face macrogroup is found in temperate and boreal climates, on the Alaska peninsula and Aleutian Islands, boreal Alaska and Yukon Territory, the Coast Mountains of British Columbia, in Washington and northwestern Oregon. Stands include patchy vegetated fractures in the rock surface and less steep or more stable slopes that are composed of scattered trees and/or shrubs. Mosses or lichens may be very dense, well-developed and display cover well over 10%.

6. Open Rock Vegetation
6.B.1.Nb. Western North American Temperate & Boreal Cliff, Scree & Rock Vegetation
6.B.1.Nb.1.a. M887 Western North American Cliff, Scree & Rock Vegetation

G563. Californian Cliff, Scree & Rock Vegetation

Type Concept Sentence: This cliff, scree and rock vegetation is scattered across California's Coast, Transverse, and Peninsular ranges, Klamath Mountains, southern Sierra Nevada, and the northern coast of Baja California.

OVERVIEW

Scientific Name: *Pinus contorta var. murrayana / Ceanothus megacarpus - Cercocarpus montanus var. minutiflorus* Cliff, Scree & Rock Vegetation Group
Common Name (Translated Scientific Name): Sierra Lodgepole Pine / Bigpod Ceanothus - Smooth Mountain-mahogany Cliff, Scree & Rock Vegetation Group
Colloquial Name: Jeffrey Pine / Bigberry Manzanita - Chaparral Whitethorn Sparse Shrubland

Type Concept: This group is scattered across California's Coast, Transverse, and Peninsular ranges, Klamath Mountains, southern Sierra Nevada, and the northern coast of Baja California. Sites include barren and sparsely vegetated areas of steep cliff faces, narrow canyons, smaller rock outcrops of various igneous, sedimentary, serpentinite, and metamorphic bedrock. This group also includes unstable scree and talus slopes typically occurring below cliff faces. Scattered vegetation may include trees such as *Pseudotsuga menziesii, Pinus contorta var. murrayana, Pinus ponderosa*, and *Pinus jeffreyi*. Shrubs may include *Ceanothus megacarpus, Ceanothus leucodermis, Cercocarpus montanus var. glaber (= Cercocarpus betuloides), Cercocarpus montanus var. minutiflorus (= Cercocarpus minutiflorus), Arctostaphylos glauca*, and *Xylococcus bicolor*. Soil development is limited as is herbaceous cover, but may include *Allium falcifolium, Allium cratericola, Streptanthus* spp., *Hesperolinon* spp., *Asclepias solanoana, Eriogonum ursinum, Eriogonum nudum, Eriogonum luteolum, Erigeron* spp., *Dudleya cymosa, Dudleya lanceolata, Lewisia rediviva, Pentagramma triangularis, Selaginella bigelovii, Bromus rubens, Vulpia* spp., and others. Moss and lichen can be well-developed, and needs better characterization.

Classification Comments: This type may overlap with Western North American Cliff, Scree & Rock Vegetation Macrogroup (M887), especially Southern Vancouverian Cliff, Scree & Rock Vegetation Group (G573). Further review is needed.

Similar NVC Types:
- G573 Southern Vancouverian Cliff, Scree & Rock Vegetation

Diagnostic Characteristics: This is a sparsely vegetated and barren group characterized by patchy vegetation that does not exceed 10% total cover. Species occupying these sites may be opportunistic and/or adapted to such conditions. Woody species may include *Pseudotsuga menziesii, Pinus contorta var. murrayana, Pinus ponderosa, Pinus jeffreyi, Ceanothus megacarpus, Ceanothus leucodermis, Cercocarpus montanus var. minutiflorus, Arctostaphylos glauca*, and *Xylococcus bicolor*. Soil development is limited as is herbaceous cover, but may include *Allium falcifolium, Allium cratericola, Streptanthus* spp., *Hesperolinon* spp., *Asclepias solanoana, Eriogonum ursinum, Eriogonum nudum, Eriogonum luteolum, Erigeron* spp., *Dudleya cymosa, Dudleya lanceolata, Lewisia rediviva, Pentagramma triangularis, Selaginella bigelovii, Bromus rubens, Vulpia* spp., and others. Moss and lichen can be well-developed.

VEGETATION

Physiognomy and Structure: Vegetation of the group is variable in physiognomy and structure due to harsh substrate conditions and exposure, but is composed of a patchy assemblage of needleleaf trees, broadleaf deciduous shrubs, and sporadic herbaceous cover.

Floristics: Scattered vegetation may include trees such as *Pseudotsuga menziesii, Pinus contorta var. murrayana, Pinus ponderosa*, and *Pinus jeffreyi*. Shrubs may include *Ceanothus megacarpus, Ceanothus leucodermis, Cercocarpus montanus var. minutiflorus (= Cercocarpus minutiflorus), Arctostaphylos glauca*, and *Xylococcus bicolor*. Herbaceous cover is limited but may include *Streptanthus* spp., *Hesperolinon* spp., *Allium falcifolium, Allium cratericola, Asclepias solanoana, Eriogonum ursinum, Eriogonum nudum, Eriogonum luteolum, Erigeron* spp., *Dudleya cymosa, Dudleya lanceolata, Lewisia rediviva, Pentagramma triangularis, Selaginella bigelovii, Bromus rubens, Vulpia* spp., and others. Moss and lichen can be well-developed, and needs better characterization.

ENVIRONMENT & DYNAMICS

Environmental Description: This group is known from California's Coast, Transverse, and Peninsular ranges, Klamath Mountains, southern Sierra Nevada, and the northern coast of Baja California. Sites include barren and sparsely vegetated areas of steep cliff faces, narrow canyons, smaller rock outcrops of various igneous, sedimentary, serpentinite, and metamorphic bedrock. This group also includes unstable scree and talus slopes typically occurring below cliff faces. *Soil/substrate/hydrology:* Soils are poorly developed, rocky, and loosely consolidated. Parent materials include igneous, sedimentary, serpentinite, and metamorphic bedrock and scree.

Dynamics: Poor, rocky, loosely consolidated soils help maintain stands of this group by limiting the establishment of species from adjacent communities. Not all serpentinite outcrops support distinct vegetation. Only those with very low Ca:Mg ratio impact biotic composition.

DISTRIBUTION

Geographic Range: This group is known from California's Coast, Transverse, and Peninsular ranges, Klamath Mountains, southern Sierra Nevada, and the northern coast of Baja California.

