

**INTERNATIONAL ECOLOGICAL
CLASSIFICATION STANDARD:**

TERRESTRIAL ECOLOGICAL CLASSIFICATIONS

**NVC Groups of the Western U.S. on the
LANDFIRE Legend**

28 November 2017

by

NatureServe

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This subset of the International Ecological Classification Standard include Groups occurring in the western U.S. and that are on the LANDFIRE legend. This classification has been developed in consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications. Comments and suggestions regarding the contents of this subset should be directed to Mary J. Russo, Central Ecology Data Manager, NC <mary_russo@natureserve.org> and Marion Reid, Senior Regional Ecologist, Boulder, CO <marion_reid@natureserve.org>.



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1.B.1.Nc. Californian Forest & Woodland (D007)

M009. Californian Forest & Woodland

1. Forest & Woodland

1.B.1.Nc. Californian Forest & Woodland

G195. Californian Broadleaf Forest & Woodland

Type Concept Sentence: This group consists of oak and other broadleaf woodlands largely endemic to the California Floristic Province that forms one of the most extensive and conspicuous vegetation types in California. Anchored by six endemic, widespread and overlapping characteristic oak species which are (in alphabetical order): *Quercus agrifolia*, *Quercus chrysolepis*, *Quercus douglasii*, *Quercus kelloggii*, *Quercus lobata*, and *Quercus wislizeni*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.1.Nc.1. Californian Forest & Woodland (M009)

Elcode: G195

***Scientific Name:** *Quercus agrifolia* - *Quercus lobata* - *Umbellularia californica* Forest & Woodland Group

***Common (Translated Scientific) Name:** California Live Oak - Valley Oak - California Laurel Forest & Woodland Group

***Colloquial Name:** Californian Broadleaf Forest & Woodland

***Type Concept:** This group consists of oak and other broadleaf woodlands largely endemic to the California Floristic Province. It forms one of the most extensive and conspicuous vegetation types in California. Anchored by six endemic, widespread and overlapping characteristic oak species which are (in alphabetical order): *Quercus agrifolia*, *Quercus chrysolepis*, *Quercus douglasii*, *Quercus kelloggii*, *Quercus lobata*, and *Quercus wislizeni*. These occur throughout California on coastal plains, in the coastal mountains from north to south, in the foothills surrounding the Central Valley, in the Sierra Nevada foothills up to 2000 m (rarely as high as 2500 m [8200 feet]) elevation, in the Klamath Mountains of the northwest, in the Peninsula Ranges in the south, as well as on the Channel Islands. *Quercus wislizeni* intermixes extensively with *Quercus douglasii* throughout almost all of its range. The same is true with *Quercus lobata* and *Quercus douglasii* or *Quercus wislizeni*. *Quercus lobata* and *Quercus wislizeni* may both be found in riparian or semi-riparian settings, and *Quercus lobata* is often found in mountains and foothills at higher elevations than *Quercus douglasii* in the foothills and Coast Ranges. On the Channel Islands, there are several island endemic broadleaf tree species; however, these are associated and intermix with non-island endemics, for example *Lyonothamnus* spp. and *Quercus tomentella* are often associated with *Quercus agrifolia* and are clearly ecologically related to them. Although *Umbellularia californica* is typically more mesic than many oaks, it is regularly associated with *Quercus agrifolia* in the Coast Ranges and with *Quercus chrysolepis* in the Klamath Mountains, in the Sierra Nevada and the southern California mountains. The "mixed" oak alliance (*Quercus agrifolia*, *Quercus douglasii*, *Quercus kelloggii*, *Quercus lobata*, and *Quercus wislizeni*) is another example of why a split between evergreen and deciduous species or montane versus lower-elevation types cannot represent the ecology of these woodland communities. There are many stands in the Coast Ranges and other parts of the state where two or more species of evergreen and deciduous oaks codominate.

The species with the widest range is *Quercus chrysolepis*, ranging up into central Oregon and east into Arizona. Looking at association-level diversity, these stands are primarily in the California Floristic Province. *Quercus chrysolepis*-dominated stands are clearly associated with warm California Mediterranean climate and are regularly associated with *Quercus kelloggii*, *Aesculus californica*, and *Quercus wislizeni* throughout much of the state. Thus, although *Quercus chrysolepis* and *Quercus kelloggii* are often considered more "montane" than other California oaks, they overlap extensively with other oaks in the Sierra Nevada foothills and in the Coast Ranges. Similarly, *Quercus douglasii* and *Quercus wislizeni*, a deciduous and an evergreen oak, respectively, are the most commonly overlapping species in the warmer inland foothills surrounding the Great Valley.

In addition, in southern California, in the Peninsular Ranges, *Quercus engelmannii* occurs and mixes with several of the above-mentioned species. Also included in this group are distinctive woodlands of other California endemic broadleaf tree species that occur as pure stands adjacent to oak woodlands, but also commonly are components of oak woodland canopy. These are *Aesculus californica*, *Juglans californica*, and *Umbellularia californica*.

These woodlands vary in density from open savannas, moderately closed woodlands to closed canopy forests. In some cases, oak woodlands are of a single oak dominance by *Quercus douglasii*, *Quercus lobata*, *Quercus agrifolia*, *Quercus kelloggii*, *Quercus chrysolepis*, or *Quercus wislizeni* trees that are scattered across the landscape, and in other cases, trees of mixed composition form a closed tree canopy. They share strong adaptation to dry summers and relatively warm rainy winters, characteristic of the Californian

Mediterranean climate.

***Diagnostic Characteristics:** These woodlands are characterized by warm Mediterranean climate-adapted evergreen and deciduous sclerophyllous broad-leaved trees. Characteristic taxa include *Quercus agrifolia*, *Quercus douglasii*, *Quercus wislizeni*, *Quercus chrysolepis*, *Quercus wislizeni*, *Quercus engelmannii*, *Quercus lobata*, *Aesculus californica*, *Juglans californica*, and *Umbellularia californica*.

***Classification Comments:** While it is possible to characterize large categories within this group, such as *Quercus douglasii* woodlands, *Quercus douglasii* - *Pinus sabiniana* woodlands, coast oak woodlands, and montane hardwood forests, as noted in Barbour et al. (2007) and Allen-Diaz et al. (2007), quantitative plot data and vegetation mapping projects (for example, Evens et al. 2004, Keeler-Wolf et al. 2003, and Klein et al. 2007) show that all of these woodlands co-occur, intermix, hybridize, and share similar understory shrub and herbaceous species.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---------------------------------------|------|
| G198 | Californian Conifer Forest & Woodland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Medium tall 10-15 m trees, that are evergreen and deciduous sclerophyllous broad-leaved. They occur with and without shrub understory or an herbaceous understory. Upper canopy structure ranges from open savanna to dense woodlands. They can form gallery forests along riparian corridors, and are known to form a mosaic with chaparral and conifer woodlands.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This large group consists of various mixtures of oak and/or other broadleaf species in the overstory canopy with many combinations possible among the six wide-ranging oaks. For example, *Quercus douglasii* can share dominance with *Quercus lobata*, *Quercus agrifolia*, *Quercus kelloggii*, *Quercus chrysolepis*, *Quercus wislizeni*, or *Quercus engelmannii*. However, *Quercus chrysolepis* and *Quercus kelloggii* often co-occur at slightly higher montane settings. They also often mix with *Quercus douglasii*, *Aesculus californica*, and *Quercus wislizeni* or with *Quercus lobata* and *Quercus agrifolia* (only in the coastal ranges) in canyon bottoms and riparian settings. Along the coast, *Quercus agrifolia* is frequently dominant but may be found with all of the other oaks and *Umbellularia*, *Juglans*, and *Aesculus*. In the Coast Ranges, Sierra Nevada foothills and elsewhere, *Quercus lobata* stands occur in riparian zones or alluvial valley floors at higher elevations than its upslope neighbor *Quercus douglasii*. These two species intermix in narrow tributary drainages. In southern California, *Quercus engelmannii* is limited to the Peninsular Ranges but may co-occur with *Quercus agrifolia*, *Quercus chrysolepis*, *Quercus wislizeni*, and *Quercus kelloggii*. On the Channel Islands, the island oak endemics form pure stands and stands mixed with *Quercus agrifolia*, and rarely with *Quercus chrysolepis*, *Quercus douglasii*, and *Quercus lobata*.

All of these species can occur as pure or nearly pure single-species canopies. Mosaics of *Aesculus* woodlands with *Quercus douglasii* woodlands and a few *Quercus agrifolia* woodlands are characteristic of portions of the interior coastal ranges. In the Sierra Nevada foothills, mosaics of *Quercus douglasii*, *Quercus chrysolepis*, and *Quercus kelloggii* woodlands occur and can have *Quercus lobata* along broader valley bottoms. In addition to these mosaics of single-oak-dominated woodlands, there are many associations of mixed canopies, depending on soil, exposure and past disturbance history. As such, these woodlands intermix and interchange throughout their range, making floristic separation into natural distinct subcategories impossible. Despite the overlap of several species, individual integrity of the component alliances is strong. Modal stands of *Quercus chrysolepis* occur in the lower montane zone on well-drained rocky sites, while *Quercus kelloggii* modal stands occur on deeper soils with more mesic conditions. In the foothills and valleys of central and northern California, modal stands of *Quercus douglasii* tend to occur on fine-textured soils, while *Quercus wislizeni* stands are more common on well-drained soils. Conversely, in the foothills, *Aesculus californica* occurs on very rocky but sheltered well-drained sites, and *Quercus lobata* on loamy soils or soils with higher moisture potential. Closer to the coast, *Quercus agrifolia* stands are found on loamy soils on better-drained sites compared to *Umbellularia californica* stands, which occur on sheltered slopes or on slopes exposed to moist sea breezes, while *Quercus parvula* var. *shrevei* stands occur in sheltered locations intermediate between *Quercus agrifolia* and *Pseudotsuga menziesii* or *Sequoia sempervirens* stands.

In coastal California south of the crest of the Transverse Ranges, *Quercus lobata* stands are rare and localized and may be replaced by *Quercus engelmannii*, which can occur on finer-textured soils of warm slopes and valleys. *Quercus douglasii* and

Aesculus californica are also largely absent. As it does in northern and central California, *Quercus wislizeni* occurs on coarse-textured slopes often adjacent to chaparral, or on lower slopes with well-drained soil. The winter deciduous tree *Juglans californica* forms stands on sheltered slopes and on lower slopes on moist terraces sometimes in similar ecological settings to *Quercus lobata*, sometimes with *Quercus agrifolia*.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Const-ancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|------------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:

ENVIRONMENT

Environmental Description: Woodlands of this group occur on a wide variety of habitats. All occur in valley bottoms, stream benches and terraces in canyon bottoms near streams, on gentle lower upland slopes, steep upper slopes, foothills, and on rocky outcrops, on all aspects. Slopes range from gentle to steep. *Quercus lobata* and *Quercus agrifolia* woodlands prefer deeper alluvial, residual or organic soils, while *Quercus douglasii*, *Quercus kelloggii*, *Quercus chrysolepis*, and *Quercus wislizeni* woodlands tolerate, and are more commonly found on, moderately to excessively well-drained, thin, rocky nutrient-poor soils which can have extensive rock fragments. Channel Island endemics occur on marine sedimentary (including calcareous), granitic, or volcanic substrates. *Aesculus californica*, *Juglans californica*, and *Umbellularia californica* tend to occur on slightly more mesic sites or concavities, and are more often in association with *Quercus agrifolia*, but are also known from a wide variety of habitats. The dominate tree species have considerable overlap in elevational range, from sea level to 2500 m. In general terms, *Quercus lobata*, *Quercus tomentella*, and *Lyonothamnus floribundus* range from sea level to about 700 m; *Quercus agrifolia* and *Umbellularia californica* range from sea level to 1200 m; *Quercus douglasii*, *Quercus engelmannii*, and *Quercus kelloggii* range from about 50 to 2500 m; *Aesculus californica* and *Juglans californica* range from about from 100 to 1500 m; and *Quercus chrysolepis* and *Quercus wislizeni* range from about 500 to 2000 m.

DISTRIBUTION

***Geographic Range:** Northern California Coast, Northern California Coast Ranges, Northern California Interior Coast Ranges, Klamath Mountains, Southern Cascades, Central California Coast, Central California Coast Ranges, throughout the Great Valley, Sierra Nevada lower montane elevations, Sierra Nevada Foothills, Southern California Coast, Southern Californian Mountain and Valleys, the Channel Islands, and canyons of the Mojave Desert.

Nations: MX, US

States/Provinces: CA, MXBC, OR

USFS Ecoregions (2007) [optional]: 261B:CC, 262A:CC, 263A:CC, 322A:CC, 322C:CC, 341D:CC, 342B:CC, M242A:CC, M242B:CC, M261A:CC, M261B:CC, M261C:CC, M261D:CC, M261E:CC, M261F:CC, M261G:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3348 | <i>Quercus douglasii</i> - <i>Pinus sabiniana</i> Woodland Alliance |
| A4125 | <i>Aesculus californica</i> Woodland Alliance |
| A0371 | <i>Quercus agrifolia</i> - <i>Quercus douglasii</i> - <i>Quercus kelloggii</i> Coastal Forest Alliance |
| A4124 | <i>Quercus tomentella</i> - <i>Lyonothamnus floribundus</i> California Islands Woodland Alliance |
| A3349 | <i>Quercus chrysolepis</i> - <i>Quercus kelloggii</i> Forest & Woodland Alliance |
| A3346 | <i>Quercus agrifolia</i> Woodland Alliance |
| A3351 | <i>Quercus engelmannii</i> Southern California Woodland Alliance |
| A3347 | <i>Quercus lobata</i> Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------------|---|------------------------------------|
| 2013-02-07 | G196 Californian Lower Montane Blue Oak - Foothill Pine Woodland & Savanna Group | G196 & G197 merged into G195 |
| 2013-02-07 | G207 Mediterranean California Lower Montane Black Oak-Conifer Forest & Woodland Group | G207, G196 & G197 merged into G195 |
| 2013-02-07 | G197 Californian Deciduous Oak Woodland Group | G196 & G197 merged into G195 |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--|----------------------|---|
| < | <i>Umbellularia californica</i> Alliance | Sawyer et al. 2009 | 74.100.00 |
| < | <i>Quercus wislizenii</i> Alliance | Sawyer et al. 2009 | 71.080.00 |
| < | <i>Quercus engelmannii</i> Alliance | Sawyer et al. 2009 | 71.070.00 |
| < | <i>Quercus agrifolia</i> Alliance | Sawyer et al. 2009 | 71.060.00 |
| < | <i>Quercus chrysolepis</i> Alliance | Sawyer et al. 2009 | 71.050.00 |
| < | <i>Quercus lobata</i> Alliance | Sawyer et al. 2009 | 71.040.00 |
| < | <i>Quercus douglasii</i> Alliance | Sawyer et al. 2009 | 71.020.00 |
| < | <i>Quercus kelloggii</i> Alliance | Sawyer et al. 2009 | 71.010.00 |
| = | Oak Woodland and Forests | Barbour et al. 2007a | this is only missing the Channel Island endemics. |

AUTHORSHIP***Primary Concept Source [if applicable]:** J.O. Sawyer, T. Keeler-Wolf, and J. Evens (2009)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** T. Keeler-Wolf and G. Kittel

Acknowledgments [optional]:

Version Date: 10 Nov 2015

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[<https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=18232&inline=1>]
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- Stout, D., J. Buck-Diaz, S. Taylor, and J. M. Evens. 2013. Vegetation mapping and accuracy assessment report for Carrizo Plain National Monument. California Native Plant Society, Vegetation Program, Sacramento, CA. 71 pp.

1. Forest & Woodland

1.B.1.Nc. Californian Forest & Woodland

G198. Californian Conifer Forest & Woodland

Type Concept Sentence: The group includes closed-cone cypress and native, non-plantation pine forests and woodlands along the coast, in the Coast Ranges from northern California into Baja California, Mexico. It includes clumps of pine towering over chaparral shrublands, and open woodlands on serpentine soils.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.1.Nc.1. Californian Forest & Woodland (M009)

Elcode: G198

***Scientific Name:** *Hesperocyparis* spp. - *Pinus* spp. Forest & Woodland Group

***Common (Translated Scientific) Name:** Western Cypress species - Pine species Forest & Woodland Group

***Colloquial Name:** Californian Conifer Forest & Woodland

***Type Concept:** This group consists of California endemic coniferous forests and woodlands below about 2450 m (8000 feet) elevation throughout California, primarily found along the immediate coast or within the coastal ranges facing the Great Valley. Dominant conifers include cypresses *Hesperocyparis abramsiana* (= *Callitropsis abramsiana*), *Hesperocyparis bakeri* (= *Callitropsis bakeri*), *Hesperocyparis forbesii* (= *Callitropsis forbesii*), *Hesperocyparis goveniana* (= *Callitropsis goveniana*), *Hesperocyparis macnabiana* (= *Callitropsis macnabiana*), *Hesperocyparis macrocarpa* (= *Callitropsis macrocarpa*), *Hesperocyparis nevadensis* (= *Callitropsis nevadensis*), *Hesperocyparis pigmaea* (= *Callitropsis pigmaea*), *Hesperocyparis sargentii* (= *Callitropsis sargentii*), and *Hesperocyparis stephensonii* (= *Callitropsis stephensonii*); pines *Pinus sabiniana*, *Pinus quadrifolia*, *Pinus coulteri*, *Pinus attenuata*, *Pinus muricata*, *Pinus torreyana*, and *Pinus radiata* (native, non-plantation stands). The component alliances are characteristic of the warm summer-dry California Floristic Province. These are conifer-dominated forests and woodlands that are for the most part pure or mixed stands of conifer species, but can have limited oaks and other broadleaf tree species in the canopy. The group includes closed-cone cypress and pine trees along the coast, in the Coast Ranges from northern California into Baja California, clumps of pine towering over chaparral shrublands, and open woodlands on serpentine soils. These stands occupy gentle to steep foothill slopes, alluvial fans, streamside terraces, or valleys, often intermixed with stands of chaparral. Soils vary in fertility, typically are dry, derived from granitic, sandstone or serpentine substrates, and are often shallow, stony, sandy, silty, infertile, and moderately to excessively drained. Stands occur from sea level to 2450 m in elevation.

***Diagnostic Characteristics:** This group consists entirely of California lower elevation forests dominated by conifers which include cypresses *Hesperocyparis abramsiana*, *Hesperocyparis bakeri*, *Hesperocyparis forbesii*, *Hesperocyparis goveniana*, *Hesperocyparis macnabiana*, *Hesperocyparis macrocarpa*, *Hesperocyparis nevadensis*, *Hesperocyparis pigmaea*, *Hesperocyparis sargentii*, and *Hesperocyparis stephensonii*; pines *Pinus sabiniana*, *Pinus quadrifolia*, *Pinus coulteri*, *Pinus attenuata*, *Pinus muricata*, *Pinus*

torreyana, and *Pinus radiata* (native, non-plantation stands), and occurs in southern, central and northern California.

***Classification Comments:** Stands dominated by *Pinus contorta* var. *contorta* are included in ~Vancouverian Dry Coastal Beach Pine Forest & Woodland Group (G205)\$. Stands where conifers of *Pinus sabiniana* are codominated with *Quercus douglasii*, *Quercus kelloggii*, or other broadleaf species, where they are equal to or greater than the conifers in cover, are included in broadleaf alliances and are a part of ~Californian Broadleaf Forest & Woodland Group (G195)\$. ~*Juniperus californica* - *Pinus quadrifolia* / *Quercus cornelius-mulleri* Woodland Alliance (A3353)\$ is hard to place. It could be moved from G198 to G281 (J. Evens pers. comm. 2013) or stay with this groups (T. Keeler-Wolf pers. com. 2013). Further review is needed. This comment from J. Evens (2013) is one perspective on this issue: "*Juniperus californica* stands should not be included in this group or alliances in this group, as it is not the same type of closed-cone pine and cypress vegetation that is found in typically infertile habitats along the Coast Ranges and Sierra Nevada. *Juniperus* is found in semi-desert environments in the Mojave Desert, inner Central Coast Ranges and Sierra Nevada foothills often associated with semi-desert shrub types."

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|---|
| G195 | Californian Broadleaf Forest & Woodland | consists of oaks and other broadleaf tree species. Conifers can be present to codominant, but are never more abundant than the broadleaf component. |
| G344 | Californian Montane Conifer Forest & Woodland | occurs at higher and cooler elevations in the Klamath Mountains and Sierra Nevada foothills, and has entirely different conifer species. |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Tall and stunted conifer trees with at least 10% canopy cover. These are upland forests and woodlands. Dominant taxa include *Hesperocyparis macrocarpa*, *Hesperocyparis goveniana*, *Hesperocyparis abramsiana*, *Pinus sabiniana*, *Pinus coulteri*, *Pinus attenuata*, *Pinus quadrifolia*, or *Juniperus californica*.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: *Pinus sabiniana*, *Pinus coulteri*, and *Pinus attenuata* are widespread conifers of this group. Stands have varied species composition and structure, depending on their juxtaposition to other stands of chaparral, coastal scrub, desert scrub, or woodland vegetation. In some stands, the conifers are open-grown trees over grassy understories. In others, they form a mixed canopy with other trees or shrubs. Companion canopy species vary depending upon geographic location and include *Arbutus menziesii*, *Notholithocarpus densiflorus* (= *Lithocarpus densiflorus*), *Calocedrus decurrens*, *Pinus jeffreyi*, *Pinus monophylla*, *Pinus ponderosa*, *Pseudotsuga menziesii*, *Pseudotsuga macrocarpa*, *Quercus agrifolia*, *Quercus chrysolepis*, *Quercus kelloggii*, *Quercus wislizeni*, or *Quercus douglasii*. Shrub layers are sparse to continuous, and often variable. The herbaceous layer is usually sparse. Understory shrubs may include *Adenostoma fasciculatum*, *Adenostoma sparsifolium*, *Arctostaphylos glauca*, *Arctostaphylos glandulosa*, *Arctostaphylos viscida*, *Ceanothus cuneatus*, *Ceanothus greggii*, *Cercocarpus montanus*, *Eriogonum fasciculatum*, *Agave deserti*, *Artemisia tridentata*, *Coleogyne ramosissima*, *Ephedra* spp., *Hesperoyucca whipplei*, *Lepidospartum squamatum*, *Nolina parryi*, *Purshia mexicana*, *Quercus cornelius-mulleri*, *Quercus durata*, *Rhododendron macrophyllum*, *Rhus ovata*, *Vaccinium ovatum*, and *Yucca schidigera*.

Highly localized endemic tree taxa include *Hesperocyparis macrocarpa* (= *Cupressus macrocarpa*), *Hesperocyparis goveniana* (= *Cupressus goveniana*), *Hesperocyparis abramsiana* (= *Cupressus abramsiana*), *Pinus contorta* var. *bolanderi*, *Pinus radiata*, and *Pinus torreyana* that occur in scattered groves along the coast. *Pinus attenuata*, *Pinus contorta* var. *contorta*, and *Pinus muricata* are dominant or codominant in these and other occurrences. These occurrences can also include pygmy woodland expressions where indurated subsoil underlies acidic sands (ancient marine terraces). Other associated plant species include *Arctostaphylos hookeri* ssp. *montana* (= *Arctostaphylos montana*), *Arctostaphylos nummularia*, *Arctostaphylos tomentosa*, *Ledum groenlandicum*, *Vaccinium ovatum*, *Gaultheria shallon*, *Rhododendron macrophyllum*, and *Morella californica* (= *Myrica californica*). The lichen and moss

component of this group is very diverse, includes *Cladonia* spp., and can be abundant in these communities. Other highly localized endemic taxa include *Hesperocyparis nevadensis* (= *Cupressus nevadensis*) and *Hesperocyparis stephensonii* (= *Cupressus stephensonii*) that occur inland in scattered groves.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Const-ancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|------------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Stands of many of these warm-temperate conifer alliances are largely perpetuated through periodic fire. *Pinus attenuata*, *Pinus contorta* var. *bolanderi*, *Pinus radiata*, *Pinus muricata*, and all the *Hesperocyparis* species are considered serotinous species (Barbour et al. 2007). Fire heats the resin-sealed cones and initiates seed dispersal. Only limited seed is released during periods of prolonged hot dry weather. *Pinus coulteri*, and to a lesser degree *Pinus torreyana*, are somewhat serotinous and, depending upon populations, may retain seeds in cones on the trees for several years until released by fire. All of these serotinous or semi-serotinous species are relatively short-lived. Stand-replacing fire events optimally occur between 50- and 125-year intervals. Fires spaced more closely tend to reduce stands because trees cannot develop large seedbanks stored in the cones, while fires at very long intervals tend to cause senescence in the conifers and many trees die without releasing seed.

Another suite of species diagnostic of this group, including *Pinus sabiniana*, *Juniperus californica*, and *Pinus quadrifolia*, are not serotinous, but their stand dynamics are also affected by fire. These species are fire-sensitive with relatively thin bark and typically do not release seed stored in cones following fire scorching. Instead these species tend to form stands only under conditions of low fire intensity or in local fire-protected areas. *Pinus sabiniana* and *Pinus coulteri* tend to form stands in chaparral where fire has been absent for many decades or may also form stands in drier portions of the state where shrub and herbaceous understories are relatively sparse and do not carry fire regularly. *Pinus quadrifolia* is the most restricted of these fire-sensitive species and only forms stands in older stands of chaparral or in steep rocky terrain in semi-desert conditions in the Peninsular Ranges of southern California. *Pinus sabiniana* is largely restricted to the foothills surrounding the Great Valley and is also found throughout the California Coast Ranges inland from the immediate maritime zone.

ENVIRONMENT

Environmental Description: These stands occupy gentle to steep foothill slopes, alluvial fans, streamside terraces, or valleys, often intermixed with stands of chaparral. Soils vary in fertility, typically are dry, derived from granitic, sandstone or serpentine substrates, and are often shallow, stony, sandy, silty, infertile, and moderately to excessively drained. Elevation ranges from 0-2450 m. Coniferous forests and woodlands limited to the immediate coastal area occur on marine sedimentary, non-metamorphosed features, often on podsols or on sterile sandstone. These forests and woodlands are limited to coastal areas with moderate maritime climate and likely receive more annual precipitation than nearby coastal chaparral in part due to fog drip.

DISTRIBUTION

***Geographic Range:** This group is found in scattered locations along California's entire coastline in the Northern California Interior Coast Ranges, Central California Coast, Central California Coast Ranges, Southern California, Southern California Mountains and Valleys, Mojave Desert, Sierra Nevada, Sierra Nevada Foothills, and Southern California Mountains and Valleys. It also occurs into southern Oregon in southern Coos and Curry counties.

Nations: MX?, US

States/Provinces: CA, OR

USFS Ecoregions (2007) [optional]: 261B:CC, 263A:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3352 | <i>Hesperocyparis goveniana</i> - <i>Hesperocyparis macrocarpa</i> Woodland Alliance |
| A3356 | <i>Pinus attenuata</i> - <i>Pinus coulteri</i> - <i>Pinus sabiniana</i> Woodland Alliance |

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A4097 | <i>Pinus muricata</i> - <i>Pinus radiata</i> Woodland Alliance |
| A3354 | <i>Hesperocyparis forbesii</i> - <i>Hesperocyparis nevadensis</i> Woodland Alliance |
| A4221 | <i>Pinus torreyana</i> Woodland Alliance |
| A3353 | <i>Juniperus californica</i> - <i>Pinus quadrifolia</i> / <i>Quercus cornelius-mulleri</i> Woodland Alliance |
| A3355 | <i>Hesperocyparis sargentii</i> - <i>Hesperocyparis macnabiana</i> - <i>Hesperocyparis bakeri</i> Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

*Recent Concept Lineage [if applicable]:

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---|--------------------|-----------|
| < | <i>Pinus sabiniana</i> Alliance | Sawyer et al. 2009 | 87.130.00 |
| < | <i>Pinus quadrifolia</i> Alliance | Sawyer et al. 2009 | 87.030.00 |
| < | <i>Pinus muricata</i> Alliance | Sawyer et al. 2009 | 87.070.00 |
| < | <i>Pinus coulteri</i> Alliance | Sawyer et al. 2009 | 87.090.00 |
| < | <i>Pinus attenuata</i> Alliance | Sawyer et al. 2009 | 87.100.00 |
| < | <i>Callitropsis stephensonii</i> Special Stands | Sawyer et al. 2009 | 81.610.00 |
| < | <i>Callitropsis sargentii</i> Alliance | Sawyer et al. 2009 | 81.500.00 |
| < | <i>Callitropsis pigmaea</i> Alliance | Sawyer et al. 2009 | 81.400.00 |
| < | <i>Callitropsis nevadensis</i> Alliance | Sawyer et al. 2009 | 81.605.00 |
| < | <i>Callitropsis macrocarpa</i> Special Stands | Sawyer et al. 2009 | 81.604.00 |
| < | <i>Callitropsis macnabiana</i> Alliance | Sawyer et al. 2009 | 81.300.00 |
| < | <i>Callitropsis goveniana</i> Special Stands | Sawyer et al. 2009 | 81.603.00 |
| < | <i>Callitropsis forbesii</i> Alliance | Sawyer et al. 2009 | 81.607.00 |
| < | <i>Callitropsis bakeri</i> Alliance | Sawyer et al. 2009 | 81.601.00 |
| < | <i>Callitropsis abramsiana</i> Special Stands | Sawyer et al. 2009 | 81.606.00 |

AUTHORSHIP

*Primary Concept Source [if applicable]: J.O. Sawyer, T. Keeler-Wolf, and J. Evens (2009)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

*Author of Description: T. Keeler-Wolf and G. Kittel

Acknowledgments [optional]: J. Evens

Version Date: 10 Nov 2015

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1. Forest & Woodland

1.B.1.Nc. Californian Forest & Woodland

G208. Californian Moist Coastal Mixed Evergreen Forest

Type Concept Sentence: This forested group is characterized by mixes of coniferous and broad-leaved evergreen trees, such as *Arbutus menziesii*, *Chrysolepis chrysophylla*, *Notholithocarpus densiflorus*, *Pseudotsuga menziesii*, *Quercus chrysolepis*, and *Umbellularia californica*, found in coastal California mountains.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.1.Nc.1. Californian Forest & Woodland (M009)

Elcode: G208

***Scientific Name:** *Pseudotsuga menziesii* - *Notholithocarpus densiflorus* - *Arbutus menziesii* Forest Group

***Common (Translated Scientific) Name:** Douglas-fir - Tanoak - Pacific Madrone Forest Group

***Colloquial Name:** Californian Moist Coastal Mixed Evergreen Forest

***Type Concept:** This forest group is characterized by mixes of coniferous and broad-leaved evergreen trees. Characteristic trees include *Arbutus menziesii*, *Chrysolepis chrysophylla*, *Notholithocarpus densiflorus* (= *Lithocarpus densiflorus*), *Pseudotsuga menziesii*, *Quercus chrysolepis*, and *Umbellularia californica*. *Pinus coulteri* occurs in scattered stands. On the eastern fringe of this group, in the western Klamath Mountains, other conifers occur such as *Calocedrus decurrens*, *Pinus ponderosa*, and *Chamaecyparis lawsoniana*. In the southern portion of the range, stands are a mixture of *Abies bracteata* and *Quercus chrysolepis*. More northerly stands tend to have dense or diverse shrub understories, with *Corylus cornuta*, *Gaultheria shallon*, *Mahonia nervosa*, *Quercus sadleriana*, *Rhododendron macrophyllum*, *Toxicodendron diversilobum*, and *Vaccinium ovatum* being common. This group occurs in California in the Santa Cruz Mountains, the Santa Lucia Mountains, throughout the outer and middle Coast Ranges, south across the outer central Coast Ranges and north in the northern Coast Ranges and western Klamath Mountains, into southwestern Oregon, and locally in the northern Sierra Nevada. It can occur on metasediments and granitic substrate, on Franciscan Formation soils (metasedimentary sandstones, schists and shales) with moderate to high rainfall in the Coast Ranges. Historic fire frequency in this group was higher than for redwood-dominated systems (every 50-100 years). Southern stands have a sparser shrub understory; *Toxicodendron diversilobum* is the most constant shrub, along with much *Polystichum munitum*. Especially in the south, stands are restricted to fire-protected sites (extremely steep, northerly, mesic slopes and coves) where fires from adjacent chaparral systems do not carry. Historic fire frequency was likely higher than the north. Stands with just conifers present are a part of ~Californian Conifer Forest & Woodland Group (G198)\$.

***Diagnostic Characteristics:** This forested group is characterized by mixes of coniferous and broad-leaved evergreen trees. Characteristic trees include *Pseudotsuga menziesii*, *Pseudotsuga macrocarpa*, *Quercus chrysolepis*, *Notholithocarpus densiflorus*, *Arbutus menziesii*, *Umbellularia californica*, and *Chrysolepis chrysophylla* var. *chrysophylla*.

***Classification Comments:** In northern California, especially around Point Reyes, there are stands dominated by *Umbellularia californica*. These nearly pure stands are a part of this group, as it is a disturbance-driven species and grows rapidly with full sunlight. With time and succession, other trees will succeed into the canopy. This is in contrast to small patches or individuals of *Umbellularia californica* in some of the various chaparral groups. Here there are no chaparral shrubs in the understory. *Notholithocarpus densiflorus* in mixed stands of various pines and oaks is the indicator species for this group in many places in the Coast Ranges throughout northern and central California, and locally in the northern Sierra Nevada.

It has been proposed by the reviewer to limit this group to the distribution of *Notholithocarpus densiflorus* and *Arbutus menziesii*, with *Pseudotsuga menziesii*. The southerly stands with *Pseudotsuga macrocarpa* (and lacking *Notholithocarpus densiflorus* or *Arbutus menziesii*) do not belong in this group. It is suggested to have a more southerly "mixed evergreen" group. For now this represents a more limited group concept. *Pseudotsuga macrocarpa* stands have been moved to ~Californian Montane Conifer Forest & Woodland Group (G344)\$\$, which is where Sawyer et al. (2009) place them, along with the *Abies bracteata* stands.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|--|
| G205 | Vancouverian Dry Coastal Beach Pine Forest & Woodland | occurs farther north around the Willamette Valley and Puget Trough area. |
| G344 | Californian Montane Conifer Forest & Woodland | occurs at higher and cooler elevations in the Klamath Mountains and Sierra Nevada foothills. |

Similar NVC Types General Comments [optional]:**VEGETATION**

Physiognomy and Structure Summary: Forests generally have closed or near-closed canopies, often in older stands with two strata in the canopy, 15-35 m tall, and often with a dense shrub understory structure consisting of many regenerating canopy tree species.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: It is characterized by mixes of coniferous and broad-leaved evergreen trees. Characteristic trees include *Arbutus menziesii*, *Chrysolepis chrysophylla* var. *chrysophylla*, *Notholithocarpus densiflorus* (= *Lithocarpus densiflorus*), *Pseudotsuga menziesii*, *Quercus chrysolepis*, *Umbellularia californica*. *Pinus coulteri* occurs in scattered stands. On the eastern fringe of this group, in the western Klamath Mountains, other conifers occur such as *Calocedrus decurrens*, *Pinus ponderosa*, and *Chamaecyparis lawsoniana*. In the southern portion of the range, stands are a mixture of *Abies bracteata* and *Quercus chrysolepis*, and *Notholithocarpus densiflorus*, *Arbutus menziesii*, *Umbellularia californica*, and *Chrysolepis chrysophylla* become less important. More northerly stands tend to have dense or diverse shrub understories, with *Corylus cornuta*, *Gaultheria shallon*, *Mahonia nervosa*, *Quercus sadleriana*, *Rhododendron macrophyllum*, *Toxicodendron diversilobum*, and *Vaccinium ovatum* being common. Southern stands have a sparser shrub understory; *Toxicodendron diversilobum* is the most constant shrub, with *Ribes* spp. occasionally present, along with much *Polystichum munitum*.

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Especially in the south, stands are restricted to fire-protected sites (extremely steep, northerly, mesic slopes and coves) where fires from adjacent chaparral systems do not carry. Historic fire frequency was likely higher than the north.

ENVIRONMENT

Environmental Description: This group occurs just inland from the redwood belt of this region. It can occur on metasediments and granitic substrate, on Franciscan Formation soils (metasedimentary sandstones, schists and shales) in areas with moderate to high rainfall on the Coast Ranges of California. Especially in the south, stands are restricted to fire-protected sites (extremely steep, northerly, mesic slopes and coves) where fires from adjacent chaparral systems do not carry.

DISTRIBUTION

***Geographic Range:** This group occurs in California from the Santa Lucia and Santa Cruz mountains north to the North Coast Ranges and western Klamath Mountains into southwestern Oregon, and locally in the Sierra Nevada. It also occurs in localized areas of the central to northern Sierra Nevada and southern and eastern Klamath Mountains.

Nations: US

States/Provinces: CA, OR

USFS Ecoregions (2007) [optional]: 262A:PP, 263A:CC, 322A:PP, M242A:CC, M242B:C?, M261A:CC, M261B:CC, M261C:CC, M261D:CC, M261E:CC, M261F:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS***Plot Analysis Summary [Med - High Confidence]:**

Plots Used to Define the Type [Med - High Confidence]:*CONFIDENCE LEVEL**

USNVC Confidence Level: High

USNVC Confidence Comments [optional]:

HIERARCHY***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A0106 | <i>Pseudotsuga menziesii</i> - <i>Notholithocarpus densiflorus</i> Forest Alliance |
| A3357 | <i>Notholithocarpus densiflorus</i> - <i>Arbutus menziesii</i> Forest Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------------|---|-----------------------|
| 2013-02-07 | G199 Central & Southern California Mixed Evergreen Woodland Group | G199 merged into G208 |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--|--------------------|-----------|
| < | <i>Lithocarpus densiflorus</i> (Tanoak forest) Alliance | Sawyer et al. 2009 | 73.100.00 |
| < | <i>Arbutus menziesii</i> (Madrone forest) Alliance | Sawyer et al. 2009 | 73.200.00 |
| < | <i>Pseudotsuga menziesii</i> - <i>Lithocarpus densiflorus</i> (Douglas fir - tanoak forest) Alliance | Sawyer et al. 2009 | 82.500.00 |
| = | Douglas-fir - Tanoak - Pacific Madrone: 234 | Eyre 1980 | |

AUTHORSHIP***Primary Concept Source [if applicable]:** J.O. Sawyer, T. Keeler-Wolf, and J. Evens (2009)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** G. Kittel, R.J. Cole, M.S. Reid**Acknowledgments [optional]:** R.J. Cole and J. Evens

Version Date: 10 Nov 2015

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1.B.1.Nd. Madrean-Balconian Forest & Woodland (D060)

M010. Madrean Lowland Evergreen Woodland

1. Forest & Woodland

1.B.1.Nd. Madrean-Balconian Forest & Woodland

G201. Madrean Encinal

Type Concept Sentence: Madrean Encinal occurs the Sierra Madre Occidentale and Sierra Madre Orientale in Mexico, extending north into Trans-Pecos Texas, southern New Mexico and sub-Mogollon Arizona and is characterized by open-canopied to moderately closed woodlands dominated by Madrean evergreen oaks *Quercus albocincta*, *Quercus arizonica*, *Quercus chihuahuensis*, *Quercus emoryi*, *Quercus grisea*, and *Quercus oblongifolia*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.1.Nd.1. Madrean Lowland Evergreen Woodland (M010)

Elcode: G201

***Scientific Name:** *Quercus arizonica* - *Quercus emoryi* - *Quercus oblongifolia* Woodland Group

***Common (Translated Scientific) Name:** Arizona White Oak - Emory Oak - Mexican Blue Oak Woodland Group

***Colloquial Name:** Madrean Encinal

***Type Concept:** Madrean Encinal occurs in the Sierra Madre Occidentale and Sierra Madre Orientale in Mexico, extending north into Trans-Pecos Texas, southern New Mexico and sub-Mogollon Arizona. These open-canopied to moderately closed woodlands are dominated by Madrean evergreen oaks and occur at lower elevations than ~Madrean Lower Montane Pine - Oak Forest & Woodland Group (G203)\$\$ and above ~Madrean Pinyon - Juniper Woodland Group (G200)\$\$\$. Lower-elevation stands are typically open woodlands or savannas where they transition into desert grasslands, chaparral or, in some cases, desert scrub. Dominant and diagnostic evergreen oak tree species include *Quercus albocincta*, *Quercus arizonica*, *Quercus chihuahuensis*, *Quercus emoryi*, *Quercus grisea*, and *Quercus oblongifolia*. *Arbutus arizonica* and *Arbutus xalapensis* may be present with evergreen oaks in some stands. Madrean pines and Arizona cypress, pinyon and juniper trees may also be present but do not codominate. Chaparral species such as *Arctostaphylos pungens*, *Cercocarpus montanus*, *Frangula betulifolia* (= *Rhamnus betulifolia*), *Garrya wrightii*, *Purshia* spp., *Quercus turbinella*, *Quercus intricata*, *Quercus toumeyi*, or *Rhus* spp. are common in shrub understory layers, but do not dominate the vegetation. An herbaceous layer is usually prominent, especially in interspaces between trees in open woodlands. Dominant species are typically warm-season perennial grasses such as *Aristida* spp., *Bouteloua gracilis*, *Bouteloua curtipendula*, *Bouteloua rothrockii*, *Digitaria californica*, *Eragrostis intermedia*, *Hilaria belangeri*, *Leptochloa dubia*, *Muhlenbergia emersleyi*, *Muhlenbergia pauciflora*, or *Schizachyrium cirratum*, species typical of desert grasslands and steppe. Stands are found from 1200 to 2200 m elevation in foothills, canyons, alluvial fan piedmonts (bajadas) and plateaus. Substrates are typically shallow, coarse-textured, lithic soils. This woodland group includes seral stands dominated by short (2-5 m tall) Madrean tree oaks, typically with a strong graminoid layer. In transition areas with drier chaparral, the stands of chaparral are not dominated by Madrean tree oak species; however, Madrean Encinal may extend down along drainages.

***Diagnostic Characteristics:** Diagnostic characteristics of this group include the dominance of evergreen oaks in the typically short to medium-tall (3-20 m), open to closed tree/tall-shrub canopy. Understory layers are variable, ranging from sparse to dense grass or shrub layers. Diagnostic species include Madrean trees *Quercus arizonica*, *Quercus emoryi*, *Quercus grisea*, *Quercus oblongifolia*, and in Mexico, *Quercus chihuahuensis* and *Quercus albocincta* (where they are both diagnostic and dominant). Other tree species may be present with lower cover (not codominant), such as *Pinus cembroides*, *Pinus discolor*, *Juniperus coahuilensis*, and *Juniperus deppeana* at lower elevations, and *Pinus arizonica*, *Pinus engelmannii*, *Pinus leiophylla*, or *Pinus strobiformis* at montane elevations. Diagnostic shrub and herbaceous species overlap with chaparral. Shrub species include *Arctostaphylos pungens*, *Cercocarpus montanus*, *Dasyliirion wheeleri*, *Frangula betulifolia*, *Purshia* spp., *Garrya wrightii*, *Quercus intricata*, *Quercus toumeyi*, and *Quercus turbinella*. Desert grass species *Bouteloua gracilis*, *Bouteloua rothrockii*, *Digitaria californica*, *Eragrostis intermedia*, *Hilaria belangeri*, *Leptochloa dubia*, *Muhlenbergia emersleyi*, *Muhlenbergia longiligula*, *Muhlenbergia pauciflora*, *Piptochaetium fimbriatum*, or *Schizachyrium cirratum* are typically present to abundant.

***Classification Comments:** Although some stands may be composed of relatively short trees (2-4 m tall), especially in the northern extent, encinal is considered woodland in Mexico (E. Muldavin pers. comm. 2003). Some encinal classifiers include mixed conifer and

broadleaf evergreen types (including codominance with pinyon, juniper, and montane pines, whereas here we restrict the type to evergreen Madrean oak-dominated stands).

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|-------------------------------|------|
| | | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Stands in this warm temperate, broad-leaved evergreen Madrean woodland group are typically a short to medium-tall (3-20 m), open to closed evergreen broad-leaved woodlands or tree savannas with 10-60% tree cover. Madrean oak species and other evergreen broad-leaved trees and tall shrubs dominate the upper canopy. Evergreen conifer tree species may be present with lower cover (but are not codominant). The herbaceous layer, if present, is usually dominated by perennial grasses, sometimes with diverse forb species. Some open woodland stands with dense grass understory may resemble oak savanna.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Stands of this group are dominated by diagnostic Madrean evergreen oak tree species, including *Quercus arizonica*, *Quercus emoryi*, *Quercus grisea*, *Quercus oblongifolia* and, in Mexico, *Quercus albocincta* and *Quercus chihuahuensis*. *Arbutus arizonica* or *Arbutus xalapensis* may be present with evergreen oaks in some stands. Other evergreen tree species may be present with lower cover (not codominant), including *Juniperus coahuilensis*, *Juniperus deppeana*, *Pinus cembroides*, and *Pinus discolor* at lower elevations and *Pinus arizonica*, *Pinus engelmannii*, *Pinus leiophylla*, or *Pinus strobiformis* at montane elevations. Chaparral species such as *Arctostaphylos pungens*, *Cercocarpus montanus*, *Frangula betulifolia* (= *Rhamnus betulifolia*), *Purshia* spp., *Garrya wrightii*, *Quercus intricata*, *Quercus toumeyii*, *Quercus turbinella*, or *Rhus* spp. are common in shrub layers, but do not dominate the vegetation. Other shrubs present may include rosette shrubs such as *Dasyliirion wheeleri* or *Yucca baccata*, and cacti *Opuntia engelmannii*, *Cylindropuntia imbricata* (= *Opuntia imbricata*), or *Opuntia phaeacantha*. The herbaceous layer is usually prominent, especially in interspaces between trees in open woodlands. Dominant species are typically warm-season perennial grasses such as *Aristida* spp., *Bouteloua gracilis*, *Bouteloua curtipendula*, *Bouteloua rothrockii*, *Digitaria californica*, *Eragrostis intermedia*, *Hilaria belangeri*, *Leptochloa dubia*, *Muhlenbergia emersleyi*, *Muhlenbergia longiligula*, *Muhlenbergia pauciflora*, *Piptochaetium fimbriatum*, or *Schizachyrium cirratum*, species typical of desert grasslands and steppe. This woodland group includes seral stands dominated by short (2-5 m tall) Madrean tree oaks, typically with a strong graminoid layer. In transition areas with drier chaparral, the stands of chaparral are not dominated by Madrean tree oak species; however, Madrean Encinal may extend down along drainages.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Const-ancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|------------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:

ENVIRONMENT

Environmental Description: Madrean Encinal occurs in foothills, canyons, alluvial fan piedmonts (bajadas) and plateaus in the Sierra Madre Occidentale and Sierra Madre Orientale in Mexico, extending north into Trans-Pecos Texas, southern New Mexico and sub-Mogollon Arizona. Stands occur down to 900 m elevation in southern Sonora, but generally range from around 1200-1350 m intermixed with semi-desert grasslands, and extend up to 1650-2200 m as pure oak patches within Madrean montane forests and woodlands (Brown 1982a). Soils are variable but generally thin and rocky. Where encinal occurs within grasslands, it generally occupies the rockier substrates or is restricted to drainages (Brown 1982a). *Soil/substrate/hydrology:* Soils are variable but generally thin and rocky. Where encinal occurs within grasslands, it generally occupies the rockier substrates or is restricted to drainages (Brown 1982a).

