

Field Key to Ecological Systems and Target Alliances of the Mogollon Rim, 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 zone 15 (the Mogollon Rim). The systems and alliances included in these keys are intended to represent the legend that LANDFIRE will be striving to map for existing vegetation in the Mogollon Rim (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. *Pinus ponderosa* Woodland Alliance).

Systems do not include Latin species names in them, and always start with a Biogeographic region (e.g. Columbia Plateau Steppe and Grassland). 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.

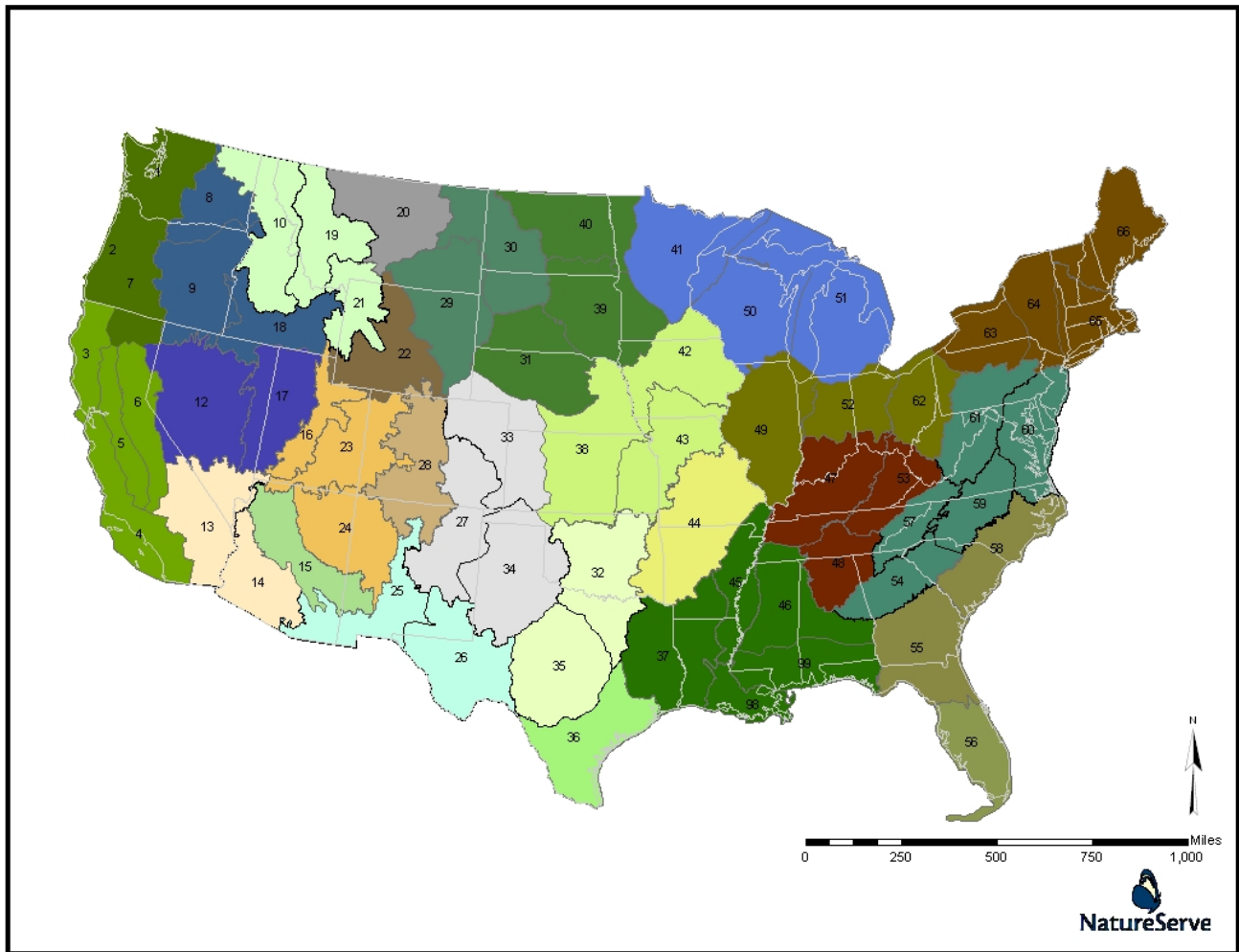


Figure 1. LANDFIRE map zone clusters with keys to ecological systems and selected alliances.

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.