Spatial Scale & Pattern [optional]: Large patch, Small patch
Nations: MX, US
States/Provinces: CA, MXBC
TNC Ecoregions [optional]: 5:C, 12:C, 14:C, 15:C, 16:C
USFS Ecoregions (2007): 261B:PP, 262A:PP, 322C:PP, M261A:CC, M261B:CC, M261C:CC, M261D:CC, M261E:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Alliances:
- A3784 *Sedum spathulifolium* Sparse Rock Vegetation Alliance
- A3785 *Selaginella bigelovii* Rock Alliance
- A3782 *Pinus jeffreyi / Arctostaphylos glauca - Ceanothus leucodermis* Sparse Shrubland Alliance
- A4073 *Dudleya cymosa - Dudleya lanceolata* - Lichen/Moss Sparse Rock Vegetation Alliance
- A3783 *Allium* spp. - *Streptanthus* spp. - *Hesperolinon* spp. Serpentinite Sparse Rock Vegetation Alliance

AUTHORSHIP

Primary Concept Source: P. Comer and T. Keeler-Wolf, in Faber-Langendoen et al. (2011)
Author of Description: M.E. Hall and J. Evens
Acknowledgments: J. Evens
Version Date: 10/08/2014
Classif Resp Region: West
Internal Author: MEH 11-10, mod. DFL/JE 10-13, mod. DFL 10-14

REFERENCES

References: Barbour and Major 1988, Comer et al. 2003, Faber-Langendoen et al. 2017a, Holland and Keil 1995, Kittel et al. 2012a, Rodriguez et al. 2017, Sawyer and Keeler-Wolf 1995

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6. Open Rock Vegetation
6.B.1.Nb. Western North American Temperate & Boreal Cliff, Scree & Rock Vegetation
G563. Californian Cliff, Scree & Rock Vegetation

G565. Rocky Mountain Cliff, Scree & Rock Vegetation

Type Concept Sentence: This group consists of dry barren and sparsely vegetated rock outcrops and cliff faces of the Rocky Mountains and Cascade Range in North America, where there is often very high cover of nonvascular lichens and, in wetter places, mosses.

OVERVIEW

Scientific Name: Nonvascular Rocky Mountain Cliff, Scree & Rock Vegetation Group
Common Name (Translated Scientific Name): Nonvascular Rocky Mountain Cliff, Scree & Rock Vegetation Group
Colloquial Name: Rocky Mountain Indian-parsley - Rockspirea - Raspberry Cliff, Scree & Rock

Type Concept: This group consists of barren and sparsely vegetated rock outcrops and cliff faces located throughout the Rocky Mountains and northeastern Cascade Range in North America. These sparsely vegetated surfaces (generally <10% plant cover) are found from foothill to subalpine elevations on steep cliff faces, narrow canyons, and smaller rock outcrops of various igneous (intrusives), sedimentary, and metamorphic bedrock types. It also occurs on unstable scree and talus slopes that can occur below cliff faces. In general these are the dry, sparsely vegetated places. The biota reflects what is surrounding them, unless it is an extreme parent material. There is often very high cover of nonvascular lichens and, in wetter places, mosses. There may be small patches of dense vascular vegetation and can include scattered trees and/or shrubs. Characteristic trees include species from the surrounding landscape, such as *Pseudotsuga menziesii, Pinus ponderosa, Pinus flexilis, Populus tremuloides, Abies concolor, Abies lasiocarpa*, or *Pinus edulis* and *Juniperus* spp. at lower elevations. There may be scattered shrubs present, such as species of

Holodiscus, Ribes, Physocarpus, Rosa, Juniperus, and *Jamesia americana, Mahonia repens, Rhus trilobata*, or *Amelanchier alnifolia*. Soil development is limited, as is herbaceous cover. Characteristic nonvascular species information is not available

Classification Comments: Need moss and other nonvascular species information. Cliff, scree and rock vegetation in Alaska is placed into North Vancouverian Montane Bedrock, Cliff & Talus Vegetation Group (G318), Western North American Boreal Cliff & Rock Vegetation Group (G822), or North American Arctic Cliff, Scree & Rock Vegetation Group (G375).

Similar NVC Types:
- G569 North American Warm Semi-Desert Cliff, Scree & Pavement Sparse Vegetation
- G570 Intermountain Basins Cliff, Scree & Badland Sparse Vegetation
- G571 Rocky Mountain & Sierran Alpine Bedrock & Scree: occurs above treeline.
- G319 North Pacific Alpine-Subalpine Bedrock & Scree: occurs above treeline in the Pacific Northwest mountains.
- G567 Great Plains Cliff, Scree & Rock Vegetation
- G318 North Vancouverian Montane Bedrock, Cliff & Talus Vegetation: occurs in the Pacific Northwest mountains.

Diagnostic Characteristics: Dense covering of mosses and/or nonvasculars and sparse cover of herbaceous and woody vascular plants on exposed bedrock or talus.

VEGETATION

Physiognomy and Structure: Nonvascular, woody and herbaceous vascular plants.

Floristics: Herbaceous cover is limited. Characteristic trees include species from the surrounding landscape, such as *Pseudotsuga menziesii, Pinus ponderosa, Pinus flexilis, Populus tremuloides, Abies concolor, Abies lasiocarpa*, or *Pinus edulis* and *Juniperus* spp. at lower elevations. There may be scattered shrubs present, such as species of *Holodiscus, Ribes, Physocarpus, Rosa, Juniperus*, and *Jamesia americana, Mahonia repens, Rhus trilobata*, or *Amelanchier alnifolia*. Characteristic nonvascular species information is not available. Floristic information compiled from Hess and Wasser (1982), Andrews and Righter (1992), Ecosystem Working Group (1998), and Larson et al. (2000).

ENVIRONMENT & DYNAMICS

Environmental Description: *Climate:* Temperate. *Soil/substrate/hydrology:* Foothill to subalpine elevations on steep cliff faces, narrow canyons, and smaller rock outcrops of various igneous (intrusives), sedimentary, and metamorphic bedrock types. Also included are unstable scree and talus slopes that typically occur below cliff faces. In general these are the dry, sparsely vegetated places. Soil development is limited. Environmental information compiled from Hess and Wasser (1982), Andrews and Righter (1992), Ecosystem Working Group (1998), and Larson et al. (2000).

Dynamics:

DISTRIBUTION

Geographic Range: This group is located throughout the Rocky Mountain, including the isolated island ranges of central Montana, and northeastern Cascade Ranges in North America.