DISTRIBUTION

***Geographic Range:** This group is found in the Sierra Madre Occidentale and Sierra Madre Orientale of Mexico, Trans-Pecos Texas, southern New Mexico and southeastern Arizona.

Nations: MX, US

States/Provinces: AZ, NM, TX

USFS Ecoregions (2007) [optional]: 313C:CC, 315A:CC, 321A:CC, 322A:CP, 322B:CC, M313A:CC, M313B:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3101 | <i>Quercus arizonica</i> - <i>Quercus emoryi</i> - <i>Quercus grisea</i> Scrub Woodland Alliance |
| A0791 | <i>Quercus oblongifolia</i> Scrub Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--|-------------------|------|
| = | Madrean Evergreen Forest and Woodland, Encinal (Oak) Series - 123.31 | Brown et al. 1979 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** D.E. Brown, C.H. Lowe and C.P. Pase (1979)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz

Acknowledgments [optional]: E. Muldavin

Version Date: 10 Nov 2015

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1. Forest & Woodland

1.B.1.Nd. Madrean-Balconian Forest & Woodland

G487. Madrean Juniper Open Woodland

Type Concept Sentence: This Madrean juniper savanna and woodland group occurs in lower foothills and plains of southeastern Arizona and southern New Mexico, extending into western Texas and Mexico and is characterized by an open to moderately dense tree canopy that is dominated by diagnostic Madrean junipers *Juniperus coahuilensis* or *Juniperus deppeana* or *Juniperus monosperma* when diagnostic Madrean species are present in the canopy or understory.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.1.Nd.1. Madrean Lowland Evergreen Woodland (M010)

Elcode: G487

***Scientific Name:** *Juniperus coahuilensis* - *Juniperus deppeana* - *Juniperus monosperma* Open Woodland Group

***Common (Translated Scientific) Name:** Redberry Juniper - Alligator Juniper - One-seed Juniper Open Woodland Group

***Colloquial Name:** Madrean Juniper Open Woodland

***Type Concept:** This Madrean juniper savanna and woodland group occurs in northern Mexico, southeastern Arizona and southern New Mexico, extending into western Texas. These savannas and woodlands have juniper tree canopies (5-60% cover). The lack of pinyon trees and the presence of Madrean junipers *Juniperus coahuilensis* or *Juniperus deppeana* are diagnostic of this group. *Juniperus monosperma* may be present to sole dominant when diagnostic Madrean species are present. The understory may be dominated by shrubs or grasses. If present, the shrub layer may be open to dense with desert scrub, chaparral or mountain shrub species. Characteristic species include *Agave lechuguilla*, *Arctostaphylos pungens*, *Canotia holacantha*, *Ceanothus greggii*, *Cercocarpus montanus*, *Larrea tridentata*, *Nolina microcarpa*, *Prosopis glandulosa*, *Quercus grisea*, *Quercus turbinella*, or *Rhus trilobata*. The herbaceous layer is diverse and resembles ~Chihuahuan Desert Foothill-Piedmont & Lower Montane Grassland Group (G490)\$. Characteristic graminoid species include *Bouteloua eriopoda*, *Muhlenbergia emersleyi*, *Muhlenbergia pauciflora*, *Muhlenbergia setifolia*, *Piptochaetium fimbriatum*, or *Schizachyrium cirratum*. Some of the widespread graminoid species are similar to those found in ~Great Plains Shortgrass Prairie Group (G144)\$ and may be present to dominant, with *Aristida purpurea*, *Bouteloua gracilis*, and *Eragrostis intermedia* being most common. This group is found in lower foothills and plains. Savanna stands occur primarily on flat ridge summits and upper slopes of foothills, canyons and alluvial fans usually at about 1800 m elevation. Woodland sites are typically found on cool aspects of steep scarp slopes at elevations of 1700 to 2200 m. Substrates are generally shallow rocky soils, but include deeper loamy soils, especially on sites where junipers have recently colonized.

***Diagnostic Characteristics:** This group is characterized by an open to moderately dense canopy of Madrean junipers *Juniperus coahuilensis* or *Juniperus deppeana*. *Juniperus monosperma* may be present to dominant when diagnostic Madrean species are present. If present, pinyon trees are accidental. Diagnostic Madrean understory species include evergreen oaks, desert scrub, chaparral and graminoids such as *Agave lechuguilla*, *Bouteloua eriopoda*, *Canotia holacantha*, *Cercocarpus montanus* var. *paucidentatus*, *Dasyllirion leiophyllum*, *Larrea tridentata*, *Mahonia trifoliolata*, *Mimosa aculeaticarpa* var. *biuncifera*, *Muhlenbergia emersleyi*, *Muhlenbergia pauciflora*, *Muhlenbergia setifolia*, *Nolina microcarpa*, *Piptochaetium fimbriatum*, *Prosopis glandulosa*, *Quercus arizonica*, *Quercus emoryi*, *Quercus grisea*, *Quercus mohriana*, *Quercus pungens*, *Quercus turbinella*, *Schizachyrium cirratum*, or *Yucca torreyi*.

***Classification Comments:** This group is similar to the more northerly ~Southern Rocky Mountain Juniper Open Woodland Group (G252)\$; however, Madrean species are not present in it. Stands dominated by the shrubby tree *Juniperus pinchotii* form a shrubland and are included in ~Eastern Madrean Chaparral Group (G280)\$.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G200 | Madrean Pinyon - Juniper Woodland | |
| G252 | Southern Rocky Mountain Juniper Open Woodland | |
| G144 | Great Plains Shortgrass Prairie | |
| G490 | Chihuahuan Desert Foothill-Piedmont & Lower Montane Grassland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This savanna and woodland group is variable and ranges from widely spaced, mature, evergreen, scale-leaved trees (5-25% cover) to moderately dense woodlands (10-60% cover). A sparse to dense shrub layer may be present and dominated by a variety of typically Madrean species such as evergreen broad-leaved oaks. The more open-canopied stands often have moderate to high cover of perennial graminoids (>25% cover); however, open woodlands lacking an understory tree because of substrate such as rock outcrops are also included in this group.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This juniper savanna and woodland group has an open to moderately dense canopy of trees (5-60% cover) with an understory dominated by shrubs or grasses. The presence of Madrean junipers *Juniperus coahuilensis* or *Juniperus deppeana* is diagnostic. *Juniperus deppeana* trees have a broader range than this Madrean group, extending north into southern stands of ~Southern Rocky Mountain Juniper Open Woodland Group (G252)\$\$, but do not dominate there. *Juniperus monosperma* may be present to sole dominant when diagnostic Madrean species are present. The understory may be dominated by shrubs or grasses. If present, the shrub layer may be open to dense with desert scrub, chaparral or mountain shrub species. Characteristic species include *Agave lechuguilla*, *Arctostaphylos pungens*, *Canotia holacantha*, *Ceanothus greggii*, *Cercocarpus montanus*, *Dasyllirion leiophyllum*, *Larrea tridentata*, *Mahonia trifoliolata*, *Mimosa aculeaticarpa* var. *biuncifera*, *Nolina microcarpa*, *Prosopis glandulosa*, *Quercus arizonica*, *Quercus emoryi*, *Quercus grisea*, *Quercus mohriana*, *Quercus pungens*, *Quercus turbinella*, or *Yucca torreyi*. The herbaceous layer is typically diverse and resembles ~Chihuahuan Desert Foothill-Piedmont & Lower Montane Grassland Group (G490)\$\$\$. Characteristic graminoid species include *Bouteloua eriopoda*, *Muhlenbergia emersleyi*, *Muhlenbergia pauciflora*, *Muhlenbergia setifolia*, *Piptochaetium fimbriatum*, or *Schizachyrium cirratum*. Some of the widespread graminoid species are similar to those found in ~Great Plains Shortgrass Prairie Group (G144)\$\$ with *Aristida purpurea*, *Bouteloua gracilis*, and *Eragrostis intermedia* being most common.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Const-ancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|------------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:

ENVIRONMENT

Environmental Description: This Madrean juniper savanna and woodland group occurs in lower foothills and plains of southeastern Arizona and southern New Mexico, extending into western Texas and Mexico. Savanna stands occur primarily on flat ridge summits and upper slopes of foothills and alluvial fans usually at about 1800 m elevation. Woodland sites are typically found on cool aspects of steep scarp slopes at elevations of 1700 to 2200 m. Substrates are generally shallow rocky soils, but include deeper loamy soils, especially on sites where junipers have recently colonized.

DISTRIBUTION

***Geographic Range:** This Madrean juniper savanna group occurs in lower foothills and plains of southeastern Arizona and southern New Mexico, extending into western Texas and Mexico.

Nations: MX, US

States/Provinces: AZ, NM, TX

USFS Ecoregions (2007) [optional]: 313B:CC, 313C:CC, 313D:CC, 315A:CC, 315B:CC, 315H:CC, 321A:CC, 322A:CC, 322B:CC, M313A:CC, M313B:CC, M331F:??

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS***Plot Analysis Summary [Med - High Confidence]:*****Plots Used to Define the Type [Med - High Confidence]:****CONFIDENCE LEVEL**

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3134 | <i>Juniperus coahuilensis</i> - <i>Juniperus deppeana</i> - <i>Juniperus monosperma</i> / Grass Understory Open Woodland Alliance |
| A3133 | <i>Juniperus coahuilensis</i> - <i>Juniperus deppeana</i> - <i>Juniperus monosperma</i> / Shrub Understory Open Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--|------------------------|------|
| = | High Sun Mild (HSM) Pinyon - Juniper Climatic Region | Moir and Carleton 1987 | |
| = | Madrean Juniper Savanna Woodland | Muldavin et al. 2003a | |

AUTHORSHIP***Primary Concept Source [if applicable]:** E. Muldavin et al. (2003)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz and E. Muldavin**Acknowledgments [optional]:** E. Muldavin

Version Date: 10 Nov 2015

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1. Forest & Woodland

1.B.1.Nd. Madrean-Balconian Forest & Woodland

G200. Madrean Pinyon - Juniper Woodland

Type Concept Sentence: This conifer woodland group occurs in foothill and lower montane zones of northern Mexico, Trans-Pecos Texas, southern New Mexico and Arizona and is characterized pinyons *Pinus cembroides*, *Pinus discolor*, *Pinus remota*, or *Pinus edulis* (with Madrean elements in understory) with *Juniperus coahuilensis*, *Juniperus deppeana*, or *Juniperus monosperma* often present to dominant.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.1.Nd.1. Madrean Lowland Evergreen Woodland (M010)

Elcode: G200

***Scientific Name:** *Pinus cembroides* - *Pinus discolor* - *Juniperus coahuilensis* Woodland Group

***Common (Translated Scientific) Name:** Mexican Pinyon - Border Pinyon - Redberry Juniper Woodland Group

***Colloquial Name:** Madrean Pinyon - Juniper Woodland

***Type Concept:** This conifer evergreen woodland group is found in the Sierra Madre Occidentale and Sierra Madre Orientale in Mexico, Trans-Pecos Texas, southern New Mexico and Arizona, generally south of the Mogollon Rim. Vegetation is characterized by an open tree canopy dominated by pinyon and juniper trees 2-5 m tall. The presence of pinyons *Pinus cembroides*, *Pinus discolor*, *Pinus remota*, or *Pinus edulis* with Madrean elements in understory is diagnostic of this group. *Juniperus coahuilensis* and *Juniperus deppeana* are characteristic species that are often present to dominant. *Pinus edulis* and *Juniperus monosperma* may be the dominants in the northern distribution of the group but in combination with Madrean shrub and/or graminoid elements. *Pinus ponderosa* is absent or scattered. Understory layers are variable, ranging from sparse to dense grass or shrub layers. If Madrean oak trees are present, then they do not dominate the tree canopy. Common shrub species may include chaparral, desert scrub or lower montane shrubs such as *Arctostaphylos pungens*, *Canotia holacantha*, *Ceanothus greggii*, *Cercocarpus montanus*, *Quercus turbinella*, *Mimosa dysocarpa*, or *Rhus trilobata*. Perennial grasses such as *Bouteloua curtipendula*, *Bouteloua eriopoda*, *Bouteloua gracilis*, *Muhlenbergia emersleyi*, *Muhlenbergia pauciflora*, *Piptochaetium fimbriatum*, or *Piptochaetium pringlei* are present in many stands and may form an herbaceous layer. Stands occur on foothills, mountains and plateaus generally between 1460-2225 m in elevation. Substrates are variable, but soils are generally dry and rocky.

***Diagnostic Characteristics:** This woodland has pinyon trees present in the tree canopy. *Pinus cembroides*, *Pinus discolor*, and *Juniperus coahuilensis* are diagnostic species that may or may not be dominant tree species in this Madrean woodland. These species may occur with other, more widespread tree species such as *Juniperus monosperma* or *Pinus edulis* and still indicate this type. *Juniperus deppeana* has high constancy and is a diagnostic species when dominant, except when occurring in the subcanopy of montane forests or in the northern range extent with ~Southern Rocky Mountain Pinyon - Juniper Woodland Group (G253) where *Pinus edulis* and/or *Juniperus monosperma* dominate and other Madrean canopy and understory species are absent. Characteristic understory species include the shrubs *Arctostaphylos pungens*, *Canotia holacantha*, *Ceanothus greggii*, *Quercus turbinella*, *Mimosa dysocarpa*, and perennial grasses *Bouteloua curtipendula*, *Bouteloua eriopoda*, *Bouteloua gracilis*, *Muhlenbergia emersleyi*, *Muhlenbergia pauciflora*, *Piptochaetium fimbriatum*, and *Piptochaetium pringlei*.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G487 | Madrean Juniper Open Woodland | |
| G252 | Southern Rocky Mountain Juniper Open Woodland | |
| G253 | Southern Rocky Mountain Pinyon - Juniper Woodland | |
| G191 | Comanchian Oak - Juniper Scrub | |

Similar NVC Types General Comments [optional]:**VEGETATION**

Physiognomy and Structure Summary: This upland group is typically a short (<5 m tall) open evergreen woodland or tree savanna with 10-60% tree cover, but may have a closed forest canopy. Needle- or scale-leaved trees dominate the tree canopy, such as *Pinus cembroides*, *Pinus discolor*, *Juniperus coahuilensis*, and *Juniperus deppeana*. Evergreen broad-leaved trees, including evergreen oaks such as *Quercus arizonica*, *Quercus emoryi*, or *Quercus grisea*, may be present, but they do not dominate the tree canopy (<50% relative tree cover). Shrub and herbaceous layers may be present or absent. The herbaceous layer, if present, is usually dominated by perennial grasses, sometimes with diverse forb species.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: These typically open pinyon - juniper woodlands are characterized by the presence of pinyon trees. Madrean tree species *Pinus cembroides*, *Pinus discolor*, *Pinus remota*, *Juniperus coahuilensis*, *Juniperus deppeana*, *Juniperus flaccida*, or *Juniperus pinchotii* are diagnostic of this group. Communities may actually be dominated by northern species tree species such as *Juniperus monosperma* and/or *Pinus edulis*, but then Madrean species will always be present as indicator species. These indicator species include the above-mentioned evergreen trees, as well as evergreen oaks such as *Quercus arizonica*, *Quercus emoryi*, *Quercus grisea*, *Quercus hypoleuroides*, and *Quercus rugosa*. *Pinus ponderosa* is absent or scattered. Understory layers are variable, ranging from sparse to dense grass or shrub layers. Common shrub species may include chaparral, desert scrub or lower montane shrubs such as *Acacia angustissima*, *Arctostaphylos pungens*, *Canotia holacantha*, *Ceanothus greggii*, *Cercocarpus montanus*, *Dasyllirion wheeleri*, *Garrya wrightii*, *Quercus gravesii*, *Quercus graciliformis*, *Quercus mohriana*, *Quercus turbinella*, *Quercus toumeyii*, *Mimosa dysocarpa*, *Agave lechuguilla*, *Larrea tridentata*, *Mimosa dysocarpa*, *Nolina microcarpa*, *Prosopis glandulosa*, *Rhus trilobata*, *Yucca baccata*, and *Yucca madrensis* (= *Yucca schottii*). Perennial grasses such as *Bouteloua curtipendula*, *Bouteloua eriopoda*, *Bouteloua gracilis*, *Muhlenbergia emersleyi*, *Muhlenbergia pauciflora*, *Piptochaetium fimbriatum*, or *Piptochaetium pringlei* are present in many stands and may form an herbaceous layer.

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:**ENVIRONMENT**

Environmental Description: This group is common in foothills, mountains and plateaus in the Sierra Madre Occidentale and Sierra Madre Orientale in Mexico, Trans-Pecos Texas, southern New Mexico and Arizona, generally south of the Mogollon Rim. Stands are generally restricted to foothill and lower montane elevations. Elevation generally ranges from 1460-2225 m with high-elevation stands restricted to warmer southern aspects. Stands extend down to 760 m elevation in Trans-Pecos ranges. Sites range from gentle to steep slopes. Ground cover often has high cover of rock or bare ground. *Soil/substrate/hydrology:* Substrates are variable, but soils are generally shallow, dry and rocky often with rock outcrops.

DISTRIBUTION

***Geographic Range:** This group occurs in the Sierra Madre Occidentale and Sierra Madre Orientale of northern Mexico, Trans-Pecos Texas, southern New Mexico and Arizona, generally south of the Mogollon Rim. Stands occur on the southwestern side of the Sacramento Mountains, but transition into ~Southern Rocky Mountain Pinyon - Juniper Woodland Group (G253)\$\$ further north.

Nations: MX, US

States/Provinces: AZ, MXCH, MXCO, MXSO, NM, TX

USFS Ecoregions (2007) [optional]: 313B:CC, 313C:CC, 313D:CP, 315A:CC, 315B:CC, 315H:CC, 321A:CC, 322A:CC, 322B:CC, 331I:??, M313A:CC, M313B:CC, M331F:??

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3132 | <i>Pinus cembroides</i> - <i>Pinus discolor</i> - <i>Pinus edulis</i> / Grass Understory Woodland Alliance |
| A3131 | <i>Pinus cembroides</i> - <i>Pinus discolor</i> - <i>Pinus edulis</i> / Shrub Understory Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--|------------------------|------|
| = | High Sun Mild (HSM) Pinyon - Juniper Climatic Region | Moir and Carleton 1987 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** W.H. Moir and J.O. Carleton (1987)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz and E. Muldavin

Acknowledgments [optional]: E. Muldavin

Version Date: 10 Nov 2015

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- USDA [U.S. Department of Agriculture]. 2001. Existing vegetation map (base - 1:24,000). Lincoln National Forest, Alamogordo, New Mexico. Terrestrial Ecosystem Survey (TES). [<http://www.fs.fed.us/r3/lincoln/contact/gis/index.htm>].

M011. Madrean Montane Forest & Woodland

1. Forest & Woodland

1.B.1.Nd. Madrean-Balconian Forest & Woodland

G203. Madrean Lower Montane Pine - Oak Forest & Woodland

Type Concept Sentence: This Madrean forest and woodland group occurs at mid elevations in mountains in northern Mexico and extends into mountains of Trans-Pecos Texas, southern New Mexico and southern Arizona and is characterized by an open to closed, conifer and mixed conifer - evergreen broad-leaved tree canopy typically composed of Madrean pines (*Pinus arizonica*, *Pinus engelmannii*, and *Pinus leiophylla*) and evergreen oaks (*Quercus arizonica*, *Quercus emoryi*, *Quercus gravesii*, *Quercus grisea*, *Quercus hypoleucoides*, or *Quercus rugosa*) sometimes with *Arbutus arizonica*, *Arbutus xalapensis*, or *Hesperocyparis arizonica*, present to dominant. *Pinus ponderosa* var. *scopulorum* may replace *Pinus arizonica*; however, Madrean species still characterize the understory.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.1.Nd.2. Madrean Montane Forest & Woodland (M011)

Elcode: G203

***Scientific Name:** *Pinus engelmannii* - *Pinus leiophylla* - *Pinus arizonica* Forest & Woodland Group

***Common (Translated Scientific) Name:** Apache Pine - Chihuahuan Pine - Arizona Pine Forest & Woodland Group

***Colloquial Name:** Madrean Lower Montane Pine - Oak Forest & Woodland

***Type Concept:** This forest and woodland group occurs in mountains and plateaus generally at mid-elevations (1460-2400 m) in the Sierra Madre Occidentale and Sierra Madre Orientale in Mexico, Trans-Pecos Texas, southern New Mexico and Arizona, generally south of the Mogollon Rim. These forests and woodlands are composed of Madrean pines (*Pinus arizonica*, *Pinus engelmannii*, and *Pinus leiophylla*) or madrones (*Arbutus arizonica*, *Arbutus xalapensis*) and evergreen oaks (*Quercus arizonica*, *Quercus emoryi*, *Quercus gravesii*, *Quercus grisea*, *Quercus hypoleucoides*, or *Quercus rugosa*) intermingled with shrublands and pinyon-juniper woodlands. In northern stands and at higher elevations, *Pinus ponderosa* var. *scopulorum* may replace *Pinus arizonica*; however, Madrean species still characterize the subcanopy or understory. This group also includes *Hesperocyparis arizonica* (= *Cupressus arizonica*)-dominated stands with *Quercus hypoleucoides* or *Quercus rugosa* in the understory. Other tree species may include *Juniperus deppeana*, *Juniperus flaccida*, *Pinus cembroides*, *Pinus discolor*, and *Pseudotsuga menziesii*. Subcanopy and shrub layers may include typical encinal and chaparral species, such as *Agave* spp., *Arctostaphylos pringlei*, *Arctostaphylos pungens*, *Garrya wrightii*, *Nolina* spp., and *Quercus turbinella*. Some stands have moderate cover of perennial graminoids, such as *Muhlenbergia emersleyi*, *Muhlenbergia longiligula*, *Muhlenbergia straminea* (= *Muhlenbergia virescens*), and *Schizachyrium cirratum*. Sites are variable, ranging from warm to cool, xeric to dry-mesic, gentle to very steep slopes, and dry benches that occur at lower to mid-montane elevation (1460-2400 m). Substrates are generally lithic soils, but include finer-textured alluvial soils along streams. Fires are frequent with perhaps more crown fires than ponderosa pine woodlands, which tend to have more frequent ground fires on gentle slopes.

***Diagnostic Characteristics:** The Madrean pines *Pinus arizonica*, *Pinus engelmannii*, and *Pinus leiophylla* are characteristic species that indicate this lower montane Madrean forest and woodland type. Madrean evergreen oak trees are typically present to codominate in the tree canopy, but dominance by tree oaks indicates encinal. Stands dominated by *Arbutus arizonica*, *Arbutus xalapensis*, and *Hesperocyparis arizonica* are less common diagnostic species. In northern parts of the range, *Pinus ponderosa* may also dominate or codominate the tree canopy as long as Madrean evergreen oaks such as *Quercus arizonica*, *Quercus emoryi*, *Quercus grisea*, *Quercus hypoleucoides*, *Quercus oblongifolia*, or *Quercus rugosa* are present to codominant.

Classification Comments:**Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|-------------------------------|------|
| | | |

Similar NVC Types General Comments [optional]:**VEGETATION**

Physiognomy and Structure Summary: This warm-temperate upland group includes open to closed evergreen, needle-leaved or mixed needle-leaved and evergreen broad-leaved Madrean forests and woodlands. The upper tree canopy is 15-30 m tall, depending on the dominant tree species, and is typically dominated by needle-leaved trees. Subcanopy and tall-shrub layers are often dominated by evergreen oaks, pinyon and juniper trees. Short-shrub and herbaceous layers are often present, but cover varies inversely with tree density.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This warm-temperate upland group includes open to closed evergreen, conifer and mixed conifer evergreen broad-leaved Madrean forests and woodlands. The upper tree canopy is 15-30 m tall depending on dominant species and is typically dominated or codominated by conifers such as *Pinus arizonica*, *Pinus engelmannii*, *Pinus leiophylla*, *Hesperocyparis arizonica* (= *Cupressus arizonica*), and occasionally *Pinus ponderosa* at higher elevations or in the northern range extent. The subcanopy is often dominated by evergreen oak trees such as *Quercus albocincta*, *Quercus arizonica*, *Quercus emoryi*, *Quercus fulva*, *Quercus grisea*, *Quercus hypoleucoides*, *Quercus rugosa*, or *Quercus viminea*. This group also includes *Arbutus arizonica* or *Arbutus xalapensis*. Other tree species may include *Juniperus deppeana*, *Juniperus flaccida*, *Pinus cembroides*, and *Pinus discolor*; *Pseudotsuga menziesii* is accidental or absent. A moderately dense shrub layer is often present and includes encinal, chaparral, or montane shrub species, such as *Agave* spp., *Arctostaphylos pringlei*, *Arctostaphylos pungens*, *Garrya wrightii*, *Nolina* spp., and *Quercus turbinella*. If deciduous oak species are present, such as *Quercus gambelii* or *Quercus x pauciloba*, then Madrean oak species are present. Open stands often have moderate to dense cover of perennial graminoids, such as *Muhlenbergia emersleyi*, *Muhlenbergia longiligula*, *Muhlenbergia straminea* (= *Muhlenbergia virescens*), and *Schizachyrium cirratum*, between trees.

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:**ENVIRONMENT**

Environmental Description: This woodland and forest group occurs in mountains and plateaus in the Sierra Madre Occidentale and Sierra Madre Orientale in Mexico, Trans-Pecos Texas, southern New Mexico and Arizona, generally south of the Mogollon Rim. Sites are variable, ranging from warm to cool, xeric to dry-mesic, gentle to very steep slopes, and dry benches that occur at lower to mid-montane elevation (1460-2400 m). Occasionally stands dominated by *Pinus ponderosa* may extend into the upper montane zone (2700 m elevation). Aspect tends to be southern at higher elevation and northerly at lower elevation. Substrates are generally rocky and lithic soils, but include finer-textured alluvial soils along streams. Soils are derived from a variety of parent material, including granite, rhyolite, and their metamorphic derivatives. Stands with a grass-dominated understory tend to occur on less steep and rocky slopes and have finer-textured soils.

DISTRIBUTION

***Geographic Range:** This Madrean woodland and forest group occurs in mountains and plateaus in the Sierra Madre Occidentale and Sierra Madre Orientale in Mexico, Trans-Pecos Texas, and southern New Mexico and Arizona, generally south of the Mogollon Rim.

Nations: MX, US

States/Provinces: AZ, NM, TX

USFS Ecoregions (2007) [optional]: 313B:CC, 313C:CC, 313D:C?, 315A:CC, 315H:CC, 321A:CC, 322A:CC, 322B:CC, M313A:CC, M313B:CC, M331F:??, M331G:??

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

*Plot Analysis Summary [Med - High Confidence]:

*Plots Used to Define the Type [Med - High Confidence]:

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

*Lower Level NVC Types:

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A0163 | <i>Hesperocyparis arizonica</i> Forest & Woodland Alliance |
| A3112 | <i>Pinus arizonica</i> - <i>Pinus engelmannii</i> - <i>Pinus leiophylla</i> Woodland Alliance |
| A0368 | <i>Arbutus xalapensis</i> - <i>Acer grandidentatum</i> - <i>Quercus</i> spp. Forest & Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

*Recent Concept Lineage [if applicable]:

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---|-------------------|------|
| = | Madrean Evergreen Forest and Woodland, Oak-Pine Series - 123.32 | Brown et al. 1979 | |
| < | Relict Conifer Forest and Woodland, Cypress Series - 123.52 | Brown et al. 1979 | |

AUTHORSHIP

*Primary Concept Source [if applicable]: D.E. Brown, C.H. Lowe and C.P. Pase (1979)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

*Author of Description: K.A. Schulz

Acknowledgments [optional]: E. Muldavin

Version Date: 10 Nov 2015

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- NHNM [Natural Heritage New Mexico]. No date. Unpublished data on file. Natural Heritage New Mexico, University of New Mexico, Albuquerque.
- NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

1. Forest & Woodland

1.B.1.Nd. Madrean-Balconian Forest & Woodland

G202. Madrean Upper Montane Conifer - Oak Forest & Woodland

Type Concept Sentence: This Madrean forest and woodland group occurs at upper elevations in mountains in northern Mexico and extends into the mountains of Trans-Pecos Texas, southern New Mexico and southern Arizona and is characterized by an open to closed, conifer and mixed conifer - evergreen broad-leaved tree canopy typically composed of *Abies coahuilensis*, *Abies concolor*, *Pinus strobiformis*, or *Pseudotsuga menziesii*, and Madrean evergreen oaks that frequently include *Quercus hypoleucooides* and *Quercus rugosa* with other oaks such as *Quercus arizonica*, *Quercus chrysolepis*, *Quercus emoryi*, *Quercus gravesii*, *Quercus grisea*, *Quercus muehlenbergii* and maples *Acer grandidentatum* found mostly in lower elevation stands.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.1.Nd.2. Madrean Montane Forest & Woodland (M011)

Elcode: G202

***Scientific Name:** *Pseudotsuga menziesii* - *Pinus strobiformis* / *Quercus hypoleucooides* Forest & Woodland Group

***Common (Translated Scientific) Name:** Douglas-fir - Southwestern White Pine / Silverleaf Oak Forest & Woodland Group

***Colloquial Name:** Madrean Upper Montane Conifer - Oak Forest & Woodland

***Type Concept:** This forest and woodland group is found at upper elevations in the Sierra Madre Occidentale and Sierra Madre Orientale of Mexico. In the U.S., it occurs in the Sky Islands (Chiricahua, Huachuca, Pinaleno, Santa Catalina, and Santa Rita mountains) and along the Nantanes Rim and in southern New Mexico and the Trans-Pecos region of Texas (it does not occur north of the Mogollon Rim). The vegetation is characterized by large- and small-patch forests and woodlands dominated by *Abies coahuilensis*, *Abies concolor*, *Pinus strobiformis*, or *Pseudotsuga menziesii*, and Madrean evergreen oaks that include *Quercus hypoleucooides* and *Quercus rugosa*. Other oaks found mostly at the lower elevation limit include *Quercus arizonica*, *Quercus chrysolepis*, *Quercus emoryi*, *Quercus gravesii*, *Quercus grisea*, and *Quercus muehlenbergii*. *Acer grandidentatum* can be a canopy codominant, and *Juniperus deppeana* or *Juniperus flaccida* may also be present in the subcanopy. If *Quercus gambelii* is prominent in the shrub layer, then other Madrean elements are present. *Pinus ponderosa* and *Pinus arizonica* may occur as seral species mixed into the stands. Stands occur in cooler upper montane and subalpine sites in the Sierra Madres. Where it occurs in the U.S., it is restricted to the cooler north and east aspects at the upper elevations (1980-2700 m) in the Sky Island ranges. It may also occur at lower elevations in ravines and canyons where there is significant cold-air drainage. Soils are very rocky and derived from granite and rhyolite. It is similar to ~Southern Rocky Mountain White Fir - Douglas-fir Dry Forest Group (G226)\$\$, but that group typically lacks Madrean elements.

***Diagnostic Characteristics:** This upper montane Madrean forest and woodland group is characterized by an upper tree canopy dominated by *Abies coahuilensis*, *Abies concolor*, *Pinus strobiformis*, or *Pseudotsuga menziesii*, and Madrean oaks, especially at higher elevations, where *Quercus hypoleucooides* and *Quercus rugosa* are present. Other Madrean species are usually present and further characterize the group. Stands are restricted to upper elevations in the Sierra Madre Occidentale and Sierra Madre Orientale of Mexico and the Sky Islands of southern Arizona and New Mexico, and the Trans-Pecos of Texas.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|-----------------------------------|
| G226 | Southern Rocky Mountain White Fir - Douglas-fir Dry Forest | typically lacks Madrean elements. |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This warm temperate forest and woodland group includes moderately open to closed evergreen, needle-leaved Madrean forests. The upper tree canopy is 20-30 m tall depending on dominant tree species and is typically dominated by needle-leaved trees. Subcanopy and tall-shrub layers are often dominated by evergreen oaks, with other needle-leaved or scale-leaved trees. An open short-shrub layer and a robust herbaceous layer may be present, depending on tree density and substrate.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: The vegetation is characterized by large- and small-patch forests and woodlands dominated by *Abies coahuilensis*, *Abies concolor*, or *Pseudotsuga menziesii*, and Madrean oaks, especially at higher elevations, where *Quercus hypoleucoides* and *Quercus rugosa* are present. Scattered *Pinus ponderosa*, *Pinus strobiformis*, and *Juniperus deppeana* may be present. Other oaks may include *Quercus arizonica*, *Quercus chrysolepis*, *Quercus emoryi*, *Quercus gravesii*, *Quercus grisea*, and *Quercus toumeyi*. If *Quercus gambelii* is prominent in the shrub layer, then other Madrean elements are also present. An open shrub layer may be present, dominated by *Ceanothus fendleri*, *Cercocarpus montanus*, *Garrya wrightii*, and other oaks. The herbaceous layer may be sparse to moderately dense and is typically dominated by perennial graminoids, such as *Muhlenbergia longiligula*, *Bromus ciliatus* var. *richardsonii* (= *Bromus richardsonii*), *Carex geophila*, *Koeleria macrantha*, and *Poa fendleriana*. The typically sparse forbs include *Comandra umbellata*, *Galium tinctorium*, *Hedeoma hyssopifolia*, *Lathyrus graminifolius*, *Mirabilis comata* (= *Oxybaphus comatus*), *Packera neomexicana*, *Thalictrum fendleri*, and *Vicia americana*.

*Floristics Table [Med - High Confidence]:

*Number of Plots:

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:

ENVIRONMENT

Environmental Description: This forest and woodland group occurs at the upper elevations in the Sierra Madre Occidentale and Sierra Madre Orientale of Mexico. In the U.S., it occurs on cooler north and east aspects at high elevations (1980-2700 m) in the Sky Islands (Chiricahua, Huachuca, Pinaleno, Santa Catalina, and Santa Rita mountains) and along the Nantanes Rim and in southern New Mexico and the Trans-Pecos region of Texas. Stands may occur at lower elevations in ravines and canyons where there is significant cold-air drainage. *Soil/substrate/hydrology:* Soils are very rocky and derived from granite and rhyolite.

DISTRIBUTION

***Geographic Range:** This forest and woodland group occurs at the upper elevations in the Sierra Madre Occidentale and Sierra Madre Orientale of Mexico. In the U.S., it occurs on cooler aspects at high elevations in the Sky Islands (Chiricahua, Huachuca, Pinaleno, Santa Catalina, and Santa Rita mountains) and along the Nantanes Rim and in southern New Mexico and the Trans-Pecos region of Texas (it does not occur north of the Mogollon Rim).

Nations: MX, US

States/Provinces: AZ, NM, TX

USFS Ecoregions (2007) [optional]: 313D:??, 321A:CC, 322B:??, M313A:CC, M313B:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3109 | <i>Acer grandidentatum</i> - <i>Quercus gravesii</i> - <i>Quercus muehlenbergii</i> Forest & Woodland Alliance |
| A3108 | <i>Pseudotsuga menziesii</i> / <i>Quercus hypoleucoides</i> - <i>Quercus rugosa</i> Forest & Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--|-------------------|------|
| < | Madrean Subalpine Conifer Forest - 121.5 | Brown et al. 1979 | |

AUTHORSHIP***Primary Concept Source [if applicable]:** D.E. Brown, C.H. Lowe and C.P. Pase (1979)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz and E. Muldavin**Acknowledgments [optional]:** E. Muldavin

Version Date: 10 Nov 2015

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1.B.2.Nb. Rocky Mountain Forest & Woodland (D194)

M022. Southern Rocky Mountain Lower Montane Forest

1. Forest & Woodland

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

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

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

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nb.1. Southern Rocky Mountain Lower Montane Forest (M022)

Elcode: G225

***Scientific Name:** *Abies concolor* - *Picea pungens* - *Pseudotsuga menziesii* Mesic Southern Rocky Mountain Forest Group

***Common (Translated Scientific) Name:** White Fir - Blue Spruce - Douglas-fir Mesic Southern Rocky Mountain Forest Group

***Colloquial Name:** Rocky Mountain Douglas-fir - White Fir - Blue Spruce Mesic Forest

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

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

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

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G226 | Southern Rocky Mountain White Fir - Douglas-fir Dry Forest | |

Similar NVC Types General Comments [optional]:

VEGETATION

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

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

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

*Floristics Table [Med - High Confidence]:

*Number of Plots:

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Const-ancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|------------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:

ENVIRONMENT

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

DISTRIBUTION

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

Nations: MX?, US

States/Provinces: AZ, CO, ID, NM, NV, UT, WY

USFS Ecoregions (2007) [optional]: 313A:CC, 313B:CC, 313C:CC, 313D:CP, 315A:C?, 315H:CC, 321A:??, 322A:CC, 331B:CC, 331G:C?, 331H:CP, 331I:CC, 331J:CC, 341A:CC, 341B:CC, 341C:CP, 341D:CC, 341F:CC, 342A:C?, 342B:C?, 342D:CP, 342E:CC, 342F:CP, 342G:CP, 342J:CP, M313A:CC, M313B:CC, M331B:CP, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M341A:CC, M341B:CC, M341C:CC, M341D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

*Plot Analysis Summary [Med - High Confidence]:

*Plots Used to Define the Type [Med - High Confidence]:

CONFIDENCE LEVEL

USNVC Confidence Level: High

USNVC Confidence Comments [optional]:

HIERARCHY

*Lower Level NVC Types:

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A0165 | <i>Picea pungens</i> Southern Rocky Mountain Mesic Forest Alliance |
| A3370 | <i>Pseudotsuga menziesii</i> Southern Rocky Mountain Mesic Forest Alliance |
| A3369 | <i>Abies concolor</i> Southern Rocky Mountain Mesic Forest & Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

*Recent Concept Lineage [if applicable]:

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------------------|----------------------|------|
| < | Blue Spruce: 216 | Eyre 1980 | |
| >< | <i>Pseudotsuga menziesii</i> Series | DeVelice et al. 1986 | |
| >< | <i>Picea pungens</i> Series | DeVelice et al. 1986 | |
| >< | <i>Abies concolor</i> Series | DeVelice et al. 1986 | |
| >< | <i>Pseudotsuga menziesii</i> Series | Moir and Ludwig 1979 | |
| >< | <i>Picea pungens</i> Series | Moir and Ludwig 1979 | |
| >< | <i>Abies concolor</i> Series | Moir and Ludwig 1979 | |
| >< | White Fir: 211 | Eyre 1980 | |
| >< | Interior Douglas-fir: 210 | Eyre 1980 | |

AUTHORSHIP

*Primary Concept Source [if applicable]: W.H. Moir and J.A. Ludwig (1979)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

*Author of Description: K.A. Schulz and M.E. Hall

Acknowledgments [optional]:

Version Date: 30 May 2013

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G229. Southern Rocky Mountain Ponderosa Pine Open Woodland

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

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nb.1. Southern Rocky Mountain Lower Montane Forest (M022)

Elcode: G229

***Scientific Name:** *Pinus ponderosa* / *Festuca* spp. - *Muhlenbergia* spp. Southern Rocky Mountain Open Woodland Group

***Common (Translated Scientific) Name:** Ponderosa Pine / Fescue species - Muhly species Southern Rocky Mountain Open Woodland Group

***Colloquial Name:** Southern Rocky Mountain Ponderosa Pine Open Woodland

***Type Concept:** This group is found predominantly in the Colorado Plateau region, west into scattered locations in the Great Basin, and north along the eastern front of the southern Rocky Mountains into southeastern Wyoming. These savannas occur at the lower treeline/ecotone between grassland or shrubland and more mesic coniferous forests typically in warm, dry, exposed sites. Elevations range from less than 1900 m in central and northern Wyoming to 2800 m in the New Mexico mountains to well over 2700 m on the higher plateaus of the Southwest. It is found on rolling plains, plateaus, or dry slopes usually on more southerly aspects. This group is best described as a savanna that has widely spaced (<25% tree canopy cover) (>150 years old) *Pinus ponderosa* (primarily var. *scopulorum* and var. *brachyptera*) as the predominant conifer. It is maintained by a fire regime of frequent, low-intensity surface fires. A healthy occurrence often consists of open and parklike stands dominated by *Pinus ponderosa*. Understory vegetation in the true savanna occurrences is predominantly fire-resistant grasses and forbs that resprout following surface fires; shrubs, understory trees and downed logs are uncommon. Important species include *Festuca arizonica*, *Muhlenbergia straminea* (= *Muhlenbergia virescens*), *Pseudoroegneria spicata*, *Andropogon gerardii*, *Schizachyrium scoparium*, *Festuca idahoensis*, *Piptatheropsis micrantha* (= *Piptatherum micranthum*), and *Bouteloua gracilis*. A century of anthropogenic disturbance and fire suppression has resulted in a higher density of *Pinus ponderosa* trees, altering the fire regime and species composition.

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

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

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G228 | Southern Rocky Mountain Ponderosa Pine Forest & Woodland | |
| G216 | Black Hills-Northwestern Great Plains Ponderosa Pine Forest & Woodland | |
| G213 | Central Rocky Mountain Ponderosa Pine Open Woodland | |

Similar NVC Types General Comments [optional]:

VEGETATION

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

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

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

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Fire is a key factor in maintaining the open canopies characteristic of these savannas. Historically, surface fires and drought were influential in maintaining open-canopy conditions in these savannas. With settlement and subsequent fire suppression, stands have become more dense. Presently, many contain understories of more shade-tolerant species, such as *Pseudotsuga menziesii* and/or *Abies* spp., as well as younger cohorts of *Pinus ponderosa*. These altered stand structures have affected fuel loads and altered fire regimes. Presettlement fire regimes were primarily frequent (5- to 15-year return intervals), low-intensity surface fires triggered by lightning strikes or deliberately set by Native Americans. With fire suppression and increased fuel loads, fires are now less frequent and often become intense crown fires which can kill mature *Pinus ponderosa*. Establishment is erratic and believed to be linked to periods of adequate soil moisture and good seed crops, as well as fire frequencies which allow seedlings to reach sapling size. Longer fire intervals have resulted in many stands having dense subcanopies of overstocked and unhealthy young *Pinus ponderosa*. Savage and Swetnam (1990) suggest that continuity of understory fuels, especially the grass layer, maintained high frequencies of low-intensity, surface fires along the entire gradient from ponderosa pine woodlands to spruce-fir forests. This hypothesis is supported by evidence that forests with grassy understories were once extensive and continuous over a large elevational range (Savage and Swetnam 1990, Moir et al. 1997). Descriptions of forests around the turn of the century noted open, large areas not confined to ponderosa pine forests. Most ecologists agree that hot, crown fires were not extensive in these open ponderosa pine savannas, although small thickets would have been destroyed by spot crown fires.

ENVIRONMENT

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

DISTRIBUTION

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

Nations: US

States/Provinces: AZ, CO, NM, NV, UT, WY

USFS Ecoregions (2007) [optional]: 315A:CC, 315B:CC, 315H:CP, 321A:PP, 331B:CC, 331G:C?, 331H:CC, 331I:CC, 331J:CP, 342F:CC, M313B:PP, M331B:CC, M331F:CC, M331G:CP, M331I:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3419 | <i>Pinus ponderosa</i> / Grass Understory Southern Rocky Mountain Open Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|------------------------------|----------------|------|
| > | Interior Ponderosa Pine: 237 | Eyre 1980 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** M.G. Harrington and S.S. Sackett (1992)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** M.E. Hall

Acknowledgments [optional]:

Version Date: 17 Mar 2010

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1. Forest & Woodland

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

G228. Southern Rocky Mountain Ponderosa Pine Forest & Woodland

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

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nb.1. Southern Rocky Mountain Lower Montane Forest (M022)

Elcode: G228

***Scientific Name:** *Pinus ponderosa* Southern Rocky Mountain Forest & Woodland Group

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

***Colloquial Name:** Southern Rocky Mountain Ponderosa Pine Forest & Woodland

***Type Concept:** This widespread group is most common throughout the cordillera of the Rocky Mountains, from the Greater Yellowstone region south. It is also found in the Colorado Plateau region, west into scattered locations of the Great Basin. Its easternmost extent in Wyoming is in the Bighorn Mountains. These woodlands occur at the lower treeline/ecotone between grassland or shrubland and more mesic coniferous forests typically in warm, dry, exposed sites. Elevations range from less than 1900 m in northern Wyoming to 2800 m in the New Mexico mountains. Occurrences are found on all slopes and aspects; however, moderately steep to very steep slopes or ridgetops are most common. This group generally occurs on soils derived from igneous, metamorphic, and sedimentary material, with characteristic features of good aeration and drainage, coarse textures, circumneutral to slightly acidic pH, an abundance of mineral material, rockiness, and periods of drought during the growing season. *Pinus ponderosa* (primarily var. *scopulorum* and var. *brachyptera*) is the predominant conifer; *Pseudotsuga menziesii*, *Pinus edulis*, *Pinus contorta*, *Populus tremuloides*, and *Juniperus* spp. may also be present in the tree canopy. The understory is usually shrubby, with *Artemisia nova*, *Artemisia tridentata*, *Arctostaphylos patula*, *Arctostaphylos uva-ursi*, *Cercocarpus montanus*, *Purshia stansburiana*, *Purshia tridentata*, *Quercus gambelii*, *Symphoricarpos* spp., *Prunus virginiana*, *Amelanchier alnifolia*, and *Rosa* spp. common. *Pseudoroegneria spicata*, *Pascopyrum smithii*, and species of *Hesperostipa*, *Achnatherum*, *Festuca*, *Muhlenbergia*, and *Bouteloua* are some of the common grasses. Mixed fire regimes and surface fires of variable return intervals maintain these woodlands, depending on climate, degree of soil development, and understory density.

