

# Field Key to Ecological Systems and Target Alliances of Map Zones 29 and 30 (Northwestern Great Plains) United States

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## Introduction

The following keys to NatureServe ecological systems and selected US-NVC vegetation alliances cover the areas found in NLCD map zones 29 and 30 (eastern Wyoming, eastern Montana and east into the western Dakotas). The systems and alliances included in these keys are intended to represent the legend that LANDFIRE will be striving to map for existing vegetation (Figure 1). Some types are in the keys that characteristically occur at small spatial scales (generally <2 ha in size) and hence may not be mappable by the LANDFIRE project. However, we have chosen to be inclusive in the keys, so that the user will have information on these system types for comparison purposes. In some cases they may be important for modeling fire condition class and, given their relative distinctiveness on the landscape, they may indeed be mappable.

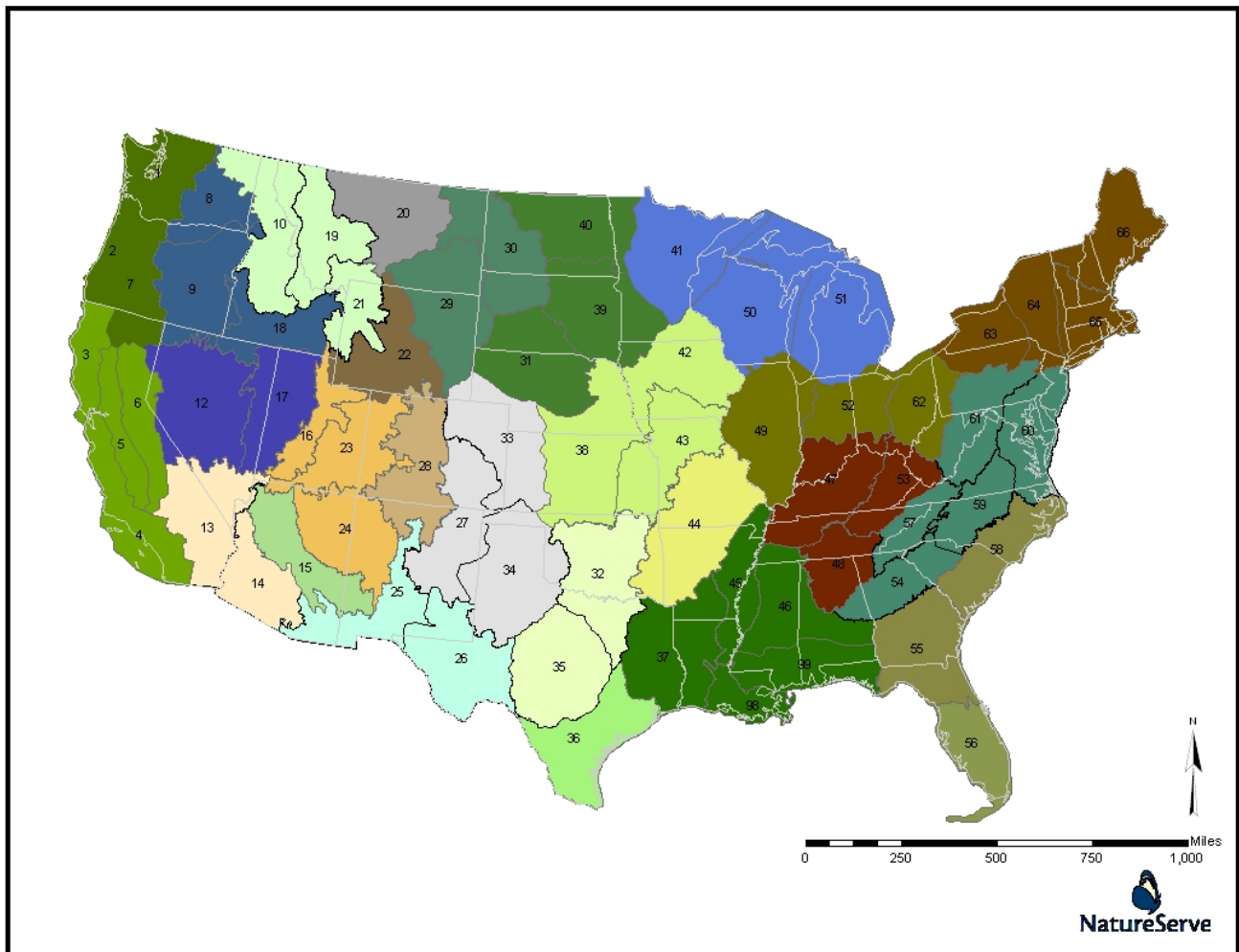
Plant names are almost always in Latin and follow the nomenclature of Kartesz (1999). In limited cases, we have included synonyms for some taxa.

The keys are “dichotomous”, which means the user follows the order of the ‘couplets’ and makes a choice between the 2 options represented in the couplet. The ordering of the couplets in each key does matter, and the user should choose the option in each couplet that best fits the data or field situation. A choice leads the user to the next couplet to be utilized in the keying process, via a number at the far right, or else leads to a final result (an ecological system type or an alliance).

If the choice the user makes leads to a “result”, then either an Ecological System is named or a Vegetation Alliance is named. Alliances are recognizable because “alliance” is in the name, and they all start with one or more Latin names (e.g. *Abies concolor* Forest Alliance).

Systems do not include Latin species names in them, and always start with a Biogeographic region (e.g. Inter-Mountain Basins Big Sagebrush Steppe). If an ecological system is followed by a number in parentheses, then the couplet so numbered is to alliances that are part of the system and which may be mappable.

All the keys follow the same logic. First the user determines if the vegetation (or land cover) is ‘sparse’; if not then you go to Key A and are lead into riparian or wetland woodlands or shrublands, then to upland deciduous forest/woodlands, then to upland coniferous forests/woodlands, then savannas, then shrublands and shrub-steppe. The second section of each key (Key B) is for the herbaceous systems and alliances, and keys through wetland/riparian situations first.



**Figure 1. LANDFIRE map zone clusters with keys to ecological systems and selected alliances.**

Keys are generally based on dominance within vegetation strata, with tree cover generally considered first, then that of shrubs, then the herbaceous component. Codominant species within a given strata are important as well, in some cases a system type or alliances will have 2 or more codominant species, which may or may not be present in all stands. Many ecological systems will have a variable physiognomy; where appropriate these variable systems have been placed into the keys in several places (i.e. some grassland systems have a “shrub-steppe” physiognomy and hence will be in the key both as shrub-steppe and herbaceous).

Some terminology is commonly employed throughout the keys that distinguish general spatial characteristics of the vegetation or environmental setting. For example ‘matrix’ types of vegetation are dominant across the majority of a given landscape, while ‘large patch’ types tend to occur as distinctive patches within the larger ‘matrix.’ Elevation-based life zones are commonly employed, with reference to ‘alpine,’ ‘subalpine,’ ‘montane,’ or ‘foothill’ zones. These zones vary in actual elevational thresholds across multiple map zones, and within individual map zones. More precise definition of these elevation breaks by map zone could be accomplished with additional research.

In the next section of the document we have provided a table showing the LANDFIRE legend units that represent non-natural vegetation and a short description for each of them. They are not formally incorporated into the keys, since they are typically recognizable without the use of a key, or else their floristic composition is so variable as to be not useful in a field key. Our primary purpose was to provide keys for the natural and near-natural vegetation of these zones.

## Land Use, Unvegetated, Semi-natural and Altered Vegetation

LAND USE OR UNVEGETATED SURFACES	
Open Water	Open water
Developed	Generally developed lands.
Developed, Open Space	Vegetation (primarily grasses) planted in developed settings for recreation, erosion control, or aesthetic purposes. Impervious surfaces account for less than 20% of total cover. Examples include parks, lawns, golf courses, airport grasses, and industrial site grasses.
Developed, Low Intensity	Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20-50% of total cover. These areas most commonly include single-family housing units.
Developed, Medium Intensity	Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50-80% of the total cover. These areas most commonly include single-family housing units
Developed, High Intensity	Includes highly developed areas where people reside in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80 to 100% of the total cover.
Agriculture	Generally developed for agricultural uses.
Pasture/Hay	These agriculture lands typically have perennial herbaceous cover (e.g. regularly-shaped plantings) used for livestock grazing or the production of hay. There are obvious signs of management such as irrigation and haying that distinguish it from natural grasslands. Identified CRP lands are included in this land cover type.
Cultivated Crops and Irrigated Agriculture	These areas used for the production of crops, such as corn, soybeans, small grains, sunflowers, vegetables, and cotton, typically on an annual cycle. Agricultural plant cover is variable depending on season and type of farming. Other areas include more stable land cover of orchards and vineyards.