Spatial Scale & Pattern [optional]: Large patch
Nations: CA, US
States/Provinces: AB, AZ, BC, CO, ID, MT, NM, NV, OR, SD, UT, WA, WY
TNC Ecoregions [optional]: 7:C, 8:C, 9:C, 11:C, 20:C, 21:C, 25:C, 26:C, 68:C
USFS Ecoregions (2007): 313A:CC, 313B:CC, 313D:CC, 315A:CC, 315H:CC, 321A:CC, 331A:C?, 331B:CC, 331D:C?, 331G:CC, 331H:CC, 331I:CP, 331J:CC, 331K:CP, 331N:CP, 341A:CC, 341B:CC, 341C:CC, 341F:CC, 341G:CC, 342A:CP, 342B:CC, 342C:CC, 342D:CP, 342E:CC, 342F:CP, 342G:CP, 342H:CP, 342I:CP, 342J:CC, M242B:CP, M242C:CC, M242D:CC, M313A:CC, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M334A:CC, M341A:CC, M341B:CC, M341C:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Great Basin)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate. Need moss and other nonvascular species information.

SYNONYMY

- **<** CL Cliff (Ecosystems Working Group 1998)
- **<** RO Rock (Ecosystems Working Group 1998)
- **<** TA Talus (Ecosystems Working Group 1998)

LOWER LEVEL UNITS

Alliances:
- A3742 Black Hills Cliff, Scree & Rock Alliance
- A0556 *Picea engelmannii* Rock Alliance
- A3740 *Aletes anisatus - Holodiscus dumosus - Rubus idaeus* Cliff, Scree & Rock Alliance
- A4146 *Sullivantia hapemanii - Mimulus* spp. Wet Rock Alliance
- A3741 *Aquilegia flavescens - Phacelia hastata* Cliff, Scree & Rock Alliance

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2011)
Author of Description: G. Kittel and M.S. Reid
Acknowledgments:
Version Date: 12/21/2010
Classif Resp Region: West
Internal Author: GK 10-10, 12-15, mod. MSR 3-17

REFERENCES

References: Andrews and Righter 1992, Comer et al. 2003, Ecosystems Working Group 1998, Faber-Langendoen et al. 2017a, Hess and Wasser 1982, Larson et al. 2000a, NCC 2002, Neely et al. 2001, Peet 1981

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6. Open Rock Vegetation
6.B.1.Nb. Western North American Temperate & Boreal Cliff, Scree & Rock Vegetation
G565. Rocky Mountain Cliff, Scree & Rock Vegetation

A3740. Aletes anisatus - Holodiscus dumosus - Rubus idaeus Cliff, Scree & Rock Alliance

Type Concept Sentence: Sparsely vegetated areas dominated by various forbs and graminoids occupying cliffs, outcrops and scree areas of the Colorado and Wyoming Rocky Mountains in subalpine to alpine settings.

OVERVIEW

Scientific Name: *Aletes anisatus - Holodiscus dumosus - Rubus idaeus* Cliff, Scree & Rock Alliance
Common Name (Translated Scientific Name): Rocky Mountain Indian-parsley - Rockspirea - American Red Raspberry Cliff, Scree & Rock Alliance
Colloquial Name: Rocky Mountain Indian-parsley - Rockspirea - Raspberry Cliff, Scree & Rock

Type Concept: Associations within this alliance include sparsely vegetated areas of the Colorado and Wyoming Rocky Mountains in subalpine to alpine settings. Stands are typically herbaceous-dominated, although some are shrub-dominated. Due to the rocky substrate, total vegetation cover is typically sparse. Characteristic shrubs may include *Artemisia frigida, Chrysothamnus viscidiflorus, Holodiscus dumosus, Purshia tridentata, Rhus trilobata*, and *Ribes cereum*. The most consistent dominant herbaceous species include *Aletes anisatus, Aquilegia coerulea, Cirsium scopulorum, Claytonia megarhiza, Heuchera bracteata, Heuchera parvifolia*, and *Scutellaria brittonii*. Elevations range from 1800 to >3900 m. Stands occur in patches on rock ledges, scree and other steep slopes (20-100%). Substrates are shallow, rocky, rapidly drained, coarse-textured soils derived from various parent materials. Sites include windblown summits and ridges, scree and talus slopes, outcrops, and cliffs.

Classification Comments: The associations attributed here are done so based on geographic proximity and may not have much floristic overlap. More information is needed to fully describe and classify stands in this and other scree, gravel slide, and talus vegetation.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Characteristic of this alliance is perennial forb, shrub and graminoid vegetation of rock, scree and cliff areas of the Colorado and Wyoming Rocky Mountains. Sites have little to no soil development which promotes sparse vegetation cover. Most of the unvegetated surface is barren rock.

VEGETATION

Physiognomy and Structure: This alliance is characterized by a moderate cover of low-growing shrubs, perennial forbs and graminoids that grow in the crevices of rocks. Scattered trees are occasionally present as saplings from 1.5-3 m tall. The moss layer is sparse.

Floristics: Stands are typically herbaceous-dominated, although some are shrub-dominated. Due to the rocky substrate, total vegetation cover is typically sparse. Characteristic shrubs may include *Artemisia frigida, Chrysothamnus viscidiflorus, Holodiscus dumosus, Purshia tridentata, Rhus trilobata*, and *Ribes cereum*. The most consistent dominant herbaceous species include *Aletes anisatus, Aquilegia coerulea, Cirsium scopulorum, Claytonia megarhiza, Heuchera bracteata, Heuchera parvifolia*, and *Scutellaria brittonii*. Other herbaceous associates present may include *Aquilegia saximontana, Bouteloua gracilis, Bromus inermis var. pumpellianus (= Bromus pumpellianus), Carex geophila, Carex heteroneura, Cryptogramma acrostichoides, Cystopteris fragilis, Deschampsia cespitosa, Elymus elymoides, Elymus trachycaulus, Festuca arizonica, Festuca brachyphylla, Mertensia lanceolata, Muhlenbergia montana, Oreoxis alpina, Trisetum spicatum*, and *Viola biflora*. Scattered trees, such as *Juniperus scopulorum, Pinus contorta, Pinus edulis, Pinus flexilis, Pinus ponderosa*, and *Pseudotsuga menziesii*, are occasionally present as saplings from 1.5-3 m tall.

ENVIRONMENT & DYNAMICS

Environmental Description: Vegetation of this alliance occurs at elevations ranging from 1800 to >3900 m in the subalpine and alpine zones of the mountains of Colorado and Wyoming. The climate regime is continental, with long, cold winters and short summers with frequent afternoon thunderstorms. Strong westerly winds are common in the winter. Stands occur in patches on rock ledges, scree and other steep slopes (20-100%). Substrates are shallow, rocky, rapidly drained, coarse-textured soils derived from various parent materials. Sites include windblown summits and ridges, scree and talus slopes, outcrops, and cliffs. Soils are young and poorly developed due to low soil temperature, low soil moisture during the summer, and a short growing season.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is known from the Colorado and Wyoming Rocky Mountains.