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

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

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G229 | Southern Rocky Mountain Ponderosa Pine Open Woodland | |
| G210 | Central Rocky Mountain Douglas-fir - Pine Forest | |
| G216 | Black Hills-Northwestern Great Plains Ponderosa Pine Forest & Woodland | |
| G213 | Central Rocky Mountain Ponderosa Pine Open Woodland | |

Similar NVC Types General Comments [optional]:

VEGETATION

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

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This group is dominated by *Pinus ponderosa* with *Pseudotsuga menziesii*, *Pinus edulis*, *Pinus contorta*, *Populus tremuloides*, and *Juniperus* spp. as common canopy associates. In the southern Rocky Mountains and the mountains of southern Arizona and New Mexico, associated trees include *Pseudotsuga menziesii*, *Abies concolor*, *Picea pungens*, *Pinus strobiformis*, *Pinus edulis*, *Pinus discolor*, *Pinus cembroides*, *Pinus flexilis*, *Juniperus scopulorum*, and *Populus tremuloides*. In far southern stands, *Juniperus deppeana* may also be common. Average tree canopy cover ranges from 20-70%. The understory may include dense stands of shrubs or be dominated by grasses, sedges, or herbaceous species, although many of the associations are named for shrub species. Existing stands usually have younger cohorts of *Pinus ponderosa* present and may be less open than in the past. Understory

shrub species include *Artemisia nova*, *Artemisia tridentata*, *Arctostaphylos patula*, *Arctostaphylos uva-ursi*, *Cercocarpus montanus*, *Purshia stansburiana*, *Purshia tridentata*, *Quercus gambelii*, *Symphoricarpos* spp., *Fallugia paradoxa*, *Ribes* spp., *Robinia neomexicana*, *Alnus incana*, *Forestiera pubescens*, *Prunus virginiana*, *Amelanchier alnifolia*, and *Rosa* spp. The herbaceous layer tends to vary inversely with shrub cover, but is composed primarily of graminoids. Important species include *Bouteloua gracilis*, *Carex geyeri*, *Carex rossii*, *Carex pensylvanica*, *Koeleria macrantha*, *Leucopoa kingii* (= *Festuca kingii*), *Muhlenbergia straminea* (= *Muhlenbergia virescens*), *Muhlenbergia montana*, *Achnatherum hymenoides* (= *Oryzopsis hymenoides*), *Achnatherum occidentale* (= *Stipa occidentalis*), *Pseudoroegneria spicata*, *Poa secunda*, *Elymus elymoides*, *Festuca idahoensis*, *Festuca arizonica*, and *Hesperostipa comata* (= *Stipa comata*). Important or diagnostic forb species include *Aspidotis densa*, *Wyethia mollis*, *Balsamorhiza sagittata*, *Achillea millefolium*, *Sedum stenopetalum*, *Maianthemum racemosum* (= *Smilacina racemosa*), *Vicia americana*, and species of many other genera, such as *Erigeron*, *Lupinus*, *Fragaria*, *Lathyrus*, *Heterotheca*, *Arenaria*, and *Antennaria*.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

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

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

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

ENVIRONMENT

Environmental Description: This group within the region occurs at the lower treeline/ecotone between grassland or shrubland and more mesic coniferous forests typically in warm, dry, exposed sites at elevations ranging from 1980-2800 m (6500-9200 feet). It can occur on all slopes and aspects; however, it commonly occurs on moderately steep to very steep slopes or ridgetops. At higher elevations, it will typically occur on south- or west-facing slopes. This group generally occurs on soils derived from igneous, metamorphic, and sedimentary material, including basalt, basaltic, andesitic flows, intrusive granitoids and porphyrites, and tuffs (Youngblood and Mauk 1985). Characteristic soil features include good aeration and drainage, coarse textures, circumneutral to slightly acidic pH, an abundance of mineral material, and periods of drought during the growing season. Some occurrences may occur as edaphic climax communities on very skeletal, infertile, and/or excessively drained soils, such as pumice, cinder or lava fields, and scree slopes. Surface textures are highly variable in this group, ranging from sand to loam and silt loam. Exposed rock and bare soil consistently occur to some degree in all the associations. *Pinus ponderosa* / *Arctostaphylos patula* represents the extreme, with typically a high percentage of rock and bare soil present.

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

Climate: The quantity and timing of precipitation vary across the range of the group, ranging from 25-60 cm annually, with at least some seasonal drought. East of the Continental Divide and in the Southwest, summer precipitation predominates, whereas western stands receive most of their precipitation from westerly winter storms. Monsoonal summer rains can contribute a substantial proportion to the annual precipitation totals in the Southwest. Elevations decrease with increasing latitude, from less than 1000 m in eastern Washington to over 2750 m in southern Arizona and New Mexico. **Soil/substrate/hydrology:** Fire is a key factor in maintaining the open canopies characteristic of these woodlands, but soil drought or infertility may be equally important in some areas. This group generally occurs on soils derived from igneous, metamorphic, and sedimentary material, including basalt,

basaltic, andesitic flows, intrusive granitoids and porphyrites, and tuffs (Youngblood and Mauk 1985). Characteristic soil features include good aeration and drainage, coarse textures, circumneutral to slightly acidic pH, an abundance of mineral material, and periods of drought during the growing season. Some occurrences may occur as edaphic climax communities on very skeletal, infertile, and/or excessively drained soils, such as pumice, cinder or lava fields, and scree slopes. Surface textures are highly variable in this group, ranging from sand to loam and silt loam. Exposed rock and bare soil consistently occur to some degree in all the associations.

DISTRIBUTION

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

Nations: MX, US

States/Provinces: AZ, CO, ID?, NM, NV, UT, WY

USFS Ecoregions (2007) [optional]: 313A:CC, 313B:CC, 313C:CC, 313D:CC, 315A:CC, 315B:CC, 315H:CC, 321A:CC, 331B:CC, 331F:CP, 331G:CP, 331H:CC, 331I:CC, 331J:CC, 341A:CP, 341B:CC, 341F:CC, 342F:CC, 342G:CC, M313A:CC, M313B:CC, M331B:CC, M331D:CP, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M341A:CP, M341B:CC, M341C:CC, M341D:C?

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3398 | <i>Pinus ponderosa</i> Southern Rocky Mountain Forest & Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--|--------------------------|------|
| > | Interior Ponderosa Pine: 237 | Eyre 1980 | |
| < | Pine Series, <i>Pinus ponderosa</i> Association - 122.321 | Brown et al. 1979 | |
| < | Pine Series, <i>Pinus ponderosa-Quercus gambelii</i> Association - 122.321 | Brown et al. 1979 | |
| < | Pine Series, <i>Pinus ponderosa</i> -Mixed Conifer Association - 122.321 | Brown et al. 1979 | |
| = | Ponderosa Pine Series | Muldavin et al. 1996 | |
| = | Ponderosa Pine Series | Komarkova et al. 1988b | |
| = | Ponderosa Pine Series | Hess and Alexander 1986 | |
| = | Ponderosa Pine Series | DeVelice et al. 1986 | |
| = | Ponderosa Pine Series | Youngblood and Mauk 1985 | |
| = | Ponderosa Pine Series | Mauk and Henderson 1984 | |

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------------------|----------------------------|------|
| = | Ponderosa Pine Series | Hoffman and Alexander 1976 | |
| = | Xeric <i>Pinus ponderosa</i> Forest | Peet 1981 | |

AUTHORSHIP

*Primary Concept Source [if applicable]: F.H. Eyre (1980)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

*Author of Description: M.E. Hall

Acknowledgments [optional]:

Version Date: 17 Mar 2010

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1. Forest & Woodland

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

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

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

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nb.1. Southern Rocky Mountain Lower Montane Forest (M022)

Elcode: G226

***Scientific Name:** *Abies concolor* - *Pseudotsuga menziesii* Southern Rocky Mountain Dry Forest Group

***Common (Translated Scientific) Name:** White Fir - Douglas-fir Southern Rocky Mountain Dry Forest Group

***Colloquial Name:** Southern Rocky Mountain White Fir - Douglas-fir Dry Forest

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

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

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

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G202 | Madrean Upper Montane Conifer - Oak Forest & Woodland | |
| G225 | Rocky Mountain Douglas-fir - White Fir - Blue Spruce Mesic Forest | |
| G215 | Middle Rocky Mountain Montane Douglas-fir Forest & Woodland | |

Similar NVC Types General Comments [optional]:**VEGETATION**

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

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

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

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

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

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

Pseudotsuga menziesii forests are the only true "fire-tolerant" occurrences in this group. *Pseudotsuga menziesii* forests were probably subject to a moderate-severity fire regime in presettlement times, with fire-return intervals of 30-100 years. Many of the important tree species in these forests are fire-adapted (*Populus tremuloides*, *Pinus ponderosa*, *Pinus contorta*) (Pfister et al. 1977), and fire-induced reproduction of *Pinus ponderosa* can result in its continued codominance in *Pseudotsuga menziesii* forests (Steele et al. 1981). Seeds of the shrub *Ceanothus velutinus* can remain dormant in forest occurrences for 200 years (Steele et al. 1981) and germinate abundantly after fire, competitively suppressing conifer seedlings. Successional relationships in this group are complex. *Pseudotsuga menziesii* is less shade-tolerant than many northern or montane trees such as *Tsuga heterophylla*, *Abies concolor*, *Picea engelmannii*, and seedlings compete poorly in deep shade. At drier locales, seedlings may be favored by moderate shading, such as

by a canopy of *Pinus ponderosa*, which helps to minimize drought stress. In some locations, much of these forests have been logged or burned during European settlement, and present-day occurrences are second-growth forests dating from fire, logging, or other occurrence-replacing disturbances (Mauk and Henderson 1984, Chappell et al. 1997).

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

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

ENVIRONMENT

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

DISTRIBUTION

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

Nations: US

States/Provinces: AZ, CO, NM, NV, TX, UT, WY

USFS Ecoregions (2007) [optional]: 313A:CC, 313B:CC, 313C:CC, 313D:CP, 315A:C?, 315H:CC, 321A:??, 322A:CC, 331B:CC, 331G:C?, 331H:CC, 331I:CC, 331J:CC, 341A:CC, 341B:CC, 341C:CP, 341D:C?, 341E:CC, 341F:CC, 341G:CP, 342A:C?, 342B:C?, 342C:C?, 342D:C?, 342E:CC, 342F:CC, 342G:CC, 342J:C?, M313A:CC, M313B:CC, M331B:C?, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:C?, M341A:CC, M341B:CC, M341C:CC, M341D:CC

Omerik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3420 | <i>Abies concolor</i> Dry Forest & Woodland Alliance |
| A3453 | <i>Picea pungens</i> Southern Rocky Mountain Forest & Woodland Alliance |
| A3454 | <i>Pseudotsuga menziesii</i> Southern Rocky Mountain Forest & Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------------------|----------------------|------|
| < | Blue Spruce: 216 | Eyre 1980 | |
| >< | <i>Pseudotsuga menziesii</i> Series | DeVelice et al. 1986 | |
| >< | <i>Abies concolor</i> Series | DeVelice et al. 1986 | |
| >< | <i>Pseudotsuga menziesii</i> Series | Moir and Ludwig 1979 | |
| >< | <i>Abies concolor</i> Series | Moir and Ludwig 1979 | |
| >< | White Fir: 211 | Eyre 1980 | |
| >< | Interior Douglas-fir: 210 | Eyre 1980 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** W.H. Moir and J.A. Ludwig (1979)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** M.E. Hall

Acknowledgments [optional]:

Version Date: 17 Mar 2010

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1. Forest & Woodland

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

M501. Central Rocky Mountain Dry Lower Montane-Foothill Forest

1. Forest & Woodland

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

G216. Black Hills-Northwestern Great Plains Ponderosa Pine Forest & Woodland

Type Concept Sentence: This *Pinus ponderosa* forest and woodland group occurs throughout the Great Plains Division along areas that border the Rocky Mountain Division and into the central Great Plains and range from very sparse patches of trees on drier sites, to nearly closed-canopy forest stands on north slopes or in draws where available soil moisture is higher. Deciduous trees are an important component in the western Dakotas.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nb.2. Central Rocky Mountain Dry Lower Montane-Foothill Forest (M501)

Elcode: G216

***Scientific Name:** *Pinus ponderosa* Northwestern Great Plains Forest & Woodland Group

***Common (Translated Scientific) Name:** Ponderosa Pine Northwestern Great Plains Forest & Woodland Group

***Colloquial Name:** Black Hills-Northwestern Great Plains Ponderosa Pine Forest & Woodland

***Type Concept:** This group occurs throughout the Great Plains Division along areas that border the Rocky Mountain Division and into the central Great Plains. These are physiognomically variable woodlands, ranging from very sparse patches of trees on drier, rock outcrop sites to nearly closed-canopy forest stands on north slopes or in draws where available soil moisture is higher. This group is primarily dominated by *Pinus ponderosa* but may include a sparse to relatively dense subcanopy of *Juniperus scopulorum*

with just a few scattered trees. Deciduous trees are an important component in some areas (western Dakotas, Black Hills) and are sometimes codominant with the pines, including *Acer negundo*, *Betula papyrifera*, *Fraxinus pennsylvanica*, *Populus tremuloides*, *Quercus macrocarpa*, and *Ulmus americana*. Important or common shrub species with ponderosa pine can include *Arctostaphylos uva-ursi*, *Amelanchier alnifolia*, *Juniperus communis*, *Juniperus horizontalis*, *Mahonia repens*, *Physocarpus monogynus*, *Prunus virginiana*, *Rhus trilobata*, *Symphoricarpos* spp., and *Yucca glauca*. The herbaceous understory can range from sparse to a dense layer with species typifying the surrounding prairie group, with mixedgrass species common, such as *Andropogon gerardii*, *Bouteloua curtipendula*, *Carex filifolia*, *Carex inops* ssp. *heliophila*, *Danthonia intermedia*, *Koeleria macrantha*, *Nassella viridula*, *Oryzopsis asperifolia*, *Pascopyrum smithii*, *Piptatheropsis micrantha* (= *Piptatherum micranthum*), and *Schizachyrium scoparium*. This group occurs on gentle to steep slopes in the montane zone of the Black Hills and in surrounding areas along escarpments, buttes, canyons, rock outcrops or ravines and can grade into one of the Great Plains canyon groups or the surrounding mixedgrass prairie group. Soils typically range from well-drained loamy sands to sandy loams formed in colluvium of weathered sandstone, limestone, or scoria, rock outcrop or eolian sand. Timber cutting and other disturbances have degraded many examples of this group within the Great Plains; however, some good examples may occur along the Pine Ridge escarpment and Pine Ridge district of the Nebraska National Forest in Nebraska. The expansion of this group from the Black Hills montane zone into the central Great Plains may be due to fire suppression.

***Diagnostic Characteristics:** *Pinus ponderosa*-dominated forests, woodlands, or "savannas" found in the western Great Plains and the Black Hills region. Floristically can be similar to ponderosa pine woodlands found in the Rockies, but often have floristic affinities with the western Great Plains mixedgrass regions.

***Classification Comments:** Ponderosa pine woodlands found in the Great Plains do show some floristic similarities to those found within the forested mountains of the Rockies, but have herbaceous floristics related to the Great Plains "mixedgrass and Rocky Mountains." This group also includes mesic draws and swales where ponderosa pine might be mixed with deciduous trees typifying the northern Great Plains regions. Physiognomically, this is a variable group, with everything from sparse woodlands on breaks and scoria bluffs to dense closed-canopy stands in the Black Hills included. Woodlands dominated by *Pseudotsuga menziesii* found in breaks along rivers and on escarpments in central and eastern Montana and Wyoming are not included in this group, they are placed with ~Middle Rocky Mountain Montane Douglas-fir Forest & Woodland Group (G215)\$\$ or ~Central Rocky Mountain Douglas-fir - Pine Forest Group (G210)\$\$.

The transition from this group (G216) to ~Southern Rocky Mountain Ponderosa Pine Forest & Woodland Group (G228)\$\$ is now defined to occur in the montane zones and Laramie Range (USFS section M3311) and to the west and south of these mountains. The southern Rocky Mountain group will also occur in other isolated mountain ranges of southern Wyoming. The Bighorns (USFS section M331B); all Montana ponderosa pine woodlands are placed into ~Central Rocky Mountain Ponderosa Pine Open Woodland Group (G213)\$\$ or this group as appropriate. The southern extent of this Great Plains group is hard to determine, but farther south in Colorado, there is more *Juniperus*, *Pinus edulis*, and *Quercus gambelii*. This group certainly occurs in New Mexico, but stands at the Black Mesa in western Oklahoma and in southeastern Colorado may also be viewed as having the southwestern affinities.

In the Pine Ridge escarpments of Nebraska, pine communities can range from open canopies with grassy understories to more closed canopies. Included within these areas are also several rocky outcrops, which are included in this group for now.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G228 | Southern Rocky Mountain Ponderosa Pine Forest & Woodland | |
| G209 | Rocky Mountain Foothill-Rock Outcrop Limber Pine - Juniper Woodland | |
| G229 | Southern Rocky Mountain Ponderosa Pine Open Woodland | |
| G213 | Central Rocky Mountain Ponderosa Pine Open Woodland | |

Similar NVC Types General Comments [optional]:

VEGETATION

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

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This group is primarily dominated by *Pinus ponderosa* but may include a sparse to relatively dense subcanopy of *Juniperus scopulorum*, *Thuja occidentalis*, or *Cercocarpus* with just a few scattered trees. Deciduous trees are an important

component in some areas (western Dakotas, Black Hills) and are sometimes codominant with the pines, including *Acer negundo*, *Betula papyrifera*, *Fraxinus pennsylvanica*, *Populus tremuloides*, *Quercus macrocarpa*, and *Ulmus americana*. The shrub layer may be sparse to dense. Important or common shrub species with ponderosa pine can include *Arctostaphylos uva-ursi*, *Amelanchier alnifolia*, *Juniperus communis*, *Juniperus horizontalis*, *Mahonia repens*, *Physocarpus monogynus*, *Prunus virginiana*, *Rhus trilobata*, *Symphoricarpos* spp., and *Yucca glauca*. The herbaceous understory is variable and can range from a sparse to dense layer with species typifying the surrounding prairie group, with mixedgrass species common, such as *Andropogon gerardii*, *Bouteloua curtipendula*, *Carex filifolia*, *Carex inops* ssp. *heliophila*, *Danthonia intermedia*, *Koeleria macrantha*, *Nassella viridula*, *Oryzopsis asperifolia*, *Pascopyrum smithii*, *Piptatheropsis micrantha* (= *Piptatherum micranthum*), and *Schizachyrium scoparium*. Higher-elevation stands often have herbaceous species more typical of the Rocky Mountains such as *Achillea millefolium*, *Antennaria rosea*, *Balsamorhiza sagittata*, *Cerastium arvense*, *Danthonia intermedia*, *Fragaria* spp., *Galium boreale*, *Lathyrus ochroleucus*, and *Pulsatilla patens*.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Const-ancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|------------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Marriot and Faber-Langendoen (2000) report different fire regimes for ponderosa pine communities in the Black Hills, with their "Dry Group" more typically having frequent surface fires and the "Mesic Group" having infrequent catastrophic fires (every 100-200 years). The Dry Group of associations includes lower elevation foothill savanna associations, and the mesic group somewhat higher elevation, north-slope, swale associations. K. Kindscher (pers. comm. 2007) believes that almost all of the stands in Nebraska were there at the time of settlement and are not a result of pine expansion due to fire suppression; in addition, at least some have disappeared, such as the one in southern Nebraska (Franklin County). It is possible, however, that some areas of this group have expanded in size due to fire suppression, but this needs substantiation.

ENVIRONMENT

Environmental Description: These are ponderosa pine occurrences found typically in the matrix of Great Plains grassland systems. They are often surrounded by mixedgrass or tallgrass prairie, in places where available soil moisture is higher or soils are more coarse and rocky. In some cases, these woodlands or savannas may occur where fire suppression has allowed trees to become established (in areas where deciduous trees are more abundant (Girard et al. 1987)). These are typically not in the same setting as Rocky Mountain ponderosa pine, where ponderosa pine forms woodlands at lower treeline and grades into mixed montane conifer systems at higher elevations. These are physiognomically variable woodlands, ranging from very sparse patches of trees on drier sites, to nearly closed-canopy forest stands on north slopes or in draws where available soil moisture is higher. This group occurs primarily on gentle to steep slopes along escarpments, buttes, canyons, rock outcrops or ravines and can grade into one of the Great Plains canyon groups or the surrounding mixedgrass prairie group. Soils typically range from well-drained loamy sands to sandy loams formed in colluvium, weathered sandstone, limestone, scoria or eolian sand.

DISTRIBUTION

***Geographic Range:** This group occurs throughout the Great Plains Division along areas that border the Rocky Mountain Division and into the central Great Plains.

Nations: US

States/Provinces: CO, KS?, MT, ND, NE, SD, WY

USFS Ecoregions (2007) [optional]: 331C:C?, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 331H:CC, 331K:CC, 331L:CC, 331M:CC, 331N:CC, 332A:C?, 332B:C?, 332C:CC, 332D:C?, 332E:C?, M334A:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3464 | <i>Pinus ponderosa</i> Dry-Mesic Black Hills Forest & Woodland Alliance |

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3465 | <i>Pinus ponderosa</i> Mesic Black Hills Forest Alliance |
| A3466 | <i>Pinus ponderosa</i> Northwest Great Plains Open Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

*Recent Concept Lineage [if applicable]:

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP

*Primary Concept Source [if applicable]: P.L. Hansen and G.R. Hoffman (1988)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

*Author of Description: M.S. Reid, K.A. Schulz and H. Marriott

Acknowledgments [optional]: H. Marriott

Version Date: 09 Nov 2015

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G213. Central Rocky Mountain Ponderosa Pine Open Woodland

Type Concept Sentence: This inland Pacific Northwest woodland and savanna group is found in the foothills of the central Rocky Mountains in the Columbia Plateau region and west along the foothills of the Modoc Plateau and eastern Cascades into southern interior British Columbia, occurring at the lower treeline/ecotone between grasslands or shrublands and more mesic coniferous forests, typically on warm, dry, exposed sites. This group includes two physiognomic phases: true woodlands of *Pinus ponderosa* with shrubby or grassy understories, and "wooded steppes" with widely spaced, scattered *Pinus ponderosa* trees over generally shrubby but sparse understories.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nb.2. Central Rocky Mountain Dry Lower Montane-Foothill Forest (M501)

Elcode: G213

***Scientific Name:** *Pinus ponderosa* var. *ponderosa* Central Rocky Mountain Open Woodland Group

***Common (Translated Scientific) Name:** Ponderosa Pine Central Rocky Mountain Open Woodland Group

***Colloquial Name:** Central Rocky Mountain Ponderosa Pine Open Woodland

***Type Concept:** This inland Pacific Northwest group occurs in the foothills of the central Rocky Mountains in the Columbia Plateau region and west along the foothills of the Modoc Plateau and eastern Cascades into southern interior British Columbia. It also occurs east across Idaho into the eastern foothills of the Montana Rockies. This group includes two physiognomic phases: true woodlands of *Pinus ponderosa* with shrubby or grassy understories, and "wooded steppes" with widely spaced, scattered *Pinus ponderosa* trees over generally shrubby but sparse understories. The former are generally fire-maintained, while the later are often too dry and with widely spaced vegetation to carry fire. *Pinus ponderosa* var. *ponderosa* is the predominant conifer; *Pseudotsuga menziesii* or *Pinus flexilis* may be present in the tree canopy but are usually absent. The understory can be shrubby, with *Amelanchier alnifolia*, *Arctostaphylos patula*, *Arctostaphylos uva-ursi*, *Artemisia tridentata*, *Cercocarpus ledifolius*, *Physocarpus malvaceus*, *Purshia tridentata*, *Rosa* spp., *Symphoricarpos albus*, or *Symphoricarpos oreophilus* as common species. In transition areas with sagebrush steppe, *Artemisia tridentata* ssp. *tridentata*, *Artemisia tridentata* ssp. *wyomingensis*, *Artemisia tripartita*, and *Purshia tridentata* may be common in fire-protected sites such as rocky areas. Deciduous shrubs, such as *Physocarpus malvaceus*, *Spiraea betulifolia*, or *Symphoricarpos albus*, can be abundant in more northerly sites or more moist climates. Herbaceous vegetation in the true savanna occurrences is predominantly fire-resistant grasses and forbs that resprout following surface fires; shrubs, understory trees and downed logs are uncommon. These more open stands support grasses such as *Achnatherum* spp., dry *Carex* species (*Carex inops*), *Elymus elymoides*, *Festuca campestris*, *Festuca idahoensis*, *Hesperostipa* spp., or *Pseudoroegneria spicata*. These woodlands and savannas occur at the lower treeline/ecotone between grasslands or shrublands and more mesic coniferous forests, typically on warm, dry, exposed sites. These interior Pacific Northwest woodlands receive winter and spring rains, and thus have a greater spring "green-up" than the drier woodlands in the Central Rockies. However, sites are often too droughty to support a closed tree canopy. Elevations range from less than 500 m in British Columbia to 1600 m in the central Idaho mountains. Occurrences are found on all slopes and aspects; however, moderately steep to very steep slopes or ridgetops and plateaus are most common. This group generally occurs on most geological substrates from weathered rock to glacial deposits to eolian deposits. Characteristic soil features include good aeration and drainage, coarse textures, circumneutral to slightly acidic pH, an abundance of mineral material, and periods of drought during the growing season. Some occurrences may occur as edaphic climax communities on very skeletal, infertile and/or excessively drained soils, such as pumice, cinder or lava fields, and scree slopes. Surface textures are highly variable in this group, ranging from sand to loam and silt loam. Exposed rock and bare soil consistently occur to some degree in all the associations. The more mesic portions of this group may include *Calamagrostis rubescens* or *Carex geyeri*, species more typical of ~Central Rocky Mountain Douglas-fir - Pine Forest Group (G210)\$. Mixed fire regimes and surface fires of variable return intervals maintain these woodlands, typically with a shrub-dominated or patchy shrub layer, depending on climate, degree of soil

development, and understory density. Historically, many of these woodlands and savannas lacked the shrub component as a result of 3- to 7-year fire-return intervals.

***Diagnostic Characteristics:** *Pinus ponderosa* var. *ponderosa* woodlands, savannas and "wooded steppes" in the central Rocky Mountains and eastern Cascades, lacking other conifers and oaks. Generally other floristic components are Central Rockies or somewhat similar to the northern Basin and Range region.

***Classification Comments:** This includes the northern race of Interior Ponderosa Pine old-growth (USFS Region 6, USFS Region 1). The FEIS site describes different varieties of *Pinus ponderosa* and associated species. This group of the Central Rockies is primarily *Pinus ponderosa* var. *ponderosa* (Habeck 1992). Johansen and Latta (2003) have mapped the distribution of two varieties (*Pinus ponderosa* var. *scopulorum* and *Pinus ponderosa* var. *ponderosa*) using mitochondrial DNA. They hybridize along the Continental Divide in Montana backing up the FEIS information. ~Southern Rocky Mountain Ponderosa Pine Forest & Woodland Group (G228)\$\$ and ~Southern Rocky Mountain Ponderosa Pine Open Woodland Group (G229)\$\$ mostly contain *Pinus ponderosa* var. *scopulorum*, *Pinus ponderosa* var. *brachyptera*, and *Pinus arizonica* var. *arizonica*. The transition from this group to G228 is now defined to occur in the montane zones of the Bighorns (USFS section M331B) and Laramie Range (USFS section M331I) and to the east and south of these mountains. The Southern Rocky Mountain group will also occur in other isolated mountain ranges of central Wyoming, but not in eastern Wyoming. It does not occur farther north than Wyoming; all western Montana ponderosa pine woodlands are placed into this ~Central Rocky Mountain Ponderosa Pine Open Woodland Group (G213)\$\$\$. Ponderosa woodlands and "steppes" in eastern Wyoming, eastern and central Montana, including the Missouri River Breaks, are now included in ~Black Hills-Northwestern Great Plains Ponderosa Pine Forest & Woodland Group (G216)\$\$\$, which is predominantly *Pinus ponderosa* var. *scopulorum*. Ponderosa pine woodlands found in the Great Plains do show some floristic similarities to these found within the forested mountains of the Central Rockies, but typically have herbaceous floristics related to the Great Plains "mixedgrass." South of the Modoc Plateau in California, *Pinus ponderosa* forests and woodlands are included in ~Californian Montane Conifer Forest & Woodland Group (G344)\$\$\$.

Woodlands dominated by *Pseudotsuga menziesii* found in breaks along rivers and on escarpments in central and eastern Montana and Wyoming are not included in this group, they are placed with ~Middle Rocky Mountain Montane Douglas-fir Forest & Woodland Group (G215)\$\$ or ~Central Rocky Mountain Douglas-fir - Pine Forest Group (G210)\$\$\$. Hot, dry Douglas-fir types with grass are also not included here, although they are floristically similar. In southern interior British Columbia, *Pseudotsuga menziesii* or *Pinus flexilis* may form woodlands or fire-maintained savannas with and without *Pinus ponderosa* var. *ponderosa* at the lower treeline transition into grassland or shrub-steppe. In interior British Columbia, *Pseudotsuga menziesii* is the characteristic canopy dominant. These Douglas-fir and limber pine associations are currently placed into other groups.

A meeting of Pacific Northwest ecologists for Landfire concluded that the "true savannas" of high-frequency / low-intensity fires and grassy understories are now rare. See Dynamics section for more information.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G228 | Southern Rocky Mountain Ponderosa Pine Forest & Woodland | |
| G229 | Southern Rocky Mountain Ponderosa Pine Open Woodland | |
| G216 | Black Hills-Northwestern Great Plains Ponderosa Pine Forest & Woodland | |
| G210 | Central Rocky Mountain Douglas-fir - Pine Forest | |
| G344 | Californian Montane Conifer Forest & Woodland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These are conifer-dominated woodlands, forests, and savannas, with grassy or shrubby understories. Shrubs can be broad-leaved deciduous or microphyllous evergreen (sagebrush), while the graminoids are primarily bunch grasses, along with rhizomatous grasses. Understories are generally low to moderate in cover, especially in the most droughty and rocky sites. In some cases due to a climate-edaphic interaction, the structure is that of widely scattered trees over "shrub-steppe" of sage, bitterbrush, or sparsely distributed grasses.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This group includes two physiognomic phases: true woodlands of *Pinus ponderosa* with shrubby or grassy understories, and "wooded steppes" with widely spaced, scattered *Pinus ponderosa* trees over generally shrubby but sparse

understories. The former are generally fire-maintained, while the later are often too dry and with widely spaced vegetation to carry fire. *Pinus ponderosa* var. *ponderosa* is the predominant conifer; *Pinus flexilis* or *Pseudotsuga menziesii* may be present in the tree canopy but are usually absent. The understory can be shrubby, with *Amelanchier alnifolia*, *Arctostaphylos patula*, *Arctostaphylos uva-ursi*, *Ceanothus velutinus*, *Cercocarpus ledifolius*, *Physocarpus malvaceus*, *Purshia tridentata*, *Rosa* spp., *Symphoricarpos albus* or *Symphoricarpos oreophilus*, and *Vaccinium cespitosum* as common species. In transition areas with big sagebrush steppe systems, *Artemisia arbuscula*, *Artemisia tridentata* ssp. *tridentata*, *Artemisia tridentata* ssp. *wyomingensis*, *Artemisia tripartita*, *Artemisia tridentata* ssp. *wyomingensis*, *Artemisia tripartita*, and *Purshia tridentata* may be common in fire-protected sites such as rocky areas. Deciduous shrubs, such as *Physocarpus malvaceus*, *Spiraea betulifolia*, or *Symphoricarpos albus*, can be abundant in more northerly sites or more moist climates. Understory vegetation in the true savanna occurrences is predominantly fire-resistant grasses and forbs that resprout following surface fires; shrubs, understory trees and downed logs are uncommon. These more open stands support grasses such as *Achnatherum* spp., dry *Carex* species (*Carex inops*), *Festuca campestris*, *Festuca idahoensis*, *Hesperostipa* spp., or *Pseudoroegneria spicata*. The more mesic portions of this group may include *Calamagrostis rubescens* or *Carex geyeri*, species more typical of ~Central Rocky Mountain Douglas-fir - Pine Forest Group (G210)\$.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: *Pinus ponderosa* is a drought-resistant, shade-intolerant conifer which usually occurs at lower treeline in the major ranges of the western United States. Historically, surface fires and drought were influential in maintaining open-canopy conditions in these woodlands. With settlement and subsequent fire suppression, occurrences have become denser. Presently, some occurrences contain understories of more shade-tolerant species, such as *Pseudotsuga menziesii* and/or *Abies* spp., as well as younger cohorts of *Pinus ponderosa*. These altered structures have affected fuel loads and fire regimes. Presettlement fire regimes were primarily frequent (5- to 15-year return intervals), low-intensity surface fires triggered by lightning strikes or deliberately set fires by Native Americans. With fire suppression and increased fuel loads, fire regimes are now less frequent and often become intense crown fires, which can kill mature *Pinus ponderosa* (Reid et al. 1999). Establishment is erratic and believed to be linked to periods of adequate soil moisture and good seed crops as well as fire frequencies, which allow seedlings to reach sapling size. Longer fire-return intervals have resulted in many occurrences having dense subcanopies of overstocked and unhealthy young *Pinus ponderosa*, along with *Pseudotsuga menziesii* on moist sites (Reid et al. 1999).

Additional associations included in this group are subject to periodic drought that limits tree establishment. This climate-edaphic interaction results in widely scattered trees over "shrub-steppe" of sagebrush, bitterbrush, or sparsely distributed grasses. Tree growth is likely episodic, with regeneration episodes in years with available moisture. Tree density is limited in some areas by available growing space due to rocky conditions of the site. Hence the tree canopy in these associations will never reach woodland density or close due to the interaction of climate and edaphic factors, even in the absence of fire. They burn occasionally, but the vegetation is sparse enough that fires are typically not carried through the stand. Fire frequency is speculated to be 30-50 years. Some stands also occur on areas of sand dunes, scablands, and pumice where the edaphic conditions limit tree abundance.

A meeting of Pacific Northwest ecologists for Landfire concluded that the "true savannas" of high-frequency / low-intensity fires and grassy understories are now rare. Most areas that may have been savanna in the past are now more nearly closed-canopy woodlands/forests. Conclusion was that these true savannas should be included with this woodland group, along with the climatically-edaphically controlled "wooded steppes" which are also in this group. The wooded steppes included here are not fire-maintained; they occur on sites too droughty to support a closed tree canopy. They do burn with a high-frequency / low-intensity regime, but fire is not carried because of the sparse vegetation of the edaphically constrained sites (rock outcrops, dunes, super-dry, sparse trees over shrubs and sometimes grasses but widely spaced). Louisa Evers (pers. comm. 2006) notes that she has not found any evidence that ponderosa pine savanna existed historically in north-central and central Oregon. In north-central Oregon, the savanna would have been oak or pine-oak. In central Oregon, it may well have been western juniper. Condition surveys of the Cascades Forest Reserve and General Land Office survey notes suggest that ponderosa pine formed a woodland with grassy understories, but still was often referred to as open-parklike. Conversely pine-oak and Douglas-fir-oak savannas appeared to have once been quite common in the Willamette Valley.

ENVIRONMENT

Environmental Description: This group within the interior Pacific Northwest region occurs at the lower treeline/ecotone between grasslands or shrublands and more mesic coniferous forests typically in warm, dry, exposed sites at elevations ranging from 500-1600 m (1600-5248 feet). These interior Pacific Northwest woodlands receive winter and spring rains, and thus have a greater spring "green-up" than the drier woodlands in the Central Rockies. However, these sites are often too droughty to support a closed tree canopy. They can occur on all slopes and aspects; however, they commonly occur on moderately steep to very steep slopes or ridgetops and plateaus. Substrates include glacial till, glacio-fluvial sand and gravel, dunes, basaltic rubble and scablands, colluvium, or deep loess or volcanic ash-derived soils, all with characteristic features of good aeration and drainage, coarse textures,

circumneutral to slightly acidic pH, an abundance of mineral material, rockiness, and periods of drought during the growing season. In the Oregon "pumice zone" this group occurs as matrix-forming, extensive woodlands on rolling pumice plateaus and other volcanic deposits.

Climate: This group within the interior Pacific Northwest region occurs at the lower treeline/ecotone between grasslands or shrublands and more mesic coniferous forests typically in warm, dry, exposed sites at elevations ranging from 500-1600 m (1600-5248 feet). These interior Pacific Northwest woodlands receive winter and spring rains, and thus have a greater spring "green-up" than the drier woodlands in the Central Rockies.

Soil/substrate/hydrology: These sites are often too droughty to support a closed tree canopy. They can occur on all slopes and aspects; however, they commonly occur on moderately steep to very steep slopes or ridgetops and plateaus. Substrates include glacial till, glacio-fluvial sand and gravel, dunes, basaltic rubble and scablands, colluvium, or deep loess or volcanic ash-derived soils, all with characteristic features of good aeration and drainage, coarse textures, circumneutral to slightly acidic pH, an abundance of mineral material, rockiness, and periods of drought during the growing season. In the Oregon "pumice zone" this group occurs as matrix-forming, extensive woodlands on rolling pumice plateaus and other volcanic deposits.

DISTRIBUTION

***Geographic Range:** This group is found in the Fraser River drainage of southern British Columbia south along the Cascades and central Rocky Mountains of Washington, Oregon and the Modoc Plateau of northeastern California. In the northeastern part of its range, it extends across the central Rocky Mountains west of the Continental Divide into northwestern Montana, south to the Snake River Plain in Idaho, and east into the foothills of western Montana (but not into central or eastern Montana). In Oregon, it is most common in south-central Oregon, in lands managed by the Lakeview District of the BLM, and by the adjacent Fremont and Deschutes national forests. It also occurs on the marginal lands coming south out of the Blue Mountains, on the edge of the northern Basin and Range.

Nations: CA, US

States/Provinces: AB, BC, CA, ID, MT, NV?, OR, WA

USFS Ecoregions (2007) [optional]: 331A:CC, 342B:CC, 342C:CC, 342D:CP, 342H:CC, 342I:CC, M242B:CC, M242C:CC, M242D:CC, M261G:CC, M331A:PP, M332A:CC, M332B:CC, M332D:CP, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3447 | <i>Pinus ponderosa</i> / Herbaceous Understory Central Rocky Mountain Open Woodland Alliance |
| A3446 | <i>Pinus ponderosa</i> / Shrub Understory Central Rocky Mountain Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP***Primary Concept Source [if applicable]:** R.F. Daubenmire and J.B. Daubenmire (1968)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** M.S. Reid, K.A. Schulz and M. Manning**Acknowledgments [optional]:** M. Manning

Version Date: 09 Nov 2015

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1. Forest & Woodland

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

G210. Central Rocky Mountain Douglas-fir - Pine Forest

Type Concept Sentence: This group is composed of highly variable montane coniferous forests found in the interior Pacific Northwest, from southernmost interior British Columbia, eastern Washington, eastern Oregon, northern Idaho, western and north-central Montana, and south along the east slope of the Cascades in Washington and Oregon. It is dominated by a mix of *Pseudotsuga menziesii* and *Pinus ponderosa* (but there can be one without the other) and other typically seral species.

OVERVIEW***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nb.2. Central Rocky Mountain Dry Lower Montane-Foothill Forest (M501)

Elcode: G210

Scientific Name:** *Pseudotsuga menziesii* - *Pinus ponderosa* Central Rocky Mountain Forest GroupCommon (Translated Scientific) Name:** Douglas-fir - Ponderosa Pine Central Rocky Mountain Forest Group***Colloquial Name:** Central Rocky Mountain Douglas-fir - Pine Forest

***Type Concept:** This group is composed of highly variable montane coniferous forests found in the interior Pacific Northwest, from southernmost interior British Columbia, eastern Washington, eastern Oregon, northern Idaho, western and north-central Montana, and south along the east slope of the Cascades in Washington and Oregon. Most occurrences of this group are dominated by a mix of *Pseudotsuga menziesii* and *Pinus ponderosa* (but there can be one without the other) and other typically seral species, including *Larix occidentalis* (not in central Montana), *Pinus contorta*, and *Pinus monticola* (not in central Montana). *Picea engelmannii* (or *Picea glauca* or their hybrid) becomes increasingly common towards the eastern edge of the range. In the eastern Cascades, *Pinus contorta* may be the codominant pine, rather than *Pinus ponderosa*. The nature of this forest group is a matrix of large patches dominated or codominated by one or combinations of the above species; *Abies grandis* (a fire-sensitive, shade-tolerant species not occurring in central Montana) has increased on many sites once dominated by *Pseudotsuga menziesii* and *Pinus ponderosa*, which were formerly maintained by low-severity wildfire. Understories are typically dominated by graminoids, such as *Calamagrostis rubescens*, *Carex geyeri*, *Carex rossii*, and *Pseudoroegneria spicata*, and a variety of shrubs, such as *Acer glabrum*, *Juniperus communis*, *Physocarpus malvaceus*, *Spiraea betulifolia*, *Symphoricarpos albus*, or *Vaccinium membranaceum* on mesic sites. *Abies concolor* and *Abies grandis* x *concolor* hybrids in central Idaho (the Salmon Mountains) may occur in some stands, but have very restricted ranges in this area. *Abies concolor* and *Abies grandis* in the Blue Mountains of Oregon are probably hybrids of the two and mostly *Abies grandis*. This group is associated with a submesic climate regime with annual precipitation ranging from 50 to 100 cm, with a maximum in winter or late spring. Winter snowpacks typically melt off in early spring at lower elevations. Elevations range from 460 to 1920 m. These communities rarely form either upper or lower timberline forests. Presettlement fire regimes may have been characterized by frequent, low-intensity surface fires that maintained relatively open stands of a mix of fire-resistant species. Under present conditions the fire regime is mixed-severity and more variable, with stand-replacing fires more common, and the forests are more homogeneous. With vigorous fire suppression, longer fire-return intervals are now prevalent, and multi-layered stands of *Pseudotsuga menziesii*, *Pinus ponderosa*, and/or *Abies grandis* provide fuel "ladders," making these forests more susceptible to high-intensity, stand-replacing fires. They are very productive forests which have been priority areas for timber production.

***Diagnostic Characteristics:** Montane coniferous forests found in the interior Pacific Northwest; most occurrences of this group are dominated by a mix of *Pseudotsuga menziesii* and *Pinus ponderosa*, but *Pinus ponderosa* can be absent. Other typically seral species, including *Pinus contorta*, *Pinus monticola* (not in central Montana), and *Larix occidentalis* (not in central Montana). *Abies grandis* (a fire-sensitive, shade-tolerant species) have increased on many sites once dominated by *Pseudotsuga menziesii* and *Pinus ponderosa*, which were formerly maintained by low-severity wildfire. Generally, floristic affinities are with areas of maritime-influenced climate of the interior Pacific Northwest.

***Classification Comments:** Need to re-assess the concept of this group in relation to several other groups, including ~Central Rocky Mountain Mesic Grand Fir - Douglas-fir Forest Group (G211)\$\$, ~East Cascades Mesic Grand Fir - Douglas-fir Forest Group (G212)\$\$, ~Central Rocky Mountain Ponderosa Pine Open Woodland Group (G213)\$\$, and ~Middle Rocky Mountain Montane Douglas-fir Forest & Woodland Group (G215)\$\$. In PNV (PAGs) concept, this is mostly *Pseudotsuga menziesii*, moist *Pinus ponderosa* series, dry *Abies grandis* or warm, dry *Abies lasiocarpa* series in the Canadian Rockies, northern Middle Rockies, East Cascades and Okanagan ecoregions. Everett et al. (2000) indicate that in the eastern Cascades of Washington, this group forms fire polygons due to abrupt north and south topography with presettlement fire-return intervals of 11-12 years typically covering less than 810 ha. Currently, fires have 40- to 45-year return intervals with thousands of hectares in size. ~East Cascades Mesic Grand Fir - Douglas-fir Forest Group (G212)\$\$ has a North Pacific floristic composition and is mostly found in the East Cascades ecoregion, peripheral in Okanagan ecoregion, and West Cascades.

For now, the associations attributed to this group do not include any *Abies grandis*-named types; all of those have been placed in other groups. It may be that some of the drier end of *Abies grandis* forests should be included in this group, as they may well be mixed with *Pinus ponderosa*, or *Pseudotsuga menziesii*.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G211 | Central Rocky Mountain Mesic Grand Fir - Douglas-fir Forest | |
| G215 | Middle Rocky Mountain Montane Douglas-fir Forest & Woodland | |
| G228 | Southern Rocky Mountain Ponderosa Pine Forest & Woodland | |
| G213 | Central Rocky Mountain Ponderosa Pine Open Woodland | |

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G212 | East Cascades Mesic Grand Fir - Douglas-fir Forest | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary:

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This forest group is typically dominated by a mix of *Pseudotsuga menziesii* and *Pinus ponderosa* in the tree canopy, although either can be absent. Other typically seral species may occur in the tree canopy, including *Larix occidentalis* (not in central Montana), *Pinus contorta*, and *Pinus monticola* (not in central Montana). *Picea engelmannii* (or *Picea glauca* or their hybrid) becomes increasingly common towards the eastern edge of the range. In the eastern Cascades, *Pinus contorta* may be the codominant pine with *Pseudotsuga menziesii*, rather than *Pinus ponderosa*. This forest group is composed of a matrix of large patches dominated or codominated by one or combinations of the above species; *Abies grandis* (a fire-sensitive, shade-tolerant species not occurring in central Montana) has increased on many sites once dominated by *Pseudotsuga menziesii* and *Pinus ponderosa*, which were formerly maintained by low-severity wildfire. Understories are typically dominated by graminoids, such as *Calamagrostis rubescens*, *Carex geyeri*, *Carex rossii*, and *Pseudoroegneria spicata*, and a variety of shrubs, such as *Acer glabrum*, *Juniperus communis*, *Physocarpus malvaceus*, *Spiraea betulifolia*, *Symphoricarpos albus*, or *Vaccinium membranaceum* on mesic sites. *Abies concolor* and *Abies grandis* x *concolor* hybrids in central Idaho (the Salmon Mountains) may occur in some stands, but have very restricted ranges in this area. *Abies concolor* and *Abies grandis* in the Blue Mountains of Oregon are probably hybrids of the two and mostly *Abies grandis*.

*Floristics Table [Med - High Confidence]:

*Number of Plots:

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Presettlement fire regimes may have been characterized by frequent, low-intensity surface fires that maintained relatively open stands of a mix of fire-resistant species. Under present conditions, the fire regime is mixed severity and more variable, with stand-replacing fires more common, and the forests are more homogeneous. With vigorous fire suppression, longer fire-return intervals are now the rule, and multi-layered stands of *Pseudotsuga menziesii*, *Pinus ponderosa*, and/or *Abies grandis* provide fuel "ladders," making these forests more susceptible to high-intensity, stand-replacing fires. They are very productive forests which have been priorities for timber production.

ENVIRONMENT

Environmental Description: *Climate:* This group is associated with a submesic climate regime with annual precipitation ranging from 50 to 100 cm, with a maximum in winter or late spring. Winter snowpacks typically melt off in early spring at lower elevations. Elevations range from 460 to 1920 m. These communities rarely form either upper or lower timberline forests.

DISTRIBUTION

***Geographic Range:** This group is found in the interior Pacific Northwest, from southern interior British Columbia south and east into Oregon, Idaho (including north and central Idaho, down to the Boise Mountains), and western Montana, and south along the east slope of the Cascades in Washington and Oregon.