<b>Perennial Ice/Snow</b>	
<b>SEMI-NATURAL / ALTERED VEGETATION</b>	
<b>Ruderal Vegetation</b>	Vegetation resulting from succession following significant anthropogenic disturbance of an area. It is generally characterized by unnatural combinations of species (primarily native species, though they often contain slight or substantial numbers and amounts of species alien to the region as well)
Ruderal Upland - Old Field	
Ruderal Upland - Abandoned Tree Plantation	
Ruderal Wetland	
<b>Introduced Vegetation</b>	Vegetation dominated by introduced species. These are spontaneous, self-perpetuating, and not (immediately) the result of planting, cultivation, or human maintenance. Land occupied by introduced vegetation is generally permanently altered (converted) unless restoration efforts are undertaken.
Introduced Upland Vegetation - Treed	Land cover is significantly altered/disturbed by introduced tree species.
Introduced Upland Vegetation - Shrub	Land cover is significantly altered/disturbed by introduced woody and/or herbaceous vegetation.
Introduced Upland Vegetation - Annual and Biennial Forbland	Land cover is significantly altered/disturbed by introduced annual and biennial forbs. Natural vegetation types are no longer recognizable. Typical species that dominate these areas are <i>Acroptilon repens</i> , <i>Leucanthemum vulgare</i> , <i>Cirsium arvense</i> , <i>C. vulgare</i> , <i>Euphorbia esula</i> , <i>Lepidium latifolium</i> , <i>Carduus nutans</i> , <i>Centaurea</i> spp. ( <i>diffusa</i> , <i>solstitialis</i> ), <i>Salsola kali</i> , <i>Bassia scoparia</i> , <i>Halogeton glomeratus</i> , <i>Melilotus officinalis</i> , and <i>Cardaria</i> spp.
Introduced Upland Vegetation – Annual Grassland	Land cover is significantly altered/disturbed by introduced annual grasses. Natural vegetation types are no longer recognizable. Typical species include <i>Bromus japonicus</i> , <i>B. rigidus</i> , <i>B. rubens</i> , <i>B. tectorum</i> , <i>Taeniatherum caput-medusae</i> , and/or <i>Schismus barbatus</i> .
Introduced Upland Vegetation - Perennial Grassland and Forbland	Land cover is significantly altered/disturbed by introduced, non-native perennial grasses and forbs. Natural vegetation types are no longer recognizable. Grass species include <i>Agropyron cristatum</i> , <i>Poa bulbosa</i> , <i>Bromus inermis</i> , <i>Phleum pratense</i> , and <i>Poa pratensis</i> . Forbs may include: <i>Centaurea</i> spp., <i>Cirsium arvense</i> , <i>Euphorbia esula</i> , <i>Lepidium</i> spp., <i>Melilotus</i> spp.
Introduced Riparian Vegetation	Land cover is altered/disturbed and dominated by introduced woody vegetation (woodlands and shrublands). Typical riparian trees and shrubs include <i>Elaeagnus angustifolia</i> , <i>Tamarix</i> spp., <i>Triadica sebifera</i> , etc.
Introduced Wetland Vegetation	Land cover is altered/disturbed and dominated by introduced wetland vegetation. Species may include <i>Lythrum salicaria</i> , <i>Phalaris arundinacea</i> , <i>Phragmites australis</i> , etc.
<b>Modified/Managed Vegetation</b>	Vegetation resulting from management or modification of natural/near natural; vegetation, but producing a structural and floristic combination not clearly known to have a natural analogue. Modified vegetation may be easily restorable by either management, restoration of ecological processes, and/or succession.
Modified/Managed Upland Vegetation	Land cover is apparently managed/modified and dominated by trees and/or shrubs. Vegetation is a mixture of herbaceous, shrub, and tree species.
Recently Burned Forest and Woodland	Land cover is apparently modified by recent fires which have burned forest and woodland vegetation. Vegetation is a mixture of herbaceous, shrub, and tree species.
Recently Burned Shrubland	Land cover is apparently modified by recent fires which have shrubland vegetation. Vegetation is a mixture of herbaceous and shrub species.
Recently Burned Grassland	Land cover is apparently modified by recent fires which have burned grassland vegetation. Vegetation is a mixture of herbaceous and shrub species.
Managed Tree Plantation	Land cover is apparently modified and appears as a managed tree plantation.
Recently Logged Timberland	Land cover is apparently modified and appears as logged timberland.
Modified/Managed Wetland Vegetation	These areas include created and obviously managed wetlands of varying size resulting from water diversion. Artificial Wetlands will be mapped where obvious built structures may be distinguished from imagery.

**Northwest Great Plains Ecological Systems and Target Alliances**

This key is intended for identifying Ecological Systems and selected alliances that are found in the Northwestern Great Plains, from southeastern Wyoming east and north into eastern Montana and the western regions of the Dakotas. Much of the central Wyoming Basins of Wyoming are not included although some systems from that area extend into the eastern Wyoming area. The Black Hills of Wyoming and South Dakota are included in this region and these keys. Additional alliance couplets are to proposed mappable or target alliances and are not intended to be comprehensive.

**Please note the following conventions used to designate the systems and alliances:**

- <sup>a</sup> indicates a NS ecological system that has been grouped into a broader LANDFIRE Map Unit (wetland, riparian, and sparsely vegetated circumstances). Included to help clarify key, but crews need to record broader LANDFIRE Map Unit <sup>(b)</sup>
- <sup>b</sup> indicates a broader LANDFIRE Map Unit (system group).
- <sup>c</sup> indicates a typically small patch ecological system type not being mapped by LANDFIRE.
- <sup>d</sup> indicates an alliance not considered to be mappable for LANDFIRE purposes, but included to help characterize the vegetation.
- <sup>e</sup> indicates a type that is peripheral map zones 25 and 26 and would only occur in transition areas near boundaries of these map zones.

1a. Total woody canopy cover generally 10% or more.....2

1b. Total woody canopy cover generally less than 10% .....4

2a. Land cover is restricted to riparian or floodplain zones of drainages, semi-riparian flats, springs or seeps and areas with high water tables.....  
 ..... **TO KEY A: Riparian Woodlands or Shrublands**

2b. Land cover is upland vegetation, without seeps or areas with high water tables .....3

3a. Upland forests and woodlands (trees generally with >25% cover) **or upland savannas** (10-25% cover of trees, generally >3 m tall with a single main stem and often >20% cover perennial graminoids) .....  
 ..... **GO TO KEY B: Woodlands and Savannas**

3b. Upland shrublands, including dwarf-shrublands and shrub-steppe (10-25% cover of shrubs and >20% cover of perennial graminoids).....  
 .....**GO TO KEY C: Shrublands, Dwarf-shrublands and Shrub-steppes**

4a. Total canopy cover generally 10% or more..... **GO TO KEY D: Herbaceous Systems and Alliances**

4b. Total canopy cover generally less than 10% or annual herbaceous cover dominates vegetation.....  
 ..... **Sparse Vegetation (5)**

**SPARSELY VEGETATED SYSTEMS (<10% vascular cover)**

5a. Barren and typically sparsely vegetated alpine substrates. Land cover is mostly exposed rock (usually >90% cover of either bedrock, boulders or scree). Nonvascular cover (lichens) may be significant. ....  
 ..... **(Rocky Mountain Alpine Bedrock and Scree<sup>a, e</sup>)**  
 .....**Rocky Mountain Alpine/Montane Sparsely Vegetated Systems<sup>b</sup>**

5b. Barren and sparsely vegetated substrates NOT alpine; subalpine or below. Upland dune, mudstone or shale badlands, volcanic rock outcrop or cinder sites, or escarpments or canyons.....6

6a. Land cover is non-volcanic, consolidated rock (cliffs, outcrops).....7

- 6b. Land cover is unconsolidated material and/or volcanic .....10
- 7a. Land cover is largely of exposed bedrock cliffs and outcrops common on escarpments and canyons in the plains .....8
- 7b. Land cover is largely exposed bedrock and scree that does not occur on plains.....9
- 8a. Land cover is largely exposed bedrock cliffs and outcrops common on escarpments in the plains, excluding canyon sites. Substrates range from consolidated sandstone and limestone to gravelly breaks. Vegetation is typically restricted to shelves, cracks and crevices in the rock. Scattered *Pinus flexilis*, *P. ponderosa*, *Juniperus* spp. trees or shrubs such as *Artemisia longifolia*, *Artemisia tridentata*, *Cercocarpus* spp. and *Rhus trilobata* are often present. Some stands of Western Great Plains Badlands are similar, but they occur in much larger patches and more erodible soils than this small patch system.....  
 .....(Western Great Plains Cliff and Outcrop<sup>a</sup>)  
 ..... Western Great Plains Sparsely Vegetated Systems<sup>b</sup>
- 8b. Land cover occurs along springbranch or dry canyons in the plains. Limestone and sandstone rock outcrops and cliffs are common. These canyons typically sparse, but may contain elements of other systems that form a complex, small-patch or linear mosaic. Vegetation varies locally depending on aspect, slope position and substrate and can range from riparian vegetation to xeric or mesic woodlands. Dominant tree species include *Populus deltoides*, *Fraxinus pennsylvanica*, *Ulmus rubra*, *Pinus ponderosa*, and *Juniperus* spp.; shrub species may be present. If this occurs in this map zone, it will most likely be associated with the North Platte River and its tributaries... .....(Northwestern Great Plains Canyon<sup>a</sup>)  
 ..... Western Great Plains Sparsely Vegetated Systems<sup>b</sup>
- 9a. Land cover is largely of exposed bedrock and restricted to montane-subalpine zone in the Black Hills and possibly scattered other ranges in these zones.....(Rocky Mountain Cliff, Canyon and Massive Bedrock<sup>a</sup>)  
 ..... Rocky Mountain Alpine/Montane Sparsely Vegetated Systems<sup>b</sup>
- 9b. Land cover is largely exposed bedrock and scree that is widespread across the intermountain western US from foothill to subalpine elevations (outside the Colorado Plateau Region). It occurs at below montane zone in the Wind River and Bighorn Mountains and extends into the foothills and escarpments in southwestern Wyoming (unlikely to occur in zones 29 & 30). .....(Inter-Mountain Basins Cliff and Canyon<sup>a, e</sup>)  
 ..... Inter-Mountain Basins Sparsely Vegetated Systems<sup>b</sup>
- 10a. Land cover is active or partially vegetated dunes or sand sheets that occur in central Wyoming. Common herbaceous species include *Achnatherum hymenoides*, *Hesperostipa comata*, *Leymus simplex*, *Lygodesmia juncea*, *Muhlenbergia arenicola*, *Muhlenbergia pungens*, *Psoralidium lanceolatum*, and *Sporobolus cryptandrus*. Shrubs such as *Artemisia cana*, *A. tridentata*, *Ericameria nauseosa*, *Grayia spinosa*, and *Purshia tridentata* may also be present .....  
 ..... (Inter-Mountain Basins Active and Stabilized Dune<sup>a</sup>)  
 ..... Inter-Mountain Basins Sparsely Vegetated Systems<sup>b</sup>
- 10b. Land cover is NOT dunes or sand sheets .....11
- 11a. Small patch ecological system is eroded hills and flats typically derived from marine shales, but also includes substrates derived from siltstones and mudstones (clay). Harsh (saline/alkaline) soil properties and/or high rates of erosion and deposition limit plant growth to scattered dwarf-shrubs e.g., *Atriplex corrugata*, *Atriplex gardneri*, *Artemisia pedatifida*, and herbaceous vegetation. This system may occur in the far western region of zone 29, but most badlands in these 2 zones are part of the Western Great Plains Badland system ..... (Inter-Mountain Basins Shale Badland<sup>a, e</sup>)  
 ..... Inter-Mountain Basins Sparsely Vegetated Systems<sup>b</sup>
- 11b. Large patch ecological system is found within the Great Plains. This system is typified by extremely dry and easily eroded, consolidated clay soils (sometimes derived from volcanic tuffs and ash) with bands of sandstone or isolated consolidates and little to no cover of vegetation (usually less than 10%). In those areas with vegetation, species can include scattered individuals of *Grindelia squarrosa*, *Gutierrezia sarothrae*, *Sarcobatus vermiculatus*, *Atriplex gardneri*, *Eriogonum* spp., *Muhlenbergia cuspidata*, *Pseudoroegneria spicata*, and *Arenaria hookeri*. Patches of *Artemisia* spp. can also occur. This system

occurs where the land lies well above its local base level and is created by several factors including elevation, rainfall and carving action of streams)..... (**Western Great Plains Badlands<sup>a</sup>**)  
..... **Western Great Plains Sparsely Vegetated Systems<sup>b</sup>**



**KEY A: Map Zone 29 & 30: Riparian Woodland and Shrubland  
Ecological Systems and Mappable Alliances  
(Woody cover >10% cover present)**