Nations: US
States/Provinces: CO, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Claytonia megarhiza-Silene acaulis ssp. subacaulescens* habitat type (Komarkova 1986)
- **?** *Heucheretum bracteato-parvifoliae* Association (Komarkova 1976)
- **><** *Pseudocymopterus-Mentzelia-Chalicodium* Formation (Clements 1904)
- **?** *Sagino saginoidis-Claytonietum megarhizae* Association (Komarkova 1976)

LOWER LEVEL UNITS

Associations:

- CEGL001971 *Heuchera bracteata - Heuchera parvifolia var. nivalis* Rock Vegetation
- CEGL001938 *Aquilegia coerulea - Cirsium scopulorum* Scree Sparse Vegetation
- CEGL001878 *Claytonia megarhiza* Rock Vegetation
- CEGL009605 *Petrophyton caespitosum* Sparse Vegetation
- CEGL001134 *Rubus idaeus* Scree Shrubland
- CEGL002801 *Holodiscus dumosus* Rock Outcrop Sparse Vegetation
- CEGL001948 *Aletes anisatus - Scutellaria brittonii* Scree Vegetation

AUTHORSHIP

Primary Concept Source: M. Damm and K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Clements 1904, Faber-Langendoen et al. 2017b, Komarkova 1976, Komarkova 1986

A3741. Aquilegia flavescens - Phacelia hastata Cliff, Scree & Rock Alliance

Type Concept Sentence: Sparse cliff, scree and rock outcrop vegetation of the northern Rocky Mountains. The most common dominants include *Aquilegia flavescens, Penstemon ellipticus, Phacelia hastata* and *Senecio megacephalus*.

OVERVIEW

Scientific Name: *Aquilegia flavescens - Phacelia hastata* Cliff, Scree & Rock Alliance
Common Name (Translated Scientific Name): Yellow Columbine - Silverleaf Phacelia Cliff, Scree & Rock Alliance
Colloquial Name: Yellow Columbine - Silverleaf Phacelia Cliff, Scree & Rock

Type Concept: Sparse cliff, scree and rock outcrop vegetation of the northern Rocky Mountains. Structurally, vegetation is very open and characterized by the dominance of forbs, the most important species including *Aquilegia flavescens, Phacelia hastata, Penstemon ellipticus*, and *Senecio megacephalus*. Associated herbaceous species may include *Achillea millefolium, Aquilegia flavescens, Arenaria capillaris, Arnica x diversifolia, Castilleja miniata, Chamerion angustifolium (= Epilobium angustifolium), Cirsium hookerianum, Epilobium anagallidifolium (= Epilobium alpinum), Galium boreale, Minuartia nuttallii (= Arenaria nuttallii), Phacelia sericea, Potentilla diversifolia, Sedum lanceolatum, Senecio megacephalus, Stellaria americana, Symphyotrichum foliaceum (= Aster foliaceus)*, and *Valeriana sitchensis*. This subalpine to alpine community occurs from 1800 to 2400 m on steep to very steep (45-80%) talus slopes and scree fields spanning a range of exposures from east to primarily southwest (facing prevailing winds).

Classification Comments: The associations attributed here are done so based on geographic proximity and may not have much floristic overlap.

Internal Comments: MSR 11-14: alpine? Need to move out of here.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Sparse perennial forb-dominated vegetation of the subalpine and alpine zones of the northern Rocky Mountains occupying cliff, scree and rock outcrop areas. Sites have little to no soil development which promotes sparse vegetation cover. Most of the unvegetated surface is barren rock.

VEGETATION

Physiognomy and Structure: This alliance is characterized by a rock-dominated substrate and a sparse cover of moderately tall (<1 m) perennial herbs that grow in patches between the rocks. Moss cover is sparse.

Floristics: Structurally, vegetation is very open and characterized by the dominance of forbs, the most important species including *Aquilegia flavescens, Phacelia hastata, Penstemon ellipticus*, and *Senecio megacephalus*. Associated herbaceous species may include *Achillea millefolium, Aquilegia flavescens, Arenaria capillaris, Arnica x diversifolia, Castilleja miniata, Chamerion angustifolium (= Epilobium angustifolium), Cirsium hookerianum, Epilobium anagallidifolium (= Epilobium alpinum), Galium boreale, Minuartia nuttallii (= Arenaria nuttallii), Phacelia sericea, Potentilla diversifolia, Sedum lanceolatum, Senecio megacephalus, Stellaria americana, Symphyotrichum foliaceum (= Aster foliaceus)*, and *Valeriana sitchensis*. *Elymus alaskanus ssp. latiglumis (= Agropyron latiglume)* is the only characteristic graminoid. Mosses and lichens usually comprise less than 1% canopy cover.

ENVIRONMENT & DYNAMICS

Environmental Description: The climate regime of this alliance is continental, with long, cold winters and short summers with frequent afternoon thunderstorms. Strong westerly winds are common in the winter. Stands occur between 1800 and 2400 m elevation on all aspects of gentle to very steep (45-80%) talus slopes and scree fields. The ground is covered with small- to large-sized boulders that are snow-covered in winter. The boulders provide protection from the wind and an increased moisture supply to the vegetation. Precipitation that falls on the boulders concentrates in the crevices between the rocks creating mesic microsites suitable for the vegetation in the alliance. Stands also occur among the krummholz, where the stunted trees may provide similar sheltered sites. Soils are young and poorly developed due to low soil temperature, low soil moisture during the summer, and a short growing season.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is currently only known from Waterton - Glacier National International Peace Park in Alberta and Montana.

Nations: CA, US
States/Provinces: AB, MT

TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL005901 *Phacelia hastata - (Penstemon ellipticus)* Sparse Vegetation
- CEGL005899 *Aquilegia flavescens - Senecio megacephalus* Sparse Vegetation

AUTHORSHIP

Primary Concept Source: M. Damm, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Faber-Langendoen et al. 2017b

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6. Open Rock Vegetation
6.B.1.Nb. Western North American Temperate & Boreal Cliff, Scree & Rock Vegetation
G565. Rocky Mountain Cliff, Scree & Rock Vegetation

A3742. Black Hills Cliff, Scree & Rock Alliance

Type Concept Sentence: This alliance is characterized by sparsely vegetated rock, cliff and scree areas of the Black Hills. Vegetation is dominated by widely spaced woody species of trees and shrubs.