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.
Perennial Ice/Snow	
SEMI-NATURAL / ALTERED VEGETATION	
Ruderal Vegetation	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	
Introduced Vegetation	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>Centaurea repens</i> , <i>Chrysanthemum leucanthemum</i> , <i>Cirsium arvense</i> , <i>C. vulgare</i> , <i>Euphorbia esula</i> , <i>Lepidium latifolia</i> , <i>Cardus nutans</i> , <i>Centaurea spp (difusa, solstitialis)</i> , <i>Salsola kali</i> , <i>Kochia scoparia</i> , <i>Halogeton glomeratus</i> , <i>Melilotus officinalis</i> , <i>M. albus</i> , and <i>Cardaria officinalis</i> .
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> .
California Annual Grassland	Land cover dominated by introduced, non-native annual grasses within the central valley and coastal portions of California. Natural vegetation types are no longer recognizable. Grass and forb species include <i>Bromus spp.</i> (e.g., <i>madritensis</i> , <i>diandris</i> , <i>hordeaceus</i>), <i>Eschschlozia californica</i> , <i>Aira caryophylla</i> , <i>Lasthenia spp.</i> , <i>Castilleja spp.</i> , <i>Avena spp</i> , <i>Mesembryanthemum</i> , <i>Malephora</i> , and/or <i>Carpobrotus</i> , commonly referred to as 'iceplant.' The native shrubs <i>Ambrosia chamissonis</i> , <i>Eriogonum latifolium</i> , and/or <i>Abronia latifolia</i> may be present as emergents. <i>Poa douglasii</i> may also be present.
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>Centarea spp.</i> , <i>Cirsium arvense</i> , <i>Euphorbia esula</i> , <i>Lepidium spp.</i> , <i>Melilotus spp.</i>
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 spp.</i> , <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 arundancea</i> , <i>Phragmites australis</i> , etc.
Modified/Managed Vegetation	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.

Mogollon Rim and Sky Island Ecological Systems and Target Alliances

This key is intended to identify Ecological Systems of the Mogollon rim and Sky Island regions (Mapping Zone #15). 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:

- * indicates 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 (**)
- ** indicates broader LANDFIRE Map Unit.
- *** typically a small patch ecological system type not being mapped by LANDFIRE.
- **** the alliance is not considered to be mappable for LANDFIRE purposes.

- | | |
|--|---|
| 1a. Total woody canopy cover generally 10% or more ..... | ..... |
| ..... | GO TO KEY A: Woodland, Savanna, Shrub Steppe, or Shrubland Systems and Alliances |
| 1b. Total woody canopy cover generally less than 10% |2 |
| 2a. Total herbaceous canopy cover generally 10% or more and is dominated by perennial vegetation. .... | ..... |
| ..... | GO TO KEY B: Herbaceous Systems and Alliances |
| 2b. Total canopy cover generally less than 10% or annual herbaceous cover dominates vegetation..... | ..... |
| ..... | Sparse Vegetation (3) |
| 3a. Sparse desert land cover that generally occurs south of, or below, the Mogollon “Rim” |4 |
| 3b. Sparse land cover that generally occurs on the Colorado Plateau, or above, the Mogollon “Rim” |11 |
| 4a. Land cover is bottomland or drainage |5 |
| 4b. Land cover is upland dune, mudstone or shale badlands, volcanic rock outcrop or cinder site |6 |
| 5a. Land cover is a barren to sparsely vegetated playa |(North American Warm Desert Playa*) |
| ..... | .....North American Warm Desert Sparsely Vegetated Systems** |
| 5b. Land cover is a restricted intermittently flooded drainages with a variety of sparse or patchy vegetation including <i>Sarcobatus vermiculatus</i> , <i>Ericameria nauseosa</i> , <i>Fallugia paradoxa</i> , <i>Artemisia cana ssp. cana</i> or <i>Grayia spinosa</i> . Herbaceous vegetation such as perennial grasses, <i>Distichlis spicata</i> or <i>Sporobolus airoides</i> , may also dominate wash..... | (North American Warm Desert Wash*) |
| ..... | .....North American Warm Desert Sparsely Vegetated Systems** |
| 6a. Land cover is volcanic in origin (includes lava, cinder, ash deposits) ..... | ..... |
| ..... | .....(North American Warm Desert Volcanic Rockland*) |
| ..... | .....North American Warm Desert Sparsely Vegetated Systems** |
| 6b. Land cover is not volcanic in origin..... |7 |
| 7a. Land cover is non-volcanic consolidated rock (cliffs, outcrops, barren mountain tops) |8 |
| 7b. Land cover is unconsolidated material..... |9 |
| 8a. Land cover is largely exposed sedimentary bedrock and scree found along the southern escarpments of the Colorado Plateau and adjacent canyons and plateaus. Typically occurs below montane elevation zone (~<2000 m) | (Colorado Plateau Mixed Bedrock Canyon and Tableland*) |
| ..... | ..... Intermountain Basins Sparsely Vegetated Systems** |
| 8b. Land cover is non-volcanic consolidated rock (cliffs, outcrops, barren mountain tops) ..... | ..... |
| ..... | .....(North American Warm Desert Bedrock Cliff and Outcrop *) |