- 1a. Higher elevation woodlands and shrublands generally >2600 m (subalpine-montane) .....2  
 1b. Middle and lower elevation (generally <2600 m) woodlands and shrublands (lower montane to valley floor) .....4
- 2a. Shrublands restricted to drainages, stream terraces, semi-riparian flats and spring or seep fed slopes.  
 Dominant shrubs reflect the large elevational gradient and include *Alnus incana*, *Betula nana*, *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 are of either conifer or aspen forests.....  
 ..... **(Rocky Mountain Subalpine - Montane Riparian Shrubland<sup>a</sup>)**  
 ..... **Rocky Mountain Subalpine/Upper Montane Riparian Systems<sup>b</sup>**
- 2b. Woodlands restricted to drainages, stream terraces, semi-riparian flats and spring or seep fed slopes.  
 Common tree species vary across the latitudinal range, although it usually includes *Abies lasiocarpa* and/or *Picea engelmannii*; other important species include *Pseudotsuga menziesii*, *Picea pungens*, *Picea engelmannii* X *glauca*, *Populus tremuloides*, and *Juniperus scopulorum* .....3
- 3a. Poorly drained soils saturated year-round or with 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). Soils are poorly drained, mucky areas, and areas are often a mosaic of moving water and stagnant water. Soils can be woody peat, muck or mineral but tend toward mineral. ....  
 ..... **Northern Rocky Mountain Conifer Swamp**
- 3b. Riparian environments; well drained soils of drainages, steam terraces, semi-riparian flats and spring or seep fed slopes. If dominated by conifers then site is well drained; soils may remain wet seasonally, but are rarely saturated year-round, never boggy or anoxic. These are conifer or aspen dominated woodlands in the montane and subalpine zone.....**(Rocky Mountain Subalpine - Montane Riparian Woodland<sup>a</sup>)**  
 ..... **Rocky Mountain Subalpine/Upper Montane Riparian Systems<sup>b</sup>**
- 4a. Lower montane, foothill and plains woodlands and shrublands restricted to drainages, floodplains and semi-riparian draws and ravines.....5  
 4b. Valley bottom shrublands restricted to temporarily flooded drainages and flats .....11
- 5a. Woodlands and shrublands restricted to drainages and semi-riparian flats that are dominated by the introduced species *Elaeagnus angustifolia* or *Tamarix* spp. ....6  
 5a. Woodlands and shrublands restricted to drainages and semi-riparian flats that are NOT dominated by the introduced species *Elaeagnus angustifolia* or *Tamarix* spp. ....7
- 6a. Woodlands restricted to drainages and semi-riparian flats that are dominated by introduced *Elaeagnus angustifolia*.....**(Elaeagnus angustifolia Semi-Natural Woodland Alliance<sup>a</sup>)**  
 ..... **Invasive Riparian Woodland and Shrubland<sup>b</sup>**
- 6b. Woodlands and shrublands restricted to drainages and semi-riparian flats that are dominated by introduced *Tamarix* spp.....**(Tamarix spp. Semi-Natural Temporarily Flooded Shrubland Alliance<sup>a, e</sup>)**  
 ..... **Invasive Riparian Woodland and Shrubland<sup>b</sup>**
- 7a. Lower montane and foothill woodlands and shrublands associated with mountainous areas around the Black Hills, Bearlodge Mountains, and Bighorn Range, as well as the high elevation intermountain basins of central Wyoming. Stands occur within a broad elevation range from about 1220 m (4000 feet) to over 2135 m (7000 feet). Woodlands are often dominated by *Populus angustifolia*, *Populus deltoides*, *Salix amygdaloides*, *Pseudotsuga menziesii*, *Picea pungens*. Dominant shrubs include *Acer glabrum*, *Alnus incana*, *Betula occidentalis*, *Cornus sericea*, *Crataegus rivularis*, *Prunus virginiana*, *Rhus trilobata*, *Salix monticola*, *Salix drummondiana*, *Salix exigua*, *Salix irrorata*, *Salix lucida*, *Shepherdia argentea*, or *Symphoricarpos* spp .....**(Rocky Mountain Lower Montane Riparian Woodland and Shrubland<sup>a</sup>)**  
 ..... **Rocky Mountain Montane Riparian Systems<sup>b</sup>**

- 7b. Mesic woodlands and shrublands that occur in riparian woodlands and shrublands of the western Great Plains that extend into central Wyoming along rivers such as the Northern Platte. ....8
- 8a. Stands are typically smaller riparian or mesic swale woodlands and shrublands that occur in draws and ravines in Great Plains and may extend into central Wyoming. Often associated with permanent or ephemeral streams and may occur on steep northern slopes or within canyon bottoms that do not experience periodic flooding, although soil moisture and topography allow greater than normal moisture conditions compared to the surrounding areas. *Juniperus* spp. (especially *J. scopulorum*), *Fraxinus* spp., *Acer negundo*, *Populus tremuloides*, *Ulmus rubra* or *Ulmus americana* are typically dominant. Important shrubs include *Cornus sericea*, *Crataegus douglasii*, *Crataegus chrysocarpa*, *Crataegus succulenta*, *Elaeagnus commutata*, *Prunus virginiana*, *Rhus* spp., *Rosa woodsii*, *Shepherdia argentea*, *Symphoricarpos occidentalis*, or *Viburnum lentago*. .... **Western Great Plains Wooded Draw and Ravine**
- 8b. Riparian woodlands and shrublands stands that are NOT restricted to mesic draws and ravines, but occur on small to large rivers in the western Great Plains. ....9
- 9a. Woodlands and shrublands found in the riparian areas of medium and small rivers and streams in the northwestern Great Plains of eastern Montana and eastern Wyoming, most commonly in the Northern Great Plains Steppe. These are found on alluvial soils in highly variable landscape settings, from deep cut ravines to wide, braided streambeds. Hydrologically, these tend to be more flashy with less developed floodplain than on larger rivers, and typically dry down completely for some portion of the year. Dominant vegetation shares much with generally drier portions of larger floodplain systems downstream, but overall abundance of vegetation is generally lower. Communities within this system range from riparian forests and shrublands to gravel/sand flats. Dominant species include *Populus deltoides*, *Populus balsamifera ssp. trichocarpa*, *Salix* spp., *Artemisia cana ssp. cana*, and *Pascopyrum smithii*. These areas are often subjected to heavy grazing and/or agriculture and can be heavily degraded. .... **(Northwestern Great Plains Riparian<sup>a</sup>)**  
..... **Western Great Plains Riparian Systems<sup>b</sup>**
- 9b. Riparian woodlands and shrublands occurring on medium to large rivers in the western Great Plains, or if on small rivers and streams found in south-central and south-eastern Wyoming. ....10
- 10a. Woodlands and shrublands found in the riparian areas of medium and small rivers and streams throughout the Western Great Plains extending into south-eastern and south-central Wyoming. Stands occur in highly variable landscape settings, from deep cut ravines to wide, braided streambeds. Hydrologically, these sites tend to be more flashy with less developed floodplain than on larger rivers, and may dry down for some portion of the year. Communities within this system range from riparian forests and shrublands, herbaceous meadows (with no woody vegetation), to gravel/sand flats. Dominant species include *Populus deltoides ssp. monilifera*, *Salix* spp., *Artemisia cana ssp. cana*, *Pascopyrum smithii*, *Sporobolus cryptandrus*, and *Schizachyrium scoparium*. These areas are often subjected to heavy grazing and/or agriculture and can be degraded by introduced species such as *Elaeagnus angustifolia* and *Tamarix* spp., but not dominated by them. .... **(Western Great Plains Riparian Woodland and Shrubland<sup>a, e</sup>)**  
..... **Western Great Plains Riparian Systems<sup>b</sup>**
- 10b. Woodlands and shrublands found in the riparian areas of medium and large rivers of the Northwestern Great Plains, generally north of the North Platte River in Wyoming, into Canada. Alluvial soils and periodic, intermediate flooding (every 5-25 years) typify this system. Dominant communities within this system range from floodplain forests to wet meadows to gravel/sand flats; however, they are linked by underlying soils and the flooding regime. *Populus balsamifera ssp. trichocarpa* or *Populus deltoides* and *Salix* spp. Grass cover underneath the trees is an important part of this system and is a mix of cool-season graminoid species, including *Carex pellita* (= *Carex lanuginosa*), *Panicum virgatum*, *Schizachyrium scoparium*, and *Elymus lanceolatus*. This system is often subjected to heavy grazing and/or agriculture and can be heavily degraded. In Montana, most occurrences are now degraded to the point where the cottonwood overstory is the only remaining natural composition, and undergrowth is dominated by *Bromus inermis*, or a complex of pasture grasses ..... **(Northwestern Great Plains Floodplain<sup>a</sup>)**  
..... **Western Great Plains Riparian Systems<sup>b</sup>**
- 11a. Open to moderately dense shrublands dominated or codominated by *Sarcobatus vermiculatus*. Stands are widespread in the Intermountain Basins region. *Atriplex canescens*, *Atriplex confertifolia*, *Atriplex gardneri*, or *Krascheninnikovia lanata* may be present to codominant with patches of *Distichlis spicata*,

*Sporobolus airoides*, *Pascopyrum smithii*, *Calamovilfa longifolia*, *Leymus cinereus*, *Poa pratensis*, *Puccinellia nuttalliana*, or *Eleocharis palustris* herbaceous types. Commonly occurs on saline/alkaline plains and basins, sometimes encircling playas or on stream terraces.....

..... **Inter-Mountain Basins Greasewood Flat**

11b. Open to moderately dense shrublands dominated by one or more species of *Atriplex* and/or *Krascheninnikovia lanata*. In Wyoming, occurrences are typically a mix of *Atriplex confertifolia*, *Grayia spinosa*, *Artemisia tridentata* ssp. *wyomingensis*, *Sarcobatus vermiculatus*, *Krascheninnikovia lanata*, and various *Ericameria* or *Chrysothamnus* species. Some places are a mix of *Atriplex confertifolia* and *Artemisia tridentata* ssp. *wyomingensis*. This system is typical of saline basins, alluvial slopes and plains across the Intermountain western U.S. and extends into the Great Plains especially on stream terraces and flood plains (Great Divide and Bighorn Basins in Wyoming) .....