OVERVIEW

Scientific Name: Black Hills Cliff, Scree & Rock Alliance
Common Name (Translated Scientific Name): Black Hills Cliff, Scree & Rock Alliance
Colloquial Name: Black Hills Cliff, Scree & Rock

Type Concept: This alliance is characterized by sparsely vegetated rock, cliff and scree areas of the Black Hills. Vegetation is dominated by widely spaced woody species of trees and shrubs. Common dominant trees include *Pinus ponderosa* and *Juniperus scopulorum*. *Arctostaphylos uva-ursi* and *Juniperus communis* are the most common dwarf-shrub species. Depending on the site, ferns, forbs or graminoids may dominate the sparse herbaceous layer. Common dominants include *Achillea millefolium, Carex inops ssp. heliophila, Campanula rotundifolia*, and *Woodsia oregana*. Few vascular plants grow in this community, although lichens are common. Stands occur on volcanic cones, buttes, large rock outcrops (greater than 20 m vertical relief) and hills or small mountains with large rock exposures on multiple sides. There is little soil development; what soil there is can be found in cracks and depressions in the rock surface.

Classification Comments: Very little floristic information has been compiled regarding associations attributed here.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Sparsely vegetated rocky areas of the Black Hills. Vegetation is highly variable and may be composed of *Pinus ponderosa* in association with other widely spaced shrubs, forbs and graminoids.

VEGETATION

Physiognomy and Structure: This alliance is characterized by widely spaced woody species of needle- and scale-leaved evergreen trees and broad-leaved deciduous shrubs.

Floristics: Vegetation is dominated by widely spaced woody species of trees and shrubs. Common dominant trees include *Pinus ponderosa* and *Juniperus scopulorum*. *Arctostaphylos uva-ursi* and *Juniperus communis* are the most common dwarf-shrub species.

Depending on the site, ferns, forbs or graminoids may dominate the sparse herbaceous layer. Common dominants include *Achillea millefolium, Carex inops ssp. heliophila, Campanula rotundifolia*, and *Woodsia oregana*. Few vascular plants grow in this community, although lichens are common.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands occur on volcanic cones, buttes, large rock outcrops (greater than 20 m vertical relief) and hills or small mountains with large rock exposures on multiple sides. Slopes range from none (flat) to steep. There is little soil development; what soil there is can be found in cracks and depressions in the rock surface. Substrates include igneous and metamorphic rock types (e.g., granites, slates, phonolite porphyry).

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is currently known from the Black Hills in South Dakota.

Nations: US
States/Provinces: SD
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL002295 Granite - Metamorphic Black Hills Rock Outcrop Sparse Vegetation
- CEGL005283 Igneous - Metamorphic Black Hills Butte Sparse Vegetation
- CEGL002307 Scree - Talus Black Hills Sparse Vegetation

AUTHORSHIP

Primary Concept Source: D. Faber-Langendoen, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: Faber-Langendoen et al. 2017b

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6. Open Rock Vegetation
6.B.1.Nb. Western North American Temperate & Boreal Cliff, Scree & Rock Vegetation
G565. Rocky Mountain Cliff, Scree & Rock Vegetation

A0556. Picea engelmannii Rock Alliance

Type Concept Sentence: These wooded scree communities are characterized by *Picea engelmannii* as the dominant mature tree species and occur on steep slopes of any exposure in the southern Rocky Mountains of southern Colorado and northern New Mexico.

OVERVIEW

Scientific Name: *Picea engelmannii* Rock Alliance
Common Name (Translated Scientific Name): Engelmann Spruce Rock Alliance
Colloquial Name: Engelmann Spruce Wooded Scree

Type Concept: These wooded screes are characterized by *Picea engelmannii* as the dominant mature tree species. The trees are typically widely spaced and rarely reach over 20% cover. A few other trees can occur, usually as seedlings and saplings, including *Abies lasiocarpa, Pinus flexilis*, or *Populus tremuloides*. The shrub layer, also very sparse, can include *Jamesia americana, Juniperus communis, Ribes montigenum*, and *Ribes wolfii*. The herbaceous component is nearly unnoticeable, as plants typically are found only in crevices in the talus where small amounts of soil may have accumulated. Species can include *Carex rossii, Festuca brachyphylla, Koeleria macrantha, Saxifraga bronchialis, Sedum lanceolatum*, and *Senecio atratus*. These wooded scree communities occur on steep slopes of any exposure in the southern Rocky Mountains of southern Colorado and northern New Mexico. Differences in rock

size and rates of movement cause heterogeneity in the development of vegetation. Elevations are upper montane to subalpine, ranging from about 3000 to 3600 m. Winter snowfall comprises the major portion of annual precipitation in this region. Melting snow can be held within the rocky matrix of these scree slopes, providing greater moisture-holding capacity than at first appearance. Slopes of these screes are typically greater than 50%. Greater than 80% of the substrate is composed of coarse rock fragments, with mineral soils confined to pockets.

Classification Comments: Scree and talus slopes with sparse vegetation have been poorly sampled and classified in the West. Undoubtedly there are coniferous tree-dominated communities in mountainous areas throughout the West occurring on talus, such as in this alliance. Also, several other wooded scree associations (e.g., dominated by *Abies lasiocarpa, Abies concolor, Pinus aristata, Pinus ponderosa*, and *Pseudotsuga menziesii*, and others) have been mentioned in the literature (Pfister et al. 1977, DeVelice et al. 1986, Fitzhugh et al. 1987), and are currently placed into their respective woodland alliances. Without more quantitative data for these scree communities, it is difficult to judge their proper classification and placement in the hierarchy. Wooded screes should be reviewed, and most probably belong in the Sparse Vegetation Class in the USNVC.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Needle-leaved evergreen sparsely vegetated scree slopes of the southern Rocky Mountains where *Picea engelmannii* is the dominant species but typically not exceeding 20% cover.

VEGETATION

Physiognomy and Structure: The primary feature of this alliance is its occurrence on semi-stabilized talus slopes. These are very open woodlands dominated by needle-leaved evergreen trees up to 30 m in height and of only sparse cover (5-20%). There is a very sparse layer of short shrubs, primarily of scale-leaved evergreen species, although some cold-deciduous species may be present. There are very few forbs or graminoids present in most stands, typically found in crevices in the rocks where small amounts of soil may have accumulated. Total cover is characteristically less than 10%, although some stands may be somewhat higher.

Floristics: These wooded screes are characterized by *Picea engelmannii* as the dominant mature tree species. The trees are typically widely spaced and rarely reach over 20% cover. A few other trees can occur, usually as seedlings and saplings, including *Abies lasiocarpa, Pinus flexilis*, or *Populus tremuloides*. The shrub layer, also very sparse, can include *Jamesia americana, Juniperus communis, Ribes montigenum*, and *Ribes wolfii*. The herbaceous component is nearly unnoticeable, as plants typically are found only in crevices in the talus where small amounts of soil may have accumulated. Species can include *Carex rossii, Festuca brachyphylla, Koeleria macrantha, Saxifraga bronchialis, Sedum lanceolatum*, and *Senecio atratus*.