	North American Warm Desert Sparsely Vegetated Systems**
9a. Land cover is active sands or partially vegetated dunes or sand sheets.....	.....
	(North American Warm Desert Active and Stabilized Dune*)
	North American Warm Desert Sparsely Vegetated Systems**
9b. Land cover is not sand dunes	10
10a. Land cover is eroded shale or clay hills (may not occur in Sonoran Desert) .....	.....
	(North American Warm Desert Badland*)
	North American Warm Desert Sparsely Vegetated Systems**
10b. Land cover is wind swept plains and flats with a surface layer of pebbles. Total vegetation cover is low (<10%) excepting ephemeral annual cover following wet year precipitation events. Stand is co-dominated by <i>Larrea tridentata</i> and <i>Ambrosia dumosa</i> with less than 2% cover.....	.....
	(North American Warm Desert Pavement*)
	North American Warm Desert Sparsely Vegetated Systems**
11a. Barren and typically sparsely vegetated alpine substrates.....	12
11b. Barren and sparsely vegetated substrates NOT alpine	13
12a. Land cover is mostly exposed rock (usually > 90% cover of either bedrock, boulders or scree). Non-vascular cover (lichens) may be significant	(Rocky Mountain Alpine Bedrock and Scree*)
	Rocky Mountain Alpine/Montane Sparsely Vegetated Systems**
12b Land cover has significant amounts (10-50% cover) of vascular herbaceous vegetation (typically dominated by cushion plants) and exposed rock (50-90% % cover). Sites are windswept by prevailing winds and snow does not remain long. This system is unlikely to occur in zone 15	Rocky Mountain Alpine Fell field
13a. Land cover is bottomland or drainages	14
13b. Land cover is upland dune, mudstone or shale badlands, volcanic rock outcrop or cinder site	15
14a. 6a. Land cover is a barren to sparsely vegetated playa.....	.....
	(Inter-Mountain Basins Playa*)
	Inter-Mountain Basins Sparsely Vegetated Systems**
14b. Land cover is restricted to drainages with a variety of sparse or patchy vegetation including <i>Sarcobatus vermiculatus</i> , <i>Ericameria nauseosa</i> , <i>Fallugia paradoxa</i> , <i>Artemisia cana ssp. cana</i> or <i>Grayia spinosa</i> . Herbaceous vegetation such as perennial grasses, <i>Distichlis spicata</i> or <i>Sporobolus airoides</i> , may also dominate wash.....	(Inter-Mountain Basins Wash*)
	Inter-Mountain Basins Sparsely Vegetated Systems**
15a. Land cover is volcanic substrate (includes lava, cinder, ash deposits).....	.....
	(Inter-Mountain Basins Volcanic Rock and Cinder Land*)
	Inter-Mountain Basins Sparsely Vegetated Systems**
15b. Land cover is not volcanic substrate.	16
16a. Land cover is non-volcanic, consolidated rock (cliffs, outcrops).....	17
16b. Land cover is unconsolidated material.....	18
17a. Land cover is largely of exposed bedrock (usually sedimentary) and scree largely found within the Colorado Plateau Region. Typically occurs below montane elevation zone (<2000 m). .....	.....
	(Colorado Plateau Mixed Bedrock Canyon and Tableland*)
	Inter-Mountain Basins Sparsely Vegetated Systems**
17b. Land cover is largely exposed bedrock and scree found in the restricted to montane-subalpine zone in higher mountain ranges of the Colorado Plateau and Mogollon Rim regions (usually above 2000m elevation and/or on non-sedimentary rock.)	(Rocky Mountain Cliff and Canyon*)
	Rocky Mountain Alpine/Montane Sparsely Vegetated Systems**

- 18a. Land cover is active and/or partially vegetated (stabilized) dunes or sand sheets.....
 **(Inter-Mountain Basins Active and Stabilized Dune*)**
 **Inter-Mountain Basins Sparsely Vegetated Systems****
- 18b. Land cover is NOT dunes or sand sheets **19**
- 19a. Land cover is eroded shale or clay hills **(Inter-Mountain Basins Shale Badland*)**
 **Inter-Mountain Basins Sparsely Vegetated Systems ****
- 19b. Land cover is barren, but not as above (review land use and disturbed classes) **(Undifferentiated Barren*)**
 **Inter-Mountain Basins Sparsely Vegetated Systems****

KEY A (Mogollon Rim): Woodland or Shrubland Systems and Alliances
(Woody cover > 10% cover present)

1a. Land cover is restricted to drainages, semi-riparian flats, springs or seeps and areas with high water tables.....2
1b. Land cover is upland vegetation without seeps and areas with high water tables.....12