..... **Inter-Mountain Basins Mixed Salt Desert Scrub**

**KEY B: Map Zone 29 & 30: Upland Woodlands and Savannas**  
**Ecological Systems and Mappable Alliances**  
**(Woody cover >10% present)**

**Forests and Woodlands**

1a. Broadleaf forests and woodlands or mixed conifer-aspen forests and woodlands (deciduous trees make up 25-100% of the tree canopy) .....	2
1b. Conifer forests and woodlands (deciduous trees may make up less than 25% relative cover of the tree canopy) .....	8
2a. Woodland is typically found on relatively mesic, northern slopes and bottoms of ravines, draws and canyons and is often associated with perennial or ephemeral streams and small rivers. Occurs on steep slopes to level stream terraces that do not experience periodic flooding, <i>Fraxinus pennsylvanica</i> and <i>Ulmus rubra</i> or <i>Ulmus americana</i> typically dominate this system, although <i>Juniperus scopulorum</i> , <i>Populus tremuloides</i> , <i>Betula papyrifera</i> , or <i>Acer negundo</i> are commonly present and may codominate in the northwestern Great Plains. ....	<b>Western Great Plains Wooded Draw and Ravine</b>
2b. Woodlands that are NOT restricted to mesic draws and ravines. ....	3
3a. Broadleaf forests and woodlands typically dominated or codominated by aspen .....	4
3b. Broadleaf forests and woodlands typically dominated or codominated by trees other than aspen, although aspen may be present.....	6
4a. Stand occurs in boreal-mixedgrass prairie grassland transition region in North Dakota and adjacent Manitoba west into central Alberta. Substrates are undulating to kettled glacial till. <i>Populus tremuloides</i> dominates the tree canopy with associates such as <i>Betula papyrifera</i> and <i>Populus balsamifera</i> with an understory of mixedgrass species and tall shrubs. Poorly drained sites may contain willow ( <i>Salix</i> spp.) and sedges ( <i>Carex</i> spp.). Scattered <i>Picea glauca</i> and <i>Abies balsamea</i> trees may be present. ....	<b>Northwestern Great Plains Aspen Forest and Parkland</b>
4b. Not as above. Woodland found on hills and mountains that occur in the northwestern Great Plains. Stands are most similar to montane aspen stands in the Rocky Mountains. ....	5
5a. Broadleaf forest or woodland typically dominated by <i>Populus tremuloides</i> (and possible inclusions of other broadleaf tree species) with less than 25% relative tree canopy cover of conifers.....	<b>Rocky Mountain Aspen Forest and Woodland</b>
5b. Mixed conifer-broadleaf forest or woodland codominated by <i>Populus tremuloides</i> and conifer trees with 25-75% relative tree canopy of each canopy type. These mixed stands will commonly occur in relatively small areas; found in the Bighorn Mountains and adjacent areas, but does not occur in the Black Hills.....	<b>Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland</b>
6a. Woodland or forest dominated by <i>Quercus macrocarpa</i> and is found in upland areas in the northern part of the Western Great Plains. Other trees such as <i>Tilia americana</i> , <i>Ostrya virginiana</i> , <i>Juniperus virginiana</i> , and <i>Fraxinus</i> spp. may be present. The herbaceous layer can vary from sparsely to moderately vegetated, and shrubs include <i>Amelanchier alnifolia</i> , <i>Cornus drummondii</i> , <i>Corylus americana</i> , and <i>Corylus cornuta</i> . ....	<b>Western Great Plains Dry Bur Oak Forest and Woodland</b>
6b. Not as above. Woodlands found on hills and escarpments that occur in the northwestern Great Plains. <i>Quercus macrocarpa</i> does not dominate stand.....	7
7a. Low stature (<1.5 m) woodland and/or shrublands dominated by <i>Cercocarpus ledifolius</i> (see note following couplet). <i>Artemisia tridentata</i> ssp. <i>vaseyana</i> , <i>Purshia tridentata</i> , with species of <i>Arctostaphylos</i> , <i>Ribes</i> , or <i>Symphoricarpos</i> are often present. Throughout the intermountain west, often as small patches in forested landscapes. ....	<b>Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland</b>

- 7b. Tall stature (>2 m) woodlands dominated by *Cercarpus ledifolius* (see note following couplet). If other tree species present, then *Cercocarpus* must have at least 50% relative cover. *Juniperus* spp. or *Pinus* spp. may be present (if conifer cover exceeds 15% relative cover, key via conifer dominated system). Stands tend to be unburned and not browsed, slightly more mesic, found in higher elevations than above.....  
 ..... ***Cercocarpus ledifolius* Woodland Alliance**

**Note:** If you can key to subspecies:

*Cercocarpus ledifolius* var. *intercedens* small trees 4-5 m tall— *Cercocarpus ledifolius* Woodland Alliance

*Cercocarpus ledifolius* var. *ledifolius* shrublands to 1.5 m tall—shrublands

*Cercocarpus intricatus* (= *Cercocarpus ledifolius* var. *intricatus*) shrublands to 1.5 m tall—shrublands

### Conifer Forest and Woodland

- 8a. Subalpine conifer forests and woodlands (spruce-fir zone).....**9**  
 8b. Montane and foothills conifer forests and woodlands (Douglas-fir – ponderosa pine – foothill zones).....**13**

### Subalpine Conifer Forest and Woodland

- 9a. Stunted tree clumps, open woodlands, and herb- or dwarf-shrub-dominated openings, occurring above closed forest ecosystems and below alpine communities. Tree clumps and woodlands dominated by *Pinus flexilis*. Found only in zone 29, generally above 2500 m in elevation.....  
 ..... **Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland**  
 9b. Not as above. Woodland not dominated or codominated by *Pinus flexilis* .....**10**

- 10a. Conifer forests and woodlands strongly dominated by *Pinus contorta* sometimes with *Populus tremuloides* codominating. *Abies lasiocarpa* and/or *Picea engelmannii* may be present, especially in the subcanopy.....**11**  
 10b. Conifer forests and woodlands typically dominated or codominated by *Abies lasiocarpa* and/or *Picea engelmannii* sometimes with *Pinus contorta*, *Pinus ponderosa* (in the Bighorns this is common) or *Populus tremuloides* codominating .....**12**

- 11a. Conifer forests and woodlands strongly dominated by *Pinus contorta* (>2/3 total tree canopy) or with *Populus tremuloides* codominating. These are subalpine forests, occasionally found in the montane zone, where the dominance of *Pinus contorta* is related to topo-edaphic conditions and nutrient-poor soils. These include 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. Other conifers do not occur, not even in the regeneration layer. .... **Rocky Mountain Poor Site Lodgepole Pine Forest<sup>e</sup>**  
 11b. Conifer forests and woodlands strongly dominated by *Pinus contorta* (>2/3 total tree canopy) or with *Populus tremuloides* codominating. These are subalpine forests where the dominance of *Pinus contorta* is related to fire history and topo-edaphic conditions. Following stand-replacing fires, *Pinus contorta* will rapidly colonize and develop into dense, even-aged stands. Most forests in this ecological system occur as early- to mid-successional forests which developed following fires. This system includes *Pinus contorta*-dominated stands that, while typically persistent for >100-year time frames, may succeed to spruce-fir forests and woodlands in the central Rocky Mountains. .... **Rocky Mountain Lodgepole Pine Forest**

- 12a. Subalpine conifer forests and woodlands of drier environments that are dominated or codominated by *Abies lasiocarpa* and/or *Picea engelmannii*. In the Bighorns, *Pinus ponderosa* is a common component, along with *Populus tremuloides*, and *Pinus contorta*. Stands may extend into montane zone locally in cold air drainage areas.....**Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland**  
 12b. Large and small patch subalpine conifer forests and woodlands of mesic environments (north aspect or toeslopes) that are dominated or codominated by *Abies lasiocarpa* and/or *Picea engelmannii* with mesic understory shrubs such as *Amelanchier alnifolia*, *Rubus parviflorus*, *Vaccinium membranaceum*, *Rhododendron albiflorum*, *Ledum glandulosum*, *Phyllodoce empetrifomis*, and *Salix* spp. Herbaceous species include *Actaea rubra*, *Clintonia uniflora*, *Maianthemum stellatum*, *Cornus canadensis*, *Erigeron eximius*, *Gymnocarpium dryopteris*, *Rubus pedatus*, *Saxifraga bronchialis*, *Tiarella* spp., *Lupinus arcticus*

*ssp. subalpinus*, *Valeriana sitchensis*, and graminoids *Luzula glabrata* var. *hitchcockii* or *Calamagrostis canadensis*. Stands may extend into montane zone locally in cold air drainage areas. ....  
 ..... **Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland**

**Montane and Foothill Conifer Forest and Woodland**

- 13a. Montane conifer forests and woodlands .....14
- 13b. Foothill conifer forests, woodlands and savannas .....21

**Montane Conifer Forest and Woodland**

- 14a. Montane woodland characterized by *Picea glauca*, but *Pinus ponderosa*, *Populus tremuloides*, and *Betula papyrifera* may be present. Stands are known from high-elevation outliers of montane environments in the northwestern Great Plains such as Black Hills and possibly Big Horn Mountains. Also found in Cypress Upland of southern Alberta and Saskatchewan Sites are limited to sideslopes and depressions, likely adjoining riparian zones, where snow is well-retained. ....  
 ..... **Northwestern Great Plains Highland White Spruce Woodland**

- 14b. Conifer forests and woodlands not characterized by *Picea glauca*. Other trees *Pseudotsuga menziesii*, and sometime codominated by *Pinus ponderosa*, *Pinus flexilis*, *P. contorta*, *Juniperus scopulorum* or and/or *Populus tremuloides* .....22

- 15a. Conifer forests and woodlands strongly dominated by *Pinus contorta* and sometimes codominated by *Populus tremuloides* .....16

- 15b. Conifer forests and woodlands NOT strongly dominated *Pinus contorta*, but it may be present with low cover .....17

- 16a. Conifer forests and woodlands strongly dominated by *Pinus contorta* (>2/3 total tree canopy) or with *Populus tremuloides* codominating. These subalpine forests are occasionally found in the montane zone, where the dominance of *Pinus contorta* is related to topo-edaphic conditions and nutrient-poor soils. These include 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. ....  
 ..... **Rocky Mountain Poor Site Lodgepole Pine Forest<sup>e</sup>**

- 16b. Conifer forests and woodlands strongly dominated by *Pinus contorta* (>2/3 total tree canopy) or with *Populus tremuloides* codominating. These are upper montane to subalpine forests where the dominance of *Pinus contorta* is related to fire history and topo-edaphic conditions. Following stand-replacing fires, *Pinus contorta* will rapidly colonize and develop into dense, even-aged stands. Most forests in this ecological system occur as early- to mid-successional forests which developed following fires. This system includes *Pinus contorta*-dominated stands that, while typically persistent for >100-year time frames, may succeed to Douglas-fir forests and woodlands in the central Rocky Mountains. .... **Rocky Mountain Lodgepole Pine Forest**

- 17a. Matrix *Pinus ponderosa*-dominated woodlands sometimes with inclusions of *Pseudotsuga menziesii* woodlands on cool aspects. *Pinus flexilis*, *Juniperus* spp., or *Populus tremuloides* may be also be present. In zones 29 & 30, stands are found in the Bighorns, Laramie Range and Medicine Bow Mountains of Wyoming and the adjacent foothill areas ..... **Southern Rocky Mountain Ponderosa Pine Woodland**