ENVIRONMENT & DYNAMICS

Environmental Description: These wooded scree communities occur on steep slopes of any exposure in the southern Rocky Mountains of southern Colorado and northern New Mexico. Elevations are upper montane to subalpine, ranging from about 3000 to 3600 m. Winter snowfall comprises the major portion of annual precipitation in this region, although summer monsoon rain events contribute as well. Maximum snowfall accumulations range from 5 m in northern New Mexico to over 13 m in the San Juan Mountains. Melting snow can be held within the rocky matrix of these scree slopes, providing greater moisture-holding capacity than at first appearance. Slopes of these screes are typically greater than 50% (24°). Greater than 80% of the substrate is composed of coarse rock fragments, with mineral soils confined to pockets (DeVelice et al. 1986). Differences in rock size and rates of movement cause heterogeneity in the development of vegetation (Pfister et al. 1977).

Dynamics: Vegetation on scree slopes reaches a quasi-equilibrium with the shifting substrate. Differences in rock size and rates of movement cause heterogeneity in the development of vegetation (Pfister et al. 1977), and there is a corresponding variability in species composition from one slope to another. The instability of the substrate leads to lack of soil development and slow regeneration of trees. Why some screes are dominated by *Picea engelmannii* and others by *Abies lasiocarpa* (or other conifers) is not documented in the literature.

DISTRIBUTION

Geographic Range: This woodland alliance is presently known only from the mountains of southern Colorado and northern New Mexico. It is probable that it occurs elsewhere in the Rocky Mountain cordillera.

Nations: US
States/Provinces: CO, NM
TNC Ecoregions [optional]:
USFS Ecoregions (2007):

Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Picea engelmannii* Series (DeVelice et al. 1986) [Scree Forests and Habitat Types]

LOWER LEVEL UNITS

Associations:

- CEGL000893 *Picea engelmannii / Saxifraga bronchialis* Scree Sparse Vegetation

AUTHORSHIP

Primary Concept Source: M.S. Reid, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/09/26

REFERENCES

References: DeVelice et al. 1986, Faber-Langendoen et al. 2017b, Fitzhugh et al. 1987, Pfister et al. 1977

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6. Open Rock Vegetation
6.B.1.Nb. Western North American Temperate & Boreal Cliff, Scree & Rock Vegetation
G565. Rocky Mountain Cliff, Scree & Rock Vegetation

A4146. Sullivantia hapemanii - Mimulus spp. Wet Rock Alliance [Low - Poorly Documented]

Type Concept Sentence: These are seepage areas along vertical rockfaces, vertical to sloped rockwalls at the base of waterfalls, and large rocks and boulders kept wet by spray from nearby turbulent waterflow (e.g., cascading streamflow or churning of plunge pools at the base of waterfalls). They have a water regime ranging from seasonally to perennially wet but a minimum duration of wetness is needed to maintain these communities. This alliance is found in montane to alpine regions of the Rocky Mountain cordillera, from southern New Mexico north into Montana, Idaho, northeast Washington, Alberta and British Columbia, and west into the lower elevations and mountain ranges within the Intermountain West region.

OVERVIEW

Scientific Name: *Sullivantia hapemanii - Mimulus* spp. Wet Rock Alliance
Common Name (Translated Scientific Name): Hapeman's Coolwort - Monkeyflower species Wet Rock Alliance
Colloquial Name: Rocky Mountain-Great Basin Wet Cliff & Spray Zone

Type Concept: These are seepage areas along vertical rockfaces, vertical to sloped rockwalls at the base of waterfalls, and large rocks and boulders kept wet by spray from nearby turbulent waterflow (e.g., cascading streamflow or churning of plunge pools at the base of waterfalls). They have a water regime ranging from seasonally to perennially wet but a minimum duration of wetness is needed to maintain these communities. Generally they are freshwater but water chemistry and pH can vary according to local bedrock. These are wet surfaces that range from nearly unvegetated to supporting mats of mosses and liverworts that in turn may support vascular plants and invertebrates. These areas are sometimes called "hanging gardens," or "vertical wetlands." This alliance is found in montane to alpine regions of the Rocky Mountain cordillera, from southern New Mexico north into Montana, Idaho, northeast Washington, Alberta and British Columbia, and west into the lower elevations and mountain ranges within the Intermountain West region.

Classification Comments: These habitats have not been well-studied. The types and diversity of nonvascular and vascular plant communities are not well-known. Abiotic variation such as pH, water chemistry, shading effects, microclimatic effects, etc. are also understudied.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics:

VEGETATION

Physiognomy and Structure:

Floristics:

ENVIRONMENT & DYNAMICS

Environmental Description:

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is found in montane to alpine regions of the Rocky Mountain cordillera, from southern New Mexico north into Montana, Idaho, northeast Washington, Alberta and British Columbia, and west into the lower elevations and mountain ranges within the Intermountain West region.

Nations: CA, US
States/Provinces: AB, BC, CO, ID, MT, NM, NV, UT, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL005509 *Sullivantia hapemanii - Mimulus* spp. Wet Rock Vegetation

AUTHORSHIP

Primary Concept Source: J. Rocchio, in Faber-Langendoen et al. (2014)
Author of Description: J. Rocchio
Acknowledgments:
Version Date: 2014/12/13

REFERENCES

References: Christy 2012, Faber-Langendoen et al. 2017b

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6. Open Rock Vegetation
6.B.1.Nb. Western North American Temperate & Boreal Cliff, Scree & Rock Vegetation
6.B.1.Nb.1.c. M887 Western North American Cliff, Scree & Rock Vegetation

G573. Southern Vancouverian Cliff, Scree & Rock Vegetation

Type Concept Sentence: This group is found on steep slopes, cliff faces, and rock outcrops, where the vegetation is highly variable, sparse and scattered, and dominated by mosses and lichens, and occasionally woody species. It occurs in the eastern Cascades, subalpine elevations of the Sierra Nevada, and the Klamath Mountains.