2a. Desert land cover that generally occurs south of, or below, the Mogollon “Rim”; Madrean species are common in these types.3
2b. Land cover generally occurring on the Colorado Plateau above, the Mogollon “Rim” or at high elevations on isolated “Sky Island” desert mountain ranges7

3a. Land cover is restricted to intermittently flooded drainages with vegetation forming an intermittent to continuous linear band along the sides of the wash **North American Warm Desert Wash*****
3b. Land cover is not restricted to intermittently flooded drainages7

4a. Woodlands and shrublands restricted to drainages and semi-riparian flats that are dominated by species of *Prosopis*..... (**North American Warm Desert Riparian Mesquite Bosque***)
..... **North American Warm Desert Riparian Systems ****
4b. Woodlands and shrublands restricted to drainages and semi-riparian flats that are NOT dominated by species of *Prosopis*5

5a. Woodlands and shrublands that occur in mountain canyons and valleys of southern Arizona and New Mexico, and adjacent Mexico and consist of mid- to low-elevation (1100-1800 m) riparian corridors along perennial and seasonally intermittent streams. Dominant trees include *Populus angustifolia*, *Populus deltoides ssp. wislizeni*, *Populus fremontii*, *Platanus wrightii*, *Juglans major*, *Fraxinus velutina*, and *Sapindus saponaria*. Shrub dominants include *Salix exigua*, *Prunus* spp., *Alnus oblongifolia*, and *Baccharis salicifolia*..... (**North American Warm Desert Lower Montane Riparian Woodland and Shrubland***)
..... **North American Warm Desert Riparian Systems**(6)**

5b. Woodlands and shrublands of low-elevation (<1200 m) riparian corridors along medium to large perennial streams throughout canyons and the desert valleys of the southwestern United States and adjacent Mexico. The vegetation is a mix of riparian woodlands and shrublands. Dominant trees include *Acer negundo*, *Fraxinus velutina*, *Populus fremontii*, *Salix gooddingii*, *Salix lasiolepis*, *Celtis laevigata var. reticulata*, and *Juglans major*. Shrub dominants include *Salix geyeriana*, *Shepherdia argentea*, and *Salix exigua*
..... (**North American Warm Desert Riparian Woodland and Shrubland***)
..... **North American Warm Desert Riparian Systems **(6)**

6a. Woodlands restricted to drainages and semi-riparian flats that are dominated by introduced *Elaeagnus angustifolia*..... (**Elaeagnus angustifolia Semi-Natural Woodland Alliance***)
..... **Invasive Riparian Woodland and Shrubland****
6b. Woodlands and shrublands restricted to drainages and semi-riparian flats that are dominated by *Tamarix* spp (**Tamarix spp. Semi-Natural Temporarily Flooded Shrubland Alliance***)
..... **Invasive Riparian Woodland and Shrubland****

7a. Higher elevation riparian woodlands and shrublands generally >2600 m (subalpine-montane).....8
7b. Middle and lower elevation (generally <2600 m) riparian (or semi-riparian flats) woodlands and shrublands (lower montane to valley floor).....9

8a. Woodlands restricted to drainages, stream terraces, semi-riparian flats and spring or seep fed slopes.....
..... (**Rocky Mountain Subalpine - Montane Riparian Woodland***)
..... **Rocky Mountain Subalpine/Upper Montane Riparian Systems****
8b. Shrublands restricted to drainages, stream terraces, semi-riparian flats and spring or seep fed slopes. Species of *Salix*, *Alnus* or *Betula* are commonly present.....
..... (**Rocky Mountain Subalpine - Montane Riparian Shrubland***)
..... **Rocky Mountain Subalpine/Upper Montane Riparian Systems****