- 17b. Conifer forests and woodlands dominated by *Pseudotsuga menziesii*, and sometime codominated by *Pinus ponderosa*, *Pinus flexilis*, *P. contorta*, *Juniperus scopulorum* or and/or *Populus tremuloides* .....18

- 18a. Montane conifer forests and woodlands of the southern Rocky Mountains and common in Laramie Range and Medicine Bow Mountains. Stands are dominated or codominated by *Pseudotsuga menziesii*, and sometimes codominated by *Pinus ponderosa*, *Pinus flexilis*, or *P. contorta* and/or *Populus tremuloides* .....19

- 18b. Montane conifer forests and woodlands often occurring at the lower treeline immediately above valley grasslands, or sagebrush steppe and shrublands in the central Rocky Mountains such as the Wind River Range and Big Horn Mountains where the southern monsoon influence is less and maritime climate regime is not important. *Pseudotsuga menziesii* typically dominates, occasionally with *Pinus flexilis* on calcareous

substrates, and *Pinus contorta* present at higher elevations. True firs, such as *Abies lasiocarpa*, are absent, but *Picea engelmannii* does occur, especially in the Bighorn Mountains. Understory components include shrubs such as *Physocarpus malvaceus*, *Juniperus communis*, *Symphoricarpos oreophilus*, and *Mahonia repens*, and graminoids such as *Calamagrostis rubescens*, *Carex rossii*, and *Leucopoa kingii*.  
 .....**Middle Rocky Mountain Montane Douglas-fir Forest and Woodland**

- 19a. Montane conifer forests and woodlands of drier environments that are dominated or codominated by *Pseudotsuga menziesii*, and sometimes codominated by *Pinus ponderosa* or *P. contorta* and/or *Populus tremuloides* ..... **Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland (20)**
- 19b. Large and small patch montane conifer forests and woodlands of relative mesic environments (north aspects or toeslopes). Dominated or codominated by *Pseudotsuga menziesii* or *Picea pungens* with *Abies lasiocarpa* occasionally present in upper montane stands. ....  
 ..... **Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland (20)**
- 20a. Conifer forests and woodlands dominated or codominated by *Pseudotsuga menziesii*. Other trees species such as *Pinus ponderosa* and/or *Populus tremuloides* may be present.....  
 ..... ***Pseudotsuga menziesii* Forest Alliance**
- 20b. Conifer forests and woodlands NOT dominated or codominated by *Pseudotsuga menziesii* .....  
 ..... **Unidentified Forest Alliance<sup>d</sup>**

**Foothill Conifer Forest, Woodland and Savanna**

- 21a. Foothill or prairie-breaks conifer woodlands ..... **22**
- 21b. Foothill or prairie-breaks conifer savannas. .... **24**
  
- 22a. Foothill or prairie-breaks conifer woodlands dominated by *Pinus flexilis*, *Juniperus scopulorum* or *Juniperus osteosperma*. Common foothills woodland from north-central to eastern Wyoming, and across southern Wyoming, extending into extreme northern portions of Colorado and northeastern Utah, as well as north into Alberta along the Front Range. *Pinus flexilis* is often present, not always. *Pinus ponderosa* is absent or only occasional (<5% cover). *Pinus edulis* is never present. ....  
 ..... **Rocky Mountain Foothill Limber Pine-Juniper Woodland**
- 22b. Foothill conifer woodlands characterized by *Pinus ponderosa*, which may dominate or codominate with relatively low cover (>5% cover), sometimes with *Pinus flexilis* and/or *Juniperus* spp. forming a strong subcanopy..... **23**
  
- 23a. Foothill conifer woodlands characterized *Pinus ponderosa* (dominated or codominated by *Pinus flexilis* and/or *Juniperus* spp. with *Pinus ponderosa* >5% cover). Common on the lower slopes of Bighorn Mountains, Laramie Range and other Rocky Mountain foothills.....  
 ..... **Southern Rocky Mountain Ponderosa Pine Woodland**
- 23b. Foothill conifer woodlands primarily dominated by *Pinus ponderosa* often with sparse to dense cover of *Juniperus scopulorum* or *Cercocarpus*. Common on gentle to steep slopes along escarpments, buttes, canyons, rock outcrops, ravines or canyons and can grade into the surrounding prairie foothills woodland from north-central to eastern Wyoming, eastern Montana, the Dakotas, and eastern Nebraska. Deciduous trees are an important component in some areas (western Dakotas, Black Hills) and are sometimes codominant with the pines, including *Fraxinus pennsylvanica*, *Betula papyrifera*, *Quercus macrocarpa*, *Ulmus americana*, *Acer negundo*, and *Populus tremuloides*. Along the Missouri Breaks in north-central Montana, woodlands dominated by *Pseudotsuga menziesii* occur in similar ecological settings as *Pinus ponderosa* in the Great Plains and are included in this system. Good examples occur along the Pine Ridge escarpment and Pine Ridge district of the Nebraska National Forest in Nebraska. This is the predominant Ponderosa system of the Black Hills and adjacent areas and does not includes ponderosa stands in the Big Horn Mountains or Laramie Range .....  
 ..... **Northwestern Great Plains - Black Hills Ponderosa Pine Woodland and Savanna**

## Savannas (open tree canopy)

- 24a. Savannas with 10-25% cover of trees (generally >3 m tall with a single main stem) over perennial grassland (25% or more herbaceous cover).....**25**
- 24b. Shrub-steppe, shrublands and dwarf-shrublands (trees with less than 10% cover)..... **Key C**
- 25b. Conifer savanna characterized by *Pinus ponderosa* often with sparse to dense cover of *Juniperus scopulorum* or *Cercocarpus*. The herbaceous understory can is typically dense layer with species typifying the surrounding prairie system, with mixedgrass species common, such as *Andropogon gerardii*, *Bouteloua curtipendula*, *Carex inops ssp. heliophila*, *Carex filifolia*, *Danthonia intermedia*, *Koeleria macrantha*, *Nassella viridula*, *Oryzopsis asperifolia*, *Pascopyrum smithii*, *Piptatherum micranthum*, and *Schizachyrium scoparium*. Common on gentle to steep slopes along escarpments, buttes, canyons, rock outcrops, ravines or canyons and can grade into the surrounding prairie foothills woodland from north-central to eastern Wyoming, eastern Montana, the Dakotas, and eastern Nebraska. Deciduous trees are an important component in some areas (western Dakotas, Black Hills) and are sometimes codominant with the pines, including *Fraxinus pennsylvanica*, *Betula papyrifera*, *Quercus macrocarpa*, *Ulmus americana*, *Acer negundo*, and *Populus tremuloides*. Along the Missouri Breaks in north-central Montana, woodlands dominated by *Pseudotsuga menziesii* occur in similar ecological settings as *Pinus ponderosa* in the Great Plains and are included in this system. Does not includes ponderosa stands in the Big Horn Mountains or Laramie Range. ....
- ..... **Northwestern Great Plains - Black Hills Ponderosa Pine Woodland and Savanna**
- 24b. Not as above.....**25**
- 25a. Open tree layer dominated by *Pinus ponderosa*, but may have *Pinus flexilis* or *Juniperus* spp. present to codominant and extends from foothills out into the plains near stands in the Laramie Range. Typically stands have a strong perennial grass layer (>20% cover).....
- ..... **Southern Rocky Mountain Ponderosa Pine Savanna**
- 25b. Open tree layer NOT dominated or codominated by *Pinus ponderosa*. Open tree layer is typically dominated by *Juniperus osteosperma* or *Juniperus scopulorum* with a strong perennial grass layer (>20% cover) (in zone 22, uncertain if occurs in zone 29). .... **Inter-Mountain Basins Juniper Savanna<sup>e</sup>**



**KEY C Map Zone 29 & 30: Upland and Dwarf-shrublands, and Shrub-steppe  
Ecological Systems and Mappable Alliances  
(Woody cover >10% cover present)**

1a. Dwarf- or low shrubland or dwarf shrub-steppe.....2  
1b. Shrubland or shrub-steppe.....5

**Dwarf-shrubland or Shrub-steppe**

2a. Alpine and subalpine dwarf-shrublands may be dominated by *Cassiope mertensiana*, *Salix arctica*, *S. reticulata*, *S. vestita*, or *Phyllodoce empetriformis*. Other shrub associates may include *Vaccinium* spp., *Ledum glandulosum*, *Phyllodoce glanduliflora*, and *Kalmia microphylla*. Stands are restricted to high elevation sites in MZ 29 such as in the Big Horn Mountains and Laramie Range.....  
.....**Rocky Mountain Alpine Dwarf-Shrubland**

2b. Dwarf- or low shrubland or dwarf shrub-steppe Not alpine or subalpine .....3

3a. Open to moderately dense shrublands dominated by one or more species of *Atriplex* and/or *Krascheninnikovia lanata*. In Wyoming, occurrences are typically a mix of *Atriplex confertifolia*, *Grayia spinosa*, *Artemisia tridentata* ssp. *wyomingensis*, *Sarcobatus vermiculatus*, *Krascheninnikovia lanata*, and various *Ericameria* or *Chrysothamnus* species. Some places are a mix of *Atriplex confertifolia* and *Artemisia tridentata* ssp. *wyomingensis*. This system is typical of saline basins, alluvial slopes and plains across the Intermountain western U.S. and extends into the Great Plains especially on stream terraces and flood plains (Great Divide and Bighorn Basins in Wyoming).....  
.....**Inter-Mountain Basins Mixed Salt Desert Scrub**

3b. Low shrubland NOT as above.....4

4a. Low shrubland dominated by *Artemisia pedatifida*, *Atriplex corrugata*, *Atriplex gardneri*, *Artemisia longifolia*, *Picrothamnus desertorum*, sometimes with a mix of other low shrubs, such as *Krascheninnikovia lanata* or *Tetradymia spinosa*. Stands occur on dry sites such as shale hills and shaley or windswept plains. Stands may form a mosaic with big sagebrush stands where big sagebrush is restricted to deeper soils, sandy deposits, and/or washes with well-drained substrates .....  
.....**Inter-Mountain Basins Mat Saltbush Shrubland**

4b. Low shrubland or shrub-steppe dominated or codominated by *Artemisia nova* or *Artemisia tripartita* ssp. *rupicola*. Common in dry habitats throughout the basins of central and southern Wyoming, and may extend into northern Colorado and northeastern Utah. Stands typically occur on windswept ridges and south and west facing slopes above 2135 m ..... **Wyoming Basins Dwarf Sagebrush Shrubland and Steppe**

**Shrub-steppe and Shrubland**

5a. *Cercocarpus ledifolius* dominates the shrub (or tree) layer.....  
.....**Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland**

5b. Shrubland NOT dominated by *Cercocarpus ledifolius* .....6

6a. Shrub layer is dominated or codominated by species of *Artemisia* (and sometimes *Purshia tridentata*), but NOT *Quercus gambelii* (<5% cover). .....7

6b. Other taxa dominate or codominate the shrub layer including *Artemisia* spp. and *Quercus gambelii*.....12

**Sagebrush Shrublands or Steppe**

7a. Montane or subalpine (>2000 m elevations) shrubland or shrub-steppe dominated or codominated by *Artemisia tridentata* ssp. *vaseyana*, *A. tridentata* ssp. *spiciformis*, non-riparian *A. cana* ssp. *viscidula*, *A. arbuscula* ssp. *arbuscula* and/or *Purshia tridentata*. *Symphoricarpos* spp. may codominate some stands.....