OVERVIEW

Scientific Name: *Pinus monticola / Arctostaphylos nevadensis* Vancouverian Cliff, Scree & Rock Vegetation Group
Common Name (Translated Scientific Name): Western White Pine / Pinemat Manzanita Cliff, Scree & Rock Vegetation Group
Colloquial Name: Lemmon's Needlegrass - Dense Rock Moss Sparse Cliff, Bald & Outcrop

Type Concept: This group is known from the Wenatchee Mountains in the east Cascades, subalpine elevations throughout the Sierra Nevada, and Klamath Mountains. Sites include steep slopes, steep cliff faces, narrow canyons, and rock outcrops. Substrates include thin rocky, ultramafic (peridotite, serpentinite) soils in the Cascades, and unstable scree below cliff faces in the Sierra Nevada and Klamath Range. Parent materials are derived from various igneous, sedimentary, and metamorphic bedrock. Vegetation is highly variable and typically sparse and scattered, varying from areas dominated by mosses and lichens to occasional closed forests in the Cascades. Species in the Cascades may include *Pseudotsuga menziesii, Pinus ponderosa*, and *Pinus monticola* trees with a sparse ground cover with *Aspidotis densa, Arctostaphylos nevadensis*, and *Pseudoroegneria spicata* at low-elevation sites. Higher elevations have *Pinus contorta var. latifolia, Pinus albicaulis, Abies lasiocarpa*, and *Tsuga mertensiana* with *Juniperus communis, Ledum glandulosum, Vaccinium scoparium, Poa curtifolia*, and *Festuca viridula*. Scattered vegetation in the Sierra Nevada and Klamath Mountains may include *Abies magnifica, Pseudotsuga menziesii, Pinus contorta var. murrayana, Pinus ponderosa, Pinus jeffreyi,*

Populus tremuloides, or *Pinus monophylla, Juniperus osteosperma*, and *Cercocarpus ledifolius* at lower elevations. There may be shrubs, including species of *Arctostaphylos* or *Ceanothus*. Soil development is limited as is herbaceous cover.

Classification Comments: This group (G573) and North Vancouverian Montane Bedrock, Cliff & Talus Vegetation Group (G318) both represent Vancouverian cliff, scree and rock vegetation. They are distinguished as northern and southern analogs; this group being the latter. However, more work is required to delineate a more accurate geographic distribution between the two. This group, as well as other lithomorphic types of vegetation, may be better defined by nonvascular species. However, insufficient information is available to validate this possibility.

Similar NVC Types:
- G563 Californian Cliff, Scree & Rock Vegetation

Diagnostic Characteristics: Sparsely vegetated to rarely forested mixed shrub and tree vegetation occupying cliffs, steep cliff faces, bald ridgetops and shoulder outcrops, narrow canyons, smaller rock outcrops and scree slopes of the Sierra Nevada, Cascade Range and Klamath Mountains. The importance of nonvascular species such as mosses and lichens are one of the defining characteristics which distinguish this group from surrounding shrub or treed groups.

VEGETATION

Physiognomy and Structure: Highly variable structure and physiognomy ranging from sparse woody vegetation consisting of open tree and shrub strata or exclusively shrubs to closed canopy forests. Herbs contribute little cover.

Floristics: Vegetation is highly variable and typically sparse and scattered with occasional closed forests in the Cascades. Species in the Cascades may include *Pseudotsuga menziesii, Pinus ponderosa*, and *Pinus monticola* trees with a sparse ground cover with *Aspidotis densa, Arctostaphylos nevadensis*, and *Pseudoroegneria spicata* at low-elevation sites. Higher elevations have *Pinus contorta var. latifolia, Pinus albicaulis, Abies lasiocarpa*, and *Tsuga mertensiana* with *Juniperus communis, Ledum glandulosum, Vaccinium scoparium, Poa curtifolia*, and *Festuca viridula*. Vegetation in the Sierra Nevada and Klamath Mountains may include *Abies magnifica, Pseudotsuga menziesii, Pinus contorta var. murrayana, Pinus ponderosa, Pinus jeffreyi, Populus tremuloides*, or *Pinus monophylla, Juniperus osteosperma*, and *Cercocarpus ledifolius* at lower elevations. There may be shrubs, including species of *Arctostaphylos* or *Ceanothus*. Herbaceous cover is limited.

ENVIRONMENT & DYNAMICS

Environmental Description: This group is known from the Wenatchee Mountains in the east Cascades, subalpine elevations throughout the Sierra Nevada, and Klamath Mountains. Sites include steep slopes, steep cliff faces, narrow canyons, and rock outcrops. *Soil/substrate/hydrology:* Substrates include thin rocky, ultramafic (peridotite, serpentinite) soils in the Cascades, and unstable scree below cliff faces in the Sierra Nevada and Klamath Mountains. Parent materials are derived from various igneous, sedimentary, and metamorphic bedrock. Soil development is limited.

Dynamics: Poor soil development, high levels of exposure and steep sites impede the establishment of species from surrounding communities and maintain occurrences of this group.

DISTRIBUTION

Geographic Range: This group is known from the Wenatchee Mountains in the east Cascades, subalpine elevations throughout the Sierra Nevada, and Klamath Mountains.

Spatial Scale & Pattern [optional]: Small patch, Large patch
Nations: CA, US
States/Provinces: CA, OR
TNC Ecoregions [optional]: 3:P, 4:C, 5:C, 12:C, 81:C
USFS Ecoregions (2007): 322A:??, 341D:CC, 341E:CC, 341F:CC, 342B:CC, M242A:CC, M242B:C?, M242C:CP, M242D:CP, M261A:CC, M261B:CC, M261D:CC, M261E:CC, M261F:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Alliances:

- A3788 *Aspidotis densa - Poa curtifolia* Serpentine Rock Vegetation Alliance
- A3789 *Rhodiola integrifolia - Penstemon newberryi* Rock Alliance
- A3787 *Achnatherum lemmonii - Racomitrium ericoides* Sparse Rock Vegetation Alliance

AUTHORSHIP

Primary Concept Source: R. Crawford and T. Keeler-Wolf, in Faber-Langendoen et al. (2011)
Author of Description: M.E. Hall
Acknowledgments: D. Meidinger, J. Sawyer
Version Date: 09/09/2013
Classif Resp Region: West
Internal Author: MEH 10-10, 9-13, mod. GK 12-15

REFERENCES

References: Barbour and Major 1988, Barbour et al. 2007a, Comer et al. 2003, Faber-Langendoen et al. 2017a, Holland and Keil 1995, Kruckeberg 1984, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, del Moral 1982

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6. Open Rock Vegetation
6.B.1.Nb. Western North American Temperate & Boreal Cliff, Scree & Rock Vegetation
G573. Southern Vancouverian Cliff, Scree & Rock Vegetation

G318. North Vancouverian Montane Bedrock, Cliff & Talus Vegetation

Type Concept Sentence: This group consists of sparsely vegetated rock outcrops and cliff faces from Alaska south into northern California. It occurs as small patches of dense vegetation, typically scattered trees and/or shrubs, such as trees *Abies* spp., *Callitropsis nootkatensis, Pseudotsuga menziesii* (not in Alaska), *Thuja plicata*, or *Tsuga* spp., and shrubs *Acer circinatum, Alnus viridis*, and *Ribes* spp.; mosses or lichens may be very dense.