9a. Lower montane – foothill woodlands and shrublands restricted to drainages, semi-riparian flats and spring or seep fed slopes	Rocky Mountain Lower Montane Riparian Woodland and Shrubland (6)
9b. Valley bottom shrublands restricted to temporarily flooded drainages and flats	10
10a. Open to moderately dense shrublands dominated or codominated by <i>Sarcobatus vermiculatus</i> that are widespread in the Intermountain Basins region. <i>Atriplex canescens</i> , <i>Atriplex confertifolia</i> , or <i>Krascheninnikovia lanata</i> may be present to codominant with patches of <i>Distichlis spicata</i> grasslands. Commonly occurs on saline/alkaline plains and basins, sometimes encircling playas or on stream terraces.....	Inter-Mountain Basins Greasewood Flat
10b. Open to moderately dense shrublands Not dominated or codominated by <i>Sarcobatus vermiculatus</i>	11
11a. Desertscrub dominated by an open shrub layer of one or more species of <i>Atriplex</i> . Species of <i>Allenrolfea</i> , <i>Salicornia</i> , <i>Suaeda</i> , or other halophytic plants are often present to codominant. Commonly occurs on saline/alkaline plains and basins, sometimes encircling playas or on stream terraces.....	Sonora-Mojave Mixed Salt Desert Scrub
11b. Open to moderately dense shrublands dominated by one or more species of <i>Atriplex</i> and/or <i>Krascheninnikovia lanata</i> . <i>Sarcobatus vermiculatus</i> is absent or has low cover. Other shrubs present to codominate including <i>Artemisia tridentata ssp. wyomingensis</i> . Typical of saline basins, alluvial slopes and plains across the Intermountain western U.S and extends into the Great Plains	Inter-Mountain Basins Mixed Salt Desert Scrub
12a. Upland forests and woodlands (trees generally with >25% cover)	13
12b. Upland savannas (10-25% cover of trees, generally >3 m tall with a single main stem and >25% cover graminoids), shrublands and shrub-steppe (10-25% cover of shrubs and >25% cover graminoids).....	30
13a. Broadleaf forests and woodlands or mixed conifer-aspen forests and woodlands (deciduous trees make up 25-100% of the tree canopy)	14
13b. Conifer forests and woodlands (deciduous trees may make up less than 25% cover of the tree canopy).....	17
14a. Broadleaf forest or woodland typically dominated or codominated by <i>Populus tremuloides</i>	15
14b. Broadleaf forests and woodlands co-dominated by <i>Acer grandidentatum</i> or Madrean oaks with less than 25% relative tree canopy of each canopy type.	16
15a. Broadleaf forest or woodland typically dominated by <i>Populus tremuloides</i> (and possible inclusions of other broadleaf tree species) with less than 25% total tree canopy cover of conifers.....	Rocky Mountain Aspen Forest and Woodland
15b. Mixed conifer-broadleaf forests and woodlands co-dominated by <i>Populus tremuloides</i> and a conifer trees such as <i>Abies concolor</i> or <i>Pseudotsuga menziesii</i> (both broadleaf and conifer tree cover over 25% total tree canopy cover). Common on the Colorado Plateau, but may extend south on to the Mogollon Rim.....	Inter-Mountain Basins Aspen - Mixed Conifer Forest and Woodland
16a. Broadleaf forest or woodland dominated by <i>Acer grandidentatum</i> , often found in mesic ravines	Rocky Mountain Bigtooth Maple Ravine Woodland
16b. Broadleaf woodlands dominated by Madrean oaks such as <i>Quercus arizonica</i> , <i>Q. emoryii</i> , <i>Q. gravesii</i> , <i>Q. grisea</i> , <i>Q. hypoleucoides</i> , <i>Q. mohriana</i> , <i>Q. oblongifolia</i> , and <i>Q. rugosa</i> . May occur in the extreme southern portion of the Colorado Plateau.....	Madrean Encinal
17a. Subalpine conifer forests and woodlands (spruce-fir zone)	18
17b. Montane and foothills conifer forests and woodlands (Douglas-fir – white fir zone)	20
18a. Conifer forests and woodlands dominated or co-dominated by <i>Pinus aristata</i> and/or <i>P. flexilis</i> (may not be present in mountains Colorado Plateau known from the San Francisco Peaks near Flagstaff, AZ, Southern, Middle and Northern Rocky Mountain, excluding western Uinta Mountains.)	RockyMountains Subalpine Limber-Bristlecone Pine Woodland

18b. Subalpine conifer forests and woodlands NOT dominated or co-dominated by <i>P. aristida</i> and/or <i>P. flexilis</i>	19
19a. Widespread matrix subalpine conifer forests and woodlands of dryer environments that are dominated or co-dominated by <i>Abies lasiocarpa</i> and/or <i>Picea engelmannii</i>	
..... Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	
19b. Large and small patch subalpine conifer forests and woodlands of mesic environments (north aspect toeslopes) that are dominated or co-dominated by <i>Abies lasiocarpa</i> and/or <i>Picea engelmannii</i> with mesic understory species such as <i>Actaea rubra</i> , <i>Amelanchier alnifolia</i> , <i>Erigeron eximius</i> , <i>Rubus parviflorus</i> , or <i>Trifolium dasyphyllum</i>	
..... Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland	
20a. Montane conifer forests and woodlands.....	21
20b. Foothill conifer forests and woodlands.....	26
21a. Matrix <i>Pinus ponderosa</i> dominated woodlands with inclusions of <i>Pseudotsuga menziesii</i> woodlands on cool aspects. <i>Pinus edulis</i> , <i>Juniperus</i> spp., or <i>Populus tremuloides</i> may be also be present.....	
..... Southern Rocky Mountain Ponderosa Pine Woodland	
21b. Conifer forests and woodlands dominated by <i>Abies concolor</i> or <i>Pseudotsuga menziesii</i> , and sometime co-dominated by <i>Pinus ponderosa</i> or <i>P. contorta</i> and/or <i>Populus tremuloides</i>	22
22a. Conifer forests and woodlands typically with Madrean species in the tree canopy and/or other conifers with understory of Madrean oaks such as <i>Quercus hypoleucooides</i> and <i>Quercus rugosa</i> . Common Submogollon and Sky Island mountain vegetation, but restricted to the extreme southern end of the Colorado Plateau	23
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..... Abies concolor Forest Alliance	
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..... Pseudotsuga menziesii Forest Alliance****	