	<b>Inter-Mountain Basins Montane Sagebrush Steppe (8)</b>
7b. Foothill sagebrush shrublands .....	9
8a. <i>Artemisia tridentata ssp. vaseyana</i> typically dominates shrub layer of 10% or more cover with typically less than 20% total perennial herbaceous cover. ....	<i>Artemisia tridentata ssp. vaseyana</i> Shrubland Alliance
8b. <i>Artemisia arbuscula ssp. arbuscula</i> -dominated shrubland .....	<i>Artemisia arbuscula ssp. arbuscula</i> Dwarf-Shrubland Alliance <sup>d</sup>
9a. Low shrubland or shrub-steppe dominated or codominated by <i>Artemisia nova</i> or <i>Artemisia tripartita ssp. rupicola</i> . Common in dry habitats throughout the basins of central and southern Wyoming, and may extend into northern Colorado. Typically occurs on windswept ridges and south and west aspect slopes above 2135 m.....	<b>Wyoming Basins Dwarf Sagebrush Shrubland and Steppe</b>
9b. Shrubland or shrub-steppe dominated or codominated by <i>Artemisia tridentata ssp. tridentata</i> and/or <i>Artemisia tridentata ssp. wyomingensis</i> . <i>Symphoricarpos</i> spp. or <i>Purshia tridentata</i> may codominate some stands .....	10
10a. <i>Artemisia tridentata ssp. tridentata</i> and/or <i>Artemisia tridentata ssp. wyomingensis</i> dominate relative cover of shrub layer with 10% or more absolute cover and with less than 25% total perennial herbaceous cover; generally in broad basins between mountain ranges, plains and foothills between 1500 and 2300 m elevation. Soils are typically deep, well-drained and non-saline .....	<b>Inter-Mountain Basins Big Sagebrush Shrubland</b>
10b. <i>Artemisia tridentata ssp. tridentata</i> , <i>Artemisia tridentata ssp. xericensis</i> , <i>Artemisia tridentata ssp. wyomingensis</i> , <i>Artemisia tripartita ssp. tripartita</i> , and/or <i>Purshia tridentata</i> dominate open to moderately dense (10-40% cover) shrub layer and with at least 25% total perennial herbaceous cover. The natural fire regime of this ecological system likely maintains a patchy distribution of shrubs, so the general aspect of the vegetation is a grassland .....	<b>Inter-Mountain Basins Big Sagebrush Steppe (11)</b>
11a. <i>Purshia tridentata</i> dominates shrub layer of 10% or more absolute cover and with typically greater than 20% total perennial herbaceous cover. <i>Artemisia tridentata</i> may be present, but not codominant. ....	<i>Purshia tridentata</i> Shrub Herbaceous Alliance
11b. <i>Purshia tridentata</i> dominates shrub layer of 10% or more absolute cover and with typically less than 20% total perennial herbaceous cover. <i>Artemisia tridentata</i> may be present, but not codominant. ....	<i>Purshia tridentata</i> Shrubland Alliance <sup>d</sup>
<b>Non-Sagebrush Shrublands and Steppe</b>	
12a. Alpine and upper subalpine dwarf-shrublands may be dominated by <i>Cassiope mertensiana</i> , <i>Salix arctica</i> , <i>S. reticulata</i> , <i>S. vestita</i> , or <i>Phyllodoce empetriformis</i> . Other shrub associates may include <i>Vaccinium</i> spp., <i>Ledum glandulosum</i> , <i>Phyllodoce glanduliflora</i> , and <i>Kalmia microphylla</i> . Stands are restricted to high elevation sites in MZ 29 such as in the Big Horn Mountains and Laramie Range. ....	<b>Rocky Mountain Alpine Dwarf-Shrubland</b>
12b. Shrubland or shrub-steppe Not alpine.....	13
13a. Shrubland occurs within the zone of continuous forest in the upper montane and lower subalpine zones. Stands are dominated by <i>Menziesia ferruginea</i> , <i>Rhamnus alnifolia</i> , <i>Ribes lacustre</i> , <i>Rubus parviflorus</i> , <i>Alnus viridis</i> , <i>Rhododendron albiflorum</i> , <i>Sorbus scopulina</i> , <i>Sorbus sitchensis</i> , <i>Vaccinium myrtillus</i> , <i>V. scoparium</i> , and <i>V. membranaceum</i> occurring alone or in any combination. Other shrubs can include <i>Shepherdia canadensis</i> and <i>Ceanothus velutinus</i> , but these also commonly occur in Northern Rocky Mountain Lower Montane-Foothill Mesic Deciduous Shrubland.....	<b>Northern Rocky Mountain Subalpine Deciduous Shrubland</b>
13b. Shrublands of montane and foothill zones or Great Plains .....	14
14a. Shrubland or shrub-steppe of lower montane and foothill .....	15
14b. Shrubland or shrub-steppe of basins or plains.....	16

- 15a. Common shrubland or shrub-steppe of lower montane and foothill elevations (drier) with *Quercus gambelii* absent or with low cover (<5%) and NOT codominant. Shrub layer is dominated or codominated by *Amelanchier utahensis*, *Cercocarpus montanus*, *Purshia tridentata*, *Rhus trilobata*, *Ribes cereum*, *Symphoricarpos oreophilus*, and/or *Yucca glauca*. *Artemisia tridentata* may be present, but not codominant. .... **Rocky Mountain Lower Montane-Foothill Shrubland**
- 15b. This shrubland ecological system is found in the lower montane and foothill regions around the Columbia Basin, and north and east into the northern Rockies, including MZ 29. These shrublands typically occur below treeline, adjacent to the lower treeline of generally forested mountains and highlands and rarely up into the dry sites of the subalpine zone. The shrublands are usually found on steep slopes of canyons and in areas with some soil development. These communities develop near talus slopes as garlands, at the heads of dry drainages, and toeslopes in the moist shrub-steppe and steppe zones. Occurrences in central and eastern Wyoming can include *Artemisia tridentata ssp. vaseyana* and *Cercocarpus montanus*, but neither of these 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. *Physocarpus malvaceus*, *Prunus emarginata*, *Prunus virginiana*, *Rosa* spp., *Rhus glabra*, *Acer glabrum*, *Spiraea betulifolia*, *Amelanchier alnifolia*, *Symphoricarpos* spp., and *Holodiscus discolor* are the most common dominant shrubs. In moist areas *Crataegus douglasii* can be common. .... **Northern Rocky Mountain Montane-Foothill Deciduous Shrubland**
- 16a. This shrubland ecological system ranges from southern Canada to South Dakota, eastern Wyoming and Montana, occurring in the grassland matrix of the Great Plains. These shrublands occur in relatively mesic areas such as along upper terraces of rivers and streams, gently inclined slopes near breaklands, and upland sandy loam areas throughout its range. Stands are dominated by shrub species such as *Amelanchier alnifolia*, *Rhus trilobata*, *Symphoricarpos* spp., *Shepherdia argentea*, *Crataegus douglasii*, *Dasiphora fruticosa ssp. floribunda*, and dwarf-shrubs such as *Juniperus horizontalis*. .... **Northwestern Great Plains Shrubland**
- 16b. These dry shrublands are common in saline basins or disturbed sites and may extend out into the plains.....**17**
- 17a. Open to moderately dense shrublands dominated or codominated by *Sarcobatus vermiculatus*. Stands are widespread in the Intermountain Basins region. *Atriplex canescens*, *Atriplex confertifolia*, or *Krascheninnikovia lanata* may be present to codominant with patches of *Distichlis spicata* grasslands. Commonly occurs on saline/alkaline plains and basins, sometimes encircling playas or on stream terraces..... **Inter-Mountain Basins Greasewood Flat**
- 17b. *Sarcobatus vermiculatus* does Not dominate the shrub layer.....**18**
- 18a. Open to moderately dense shrublands dominated by one or more species of *Atriplex* and/or *Krascheninnikovia lanata*. In Wyoming, occurrences are typically a mix of *Atriplex confertifolia*, *Grayia spinosa*, *Artemisia tridentata ssp. wyomingensis*, *Sarcobatus vermiculatus*, *Krascheninnikovia lanata*, and various *Ericameria* or *Chrysothamnus* species. Some places are a mix of *Atriplex confertifolia* and *Artemisia tridentata ssp. wyomingensis*. This system is typical of saline basins, alluvial slopes and plains across the Intermountain western U.S. and extends into the Great Plains especially on stream terraces and flood plains (Great Divide and Bighorn Basins in Wyoming). .... **Inter-Mountain Basins Mixed Salt Desert Scrub**
- 18b. *Ericameria nauseosa* and/or *Gutierrezia sarothrae* dominate an open shrub layer with or without perennial grass understory.....**19**
- 19a. Heavily disturbed sites of the western Great Plains, with an open to dense shrub layer and limited graminoid herbaceous cover. Shrub species may include *Ericameria nauseosa* and/or *Gutierrezia sarothrae*. Without disturbance, these sites would be characterized as shortgrass prairie, dominated by moderately dense to dense perennial shortgrasses with low cover of shrubs and dwarf shrubs. However, heavy disturbance has led to loss of the grass component, leaving an open to dense shrub layer that resembles a shrubland. .... **Western Great Plains Shortgrass Prairie**
- 19b. Widespread large patch shrub-steppe found on dry foothills, and plains, and mesas in the intermountain western US. It occurs across central Wyoming and grades into prairie grassland/steppe to the east. The shrub layer may be open to dense, with a sparse to moderately dense perennial graminoid layer.