Nations: CA, US

States/Provinces: AB, BC, ID, MT, OR, UT, WA, WY

USFS Ecoregions (2007) [optional]: 331A:CC, 331D:C?, 341G:PP, 342C:CC, 342D:CC, 342H:CC, 342I:CC, M242C:CC, M242D:CC, M331A:PP, M332A:CC, M332B:CC, M332D:CP, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL**USNVC Confidence Level:** Moderate**USNVC Confidence Comments [optional]:****HIERARCHY*****Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3396 | <i>Pseudotsuga menziesii</i> - <i>Pinus contorta</i> var. <i>latifolia</i> Central Rocky Mountain Forest Alliance |
| A3392 | <i>Pseudotsuga menziesii</i> - <i>Pinus ponderosa</i> / Shrub Understorey Central Rocky Mountain Forest & Woodland Alliance |
| A3395 | <i>Pseudotsuga menziesii</i> - <i>Pinus ponderosa</i> / Herbaceous Understorey Central Rocky Mountain Woodland Alliance |

DISCUSSION**Discussion [optional]:****CONCEPT HISTORY*****Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP***Primary Concept Source [if applicable]:** R.F. Daubenmire and J.B. Daubenmire (1968)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** M.S. Reid and K.A. Schulz**Acknowledgments [optional]:** M. Manning

Version Date: 09 Nov 2015

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1. Forest & Woodland

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

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

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

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nb.2. Central Rocky Mountain Dry Lower Montane-Foothill Forest (M501)

Elcode: G215

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

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

***Colloquial Name:** Middle Rocky Mountain Montane Douglas-fir Forest & Woodland

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

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

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

heterophylla occur. However, it does have some overlap with ~Central Rocky Mountain Douglas-fir - Pine Forest Group (G210)\$\$, and there are *Pseudotsuga menziesii*-dominated forests extending south in the Rockies well into New Mexico, so the floristic "transition" from middle to southern Rocky Mountains is not yet clear.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G226 | Southern Rocky Mountain White Fir - Douglas-fir Dry Forest | |
| G210 | Central Rocky Mountain Douglas-fir - Pine Forest | |
| G211 | Central Rocky Mountain Mesic Grand Fir - Douglas-fir Forest | |

Similar NVC Types General Comments [optional]:

VEGETATION

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

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

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

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Const-ancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|------------|--------------|--------------------|------------|
| | | | | | | |

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

ENVIRONMENT

Environmental Description: These are forests and woodlands occurring in the Central Rockies where the southern monsoon influence is less and maritime climate regime is not important. In the middle Rocky Mountains, *Pseudotsuga menziesii* forests occur under a comparatively drier and more continental climate regime, and at higher elevations than in the Pacific Northwest. Elevations range from less than 1000 m in the central Rocky Mountains to over 2400 m in the Wyoming Rockies. Lower elevation stands typically occupy protected northern exposures or mesic ravines and canyons, often on steep slopes. At higher elevations, these

forests occur primarily on southerly aspects or ridgetops and plateaus. Annual precipitation ranges from 50-100 cm with moderate snowfall and a greater proportion falling during the growing season. Monsoonal summer rains can contribute a significant proportion of the annual precipitation in the southern portion of the range. Soils are highly variable and derived from diverse parent materials. *Pseudotsuga menziesii* forests are reported by most studies (Pfister et al. 1977, Steele et al. 1981, Mauk and Henderson 1984, Lillybridge et al. 1995) to show no particular affinities to geologic substrates. Rock types can include extrusive volcanics in the Yellowstone region, and sedimentary rocks elsewhere in the Rockies. The soils are typically slightly acidic (pH 5.0-6.0), well-drained, and well-aerated. They can be derived from moderately deep colluvium or shallow-jointed bedrock, and are usually gravelly or rocky.

DISTRIBUTION

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

Nations: CA, US

States/Provinces: CO, ID, MT, OR?, UT, WY

USFS Ecoregions (2007) [optional]: 342A:CC, 342C:CP, 342D:CP, 342J:CP, M331A:CC, M331B:CC, M331D:CP, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CP

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3462 | <i>Pseudotsuga menziesii</i> Middle Rocky Mountain Dry-Mesic Forest & Woodland Alliance |
| A3463 | <i>Pseudotsuga menziesii</i> Middle Rocky Mountain Mesic-Wet Forest Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---------------------------|----------------|------|
| > | Interior Douglas-fir: 210 | Eyre 1980 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** R. Steele, R.D. Pfister, R.A. Ryker, and J.A. Kittams (1981)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** M.S. Reid and K.A. Schulz

Acknowledgments [optional]:

Version Date: 09 Nov 2015

REFERENCES

***References [Required if used in text]:**

- Cooper, S. V., K. E. Neiman, R. Steele, and D. W. Roberts. 1987. Forest habitat types of northern Idaho: A second approximation. General Technical Report INT-236. USDA Forest Service, Intermountain Research Station, Ogden, UT. 135 pp. [reprinted in 1991]
- Daubenmire, R. F., and J. B. Daubenmire. 1968. Forest vegetation of eastern Washington and northern Idaho. Washington State University Agricultural Experiment Station Technical Bulletin No. 60. 104 pp.
- Eyre, F. H., editor. 1980. Forest cover types of the United States and Canada. Society of American Foresters, Washington, DC. 148 pp.
- Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2017a. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]
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- Steele, R., R. D. Pfister, R. A. Ryker, and J. A. Kittams. 1981. Forest habitat types of central Idaho. General Technical Report INT-114. USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, UT. 138 pp.
- Steele, R., and K. Geier-Hayes. 1995. Major Douglas-fir habitat types of central Idaho: A summary of succession and management. General Technical Report INT-GTR-331. USDA Forest Service, USDA Forest Service Intermountain Research Station, Ogden, UT.

1. Forest & Woodland

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

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

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

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nb.2. Central Rocky Mountain Dry Lower Montane-Foothill Forest (M501)

Elcode: G209

***Scientific Name:** *Pinus flexilis* - *Juniperus scopulorum* Rocky Mountain Foothill Woodland Group

***Common (Translated Scientific) Name:** Limber Pine - Rocky Mountain Juniper Rocky Mountain Foothill Woodland Group

***Colloquial Name:** Rocky Mountain Foothill-Rock Outcrop Limber Pine - Juniper Woodland

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

composed of some of the above species.

***Diagnostic Characteristics:** Patchy woodlands found on rock outcrops and escarpments at foothill elevations along the eastern Rocky Mountains Front out into the western Great Plains. Dominant and characteristic species are *Pinus flexilis*, *Juniperus osteosperma*, or *Juniperus scopulorum*. Understory diagnostic species include both widespread Interior West species such as *Artemisia nova*, *Artemisia tridentata*, *Cercocarpus ledifolius*, *Cercocarpus montanus*, *Ericameria nauseosa*, *Purshia tridentata*, or *Pseudoroegneria spicata* and primarily Great Plains species such as *Bouteloua gracilis*, *Koeleria macrantha*, or *Schizachyrium scoparium*. Floristically these are more related to the Great Plains than to the main Rocky Mountains. High winds, cold winters, and fractured rock substrates are limiting ecological factors influencing the species composition. This group is somewhat analogous to pinyon-juniper woodlands, but pinyon pines are not present this far north, and limber pine is more tolerant of the high winds generally found east of the Continental Divide out in the northwestern Great Plains.

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

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G221 | Rocky Mountain Subalpine-Montane Limber Pine - Bristlecone Pine Woodland | |
| G216 | Black Hills-Northwestern Great Plains Ponderosa Pine Forest & Woodland | |
| G224 | Intermountain Basins Subalpine Limber Pine - Bristlecone Pine Woodland | |

Similar NVC Types General Comments [optional]:

VEGETATION

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

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

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

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

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

ENVIRONMENT

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

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

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

DISTRIBUTION

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

Nations: CA?, US

States/Provinces: AB, CO, ID, MT, ND, SD, WY

USFS Ecoregions (2007) [optional]: 331D:CC, 331F:CC, 331G:CC, 331H:CC, 331K:CP, 331N:CC, 332C:CC, 342A:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, M242D:PP, M331A:C?, M331B:CC, M331D:C?, M331E:CC, M331I:CC, M331J:CC, M332B:CP, M332D:CC, M333C:PP, M334A:??

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3427 | <i>Juniperus osteosperma</i> - <i>Juniperus scopulorum</i> / Grass Understory Central Rocky Mountain Woodland Alliance |
| A3426 | <i>Juniperus osteosperma</i> - <i>Juniperus scopulorum</i> / Shrub Understory Central Rocky Mountain Woodland Alliance |
| A3425 | <i>Pinus flexilis</i> / Grass Understory Central Rocky Mountain Woodland Alliance |
| A3424 | <i>Pinus flexilis</i> / Shrub Understory Central Rocky Mountain Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-----------------------------|----------------|------|
| >< | Limber Pine: 219 | Eyre 1980 | |
| >< | Rocky Mountain Juniper: 220 | Eyre 1980 | |

AUTHORSHIP

*Primary Concept Source [if applicable]: D.H. Knight (1994)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

*Author of Description: M.S. Reid and K.A. Schulz

Acknowledgments [optional]:

Version Date: 30 May 2013

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1. Forest & Woodland

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

M500. Central Rocky Mountain Mesic Lower Montane Forest

1. Forest & Woodland

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

G211. Central Rocky Mountain Mesic Grand Fir - Douglas-fir Forest

Type Concept Sentence: This group includes woodlands of the central Rocky Mountains dominated by the deciduous conifer *Larix occidentalis*, in places where frequent fires maintain open woodlands, usually with abundant undergrowth dominated by low-growing shrubs and graminoids.

OVERVIEW

*Hierarchy Level: Group

*Placement in Hierarchy: 1.B.2.Nb.3. Central Rocky Mountain Mesic Lower Montane Forest (M500)

Elcode: G211

***Scientific Name:** *Abies grandis* - *Pseudotsuga menziesii* - *Larix occidentalis* Central Rocky Mountain Forest Group

***Common (Translated Scientific) Name:** Grand Fir - Douglas-fir - Western Larch Central Rocky Mountain Forest Group

***Colloquial Name:** Central Rocky Mountain Mesic Grand Fir - Douglas-fir Forest

***Type Concept:** This group also includes woodlands or "savannas" of the deciduous conifer *Larix occidentalis*; these were typically stands initiated following stand-replacing crown fires of other conifer forests, but are maintained by a higher frequency, surface-fire regime. Fire suppression has led to invasion of the more shade-tolerant tree species *Abies grandis*, *Abies lasiocarpa*, *Picea engelmannii*, or *Tsuga* spp. and loss of much of the single-story canopy woodlands. *Larix occidentalis* communities occur in settings where low-intensity, high-frequency fires create open larch woodlands, often with the undergrowth dominated by low-growing *Arctostaphylos uva-ursi*, *Cornus canadensis*, *Calamagrostis rubescens*, *Linnaea borealis*, *Spiraea betulifolia*, *Vaccinium cespitosum*, and/or *Xerophyllum tenax*. Less frequent or absence of fire creates mixed-dominance stands with often shrubby undergrowth; *Vaccinium cespitosum* is common, and taller shrubs can include *Acer glabrum*, *Ceanothus velutinus*, *Shepherdia canadensis*, *Holodiscus discolor*, *Physocarpus malvaceus*, *Rubus parviflorus*, or *Vaccinium membranaceum*.

***Diagnostic Characteristics:** Mesic conifer forests of the northern Rocky Mountains, where *Abies grandis*, *Pseudotsuga menziesii*, or *Larix occidentalis* are the major dominants.

***Classification Comments:** This group should be considered for merging with ~East Cascades Mesic Grand Fir - Douglas-fir Forest Group (G212)\$\$; they share a number of floristic similarities, along with some differences. But perhaps those differences would be better handled as alliance-level distinctions. This needs review.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G212 | East Cascades Mesic Grand Fir - Douglas-fir Forest | |
| G215 | Middle Rocky Mountain Montane Douglas-fir Forest & Woodland | |
| G210 | Central Rocky Mountain Douglas-fir - Pine Forest | |
| G217 | Central Rocky Mountain Interior Western Red-cedar - Western Hemlock Forest | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Mesic conifer forests, ranging from closed-canopy to more open "savanna-like" woodlands, over deciduous shrub layer, or forb-rich herbaceous layer.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: *Abies grandis* is dominant in these forests and *Pseudotsuga menziesii* commonly shares the canopy. *Pinus monticola*, *Picea engelmannii*, *Pinus contorta*, *Abies lasiocarpa*, and *Larix occidentalis* are major associates. On most mesic sites, intermediate to older age stands of this forest group may support some *Thuja plicata* and *Tsuga heterophylla* in the overstory. Common shrubs include *Paxistima myrsinites*, *Amelanchier alnifolia*, *Rosa gymnocarpa*, *Acer glabrum*, *Spiraea betulifolia*, *Symphoricarpos albus*, *Cornus canadensis*, *Rubus parviflorus*, *Menziesia ferruginea*, *Taxus brevifolia*, and *Vaccinium membranaceum*. Composition of the herbaceous layer reflects local climate and degree of canopy closure; it is typically highly diverse in all but closed-canopy conditions. *Clintonia uniflora*, *Linnaea borealis*, *Aralia nudicaulis*, and *Xerophyllum tenax* are common forbs in these forests. Other forbs include *Actaea rubra*, *Adenocaulon bicolor*, *Arnica latifolia*, *Galium triflorum*, *Goodyera oblongifolia*, *Orthilia secunda*, *Streptopus amplexifolius*, *Prosartes hookeri* (= *Disporum hookeri*), *Thalictrum occidentale*, and *Trillium ovatum*. *Asarum caudatum* occurs in the Kootenai and Yak river areas of extreme northwestern Montana, north-central Idaho and in the Blue Mountains in Oregon. Graminoids usually form a very minor component and typically include *Bromus vulgaris* and minor amounts of *Carex geyeri*, *Elymus glaucus*, *Festuca subulata*, and *Oryzopsis asperifolia*. This group also includes woodlands or "savannas" of the deciduous conifer *Larix occidentalis*. Important low-growing shrubs include *Arctostaphylos uva-ursi*, *Spiraea betulifolia*, and *Vaccinium cespitosum*; taller shrubs can include *Acer glabrum*, *Ceanothus velutinus*, *Shepherdia canadensis*, *Physocarpus malvaceus*, *Rubus parviflorus*, or *Vaccinium membranaceum*. Herbaceous species include *Calamagrostis rubescens*, *Clintonia uniflora*, *Linnaea borealis*, or *Xerophyllum tenax*.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Typically, stand-replacement fires have 150- to 500-year return intervals, with moderate-severity fire intervals of 50-100 years. *Abies grandis* forests include many sites dominated by *Pseudotsuga menziesii* and *Pinus ponderosa* which were formerly maintained by wildfire, and may now be dominated by *Abies grandis* (a fire-sensitive, shade-tolerant species) due to fire exclusion (Lillybridge et al. 1995, Chappell et al. 1997). Pre-European settlement fire regimes were typically of frequent, low-intensity surface fires, maintaining relatively open stands of a mix of fire-resistant species. With the advent of effective fire suppression, longer fire-return intervals are now the rule, and mixed-stature stands with *Abies grandis* in various size classes now create ladder fuels making these forests more susceptible to high-intensity, stand-replacing fires (Cooper et al. 1987, Lillybridge et al. 1995).

Larix occidentalis is a long-lived species (in excess of 700 years in the northern Rocky Mountains), and thus stands of western larch are themselves persistent. However, the life of *Larix*-dominated stands probably rarely exceeds 250 years due to various mortality sources and the in-growth of shade-tolerant species, especially on mesic sites. Occurrences of *Larix occidentalis* stands are generated by stand-replacing fire, the fire-return interval for which is speculated to be approximately 80 to 200 years (Cooper et al. 1987). These sites may be maintained in a seral status for hundreds of years since *Larix occidentalis* is a long-lived species and the understory is often dominated by *Pseudotsuga*, which will grow into the upper canopy. The potential dominants, typically *Abies lasiocarpa*, *Picea engelmannii*, and/or *Abies grandis* or rarely *Tsuga heterophylla* or *Thuja plicata*, establish and grow on these sites, presenting the distinct probability, given the fire-return intervals for this type, that the "climax" (long-term stable) condition is never attained. It has been noted in northern Idaho that, following disturbance (particularly logging) in some mesic-site occurrences, *Larix occidentalis* does not necessarily replace itself, the first tree-dominated successional stages being dominated by *Pseudotsuga menziesii*, *Pinus contorta*, or less frequently by more shade-tolerant species (Cooper et al. 1987); this response is a consequence of the episodic nature of favorable cone crop years in *Larix occidentalis*.

ENVIRONMENT

Environmental Description: These forests occur in areas influenced by incursions of mild, wet, Pacific maritime air masses. Much of the annual precipitation occurs as rain, but where snow does occur, it is generally melted by rain during warm winter storms. Elevations range from 610 to 2195 m (2000-7200 feet). Occurrences generally are found on all slopes and aspects but grow best on sites with high soil moisture, such as valley bottoms, on benches, well-drained slopes and moist ravines. Sites supporting these forests are typically warmer and moister than the prevailing local climate. However, these are moist, non-flooded or upland sites. *Soil/substrate/hydrology:* Parent materials are non-calcareous materials, predominately sedimentary rock and argillite. Intermittent shallow A horizons overlying a dominant B horizon indicate that volcanic ash and loess deposits have significant contribution to soil development. These forests occur on gravelly loams and silt loams are slightly acidic.

DISTRIBUTION

***Geographic Range:** This group occurs in the Northern Rockies of western Montana west into north-central Idaho, the Blue Mountains in Oregon, northeastern Washington and possibly southern British Columbia. *Larix occidentalis* extends beyond the typical range of this group in north-central Washington and a short distance in southern British Columbia and then jumps to the Wenatchee Mountains and south along the eastern Cascades to the Columbia River.

Nations: CA, US

States/Provinces: BC?, ID, MT, OR, WA

USFS Ecoregions (2007) [optional]: 331A:CC, 342H:??, 342I:??, M331A:PP, M332A:CC, M332B:CP, M332E:C?, M332F:C?, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3362 | <i>Abies grandis</i> - <i>Pseudotsuga menziesii</i> Central Rocky Mountain Forest & Woodland Alliance |
| A0275 | <i>Larix occidentalis</i> Central Rocky Mountain Forest Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|--|
| >< | Grand Fir: 213 | Eyre 1980 | Grand fir stands are an important component of this group. |
| > | Western Larch: 212 | Eyre 1980 | |
| >< | Western White Pine: 215 | Eyre 1980 | |

AUTHORSHIP***Primary Concept Source [if applicable]:** R.F. Daubenmire and J.B. Daubenmire (1968)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** M.S. Reid, R. Crawford and M. Manning**Acknowledgments [optional]:** R. Crawford and M. Manning

Version Date: 30 May 2013

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Steele, R., R. D. Pfister, R. A. Ryker, and J. A. Kittams. 1981. Forest habitat types of central Idaho. General Technical Report INT-114. USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, UT. 138 pp.

Williams, C. K., B. F. Kelly, B. G. Smith, and T. R. Lillybridge. 1995. Forest plant associations of the Colville National Forest. General Technical Report PNW-GTR-360. USDA Forest Service, Pacific Northwest Region, Portland, OR. 140 pp.

1. Forest & Woodland

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

G217. Central Rocky Mountain Interior Western Red-cedar - Western Hemlock Forest

Type Concept Sentence: This forest group occurs in the Northern Rockies west of the Continental Divide within the maritime-influenced climatic zone dominated by *Tsuga heterophylla* and *Thuja plicata*; *Pseudotsuga menziesii* commonly shares the canopy, and *Abies grandis*, *Larix occidentalis*, *Pinus contorta*, *Pinus monticola*, and *Taxus brevifolia* are major associates. The composition of shrub and herbaceous layers reflects local climate and degree of canopy closure and is typically highly diverse in all but closed-canopy conditions.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nb.3. Central Rocky Mountain Mesic Lower Montane Forest (M500)

Elcode: G217

***Scientific Name:** *Thuja plicata* - *Tsuga heterophylla* Central Rocky Mountain Forest Group

***Common (Translated Scientific) Name:** Western Red-cedar - Western Hemlock Central Rocky Mountain Forest Group

***Colloquial Name:** Central Rocky Mountain Interior Western Red-cedar - Western Hemlock Forest

***Type Concept:** This forest group occurs in the Northern Rockies west of the Continental Divide within the maritime-influenced climatic zone of the northern Rocky Mountains of western Montana, west into northeastern Washington and southern British Columbia. These are forests dominated by *Tsuga heterophylla* and *Thuja plicata* in most cases, found in areas influenced by incursions of mild, wet, Pacific maritime air masses. Much of the annual precipitation occurs as rain, 25-50% falls as snow. Snowpacks are often melted by rain during warm winter storms. Occurrences generally are found on all slopes and aspects but grow best on sites with high soil moisture, such as toeslopes and bottomlands. At the periphery of its distribution, this group is confined to moist canyons and cooler, moister aspects. Generally these are moist, non-flooded or upland sites that are not saturated yearlong. Along with *Tsuga heterophylla* and *Thuja plicata*, *Pseudotsuga menziesii* commonly shares the canopy, and *Pinus monticola*, *Pinus contorta*, *Abies grandis*, *Taxus brevifolia*, and *Larix occidentalis* are major associates. *Cornus nuttallii* may be present in some situations. *Picea engelmannii*, *Abies lasiocarpa*, and *Pinus ponderosa* may be present but only on the coldest or warmest and driest sites. *Linnaea borealis*, *Mahonia nervosa*, *Paxistima myrsinites*, *Acer glabrum*, *Spiraea betulifolia*, *Symphoricarpos hesperius* (= *Symphoricarpos mollis* ssp. *hesperius*), *Cornus canadensis*, *Rubus parviflorus*, *Menziesia ferruginea*, and *Vaccinium membranaceum* are common shrub species. The composition of the herbaceous layer reflects local climate and degree of canopy closure; it is typically highly diverse in all but closed-canopy conditions. Important forbs and ferns include *Actaea rubra*, *Achlys triphylla*, *Anemone piperi*, *Aralia nudicaulis*, *Asarum caudatum*, *Clintonia uniflora*, *Coptis occidentalis*, *Thalictrum occidentale*, *Tiarella trifoliata*, *Trientalis borealis*, *Trillium ovatum*, *Viola glabella*, *Gymnocarpium dryopteris*, *Polystichum munitum*, and *Adiantum pedatum*. Typically, stand-replacement, fire-return intervals are 150-500 years, with moderate-severity fire intervals of 50-100 years. Species in East Cascade forests (G212) that are absent to rare in the Northern Rockies are *Picea sitchensis*, *Abies amabilis*, *Acer macrophyllum*, *Acer circinatum*, *Gaultheria shallon*, *Rhododendron macrophyllum*, *Mahonia nervosa*, *Rubus spectabilis*, *Vaccinium alaskaense*, *Vaccinium parvifolium*, *Blechnum spicant*, *Achlys triphylla*, *Oxalis oregana*, *Anemone deltoidea*, *Anemone oregana*, *Rubus lasiococcus*, and *Streptopus streptopoides*.

***Diagnostic Characteristics:** Productive and diverse forests dominated by *Tsuga heterophylla* and/or *Thuja plicata* in most cases, found in the interior of the Pacific Northwest, in areas influenced by incursions of mild, wet, Pacific maritime air masses. Floristic affinities are with the Rocky Mountains. These forests persist for centuries, having fire-return intervals often >500 years.

***Classification Comments:** *Tsuga heterophylla* is a major tree species in the Pacific Northwest, and there are many other groups where it is a dominant species. This group contains western hemlock and western red-cedar associations that are confined to the interior regions of the Northwest. Certainly, there are some floristic similarities between the Northern Rockies types and those found west of the Cascades. However, there's a distinct "Rocky Mountain" set of species i.e., *Anemone piperi*, *Aralia nudicaulis*, *Coptis occidentalis*, found in this group. Further information needs to be included here for interior western hemlock and western red-cedar forests of British Columbia. Concept needs to be narrowed to remove the East Cascadian portion of this group.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G212 | East Cascades Mesic Grand Fir - Douglas-fir Forest | |
| G211 | Central Rocky Mountain Mesic Grand Fir - Douglas-fir Forest | |

Similar NVC Types General Comments [optional]:**VEGETATION**

Physiognomy and Structure Summary: These are productive forests composed of tall, long-lived, needle-leaved evergreen trees, sometimes composed of just one tree species, but more often are of mixed composition. Deciduous tall and short shrubs, and perennial forbs and ferns often form shrub and herbaceous layers, respectively. These forests are the most diverse of any Rocky Mountain forest, sometimes approaching or equaling the within-stand diversity of some eastern North American forests, but the diversity resides in the shrub and herb taxa, not the trees.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: In addition to the dominant *Tsuga heterophylla* and *Thuja plicata*, *Pseudotsuga menziesii* and *Abies grandis* commonly share the canopy, and *Pinus monticola*, *Pinus contorta*, *Abies grandis*, *Abies lasiocarpa*, and *Larix occidentalis* are major associates. *Picea engelmannii* and *Abies lasiocarpa* may be present but only on the coldest sites, and *Pinus ponderosa* may be present but only on the warmest and driest sites. Common shrubs include *Paxistima myrsinites*, *Acer glabrum*, *Spiraea betulifolia*, *Symphoricarpos albus*, *Cornus canadensis*, *Rubus parviflorus*, *Menziesia ferruginea*, *Taxus brevifolia*, and *Vaccinium membranaceum*. *Oplopanax horridus* is common in the understory in depressional areas with high water tables. Composition of the herbaceous layer reflects local climate and degree of canopy closure; it is typically highly diverse in all but closed-canopy conditions. *Clintonia uniflora*, *Tiarella trifoliata*, *Xerophyllum tenax*, and *Viola orbiculata* are the most common forbs in these forests. Other forbs include *Actaea rubra*, *Adenocaulon bicolor*, *Aralia nudicaulis*, *Arnica* spp., *Galium triflorum*, *Goodyera oblongifolia*, *Linnaea borealis*, *Orthilia secunda*, *Streptopus amplexifolius*, *Thalictrum occidentale*, and *Trillium ovatum*. *Asarum caudatum* occurs in the Kootenai and Yak river areas of extreme northwestern Montana. Ferns and fern allies also form an important component of the understory and commonly include *Athyrium filix-femina*, *Botrychium* spp., *Dryopteris filix-mas*, *Equisetum* spp., *Gymnocarpium dryopteris*, and *Polystichum munitum*. Under closed-canopy conditions, a dense moss layer can form on the forest floor. Graminoids usually form a very minor component and typically include *Bromus vulgaris*, *Carex deweyana*, *Carex geyeri*, *Elymus glaucus*, *Festuca subulata*, and *Oryzopsis asperifolia*.

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: These are very productive forests which have been priority stands for timber production. Typically, stand-replacement fire-return intervals are 150-500 years in the Cascades, or 150-500 years in the Northern Rockies, with moderate-severity fire-return intervals of 50-100 years. *Thuja* and *Tsuga* are capable of remaining dominant within these forests due to their longevity and *Thuja*'s ability to regenerate vegetatively. In the absence of disturbance, both species continue to regenerate under shaded conditions. Under closed-canopy conditions, both species favor vegetative reproduction over sexual reproduction, thus intermediate and young trees are found under these conditions.

ENVIRONMENT

Environmental Description: This forest group is found in areas influenced by incursions of mild, wet, Pacific maritime air masses. Much of the annual precipitation occurs as rain, but where snow does occur, it can generally be melted by rain during warm winter storms. In the Cascades, it occurs on the upper east slopes in Washington, south of Lake Chelan and south to Mount Hood in Oregon. Elevations in the Cascades range from 610 to 1220 m (2000-4000 feet) in a very restricted range occupying less than 5% of the forested landscape in the East Cascades. In this region, these forests are associated with a submesic climate regime with annual precipitation ranging from 100 to 200 cm (40-80 inches) and maximum winter snowpacks that typically melt off in spring at lower elevations. Further east in the Northern Rockies, annual precipitation tends to be lower, averaging around 75 cm, while the elevation ranges from 550 m to over 1600 m (1700-5248 feet). Cooper et al. (1987) report that these interior hemlock-cedar forests require at least 20 cm of precipitation during the warm season. Occurrences generally are found on all slopes and aspects but grow best on sites with high soil moisture, such as toeslopes and bottomlands. At the periphery of its distribution, this group is confined

to moist canyons and cooler, moister aspects. Generally these are moist, non-flooded or upland sites that are not saturated yearlong. This group differs from west of the Cascade groups in lower overall precipitation, warmer summer and colder winter temperatures, and more frequent fire (Goward and Spribille 2005).

Climate: This forest group is found in areas influenced by incursions of mild, wet, Pacific maritime air masses. Much of the annual precipitation occurs as rain, but where snow does occur, it can generally be melted by rain during warm winter storms. In the East Cascades, these forests are associated with a submesic climate regime with annual precipitation ranging from 100 to 200 cm (40-80 inches) and maximum winter snowpacks that typically melt off in spring at lower elevations. Further east in the Northern Rockies, annual precipitation tends to be lower, averaging around 75 cm. Cooper et al. (1987) report that these interior hemlock-cedar forests require at least 20 cm of precipitation during the warm season. *Soil/substrate/hydrology:* Parent materials are predominately sedimentary rock and argillite. Volcanic ash and loess deposits may have an influence on soil development, resulting in higher fertility and moisture-holding capacity required for supporting the dominant species. These forests occur on gravelly loams and silts with good aeration and drainage and a neutral to slightly acidic pH.

DISTRIBUTION

***Geographic Range:** This forest group occurs in the interior regions of the Pacific Northwest, east of the Cascades; from interior British Columbia south to eastern Washington, Oregon, northern Idaho and western Montana east to the Continental Divide (DellaSala et al. 2011).

Nations: CA, US

States/Provinces: BC, ID, MT, OR, WA

USFS Ecoregions (2007) [optional]: 242A:CC, 331A:CC, 342H:CP, 342I:CC, M242B:CC, M242C:CC, M242D:CC, M261G:CC, M331A:PP, M332A:CC, M332B:CP, M332E:C?, M332F:C?, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3612 | <i>Tsuga heterophylla</i> - <i>Thuja plicata</i> Cool-Mesic Central Rocky Mountain Forest & Woodland Alliance |
| A3613 | <i>Tsuga heterophylla</i> - <i>Thuja plicata</i> Warm-Mesic Central Rocky Mountain Forest & Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---|----------------|---|
| >< | Western Hemlock: 224 | Eyre 1980 | Moist western slopes of the northern Rocky Mountains, in northern ID, northwest MT, and northeast WA. |
| >< | Western Redcedar - Western Hemlock: 227 | Eyre 1980 | NW MT, N ID |
| >< | Western Redcedar: 228 | Eyre 1980 | |

AUTHORSHIP***Primary Concept Source [if applicable]:** R.F. Daubenmire and J.B. Daubenmire (1968)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** M.S. Reid**Acknowledgments [optional]:** R. Crawford

Version Date: 05 Jun 2013

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1. Forest & Woodland

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

G212. East Cascades Mesic Grand Fir - Douglas-fir Forest

Type Concept Sentence: This forested group occurs in the eastern Cascades of Washington and Oregon and are dominated by a mix of *Pseudotsuga menziesii* with *Abies grandis*. Several other conifers such as *Pinus contorta*, *Pinus monticola*, and/or *Larix occidentalis* can dominate or codominate; common shrub species include *Acer circinatum*, *Cornus nuttallii*, *Mahonia nervosa*, *Paxistima myrsinites*, *Rubus parviflorus*, *Spiraea betulifolia*, and *Symphoricarpos hesperius*.

OVERVIEW***Hierarchy Level:** Group***Placement in Hierarchy:** 1.B.2.Nb.3. Central Rocky Mountain Mesic Lower Montane Forest (M500)

Elcode: G212

Scientific Name:** *Abies grandis* - *Pseudotsuga menziesii* East Cascades Forest GroupCommon (Translated Scientific) Name:** Grand Fir - Douglas-fir East Cascades Forest Group***Colloquial Name:** East Cascades Mesic Grand Fir - Douglas-fir Forest

***Type Concept:** This forested group occurs on the upper slopes of the eastern Cascades in Washington, south of Lake Chelan to Mount Hood in Oregon. These forests are dominated by a mix of *Pseudotsuga menziesii* with *Abies grandis*. Several other conifers can dominate or codominate, including *Pinus contorta*, *Pinus monticola*, and *Larix occidentalis*. *Acer circinatum*, *Cornus nuttallii*, *Linnaea borealis*, *Mahonia nervosa*, *Paxistima myrsinites*, *Rubus parviflorus*, *Spiraea betulifolia*, *Symphoricarpos hesperius*, and *Vaccinium membranaceum* are common shrub species. The composition of the herbaceous layer reflects local climate and degree of canopy closure and contains species more restricted to the Cascades, for example, *Achlys triphylla*, *Anemone deltoidea*, and *Vancouveria hexandra*. Elevations range from 610 to 1220 m (2000-4000 feet) in a very restricted range occupying less than 5% of the forested landscape in the eastern Cascades. This group typically occurs below the Pacific silver fir forests found along the crest of the Cascades, and occurs along rivers and in mesic "coves" which were historically protected from wildfires. Typically, stand-replacement fire-return intervals are 150-500 years with moderate-severity fire-return intervals of 50-100 years. These are very productive forests in the eastern Cascades which have been priority stands for timber production. This group is associated with a submesic climate regime with annual precipitation ranging from 100 to 200 cm (40-80 inches) and maximum winter snowpacks that typically melt off in spring at lower elevations.

***Diagnostic Characteristics:** Productive conifer forests found in the eastern Cascades, dominated by *Abies grandis* or *Pseudotsuga menziesii*, in relatively mesic settings, where fire-return intervals are long.

***Classification Comments:** This group includes moister *Abies grandis* associations in the eastern Cascades. This group should perhaps be merged with ~Central Rocky Mountain Mesic Grand Fir - Douglas-fir Forest Group (G211)\$\$, which does have some similar floristic components. The problem with this group (along with many associations of the eastern Cascades) is that the associations in it have both coastal/Vancouverian floristic relationships, along with Northern Rocky Mountain affinities. Either way, it seems to the writer of this description to be a relatively fine distinction, perhaps better handled at the alliance level.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G211 | Central Rocky Mountain Mesic Grand Fir - Douglas-fir Forest | |
| G210 | Central Rocky Mountain Douglas-fir - Pine Forest | |
| G217 | Central Rocky Mountain Interior Western Red-cedar - Western Hemlock Forest | |

Similar NVC Types General Comments [optional]:**VEGETATION**

Physiognomy and Structure Summary: Productive conifer forests, generally tall, with mixed shrub and herb understories. Shrubs are broad-leaved deciduous species, and the herbaceous component is predominantly forbs rather than grasses or sedges.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Most occurrences of this group are dominated by a mix of *Pseudotsuga menziesii* with *Abies grandis*. Several other conifers can dominate or codominate, including *Pinus contorta*, *Pinus monticola*, and *Larix occidentalis*. Occasionally *Tsuga heterophylla* or *Thuja plicata* can be present in the canopy. *Abies grandis* and other fire-sensitive, shade-tolerant species dominate forests on many sites once dominated by *Pseudotsuga menziesii* and *Pinus ponderosa*, which were formerly maintained by wildfire. *Mahonia nervosa*, *Linnaea borealis*, *Paxistima myrsinites*, *Acer circinatum*, *Spiraea betulifolia*, *Symphoricarpos hesperius*, *Cornus nuttallii*, *Rubus parviflorus*, and *Vaccinium membranaceum* are common shrub species. The composition of the herbaceous layer reflects local climate and degree of canopy closure and contains species more restricted to the Cascades, for example, *Acer circinatum*, *Achlys triphylla*, *Anemone deltoidea*, *Mahonia nervosa*, *Chrysolepis chrysophylla*, *Cornus nuttallii*, and *Vancouveria hexandra*.

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Typically, stand-replacement fire-return intervals are 150-500 years with moderate-severity fire-return intervals of 50-100 years. These are very productive forests in the eastern Cascades which have been priority stands for timber production. *Abies grandis* and other fire-sensitive, shade-tolerant species dominate forests on many sites once dominated by *Pseudotsuga menziesii* and *Pinus ponderosa*, which were formerly maintained by wildfire.

ENVIRONMENT

Environmental Description: This forested group occurs on the upper east slopes of the Cascades in Washington, south of Lake Chelan and south to Mount Hood in Oregon. Elevations range from 610 to 1220 m (2000-4000 feet) in a very restricted range occupying less than 5% of the forested landscape in the East Cascades. This group is associated with a submesic climate regime with annual precipitation ranging from 100 to 200 cm (40-80 inches) and maximum winter snowpacks that typically melt off in spring at lower elevations. This group is composed of variable montane coniferous forests typically below Pacific silver fir forests along the crest east of the Cascades. This group also includes montane forests along rivers and slopes, and in mesic "coves" which were historically protected from wildfires.

DISTRIBUTION

***Geographic Range:** This group occurs on the upper east slopes of the Cascades in Washington, south of Lake Chelan and south to Mount Hood in Oregon.

Nations: CA, US

States/Provinces: CA?, OR, WA

USFS Ecoregions (2007) [optional]: 242A:CC, 342H:CP, 342I:CC, M242B:CC, M242C:CC, M242D:CC, M261G:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3583 | <i>Abies grandis</i> - <i>Pseudotsuga menziesii</i> Mesic Cascadian Forest Alliance |
| A3582 | <i>Tsuga heterophylla</i> - <i>Abies grandis</i> Cascadian Mesic Cove Forest Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** C. Topik (1989)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** M.S. Reid, R. Crawford and G. Kittel

Acknowledgments [optional]: R. Crawford

Version Date: 09 Nov 2015

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- Topik, C., N. M. Halverson, and T. High. 1988. Plant associations and management guide of the ponderosa pine, Douglas-fir, and grand fir zone, Mt. Hood National Forest. R6-ECOL-TP-004-88. USDA Forest Service, Pacific Northwest Region, Portland, OR. 136 pp.

M020. Rocky Mountain Subalpine-High Montane Conifer Forest

1. Forest & Woodland

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

G345. Central Rocky Mountain Montane White Spruce Forest

Type Concept Sentence: This group consists of forests where *Picea glauca* is the characteristic conifer often with other trees such as *Betula papyrifera*, *Picea engelmannii* x *glauca* hybrids, *Pinus contorta*, *Pinus ponderosa*, *Populus tremuloides*, and *Pseudotsuga menziesii*. They are found in lower montane regions of western Montana, southwestern Alberta and southeastern British Columbia, with outliers in mountains of the northwestern Great Plains, especially the Black Hills of Wyoming and South Dakota.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nb.5. Rocky Mountain Subalpine-High Montane Conifer Forest (M020)

Elcode: G345

***Scientific Name:** *Picea glauca* - *Pseudotsuga menziesii* Central Rocky Mountain Forest Group

***Common (Translated Scientific) Name:** White Spruce - Douglas-fir Central Rocky Mountain Forest Group

***Colloquial Name:** Central Rocky Mountain Montane White Spruce Forest

***Type Concept:** This group is found in lower montane regions of western Montana, southwestern Alberta and southeastern British Columbia, with outliers in mountains of the northwestern Great Plains, especially the Black Hills of Wyoming and South Dakota. This forest group is limited to sideslopes and depressions, often adjoining cool, riparian zones, where snow persists well into the growing season. Soils vary widely from deep to quite shallow. *Picea glauca* is the characteristic conifer, but other trees can include *Pinus ponderosa*, *Pinus contorta*, *Picea engelmannii* x *glauca* hybrids, *Pseudotsuga menziesii*, *Populus tremuloides*, and *Betula papyrifera*.

Undergrowth shrubs typically include *Arctostaphylos uva-ursi*, *Elaeagnus commutata*, *Juniperus communis*, *Linnaea borealis*, *Shepherdia canadensis*, *Symphoricarpos albus*, and *Vaccinium scoparium*. Common forbs and graminoids include *Fragaria virginiana*, *Oxytropis* spp., *Linnaea borealis*, *Leymus innovatus*, *Lathyrus ochroleucus*, *Hedysarum alpinum*, and Asteraceae spp. Disturbance regimes are not well-documented for this group, but likely include periodic windthrow as well as fire spreading from adjacent, drier forests and woodlands.

***Diagnostic Characteristics:** Forests and woodlands with *Picea glauca* dominating. Generally in lower montane and foothill settings in the Central Rocky Mountain region, with Rocky Mountain floristic components (as opposed to boreal floristics). Other trees present can include *Pinus ponderosa*, *Pinus contorta*, *Pseudotsuga menziesii*, *Abies lasiocarpa*, and *Populus tremuloides* or *Picea engelmannii* x *glauca* hybrids.

***Classification Comments:** Information on this group needs to be better integrated across Montana, British Columbia and Alberta. Further information on this group in British Columbia is found in Meidinger and Pojar (1991) and in Alberta, in Achuff and Corns (1982), Achuff and Dudynsky (1984), Achuff et al. (2002), and Natural Areas Committee (2006). No sources are currently known for Montana. Its full geographic extent and distinguishing / diagnostic features require further work. As of 2013, the association lists for the Alberta and British Columbia parts have not been integrated.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|-------------------------------|------|
| | | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Open to closed canopies of conifers, with some deciduous hardwoods intermingled in some occurrences. Typically there is a well-developed shrub layer also of deciduous species, along with forbs, graminoids and often high cover of mosses. Some occurrences may lack the shrub layer.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: *Picea glauca* is the characteristic conifer, but other trees can include *Pinus ponderosa*, *Pinus contorta*, *Abies lasiocarpa*, *Picea engelmannii* (and *Picea glauca* x *Picea engelmannii* introgressive hybrids), *Pseudotsuga menziesii*, *Populus tremuloides*, and *Betula papyrifera*. Undergrowth shrubs typically include *Arctostaphylos uva-ursi*, *Elaeagnus commutata*, *Juniperus communis*, *Linnaea borealis*, *Shepherdia canadensis*, *Symphoricarpos albus*, and *Vaccinium scoparium*. Common forbs and graminoids include *Fragaria virginiana*, *Oxytropis* spp., *Linnaea borealis*, *Leymus innovatus*, *Lathyrus ochroleucus*, *Hedysarum alpinum*, and Asteraceae spp.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:

ENVIRONMENT

Environmental Description: In the main part of its range, this forest group is limited to sideslopes and depressions, likely adjoining riparian zones, where snow is well-retained. Soils vary widely from deep to shallow. In the Black Hills, these forests occur as small or large patches at cooler higher elevations, on level or gently sloping areas, from about 1740 to 2135 m (5700-7000 feet) elevation; at lower elevations, they are restricted to north-facing slopes within the ponderosa pine matrix.

DISTRIBUTION

***Geographic Range:** This group is found in lower montane regions of western Montana, southwestern Alberta and southeastern British Columbia, with outliers in higher mountains of the northwestern Great Plains, especially the Black Hills of Wyoming and South Dakota, and possibly the Bighorn Mountains of Wyoming. In Albert and British Columbia, this group occurs north through

Banff National Park to Jasper National Park, and in the British Columbia portion of the Rockies, these occur in the Columbia Trench north to at least Kootenay and Yoho national parks.

Nations: CA, US

States/Provinces: AB, BC, MT, SD, WY

USFS Ecoregions (2007) [optional]:

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3623 | <i>Picea glauca</i> Black Hills Forest Alliance |
| A3624 | <i>Picea glauca</i> - <i>Pseudotsuga menziesii</i> Rocky Mountain Forest Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|----------------------------|--------------------------------|--|
| = | <i>Picea glauca</i> series | Hoffman and Alexander 1987 | |
| > | Montane Spruce Zone | Meidinger and Pojar 1991 | The white spruce group is found within the mesic parts of this ecological zone, which can contain other types. |
| > | Montane Natural Subregion | Natural Regions Committee 2006 | The white spruce group is found within the mesic parts of this region, which can contain other types. |

AUTHORSHIP

***Primary Concept Source [if applicable]:** Hoffman and Alexander (1987); Meidinger and Pojar (1991); Natural Regions Committee (2006)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** D. Faber-Langendoen

Acknowledgments [optional]: Lorna Allen, Peter Achuff, Del Meidinger

Version Date: 06 Jun 2013

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***References [Required if used in text]:**

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- Natural Regions Committee. 2006. Natural regions and subregions of Alberta. Compiled by D. J. Downing and W. W. Pettapiece. Publication No. T/852. Government of Alberta.

1. Forest & Woodland

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

G224. Intermountain Basins Subalpine Limber Pine - Bristlecone Pine Woodland

Type Concept Sentence: This group consists of open woodlands ranging from krummholz to over 10 m in height with *Pinus flexilis* and/or *Pinus longaeva* as the dominant conifer with an herbaceous layer that is typically sparse. It is commonly found on steep slopes and ridges between 2530 and 3600 m (8300-12,000 feet) elevation, and extends from the Mojave Desert and eastern Sierra Nevada across the central Great Basin to the high plateaus of southwestern and central Utah.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nb.5. Rocky Mountain Subalpine-High Montane Conifer Forest (M020)

Elcode: G224

***Scientific Name:** *Pinus flexilis* - *Pinus longaeva* Intermountain Basins Subalpine Woodland Group

***Common (Translated Scientific) Name:** Limber Pine - Great Basin Bristlecone Pine Intermountain Basins Subalpine Woodland Group

***Colloquial Name:** Intermountain Basins Subalpine Limber Pine - Bristlecone Pine Woodland

***Type Concept:** This group extends from the Mojave Desert and eastern Sierra Nevada across the central Great Basin to the high plateaus of southwestern and central Utah. These open woodlands are typically found on high-elevation ridges and rocky slopes above subalpine forests and woodlands, sometimes extending down into the montane zone. Site are harsh, exposed to desiccating winds with rocky substrates and a short growing season that limit plant growth. Parent materials include dolomitic, limestone or granitic rocks. Occurrences can be found on all aspects but are more common on southwestern exposures on steep convex slopes and ridges between 2530 and 3600 m (8300-12,000 feet) elevation. Vegetation is characterized by a typically open tree canopy (<25% cover) with heights ranging from 1-2 m (krummholz) to over 10 m. *Pinus flexilis* and/or *Pinus longaeva* dominate the tree canopy, alone or in combination. *Pinus longaeva* stands tend to occur at higher elevation with less mixed canopies. Other trees present to codominant include *Picea engelmannii*, *Pseudotsuga menziesii*, *Populus tremuloides*, or *Abies concolor*. In the Sierra Nevada stands, *Pinus albicaulis*, *Pinus balfouriana*, and/or *Pinus contorta* var. *murrayana* may be present. Understory layers, if present, are sparse to moderately dense and composed of xeric shrubs, graminoids and cushion plants. Characteristic shrubs include *Arctostaphylos patula*, *Artemisia arbuscula*, *Artemisia tridentata* ssp. *vaseyana*, *Ericameria discoidea*, *Juniperus communis*, *Ribes cereum*, and *Ribes montigenum*. *Cercocarpus intricatus*, *Cercocarpus ledifolius*, or *Chrysolepis sempervirens* frequently occur in stands in the Sierra Nevada. The herbaceous layer is typically sparse. Associated herbaceous species are diverse given the wide elevational range, with alpine species occurring near the upper treeline and montane and subalpine species below.

***Diagnostic Characteristics:** *Pinus flexilis* and/or *Pinus longaeva* are the dominant and diagnostic species of this woodland group. The understory is variable, but is characterized by xeric shrubs and grasses found in subalpine zones in the Sierra Nevada and ranges

of the Great Basin.

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

~Rocky Mountain Foothill-Rock Outcrop Limber Pine - Juniper Woodland Group (G209)\$ is also similar to ~Intermountain Basins Subalpine Limber Pine - Bristlecone Pine Woodland Group (G224)\$ in that stands may be dominated by *Pinus flexilis*, but are geographically separate, occurring mostly in isolated low mountains, hills, and escarpments of the western Great Plains where soil moisture is slightly higher than surrounding grasslands, and lower foothills in northern Colorado, Wyoming and Montana. The foothill stands are typically juniper-dominated and occur below the zone of continuous *Pinus ponderosa* or *Pseudotsuga menziesii* woodlands and forests.