OVERVIEW

Scientific Name: North Vancouverian Montane Bedrock, Cliff & Talus Vegetation Group
Common Name (Translated Scientific Name): North Vancouverian Montane Bedrock, Cliff & Talus Vegetation Group
Colloquial Name: Steller's Alpine Speedwell - Coiled Sedge Sparse Rock & Talus Vegetation

Type Concept: This group consists of sparsely vegetated rock outcrops and cliff faces where fractures in the rock surface and colluvial slopes may be occupied by small patches of dense vegetation, typically scattered trees and/or shrubs. This group is found on the Alaska Peninsula and Aleutian Islands, Coast Mountains of British Columbia, as well as in the Cascade Range in Washington and Oregon, south to just inside northern California. Characteristic trees include *Abies* spp., *Callitropsis nootkatensis (= Chamaecyparis nootkatensis), Pseudotsuga menziesii* (not in Alaska), *Thuja plicata*, or *Tsuga* spp. There may be scattered shrubs present, such as *Acer circinatum, Alnus viridis*, and *Ribes* spp. Soil development is limited as is herbaceous cover. Mosses or lichens may be very dense, well-developed and display cover well over 10%. Substrates include active volcanic areas dominated by ash, pyroclastic deposits, lava, landslides and other exposed bare mineral and rock of various igneous, sedimentary, and metamorphic bedrock types. Periodic eruptions and earthquakes are the primary processes maintaining a primarily barren environment. Decades of inactivity slowly provide opportunity for vegetation development as primary successional stages. Elevation ranges from foothill to subalpine, and includes steep cliff faces, narrow canyons, larger rock outcrops, unstable scree and talus slopes. The dominant process is the extreme growing conditions created by exposed rock or unstable slopes, with drought becoming more of an issue in the southern part of the range. Alaskan montane rock and talus is not drought-limited.

Classification Comments: Need information on moss and other nonvascular species.

Similar NVC Types:
- G571 Rocky Mountain & Sierran Alpine Bedrock & Scree: occurs above treeline.
- G319 North Pacific Alpine-Subalpine Bedrock & Scree: occurs above treeline in the Pacific Northwest mountains.
- G565 Rocky Mountain Cliff, Scree & Rock Vegetation

Diagnostic Characteristics: Greater than 10% dense covering of mosses and/or nonvascular plants and sparse cover of herbaceous and woody vascular plants on exposed bedrock or talus.

VEGETATION

Physiognomy and Structure: Dense patches of moss and nonvascular cover and sparse herbaceous and woody vascular plant cover.

Floristics: Scattered, stunted characteristic trees include *Abies* spp., *Callitropsis nootkatensis (= Chamaecyparis nootkatensis)* (not southern range), *Pseudotsuga menziesii* (not in Alaska), *Pinus contorta, Thuja plicata*, or *Tsuga* spp., and the broadleaf tree species *Arbutus menziesii* and *Quercus garryana*. There may be scattered shrubs as well, such as *Arctostaphylos columbiana, Arctostaphylos uva-ursi, Rosa gymnocarpa, Holodiscus discolor, Acer circinatum, Alnus viridis*, and *Ribes* spp. Herbaceous cover is limited and may include species such as *Selaginella wallacei, Polypodium glycyrrhiza, Cryptogramma acrostichoides*, and graminoids such as *Festuca idahoensis ssp. roemeri (= Festuca roemeri), Danthonia* spp., *Koeleria macrantha*, and forbs such as *Collinsia parviflora, Eriophyllum lanatum, Heuchera glabra, Heuchera micrantha, Phlox diffusa, Saxifraga ferruginea, Saxifraga rufidula*, and *Sedum spathulifolium*. Mosses or lichens may be very dense, well-developed and display cover well over 10%. *Racomitrium* spp., *Polytrichum juniperinum, Dicranum scoparium, Amphidium lapponicum, Cladina portentosa*, and *Cystocoleus ebeneus* are characteristic mosses and lichens in the Georgia Basin. Characteristic moss and nonvascular species information is not available.

ENVIRONMENT & DYNAMICS

Environmental Description: *Soil/substrate/hydrology:* Substrates include active volcanic areas dominated by ash, pyroclastic deposits, lava, landslides and other exposed bare mineral and rock of various igneous, sedimentary, and metamorphic bedrock types. Periodic eruptions and earthquakes are the primary processes maintaining a primarily barren environment. Decades of inactivity slowly provide opportunity for vegetation development. Elevation ranges from foothill to subalpine and includes steep cliff faces, narrow canyons, larger rock outcrops, stable scree and talus slopes. The dominant process is substrate drought, especially farther south in its distribution, and other extreme growing conditions created by exposed rock or unstable slopes typically associated with steep slopes. Soil development is limited.

Dynamics:

DISTRIBUTION

Geographic Range: This group consists of sparsely vegetated rock outcrops and cliff faces found on the Alaska Peninsula and Aleutian Islands, Coast Mountains of British Columbia, as well as in the Cascade Range of Washington and Oregon, south to just inside northern California (Mount Lassen and Mount Shasta, but does not include the Sierra Nevada or Klamath Mountains).

Spatial Scale & Pattern [optional]: Matrix, Large patch, Small patch
Nations: CA, US
States/Provinces: AK, BC, CA, OR, WA
TNC Ecoregions [optional]: 1:C, 2:C, 3:C, 4:C, 5:P, 69:C, 70:C, 72:C, 73:C, 81:C
USFS Ecoregions (2007): 242A:CC, 242B:C?, 342D:C?, 342H:CP, 342I:CC, M242A:CC, M242B:C?, M242C:CC, M242D:CP, M261A:CC, M261D:CP
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low. Need moss and other nonvascular species information.

SYNONYMY

LOWER LEVEL UNITS

Alliances:
- A3779 North Pacific Nonvascular Rock Vegetation Alliance
- A4145 *Sullivantia oregana - Adiantum pedatum* Wet Rock Alliance
- A3778 *Veronica wormskjoldii var. stelleri - Carex circinata* Sparse Rock Vegetation Alliance

AUTHORSHIP

Primary Concept Source: Crawford et al., in Faber-Langendoen et al. (2011)
Author of Description: R. Crawford, G. Kittel, M.S. Reid, C. Cadrin
Acknowledgments: C. Cadrin
Version Date: 11/09/2015
Classif Resp Region: West
Internal Author: GK 10-10, 11-15, mod. C. Cadrin

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References: British Columbia Conservation Foundation and Wildlife Inventory Section 1991, Faber-Langendoen et al. 2017a, Kuramoto 1968, Madrone Consultants Ltd. 1999, Madrone Environmental Services 2008, McPhee et al. 2000, Milko 1984, Sawyer and Keeler-Wolf 1995, Stacey 2013, Ward et al. 1998, Wildlife Inventory Section 2000

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