Occurrences may be difficult to distinguish from *Ericameria nauseosa* and/or *Gutierrezia sarothrae*  
dominated stands of Western Great Plains Shortgrass Prairie system .....  
..... **Inter-Mountain Basins Semi-Desert Shrub Steppe<sup>e</sup>**

**KEY D Map Zone 29 & 30: Herbaceous Ecological Systems and Alliances**  
**(Herbaceous layer dominant >10% cover with low woody cover <10%)**

- 1a. Land cover is restricted to drainages, semi-riparian flats, springs or seeps.....2
- 1b. Land cover is upland vegetation.....10
- 2a. High elevation herbaceous wetlands (subalpine-montane) .....3
- 2b. Middle and lower elevation herbaceous wetlands (lower montane to valley floor).....4

**Wetland Herbaceous**

- 3a. Alpine to montane wet meadows without a 40 cm deep organic layer. This system often occurs as a mosaic of several plant associations, often dominated by graminoids, including *Calamagrostis stricta*, *Caltha leptosepala*, *Cardamine cordifolia*, *Carex illota*, *Carex microptera*, *Carex nigricans*, *Carex scopulorum*, *Carex utriculata*, *Carex vernacula*, *Deschampsia caespitosa*, *Eleocharis quinqueflora*, *Juncus drummondii*, *Phippsia algida*, *Rorippa alpina*, *Senecio triangularis*, *Trifolium parryi*, and *Trollius laxus*.....  
..... **Rocky Mountain Alpine - Montane Wet Meadow<sup>c</sup>**
- 3b. Subalpine to montane wetlands with a 40 cm deep organic layer. These wetlands are typically groundwater fed. Fens form at low points in the landscape or near slopes where groundwater intercepts the soil surface. These fens usually occur as a mosaic of several plant associations dominated by *Carex aquatilis*, *Carex limosa*, *Carex lasiocarpa*, *Betula nana*, *Kobresia myosuroides*, *Kobresia simpliciuscula*, and *Trichophorum pumilum* (= *Scirpus pumilus*). *Sphagnum* spp. (peatmoss) is indicative of iron fens. ....  
..... **Rocky Mountain Subalpine - Montane Fen<sup>c</sup>**
- 4a. Middle and low elevation wetland system that is widespread in the arid and semi-arid regions of western North America. Stands are marshes typically dominated by species of *Schoenoplectus*, *Typha*, or *Juncus* and other species adapted to saturated soil conditions. These wetlands may include areas of deeper water with emergent and floating vegetation. .... **North American Arid West Emergent Marsh<sup>c</sup>**
- 4b. Not as above.....5
- 5a. Site more typical of western Great Plains (depressional wetland is generally surrounded by grasslands).....6
- 5b. Site more typical of intermountain west (depressional wetland is generally surrounded by shrublands).....9
- 6a. Herbaceous wetland is associated with prairie potholes that are found primarily in the glaciated northern Great Plains of the United States and Canada. Many of the basins within this system are closed basins and receive irregular inputs of water from their surroundings (groundwater and precipitation), and export water as groundwater. Hydrology of the potholes is complex. Precipitation and runoff from snowmelt are often the principal water sources, with groundwater inflow secondary. Evapotranspiration is the major water loss, with seepage loss secondary. Most of the wetlands and lakes contain water that is alkaline (pH >7.4) and range from fresh to extremely saline. Common species include *Carex lasiocarpa*, *Carex oligosperma*, *Schoenoplectus acutus*, *Schoenoplectus fluviatilis*, *Schoenoplectus maritimus*, and *Sphagnum* spp. *Triglochin maritima*. In addition, because of periodic droughts and wet periods, many wetlands within this system may undergo vegetation cycles. This system includes elements of emergent marshes and wet, sedge meadows that develop into a pattern of concentric rings. .... **Great Plains Prairie Pothole Western Great Plains Depressional Wetland Systems<sup>b</sup>**
- 6b. Wetlands are Not characterized by prairie potholes .....7
- 7a. Herbaceous wetlands associated with saline playa lakes and intermittently flooded depressional basins (playas). Strongly saline soils cause both the shallow lakes and depressions and the surrounding areas to be more brackish. Salt encrustations can occur on the surface in some examples of this system. Species that typify this system are salt tolerant and halophytic species such as *Distichlis spicata*, *Sporobolus airoides*, and *Hordeum jubatum*. Other commonly occurring taxa include *Salicornia* sp., *Schoenoplectus maritimus*, *Schoenoplectus americanus*, *Suaeda calceoliformis*, *Spartina* spp., and shrubs such as *Krascheninnikovia lanata*. .... **(Western Great Plains Saline Depression Wetland<sup>a</sup>)**

- ..... **Western Great Plains Depressional Wetland Systems<sup>b</sup>**
- 7b. Not as above.....8
- 8a. Site occurs in upland depressional rainwater basin that is characterized by the presence of an impermeable soil layer and is usually recharged by rainwater and nearby runoff. They are rarely linked to outside groundwater sources and do not have an extensive watershed. Ponds and lakes associated with this system experience periodic drawdowns during drier seasons and years, and are often replenished by spring rains. *Eleocharis* spp., *Hordeum jubatum*, along with common forbs such as *Coreopsis tinctoria*, *Symphyotrichum subulatum*, and *Polygonum pensylvanicum* are common vegetation in the wetter and deeper depression, while *Pascopyrum smithii* and *Buchloe dactyloides* are more common in shallow depressions in rangeland..... **(Western Great Plains Closed Depression Wetland<sup>a</sup>)**  
..... **Western Great Plains Depressional Wetland Systems<sup>b</sup>**
- 8b. Site occurs in lowland depressions and also occur along lake borders that have more open basins and a permanent water source through dry years. Site has a large watershed and/or significant connection to the groundwater table. The system includes submergent and emergent marshes, and associated wet meadows and wet prairies. These types can also drift into stream margins that are more permanently wet. This system may not occur in MZ 29 or 30..... **(Western Great Plains Open Depression Wetland<sup>a, e</sup>)**  
..... **Western Great Plains Depressional Wetland Systems<sup>b</sup>**
- 9a. Site are seasonally to semipermanently flooded, usually retaining water into the growing season and drying completely only in drought years. Many are associated with springs, located in basins with internal drainage. Soils are alkaline to saline clays with hardpans. Seasonal drying exposes mudflats colonized by annual wetland vegetation. Salt encrustations can occur on the surface in some examples of this system, and the soils are severely affected and have poor structure. Species that typify this system are salt-tolerant and halophytic species such as *Distichlis spicata*, *Puccinellia lemmonii*, *Poa secunda*, *Muhlenbergia* spp., *Leymus triticoides* (= *Elymus triticoides*), *Schoenoplectus maritimus*, *Schoenoplectus americanus*, *Triglochin maritima*, and *Salicornia* spp. Types often occur along the margins of perennial lakes, in alkaline closed basins, with extremely low-gradient shorelines. Does not occur in MZ 29 or 30, but included because similar to WGP Saline Depression.....  
..... **Inter-Mountain Basins Alkaline Closed Depression<sup>c, e</sup>**
- 9b. This herbaceous wetland occurs within dune fields as small (usually less than 0.1 ha), interdunal swales. These depressions occur in wind deflation areas, where sands are scoured down to the water table. Small ponds may be associated. Water table may be perched over an impermeable layer of caliche or clay layer or a closed basin that traps water. These wetlands are typically dominated by common emergent herbaceous vegetation such as species of *Eleocharis*, *Juncus*, and *Schoenoplectus*. Dune field ecological processes distinguish these emergent wetlands from similar non-dune wetlands.  
..... **Inter-Mountain Basins Interdunal Swale Wetland<sup>c</sup>**

## Upland Herbaceous

- 10a. Herbaceous cover dominated by annual graminoids or annual and biennial forbs.....11
- 10b. Herbaceous cover dominated by perennial species.....12
- 11a. Herbaceous cover dominated by annual species of brome grass (typically *Bromus tectorum*, but including *Bromus arvensis*, *Bromus briziformis*, *Bromus japonicus*, *Bromus racemosus*, *Bromus rubens*, *Bromus hordeaceus*, *Bromus rigidus*) or other invasive annual grasses such as *Avena fatua*, *Taeniatherum caput-medusae*, or *Vulpia myuros*..... **Invasive Annual Grassland**
- 11b. Herbaceous cover dominated by introduced annual and biennial forbs (including *Ceratocephala testiculata*, *Halogeton glomeratus*, *Bassia scoparia*, *Lepidium perfoliatum*, *Salsola kali*, *Centaurea solstitialis*, *Chondrilla juncea*, *Halogeton glomeratus*, *Lepidium perfoliatum*, *Salsola tragus*, *Sisymbrium altissimum*, etc.)..... **Invasive Annual and Biennial Forbland**
- 12a. Herbaceous cover dominated by introduced perennial grasses and forbs, including *Agropyron cristatum*, *Alopecurus geniculatus*, *Agrostis stolonifera*, *Bromus inermis*, *Centaurea* sp., *Cirsium arvense*, *Dactylis glomerata*, *Euphorbia esula*, *Lepidium latifolium*, *Leucanthemum vulgare*, *Linaria vulgaris*, *Lolium*