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29b. Stunted (dwarf) woodlands/shrublands that occur on bedrock and shallow soil substrates on Colorado Plateau at lower elevations usually less than 2000 m. Typically is less than 3 m tall and dominated or codominated by <i>Pinus edulis</i> and/or <i>Juniperus osteosperma</i>	(Colorado Plateau Pinyon-Juniper Shrubland*) Colorado Plateau Pinyon-Juniper Woodland and Shrubland**
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	Chihuahuan Mixed Salt Desert Scrub

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- 56a. Upland shrublands dominated by species of *Prosopis* that occur extensively in the foothills and piedmont in the Chihuahuan Desert extending into the Sky Islands and Mogollon Rim regions, and found in transitional areas in the eastern and northern Sonoran Desert. Stands occur above desert scrub (700-1500 m elevation). Vegetation is typically dominated by *Prosopis glandulosa* or *Prosopis velutina* and succulents. Other shrubs present may include thornscrub (*Acacia neovernicosa*, *Acacia constricta*) and species *Juniperus monosperma*, or *Juniperus coahuilensis*. Perennial grass cover is low (<10%) and *Larrea tridentata* and other desert scrub is absent or occasional (never co-dominant). During the last century, the area occupied by this system has increased through conversion of desert grasslands. (See Chihuahuan - Apacherian Foothills and Piedmont Semi-Desert Grassland and Steppe in herbaceous key if stands have significant perennial graminoid cover)..... **Apacherian-Chihuahuan Mesquite Upland Scrub**
- 56b. Broadly defined desert grassland that typically includes an open mixed shrub-succulent or xeromorphic tree layer that may resemble steppe or savanna. It is common in the Borderlands of Arizona, New Mexico and northern Mexico [Apacherian region] and extends out into the Chihuahuan and Sonoran deserts and north into Mogollon Rim area of central Arizona. It is found on gently sloping bajadas, mesas and steeper piedmont and foothill slopes and is characterized by lush (>20% cover) and typically diverse desert grasses, but may have a significant woody component of shrubs, trees and cacti (10-25% cover). Common grass species include *Bouteloua eriopoda*, *B. rothrockii*, *B. curtipendula*, *B. gracilis*, *Eragrostis intermedia*, *Muhlenbergia porteri*, *M. setifolia*, *Pleuraphis jamesii*, *P. mutica*, and *Sporobolus airoides*, succulent species of *Agave*, *Dasylyrion*, and *Yucca*, and tall shrub/short tree species of *Prosopis* and various evergreen oaks (e.g., *Quercus grisea*, *Quercus emoryi*, *Quercus arizonica*). **Apacherian-Chihuahuan Semi-Desert Grassland and Steppe**
- 57a. Montane, foothill or basin shrubland. Other taxa dominate or co-dominate the shrub layer including *Artemisia* spp. and *Quercus gambelii* **58**
- 57b. Shrub layer is dominated or co-dominated by species of *Artemisia*, but NOT with *Quercus gambelii*. **60**