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

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G209 | Rocky Mountain Foothill-Rock Outcrop Limber Pine - Juniper Woodland | |
| G221 | Rocky Mountain Subalpine-Montane Limber Pine - Bristlecone Pine Woodland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Conifer-dominated woodlands with a typically open tree canopy that is often patchy. Shrub and herbaceous layers, if present, generally have low cover as substrates are characteristically rocky. Higher elevation stands often have cushion plants present.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This woodland group is characterized by a typically open tree canopy (<25% cover) with heights ranging from 1-2 m (krummholz) to over 10 m. *Pinus flexilis* and/or *Pinus longaeva* dominate the tree canopy, alone or in combination. *Pinus longaeva* stands tend to occur at higher elevation with less mixed canopies. Other trees present to codominant include *Picea engelmannii*, *Pseudotsuga menziesii*, *Populus tremuloides*, or *Abies concolor*. In the Sierra Nevada stands, *Pinus albicaulis*, *Pinus balfouriana*, and/or *Pinus contorta* var. *murrayana* may be present. Scattered *Pinus monophylla* may also be present in lowest elevation stands. Understory layers, if present, are sparse to moderately dense and composed of xeric shrubs, graminoids and cushion plants. Characteristic shrubs include *Arctostaphylos patula*, *Artemisia arbuscula*, *Arctostaphylos patula*, *Artemisia tridentata* ssp. *vaseyana*, *Ericameria discoidea*, *Juniperus communis*, *Ribes cereum*, and *Ribes montigenum*. *Acer glabrum*, *Cercocarpus intricatus*, *Cercocarpus ledifolius*, and *Chrysolepis sempervirens* frequently occur in stands in the Sierra Nevada. The herbaceous layer is typically sparse. Associated herbaceous species are diverse given the wide elevational range, with alpine species occurring near the upper treeline and montane and subalpine species below. Common species may include *Antennaria rosea*, *Aquilegia scopulorum*, *Arabis drummondii*, *Arenaria congesta*, *Arenaria kingii*, *Astragalus kentrophyta*, *Astragalus platytropis*, *Calamagrostis rubescens*, *Carex rossii*, *Cirsium eatonii*, *Cymopterus cinerarius*, *Cymopterus nivalis*, *Elymus elymoides*, *Eriogonum gracilipes*, *Eriogonum holmgrenii*, *Eriogonum ovalifolium*, *Erigeron pygmaeus*, *Erigeron tener*, *Festuca brachyphylla*, *Koeleria macrantha*, *Linanthus pungens* (= *Leptodactylon pungens*), *Packera werneriiifolia*, *Penstemon leiophyllus*, *Poa fendleriana*, *Phlox pulvinata*, *Trifolium gymnocarpon*, and *Trisetum spicatum*. *Selaginella watsonii* is common in some high-elevation stands.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Both *Pinus longaeva* and *Pinus flexilis* are slow-growing, long-lived trees that are intolerant of shade. *Pinus longaeva* may attain nearly 4900 years in age and 12 m in height, whereas *Pinus flexilis* may live 1000 years and attain 18 m in height. Bristlecone pine branches retain needles for as long as 30 years, whereas limber pine needles are lost after several years. Bristlecone pine trees produce dense, resinous wood that is resistant to rot and disease. Mature trees have massive, contorted trunks with mostly dead and gnarled wood. (Sawyer et al. 2009).

Natural regeneration of both species appears to be closely associated with caching of the large wingless seeds, primarily by Clark's nutcracker (*Nucifraga columbiana*) (Lanner and Vander Wall 1980). Germination of cached seeds often results in the multi-stemmed clumps characteristic of these sites, although the species may produce multiple stems from boles damaged near the ground. Germination and rooting will sometimes be restricted to crevices in rock. *Pinus longaeva* has smaller winged seeds and should be wind-disseminated. However, caching by nutcrackers does take place, especially when other *Pinus* species are also available (Dr. R. Lanner pers. comm.). The longevity of individuals enables stands to persist for centuries between times of favorable seedling establishment (Keeley and Zedler 1998). Fires seldom destroy this group due to the sparse nature of the canopy cover of trees and abundant bare ground.

ENVIRONMENT

Environmental Description: The bristlecone pine-limber pine woodland group denotes some of the driest and windiest sites capable of supporting trees other than *Juniperus*. Sites are typically xeric on exposed, windswept rocky slopes and ridges. It can be found on all aspects but is more common on southwestern exposures on steep convex slopes and ridges between 2530 and 3600 m (8300-12,000 feet) elevation. It commonly represents a topographic or edaphic climax within the *Abies lasiocarpa* and upper *Pseudotsuga menziesii* zones.

This group occurs on a variety of substrates but is best represented on colluvium derived from limestone and dolomite or Tertiary and Cretaceous sandstone. A characteristic feature is the predominance of bare soil; almost all sites have between 25 and 50% bare ground. Consequently, litter accumulations are slight and intermittent. Most sites are droughty, with gravel in the shallow subsurface horizons. Surface textures vary depending upon parent material. Steep slopes, high-intensity summer convection storms, and only partial ground cover for interception often result in severe sheet erosion of fine particles. This usually leads to the development of gravel pavements. Additional erosion can be expected from wind action. High insolation and wind during the winter usually result in reduced snowpack accumulations. However, soils can be expected to freeze.

The sparsity of shrubs, forbs, grasses, and litter in addition to the widely spaced trees usually means that fire does not carry easily. Individual trees may be ignited from lightning, but seldom is an entire occurrence burned.

DISTRIBUTION

***Geographic Range:** This woodland group extends from mountain ranges in the Mojave Desert and Sierra Nevada across the Great Basin to the high plateaus of southwestern Utah, central Wasatch and extreme western Uinta Mountains.

Nations: CA, US

States/Provinces: CA, NV, UT

USFS Ecoregions (2007) [optional]: 322A:CC, 341A:CC, 341D:CC, 341E:CC, 341F:CC, 341G:CC, 342B:CC, 342J:C?, M261E:CC, M261G:C?, M331D:PP, M341A:CC, M341D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A0518 | <i>Pinus longaeva</i> Forest & Woodland Alliance |
| A2035 | <i>Pinus flexilis</i> Intermountain Basins Forest & Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|----------------------------------|-----------------------------|------|
| > | Bristlecone Pine: 209 | Eyre 1980 | |
| < | Limber Pine Series | Sawyer and Keeler-Wolf 1995 | |
| < | Bristlecone Pine Series | Sawyer and Keeler-Wolf 1995 | |
| < | Limber Pine Forest (#86700) | Holland 1986b | |
| < | Bristlecone Pine Forest (#86400) | Holland 1986b | |
| >< | Limber Pine: 219 | Eyre 1980 | |

AUTHORSHIP***Primary Concept Source [if applicable]:** R.F. Holland (1986b)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz**Acknowledgments [optional]:**

Version Date: 17 Mar 2010

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- Sawyer, J. O., T. Keeler-Wolf, and J. Evens. 2009. A manual of California vegetation. Second edition. California Native Plant Society, Sacramento CA. 1300 pp.
- Sawyer, J. O., and T. Keeler-Wolf. 1995. A manual of California vegetation. California Native Plant Society, Sacramento. 471 pp.

G223. Northern Rocky Mountain Whitebark Pine - Subalpine Larch Woodland

Type Concept Sentence: This group consists of woodlands dominated by *Pinus albicaulis* and *Abies lasiocarpa*, or *Larix lyallii*, that form stunted tree clumps, or open woodlands with herb- or dwarf-shrub-dominated openings with an undergrowth that is usually somewhat depauperate. It is found in the northern Rocky Mountains at high elevations of the treeline/alpine transition zone, an often harsh, windswept environment, where trees maybe flagged from damage by blowing snow and ice crystals.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nb.5. Rocky Mountain Subalpine-High Montane Conifer Forest (M020)

Elcode: G223

***Scientific Name:** *Pinus albicaulis* - *Abies lasiocarpa* - *Larix lyallii* Northern Rocky Mountain Woodland Group

***Common (Translated Scientific) Name:** Whitebark Pine - Subalpine Fir - Subalpine Larch Northern Rocky Mountain Woodland Group

***Colloquial Name:** Northern Rocky Mountain Whitebark Pine - Subalpine Larch Woodland

***Type Concept:** This group of the Northern Rockies is typically a high-elevation mosaic of stunted tree clumps, open woodlands, with herb- or dwarf-shrub-dominated openings, occurring above upper subalpine closed forest ecosystems and below alpine communities. The climate is typically very cold and snowy in winter and relatively dry and cool in summer. The upper and lower elevational limits, due to climatic variability and differing topography, vary considerably; in interior British Columbia, this group occurs between 1400 and 2200 m elevation, and in northwestern Montana, it occurs up to 2400 m. Landforms include ridgetops, mountain slopes, glacial trough walls and moraines, talus slopes, landslides and rockslides, cirque headwalls and basins. Some sites have little snow accumulation because of high winds and sublimation. In this harsh, often windswept environment, trees are typically stunted and flagged from damage associated with wind, blowing snow and ice crystals, especially at the upper elevations of the type. The stands or patches often originate when *Pinus albicaulis*, and in some communities *Picea engelmannii*, colonize a sheltered site such as the lee side of a rock. *Abies lasiocarpa* can then colonize in the shelter of either species. These high-elevation coniferous woodlands are dominated by *Pinus albicaulis* and *Abies lasiocarpa*, or *Larix lyallii*. The undergrowth is usually somewhat depauperate, but some stands support a near sward of heath plants, such as *Phyllodoce empetriformis*, *Vaccinium myrtillus*, and *Vaccinium scoparium*, that may be present to codominant. The herbaceous layer is sparse under dense shrub canopies or may be dense where the shrub canopy is open or absent. Common species include *Ligusticum grayi*(?), *Arnica latifolia*, *Xerophyllum tenax*, *Carex rossii*, *Carex geyeri*, and *Luzula glabrata* var. *hitchcockii*. Major disturbances are windthrow and snow avalanches. Fire is known to occur infrequently in this group, at least where woodlands are present; lightning damage to individual trees is common, but sparse canopies and rocky terrain limit the spread of fire.

***Diagnostic Characteristics:** These coniferous woodlands are dominated by *Pinus albicaulis* and *Abies lasiocarpa* and locally *Larix lyallii* with occasional *Picea engelmannii*. The undergrowth is often composed of few species, but some stands support a near sward of heath plants, such as *Vaccinium myrtillus* and *Vaccinium scoparium*, that may be present to codominant. The herbaceous layer is sparse under dense shrub canopies or may be dense where the shrub canopy is open or absent. Common species include *Ligusticum grayi*, *Xerophyllum tenax*, *Festuca idahoensis*, *Carex rossii*, *Calamagrostis rubescens*, and *Luzula glabrata* var. *hitchcockii*.

***Classification Comments:** *Pinus albicaulis* and *Larix lyallii* associations are considered distinct enough to be placed in their own group. Alternatively, they could be merged into one of the Rocky Mountain spruce-fir groups, or with the limber pine group, as a "Rocky Mountain dry, cold, subalpine-montane pine" group. *Pinus albicaulis* woodlands in northeastern Oregon are included in this group. In the Sierra Nevada and Oregon Cascades, they are placed into ~Sierra-Cascade Cold-Dry Subalpine Woodland Group (G243)\$\$.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G218 | Rocky Mountain Subalpine Moist Spruce - Fir Forest & Woodland | |
| G243 | Sierra-Cascade Cold-Dry Subalpine Woodland | |

Similar NVC Types General Comments [optional]:**VEGETATION**

Physiognomy and Structure Summary: This group is characterized by *Pinus albicaulis* or *Larix lyallii*, sometimes associated with other conifers, which form woodlands and occasionally forests. Trees are often stunted and flagged as a result of harsh cold and wind. The understory is variable depending on substrates ranging from sparse on rockier sites to dense on more mesic sites and typically characterized by heaths and graminoids.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: These woodlands are mostly dominated by *Pinus albicaulis* or *Larix lyallii* and occasionally codominated by *Abies lasiocarpa*. Understories range from sparse to dense and are occupied by heath species, including *Arctostaphylos uva-ursi*, *Vaccinium membranaceum*, *Vaccinium myrtillus*, *Menziesia ferruginea*, and *Vaccinium scoparium*. The herbaceous layer is sparse under dense shrub canopies or may be dense where the shrub canopy is open or absent. Common species include *Ligusticum grayi*, *Xerophyllum tenax*, *Festuca idahoensis*, *Carex rossii*, *Calamagrostis rubescens*, and *Luzula glabrata* var. *hitchcockii*.

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: *Pinus albicaulis* is a slow-growing, long-lived conifer that is common at higher elevations in the upper subalpine zone. It typically occurs in a mosaic of tree islands and meadows where it often colonizes sites and creates habitat for less hardy tree species. In lower subalpine forests, it is a seral species, establishing after a large disturbance such as stand-replacing fire or avalanche, or it is restricted to dry, rocky ridges where it competes well with shade-tolerant tree species. Without disturbance, it will be overtopped in 100-120 years by faster growing, shade-tolerant species such as *Abies lasiocarpa*, *Picea engelmannii*, *Pseudotsuga menziesii*, and *Tsuga mertensiana*. Although crownfires and high-intensity surface fires kill *Pinus albicaulis*, it tolerates low-intensity surface fires that will kill the shade-tolerant understory. Fire intervals range from 30-300 years.

Birds and small mammals often eat and cache the large, wingless pine seeds and are responsible for the dispersal of this species. Most important is the Clark's nutcracker, which can transport the seeds long distances and cache them on exposed windswept and burned-over sites. This results in the regeneration of pines in clumps from forgotten caches (Eyre 1980, Steel et al. 1983, Burns and Honkala 1990a, Schmidt and McDonald 1990).

Pests include the mountain pine beetle (*Dendroctonus ponderosae*), which has killed many mature trees in the past, during epidemics where populations of the beetle build up in lower elevation *Pinus contorta* stands, then move up into the *Pinus albicaulis* (Steel et al. 1983, Burns and Honkala 1990a, Schmidt and McDonald 1990). The exotic pathogen white pine blister rust (*Cronartium ribicola*) is attacking and killing *Pinus albicaulis* trees in many parts of the interior northwestern U.S. It is especially destructive in more mesic habitats that favor infection of its alternate host *Ribes* spp. *Pinus albicaulis* is very susceptible to this disease, and the only real hope is propagating individuals that have high genetic resistance to blister rust (Steel et al. 1983, Burns and Honkala 1990a, Schmidt and McDonald 1990, Tomback et al. 2001).

Larix lyallii is a very slow-growing, long-lived tree, with individuals attaining up to 1000 years in age (Richards 1981). It is generally intolerant of shade from other trees, but extreme environmental conditions limit competition. Reproduction is typically by seed and is most favorable on moist mineral soil. Seedling growth is initially very slow and accelerates after an extensive root system is established. Major disturbances to stands of this group are windthrow and snow avalanches. Lightning damage to individual trees is common, but sparse canopies and rocky terrain serve to limit the spread of fire.

ENVIRONMENT

Environmental Description: This subalpine group typically occurs at elevations of 1800-2700 m and occasionally up to 3000 m. Occurrences occupy warmer southern and western aspects on mid to upper slopes, shoulder slopes, ridges, and exposed high-elevation benches. These sites are often subject to desiccating winds, heavy snowpack, and extreme diurnal temperate fluctuations. Substrates include a variety of igneous, metamorphic, and sedimentary geologic formations. Soils are well- to excessively drained and can include coarse sand, silt and clay loams. *Climate:* The climate is typically very cold and snowy in winter and relatively dry in summer. Yearly snow accumulations are often over 3 m in the northern Cascades and 2-3 m in the Rockies. Some sites have little snow accumulation because of high winds and sublimation. In this harsh, often windswept environment, trees are often stunted and flagged from damage associated with wind and blowing snow and ice crystals, especially at the upper elevations of the type. *Soil/substrate/hydrology:* Where *Larix lyallii* is dominant, soils are poorly developed and almost exclusively of fractured granitic or quartzite rocks which have not been previously colonized by other vascular plants. The majority of sites where *Larix lyallii* occurs are in areas which experienced heavy alpine glaciation less than 12,000 years ago.

DISTRIBUTION

***Geographic Range:** This group occurs in the northern Rocky Mountains, west into the eastern Cascade Range and eastern Washington and Oregon, and east into the mountain "islands" of central Montana. It also occurs in the Canadian Rockies of Alberta and eastern British Columbia.

Nations: CA, US

States/Provinces: AB, BC, CA, ID, MT, NV, OR, WA, WY

USFS Ecoregions (2007) [optional]: 342H:CC, 342I:CP, M242C:CC, M242D:CC, M331A:CC, M331B:CP, M331D:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A0631 | <i>Larix lyallii</i> Woodland Alliance |
| A3368 | <i>Pinus albicaulis</i> Forest & Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---|-------------------------------|------|
| > | WB Whitebark Pine Subalpine | Ecosystems Working Group 1998 | |
| > | FP Engelmann Spruce - Subalpine Fir Parkland | Ecosystems Working Group 1998 | |
| < | Whitebark Pine: 208 | Eyre 1980 | |
| >< | <i>Pinus albicaulis</i> - <i>Abies lasiocarpa</i> Woodlands and Parklands | Chappell et al. 1997 | |
| >< | <i>Pinus albicaulis</i> Series | Johnston 1987 | |
| >< | <i>Pinus albicaulis</i> Series | Steele et al. 1983 | |
| >< | <i>Pinus albicaulis</i> Zone | Barrows et al. 1977 | |
| >< | <i>Picea engelmannii</i> - <i>Abies lasiocarpa</i> - <i>Pinus albicaulis</i> - <i>Pinus contorta</i> forest | Achuff 1989 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** F.H. Eyre (1980)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** M.E. Hall and M.S. Reid

Acknowledgments [optional]:

Version Date: 10 Jun 2013

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1. Forest & Woodland

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

G220. Rocky Mountain Lodgepole Pine Forest & Woodland

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

OVERVIEW

*Hierarchy Level: Group

***Placement in Hierarchy:** 1.B.2.Nb.5. Rocky Mountain Subalpine-High Montane Conifer Forest (M020)

Elcode: G220

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

***Type Concept:** This group occupies upper montane to subalpine elevations of the Rocky Mountains, north into the Canadian Rockies and east into mountain "islands" of north-central Montana. Parent materials are typically well-drained, gravelly, coarse-textured, acidic, and are rarely formed from calcareous parent materials. Other stands occur over excessively well-drained pumice deposits, glacial till and alluvium on valley floors where there is cold-air accumulation, warm and droughty shallow soils over fractured quartzite bedrock, and shallow moisture-deficient soils with a significant component of volcanic ash. In these conditions where other conifers cannot become established, stands of *Pinus contorta* may persist for longer periods. These forests are dominated by *Pinus contorta* with shrub, grass, or barren understories. Sometimes there are intermingled mixed conifer/*Populus tremuloides* stands, with the latter occurring with inclusions of deeper, typically fine-textured soils. The shrub stratum may be conspicuous to absent; common species include *Arctostaphylos uva-ursi*, *Artemisia tridentata*, *Juniperus communis*, *Ceanothus velutinus*, *Linnaea borealis*, *Mahonia repens*, *Purshia tridentata*, *Spiraea betulifolia*, *Spiraea douglasii*, *Shepherdia canadensis*, *Vaccinium scoparium*, *Vaccinium cespitosum*, *Vaccinium membranaceum*, *Symphoricarpos albus*, and *Ribes* spp. Common herbaceous species include *Festuca idahoensis*, *Elymus elymoides*, *Calamagrostis rubescens*, *Carex geyeri*, *Carex pensylvanica*, and *Carex rossii*.

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

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

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G218 | Rocky Mountain Subalpine Moist Spruce - Fir Forest & Woodland | |
| G219 | Rocky Mountain Subalpine Dry-Mesic Spruce - Fir Forest & Woodland | |
| G243 | Sierra-Cascade Cold-Dry Subalpine Woodland | |

Similar NVC Types General Comments [optional]:**VEGETATION**

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

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

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

pennsylvanica, and *Carex rossii*.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: *Pinus contorta* is an aggressively colonizing, shade-intolerant conifer which usually occurs in lower subalpine forests in the major ranges of the western United States. Establishment is episodic and linked to stand-replacing disturbances, primarily fire. The incidence of serotinous cones varies within and between varieties of *Pinus contorta*, being most prevalent in Rocky Mountain populations. Closed, serotinous cones appear to be strongly favored by fire, and allow rapid colonization of fire-cleared substrates (Burns and Honkala 1990a). Hoffman and Alexander (1980, 1983) report that in stands where *Pinus contorta* exhibits a multi-aged population structure, with regeneration occurring, there is typically a higher proportion of trees bearing nonserotinous cones. The dominance of *Pinus contorta* in associations in this group is related to fire history and topo-edaphic conditions (Pfister et al. 1977, Hoffman and Alexander 1980, Steele et al. 1981, Mauk and Henderson 1984). Following stand-replacing fires, *Pinus contorta* will rapidly colonize and develop into dense stands of even-aged trees. These stands, while frequently persistent for more than 100 years, may succeed to spruce-fir forests or woodlands. Most (but not all) forests in this group are early- to mid-successional forests which developed following fires.

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

ENVIRONMENT

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

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

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

DISTRIBUTION

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

Nations: CA, US

States/Provinces: AB, BC, CA?, CO, ID, MT, NV, OR, UT, WA, WY

USFS Ecoregions (2007) [optional]: 331A:CC, 331G:CC, 331J:CC, 331K:C?, 342A:CC, 342B:C?, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:CC, 342J:CC, M242C:CC, M242D:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CP, M331G:CP, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M341B:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low

USNVC Confidence Comments [optional]:

HIERARCHY***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A0424 | <i>Pinus contorta</i> - <i>Populus tremuloides</i> Rocky Mountain Forest Alliance |
| A4079 | <i>Pinus contorta</i> Rocky Mountain Woodland Alliance |
| A3366 | <i>Pinus contorta</i> Rocky Mountain Forest Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS**Supporting Concepts [optional]:**

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

AUTHORSHIP***Primary Concept Source [if applicable]:** D.G. Despain (1973b)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** M.E. Hall**Acknowledgments [optional]:** D. Tart

Version Date: 30 May 2013

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1. Forest & Woodland

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

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

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

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nb.5. Rocky Mountain Subalpine-High Montane Conifer Forest (M020)

Elcode: G219

***Scientific Name:** *Picea engelmannii* - *Abies lasiocarpa* - *Pinus contorta* Dry-Mesic Forest & Woodland Group

***Common (Translated Scientific) Name:** Engelmann Spruce - Subalpine Fir - Lodgepole Pine Dry-Mesic Forest & Woodland Group

***Colloquial Name:** Rocky Mountain Subalpine Dry-Mesic Spruce - Fir Forest & Woodland

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

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

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

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G220 | Rocky Mountain Lodgepole Pine Forest & Woodland | |
| G218 | Rocky Mountain Subalpine Moist Spruce - Fir Forest & Woodland | |

Similar NVC Types General Comments [optional]:

VEGETATION

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

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This forest and woodland group has a tree canopy typically dominated by *Picea engelmannii* and *Abies lasiocarpa*, either mixed or alone, with a xeric understory species. *Pseudotsuga menziesii* may persist in occurrences of this group for long periods without regeneration. *Pinus contorta* is common in many occurrences, and patches of pure *Pinus contorta* are not uncommon, as well as mixed conifer/*Populus tremuloides* stands. In some areas, such as Wyoming, *Picea engelmannii*-dominated forests are on limestone or dolomite, while nearby codominated spruce-fir forests are on granitic or volcanic rocks. Upper elevation examples may have more woodland physiognomy, and *Pinus albicaulis* or *Pinus flexilis* can be a seral component. Xeric understory species may include shrubs and dwarf-shrubs such as *Jamesia americana*, *Juniperus communis*, *Mahonia repens*, *Physocarpus malvaceus*, *Ribes inerme*, *Rubus parviflorus*, *Shepherdia canadensis*, *Vaccinium cespitosum*, and *Vaccinium scoparium*. In the Bighorn Mountains, *Artemisia tridentata* is a common shrub. *Vaccinium myrtilus* occurs both on dry and mesic sites. More northern occurrences often have taller, more mesic shrub and herbaceous species such as *Empetrum nigrum*. Dry to mesic herbaceous species that are characteristic of this group include *Arnica cordifolia*, *Arnica latifolia*, *Calamagrostis rubescens*, *Carex geyeri*, *Carex rossii*, *Carex siccata*, *Leymus triticoides*, and near alpine elevation *Geum rossii* and *Trifolium dasyphyllum*. Mosses may also dominate the understory without significant cover of vascular plants.

*Floristics Table [Med - High Confidence]:

*Number of Plots:

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

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

ENVIRONMENT

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

DISTRIBUTION

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

Nations: CA, US

States/Provinces: AB, AZ, BC, CO, ID, MT, NM, NV, OR, UT, WA, WY

USFS Ecoregions (2007) [optional]: 313A:CC, 313B:CC, 315A:PP, 321A:CC, 331J:CC, 341A:CC, 341B:CC, 341D:CC, 341E:CP, 341F:CC, 341G:CC, 342A:CC, 342B:CP, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:CC, 342I:CP, 342J:CC, M242B:CC, M242C:CC, M242D:CC, M313A:CC, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M341A:CC, M341B:CC, M341C:CC, M341D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3645 | <i>Abies lasiocarpa</i> - <i>Populus tremuloides</i> Rocky Mountain Dry-Mesic Forest Alliance |
| A3643 | <i>Abies lasiocarpa</i> - <i>Picea engelmannii</i> Rocky Mountain Dry-Mesic Forest Alliance |
| A3644 | <i>Abies lasiocarpa</i> - <i>Picea engelmannii</i> Dry-Mesic Scree & Talus Woodland Alliance |
| A3641 | <i>Abies lasiocarpa</i> - <i>Picea engelmannii</i> Southern Rocky Mountain Dry-Mesic Forest Alliance |
| A3642 | <i>Abies lasiocarpa</i> - <i>Picea engelmannii</i> Treeline Dry-Mesic Forest Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---|-------------------------------|---|
| > | Engelmann Spruce - Subalpine Fir: 206 | Eyre 1980 | |
| > | EF Engelmann Spruce - Sub-alpine Fir Dry Forested | Ecosystems Working Group 1998 | Dry Grouseberry/Crowberry sites, Azalea/Rhododendron sites in ESSFdv dv1 dv2 xc 3 xc4 xv1 xv2 |

AUTHORSHIP

***Primary Concept Source [if applicable]:** F.H. Eyre (1980)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz

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1. Forest & Woodland

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

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

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

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nb.5. Rocky Mountain Subalpine-High Montane Conifer Forest (M020)

Elcode: G218

***Scientific Name:** *Picea engelmannii* - *Abies lasiocarpa* - *Tsuga mertensiana* Moist Forest & Woodland Group

***Common (Translated Scientific) Name:** Engelmann Spruce - Subalpine Fir - Mountain Hemlock Moist Forest & Woodland Group

***Colloquial Name:** Rocky Mountain Subalpine Moist Spruce - Fir Forest & Woodland

***Type Concept:** This is a high-elevation group of the Rocky Mountains and eastern Cascades dominated by *Picea engelmannii* and *Abies lasiocarpa*. It extends westward into the northeastern side of Mount Rainier in Washington, and as far east as mountain "islands" of north-central Montana. *Picea engelmannii* is generally more important in southern forests than those in the Pacific Northwest. Occurrences are typically found in locations with cold-air drainage or ponding, or where snowpacks linger late into the

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

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

***Classification Comments:** This group is similar to ~Rocky Mountain Subalpine Dry-Mesic Spruce - Fir Forest & Woodland Group (G219)\$\$ but is distinguished by its occurrence on mesic to wet microsites within the matrix of the drier (and warmer) subalpine spruce-fir or lodgepole pine forests. The microsites include north-facing slopes, swales or ravines, toeslopes, cold pockets, and other locations where available soil moisture is higher or lasts longer into the growing season. This group is NOT confined to the northern Rocky Mountains or Pacific Northwest (it is not geographically defined, rather by topographic settings in the subalpine). In the Canadian Rockies, this group transitions to a yet-to-be described Boreal mesic mixed-conifer group, where *Abies lasiocarpa* and *Picea engelmannii* occur with boreal taxa, such as *Picea mariana* or *Picea glauca*.

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

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

***Similar NVC Types [if applicable]:**

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

Similar NVC Types General Comments [optional]:

VEGETATION

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

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

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

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

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

ENVIRONMENT

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

DISTRIBUTION

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

Nations: CA, US

States/Provinces: AB, AZ, BC, CA?, CO, ID, MT, NM, NV, OR, UT, WA, WY

USFS Ecoregions (2007) [optional]: 242A:CC, 313A:CC, 313B:CC, 315A:??, 331J:CC, 341A:CC, 341B:CC, 341D:CC, 341E:CP, 341F:CC, 341G:CC, 342A:CC, 342B:CC, 342C:CP, 342D:CC, 342E:CC, 342H:CC, 342I:C?, 342J:CC, M242A:CC, M242B:CC, M242C:CC, M242D:CC, M313A:CC, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M341A:CC, M341B:CC, M341C:CC, M341D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3617 | <i>Tsuga mertensiana</i> Rocky Mountain Forest Alliance |
| A0422 | <i>Abies lasiocarpa</i> - <i>Populus tremuloides</i> Rocky Mountain Moist Forest Alliance |
| A3614 | <i>Abies lasiocarpa</i> - <i>Picea engelmannii</i> Rocky Mountain Moist Forest Alliance |
| A3616 | <i>Abies lasiocarpa</i> - <i>Picea engelmannii</i> Rocky Mountain Talus & Scree Woodland Alliance |
| A3615 | <i>Abies lasiocarpa</i> - <i>Picea engelmannii</i> Southern Rocky Mountain Moist Forest Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---------------------------------------|----------------|--|
| > | Engelmann Spruce - Subalpine Fir: 206 | Eyre 1980 | |
| >< | Mountain Hemlock: 205 | Eyre 1980 | Mountain hemlock in the northern Rockies of MT, ID and northeast WA is included in this group. |

AUTHORSHIP***Primary Concept Source [if applicable]:** F.H. Eyre (1980)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz**Acknowledgments [optional]:** D. Tart

Version Date: 08 Oct 2013

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1. Forest & Woodland

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

G222. Rocky Mountain Subalpine-Montane Aspen Forest & Woodland

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

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nb.5. Rocky Mountain Subalpine-High Montane Conifer Forest (M020)

Elcode: G222

***Scientific Name:** *Populus tremuloides* Rocky Mountain Forest & Woodland Group

***Common (Translated Scientific) Name:** Quaking Aspen Rocky Mountain Forest & Woodland Group

***Colloquial Name:** Rocky Mountain Subalpine-Montane Aspen Forest & Woodland

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

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

***Classification Comments:** This group differs from ~Northwestern Great Plains Aspen Woodland Group (G328)\$\$, which is limited to plains environments. The scattered occurrences in the Trans-Pecos of Texas are of interest as they represent disjunct outliers of the type occurring under highly limited circumstances. In Alberta and interior British Columbia, these forests transition to ~Alaskan-Yukon Boreal Dry Aspen Forest Group (G349)\$\$. Associations where aspen is mixed with one or more Rocky Mountain conifers in

the canopy, or even in the undergrowth, are placed into their respective conifer forest groups (e.g., into a spruce-fir group, or a mixed montane conifer group). Typically, in those associations, the floristics and species richness are more similar to conifer forest groups, than to the aspen group.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G328 | Northwestern Great Plains Aspen Woodland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Occurrences typically have a somewhat closed canopy of trees 5-20 m tall that is dominated by the cold-deciduous, broad-leaved tree *Populus tremuloides*. Conifers may contribute up to 15% of the canopy cover. The open-spaced stems of *Populus tremuloides* often give way to a lush understory consisting of complex multiple shrub and herbaceous layers, or just an herbaceous layer.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

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

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

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

ENVIRONMENT

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

Climate: Climate is temperate with a relatively long growing season, typically cold winters and deep snow. Mean annual precipitation is greater than 38 cm (15 inches) and typically greater than 51 cm (20 inches), except in semi-arid environments where

occurrences are restricted to mesic microsites such as seeps or where large snow drifts develop. Distribution of this group is primarily limited by adequate soil moisture required to meet its high evapotranspiration demand (Mueggler 1988). Secondly, its range is limited by the length of the growing season or low temperatures (Mueggler 1988).

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

DISTRIBUTION

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

Nations: CA, MX, US

States/Provinces: AB, AZ, BC, CA, CO, ID, MT, NM, NV, OR, SD, TX, UT, WA, WY

USFS Ecoregions (2007) [optional]: 313A:CC, 313B:CC, 313D:CC, 315H:PP, 321A:CC, 322A:CC, 331A:CC, 331F:CC, 331G:CC, 331I:C?, 331J:CC, 331K:CP, 331N:CP, 332F:??, 341A:CC, 341B:CC, 341C:CC, 341D:CC, 341E:CC, 341F:CC, 341G:CC, 342A:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:CC, 342I:CP, 342J:CC, M242B:CP, M242C:CC, M242D:CC, M261D:CC, M261E:CC, M261G:CC, M313A:CC, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CP, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CP, M333D:CC, M334A:CC, M341A:CC, M341B:CC, M341C:CC, M341D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3371 | <i>Acer grandidentatum</i> Montane Forest Alliance |
| A2036 | <i>Populus tremuloides</i> Rocky Mountain Forest & Woodland Alliance |
| A3367 | <i>Betula papyrifera</i> Rocky Mountain Forest & Woodland Alliance |
| A4078 | <i>Populus tremuloides</i> Southern Rocky Mountain Woodland & Scrub Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--|-------------------|------|
| > | Aspen Woodland (411) | Shiflet 1994 | |
| > | Aspen: 217 | Eyre 1980 | |
| < | Pine Series, <i>Populus tremuloides</i> subclimax Association - 122.326 | Brown et al. 1979 | |
| < | Engelmann Spruce-Alpine Fir Series, <i>Populus tremuloides</i> subclimax Association - 121.316 | Brown et al. 1979 | |

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---|-------------------|------|
| < | Douglas-fir-White Fir (=Mixed Conifer) Series, <i>Populus tremuloides</i> subclimax Association - 122.314 | Brown et al. 1979 | |

AUTHORSHIP

*Primary Concept Source [if applicable]: F.H. Eyre (1980)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

*Author of Description: M.E. Hall

Acknowledgments [optional]:

Version Date: 05 Jun 2013

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Youngblood, A. P., and R. L. Mauk. 1985. Coniferous forest habitat types of central and southern Utah. General Technical Report INT-187. USDA Forest Service, Intermountain Research Station, Ogden, UT. 89 pp.

1. Forest & Woodland

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

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

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

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nb.5. Rocky Mountain Subalpine-High Montane Conifer Forest (M020)

Elcode: G221

***Scientific Name:** *Pinus flexilis* - *Pinus aristata* Rocky Mountain Subalpine-Montane Woodland Group

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

***Colloquial Name:** Rocky Mountain Subalpine-Montane Limber Pine - Bristlecone Pine Woodland

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

***Diagnostic Characteristics:** *Pinus flexilis* and/or *Pinus aristata* are the dominant and diagnostic species of this woodland group. The understory is variable, but is characterized by xeric shrubs and grasses found in montane and subalpine zones in the Rocky Mountains.

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

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

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

*Similar NVC Types [if applicable]:

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G209 | Rocky Mountain Foothill-Rock Outcrop Limber Pine - Juniper Woodland | |
| G224 | Intermountain Basins Subalpine Limber Pine - Bristlecone Pine Woodland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Conifer-dominated woodlands with a typically open tree canopy that is often patchy. Shrub and herbaceous layers, if present, generally have low cover as substrates are characteristically rocky. Higher elevation stands often have cushion plants present.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This woodland group is characterized by an open tree canopy that is often patchy and dominated by *Pinus flexilis* and/or *Pinus aristata* with the latter restricted to southern Colorado, northern New Mexico and the San Francisco Mountains in Arizona. Other trees such as *Juniperus scopulorum*, *Picea engelmannii*, *Pinus contorta*, *Pinus ponderosa*, or *Pseudotsuga menziesii* are occasionally present, but do not dominate. *Arctostaphylos uva-ursi*, *Cercocarpus ledifolius*, *Juniperus communis*, *Mahonia repens*, *Purshia tridentata*, *Ribes montigenum*, or *Vaccinium* spp. may form an open shrub layer in some stands. The herbaceous layer, if present, is generally sparse and composed of xeric graminoids, such as *Calamagrostis purpurascens*, *Festuca arizonica*, *Festuca idahoensis*, *Festuca thurberi*, *Leucopoa kingii*, *Muhlenbergia filiculmis*, *Muhlenbergia montana*, *Poa fendleriana*, and *Trisetum spicatum*. Highest elevation stands have a floristic component of typically subalpine and alpine plants, such as *Sedum lanceolatum*, *Trifolium dasyphyllum*, *Carex rupestris*, *Carex elynoides*, or *Phlox pulvinata*. Other scattered forbs may include species of *Achillea*, *Antennaria*, *Artemisia*, *Arenaria*, *Arnica*, *Astragalus*, *Campanula*, *Erigeron*, *Hymenoxys*, *Penstemon*, *Polemonium*, *Senecio*, and *Thalictrum*.

*Floristics Table [Med - High Confidence]:

*Number of Plots:

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Natural regeneration of *Pinus flexilis* appears to be closely associated with caching of the large wingless seeds, primarily by Clark's nutcracker (*Nucifraga columbiana*) (Lanner and Vander Wall 1980). Germination of cached seeds often results in the multi-stemmed clumps characteristic of these sites, although the species may produce multiple stems from boles damaged near the ground. Germination and rooting will sometimes be restricted to crevices in rock. *Pinus longaeva* has smaller winged seeds and should be wind-disseminated. However, caching by nutcrackers does take place, especially when other *Pinus* species are also available (Dr. R. Lanner pers. comm.). Fires seldom destroy these woodlands due to the sparse nature of the canopy cover of trees and abundant bare ground. Peet (1978, 1981) notes that *Pinus aristata* is dominant at higher elevations in much of the southern Rocky Mountains, where *Pinus flexilis* is restricted to lower elevations. This is attributed to apparent competitive exclusion, because *Pinus flexilis* is dominant at high elevations in northern Colorado, Wyoming and Montana.

ENVIRONMENT

Environmental Description: This woodland group is found throughout the Rocky Mountains and extends west into the southern Colorado Plateau. Stands occur on dry, rocky ridges and slopes near upper treeline above the matrix spruce-fir forest and extends down to the lower montane zone. Sites are harsh, exposed to desiccating winds, with rocky substrates and a short growing season that limit plant growth. Higher elevation occurrences are found well into the subalpine-alpine transition on wind-blasted, mostly west-facing slopes and exposed ridges. Calcareous substrates are important for *Pinus flexilis*-dominated communities in the northern Rocky Mountains and possibly elsewhere.

Climate: Elevations range from 2400-3670 m. Climate is semi-arid, cold temperate with cool summers. Annual precipitation patterns and amounts vary with latitude, but locally the sites are typically xeric on exposed, windswept rocky slopes and ridges. *Soil/substrate/hydrology:* Soils are typically well-drained, shallow, skeletal and coarse-textured such as gravelly, sandy loams or loams. Stands occur most frequently on igneous, metamorphic and volcanic substrates such as andesite, granite, gneiss, breccia, tuff, and conglomerate, but also occur on sedimentary rocks like sandstone. Exposed bedrock is common. Soil pH is 4.5-6.9, acidic to slightly acidic. Calcareous substrates are important for *Pinus flexilis*-dominated communities in the northern Rocky Mountains and possibly elsewhere.

DISTRIBUTION

***Geographic Range:** This group is found throughout the Rocky Mountains, including the Uinta and northern Wasatch mountains, and the Jarbridge Mountains in northeastern Nevada, and extends west into the southern Colorado Plateau. It also occurs farther east, in the Bighorn Range of north-central Wyoming, although it is not common there. Montane limber pine communities probably occur in the mountains of Alberta as well.

Nations: CA, US

States/Provinces: AB, CO, ID, MT, NM, NV, OR, UT, WY

USFS Ecoregions (2007) [optional]: 313B:CC, 331J:CC, M313A:CC, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333C:CC, M341B:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A0537 | <i>Pinus aristata</i> Woodland Alliance |
| A0540 | <i>Pinus flexilis</i> Rocky Mountain Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| > | Bristlecone Pine: 209 | Eyre 1980 | |
| >< | Limber Pine: 219 | Eyre 1980 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** F.H. Eyre (1980)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz

Acknowledgments [optional]:

Version Date: 17 Mar 2010

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1. Forest & Woodland

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

1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub (D010)

M026. Intermountain Singleleaf Pinyon - Juniper Woodland

1. Forest & Woodland

1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub

G246. Colorado Plateau-Great Basin Juniper Open Woodland

Type Concept Sentence: This widespread juniper woodland and savanna group occurs in the Colorado Plateau and Great Basin and is characterized by dominance of *Juniperus osteosperma* trees in an open tree canopy with high cover of perennial bunchgrasses and forbs (savannas) or an open to closed canopy often with a shrub understory (woodlands) and the lack of pinyon trees *Pinus edulis* and *Pinus monophylla*, which occur outside the ecological or geographic range of this type.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nc.1. Intermountain Singleleaf Pinyon - Juniper Woodland (M026)

Elcode: G246

***Scientific Name:** *Juniperus osteosperma* Open Woodland Group

***Common (Translated Scientific) Name:** Utah Juniper Open Woodland Group

***Colloquial Name:** Colorado Plateau-Great Basin Juniper Open Woodland

***Type Concept:** This widespread juniper woodland and savanna group occupies dry foothills and sandsheets of the Colorado Plateau and eastern Great Basin from the western Colorado to Nevada and southern Idaho, and south to northwestern New Mexico and northern Arizona. The vegetation ranges from savanna, often with inclusions of denser patches of juniper, to open to dense woodland. The savanna stands are characterized by an open tree canopy of *Juniperus osteosperma* trees with high cover of perennial bunchgrasses and forbs, with *Achnatherum hymenoides*, *Bouteloua gracilis*, *Hesperostipa comata*, *Leymus salinus*, and *Pleuraphis jamesii* being most common. Woodland stands are generally open, but range from an open to closed canopy often with shrubs between trees depending on size of gaps. Characteristic shrubs include *Artemisia nova*, *Artemisia tridentata*, *Cercocarpus intricatus*, *Coleogyne ramosissima*, and *Ephedra* spp. Pinyon trees are typically not present because sites are outside the ecological or geographic range of *Pinus edulis* and *Pinus monophylla*. These juniper woodlands and wooded grasslands are generally found at lower elevations and on more xeric sites than ~Great Basin Pinyon - Juniper Woodland Group (G247)\$\$ or ~Colorado Plateau Pinyon - Juniper Woodland Group (G250)\$\$\$. Elevation ranges from 1500-2300 m. Stands occur on lower mountain slopes, hills, plateaus, basins and more recently on flats where juniper is expanding into semi-desert grasslands and steppe.

***Diagnostic Characteristics:** These woodlands and savannas are characterized by the dominance of *Juniperus osteosperma* in the tree layer and absence of *Pinus monophylla* and *Pinus edulis*. If stand is a savanna, then there is a lush perennial grass layer with scattered *Juniperus osteosperma* trees. Characteristic grasses include *Achnatherum hymenoides*, *Hesperostipa comata*, *Leymus salinus*, and *Pleuraphis jamesii*. *Juniperus occidentalis* is absent (or accidental) as it is restricted to ~Columbia Plateau Western

Juniper Woodland & Savanna Group (G248)\$\$.

***Classification Comments:** *Juniperus californica* savannas in the Central Valley of California and around the fringes of the Mojave Desert are not part of this group. In many cases, they are the result of some disturbance removing an oak component from one of the several oak woodland and savanna systems of California. This group does not extend north into the Columbia Plateau where *Juniperus occidentalis* dominates the ~Columbia Plateau Western Juniper Open Woodland Group (G248)\$\$\$. This Utah juniper savanna and woodland group does not include sparse juniper stands on rock outcrops or woodlands. It corresponds to both the *Juniperus osteosperma*-dominated portion of the *pinyon-juniper savanna* type (low to moderate cover of trees, well-developed graminoid understory, generally a minor shrub component, growing on deeper soils) and well as the *Juniperus osteosperma*-dominated portion of the *persistent pinyon-juniper woodland* type (occurs on rocky uplands with shallow, coarse-textured, and often skeletal soils that support relatively sparse herbaceous cover and rarely burn) described in Romme et al. (2009).

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G250 | Colorado Plateau Pinyon - Juniper Woodland | |
| G247 | Great Basin Pinyon - Juniper Woodland | |

Similar NVC Types General Comments [optional]:**VEGETATION**

Physiognomy and Structure Summary: This group includes both open to closed woodlands dominated by the evergreen sclerophyllous tree *Juniperus osteosperma*, as well as savannas characterized by a lush perennial grass layer (20-90% cover) with tree layer dominated by *Juniperus osteosperma*. Woodland stands may have shrubs present to dense forming a layer.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: The vegetation is typically open savanna, although there may be inclusions of denser patches of juniper. This savanna is typically dominated by *Juniperus osteosperma* trees with high cover of perennial bunchgrasses and forbs, with *Bouteloua gracilis*, *Hesperostipa comata*, *Leymus salinus*, *Pleuraphis jamesii*, *Pleuraphis mutica*, and *Pseudoroegneria spicata* being most common. Pinyon trees are typically not present because sites are outside the ecological or geographic range of *Pinus edulis* and *Pinus monophylla*. Scattered shrubs may be present with low cover relative to the perennial herbaceous layer. Characteristic shrubs include *Artemisia arbuscula*, *Artemisia nova*, *Artemisia tridentata*, *Cercocarpus intricatus*, *Cercocarpus montanus*, *Coleogyne ramosissima*, *Ephedra viridis*, *Mahonia fremontii*, *Purshia tridentata*, and *Symphoricarpos oreophilus*. *Juniperus scopulorum* may codominate or replace *Juniperus osteosperma* in upper elevation stands, near washes, and in the cooler northern extent.

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Const-ancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|------------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Some researchers believe that at one time the juniper savanna was more common than juniper woodlands (West and Young 2000). These savanna communities depend on periodic fire (once every 10-30 years) to maintain the juniper savanna structure by thinning trees that invade the interspaces between larger fire-resistant trees and create woodlands (Wright et al. 1979, West and Young 2000). Juniper trees less than 1.2 m (4 feet) tall are readily killed by fires (Wright et al. 1979). Heavy grazing by livestock reduces the fine fuel layer (grasses), which decreases the fire frequency resulting in increased juniper density (Wright et al. 1979, West and Young 2000). Over the last century, a reduction in fire frequency has caused a conversion of some juniper savanna to juniper woodland as well as invasion of juniper trees from areas of naturally low fire frequency, e.g., rocky ridges into adjacent communities, especially sagebrush steppe (Wright et al. 1979, West and Young 2000).

ENVIRONMENT

Environmental Description: This widespread juniper woodland and savanna group occupies dry foothills and sandsheets of the Colorado Plateau and eastern Great Basin. These wooded grasslands are generally found at lower elevations and on more xeric sites than ~Great Basin Pinyon - Juniper Woodland Group (G247)\$\$ or ~Colorado Plateau Pinyon - Juniper Woodland Group (G250)\$\$\$. Elevation ranges from 1500-2300 m. Stands occur on lower mountain slopes, hills, plateaus, basins and more recently on flats where

juniper is expanding into semi-desert grasslands and steppe. Soils are generally calcareous and alkaline, and often shallow and rocky, but may be acidic.

DISTRIBUTION

***Geographic Range:** This *Juniperus osteosperma* woodland and savanna group occupies dry foothills and sandsheets of the Colorado Plateau and Great Basin from western Colorado to Nevada and southern Idaho, and south to northwestern New Mexico and northern Arizona. Where it occurs in California, it is found only in the far eastern edges of the state within or adjacent to the Great Basin.