<i>perenne</i> , <i>Melilotus</i> spp., <i>Poa pratensis</i> , <i>Phleum pratense</i> , <i>Thinopyrum intermedium</i> , and other introduced forage species .....	<b>Invasive Perennial Grassland and Forbland</b>
12b. Herbaceous cover dominated by native species .....	<b>13</b>
13a. Alpine and subalpine dwarf-shrublands are dominated by dwarf willows, <i>Salix arctica</i> , <i>S. reticulata</i> , or <i>S. vestita</i> . Vegetation forms a short carpet-like cover and may be codominated by short alpine turf grasses. ....	<b>Rocky Mountain Alpine Dwarf-Shrubland</b>
13b. Vegetation not dominated (<25% total cover) by dwarf willow species.....	<b>14</b>
14a Alpine herbaceous vegetation dominated by short graminoids and forbs forming a turf. Characteristic species include <i>Artemisia arctica</i> , <i>Carex elynoides</i> , <i>Carex siccata</i> , <i>Carex scirpoidea</i> , <i>Carex nardina</i> , <i>Carex rupestris</i> , <i>Festuca brachyphylla</i> , <i>Festuca idahoensis</i> , <i>Geum rossii</i> , <i>Kobresia myosuroides</i> , <i>Phlox pulvinata</i> , and <i>Trifolium dasyphyllum</i> . ....	<b>Rocky Mountain Alpine Turf</b>
14b Subalpine, montane, foothill and basin vegetation.....	<b>15</b>
15a Subalpine and montane herbaceous upland vegetation .....	<b>16</b>
15b. Lower montane, foothill, mesa and lower elevation grasslands found in basins and plains, and alkaline flats .....	<b>18</b>
16a. Subalpine herbaceous vegetation that is typically dominated or codominated by mesic, perennial forbs. Important taxa include forbs such as <i>Balsamorhiza sagittata</i> , <i>Campanula</i> spp., <i>Ligusticum</i> spp., <i>Lupinus</i> spp., <i>Mertensia</i> spp., <i>Penstemon</i> spp., <i>Rudbeckia occidentalis</i> , <i>Solidago</i> spp., <i>Thalictrum occidentale</i> , <i>Valeriana sitchensis</i> , <i>Wyethia</i> spp., and grasses <i>Deschampsia caespitosa</i> , <i>Koeleria macrantha</i> , perennial <i>Bromus</i> spp., and species of <i>Carex</i> . Mesic shrubs <i>Dasiphora fruticosa ssp. floribunda</i> and <i>Symphoricarpos</i> spp. are occasionally present. ....	<b>Rocky Mountain Subalpine - Montane Mesic Meadow</b>
16b. Subalpine herbaceous vegetation that is typically dominated or codominated by perennial grasses. ....	<b>17</b>
17a. Upper montane to subalpine grasslands from the Northern Rocky Mountains and extends east from the Rocky Mountain Front to the isolated mountains of central Montana. These dry grasslands range from small meadows to large open parks surrounded by conifer trees, but lack tree cover within them. Typical dominant species include <i>Leymus innovatus</i> , <i>Koeleria macrantha</i> , <i>Festuca campestris</i> , <i>Festuca idahoensis</i> , <i>Festuca viridula</i> , <i>Achnatherum occidentale</i> , <i>Achnatherum richardsonii</i> , <i>Bromus inermis ssp. pumpellianus</i> , <i>Elymus trachycaulus</i> , <i>Phleum alpinum</i> , <i>Trisetum spicatum</i> , and a variety of Carices, such as <i>Carex hoodii</i> , <i>Carex obtusata</i> , and <i>Carex scirpoidea</i> . Important forbs include <i>Lupinus argenteus var. laxiflorus</i> , <i>Potentilla diversifolia</i> , <i>Potentilla flabellifolia</i> , <i>Fragaria virginiana</i> , and <i>Chamerion angustifolium</i> . This system is similar to Northern Rocky Mountain Lower Montane, Foothill and Valley Grassland (below), but is found at higher elevations and is more often composed of <i>Festuca</i> spp. and <i>Achnatherum</i> and/or <i>Hesperostipa</i> spp. (= <i>Stipa</i> spp.) with additional floristic components more characteristic of subalpine taxa. Occurrences of this system are often more forb-rich than Southern Rocky Mountain subalpine grasslands. ....	<b>Northern Rocky Mountain Subalpine – Upper Montane Grassland</b>
17b. Montane to subalpine grasslands from the Southern Rocky Mountains which include the Laramie Range and Medicine Bow Mountains in southern Wyoming. Stands occur between 2200-3000 m elevation on dry flat to rolling plains or lower side slopes, but may extend up to 3350 m on warm aspects. Vegetation is dominated by bunch grasses such as <i>Danthonia</i> spp., <i>Festuca</i> spp., <i>Muhlenbergia filiculmis</i> , <i>M. montana</i> or <i>Pseudoroegneria spicata</i> . ....	<b>Southern Rocky Mountain Montane - Subalpine Grassland</b>
18a. Lower montane, mesa, foothill, piedmont and high valley grasslands .....	<b>19</b>
18b. Low elevation grasslands found in dryer basins, alkaline flats and Great Plains.....	<b>20</b>
19a Lower montane to foothill elevation grasslands in the mountains and large valleys of western Montana and northern Wyoming, such as the Bighorn Valley. These grasslands are floristically similar, particularly in dominant grasses to Inter-Mountain Basins Big Sagebrush Steppe, but lack a big sagebrush shrub layer. Stands range 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. Stands are dominated by cool-season perennial bunch grasses and forbs (>25% cover), sometimes with a sparse shrub cover (<10%). Dominant grasses are *Pseudoroegneria spicata*, *Festuca campestris*, *Festuca idahoensis*, or *Hesperostipa comata* with a variety of other graminoids, such as *Achnatherum hymenoides*, *Achnatherum occidentale*, *A. richardsonii*, *Bromus inermis ssp. pumpellianus*, *Carex filifolia*, *Danthonia intermedia*, *Elymus trachycaulus*, *Hesperostipa curtisetata*, *Koeleria macrantha*, *Leymus cinereus*, and *Pascopyrum smithii*. Important exotic grasses include *Phleum pratense*, *Bromus inermis*, and *Poa pratensis*. Scattered shrub may include *Amelanchier alnifolia*, *Artemisia tridentata*, *Eriogonum heracleoides*, *Juniperus communis*, *Rosa* spp., *Symphoricarpos* spp., and in Wyoming *Artemisia tripartita ssp. rupicola*. These are extensive grasslands, not grass-dominated patches within the sagebrush shrub-steppe ecological system. *Festuca campestris* is easily eliminated by grazing and does not occur in all areas of this system..... **Northern Rocky Mountain Lower Montane Foothill and Valley Grassland**

19b Mixed-grass to tallgrass grasslands found on moderate to gentle slopes, usually at the base of foothill slopes of the Southern Rocky Mountain Front Range that extends into southern Wyoming along the foot of the Laramie Range, Medicine Bow Mountains and around the Black Hills where it typically occurs as a relatively narrow elevational band between foothill woodlands or shrublands and the plains. Communities may be dominated by *Andropogon gerardii*, *Schizachyrium scoparium*, *Muhlenbergia montana*, *Nassella viridula*, *Pascopyrum smithii*, *Sporobolus cryptandrus*, *Bouteloua gracilis*, *B. curtipendula*, *Hesperostipa comata*, or *Hesperostipa neomexicana*. In Wyoming, typical grasses found in this system include *Pseudoroegneria spicata*, *Hesperostipa comata*, *Hesperostipa neomexicana*, *Schizachyrium scoparium* and species of *Poa*..... **Western Great Plains Foothill and Piedmont Grassland**

20a Stands occur as small patch grasslands found on sand deposits within a northern mixedgrass matrix. These stands represent peripheral examples of the typically large patch sand prairies found in the Nebraska Sandhills. *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. Only *Calamovilfa longifolia* functions as a dominant throughout the range of the system. In the western extent, *Hesperostipa comata* becomes more dominant, and *Andropogon hallii* is less abundant but still present. In central and eastern Montana, *Artemisia cana ssp. cana* can be an important shrub component..... **Western Great Plains Sand Prairie**

20b. Grassland does not occur on sand sheet or sand deposits within plains..... **21**

21b. Tallgrass prairie that extends into western high plains of eastern Montana, Wyoming and western Dakotas and Canada. It is found primarily in areas where soil characteristics allow for mesic conditions more typical of the Eastern Great Plains Division and thus are able to sustain tallgrass species. This system occurs in typically small patches interspersed within Northwestern Great Plains Mixedgrass Prairie (CES303.674) or Western Great Plains Shortgrass Prairie (CES303.672) and may also be associated with upland terraces above a floodplain system where these more mesic conditions persist. This grassland is dominated primarily by *Andropogon gerardii* and may also include *Sorghastrum nutans*, *Schizachyrium scoparium*, *Pascopyrum smithii*, *Hesperostipa spartea*, and *Sporobolus heterolepis*. *Andropogon gerardii* often dominates the lowland regions, although *Pascopyrum smithii* can be prolific if conditions are favorable. .... **Western Great Plains Tallgrass Prairie**

21b. Grassland Not dominated by tallgrass species..... **22**

22a. Widespread mixed-grass prairie that extends into high plains of eastern Wyoming from northern Nebraska, Dakotas and eastern Montana on both glaciated and non-glaciated substrates. Soil texture tends to be finer textured loams and clay loams. Cool-season grasses typically dominate the ground cover (greater than 50% cover). Characteristic species include *Pascopyrum smithii*, *Nassella viridula*, *Bouteloua gracilis*, *Hesperostipa comata*, *Koeleria macrantha*, and *Carex filifolia*. *Festuca campestris* and *Festuca idahoensis* may be more abundant in the north and foothill/montane grassland transition areas. *Hesperostipa comata* is also an important component and becomes increasingly so as improper grazing regimes favor it at the expense of (usually) *Pascopyrum smithii*. Progressively more destructive grazing can result in the loss of *P. smithii* from the system followed by drastic reduction in *Hesperostipa comata* and ultimately the dominance of *Bouteloua gracilis* (or *Poa secunda* and other short graminoids) and/or a lawn of *Selaginella densa*. Shrub species such as *Symphoricarpos* spp., *Artemisia frigida*, and *A. cana* also occur. Those areas with greater than 10% cover of native shrub species in conjunction with topographic relief (break) would be considered part of Northwestern Great Plains Shrubland.....



.....	<b>Northwestern Great Plains Mixedgrass Prairie</b>
22. Not as above.....	<b>23</b>
23a. Widespread mixed-grass prairie of the central Great Plains that extends north into South Dakota. It is typically dominated by <i>Schizachyrium scoparium</i> or <i>Pascopyrum smithii</i> , but may include grass species such as <i>Bouteloua curtipendula</i> , <i>Andropogon gerardii</i> , <i>Hesperostipa comata</i> , <i>Sporobolus heterolepis</i> , and <i>Bouteloua gracilis</i> . Warm season grasses typically have significant cover. If stands occur in these map zones, it is restricted to southeastern portion of MZ 29 and the eastern portions of MZ 30 in the western Dakotas (but will be uncommon if it occurs). .....	
	<b>Central Mixedgrass Prairie<sup>e</sup></b>
23b. Not as above.....	<b>24</b>
24b. Shortgrass prairie that extends into eastern Wyoming from eastern Colorado. Sites are primarily on flat to rolling uplands with loamy, ustic soils ranging from sandy to clayey. <i>Bouteloua gracilis</i> and/or <i>Buchloe dactyloides</i> typically dominating this grassland. Associated graminoids may include <i>Aristida purpurea</i> , <i>Bouteloua curtipendula</i> , <i>Bouteloua hirsuta</i> , <i>Buchloe dactyloides</i> , <i>Hesperostipa comata</i> , <i>Koeleria macrantha</i> , <i>Pascopyrum smithii</i> , <i>Pleuraphis jamesii</i> , <i>Sporobolus airoides</i> , and <i>Sporobolus cryptandrus</i> . 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 <i>Hesperostipa comata</i> , <i>Sporobolus cryptandrus</i> , and <i>Yucca glauca</i> . Scattered shrub and dwarf-dwarf species such as <i>Artemisia filifolia</i> , <i>Artemisia frigida</i> , <i>Artemisia tridentata</i> , <i>Atriplex canescens</i> , <i>Eriogonum effusum</i> , <i>Gutierrezia sarothrae</i> , and <i>Lycium pallidum</i> may also be present with low cover. ....	
	<b>Western Great Plains Shortgrass Prairie</b>
24b. Widespread dry foothill and lower elevation grasslands found on dry plains, mesas and alkaline flats in basins southwestern Wyoming and throughout much of the intermountain western US. Typically dominated or codominated by <i>Bouteloua gracilis</i> , <i>Achnatherum hymenoides</i> , <i>Pleuraphis jamesii</i> , <i>Hesperostipa comata</i> , <i>Sporobolus airoides</i> and may include scatter shrubs and dwarf-shrubs. If occurs in these map zones, it would be restricted to near the western boundary of MZ 29 in central Wyoming .....	
	<b>Inter-Mountain Basins Semi-Desert Grassland<sup>e</sup></b>