- 58a. Shrubland or shrub steppe of montane elevations usually dominated or co-dominated by *Quercus gambelii*. *Quercus gambelii* may be locally absent but then stand is mesic and dominated by *Amelanchier* spp. Other shrubs include *Acer grandidentatum*, *Cercocarpus montanus*, or *Symphoricarpos* spp., which may co-dominate some stands. *Artemisia tridentata* may be present to codominant (with *Quercus gambelii*)..... **Rocky Mountain Gambel Oak - Mixed Montane Shrubland (59)**
- 58b. Shrubland or shrub steppe of lower montane and foothill elevations (dryer) NOT co-dominated by *Quercus gambelii***60**
- 59a. *Quercus gambelii* dominates or co-dominate the shrub layer.**Quercus gambelii Shrubland Alliance**
- 59b. *Arctostyphyllos patula* dominates or co-dominate the shrub layer..... **Arctostyphyllos patula Shrubland Alliance**
- 60a. Shrubland or shrub steppe of lower montane and foothill elevations (dryer) with *Quercus gambelii* absent or with low cover (NOT codominant). Shrub layer is dominated or co-dominated by *Amelanchier utahensis*, *Cercocarpus montanus*, *Purshia tridentata*, *Rhus trilobata*, *Ribes cereum*, *Symphoricarpos oreophilus*, and/or *Yucca glauca*. *Artemisia tridentata* may be present, but not co-dominant. **Rocky Mountain Lower Montane-Foothill Shrubland**
- 60b. Other shrubland or shrub steppe dominated by other species of *Artemisia*, *Atriplex* or *Ericameria***61**
- 61a. Montane or subalpine (>2000 m elevations) shrubland or shrub steppe dominated or co-dominated 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 co-dominate some stands..... **Inter-Mountain Basins Montane Sagebrush Steppe (62)**
- 61b. Not as above. Shrublands of foothills or basin**63**
- 62a. *Artemisia tridentata* ssp. *vaseyana* typically dominates shrub layer of 10% or more absolute cover and with typically less than 20% total perennial herbaceous cover. **Artemisia tridentata ssp. vaseyana Shrubland Alliance**
- 62b. *Artemisia arbuscula* ssp. *arbuscula* dominated shrubland **Artemisia arbuscula spp. arbuscula Dwarf-Shrubland Alliance**
- 63a. Shrubland or shrub steppe dominated or co-dominated by *Artemisia tridentata* ssp. *tridentata* and/or *Artemisia tridentata* ssp. *wyomingensis*. *Symphoricarpos* spp. or *Purshia tridentata* may co-dominate some stands. Generally with less than 25% total perennial herbaceous cover..... **Inter-Mountain Basins Big Sagebrush Shrubland**
- 63b. Not as above. *Artemisia tridentata* does not dominate shrubland.....**64**
- 64b. Lower elevation dwarf shrubland or dwarf shrub steppe dominated or co-dominated by *Artemisia nova*, *A. bigelovii*, and/or *A. tridentata* ssp. *wyomingensis*. Common on shallow rocky soils at lower elevation in mountains, foothills and breaks in plains from the Colorado Plateau across southern Colorado and northern New Mexico extending out into the plains. Found on shallow, rocky soils **Colorado Plateau Mixed Low Sagebrush Shrubland**
- 64b. Not as above. *Artemisia nova* or *Artemisia bigelovii* does not dominate shrubland.....**65**
- 65a. *Atriplex* spp and/or *Krascheninnikovia lanata* dominate the shrub layer. Typically found in basins **Inter-Mountain Basins Mixed Salt Desert Scrub**
- 65b. *Ericameria nauseosa* and/or *Gutierrezia sarothrae* dominate an open shrub layer with or without grass understory **Inter-Mountain Basins Semi-Desert Shrub Steppe**

KEY B (Mogollon Rim): Herbaceous Ecological Systems and Alliances
(Herbaceous layer dominant > 20% cover with low woody cover < 10%)

1a. Land cover is restricted to drainages, semi-riparian flats, springs or seeps.....	2
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2a. High elevation herbaceous wetlands (subalpine-montane)	3
2b. Middle and lower elevation herbaceous wetlands (lower montane to valley floor).....	4
3a. Alpine to montane wet meadows without a 40 cm deep organic layer.	Rocky Mountain Alpine-Montane Wet Meadow***
3b. Subalpine to montane wetlands with a 40 cm deep organic layer. This wetland is typically groundwater fed.....	Rocky Mountain Subalpine-Montane Fen***
4a. Middle to lower elevation herbaceous wetlands (lower montane to valley floor).....	North American Arid West Emergent Marsh***
4b. Low elevation desert wetlands typically fed by alkaline springs or seeps	North American Warm Desert Cienega***
5a. Herbaceous cover dominated by annual graminoids or annual and biennial forbs	6
5b. Herbaceous cover dominated by perennial species	7
6a. Herbaceous cover dominated by annual species of brome grass (typically <i>Bromus tectorum</i> , but including <i>Bromus japonicus</i> , <i>Bromus rubens</i> , <i>Bromus hordeaceus</i> , <i>Bromus rigidus</i>)	Invasive Annual Grassland
6b. 5a. Herbaceous cover dominated by introduced annual and biennial forbs (including <i>Ceratocephala testiculata</i> , <i>Halogeton glomeratus</i> , <i>Kochia scoparium</i> , <i>Lepidium perfoliatum</i> , <i>Salsola kali</i> , etc.)	Invasive Annual and Biennial Forbland
7a. Herbaceous cover dominated by introduced perennial grasses and forbs (including <i>Agropyron cristatum</i> , <i>Alopecurus geniculatus</i> , <i>Agrostis stolonifera</i> , <i>Bromus inermis</i> , <i>Cenntareau sp</i> , <i>Cirsium arvense</i> , <i>Euphorbia esula</i> , <i>Lepidium latifolium</i> , <i>Melilotus spp.</i> , <i>Thinopyrum intermedium</i> , <i>Poa pratensis</i> , <i>Phleum pratense</i> , and other introduced forage species	Invasive Perennial Grassland and Forbland
7b. Herbaceous cover dominated by native species	8
8a. Alpine herbaceous vegetation. Restricted to tallest mountains such as San Francisco Peak	9
8b. Subalpine, montane, foothill and basin vegetation.....	10
9a. Gound cover dominated by short graminoids and forbs forming a turf	Rocky Mountain Dry Tundra
9b. Ground cover has significant amounts (10-50%) of vascular herbaceous vegetation (typically dominated by cushion plants) and exposed rock (>50% cover). Sites are windswept by prevailing winds and snow does not remain long. Unlikely to occur in the Mogollon Rim region.	Rocky Mountain Alpine Fell field
10a. Subalpine herbaceous vegetation found above 3000 m in elevation. Forbs typically contributing more to overall cover than graminoids. Important species include <i>Erigeron spp.</i> , <i>Aster spp.</i> , <i>Mertensia spp.</i> , <i>Penstemon spp.</i> , <i>Campanula spp.</i> , <i>Lupinus spp.</i> , <i>Solidago spp.</i> , <i>Ligusticum spp.</i> , <i>Balsamorhiza sagittata</i> , <i>Wyethia spp.</i> , <i>Deschampsia cespitosa</i> , <i>Koeleria macrantha</i> , and <i>Dasiphora fruticosa</i> , <i>Rosa woodsii</i> , and <i>Symphoricarpos spp</i>	Rocky Mountain Subalpine Mesic Meadow
10b. Montane, foothill and basin herbaceous vegetation	11
11a. Montane – subalpine grasslands found 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 spp.</i> , <i>Festuca spp.</i> , <i>Muhlenbergia filiculmis</i> , <i>M. montana</i> or <i>Pseudoroegneria spicata</i>	Southern Rocky Mountain Montane-Subalpine Grassland
11b. Foothill and basin vegetation	12