Nations: US

States/Provinces: AZ, CA, CO, ID, NM, NV, UT

USFS Ecoregions (2007) [optional]: 313A:CC, 313B:CC, 313C:CC, 313D:CC, 315H:CC, 321A:CC, 322A:CC, 341A:C?, 341D:C?, 341E:C?, 341F:C?, 341G:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CP, 342G:CC, 342J:CC, M313A:CC, M331D:CC, M331E:C?, M331G:CP, M331H:CC, M331I:CP, M331J:CP, M332E:CC, M341A:CC, M341D:CP

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3497 | <i>Juniperus osteosperma</i> / Herbaceous Understory Open Woodland Alliance |
| A3496 | <i>Juniperus osteosperma</i> / Shrub Understory Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--|------------------|------|
| = | Juniper steppe woodland (<i>Juniperus</i> - <i>Artemisia</i> - <i>Agropyron</i>) | Küchler 1964 | |
| = | Utah Juniper Series | Dick-Peddie 1993 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** A.W. Kuchler (1964)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz

Acknowledgments [optional]:

Version Date: 09 Nov 2015

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1. Forest & Woodland

1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub

G248. Columbia Plateau Western Juniper Open Woodland

Type Concept Sentence: This woodland and savanna group is centered on the Columbia Plateau and extends from the eastern foothills of the Cascades and the Modoc Plateau across the northern margin of the Great Basin and is characterized by an open to closed canopy of *Juniperus occidentalis* that is sometime codominated by *Cercocarpus ledifolius* and typically has a shrubby understory dominated by *Artemisia tridentata*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nc.1. Intermountain Singleleaf Pinyon - Juniper Woodland (M026)

Elcode: G248

***Scientific Name:** *Juniperus occidentalis* Open Woodland Group

***Common (Translated Scientific) Name:** Western Juniper Open Woodland Group

***Colloquial Name:** Columbia Plateau Western Juniper Open Woodland

***Type Concept:** This woodland group is found on the Columbia Plateau and extends to the northern and western margins of the Great Basin, from southwestern Idaho, along the eastern foothills of the Cascades, south to the Modoc Plateau of northeastern California. *Juniperus occidentalis* is typically the only tree species with *Pinus monophylla* absent. *Pinus ponderosa* or *Pinus jeffreyi* may be present in higher elevation stands. The tree form of *Cercocarpus ledifolius* may occasionally codominate. In the understory, *Artemisia tridentata* is the most common shrub; others are *Cercocarpus ledifolius* (shrub form), *Chrysothamnus viscidiflorus*, *Ericameria nauseosa*, *Purshia tridentata*, *Ribes cereum*, and *Tetradymia* spp. Graminoids commonly include *Carex filifolia*, *Festuca idahoensis*, *Poa secunda*, and *Pseudoroegneria spicata*. This group occurs over a wide elevation range from under 200 m along the Columbia River in central Washington to over 1500 m in the Blue Mountains. In the middle of its distribution in central Oregon, stands occur on all aspects and slope positions. Older woodlands are generally found in rocky areas where fire frequency is low. Generally soils are medium-textured, with abundant coarse fragments, and derived from volcanic parent materials. Throughout much of its range, fire exclusion and removal of fine fuels by grazing livestock have reduced fire frequency and allowed *Juniperus occidentalis* seedlings to colonize adjacent alluvial soils and expand into the shrub-steppe and grasslands. *Juniperus occidentalis* savanna may occur on the drier edges of woodlands where trees are intermingling with or invading the surrounding grasslands and where local edaphic or climatic conditions favor grasslands over shrublands. Where this group grades into relatively mesic forest or grassland habitats, these woodlands become restricted to rock outcrops or escarpments with excessively drained soils.

***Diagnostic Characteristics:** *Juniperus occidentalis* is the diagnostic and typically dominant species of this woodland and savanna group. This juniper species is largely restricted to the Columbia Plateau ecoregion. *Cercocarpus ledifolius* may codominate some stands. *Pinus monophylla* is not present in this region. The understory of stands included in this group is variable and ranges from perennial grass-dominated tree savannas and open woodlands to open and moderately dense woodlands with a shrub-dominated understory to wooded shrublands with a sparse *Juniperus occidentalis* tree layer (5-10% cover).

***Classification Comments:** This woodland group includes two very different ecological types. There are old-growth *Juniperus occidentalis* woodlands with trees and stands often over 1000 years old, with large, fairly well-spaced trees with rounded crowns. There are also large areas where juniper has expanded into sagebrush steppe and bunchgrass-dominated areas, with young, pointed-crowned trees growing closely together. Currently, these two very different types are about equally distributed across the landscape, with *Juniperus occidentalis* continuing to expand, either from the combination of fire exclusion, past grazing or climate change. *Juniperus occidentalis* has also expanded into *Pinus ponderosa* and *Pinus ponderosa* - *Pinus contorta* stands in central Oregon. These two types correspond to the *Juniperus occidentalis*-dominated portion of the *persistent pinyon-juniper woodlands* (open to denser of tree canopy occurring on shallow rocky soils) and *wooded shrublands* (open tree canopy with well-developed shrub stratum and variable grass-forb cover) described by Romme et al. (2009).

Woodland stands dominated by *Juniperus grandis* (= *Juniperus occidentalis* var. *australis*) occur in the subalpine Sierra Nevada and forested uplands of the northern Coast Ranges of California, southward to San Bernardino, San Gabriel and various desert mountain ranges and westward into Nevada are included in ~Sierra-Cascade Cold-Dry Subalpine Woodland Group (G243)\$.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G243 | Sierra-Cascade Cold-Dry Subalpine Woodland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This woodland and savanna group has an open to dense canopy that includes two very different tree canopy structures: (1) an old-growth *Juniperus occidentalis* woodland with large, fairly well-spaced trees with rounded

crowns, and (2) relatively young, often dense junipers trees with pointed crowns. The structure of the understory ranges from perennial grass-dominated tree savannas and open woodlands to shrublands with a very open tree canopy (wooded shrublands) and open to moderately dense woodlands with a shrub-dominated understory. Cover of understory species sharply declines when tree canopy cover exceeds 40% (Young et al. 1982). Many of the tree savannas have a sparse shrub layer present.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Stands have a typically open tree canopy that is dominated by *Juniperus occidentalis* trees, although *Pinus ponderosa* or *Pinus jeffreyi* may be present in some stands. *Pinus monophylla* is not present in this region. The tree form of *Cercocarpus ledifolius* may occasionally codominate. In the understory, *Artemisia tridentata* is the most common shrub; others are *Purshia tridentata*, *Ericameria nauseosa*, *Cercocarpus ledifolius* (shrub form), *Chrysothamnus viscidiflorus*, *Ribes cereum*, and *Tetradymia* spp. Graminoids commonly include *Carex filifolia*, *Festuca idahoensis*, *Poa secunda*, and *Pseudoroegneria spicata*.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: *Juniperus occidentalis* is a long-lived tree that can exceed 3000 years in age in rocky, fire-protected areas such as along rimrock (Waigchler et al. 2001, Thorne et al. 2007). These fire-sensitive trees do not sprout following fire and are typically killed by moderate to severe fires (Tirmenstein 1999h, Sawyer et al. 2009). Young junipers have thin bark and are readily killed by surface fires (Martin et al. 1978), whereas mature trees with thicker bark are described as "moderately resistant" (Fowells 1965). Reproductive age begins at about 20 years, peaks after 50 years and continues for many years (Miller and Rose 1995, Tirmenstein 1999h). Following stand-replacing fire, recovery time is relatively slow and depends on stand maturity, the size and season of burn, fire severity and juniper mortality, the persistence of the seeds in the seed bank, location of seed source, the presence of animal dispersers such as Clark's nutcrackers, competition from herbaceous species and shrubs, and the amount of post-fire precipitation (Burkhardt and Tisdale 1976, Tirmenstein 1999h). Large burns and long distances from seed sources slow recovery rates because seed dispersal is dependent on water and animals (Tirmenstein 1999h).

ENVIRONMENT

Environmental Description: This woodland group is found on the Columbia Plateau and extends to the northern and western margins of the Great Basin. Elevations range from under 200 m along the Columbia River in central Washington to over 1500 m. In central Oregon, the center of distribution, all aspects and slope positions occur. Old-growth stands are largely restricted to rocky outcrops, upper slopes and ridges, and rims of mesa and canyon that are fire-safe. Younger seral stands have invaded adjacent shrublands and grasslands and now occur on lower slopes, valleys and plains. Soils are generally medium-textured, with abundant coarse fragments, and derived from volcanic parent materials. Where this group grades into relatively mesic forest or grassland habitats, these woodlands become restricted to dry sites such as rock outcrops or escarpments with excessively drained soils. *Soil/substrate/hydrology:* Soils are generally medium-textured, with abundant coarse fragments, and derived from volcanic parent materials. In central Oregon, the center of distribution, all aspects and slope positions occur. Where this group grades into relatively mesic forest or grassland habitats, these woodlands become restricted to dry sites such as rock outcrops or escarpments with excessively drained soils.

DISTRIBUTION

***Geographic Range:** This woodland and savanna group is found along the northern and western margins of the Great Basin, from southwestern Idaho, along the eastern foothills of the Cascades, south to the Modoc Plateau of northeastern California. It also occurs in scattered localities of northern Nevada and south-central Washington.

Nations: US

States/Provinces: CA, ID, NV, OR, WA

USFS Ecoregions (2007) [optional]: 341G:CC, 342B:CC, 342C:CC, 342D:CP, 342H:CC, 342I:CC, 342J:CC, M242C:CC, M261A:C?, M261D:CC, M261E:CP, M261G:CC, M332G:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3500 | <i>Juniperus occidentalis</i> / Herbaceous Understory Open Woodland Alliance |
| A3499 | <i>Juniperus occidentalis</i> / Shrub Understory Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|------------------------------------|---------------------------|------|
| = | <i>Juniperus occidentalis</i> Zone | Franklin and Dyrness 1973 | |
| = | Northern Juniper Woodlands | Holland and Keil 1995 | |
| = | Western Juniper: 238 | Eyre 1980 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** J.F. Franklin and C.T. Dyrness (1973)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz

Acknowledgments [optional]:

Version Date: 09 Nov 2015

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1. Forest & Woodland

1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub

G247. Great Basin Pinyon - Juniper Woodland

Type Concept Sentence: This woodland group occurs on dry mountain ranges of the Great Basin region and eastern foothills of the Sierra Nevada and is characterized by an open to moderately dense tree canopy typically composed of a mix of *Pinus monophylla* and *Juniperus osteosperma*, but either tree species may dominate as long as there is significant presence of *Pinus monophylla* (not accidental) to characterize the stand as a pinyon-juniper stand and not the more xeric, typically lower-elevation *Juniperus osteosperma* woodland and savanna.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nc.1. Intermountain Singleleaf Pinyon - Juniper Woodland (M026)

Elcode: G247

***Scientific Name:** *Pinus monophylla* - *Juniperus osteosperma* Woodland Group

***Common (Translated Scientific) Name:** Singleleaf Pinyon - Utah Juniper Woodland Group

***Colloquial Name:** Great Basin Pinyon - Juniper Woodland

***Type Concept:** This woodland group occurs on dry mountain ranges of the Great Basin region and eastern foothills of the Sierra Nevada, and south in scattered locations throughout southern California. The vegetation is characterized by an open to moderately dense tree canopy typically composed of a mix of *Pinus monophylla* and *Juniperus osteosperma*, but either tree species may dominate as long as there is significant presence of *Pinus monophylla* (not accidental) to characterize the stand as a pinyon-juniper stand and not the more xeric, typically lower-elevation *Juniperus osteosperma* woodland and savanna. In some regions of southern California, *Juniperus osteosperma* is replaced by *Juniperus californica*. *Cercocarpus ledifolius* is a common associate and may occur in tree or shrub form. On the east slope of the Sierra Nevada in California, *Pinus jeffreyi* and *Juniperus grandis* (= *Juniperus occidentalis* var. *australis*) may be minor components of higher elevation stands in these woodlands. The understory layers are variable, but shrubs such as *Artemisia tridentata* frequently form a moderately dense short-shrub layer. Other associated shrubs include *Arctostaphylos patula*, *Artemisia arbuscula*, *Artemisia nova*, *Cercocarpus ledifolius*, *Cercocarpus intricatus*, *Coleogyne ramosissima*, *Juniperus californica*, *Quercus chrysolepis*, *Quercus gambelii*, *Quercus john-tuckeri*, *Quercus turbinella*, and *Yucca brevifolia*. Bunchgrasses such as *Bouteloua gracilis*, *Festuca idahoensis*, *Hesperostipa comata*, *Leymus cinereus* (= *Elymus cinereus*), *Poa fendleriana*, *Poa secunda*, and *Pseudoroegneria spicata* are commonly present and may form an herbaceous layer. These woodlands are typically found at lower elevations, but range from 1500-2600 m. Stands occur on warm, dry sites on mountain slopes, mesas, plateaus and ridges. Severe climatic events occurring during the growing season, such as frosts and drought, are thought to limit the distribution of pinyon-juniper woodlands to relatively narrow altitudinal belts on mountainsides. These woodlands occur at lower

elevation than ~Colorado Plateau Pinyon - Juniper Woodland Group (G250)\$\$ where sympatric.

***Diagnostic Characteristics:** These woodlands are characterized by diagnostic tree species *Pinus monophylla* that forms an open to dense tree layer often with the wider ranging *Juniperus osteosperma* or, less frequently, *Juniperus californica* in southern California. *Juniperus osteosperma* also may dominate woodland stands within the range of *Pinus monophylla* as long as there is significant presence of *Pinus monophylla* (not accidental) to characterize the stand as a pinyon-juniper stand and not the more xeric, typically lower-elevation *Juniperus osteosperma* woodland and savanna. Understory diagnostic species are characteristic of the Great Basin, such as *Arctostaphylos patula*, *Artemisia nova*, *Artemisia tridentata*, *Cercocarpus intricatus*, *Cercocarpus ledifolius*, *Coleogyne ramosissima*, *Purshia stansburiana*, *Purshia tridentata*, *Pleuraphis jamesii*, *Pseudoroegneria spicata*, *Poa secunda*, or *Poa fendleriana*.

***Classification Comments:** This group corresponds to the *Pinus monophylla*-dominated portion of the *persistent pinyon-juniper woodland* type from Romme et al. (2009) that occurs on rocky uplands with shallow, coarse-textured, and often skeletal soils that support relatively sparse herbaceous cover and rarely burn.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G250 | Colorado Plateau Pinyon - Juniper Woodland | |
| G246 | Colorado Plateau-Great Basin Juniper Open Woodland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This vegetation group is characterized by an open to moderately dense, short (2-10 m tall) evergreen needle-leaved or scale-leaved tree canopy. Open to dense shrub and herbaceous layers may be present or absent. Herbaceous layers are usually sparse.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: These woodlands are characterized by an open to moderately dense tree canopy typically composed of a mix of *Pinus monophylla* and *Juniperus osteosperma*, but either tree species may dominate as long as there is significant presence of *Pinus monophylla* (not accidental) to characterize the stand as a pinyon-juniper stand and not the more xeric, typically lower-elevation *Juniperus osteosperma* woodland and savanna. In some regions of southern California, *Juniperus osteosperma* is replaced by *Juniperus californica*. *Cercocarpus ledifolius* is a common associate and may occur in tree or shrub form. On the east slope of the Sierra Nevada in California, *Pinus jeffreyi* and *Juniperus grandis* (= *Juniperus occidentalis* var. *australis*) may be minor components of these woodlands. Understory layers are variable, but shrubs such as *Artemisia tridentata* frequently form a moderately dense short-shrub layer. Other associated shrubs include *Amelanchier utahensis*, *Arctostaphylos patula*, *Arctostaphylos pungens*, *Artemisia arbuscula*, *Artemisia nova*, *Ceanothus greggii*, *Cercocarpus intricatus*, *Coleogyne ramosissima*, *Glossopetalon spinescens*, *Peraphyllum ramosissimum*, *Prunus virginiana*, *Purshia stansburiana*, *Purshia tridentata*, *Quercus chrysolepis*, *Quercus gambelii*, *Quercus john-tuckeri*, *Quercus turbinella*, *Shepherdia rotundifolia*, and *Yucca brevifolia*. Bunchgrasses such as *Bouteloua gracilis*, *Festuca idahoensis*, *Hesperostipa comata*, *Leymus cinereus* (= *Elymus cinereus*), *Poa fendleriana*, *Poa secunda*, and *Pseudoroegneria spicata* are commonly present and may form an herbaceous layer.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: *Pinus monophylla*, *Juniperus osteosperma*, and *Juniperus scopulorum* are slow-growing, long-lived trees (about 650 years for *Juniperus osteosperma*, 300 years for *Juniperus scopulorum*, and 800 years for *Pinus monophylla* although older individuals are known) (Burns and Honkala 1990a, Zlatnik 1999e, Zouhar 2001b, Scher 2002, Sawyer et al. 2009). These trees are killed by severe fire because of thin bark and lack of self-pruning; however, mature trees can survive low-intensity fires (Zouhar 2001b, Sawyer et al. 2009). Although there is variation in fire frequency because of the diversity of site characteristics, stand-replacing fire was uncommon in this ecological system historically, with an average fire-return interval (FRI) of 100-1000 years occurring primarily

during extreme fire behavior conditions and during long droughts (Zouhar 2001b) (Landfire 2007a, BpS model 1210190). Mixed-severity fire (average FRI of 100-500 years) was characterized as a mosaic of replacement and surface fires distributed through stands in patches at a fine scale (<0.1 acre) (LF BpS model 1210190).

ENVIRONMENT

Environmental Description: This woodland group occurs on dry mountain ranges of the Great Basin region and eastern foothills of the Sierra Nevada, and south in scattered locations throughout southern California. It is typically found at lower elevations but ranges from 1500-2600 m. These woodlands occur on warm, dry sites on mountain slopes, mesas, plateaus and ridges. Substrates are variable but are often rocky with shallow soil. Severe climatic events occurring during the growing season, such as frosts and drought, are thought to limit the distribution of pinyon-juniper woodlands to relatively narrow altitudinal belts on mountainsides.

DISTRIBUTION

***Geographic Range:** This woodland group occurs on dry mountain ranges of the Great Basin region and eastern foothills of the Sierra Nevada. It extends southwest in California to the northern Transverse Ranges (Ventura County) and San Jacinto Mountains (Riverside County). Stands do not occur in Mexico.

Nations: US

States/Provinces: CA, ID, NV, UT

USFS Ecoregions (2007) [optional]: 313A:CC, 322A:CC, 322B:CC, 341A:CC, 341D:CC, 341E:CC, 341F:CC, 341G:CC, 342B:CC, 342C:CC, 342D:CC, 342J:CC, M242C:??, M261D:C?, M261E:CC, M261G:CC, M331D:CC, M341A:CC, M341C:CC, M341D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A2109 | <i>Pinus monophylla - Juniperus osteosperma</i> / Herbaceous Understory Open Woodland Alliance |
| A2108 | <i>Pinus monophylla - Juniperus osteosperma</i> / Shrub Understory Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|------------------|------|
| = | PIMO Series | West et al. 1998 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** N.E. West, R.J. Tausch, and P.T. Tueller (1998)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz

Acknowledgments [optional]:

Version Date: 09 Nov 2015

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1. Forest & Woodland

1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub

G249. Intermountain Basins Curl-leaf Mountain-mahogany Woodland & Scrub

Type Concept Sentence: This *Cercocarpus ledifolius*-dominated woodland and shrubland group occurs in hills and mountain ranges of the intermountain western U.S. from the eastern foothills of the Sierra Nevada northeast to the foothills of the Bighorn Mountains and includes both tree and shrub forms of *Cercocarpus ledifolius* with *Artemisia tridentata* ssp. *vaseyana*, *Purshia tridentata*, and species of *Arctostaphylos*, *Ribes*, or *Symphoricarpos* often present to codominant in the shrub layer.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nc.1. Intermountain Singleleaf Pinyon - Juniper Woodland (M026)

Elcode: G249

***Scientific Name:** *Cercocarpus ledifolius* Woodland & Scrub Group

***Common (Translated Scientific) Name:** Curl-leaf Mountain-mahogany Woodland & Scrub Group

***Colloquial Name:** Intermountain Basins Curl-leaf Mountain-mahogany Woodland & Scrub

***Type Concept:** This woodland and shrubland group includes stands dominated by either the tree or shrub form of *Cercocarpus ledifolius*. Scattered junipers or pines may also occur. *Artemisia tridentata ssp. vaseyana*, *Purshia tridentata*, along with species of *Arctostaphylos*, *Ribes*, or *Symphoricarpos* are often present to codominate in the shrub layer. Herbaceous undergrowth is often sparse and dominated by bunchgrasses, usually *Pseudoroegneria spicata* and *Festuca idahoensis*. Stands occur in hills and mountain ranges of the Intermountain West basins from the eastern foothills of the Sierra Nevada northeast to the foothills of the Bighorn Mountains. It typically occurs from 600 m to over 2650 m in elevation on rocky outcrops or escarpments and forms small- to large-patch stands in forested areas. Most stands occur as shrublands on ridges and steep rimrock slopes, but they may be composed of small trees in steppe areas. The tree form of *Cercocarpus ledifolius* is more common in the western range extent. *Cercocarpus ledifolius* is a slow-growing, drought-tolerant species that generally does not resprout after burning and needs the protection from fire that rocky sites provide.

***Diagnostic Characteristics:** *Cercocarpus ledifolius* is the diagnostic and dominant species of this woodland and shrubland group. Scattered pinyon or juniper trees may be present with low cover in woodland stands. If pinyon and juniper trees are codominant, then the stand is pinyon-juniper woodland. In shrubland stands, other shrubs, especially *Artemisia tridentata ssp. vaseyana*, *Purshia tridentata*, or *Symphoricarpos* spp., may be present to codominant.

***Classification Comments:** Within this group, the *Cercocarpus ledifolius* woodland and shrubland alliances are poorly distinguished in the literature, as most authors describe the species as having either a tall-shrub or small-tree growth form within a single association. Some associations may have shrub-dominated stands in one area and also have a woodland physiognomy in another. The woodland physiognomy appears to be more typical, based on available literature. Near the northern edge of its range in Montana and Idaho, *Cercocarpus ledifolius* is described as occurring primarily in the shrub form (Mueggler and Stewart 1980, Tisdale 1986). These northern variants are the only described stands which appear to be clearly distinct from the woodland alliance. The woodland alliance may have a different subspecies (or variety) as a dominant than the shrubland. Woodland stands tend to occur in the more western portion of the species range and are largely attributed to *Cercocarpus ledifolius var. intercedens* (= *Cercocarpus ledifolius var. intermontanus*), whereas *Cercocarpus ledifolius var. ledifolius* is found in the eastern and northern portions of the range and typically occurs as a shrubland.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|-------------------------------|------|
| | | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Structure in this group is variable as *Cercocarpus ledifolius* stands may form an open to dense short-tree canopy (3-5 m tall), a tall-shrub layer (3-4 m tall), or a short-shrub layer (1-2 m tall). Herbaceous layers are variable depending on density of woody canopy and type of substrate.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This group includes both woodlands and shrublands dominated by *Cercocarpus ledifolius*. *Artemisia tridentata ssp. vaseyana*, *Purshia tridentata*, along with *Arctostaphylos patula*, *Holodiscus dumosus*, *Mahonia repens*, and species of *Ribes* or *Symphoricarpos* are often present. Undergrowth is often sparse and dominated by bunchgrasses, usually *Pseudoroegneria spicata* with *Calamagrostis rubescens*, *Festuca idahoensis*, *Leymus salinus*, or *Poa secunda*. Scattered junipers or pines may also occur.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: *Cercocarpus ledifolius* is a slow-growing, drought-tolerant species that can inhabit very poor sites, such as cliffs and outcrops. Stands are often small and clumped near ridgetops. These sites may also afford the species some protection from fire. The

species is highly susceptible to fire damage and generally does not resprout. *Cercocarpus ledifolius* is highly favored by native ungulates for winter range, and many individual shrubs show evidence of highlining by deer or elk.

ENVIRONMENT

Environmental Description: This woodland and shrubland group occurs in hills and mountain ranges of the Intermountain West basins from the eastern foothills of the Sierra Nevada northeast to the foothills of the Bighorn Mountains. It typically occurs from 600 m to over 2650 m in elevation on rocky outcrops or escarpments and forms small- to large-patch stands in forested areas. Most stands occur as shrublands on ridges and steep rimrock slopes, but they may be composed of small trees in steppe areas.

DISTRIBUTION

***Geographic Range:** This woodland and shrubland group occurs in hills and mountain ranges of the Intermountain West basins from the eastern foothills of the Sierra Nevada northeast to the foothills of the Bighorn Mountains.

Nations: US

States/Provinces: CA, CO, ID, MT, NV, OR, UT, WY

USFS Ecoregions (2007) [optional]: 313A:CC, 331A:CC, 331G:CC, 341A:CC, 341B:CP, 341D:CC, 341E:CC, 341F:CC, 341G:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342F:CP, 342G:CC, 342H:CC, 342I:CP, 342J:CC, M242C:CC, M261E:CC, M261G:CC, M331A:C?, M331B:CC, M331D:CC, M331E:CC, M331J:C?, M332A:CC, M332B:C?, M332D:C?, M332E:CC, M332F:CC, M332G:CC, M333D:PP, M341A:CC, M341B:CC, M341C:CC, M341D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3570 | <i>Cercocarpus ledifolius</i> / Herbaceous Understory Woodland Alliance |
| A0586 | <i>Cercocarpus ledifolius</i> / Shrub Understory Woodland Alliance |
| A0828 | <i>Cercocarpus ledifolius</i> Scrub Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---|----------------|------|
| < | Curlleaf Mountain-Mahogany - Bluebunch Wheatgrass (322) | Shiflet 1994 | |
| < | Curlleaf Mountain-Mahogany (415) | Shiflet 1994 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** T.N. Shiflet (1994)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz

Acknowledgments [optional]:

Version Date: 09 Nov 2015

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M027. Southern Rocky Mountain-Colorado Plateau Two-needle Pinyon - Juniper Woodland

1. Forest & Woodland

1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub

G250. Colorado Plateau Pinyon - Juniper Woodland

Type Concept Sentence: This woodland group is centered in the Colorado Plateau region and is composed of *Pinus edulis* often with *Juniperus osteosperma* or *Juniperus scopulorum* codominant in the tree canopy and a variable understory.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nc.2. Southern Rocky Mountain-Colorado Plateau Two-needle Pinyon - Juniper Woodland (M027)

Elcode: G250

***Scientific Name:** *Pinus edulis* - *Juniperus osteosperma* Woodland Group

***Common (Translated Scientific) Name:** Two-needle Pinyon - Utah Juniper Woodland Group

***Colloquial Name:** Colorado Plateau Pinyon - Juniper Woodland

***Type Concept:** This woodland group occurs in dry mountains and foothills of the Colorado Plateau region, including the Western Slope of Colorado and the Wasatch Range, south to the Mogollon Rim, and east into the northwestern corner of New Mexico. These woodlands are typically composed of a mix of *Pinus edulis* and *Juniperus osteosperma* in the tree canopy. Either tree may dominate as long as there is significant presence of *Pinus edulis* (not accidental) to characterize the stand as a pinyon-juniper stand and not the typically more xeric lower-elevation *Juniperus osteosperma* woodland and savanna. *Juniperus scopulorum* may replace *Juniperus osteosperma* and codominate at higher-elevation/less xeric sites.

In the southern portion of the Colorado Plateau in northern Arizona and northwestern New Mexico, hybrids of *Juniperus monosperma* and *Juniperus osteosperma* or both juniper species may dominate or codominate the tree canopy. Understory layers are variable and may be dominated by shrubs, graminoids, or be absent. Associated species include *Arctostaphylos patula*, *Artemisia tridentata*, *Cercocarpus intricatus*, *Cercocarpus montanus*, *Coleogyne ramosissima*, *Purshia stansburiana*, *Purshia tridentata*, *Quercus gambelii*, *Bouteloua gracilis*, *Pleuraphis jamesii*, *Pseudoroegneria spicata*, *Poa secunda*, or *Poa fendleriana*. This group occurs at higher elevations than ~Great Basin Pinyon - Juniper Woodland Group (G247) where sympatric on the Colorado Plateau.

Stands are typically found at lower elevations but ranges from 1500-2440 m. These woodlands occur on warm, dry sites on mountain slopes, mesas, plateaus, and ridges. Severe climatic events occurring during the growing season, such as frosts and drought, are thought to limit the distribution of pinyon-juniper woodlands to relatively narrow altitudinal belts on mountainsides. Soils supporting this group vary in texture, ranging from stony, cobbly, gravelly, or sandy loams to clay loam or clay.

***Diagnostic Characteristics:** *Pinus edulis* and *Juniperus osteosperma* typically codominate the tree canopy in this group. However, either tree may dominate as long as there is significant presence of *Pinus edulis* (not accidental) to characterize the stand as a pinyon-juniper stand and not the typically more xeric lower-elevation *Juniperus osteosperma* woodland and savanna. This group is restricted to where the ranges of *Pinus edulis* and *Juniperus osteosperma* overlap and includes areas where hybrids between *Juniperus monosperma* and *Juniperus osteosperma* or mixed stands occur in northern Arizona and northwestern New Mexico. Understory diagnostic species are more characteristic of the Great Basin than Rocky Mountains, such as *Arctostaphylos patula*, *Artemisia nova*, *Artemisia tridentata*, *Cercocarpus intricatus*, *Coleogyne ramosissima*, *Purshia stansburiana*, *Purshia tridentata*, *Pleuraphis jamesii*, *Pseudoroegneria spicata*, *Poa secunda*, or *Poa fendleriana*.

***Classification Comments:** This group corresponds to the *Pinus edulis*-dominated portion of the *persistent pinyon-juniper woodland* type from Romme et al. (2009) that occurs in the Colorado Plateau on rocky uplands with shallow, coarse-textured, and often skeletal soils that support relatively sparse herbaceous cover and rarely burn. The similar ~Great Basin Pinyon - Juniper Woodland Group (G247)\$\$ is dominated or codominated by *Pinus monophylla*, not *Pinus edulis*. Hybrid pinyon stands are evaluated by overall floristics and environment with *Juniperus monosperma* more prevalent on more xeric, lower-elevation sites. Another similar group, ~Southern Rocky Mountain Pinyon - Juniper Woodland Group (G253)\$\$, that is defined by the range of *Juniperus monosperma* and *Pinus edulis* in the southern Rocky Mountains, transitions into this group in the northwestern corner of New Mexico.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G253 | Southern Rocky Mountain Pinyon - Juniper Woodland | |
| G247 | Great Basin Pinyon - Juniper Woodland | |
| G246 | Colorado Plateau-Great Basin Juniper Open Woodland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These woodlands are characterized by diagnostic tree species *Pinus edulis* and *Juniperus osteosperma* that form an open to dense tree layer 3-10 m tall. Shrub and herbaceous layers are variable and may be sparse to dense or absent. On extremely xeric sites, diagnostic trees species may only attain 2 m in height and have more of shrub form.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This woodland group is dominated by *Pinus edulis* and/or *Juniperus osteosperma* in the tree canopy. *Juniperus scopulorum* may codominate at higher elevations. In the southern portion of the Colorado Plateau in northern Arizona and northwestern New Mexico, hybrids between *Juniperus monosperma* and of *Juniperus osteosperma* or both may dominate or codominate the tree canopy. *Juniperus scopulorum* may codominate with *Juniperus osteosperma* at higher elevations. Understory layers are variable and may be dominated by shrubs, graminoids, or be absent. Associated species include *Arctostaphylos patula*, *Artemisia tridentata*, *Cercocarpus intricatus*, *Cercocarpus montanus*, *Coleogyne ramosissima*, *Purshia stansburiana*, *Purshia tridentata*, *Quercus gambelii*, *Bouteloua gracilis*, *Pleuraphis jamesii*, *Pseudoroegneria spicata*, *Poa secunda*, or *Poa fendleriana*.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Key ecological processes are drought, fire, herbivory, and insect/disease outbreaks. Both *Pinus edulis* and *Juniperus osteosperma* are relatively short (generally <15 m tall), shade-intolerant, drought-tolerant, slow-growing, long-lived trees (especially *Juniperus osteosperma* can reach 650 years old) (Meeuwig and Bassett 1983, Little 1987, Zlatnik 1999e, Romme et al. 2003). Both tree species are also non-sprouting and may be killed by fire (Wright et al. 1979). The effect of a fire on these stands is largely

dependent on the tree height and density, fine fuel load on the ground, weather conditions and season (Wright et al. 1979). Large trees generally survive unless the fire gets into the crown due to heavy fuel loads in the understory. In this system fire acts to open stands, increase diversity and productivity in understory species, and create a mosaic of stands of different sizes and ages across the landscape while maintaining the boundary between woodlands and adjacent shrublands or grasslands (Bradley et al. 1992).

ENVIRONMENT

Environmental Description: This woodland group occurs in dry mountains and foothills of the Colorado Plateau region and is typically found at lower elevations but ranges from 1500-2440 m. These woodlands occur on warm, dry sites on mountain slopes, mesas, plateaus, and ridges. Severe climatic events occurring during the growing season, such as frosts and drought, are thought to limit the distribution of pinyon-juniper woodlands to relatively narrow altitudinal belts on mountainsides. Soils supporting this group vary in texture, ranging from stony, cobbly, gravelly, or sandy loams to clay loam or clay.

DISTRIBUTION

***Geographic Range:** This group occurs on dry mountains and foothills of the Colorado Plateau region from the Western Slope of Colorado to the Wasatch Range, south to the Mogollon Rim, and east into the northwestern corner of New Mexico.

Nations: US

States/Provinces: AZ, CO, NM, UT, WY?

USFS Ecoregions (2007) [optional]: 313A:CC, 313B:CC, 313C:CC, 313D:CC, 315H:CC, 321A:CC, 322A:CC, 341A:CC, 341B:CC, 341C:CC, 341F:CP, 342E:CP, 342G:CC, M313A:CC, M313B:CC, M331D:CC, M331E:CC, M331G:CC, M331H:CC, M331I:CC, M341B:CC, M341C:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3573 | <i>Pinus edulis</i> - <i>Juniperus osteosperma</i> / Shrub Understory Colorado Plateau Woodland & Scrub Alliance |
| A3571 | <i>Pinus edulis</i> - <i>Juniperus osteosperma</i> / Shrub Understory Foothill & Lower Montane Dry-Mesic Woodland Alliance |
| A3572 | <i>Pinus edulis</i> - <i>Juniperus osteosperma</i> / Herbaceous Understory Open Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------------|---|-----------------------|
| 2013-03-14 | G251 <i>Pinus edulis</i> - <i>Juniperus osteosperma</i> Scrub Group | G251 merged into G250 |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------------------|------------------|------|
| = | Colorado Pinyon-Utah Juniper Series | Dick-Peddie 1993 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** D.E. Brown, C.H. Lowe and C.P. Pase (1979)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz

Acknowledgments [optional]: E. Muldavin

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1. Forest & Woodland

1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub

G252. Southern Rocky Mountain Juniper Open Woodland

Type Concept Sentence: This savanna and woodland group occurs along the east and south foothill slopes of the southern Rocky Mountains and into the southeastern Great Plains and includes both open woodland and savanna stands that are dominated by *Juniperus monosperma* in the tree layer with *Pinus edulis* typically absent and a grassy understory dominated by *Bouteloua gracilis*, *Bouteloua curtipendula*, *Bouteloua hirsuta*, *Bouteloua eriopoda*, *Hesperostipa neomexicana*, and *Pleuraphis jamesii*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nc.2. Southern Rocky Mountain-Colorado Plateau Two-needle Pinyon - Juniper Woodland (M027)

Elcode: G252

***Scientific Name:** *Juniperus monosperma* Open Woodland Group

***Common (Translated Scientific) Name:** One-seed Juniper Open Woodland Group

***Colloquial Name:** Southern Rocky Mountain Juniper Open Woodland

***Type Concept:** This savanna and woodland group occurs along the east and south foothill slopes of the southern Rocky Mountains and into the plains of southeastern Colorado and northern and central New Mexico, south to the east side of the Sacramento Mountains and the Tularosa Basin, and east into the panhandles of Oklahoma and Texas. This group includes both open woodland and savanna stands that are dominated by *Juniperus monosperma* in the tree layer. Savanna stands typically have widely spaced, mature (>150 years old) juniper trees with lush perennial grasses in between trees, but may have inclusions (patches) of denser juniper woodlands. *Juniperus monosperma* is the dominant tree (2-10 m tall) with an occasional *Pinus edulis* tree (usually growing within the canopy of *Juniperus monosperma*). *Juniperus scopulorum* may dominate or codominate at higher elevations. Grass species are similar to those found in shortgrass prairie of the western Great Plains with *Bouteloua gracilis*, *Bouteloua curtipendula*, *Bouteloua hirsuta*, *Bouteloua eriopoda*, *Hesperostipa neomexicana*, and *Pleuraphis jamesii* common. Shrubs are typically scattered and sparse, but may include *Quercus x pauciloba* and *Gutierrezia sarothrae*. In addition, succulents such as *Yucca glauca*, *Yucca baccata*, *Opuntia phaeacantha*, and *Opuntia polyacantha* are typically present. Woodland stands may have a more developed shrub layer characterized by *Atriplex confertifolia*, *Artemisia bigelovii*, *Artemisia tridentata*, *Cercocarpus montanus*, *Ericameria nauseosa*, *Fallugia paradoxa*, *Forestiera pubescens*, *Krascheninnikovia lanata*, *Ribes cereum*, or *Quercus turbinella*. Stands occur on all aspects of lower hillslopes, alluvial terraces and plains. This woodland phase is often found on steeper, colluvial slopes of escarpments, and occasionally on lower toeslopes and valley bottoms. Soils range from deep loams to shallow, gravelly to rocky sites. This group has expanded into adjacent grasslands and become denser during the last century. It is best represented just below the lower elevational range of ~Southern Rocky Mountain Pinyon - Juniper Woodland Group (G253)\$\$ and often intermingles with grasslands and shrublands.

***Diagnostic Characteristics:** *Juniperus monosperma* dominates the sparse to moderately dense tree layer in this woodland and savanna group. Dominant and diagnostic understory species are similar to those found in shortgrass prairie with *Bouteloua gracilis*, *Bouteloua curtipendula*, *Bouteloua hirsuta*, *Bouteloua eriopoda*, *Hesperostipa neomexicana*, and *Pleuraphis jamesii* common. Shrubs are typically scattered and sparse, but may include *Quercus x pauciloba*, *Yucca glauca*, and *Gutierrezia sarothrae*. Woodland stands may have a more developed shrub layer characterized by *Atriplex confertifolia*, *Artemisia tridentata*, *Cercocarpus montanus*, *Ericameria nauseosa*, *Fallugia paradoxa*, *Forestiera pubescens*, *Krascheninnikovia lanata*, *Ribes cereum*, or *Quercus turbinella*.

***Classification Comments:** This group corresponds to the *Juniperus monosperma*-dominated portion of the *pinyon-juniper savanna* type described by Romme et al. (2009) with low to moderate cover of trees, well-developed graminoid understory, generally a minor shrub component, growing on deeper soils most abundantly in areas with a large proportion of growing season precipitation. Denser woodland areas are the result of infilling of juniper trees and small-patch inclusions of the denser juniper occurring on shallow rocky soils that resemble the *persistent pinyon-juniper woodland* type from Romme et al. (2009).

The similar ~Southern Rocky Mountain Pinyon - Juniper Woodland Group (G253)\$\$ usually occurs at higher elevations and has *Pinus edulis* present and either dominant or codominant. This group transitions into ~Madrean Pinyon - Juniper Woodland Group (G200)\$\$ and ~Madrean Juniper Open Woodland Group (G487)\$\$ to the south. These groups are distinguished by the

presence of other Madrean tree species, such as *Juniperus coahuilensis*, *Juniperus deppeana*, *Juniperus pinchotii*, *Pinus cembroides*, *Pinus discolor*, or evergreen oaks such as *Quercus grisea* or *Quercus mohriana* along with Madrean grasses and forbs.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G487 | Madrean Juniper Open Woodland | |
| G200 | Madrean Pinyon - Juniper Woodland | |
| G253 | Southern Rocky Mountain Pinyon - Juniper Woodland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group encompasses savanna that has widely spaced, short (2-10 m tall), mature (>150 years old) juniper trees and occasionally a *Pinus edulis* tree. The open to dense herbaceous layer typically dominates the vegetation and is composed of perennial grasses. These savannas have inclusions of denser juniper stands, especially near rock outcrops, that are somewhat fire-protected, and have greatly expanded into adjacent plains during the last century. Older established stands have widely species large, mature, rounded-crown trees, whereas more recent invasive juniper savanna stands are characterized by younger, shorter (<3 m tall, pointed-crown juniper trees.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This group is best described as a savanna that has widely spaced, mature (>150 years old) juniper trees with lush perennial grasses in between trees, but may have inclusions (patches) of denser juniper woodlands. *Juniperus monosperma* is the dominant tree (2-10 m tall) with an occasional *Pinus edulis* tree. *Juniperus scopulorum* may dominate or codominate at higher elevations. Grass species are similar to those found in Shortgrass Prairie in the western Great Plains. *Bouteloua gracilis*, *Bouteloua curtipendula*, and *Pleuraphis jamesii* are most common, with *Hesperostipa comata*, *Koeleria macrantha*, *Lycurus phleoides* and *Muhlenbergia torreyi* often present. *Bouteloua eriopoda* is a more common grass in the southern extent, and *Andropogon hallii* and *Muhlenbergia pungens* are characteristic of deep sandy sites. Shrubs are poorly represented or absent; the ruderal subshrub *Gutierrezia sarothrae* and succulents such as *Cylindropuntia imbricata*, *Opuntia phaeacantha*, *Opuntia polyacantha*, *Rhus trilobata*, *Yucca baccata*, and *Yucca glauca* are the most frequent. Forbs such as *Astragalus* spp., *Cryptantha cinerea* var. *jamesii* (= *Cryptantha jamesii*), *Eriogonum jamesii*, *Erigeron divergens*, *Hymenopappus filifolius*, *Ipomopsis multiflora*, *Mentzelia* spp., and *Penstemon* spp. are also common.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: *Juniperus monosperma* is a long-lived, slow-growing, drought-tolerant small tree (3-12 m in height) that also occurs as a tall shrub (Johnson 2002). It is more drought-tolerant than *Pinus edulis* and often occurs without pinyon on more xeric, lower elevation sites (Johnson 2002). It is also non-sprouting and may be killed by fire (Wright et al. 1979). Juniper stands at cooler, higher elevation sites typically occur on xeric microsites that are too arid for pinyon or on post-disturbance sites such as where extended drought or ips beetle (*Ips confusus*) epidemics have eliminated pinyon from mixed pinyon-juniper stands. In this situation junipers and shrubs may act as nurse plants providing shade for pinyon germination and re-establishment, converting a juniper woodland to pinyon-juniper woodland.

Within a given region, the density of trees, both historically and currently, is strongly related to topo-edaphic gradients. Less steep sites, especially those with finer-textured soils, are where savannas, grasslands, and shrub-steppes have occurred in the past. Juniper stands on these gentler slopes may have been larger but more savanna-like, with very open upper canopy and high grass production. Expansion of juniper into previously non-wooded areas occurred prior to European settlement on some sites, although this expansion may have been more extensive in the 20th century versus the previous. However, loss of juniper from marginal sites also occurred historically and recently in some areas (Romme et al. 2009). Especially in areas in which trees were historically rare or absent, there have been type conversions such that the historical condition is unidentifiable/replaced today. An important result of expansion into formerly non-wooded areas in many regions is that formerly heterogeneous mosaics of small patches of woodland,

shrubland, and grassland are becoming more homogeneous as trees become established in the shrubland and grassland patches (Romme et al. 2009).

ENVIRONMENT

Environmental Description: This woodland and savanna group occupies the lower and warmest elevations, growing from 1370 to 2300 m in a semi-arid climate, primarily along the east and south slopes of the southern Rocky Mountains extending south and east into the western Great Plains. Stands occur on all aspects of lower hillslopes, alluvial terraces and plains. This woodland phase is often found on steeper, colluvial slopes of escarpments, dipslopes of moderate slope, and occasionally on lower toeslopes and valley bottoms. Soils range from deep loams to shallow, gravelly to rocky sites. Slope sites tend to be rocky and gravelly, while terraces and plains sites less so, sometimes occurring on deeper loamy soils.

DISTRIBUTION

***Geographic Range:** This savanna and woodland group occurs along the east and south foothill slopes of the southern Rocky Mountains and into the plains in southeastern Colorado and northern and central New Mexico, south to the east side of the Sacramento Mountains and the Tularosa Basin, and extending east into the panhandles of Oklahoma and Texas.

Nations: US

States/Provinces: CO, NM, OK, TX

USFS Ecoregions (2007) [optional]: 315A:CC, 315B:CC, 315H:CC, 321A:PP, 331B:CC, 331C:C?, 331I:CC, 331J:CC, M313B:CC, M331F:CC, M331G:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3575 | <i>Juniperus monosperma</i> / Herbaceous Understory Open Woodland Alliance |
| A3574 | <i>Juniperus monosperma</i> / Shrub Understory Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--|------------------|------|
| = | One-seed Juniper Series | Dick-Peddie 1993 | |
| = | One-seed Juniper-Rocky Mountain Juniper Series | Dick-Peddie 1993 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** W.A. Dick-Peddie (1993)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz and E. Muldavin

Acknowledgments [optional]: E. Muldavin

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1. Forest & Woodland

1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub

G253. Southern Rocky Mountain Pinyon - Juniper Woodland

Type Concept Sentence: This pinyon - juniper woodland group occurs in the southern Rocky Mountains on dry mountains and foothills in southern Colorado east of the Continental Divide and is characterized by *Pinus edulis* that dominates or codominates the tree canopy with *Juniperus monosperma*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nc.2. Southern Rocky Mountain-Colorado Plateau Two-needle Pinyon - Juniper Woodland (M027)

Elcode: G253

***Scientific Name:** *Pinus edulis* - *Juniperus monosperma* - *Juniperus scopulorum* Woodland Group

***Common (Translated Scientific) Name:** Two-needle Pinyon - One-seed Juniper - Rocky Mountain Juniper Woodland Group

***Colloquial Name:** Southern Rocky Mountain Pinyon - Juniper Woodland

***Type Concept:** This southern Rocky Mountain woodland group occurs on dry mountains and foothills in southern Colorado east of the Continental Divide, in mountains and plateaus of northern and central New Mexico, and extends east on breaks in the southeastern Great Plains. The vegetation is characterized by *Pinus edulis* that dominates or codominates the tree canopy with *Juniperus monosperma*. *Juniperus monosperma* may dominate stands provided *Pinus edulis* is present with significant cover. *Juniperus scopulorum* may codominate or replace *Juniperus monosperma* at higher elevations. Stands with mixed *Juniperus osteosperma* are representative of the Colorado Plateau and are not included in this group. In southern transitional areas with ~Madrean Pinyon - Juniper Woodland Group (G200)\$\$ in central New Mexico, *Juniperus deppeana* may be present but not codominant. Understory layers are variable and may be dominated by shrubs, graminoids, or be absent. Associated species are generally more typical of the southern Rocky Mountains than the Colorado Plateau. Common species include *Artemisia bigelovii*, *Cercocarpus montanus*, *Fallugia paradoxa*, *Quercus gambelii*, *Quercus x pauciloba*, and grasses such as *Achnatherum nelsonii*, *Achnatherum scribneri*, *Bouteloua gracilis*, *Festuca arizonica*, or *Pleuraphis jamesii*. Stands in this group are found on mountain slopes, mesas, plateaus, and ridges. Severe climatic events occurring during the growing season, such as frosts and drought, are thought to limit the distribution of pinyon-juniper woodlands to relatively narrow altitudinal belts on mountainsides. Elevationally, stands typically occur above the *Juniperus monosperma* only-dominated woodlands and savannas. Stands range from near 1500 to 2900 m with high-elevation stands restricted to relatively warm, dry ridges and south and west aspects. Soils vary in texture, ranging from stony, cobbly, gravelly sandy loams to clay loam or clay.

***Diagnostic Characteristics:** *Pinus edulis* dominates or codominates the tree canopy with *Juniperus monosperma* in this group. *Juniperus monosperma* may dominate stand as long as *Pinus edulis* is present with significant cover. It is restricted to where the ranges of *Pinus edulis* and *Juniperus monosperma* overlap.

***Classification Comments:** This group corresponds to the *Pinus edulis*-dominated or -codominated portion of the *persistent pinyon-juniper woodland* type from Romme et al. (2009) that occurs in the southern Rocky Mountains east of the Continental Divide on rocky uplands with shallow, coarse-textured, and often skeletal soils that support relatively sparse herbaceous cover and rarely burn. The similar ~Southern Rocky Mountain Juniper Open Woodland Group (G252)\$\$ occurs at lower elevations and typically has a strong perennial grass-dominated understory and *Pinus edulis* is absent or accidental. This group transitions into ~Madrean Pinyon - Juniper Woodland Group (G200)\$\$ and is distinguished by Madrean tree species *Juniperus coahuilensis*, *Juniperus deppeana*, *Juniperus pinchotii*, *Pinus cembroides*, *Pinus discolor*, or evergreen oaks such as *Quercus grisea* or *Quercus mohriana*.

Another similar group, ~Colorado Plateau Pinyon - Juniper Woodland Group (G250)\$\$, that is defined by the intersection of the ranges of *Juniperus osteosperma* and *Pinus edulis* on the Colorado Plateau, transitions into the Southern Rocky Mountain type in the northwestern corner of New Mexico and southwestern Colorado. Stands in northern Arizona with both *Juniperus monosperma* and *Juniperus osteosperma* are included in the Colorado Plateau group.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G200 | Madrean Pinyon - Juniper Woodland | |
| G252 | Southern Rocky Mountain Juniper Open Woodland | |
| G250 | Colorado Plateau Pinyon - Juniper Woodland | |

Similar NVC Types General Comments [optional]:**VEGETATION**

Physiognomy and Structure Summary: These woodlands are characterized by diagnostic tree species *Pinus edulis* and *Juniperus monosperma* that form an open to dense tree layer 3-10 m tall. Shrub and herbaceous layers are variable and may be sparse to dense or absent.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This southern Rocky Mountain woodland group is characterized by a relatively short (3-10 m tall), open to moderately dense tree canopy dominated by *Pinus edulis* and/or *Juniperus monosperma*. *Juniperus scopulorum* may codominate or replace *Juniperus monosperma* at higher elevations. *Juniperus monosperma* may dominate stands as long as *Pinus edulis* is present with significant cover. Stands with *Juniperus osteosperma* are representative of the Colorado Plateau and are not included in this group. In southern transitional areas with ~Madrean Pinyon - Juniper Woodland Group (G200)\$\$ in central New Mexico, *Juniperus deppeana* may be present but not dominant. Understory layers are variable and may be dominated by shrubs, graminoids, or be absent. Associated species are generally more typical of the southern Rocky Mountains or Great Plains than the Colorado Plateau. Common species include *Artemisia bigelovii*, *Atriplex canescens*, *Cercocarpus montanus*, *Ericameria nauseosa*, *Fallugia paradoxa*, *Quercus gambelii*, *Quercus x pauciloba*, *Quercus turbinella*, *Ribes cereum*, and grasses such as *Achnatherum nelsonii*, *Achnatherum scribneri*, *Andropogon hallii*, *Bouteloua gracilis*, *Festuca arizonica*, *Hesperostipa comata*, *Hesperostipa neomexicana*, or *Pleuraphis jamesii*. Many different foothill and lower montane forbs may be present, but generally with low cover.

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Both *Pinus edulis* and *Juniperus monosperma* are relatively short (generally <15 m tall), shade-intolerant, drought-tolerant, slow-growing, long-lived trees (Meeuwig and Bassett 1983, Little 1987, Anderson 2002, Johnson 2002, Romme et al. 2003). Both tree species are also non-sprouting and may be killed by fire (Wright et al. 1979).

Pinyon-juniper woodlands are influenced by drought, fires, grazing, and insect-pathogen outbreaks (West 1999b). Stands vary considerably in appearance and composition, both elevationally and geographically. Juniper tends to be more abundant at the warmer/drier lower elevations, pinyon tends to be more abundant at the higher elevations, and the two species share dominance within a broad middle-elevation zone (Woodin and Lindsey 1954).

The effect of a fire on a stand is largely dependent on the tree height and density, fine fuel load on the ground, weather conditions, and season (Dwyer and Pieper 1967, Wright et al. 1979). Some large trees may survive unless the fire gets into the crown due to heavy fuel loads in the understory or extreme fire conditions.

There are many insects, pathogens, and plant parasites that attack pinyon and juniper trees (Meeuwig and Bassett 1983, Gottfried et al. 1995, Rogers 1995, Weber et al. 1999). For pinyon and juniper, there are at least seven insects, plus blackstain root-rot (*Leptographium wageneri*) and mistletoes *Phoradendron juniperinum* and *Arceuthobium divaricatum*. Both mistletoes reduce vigor and cause occasional dieback but rarely cause mortality (Meeuwig and Bassett 1983). The insects are normally present in these woodland stands, and during drought-induced water stress periods, outbreaks may cause local to regional mortality (Wilson and Tkacz 1992, Gottfried et al. 1995, Rogers 1995). Most insect-related pinyon mortality in the West is caused by pinyon ips beetle (*Ips confusus*) (Rogers 1993). Pinyons cannot repel pinyon ips beetles when weakened by drought and many are killed.

ENVIRONMENT

Environmental Description: This southern Rocky Mountain woodland group occurs on dry mountains and foothills in southern Colorado east of the Continental Divide, in mountains and plateaus of northern New Mexico, and extends east into the southeastern Great Plains on limestone and shale breaks, escarpments and hills. Stands are found on warm, dry sites on mountain slopes, mesas, plateaus, and ridges. Elevations range from near 1500 to 2900 m with high-elevation stands restricted to relatively warm, dry ridges

and south and west aspects. Lower-elevation stands are often restricted to cooler north- and east-facing slopes. Severe climatic events occurring during the growing season, such as frosts and drought, are thought to limit the distribution of pinyon-juniper woodlands to relatively narrow altitudinal belts on a given mountainside. Soils vary in texture ranging from stony, cobbly, gravelly or sandy loams to clay loam or clay.

DISTRIBUTION

***Geographic Range:** This southern Rocky Mountain woodland group occurs on dry mountains and foothills in southern Colorado east of the Continental Divide, in mountains and plateaus of northern and central New Mexico, and extends east to breaks in the southeastern Great Plains. It extends south to the Sacramento Mountains, especially the eastern side. The western side has Madrean elements (*Quercus grisea*) and may be classified as Madrean woodland.

Nations: US

States/Provinces: CO, NM, OK

USFS Ecoregions (2007) [optional]: 313B:CC, 315A:CC, 315B:CC, 315H:CC, 321A:CC, 322B:CC, 331B:CC, 331H:CP, 331I:CC, 331J:CC, M313B:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3577 | <i>Pinus edulis</i> - <i>Juniperus monosperma</i> / Herbaceous Understory Open Woodland Alliance |
| A3576 | <i>Pinus edulis</i> - <i>Juniperus monosperma</i> / Shrub Understory Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--|------------------|--|
| > | Pinyon - Juniper: 239 | Eyre 1980 | |
| > | Juniper - Pinyon Pine Woodland (504) | Shiflet 1994 | |
| < | Colorado Pinyon-Rocky Mountain Juniper Series | Dick-Peddie 1993 | |
| < | Colorado Pinyon-One-seed Juniper Series | Dick-Peddie 1993 | |
| < | <i>Juniperus monosperma</i> / <i>Oryzopsis micrantha</i> Plant Community | Shaw et al. 1989 | <i>Pinus edulis</i> present to codominant. |

AUTHORSHIP

***Primary Concept Source [if applicable]:** W.A. Dick-Peddie (1993)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz

Acknowledgments [optional]: E. Muldavin

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1.B.2.Nd. Vancouverian Forest & Woodland (D192)

M886. Southern Vancouverian Dry Foothill Forest & Woodland

1. Forest & Woodland

1.B.2.Nd. Vancouverian Forest & Woodland

G206. Cascadian Oregon White Oak - Conifer Forest & Woodland

Type Concept Sentence: This narrowly restricted group appears at or near lower treeline in foothills of the eastern Cascades in Washington and Oregon, within 65 km (40 miles) of the Columbia River Gorge and in the adjacent Columbia Plateau ecoregion and is characterized by a mix of *Quercus garryana* and *Pinus ponderosa* or *Pseudotsuga menziesii*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nd.1. Southern Vancouverian Dry Foothill Forest & Woodland (M886)

Elcode: G206

***Scientific Name:** *Quercus garryana* - *Pinus ponderosa* - *Pseudotsuga menziesii* Forest & Woodland Group

***Common (Translated Scientific) Name:** Oregon White Oak - Ponderosa Pine - Douglas-fir Forest & Woodland Group

***Colloquial Name:** Cascadian Oregon White Oak - Conifer Forest & Woodland

***Type Concept:** This narrowly restricted group appears at or near lower treeline in foothills of the eastern Cascades in Washington and Oregon, within 65 km (40 miles) of the Columbia River Gorge. It also appears in the adjacent Columbia Plateau ecoregion. Most occurrences of this group are dominated by a mix of *Quercus garryana* and *Pinus ponderosa* or *Pseudotsuga menziesii*. Isolated, taller *Pinus ponderosa* or *Pseudotsuga menziesii* over *Quercus garryana* trees characterize parts of this group. Clonal *Quercus garryana* can create dense patches across a grassy landscape or can dominate open woodlands or even savannas. The understory may include dense stands of shrubs or, more often, be dominated by grasses, sedges or forbs. Shrub-steppe shrubs may be prominent in some stands and create a distinct tree / shrub / sparse grassland habitat, including *Artemisia nova* (in Oregon only),

Artemisia tridentata, *Chrysothamnus viscidiflorus*, and *Purshia tridentata*. Mesic sites have an open to closed sodgrass understory dominated by *Calamagrostis rubescens*, *Carex geyeri*, *Carex inops*, *Carex rossii*, or *Elymus glaucus*. Drier savanna and woodland understories typically contain bunchgrass steppe species such as *Festuca idahoensis* or *Pseudoroegneria spicata*. Common exotic grasses that often appear in high abundance are *Bromus tectorum* and *Poa bulbosa*. Disjunct occurrences in the Klamath Mountains and southernmost Cascades typically have high cover of sagebrush and bitterbrush in the understory, along with other shrubs. In the Columbia River Gorge, this group appears as small to large patches in transitional areas in the Little White Salmon and White Salmon river drainages in Washington and Hood River, Rock Creek, Moiser Creek, Mill Creek, Threemile Creek, Fifteen Mile Creek, and White River drainages in Oregon. *Quercus garryana* can create dense patches often associated with grassland or shrubland balds within a closed *Pseudotsuga menziesii* forest landscape. Commonly the understory is shrubby and composed of *Ceanothus integerrimus*, *Holodiscus discolor*, *Symphoricarpos albus*, and *Toxicodendron diversilobum*. These woodlands occur at the lower treeline/ecotone between *Artemisia* spp. or *Purshia tridentata* steppe or shrubland and *Pinus ponderosa* and/or *Pseudotsuga menziesii* forest or woodland. Elevations range from 460 to 1920 m. Sites are typically warm with southern exposures with seasonal soil drought or desiccating winds. Substrates usually have bedrock, sand, or pumice soils which are excessively well-drained. Fire plays an important role in creating vegetation structure and composition in this habitat. Decades of fire suppression have led to invasion by *Pinus ponderosa* along lower treeline and by *Pseudotsuga menziesii* in the gorge and other oak patches on xeric sites in the east Cascade foothills. In the past, most of the habitat experienced frequent low-severity fires that maintained woodland or savanna conditions. The mean fire-return interval is 20 years, although variable. Soil drought plays a role, maintaining an open tree canopy in part of this dry woodland habitat.

Westside: This group also occurs on the west side of the mountain ranges from the Cascades to the North Coast Ranges in California. It is limited to the southern portions of the North Pacific region where it occurs in southwestern British Columbia, in the Puget Trough and Willamette Valley south into the Klamath Mountains and into northern California, southward through the lower southern Cascades and western Modoc Plateau and the middle and inner North Coast Ranges into Mendocino County. The vegetation ranges from savanna and woodland to forest dominated by deciduous broadleaf trees, mostly *Quercus garryana*. Codominance by the evergreen conifer *Pseudotsuga menziesii* is common, and *Pinus ponderosa* is important in some stands. In the south, common associates also include *Quercus kelloggii* and *Arbutus menziesii*. The predominant oaks with the higher frequency fires include *Quercus kelloggii* and *Quercus garryana*, with *Quercus garryana* var. *garryana* codominant in the central and northern Coast Ranges, Klamath Mountains and Modoc Plateau. However, *Quercus garryana* var. *fruticosa* (= var. *breweri*) often codominates in the northwestern Coast Ranges. More isolated patches of shrubby, clonal *Quercus garryana* var. *semota* (similar to but apparently distinct from var. *fruticosa*) occur farther south into the Sierra Nevada southward to the Paiute and Tehachapi mountains (southern branches of the Sierra Nevada), but these are without *Pinus ponderosa* or *Pseudotsuga menziesii* and appear to behave more as montane chaparral stands. The perennial bunchgrass component includes *Danthonia californica* (close to the coast), *Elymus glaucus*, *Festuca californica*, and *Festuca idahoensis*. A variety of native forbs also occur. Other characteristic species include *Ceanothus cuneatus*, *Juniperus occidentalis*, and *Toxicodendron diversilobum*. Succession in the absence of fire tends to favor increased shrub dominance in the understory, increased tree density, and increased importance of conifers, with the end result being conversion to a conifer forest. This group merges into ~Californian Broadleaf Forest & Woodland Group (G195)\$. This group occurs as both small patch and large patch in its dynamics. This west side version of this group is associated with dry, predominantly low-elevation sites and/or sites that experienced frequent presettlement fires. Elevations range from 600-1600 m (1800-4850 feet) on steep, rocky slopes where snow and cold temperatures occur. In the Willamette Valley, soils are mesic yet well-drained, and the stands are mostly large patch. In the Puget Lowland and Georgia Basin, this group is primarily found on dry sites, typically either shallow bedrock soils or deep gravelly glacial outwash soils. It occurs on various soils in the interior valleys of the Klamath Mountains, and on shallow soils of "bald hill" toward the coast. Even where more environmentally limited, the group is strongly associated with a historic low-severity fire regime. With frequent annual burning (at lower elevations and on warmer sites), this group is an open to dense woodland of large oaks with well-developed grassy understories of native perennial bunchgrass. Succession in the absence of fire tends to favor increased shrub dominance in the understory, increased tree density, and increased importance of conifers, with the end result being conversion to a conifer forest. This group merges into ~Californian Broadleaf Forest & Woodland Group (G195)\$. This group occurs as both small patch and large patch in its dynamics.

***Diagnostic Characteristics:** Forests and woodlands dominated by a mix of *Quercus garryana* and *Pinus ponderosa* or *Pseudotsuga menziesii*. Shrubs and herbaceous species are Intermountain Basin species, diagnostic of the Columbia Plateau and Great Basin or Rocky Mountains species. Bakker and Colasurdo (2010) concluded that *Quercus garryana* tree densities in all size classes were higher in eastern Washington than on western sites. Westside: Dry low-elevation stands dominated by *Quercus garryana* which can have some *Arbutus menziesii*, *Quercus chrysolepis*, or *Quercus kelloggii*. *Pseudotsuga menziesii* is common, and *Pinus ponderosa* occurs occasionally but is not diagnostic. Other characteristic species include *Ceanothus cuneatus*, *Juniperus occidentalis*, *Symphoricarpos albus*, and *Toxicodendron diversilobum*.

***Classification Comments:** This group is a matrix type with stands of either pure *Pinus ponderosa*, pure *Quercus garryana*, or mixed *Pinus ponderosa* - (*Pseudotsuga menziesii*) - *Quercus garryana*. The description of ~*Pinus ponderosa* - *Quercus garryana* / *Arctostaphylos viscida* / *Festuca californica* Woodland (CEGL000880)\$ indicates that it is a transitional type or a clustering of plots

from the interbasins (*Festuca idahoensis* and *Pseudoroegneria spicata*) and California (*Festuca californica*, *Toxicodendron diversilobum*).

Quercus garryana var. *fruticosa* (and other shrub-form varieties) are not included in this group; in California, they are considered part of montane deciduous scrub, occurring at higher elevations than the tree-form *Quercus garryana* var. *garryana*.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G344 | Californian Montane Conifer Forest & Woodland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Medium-tall woodlands and forests often with emergent taller conifer trees. Undergrowth of medium-height shrubs and an open layer of grasses and or forbs is typical. Also medium-height open-canopy deciduous broadleaf woodlands with grassy understory.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Most occurrences of this group are dominated by *Quercus garryana* with and without *Pinus ponderosa* or *Pseudotsuga menziesii*. Isolated, taller *Pinus ponderosa* or *Pseudotsuga menziesii* over *Quercus garryana* trees characterize part of this group. Clonal *Quercus garryana* can create dense tree or tall-shrub patches across a grassy landscape or can dominate open woodlands or even savannas. The understory may include dense stands of shrubs or, more often, be dominated by grasses, sedges or forbs. Shrub-steppe shrubs may be prominent in some stands and create a distinct tree / shrub / sparse grassland habitat, including *Purshia tridentata*, *Artemisia tridentata*, *Artemisia nova*, and *Chrysothamnus viscidiflorus*. Understories are generally dominated by herbaceous species, especially graminoids. Mesic sites have an open to closed sodgrass understory dominated by *Calamagrostis rubescens*, *Carex geyeri*, *Carex rossii*, *Carex inops*, or *Elymus glaucus*. Drier savanna and woodland understories typically contain bunchgrass steppe species such as *Festuca idahoensis* or *Pseudoroegneria spicata*. Common exotic grasses that often appear in high abundance are *Bromus tectorum* and *Poa bulbosa*. These woodlands occur at the lower treeline/ecotone between *Artemisia* spp. or *Purshia tridentata* steppe or shrubland and *Pinus ponderosa* and/or *Pseudotsuga menziesii* forests or woodlands. In the Columbia River Gorge, this group appears as small to large patches in transitional areas in the Little White Salmon and White Salmon river drainages in Washington and Hood River, Rock Creek, Moiser Creek, Mill Creek, Threemile Creek, Fifteen Mile Creek, and White River drainages in Oregon. *Quercus garryana* can create dense patches often associated with grassland or shrubland balds within a closed *Pseudotsuga menziesii* forest landscape. Commonly the understory is shrubby and composed of *Ceanothus integerrimus*, *Holodiscus discolor*, *Symphoricarpos albus*, and *Toxicodendron diversilobum*. Fire plays an important role in creating vegetation structure and composition in this habitat. Decades of fire suppression have led to invasion by *Pinus ponderosa* along lower treeline and by *Pseudotsuga menziesii* in the gorge and other oak patches on xeric sites in the east Cascade foothills.

Westside floristics: With frequent annual burning (at lower elevations and on warmer sites), this group is an open to dense woodland of large oaks with well-developed grassy understories of native perennial bunchgrass. The perennial bunchgrass component includes *Danthonia californica* (close to the coast), *Elymus glaucus*, *Festuca californica*, and *Festuca idahoensis*. A variety of native forbs also occur. Other characteristic species include *Ceanothus cuneatus*, *Juniperus occidentalis*, and *Toxicodendron diversilobum*. The predominant oaks with the higher frequency fires include *Quercus kelloggii* and *Quercus garryana*, with *Quercus garryana* var. *garryana* codominant in the central and northern Coast Ranges. Succession in the absence of fire tends to favor increased shrub dominance in the understory, increased tree density, and increased importance of conifers, with the end result being conversion to a conifer forest. The vegetation ranges from savanna and woodland to forest dominated by deciduous broadleaf trees, mostly *Quercus garryana*. Codominance by the evergreen conifer *Pseudotsuga menziesii* is common, and *Pinus ponderosa* is important in some stands. In the south, common associates also include *Arbutus menziesii* and *Quercus kelloggii*.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Fire plays an important role in creating vegetation structure and composition in this habitat. Decades of fire suppression have led to invasion by *Pinus ponderosa* along lower treeline and by *Pseudotsuga menziesii* in the gorge and other oak patches on

xeric sites in the east Cascade foothills. Most of the habitat experienced frequent low-severity fires that maintained woodland or savanna conditions. The mean fire-return interval is 20 years, although variable. Landfire VDDT models: #R OAP1 Oregon White Oak-Ponderosa Pine model describes general successional pathways treating drier pine succession separate from more mesic Douglas-fir pathways. Frequent annual burning (at lower elevations and on warmer sites) is required to maintain the open to dense woodland of large oaks with well-developed grassy understories of native perennial bunchgrass. Landfire VDDT models: #R OWOA Oregon White Oak applies to southern occurrences.

ENVIRONMENT

Environmental Description: This narrowly restricted group appears at or near lower treeline in foothills of the eastern Cascades in Washington and Oregon within 65 km (40 miles) of the Columbia River Gorge. It also appears in the adjacent Columbia Plateau ecoregion associated with low-elevation slopes and valley margins. This area receives 50-80 cm of annual precipitation, falling mostly as winter rain and snow. Elevation ranges from 460 to 1920 m. Stands often occur on warm sites with southern exposures with seasonal soil drought or desiccating winds. Substrates usually have bedrock, sand, or pumice soils which drain quickly (Reid et al.1999).

Westside environment: This group is limited to southwestern British Columbia, in the Puget Trough and Willamette Valley south into the Klamath Mountains and into northern California, where it is found throughout the Sierra Nevada and Coast Ranges foothills and lower montane elevations from 600-1600 m (1800-4850 feet) on steep, rocky slopes where snow and cold temperatures occur. This group is associated with dry, predominantly low-elevation sites and/or sites that experienced frequent presettlement fires. In the Willamette Valley, soils are mesic yet well-drained, and the stands are mostly large patch. In the Puget Lowland and Georgia Basin, this group is primarily found on dry sites, typically either shallow bedrock soils or deep gravelly glacial outwash soils. It occurs on various soils in the interior valleys of the Klamath Mountains, and on shallow soils of "bald hills" toward the coast.

DISTRIBUTION

***Geographic Range:** This narrowly restricted group appears at or near lower treeline in the foothills of the eastern Cascades in Washington and Oregon within 65 km (40 miles) of the Columbia River Gorge. It also appears in the adjacent Columbia Plateau ecoregion. Disjunct occurrences in the Klamath Mountains and southernmost Cascades may have big sagebrush and bitterbrush in the understory, along with other shrubs.

Westside range: This group occurs primarily in the Puget Trough and Willamette Valley and extends southward at low elevations in the Klamath Mountains on both sides of the Oregon/California stateline, and continues south throughout the Sierra Nevada and Coast Ranges foothills and lower montane of California and Oregon at elevations from 600-1600 m (1800-4850 feet).

Nations: CA, US

States/Provinces: BC, CA, OR, WA

USFS Ecoregions (2007) [optional]: 342H:CC, 342I:CC, M242B:C?, M242C:CC, M242D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3327 | <i>Quercus garryana</i> - <i>Pinus ponderosa</i> / <i>Carex geyeri</i> Woodland Alliance |
| A3328 | <i>Quercus garryana</i> - <i>Pseudotsuga menziesii</i> / <i>Toxicodendron diversilobum</i> Forest & Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------------|--|-----------------------|
| 2012-07-20 | G204 <i>Quercus garryana</i> - <i>Quercus kelloggii</i> Woodland Group | G204 merged into G206 |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|------------------------------|----------------|------|
| > | Interior Ponderosa Pine: 237 | Eyre 1980 | |
| > | Oregon White Oak: 233 | Eyre 1980 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** G. Kittel, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** G. Kittel, C. Chappell, M.S. Reid, R. Crawford, K.A. Schulz

Acknowledgments [optional]: R. Crawford, R.J. Cole, T. Keeler-Wolf, J. Evens

Version Date: 09 Nov 2015

REFERENCES***References [Required if used in text]:**

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- Barbour, M. G., T. Keeler-Wolf, and A. A. Schoenherr, editors. 2007a. Terrestrial vegetation of California, third edition. University of California Press, Berkeley.
- Eyre, F. H., editor. 1980. Forest cover types of the United States and Canada. Society of American Foresters, Washington, DC. 148 pp.
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- Sawyer, J. O., T. Keeler-Wolf, and J. Evens. 2009. A manual of California vegetation. Second edition. California Native Plant Society, Sacramento CA. 1300 pp.
- Simpson, M. 2007. Forested plant associations of the Oregon East Cascades. Technical Paper R6-NR-ECOL-TP-03-2007. USDA Forest Service, Pacific Northwest Region, Portland, OR.
- Topik, C., N. M. Halverson, and T. High. 1988. Plant associations and management guide of the ponderosa pine, Douglas-fir, and grand fir zone, Mt. Hood National Forest. R6-ECOL-TP-004-88. USDA Forest Service, Pacific Northwest Region, Portland, OR. 136 pp.

G800. Southern Vancouverian Dry Douglas-fir - Madrone Woodland

Type Concept Sentence: This group consists of dry, mixed broadleaf-conifer forests dominated by *Arbutus menziesii* and *Pseudotsuga menziesii* with an understory that is usually species-rich and well-developed. It is found in lowland areas of the Puget Sound, including the San Juan Islands in Washington and the Gulf Islands in British Columbia, and as far south as the Klamath Mountains in northern California.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nd.1. Southern Vancouverian Dry Foothill Forest & Woodland (M886)

Elcode: G800

***Scientific Name:** Southern Vancouverian Dry Douglas-fir - Madrone Woodland Group

***Common (Translated Scientific) Name:** Southern Vancouverian Dry Douglas-fir - Madrone Woodland Group

***Colloquial Name:** Southern Vancouverian Dry Douglas-fir - Madrone Woodland

***Type Concept:** This dry, mixed broadleaf-conifer forest group is dominated by the evergreen broadleaf *Arbutus menziesii* and the evergreen conifer *Pseudotsuga menziesii*. Some stands may have only *Pseudotsuga menziesii*. The short-lived conifer *Pinus contorta*, the broad-leaved deciduous *Acer macrophyllum*, and the shade-tolerant conifer *Abies grandis* can be locally dominant or codominant species. *Calocedrus decurrens* is absent. The broad-leaved deciduous tree *Quercus garryana* may also be present in the upper tree stratum or as a subcanopy. The forest understory is usually species-rich and well-developed. This group is found in lowland areas of the Puget Sound, including the San Juan Islands in Washington and the Gulf Islands in British Columbia, and as far south as the Klamath Mountains. It occurs along low-elevation (0-1000 m) mountain slopes and valley margins, usually on southern exposures with ample sun and seasonal drought. Sites usually have bedrock or sandy soils which drain quickly.

***Diagnostic Characteristics:** Dry stands dominated by *Arbutus menziesii* and *Pseudotsuga menziesii*.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G344 | Californian Montane Conifer Forest & Woodland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Tall woodlands and forests up to 18 m in height.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Stands are dominated by *Arbutus menziesii* and *Pseudotsuga menziesii*. *Pinus contorta*, *Acer macrophyllum*, and *Abies grandis* can be locally dominant or codominant species. *Calocedrus decurrens* is absent. Other conifers, such as *Taxus brevifolia* and *Juniperus scopulorum*, may be present in the tree layer, depending upon location and stand history. The broad-leaved deciduous tree *Quercus garryana* may also be present in the upper tree stratum or as a subcanopy. The forest understory is usually species-rich and well-developed. Common shrub species include *Corylus cornuta* var. *californica*, *Gaultheria shallon*, *Holodiscus discolor*, *Lonicera hispidula*, *Symphoricarpos albus*, and *Vaccinium ovatum*. The herbaceous layer is usually well-developed and dominated by xerophytic grasses and forbs. *Festuca occidentalis*, *Elymus glaucus*, and *Bromus vulgaris* are typical grass species. *Vicia americana*, *Lathyrus nevadensis*, and *Sanicula crassicaulis* are common forbs. Ferns include *Polystichum munitum* and *Pteridium aquilinum*.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: *Arbutus menziesii* stump sprouts following fire, and these communities were probably subject to a moderate-severity fire regime in presettlement times. These sites are too dry and warm or have been too frequently and extensively burned for more than small amounts of *Tsuga heterophylla* or *Thuja plicata* to be present as regeneration. On sites where it occurs, *Arbutus menziesii* dominance is favored by high-severity fires; *Pseudotsuga menziesii* can be locally eliminated by logging and hot fire or repeated high-severity fires.

ENVIRONMENT

Environmental Description: This group occurs along low-elevation (0-1000 m) mountain slopes and valley margins, usually on southern exposures with ample sun and seasonal drought, often adjacent to saltwater shorelines. Primarily, this group occurs in areas with a pronounced rainshadow effect from the Olympics and other coastal ranges. Sites usually have bedrock or sandy soils which drain quickly.

DISTRIBUTION

***Geographic Range:** This group is found in lowland areas of the Puget Sound, including the San Juan Islands in Washington and the Gulf Islands in British Columbia, and as far south as the Klamath Mountains of northern California. It is less common around the margins of the Willamette Valley, Oregon, and on the lower foothills of the Cascades in Washington and Oregon.

Nations: CA, US

States/Provinces: BC, CA, OR, WA

USFS Ecoregions (2007) [optional]:

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3716 | <i>Pseudotsuga menziesii</i> - <i>Abies grandis</i> - <i>Arbutus menziesii</i> Forest & Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** C. Chappell, in Faber-Langendoen et al. (2015)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** G. Kittel and C. Chappell

Acknowledgments [optional]:

Version Date: 14 May 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2017a. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

1. Forest & Woodland

1.B.2.Nd. Vancouverian Forest & Woodland

M023. Southern Vancouverian Montane-Foothill Forest

1. Forest & Woodland

1.B.2.Nd. Vancouverian Forest & Woodland

G344. Californian Montane Conifer Forest & Woodland

Type Concept Sentence: This large group consists of montane forests dominated by a single species or a mix of conifers such as *Abies concolor*, *Calocedrus decurrens*, *Pinus jeffreyi*, *Pinus lambertiana*, *Pinus ponderosa*, *Pseudotsuga menziesii*, *Quercus chrysolepis*, *Quercus kelloggii*, and *Pinus monticola*. Additional species included in this group that have a more limited range are *Abies bracteata*, *Abies magnifica* var. *magnifica*, *Abies magnifica* var. *shastensis*, *Pinus ponderosa* var. *washoensis*, *Pseudotsuga macrocarpa*, and *Sequoiadendron giganteum*. Understories are variable. These forests occur from southern Oregon into Baja California, Mexico. This group includes forests dominated by conifer trees on serpentine (ultramafic) soils.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nd.2. Southern Vancouverian Montane-Foothill Forest (M023)

Elcode: G344

***Scientific Name:** *Calocedrus decurrens* - *Pinus lambertiana* - *Abies concolor* Forest & Woodland Group

***Common (Translated Scientific) Name:** Incense-cedar - Sugar Pine - White Fir Forest & Woodland Group

***Colloquial Name:** Californian Montane Conifer Forest & Woodland

***Type Concept:** This group comprises low- to mid-montane elevation forests and woodlands dominated by conifer trees, either with one dominant species or as mixed-conifer forests. They occur on all aspects in lower montane zones from southern Oregon (600-2200 m [1800-6700 feet] elevation) down to 425 m (1400 feet) in elevation along Klamath River, south through the Sierra Nevada (1200-2150 m) in southern California, throughout the Transverse Ranges of California, and into northern Baja California, Mexico (1200-2740 m [4000-8300 feet]). They also occur in the higher North Coast Ranges, Klamath Mountains, the southern Cascades, on the Modoc Plateau as well as at lower to middle elevations of the Sierra Nevada on both the east and west sides. This group occurs in a variety of topo-edaphic positions, such as upper slopes at higher elevations, canyon sideslopes, ridgetops, and south- and west-facing slopes which burn relatively frequently. It also occurs in cool ravines and north-facing slopes. Several conifer species co-occur in individual stands and the wide variation of possible combinations is difficult to capture in a few summary sentences. The following list of species are those that cover the range of the group and that occur as pure stands or mixed with two or more species as dominants with others as sub-dominants: *Abies concolor*, *Calocedrus decurrens*, *Pinus jeffreyi*, *Pinus lambertiana*, *Pinus ponderosa*, *Pseudotsuga menziesii*, *Quercus chrysolepis*, *Quercus kelloggii*, and *Pinus monticola*. Additional species included in this group that have limited ranges include *Pseudotsuga macrocarpa* stands of the Transverse Ranges of southern California; *Abies bracteata* stands of the central coast region; in the central and southern Sierra Nevada, *Sequoiadendron giganteum* dominates, usually with *Abies concolor*; at the highest elevations stands may mix with *Abies magnifica* var. *magnifica* and *Abies magnifica* var. *shastensis* (= *Abies x shastensis*); *Chrysolepis chrysophylla* occurs in the western Klamath Mountains; *Pinus ponderosa* var. *washoensis* (= *Pinus washoensis*) may replace *Pinus jeffreyi* further north in the Carson Range and Warner Mountains. Understories are variable. This group also includes forests dominated by conifer trees on serpentine (ultramafic) soils. Many of the characteristic conifer alliances of this group have associations that are specific to serpentine soils.

***Diagnostic Characteristics:** This group comprises low- to mid-montane elevation (not foothill nor upper montane-subalpine) forests and woodlands dominated by conifer trees, either with one dominant species or as mixed-conifer forests. They occur on all aspects in lower montane zones. Dominant species include *Pseudotsuga menziesii*, *Abies concolor*, *Pinus ponderosa*, *Pinus jeffreyi*, *Calocedrus decurrens*, *Pinus lambertiana*, and *Sequoiadendron giganteum* (and others).

***Classification Comments:** These are montane and relative cool temperate stands of generally mixed conifers (although single-species stands are included) that are not at low elevations near the coast. This group includes former Sierran-Intermontane Desert Western White Pine - White Fir Woodland Group (G234). This group does not include coastal mixed evergreen forests [see ~Californian Moist Coastal Mixed Evergreen Forest Group (G208)\$§], mixed conifer stands near the coast [see ~Californian Conifer Forest & Woodland Group (G198)\$§], stands of ponderosa pine on the east side of the Cascades [see ~Cascadian Oregon White Oak - Conifer Forest & Woodland Group (G206)\$§], or ~Central Rocky Mountain Ponderosa Pine Open Woodland Group (G213)\$§ north of the Warm Springs Reservation of central Oregon.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|--|
| G198 | Californian Conifer Forest & Woodland | are closed-cone conifer forests of coastal and interior foothill, lower elevation, generally not mixed, drier, harsher climates. |
| G208 | Californian Moist Coastal Mixed Evergreen Forest | are coastal forests characterized by <i>Pseudotsuga menziesii</i> - <i>Notholithocarpus densiflorus</i> , at generally lower elevations. |
| G213 | Central Rocky Mountain Ponderosa Pine Open Woodland | are ponderosa pine forests. |
| G749 | Sierra-Cascade Red Fir - Mountain Hemlock Forest | |
| G206 | Cascadian Oregon White Oak - Conifer Forest & Woodland | are ponderosa pine and Douglas-fir forests with Oregon white oak in the Cascades. |
| G800 | Southern Vancouverian Dry Douglas-fir - Madrone Woodland | occurs further north, where <i>Calocedrus decurrens</i> and <i>Pinus ponderosa</i> drop out. |

Similar NVC Types General Comments [optional]:**VEGETATION**

Physiognomy and Structure Summary: This group is characterized by open to closed tree canopies, 15-60 m in height, and evergreen needle-leaved conifer growth form.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Stands may have single or several conifer species co-occurring in individual stands; the wide variation of possible combinations is difficult to capture in a few sentences. The following list of species are those that cover the range of the group and that occur as pure stands or mixed with two or more species as dominants with others as sub-dominants: *Abies concolor*, *Calocedrus decurrens*, *Pinus jeffreyi*, *Pinus lambertiana*, *Pinus ponderosa*, *Pseudotsuga menziesii*, *Quercus chrysolepis*, *Quercus kelloggii*, and *Pinus monticola*. Additional species included in this group that have limited ranges include *Pseudotsuga macrocarpa* stands of the Transverse Ranges of southern California; *Abies bracteata* stands of the central coast region; *Picea breweriana* in the Klamath Mountains; in the central and southern Sierra Nevada, *Sequoiadendron giganteum* dominates, usually with *Abies concolor*; at the highest elevations stands may mix with *Abies magnifica* var. *magnifica* and *Abies magnifica* var. *shastensis* (= *Abies x shastensis*); *Chrysolepis chrysophylla* occurs in the western Klamath Mountains; *Pinus ponderosa* var. *washoensis* (= *Pinus washoensis*) may replace *Pinus jeffreyi* further north in the Carson Range and Warner Mountains. Understories are variable. In the Sierra Nevada, some stands can have dense understory mats of *Chamaebatia foliolosa* (and other low, spreading shrubs) which foster relatively high-frequency, low-intensity surface fires. Other common understory shrubs are *Corylus cornuta*, *Cornus nuttallii*, and at higher elevations *Chrysolepis sempervirens*. In Oregon, shrubs such as *Holodiscus discolor*, *Toxicodendron diversilobum*, *Mahonia nervosa*, *Mahonia aquifolium*, and *Symphoricarpos mollis* are common in addition to graminoids such as *Festuca californica*, *Elymus glaucus*, and *Danthonia californica*.

In areas of recent fire or other disturbance, *Arctostaphylos patula*, *Ceanothus integerrimus*, *Ceanothus cordulatus*, and *Ribes* spp. are more common. On the east side of the Sierra Nevada, there can be well-developed shrub understories with strong Great Basin affinities; species can include *Artemisia tridentata*, *Purshia tridentata*, *Symphoricarpos rotundifolius* var. *parishii* (= *Symphoricarpos parishii*), *Arctostaphylos patula*, *Ceanothus cordulatus*, *Ceanothus prostratus*, *Ceanothus integerrimus*, *Chrysolepis sempervirens*, *Eriogonum wrightii*, *Quercus vacciniifolia*, and *Lupinus elatus*. Fire of highly variable patch size and return interval maintains the structure of these forests and woodlands.

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Historically, frequent and low-intensity fires maintained these forests and woodlands. Due to fire suppression, the majority of these forests now have closed canopies, whereas in the past, a moderately high fire frequency (every 15-30 years) formerly maintained a more open forest of many conifers and correspondently diverse understory.

ENVIRONMENT

Environmental Description: This group occurs on all aspects in lower montane zones from southern Oregon (600-2200 m [1800-6700 feet] elevation) down to 425 m (1400 feet) in elevation along Klamath River, south through the Sierra Nevada (1200-2150 m) in southern California, throughout the Transverse Ranges of California, and into northern Baja California, Mexico (1200-2740 m [4000-8300 feet]). They occur in the Klamath Mountains, the southern Cascades, on the Modoc Plateau as well as at lower and middle elevations of the Sierra Nevada on both the east and west sides. High elevations of the Coast Ranges also contain pockets of this forest type. This group occurs in a variety of topo-edaphic positions, such as upper slopes at higher elevations, canyon sideslopes, ridgetops, and south- and west-facing slopes which burn relatively frequently. It also occurs in cool ravines and north-facing slopes. This group also includes forests dominated by conifer trees on serpentine (ultramafic) soils. *Climate:* This group occurs in lower montane regions in a montane (oro-) Mediterranean climate.

DISTRIBUTION

***Geographic Range:** This group occurs in lower and mid-montane zones from southern Oregon south through the Sierra Nevada, in the Klamath-Siskiyou Mountains of southern Oregon/northern California, throughout the Transverse Ranges of California and into northern Baja California, Mexico.

Nations: MX, US

States/Provinces: CA, MXBC, NV, OR

USFS Ecoregions (2007) [optional]: 263A:CC, 322A:CP, 332:P, 341D:CC, 342B:CC, M242A:CC, M242B:CC, M242C:CC, M261A:CC, M261B:CC, M261C:CC, M261D:CC, M261E:CC, M261F:CC, M261G:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3675 | <i>Pseudotsuga macrocarpa</i> - <i>Quercus chrysolepis</i> Forest Alliance |
| A0147 | <i>Abies bracteata</i> Forest Alliance |
| A3674 | <i>Abies concolor</i> - <i>Pseudotsuga menziesii</i> Coastal, Cascadian & Sierran Forest Alliance |
| A3677 | <i>Abies concolor</i> - <i>Pinus ponderosa</i> Eastern Sierran Forest & Woodland Alliance |
| A4150 | <i>Sequoiadendron giganteum</i> Forest Alliance |
| A3676 | <i>Pinus jeffreyi</i> - <i>Pinus ponderosa</i> var. <i>washoensis</i> Mixed Conifer Woodland Alliance |
| A0156 | <i>Picea breweriana</i> - <i>Abies concolor</i> Forest Alliance |
| A3673 | <i>Pinus ponderosa</i> - <i>Calocedrus decurrens</i> - <i>Pseudotsuga menziesii</i> Forest Alliance |
| A3678 | <i>Abies concolor</i> - <i>Abies magnifica</i> var. <i>magnifica</i> - <i>Abies magnifica</i> var. <i>shastensis</i> Forest Alliance |
| A3672 | <i>Abies concolor</i> - <i>Pinus lambertiana</i> Forest Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------------|--|-----------------------|
| 2013-03-12 | G234 <i>Pinus monticola</i> - <i>Abies concolor</i> var. <i>lowiana</i> Woodland Group | G234 merged into G344 |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---|----------------|---|
| > | Jeffrey Pine: 247 | Eyre 1980 | |
| >< | White Fir: 211 | Eyre 1980 | White fir (<i>Abies lowiana</i>) is a major component of this group. |
| >< | Sierra Nevada Mixed Conifer: 243 | Eyre 1980 | |
| >< | Port Orford-Cedar: 231 | Eyre 1980 | |
| >< | Pacific Ponderosa Pine: 245 | Eyre 1980 | Ponderosa pine stands in the Sierras and Klamaths are included in this group. |
| >< | Pacific Ponderosa Pine - Douglas-fir: 244 | Eyre 1980 | |
| >< | Pacific Douglas-fir: 229 | Eyre 1980 | |
| >< | Interior Ponderosa Pine: 237 | Eyre 1980 | This group includes Ponderosa pine in the Sierra Nevada of California. |

AUTHORSHIP

*Primary Concept Source [if applicable]: M.G. Barbour and J. Major (1988)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

*Author of Description: G. Kittel

Acknowledgments [optional]: M. Creasy, P. Moore, R.J. Cole

Version Date: 06 Jun 2013

REFERENCES

*References [Required if used in text]:

- Barbour, M. G., and J. Major, editors. 1988. Terrestrial vegetation of California: New expanded edition. California Native Plant Society, Special Publication 9, Sacramento. 1030 pp.
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M024. Vancouverian Lowland & Montane Forest

1. Forest & Woodland

1.B.2.Nd. Vancouverian Forest & Woodland

G235. Californian Coastal Redwood Forest

Type Concept Sentence: The California coastal redwood group occurs from the Klamath Mountains of extreme southwestern Oregon south to Monterey County, California, always within the oceanic fog belt, and contains the tallest forests in North America (over 100 m), dominated by *Sequoia sempervirens* or *Chamaecyparis lawsoniana*, with associates of *Pseudotsuga menziesii*, *Tsuga heterophylla* (northward), *Notholithocarpus densiflorus*, or *Picea sitchensis*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nd.3. Vancouverian Lowland & Montane Forest (M024)

Elcode: G235

***Scientific Name:** *Sequoia sempervirens* Forest Group

***Common (Translated Scientific) Name:** Redwood Forest Group

***Colloquial Name:** Californian Coastal Redwood Forest

***Type Concept:** This is one of the tallest conifer forests in the world, dominated by 75- to 120-m tall evergreen needle-leaved trees. This group occurs from the Klamath Mountains south to Monterey County, California. Mature stands of *Sequoia sempervirens* may produce a deep shade, so understories can be limited, and coarse woody debris from past disturbance can be quite large. *Pseudotsuga menziesii* is the common associate among the large trees. *Tsuga heterophylla* is found in old-growth stands in the northern portion of the range, and *Notholithocarpus densiflorus* (= *Lithocarpus densiflorus*) occurs as a subcanopy in almost all stands, becoming more important in the central and southern sections of the range (possibly as a result of fire suppression). The moist, coastal *Chamaecyparis lawsoniana* or *Picea sitchensis* stands from southwestern Oregon and northwestern California (often mixed with *Sequoia sempervirens*, *Pseudotsuga menziesii*, or *Tsuga heterophylla*) are included in this group, as ecologically they function in the same way and have the same overall floristic composition. Shade-tolerant understory species include *Rubus parviflorus*, *Oxalis oregana*, *Aralia californica*, *Mahonia nervosa* (= *Berberis nervosa*), *Gaultheria shallon*, and many ferns, such as *Blechnum spicant*, *Polystichum* spp., and *Polypodium* spp. The coastal redwood group generally can be found in areas of low rainfall (Mediterranean climate of dry summers and wet winters) but stands always occur within the coastal fog belt, and interior stands are limited to the fog belts inward extent. In the northern portion of the range, stands occur on upland slopes, riparian alluvial zones, or riverine terraces that are flooded approximately every 50-100 years. In the southern portion of the range, annual precipitation may be as little as 50 cm, and the group is limited to coves and ravines. Throughout its range, it is commonly found on moderately well-drained marine sediments (non-metamorphosed siltstones, sandstones, etc.).

***Diagnostic Characteristics:** This group is characterized by the presence and dominance of *Sequoia sempervirens* and/or *Chamaecyparis lawsoniana*, the northern limit within a few miles of 42°N latitude (the Oregon and California border). *Pseudotsuga menziesii*, *Tsuga heterophylla*, and *Notholithocarpus densiflorus* are common associates. Ecological correlates include the Mediterranean Pluviseasonal-Oceanic climate (a subsection of Mediterranean climate that has the smallest amount of annual temperature variation and the wettest microclimate within that climate (Rivas-Martínez and Loidi-Arregui 1999, Rivas-Martínez and Rivas-Saenz 2015)), on upland slopes, coves and in riparian zones.

***Classification Comments:** Stands dominated or codominated by *Chamaecyparis lawsoniana*, *Picea sitchensis*, or *Tsuga heterophylla* that are within 25 km (15 miles) of the coast that have some or no *Sequoia sempervirens* are either part of this group (G235) (in extreme southern Oregon and northern California), or ~North Pacific Western Hemlock - Sitka Spruce - Western Red-cedar Seasonal Rainforest Group (G751)\$ (central and northern coastal Oregon). This group (G235) is dominated by coastal redwood and/or Port Orford-cedar, while G751 is dominated by western hemlock, Sitka spruce and/or western red-cedar. Forests in the same vicinity as this redwood group that do not have *Sequoia sempervirens* or *Picea sitchensis* present and are on non-serpentine soils are considered part of ~North Pacific Maritime Douglas-fir - Western Hemlock Forest Group (G240)\$\$. *Chamaecyparis lawsoniana* associations away from the coast are members of ~North Pacific Western Hemlock - Sitka Spruce - Western Red-cedar Seasonal Rainforest Group (G751)\$\$. That is not within the fog belt, and these are pretty far north, so its not as confusing as it sounds.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G240 | North Pacific Maritime Douglas-fir - Western Hemlock Forest | |

Similar NVC Types General Comments [optional]:**VEGETATION**

Physiognomy and Structure Summary: This group forms the tallest forests in North America, with individuals reaching 120 m high (tallest being 115 m [380 feet]). Trees are needle-leaved evergreen. Typically, mature stands of *Sequoia sempervirens* produce a deep shade, so understories can be limited (perhaps more common in southern stands), and coarse woody debris from past disturbance can be quite large (perhaps most large in northern stands?).