- 12a. Widespread dry foothill and lower elevation grasslands found on sandy plains, and mesas on the Colorado Plateau region south to the Mogollon Rim. Typically dominated or codominated by *Bouteloua gracilis*, *Achnatherum hymenoides*, *Pleuraphis rigida*, *P. jamesii*, and *Hesperostipa comata* and may include scatter shrubs and dwarf-shrubs.....**Inter-Mountain Basins Semi-Desert Grassland**
- 12b. Desert grasslands that are restricted to the southernmost portions of the Colorado Plateau, but will occur in the lower elevations of the Mogollon Rim region**13**
- 13a. Broadly defined desert grassland that may include an open mixed shrub-succulent or xeromorphic tree layer and is common of the Borderlands of Arizona, New Mexico and northern Mexico [Apacherian region], but extends out into the Chihuahuan and Sonoran deserts, and north into Mogollon Rim region of central Arizona. It found on gently sloping bajadas, mesas and steeper piedmont and foothill slopes. It is characterized by lush (>20% cover) and typically diverse desert grasses, but may have a significant woody component of shrubs, trees and cacti (10-25% cover). Common grass species include *Bouteloua eriopoda*, *B. hirsuta*, *B. rothrockii*, *B. curtipendula*, *B. gracilis*, *Eragrostis intermedia*, *Muhlenbergia porteri*, *M. setifolia*, *Pleuraphis jamesii*, *P. mutica*, and *Sporobolus airoides*, succulent species of *Agave*, *Dasyllirion*, and *Yucca*, and tall shrub/short tree species of *Prosopis* and various evergreen oaks (e.g., *Quercus grisea*, *Q. emoryi*, *Q. arizonica*)..... **Apacherian-Chihuahuan Semi-Desert Grassland and Steppe**
- 13b. Not as above.....**14**
- 14b Dry grasslands found on sandy plains and mesas above the Chihuahuan desertscrub elevations. Stands are typically dominated or codominated by *Achnatherum hymenoides*, *Bouteloua eriopoda*, *B. hirsuta*, *Hesperostipa neomexicana*, *Pleuraphis. jamesii*, *Sporobolus cryptandrus*, and *S. flexuosus* often with scattered shrubs and stem succulents such as *Ephedra torreyana*, *E. trifurca*, *Fallugia paradoxa*, *Yucca elata*, and *Y. torreyana* **Chihuahuan Sandy Plains Semi-Desert Grassland**
- 14b. Basins grasslands that may occasionally flood, but lack wetland soil characteristics. Vegetation is typically dominated by *Pleuraphis mutica* (tobosa swales) or other mesic graminoids such as *Pascopyrum smithii*, *Panicum obtusum*, *Sporobolus airoides*, or *Sporobolus wrightii*.....
..... **(Chihuahuan - Sonoran Desert Bottomland and Swale Grassland*)**
.....**North American Warm Desert Riparian Systems ****