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Typically, mature stands of *Sequoia sempervirens* produce a deep shade. Stands where *Chamaecyparis lawsoniana* is dominant along moist coastal alluvial terraces in the north are also included in this group. Understories are quite varied from fern-covered slopes to scattered herbs, and coarse woody debris from past disturbance can be quite large. *Pseudotsuga menziesii* is the common associate among the large trees. *Tsuga heterophylla* is found in northern old-growth stands. Upland stands of *Sequoia sempervirens* south of Humboldt Bay are various mixtures of *Sequoia sempervirens*, *Pseudotsuga menziesii*, and hardwoods, especially *Notholithocarpus densiflorus* (= *Lithocarpus densiflorus*), *Arbutus menziesii*, and *Umbellularia californica* (Noss 2000). *Chamaecyparis lawsoniana* can be dominant along moist coastal alluvial terraces in the north, and *Notholithocarpus densiflorus* is uncommon in these stands. *Sequoia sempervirens* can be the sole canopy dominant on river terraces. Shade-tolerant understory species include *Rubus parviflorus*, *Oxalis oregana*, *Aralia californica*, *Mahonia nervosa* (= *Berberis nervosa*), *Gaultheria shallon*, *Vaccinium ovatum*, and many ferns, such as *Blechnum spicant*, *Polystichum munitum*, and *Polypodium* spp.

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Historically, surface fires likely exposed mineral soil for redwood seed germination. Less frequent disturbance can result in increases in *Tsuga heterophylla* in northern occurrences, as it is sensitive to fire and is a decreaser with fire and flood. Fire suppression has tended to result in increasing abundance of *Lithocarpus densiflorus*, *Umbellularia californica*, *Alnus rubra*, *Arbutus menziesii*, and *Acer macrophyllum*; all respond favorably to fire, flood, wind and slides, becoming more abundant in areas of frequent disturbance. Recent studies find that many occurrences now have multi-tiered structures with tall-shrub layers and subcanopies of a variety of other trees, creating fuel ladders which can result in severe fires and increased mortality of *Sequoia sempervirens* when fires occur. In addition, Sillett and Van Pelt (2000) and Sillett and Bailey (2003) report that canopies of *Sequoia sempervirens* support significant biomass of epiphytic ferns and shrubs that are also contributing to an altered crown structure in these forests, which is impacting the fire regime.

ENVIRONMENT

Environmental Description: *Climate:* The coastal redwood group generally can be found only in the Mediterranean climate of northern California, in areas of relatively low rainfall but still within the fog belt. In the southern portion of the range, annual precipitation may be as little as 50 cm, and the group is limited to coves and ravines. *Soil/substrate/hydrology:* Across its range, this type is commonly found on soils derived from moderately well-drained marine sediments (non-metamorphosed siltstones, sandstones, etc.). In the northern portion, it occurs on upland slopes and in riparian zones and on riverine terraces, above the active floodplain (flooded approximately every 50-100 years).

DISTRIBUTION

***Geographic Range:** This group occurs from the westernmost Klamath Mountains of southern Oregon south to Monterey County, California.

Nations: US

States/Provinces: CA, OR

USFS Ecoregions (2007) [optional]: 263A:CC, M242A:PP, M261A:CP, M261B:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS***Plot Analysis Summary [Med - High Confidence]:*****Plots Used to Define the Type [Med - High Confidence]:****CONFIDENCE LEVEL**

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3403 | <i>Sequoia sempervirens</i> Forest Alliance |
| A0104 | <i>Chamaecyparis lawsoniana</i> Forest Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|---|
| >< | Port Orford-Cedar: 231 | Eyre 1980 | Coastal Port Orford-cedar stands occur in this group. |
| = | Redwood: 232 | Eyre 1980 | |

AUTHORSHIP***Primary Concept Source [if applicable]:** F.H. Eyre (1980)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** G. Kittel, D. Faber-Langendoen**Acknowledgments [optional]:** J. Sawyer

Version Date: 09 Nov 2015

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1. Forest & Woodland

1.B.2.Nd. Vancouverian Forest & Woodland

G240. North Pacific Maritime Douglas-fir - Western Hemlock Forest

Type Concept Sentence: This conifer forest group comprises much of the lowland mesic to dry regions of the south-central Pacific Northwest rainforests, from western Washington, northwestern Oregon, eastern Vancouver Island and mainland southern Coast Mountains in British Columbia. *Pseudotsuga menziesii* and *Tsuga heterophylla* are the major dominants and typical ground-layer indicators are *Polystichum munitum* (mesic sites), *Gaultheria shallon* (coastal and well-drained sites), and *Vaccinium parvifolium* (higher elevation, cool nutrient-poor sites).

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nd.3. Vancouverian Lowland & Montane Forest (M024)

Elcode: G240

***Scientific Name:** *Pseudotsuga menziesii* - *Tsuga heterophylla* / *Gaultheria shallon* Forest Group

***Common (Translated Scientific) Name:** Douglas-fir - Western Hemlock / Salal Forest Group

***Colloquial Name:** North Pacific Maritime Douglas-fir - Western Hemlock Forest

***Type Concept:** This group includes much of the major coastal mesic to dry lowland forests dominated by evergreen needle-leaved trees of the Pacific Northwest. Overstory canopy is generally dominated by *Pseudotsuga menziesii* with *Tsuga heterophylla* and/or *Thuja plicata*, but *Pseudotsuga menziesii* may simply be present. *Acer macrophyllum* and *Alnus rubra* sometimes occur in the subcanopy and, if in the upper canopy, not more than 10% cover. Stands occur on dry well-drained as well as subirrigated soils. Well-drained site understory species typically include *Gaultheria shallon*, *Mahonia nervosa*, *Rhododendron macrophyllum*, *Linnaea borealis*, *Achlys triphylla*, and/or *Vaccinium ovatum*. Intermediate moisture (mesic) locations often have *Acer circinatum* and *Polystichum munitum* (especially on rich-nutrient sites) with one or more of the evergreen shrubs. Moist sites are dominated by *Polystichum munitum*, *Oxalis oregana*, *Rubus spectabilis*, and/or *Oplopanax horridus*. Indicator canopy species include *Tsuga heterophylla* and *Pseudotsuga menziesii* with a lack (or very low cover) of *Abies amabilis*. Understory indicator species include *Polystichum munitum*, *Achlys triphylla*, *Gaultheria shallon*, and *Mahonia nervosa*; in other words, stands without *Picea sitchensis* and understory species more commonly found in greater abundance close to the coast, such as *Blechnum spicant*, *Anemone deltoidea*, and *Maianthemum dilatatum*, and without wetland indicator species, such as *Lysichiton americanus*. Geographic distribution is from western Washington, northwestern Oregon, eastern Vancouver Island and mainland southern Coast Mountains in British Columbia. These forests occur on uplands on moist to dry moisture microhabitat conditions within the Western Hemlock Zone of the Pacific Northwest. Elevation ranges from sea level to 1067 m (3500 feet) in Oregon, 610 m (2000 feet) in northern Washington, and to 700 m (2275 feet) in British Columbia. Topography ranges from relatively flat glacial tillplains to steep mountainous terrain.

***Diagnostic Characteristics:** Overstory canopy is dominated by *Pseudotsuga menziesii* with *Tsuga heterophylla* and/or *Thuja plicata*, the lack of dominance by *Picea sitchensis* or *Chamaecyparis lawsoniana*, and the near absence of *Abies amabilis*. It occupies the lowland areas that are not immediately on the coast, and are therefore mesic to dry rather than super wet. It is a very abundant

forest type in this region.

***Classification Comments:** Stands dominated or codominated by *Chamaecyparis lawsoniana* that are within 25 km (15 miles) of the coast are part of either ~Californian Coastal Redwood Forest Group (G235)\$\$ (extreme southern Oregon and northern California) or ~North Pacific Western Hemlock - Sitka Spruce - Western Red-cedar Seasonal Rainforest Group (G751)\$. Stands in these areas may or may not have redwood or Sitka spruce present. Criteria for canopy cover of conifers should be reviewed between G237 and G240. Excluded from this group is the area of Douglas-fir and grand fir that does not have western hemlock that occurs in the U.S. in the northeastern part of the Olympic Peninsula, the San Juan Islands, and perhaps part of Seattle (no longer though).

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|--|
| G235 | Californian Coastal Redwood Forest | occurs farther south and is dominated or codominated by <i>Sequoia sempervirens</i> . |
| G751 | North Pacific Western Hemlock - Sitka Spruce - Western Red-cedar Seasonal Rainforest | occurs in the hypermaritime zone (is much wetter) and has at least 10% cover of <i>Picea sitchensis</i> . |
| G750 | North Pacific Maritime Western Hemlock - Sitka Spruce Rainforest | is primarily an Alaskan group that lacks <i>Pseudotsuga menziesii</i> and barely comes into northwestern British Columbia. |
| G241 | North Pacific Maritime Silver Fir - Western Hemlock Forest | is indicated by presence of <i>Abies amabilis</i> , and occurs at higher elevations. |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group contains tall coastal temperate rainforests 20 to >35 m tall, dominated by evergreen conifer trees. Undergrowth canopy varies from thick to sparse depending on site productivity and overstory canopy closure.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Overstory canopy is dominated by *Pseudotsuga menziesii* with *Tsuga heterophylla* and/or *Thuja plicata*. *Pseudotsuga menziesii* is usually at least present to more typically codominant or dominant. *Acer macrophyllum* and *Alnus rubra* sometimes be present in the subcanopy. Stands occur on dry well-drained as well as subirrigated soils. Dry-site understory shrubs typically include *Gaultheria shallon*, *Mahonia nervosa*, *Rhododendron macrophyllum* (but not in British Columbia), *Linnaea borealis*, and *Achlys triphylla*. Intermediate moisture (mesic) locations often have *Acer circinatum* and *Polystichum munitum* (especially on rich-nutrient sites) with one or more of the evergreen shrubs. Moist sites are dominated by *Polystichum munitum*, *Oxalis oregana*, *Rubus spectabilis*, and/or *Oplopanax horridus*. Indicator species include *Tsuga heterophylla* and *Pseudotsuga menziesii* with a lack (or very low amounts) of *Abies amabilis*. Understory indicator species include *Polystichum munitum*, *Achlys triphylla*, *Gaultheria shallon*, and *Vaccinium parvifolium*; in other words, stands without *Picea sitchensis* in the tree canopy and lacking understory indicator species more common near the coast, such as *Blechnum spicant*, *Anemone deltoidea*, *Maianthemum dilatatum*, and *Vaccinium ovatum*, as well as without wetland indicator species, such as *Lysichiton americanus*.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Const-ancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|------------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Stands originated from infrequent stand-replacing fires (perhaps every 150-200 years) that would occur only in the driest microsites, as well as from windthrow gaps. Stand-maintaining surface fires, both aboriginal and lightning-caused, were more frequent (perhaps every 50-100 years) (Agee 1993, Brown and Hebda 1999) prior to European settlement. Surface fires likely maintained a moderately open overstory. Gap dynamics in old forests result in multi-aged stand structure (BCCDC unpubl. data 2013). Unless growing in wind-protected conditions, windthrow and breakage tend to keep these forests from becoming or remaining very old. *Tsuga heterophylla*, one of the leading tree species, is vulnerable to wind breakage and also to uprooting given the shallow soils. If wind exposure is limited, then stand replacement is more gradual, through the process of the mortality of individuals or small numbers of canopy trees. Where windthrow is not pervasive, the age composition of these potentially old edaphic climax forests is uneven. With the exception of those geographic areas in the rainshadow of the Vancouver Ranges or the Olympic Mountains, where summer-dry conditions prevail, fire is not a viable disturbance factor. Although fire is by no means common or frequent, those sites in locations most vulnerable to fire tend to have a major component of *Pseudotsuga menziesii* in their canopies. Hemlock dwarf mistletoe (*Arceuthobium tsugense*) is a moderate threat to *Tsuga heterophylla* (Dorner and Wong 2003, Cadrin and Wolowicz 2005). Within mature and old forests, small gaps result from the death of single trees or small groups of trees due to root-rots, bark beetles or windthrow.

ENVIRONMENT

Environmental Description: *Climate:* Climate is relatively mild and moist to wet. Mean annual precipitation is mostly 90-254 cm (35-100 inches) (but as low as 50 cm [20 inches] in the extreme rainshadow) falling predominantly as winter rain. Snowfall ranges from rare to regular, but not persistent, and summers are relatively dry. Elevation ranges from sea level to 1067 m (3500 feet) in Oregon, to 610 m (2000 feet) in northern Washington, and to 700 m (2275 feet) in British Columbia.

Soil/substrate/hydrology: Topography ranges from relatively flat glacial tillplains to steep mountainous terrain. Soils range from dry to subirrigated. Typical soils for *Polystichum* sites would be deep, fine- to moderately coarse-textured, with some subsurface seepage or richer parent material, and for *Oplopanax* sites, soils typically have an impermeable layer at a moderate depth.

DISTRIBUTION

***Geographic Range:** This group encompasses lowland forests of western Washington, northwestern Oregon, eastern Vancouver Island, and the southern Coast Mountains in British Columbia. In southwestern Oregon and northwestern California, it becomes local and more small-patch in nature. It occurs throughout low-elevation western Washington, except on extremely dry sites and in the hypermaritime zone near the outer coast where it is rare. In Oregon, it occurs on the western slopes of the Cascades, around the margins of the Willamette Valley, and in the Coast Ranges. In British Columbia, it occurs commonly on the eastern (leeward) side of Vancouver Island, and rarely on the windward side, and in the southern Coast Mountains. It also extends to the east side of the Coast Mountains in British Columbia and the Cascades in Washington and Oregon, where a few more continental understory species may also be present. Stands in northern California (East side of the Klamath Mountains) with western hemlock and Douglas-fir with *Chamaecyparis lawsoniana* that are east of the range of redwood, also have *Arbutus*, tan oak and other Mediterranean species present [see Sawyer et al. (2009) and Keeler-Wolf (1990a)].

Nations: CA, US

States/Provinces: BC, CA, OR, WA

USFS Ecoregions (2007) [optional]: 242A:CC, 242B:CC, 3421:PP, M242A:CC, M242B:CC, M242C:CC, M242D:CC, M261A:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3379 | <i>Tsuga heterophylla</i> - <i>Pseudotsuga menziesii</i> / <i>Holodiscus discolor</i> Dry Forest Alliance |
| A3377 | <i>Tsuga heterophylla</i> - <i>Pseudotsuga menziesii</i> / <i>Rubus spectabilis</i> Mesic Forest Alliance |
| A3378 | <i>Tsuga heterophylla</i> - <i>Pseudotsuga menziesii</i> / <i>Cornus unalaschkensis</i> Mesic Forest Alliance |
| A3376 | <i>Tsuga heterophylla</i> - <i>Pseudotsuga menziesii</i> Serpentine Soil Forest Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|------------------------------------|----------------|----------------------------------|
| > | Douglas-fir - Western Hemlock: 230 | Eyre 1980 | Includes both wet and dry stands |
| > | Pacific Douglas-fir: 229 | Eyre 1980 | 80% Douglas-fir |
| > | Western Hemlock: 224 | Eyre 1980 | 80% western hemlock cover |

AUTHORSHIP***Primary Concept Source [if applicable]:** F.H. Eyre (1980)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** G. Kittel, D. Meidinger and D. Faber-Langendoen

Acknowledgments [optional]: D. Meidinger, R. Crawford, and J. Sawyer

Version Date: 09 Nov 2015

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1. Forest & Woodland

1.B.2.Nd. Vancouverian Forest & Woodland

G241. North Pacific Maritime Silver Fir - Western Hemlock Forest

Type Concept Sentence: This forested group occurs in the lower and montane regions of the central Pacific Northwest rainforest region, primarily west of the Cascade Crest, dominated by *Tsuga heterophylla*, *Abies amabilis*, and/or *Callitropsis nootkatensis*, in maritime and sub-maritime climatic zones from northwestern Oregon, coastal British Columbia, and possibly extreme southeastern Alaska.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nd.3. Vancouverian Lowland & Montane Forest (M024)

Elcode: G241

***Scientific Name:** *Abies amabilis* - *Tsuga heterophylla* Forest Group

***Common (Translated Scientific) Name:** Pacific Silver Fir - Western Hemlock Forest Group

***Colloquial Name:** North Pacific Maritime Silver Fir - Western Hemlock Forest

***Type Concept:** This forested group occurs in the Pacific Northwest mountains primarily west of the Cascade Crest. *Tsuga heterophylla* and/or *Abies amabilis* dominate the canopy of late-seral stands, and *Callitropsis nootkatensis* (= *Chamaecyparis nootkatensis*) can be codominant, especially at higher elevations or moister sites. *Thuja plicata* is also common and sometimes codominates in British Columbia. Major dominant understory species are *Vaccinium alaskaense*, *Blechnum spicant*, and/or *Rubus pedatus*. In drier settings, *Pseudotsuga menziesii* is usually also common. *Abies procera* forests (usually mixed with silver fir) are included in this group, as well as stands where *Abies lasiocarpa* can occur as a codominant on the east side of the Cascades. Dry-setting understory species may include *Achlys triphylla*, *Mahonia nervosa*, *Xerophyllum tenax*, *Vaccinium membranaceum*, and/or *Rhododendron macrophyllum*. This group occurs at mid-montane elevations in dry to moist maritime, some hypermaritime and some sub-maritime climatic zones from northwestern Oregon, coastal British Columbia to extreme southeastern Alaska. It generally occurs in an elevational band above *Pseudotsuga menziesii* - *Tsuga heterophylla* and hypermaritime zone forests and below *Tsuga mertensiana* forests. It is known to occur on windward and leeward sides of Vancouver Island and on the Olympic Peninsula. In the Cascade Range of northern Washington (north of Snoqualmie River) and in the Coast Mountains of mainland British Columbia, it occurs in the wettest portions, including inland to the mountain crest. A somewhat variable winter snowpack that typically lasts for 2-4 months is characteristic. The climatic zone within which it occurs is sometimes referred to as the "rain-on-snow" zone because of the common occurrence of major winter rainfall on an established snowpack.

***Diagnostic Characteristics:** This group contains full-statured, continuous forests dominated by *Tsuga heterophylla* and *Abies amabilis*.

***Classification Comments:** *Abies amabilis* in southeastern Alaska is an extreme outlier, occurring in only a few stands in the extreme southern part of the panhandle (T. DeMeo pers. comm. 2013). Therefore, *Abies amabilis* associations in Alaska need to be further documented and determined if they belong to this group or another.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|--|
| G245 | North Pacific Mountain Hemlock - Silver Fir Forest & Tree Island | occurs at higher elevations codominated by mountain hemlock. |
| G751 | North Pacific Western Hemlock - Sitka Spruce - Western Red-cedar Seasonal Rainforest | occurs at lower elevations to this group in British Columbia and very southern Alaska. |
| G240 | North Pacific Maritime Douglas-fir - Western Hemlock Forest | occurs at lower and warmer elevations within the southern range of G241. |

Similar NVC Types General Comments [optional]:**VEGETATION**

Physiognomy and Structure Summary: This group contains tall (15-45 m) evergreen coniferous forests with thick low to tall shrub undergrowth.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: *Tsuga heterophylla* and/or *Abies amabilis* dominate the canopy of late-seral stands, and *Callitropsis nootkatensis* (= *Chamaecyparis nootkatensis*) can be codominant, especially at higher elevations. *Thuja plicata* is also common and sometimes codominates in British Columbia. In Alaska, *Abies amabilis* occurs in nearly pure stands and in mixture with *Picea sitchensis* and *Tsuga heterophylla*. In more mesic settings, *Pseudotsuga menziesii* is relatively rare to absent, and a major understory dominant species is *Vaccinium ovalifolium*. Other mesic-setting understory species include *Oxalis oregana*, *Blechnum spicant*, and/or *Rubus pedatus*.

In drier settings, *Tsuga heterophylla* and/or *Abies amabilis* dominate the canopy of late-seral stands, though *Pseudotsuga menziesii* is usually also common because of its long lifespan and because it regenerates after fires and therefore is frequent as a codominant, and indeed its prevalence is an important indicator for dry climate alliances within this group. At the highest elevations, *Callitropsis nootkatensis* can be codominant. *Abies procera* forests (usually mixed with silver fir) are included in this group and occur in the Cascades from central Washington to central Oregon and rarely in the Coast Ranges of Oregon. *Abies lasiocarpa* sometimes occurs as a codominant on the east side of the Cascades and at higher elevations in British Columbia. Dry-setting understory species may include *Achlys triphylla*, *Mahonia nervosa*, *Xerophyllum tenax*, *Vaccinium membranaceum*, and/or *Rhododendron macrophyllum*.

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Fire regime is significantly different at regional scale between dry and mesic stands of this forest. Mesic stands occur within a very wet climate that is more coastal, less continental, with cooler summers, and warmer winters on average. The major disturbance process within these coastal mesic forests are small-scale gap dynamics where windthrow is common, causing gap creation that starts the successional process. These mesic stands rarely, if ever, burn and are dominated by trees that run from 700 to over 1000 years in age. In British Columbia, coastal rainforests may burn an average of once every 2000 years. Extreme, stand-replacing fires are infrequent to absent, with return intervals of several hundred or more years.

In drier stands, the dominant natural process is stand-replacing fires which occur on average every 200-500 years. Where old-growth does exist, it is mostly "young old-growth" 200-500 years in age. Natural-origin stands less than 200 years old are also common. Mixed-severity fires occur in the drier more interior and often southern parts of this group, so that forest structure, patch size and proportions can be different from northern, more mesic stands. In Oregon, there are more mixed-severity fires.

ENVIRONMENT

Environmental Description: *Climate:* This forested group occurs at mid-montane elevations in dry to moist maritime and some subarctic climatic zones from northwestern Oregon, coastal British Columbia to extreme southeastern Alaska. It generally occurs in an elevational band above *Pseudotsuga menziesii* - *Tsuga heterophylla* and hypermaritime zone forests and below *Tsuga mertensiana* forests. It is known to occur on windward and leeward sides of Vancouver Island and on the Olympic Peninsula. In the Cascade Range of northern Washington (north of Snoqualmie River) and in the Coast Mountains of mainland British Columbia, it occurs in the wettest portions but does not extend all the way inland to the mountain crest. A somewhat variable winter snowpack that typically lasts for 2-4 months is characteristic. The climatic zone within which it occurs is sometimes referred to as the "rain-on-snow" zone because of the common occurrence of major winter rainfall on an established snowpack.

DISTRIBUTION

***Geographic Range:** This forested group occurs only in the Pacific Northwest mountains, primarily west of the Cascade Crest. It dominates mid-montane dry to mesic maritime and some subarctic climatic zones from northwestern British Columbia to northwestern Oregon. In the Olympic Mountains, this group occurs on the leeward side of the mountains only. In British Columbia and the Washington Cascades, it occurs on both windward and leeward sides of the mountains. It occurs very sporadically in the Willapa Hills of southwestern Washington and in the northern Oregon Coast Range. This type may also occur on the east side of the Oregon Cascades north of 45°N latitude (Mount Hood National Forest - Hood River and Barlow ranger districts, and possibly the northern edge of Warm Springs Reservation in part of the McQuinn Strip). It is restricted in Washington's eastern Cascades to a few miles of the crest, primarily between the upper Naches drainage and Lake Wenatchee, finally dwindling to scattered stands in the upper Methow drainage in the northern Cascades (Lillybridge et al 1995). It may also extend north to about 56°N latitude in southeastern Alaska. *Abies amabilis* has a limited distribution in Alaska, and is confined to the extreme southern mainland and a few islands south of 56°N latitude.

Nations: CA, US

States/Provinces: AK, BC, CA?, OR, WA

USFS Ecoregions (2007) [optional]: 242A:CC, 342I:PP, M242A:CC, M242B:CC, M242C:CC, M242D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3386 | <i>Abies amabilis</i> - <i>Tsuga heterophylla</i> / <i>Achlys triphylla</i> Forest Alliance |
| A3387 | <i>Abies amabilis</i> - <i>Tsuga heterophylla</i> / <i>Vaccinium membranaceum</i> Cold Forest Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--------------------------------------|---------------------|------|
| = | I.A.1.h - Silver fir-western hemlock | Viereck et al. 1992 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** F.H. Eyre (1980)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** G. Kittel, D. Meidinger and D. Faber-Langendoen

Acknowledgments [optional]:

Version Date: 09 Nov 2015

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1. Forest & Woodland

1.B.2.Nd. Vancouverian Forest & Woodland

G237. North Pacific Red Alder - Bigleaf Maple - Douglas-fir Forest

Type Concept Sentence: This lowland hardwood or mixed hardwood-conifer forest group occurs throughout the Pacific Northwest rainforest region, on disturbed sites ranging from flat coastal areas to steep slopes subject to mass movements on a periodic basis. *Alnus rubra* or *Acer macrophyllum* are the major tree species, occurring with a variety of companion species, such as the conifers *Abies grandis*, *Picea sitchensis*, *Pseudotsuga menziesii*, *Thuja plicata*, and/or *Tsuga heterophylla*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nd.3. Vancouverian Lowland & Montane Forest (M024)

Elcode: G237

***Scientific Name:** *Alnus rubra* - *Acer macrophyllum* Forest Group

***Common (Translated Scientific) Name:** Red Alder - Bigleaf Maple Forest Group

***Colloquial Name:** North Pacific Red Alder - Bigleaf Maple - Douglas-fir Forest

***Type Concept:** This lowland hardwood or mixed hardwood-conifer forest group occurs in the Pacific Northwest from northern British Columbia to northern California. These forests are composed of mostly deciduous broadleaf species sometimes with varying components of conifers. *Alnus rubra* or *Acer macrophyllum* are the major tree species. Companion species are common and specific species present depend on the geographic location. Conifers, including *Abies grandis*, *Picea sitchensis*, *Pseudotsuga menziesii*, *Thuja plicata*, and/or *Tsuga heterophylla*, can be codominant (up to one-third relative cover). Other major dominant broadleaf species are *Quercus garryana*, *Frangula purshiana*, and *Cornus nuttallii*. Conifers tend to increase in abundance with time in the absence of major disturbance, although the hardwoods, particularly *Acer macrophyllum*, can persist in the overstory. The understory is characterized by deciduous shrubs such as *Acer circinatum*, *Corylus cornuta*, *Oemleria cerasiformis*, *Rubus ursinus*, *Symphoricarpos albus*, and/or *Toxicodendron diversilobum*, but evergreen shrubs, including *Gaultheria shallon* and *Mahonia nervosa* and forbs, such as *Polystichum munitum* and *Oxalis oregana*, can be dominant. This group occurs on valley terraces and slopes at low elevations in the mountains of the Pacific Northwest coast and interior valleys west of the high Cascade Range. It is the dominant forest and woodland surrounding cities and towns of the Pacific Northwest, and component species are indicators of recent and past disturbance, both human-induced and natural. It also occurs on steep slopes and bluffs that are subject to mass movements on a periodic basis.

***Diagnostic Characteristics:** These forests are composed of deciduous broadleaf forests and woodlands, sometimes with varying components of conifers. *Alnus rubra* and *Acer macrophyllum* are the major tree species. Conifers, including *Pseudotsuga menziesii*, *Thuja plicata*, *Abies grandis*, *Tsuga heterophylla*, and/or *Picea sitchensis*, can be codominant.

***Classification Comments:** This group is conceptually a combination of two ecological systems, ~North Pacific Broadleaf Landslide Forest and Shrubland (CES204.846)\$\$ and ~North Pacific Lowland Mixed Hardwood-Conifer Forest (CES204.073)\$\$\$. Open shrubby and herbaceous associations that are part of the landslide system are not included in this group. British Columbia ecologists feel this

group may extend over too broad a range north to south, because there are different understory species, such as the presence of *Vaccinium ovalifolium* and lack of *Mahonia nervosa*, and different overstory species, such as *Acer circinatum* and *Acer macrophyllum* throughout the range as currently defined. One option is to subdivide this type among several groups, north to south, and treat them as alliance-based successional stages. Further review is needed. Really wet areas along streams and hillslope springs that have an abundance of wet-loving shrubs in the understory, such as *Rubus spectabilis*, *Rubus parviflorus*, *Ribes bracteosum*, and *Oplopanax horridus*, are a part of ~North Pacific Lowland Riparian Forest & Woodland Group (G254)\$.

Should successional red alder stands that are common in coastal Del Norte and Humboldt counties be included in this group? If so, redwood should be added to the list of conifers. If redwood is present, then it is part of the ~Californian Coastal Redwood Forest Group (G235)\$.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|-------------------------------|------|
| | | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These forests are composed of deciduous broadleaf forests and woodlands, sometimes with varying components of conifers. They are 14-20 m tall, and the canopy is generally closed to slightly open.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: *Alnus rubra* or *Acer macrophyllum* are the major tree species throughout the range of this group. Stands are often mixed with other conifers or broadleaf species. As *Alnus rubra* and *Acer macrophyllum* have a wide north-to-south coastal distribution, the companion species shift with geography. Conifer species such as *Pseudotsuga menziesii*, *Thuja plicata*, *Abies grandis*, *Tsuga heterophylla*, and/or *Picea sitchensis* can be codominant. Other major dominant broadleaf species are *Quercus garryana*, *Frangula purshiana*, and *Cornus nuttallii*. Conifers tend to increase in abundance with time in the absence of major disturbance, although the hardwoods, particularly *Acer macrophyllum*, can persist in the overstory. The understory is characterized by deciduous shrubs such as *Acer circinatum*, *Corylus cornuta*, *Oemleria cerasiformis*, *Rubus ursinus*, *Symphoricarpos albus*, and/or *Toxicodendron diversilobum*, but evergreen shrubs, including *Gaultheria shallon* and *Mahonia nervosa* and forbs, such as *Polystichum munitum* and *Oxalis oregana*, can be dominant.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: This is, for the most part, an early-successional forest group. *Alnus* and *Acer* are dependent on full sunlight, and once overtopped by larger conifer species, will, without further disturbance, typically succeed to a conifer forest type. However, some stands can persist without disturbance (200 years) and remain mixed deciduous-conifer forests. When these forests are clearcut, logging companies systematically plant only conifers, causing this type to decline in heavily managed landscapes. So, it becomes an important type for conservation, especially in the Coast Ranges. In areas where it is regenerated by natural disturbances, it is not just a seral type of dry or mesic Douglas-fir - western hemlock types, but an important component of the forested landscape of the Pacific Northwest.

ENVIRONMENT

Environmental Description: This alliance occurs on valley terraces and slopes at low elevations in the mountains of the Pacific Northwest coast and interior valleys west of the high Cascade Range, and west of the Klamath Mountains in northwestern California. It is the dominant forest and woodland surrounding cities and towns of the Pacific Northwest, and component species are indicators of recent and past disturbance, both human-induced and natural. They also occur on steep slopes and bluffs that are subject to mass movements on a periodic basis. They are found in patches of differing age associated with different landslide events.

Soil/substrate/hydrology: In some places, hardwoods are truly only found in early-seral conditions. This is truer in the northern part of the range. In the southern regions, such as Washington state, there are a few places where hardwoods persist, outside of the dry Douglas-fir - madrone forests around the Willamette Valley, Puget Trough and the western Oregon interior valleys. In the Coast Ranges and Cascades, there are hardwoods (mostly *Alnus rubra* and *Acer macrophyllum*) found in most of the

valley toeslopes. They also occur in areas with exposed talus and exposed rocks, often with *Quercus garryana* and *Fraxinus latifolia*. This mix of deciduous hardwoods and conifers can be a late-seral, relatively stable forest in many areas, while in others it is successional, with the conifers completely overtaking the hardwoods after 200 years or so without disturbance.

DISTRIBUTION

***Geographic Range:** This group occurs from northern British Columbia to northern California, in the coastal areas of the Pacific Northwest, at elevations below the Silver Fir Zone in the northern Pacific mountains and in lowlands (latter especially adjacent to coastlines), becoming less prominent in the northern half of this region.

Nations: CA, US

States/Provinces: BC, CA, OR, WA

USFS Ecoregions (2007) [optional]: 242A:CC, 242B:CC, 342I:??, M242A:CC, M242B:CC, M242C:CC, M242D:CC, M261A:CC, M261D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A0427 | <i>Alnus rubra</i> - <i>Acer macrophyllum</i> - <i>Pseudotsuga menziesii</i> Forest Alliance |
| A3385 | <i>Alnus rubra</i> - <i>Acer macrophyllum</i> Forest Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| >< | Red Alder: 221 | Eyre 1980 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** F.H. Eyre (1980)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** G. Kittel, D. Faber-Langendoen

Acknowledgments [optional]:

Version Date: 09 Nov 2015

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- Franklin, J. F., and C. T. Dyrness. 1973. Natural vegetation of Oregon and Washington. General Technical Report PNW-8. USDA Forest Service, Pacific Northwest Forest and Range Experiment Station, Portland, OR. 417 pp.
- NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

G751. North Pacific Western Hemlock - Sitka Spruce - Western Red-cedar Seasonal Rainforest

Type Concept Sentence: These are tall evergreen conifer forests composed of *Tsuga heterophylla*, *Picea sitchensis*, and *Thuja plicata* (either mixed or singly) that occupy the hypermaritime zone of the Pacific Northwest rainforest region on and near the Pacific Coast, along a heavy rain and fog belt from about Prince Rupert, British Columbia, south to Point Arena, California.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nd.3. Vancouverian Lowland & Montane Forest (M024)

Elcode: G751

***Scientific Name:** *Tsuga heterophylla* - *Picea sitchensis* - *Thuja plicata* North Pacific Seasonal Rainforest Group

***Common (Translated Scientific) Name:** Western Hemlock - Sitka Spruce - Western Red-cedar North Pacific Seasonal Rainforest Group

***Colloquial Name:** North Pacific Western Hemlock - Sitka Spruce - Western Red-cedar Seasonal Rainforest

***Type Concept:** These rainforests are dominated by tall evergreen needle-leaved trees, and are restricted to the outer coastal hypermaritime areas of southeastern Alaska, British Columbia, Washington, Oregon and northern California. The forests are often open and scrubby but can have a closed upper canopy. Stands may be pure *Picea sitchensis*, *Thuja plicata*, or *Tsuga heterophylla* but are more often a mix and may occur with other conifers such as *Callitropsis nootkatensis* (= *Chamaecyparis nootkatensis*), *Chamaecyparis lawsoniana*, *Abies grandis*, *Pseudotsuga menziesii*, *Acer circinatum*, *Alnus rubra*, *Acer macrophyllum*, and *Frangula purshiana* (= *Rhamnus purshiana*). *Abies amabilis* is widespread (except in southern Washington) and can be common but is not dominant. In Washington, nearly pure stands of *Tsuga heterophylla* are common and seem to be associated with microsites where exposure to intense windstorms is likely. Wet coastal environments that support stands of *Chamaecyparis lawsoniana* in the absence of *Tsuga heterophylla*, *Thuja plicata*, or *Picea sitchensis* are also part of this group. The understory is rich with shade-tolerant shrubs and ferns, including *Gaultheria shallon*, *Vaccinium ovatum*, *Menziesia ferruginea*, *Polystichum munitum*, *Dryopteris* spp., and *Blechnum spicant*, as well as a high diversity of mosses. *Oxalis oregana* is important in the understory of moist sites in Washington. *Oplopanax horridus* and *Rubus spectabilis* are important understory shrubs on wet sites dominated by *Picea sitchensis* in the overstory canopy, these sites tend to be sub-irrigated and wet, but not saturated, soils remain well-oxygenated.

Stands are restricted to areas within 25 km of saltwater and are most abundant along coastal central British Columbia, coastal Vancouver Island, and on the Olympic Peninsula of Washington. They range from southern southeastern Alaska (approximately south of Wrangell), through British Columbia, along the southern Washington, Oregon and northern California coasts. The climate is hypermaritime, with cool summers, mild and very wet winters (coldest temperatures range 0-5°C [32-41°F), and abundant fog without a major snowpack. Annual precipitation ranges from 975 to 2399 mm (38-94 inches) with an average of 1572 mm (62 inches) with the majority falling as winter rain. Summer rains are less frequent (<10% of annual rainfall occurs in summer) which can be ameliorated by frequent, dense coastal fog and cloud cover.

Stands are found mostly below 300 m in elevation, where the terrain is mostly gentle, of low topographic relief, and often rocky. Some stands occur on stabilized dunes, others in lower toeslopes and wet sites that are also well-drained, such as sloped floodplains (but are not influenced by overbank flooding) and coarse valley bottoms. Sites occupied include the outermost coastal fringe where salt spray is prominent, riparian terraces and valley bottoms near the coast where there is major fog accumulation. Soils typically have a distinct humus layer overlying mineral horizons or bedrock. In central British Columbia the humus layers can be

very thick (mean = 17-35 cm). Soils are often imperfectly drained. These forests very rarely burn, and natural disturbance is more often single tree gap-disturbance events and intense winter storms on local and regional scales. Fire becomes more of a player in the southern portions of the range, in Oregon and California.

***Diagnostic Characteristics:**

***Classification Comments:** At its northern border this group transitions into ~North Pacific Maritime Western Hemlock - Sitka Spruce Rainforest Group (G750)\$.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G240 | North Pacific Maritime Douglas-fir - Western Hemlock Forest | |
| G750 | North Pacific Maritime Western Hemlock - Sitka Spruce Rainforest | |
| G241 | North Pacific Maritime Silver Fir - Western Hemlock Forest | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary:

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: The forests are often open and scrubby but can have a closed upper canopy. Stands may be pure *Picea sitchensis*, *Thuja plicata*, or *Tsuga heterophylla* but are more often a mix and may occur with other conifers such as *Callitropsis nootkatensis* (= *Chamaecyparis nootkatensis*), *Chamaecyparis lawsoniana*, *Abies grandis*, *Pseudotsuga menziesii*, *Acer circinatum*, *Alnus rubra*, *Acer macrophyllum*, and *Frangula purshiana* (= *Rhamnus purshiana*). *Abies amabilis* is widespread (except in southern Washington) and can be common but is not dominant. In Washington, nearly pure stands of *Tsuga heterophylla* are common and seem to be associated with microsites where exposure to intense windstorms is likely. Wet coastal environments that support stands of *Chamaecyparis lawsoniana* in the absence of *Tsuga heterophylla*, *Thuja plicata*, or *Picea sitchensis* are also part of this group. The understory is rich with shade-tolerant shrubs and ferns, including *Gaultheria shallon*, *Vaccinium ovatum*, *Menziesia ferruginea*, *Polystichum munitum*, *Dryopteris* spp., and *Blechnum spicant*, as well as a high diversity of mosses. *Oxalis oregana* is important in the understory of moist sites in Washington. *Oplopanax horridus* and *Rubus spectabilis* are important understory shrubs on wet sites dominated by *Picea sitchensis* in the overstory canopy, these sites tend to be sub-irrigated and wet, but not saturated, soils remain well-oxygenated.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Const-ancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|------------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:

ENVIRONMENT

Environmental Description: Stands are restricted to areas within 25 km of saltwater and are most abundant along coastal central British Columbia, coastal Vancouver Island, and on the Olympic Peninsula of Washington. They range from southern southeastern Alaska (approximately south of Wrangell), through British Columbia, along the southern Washington, Oregon and northern California coasts. The climate is hypermaritime, with cool summers, mild and very wet winters (coldest temperatures range 0-5°C [32-41°F]), and abundant fog without a major snowpack. Annual precipitation ranges from 975 to 2399 mm (38-94 inches) with an average of 1572 mm (62 inches) with the majority falling as winter rain. Summer rains are less frequent (<10% of annual rainfall occurs in summer) which can be ameliorated by frequent, dense coastal fog and cloud cover.

Stands are found mostly below 300 m in elevation, where the terrain is mostly gentle, of low topographic relief, and often rocky. Some stands occur on stabilized dunes, others in lower toeslopes and wet sites that are also well-drained, such as sloped floodplains (but are not influenced by overbank flooding) and coarse valley bottoms. Sites occupied include the outermost coastal fringe where salt spray is prominent, riparian terraces and valley bottoms near the coast where there is major fog accumulation. Soils typically have a distinct humus layer overlying mineral horizons or bedrock. In central British Columbia the humus layers can be

very thick (mean = 17-35 cm). Soils are often imperfectly drained. These forests very rarely burn, and natural disturbance is more often single tree gap-disturbance events and intense winter storms on local and regional scales. Fire becomes more of a player in the southern portions of the range, in Oregon and California.

DISTRIBUTION

***Geographic Range:** This group ranges from southern southeastern Alaska (approximately south of Wrangell), through British Columbia, along the southern Washington, Oregon and northern California coasts.

Nations: CA, US

States/Provinces: AK, BC, CA, OR, WA

USFS Ecoregions (2007) [optional]:

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3609 | <i>Abies grandis</i> - <i>Picea sitchensis</i> - <i>Thuja plicata</i> Forest Alliance |
| A3604 | <i>Tsuga heterophylla</i> - <i>Picea sitchensis</i> / <i>Rhytidiadelphus loreus</i> Forest Alliance |
| A3606 | <i>Chamaecyparis lawsoniana</i> - <i>Picea sitchensis</i> Forest Alliance |
| A3608 | <i>Picea sitchensis</i> / <i>Rubus spectabilis</i> Mesic Forest Alliance |
| A3607 | <i>Picea sitchensis</i> Stabilized Dune Forest Alliance |
| A3605 | <i>Tsuga heterophylla</i> - <i>Thuja plicata</i> - <i>Callitropsis nootkatensis</i> Forest Alliance |
| A3611 | <i>Tsuga heterophylla</i> - <i>Thuja plicata</i> / <i>Vaccinium ovalifolium</i> Forest Alliance |
| A3610 | <i>Tsuga heterophylla</i> - <i>Thuja plicata</i> / <i>Blechnum spicant</i> Rich Mesic Forest Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------------|---|---|
| 2013-03-21 | G238 <i>Thuja plicata</i> - <i>Tsuga heterophylla</i> / <i>Blechnum spicant</i> Maritime Forest Group | G751 formed by merging part of G239 & all of G238 |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP

***Primary Concept Source [if applicable]:**

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** G. Kittel

Acknowledgments [optional]:

Version Date: 15 May 2015

REFERENCES

***References [Required if used in text]:**

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1. Forest & Woodland

1.B.2.Nd. Vancouverian Forest & Woodland

M025. Vancouverian Subalpine Forest

1. Forest & Woodland

1.B.2.Nd. Vancouverian Forest & Woodland

G245. North Pacific Mountain Hemlock - Silver Fir Forest & Tree Island

Type Concept Sentence: This forested group occurs throughout the mountains of the North Pacific and is dominated mostly by *Tsuga mertensiana*, but other species can be codominant, including *Abies amabilis*, *Abies lasiocarpa*, *Callitropsis nootkatensis*, and/or *Tsuga heterophylla*. At the highest altitudes, the forest may begin to break up, forming "tree islands" that are surrounded by meadows or shrublands, where they form the "parkland" habitats before giving way to treeline.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nd.4. Vancouverian Subalpine Forest (M025)

Elcode: G245

***Scientific Name:** *Tsuga mertensiana* - *Abies amabilis* - *Callitropsis nootkatensis* Forest Group

***Common (Translated Scientific) Name:** Mountain Hemlock - Pacific Silver Fir - Alaska-cedar Forest Group

***Colloquial Name:** North Pacific Mountain Hemlock - Silver Fir Forest & Tree Island

***Type Concept:** This forested group occurs throughout the mountains of the North Pacific, from the central Cascades of Oregon north to the upper slopes of mountain ranges along the Gulf Coast of Alaska, to the Cook Inlet. It is the predominant forest of subalpine elevations in the coastal mountains of British Columbia, Alaska, western Washington and western Oregon. It also occurs on mountain slopes on the outer coastal islands of British Columbia. It occurs at elevations ranging from 300 to 2300 m (1000-7500 feet). At the highest altitudes, the forest may begin to break up, forming "tree islands" that are surrounded by meadows or shrublands, where they form the "parkland" habitats before giving way to treeline. The lower and upper elevational limits decrease from south to north and from east to west. *Tsuga mertensiana* is one of the dominant tree species throughout, and *Abies amabilis* becomes an important associated species in the southern and central portion of the range, and drops out completely for the Alaska portion of this group's range. *Tsuga heterophylla* often occurs at lower elevations in this group but is much less abundant than *Tsuga mertensiana*. *Callitropsis nootkatensis* (= *Chamaecyparis nootkatensis*) occurs in the more coastal-influenced sections, decreasing with increasing continental climate, while *Abies lasiocarpa* is found inland and becomes increasingly common near the transition to the Subalpine Fir-Engelmann Spruce Zone in the Cascades and British Columbia. On the leeward side of the Cascades, the group is usually a dense canopy composed of *Abies lasiocarpa* and *Tsuga mertensiana*, with some *Picea engelmannii* or *Abies amabilis*. In Alaska *Abies lasiocarpa* mixes with the canopy of *Tsuga mertensiana* in some locations. *Picea sitchensis* and *Thuja plicata* are occasionally present. Deciduous trees are rare. Common understory species include *Blechnum spicant*, *Elliottia pyroliflora*, *Empetrum nigrum*, *Geum calthifolium*, *Vaccinium ovalifolium*, *Gymnocarpium dryopteris*, *Harrimanella stelleriana*, *Luetkea pectinata*, *Menziesia ferruginea*, *Nephrophyllidium crista-galli*, *Phyllodoce aleutica* (or *Phyllodoce glanduliflora*), *Rubus pedatus*, *Streptopus lanceolatus*, *Tiarella trifoliata*, *Vaccinium membranaceum*, and *Vaccinium ovalifolium*.

***Diagnostic Characteristics:** Dominance of *Tsuga mertensiana* singly or with *Abies amabilis*. Other conifers may be present. May form large continuous forests or small clumps of trees.

***Classification Comments:** At its southern border, this group merges into ~Sierra-Cascade Red Fir - Mountain Hemlock Forest Group (G749) \$\$ in the Cascade Range south of Crater Lake National Park in Oregon. The central Oregon Cascades, and the eastern slope of the Cascades in Washington all have important high-severity fire regime (occasional intense fires), warmer, drier summers, and little to no *Abies amabilis*, and may have other floristic differences from the forests west of coastal mountain divide from northern Oregon to southeastern Alaska which have very little to no fire, lots of *Abies amabilis*, and cool summers. This group includes what the Alaska Natural Heritage Program calls Maritime Subalpine Fir-Mountain Hemlock Forest. These differences may be best handled at the alliance level.

Placement of the following associations in this group needs review as they could be Rocky Mountain associations. Even though they are on the lee side of the Coast, they are likely more floristically related to interior types: ~*Abies lasiocarpa* / *Valeriana sitchensis* - *Luzula glabrata* var. *hitchcockii* Forest (CEGL000345)\$\$; ~*Abies lasiocarpa* / *Vaccinium membranaceum* / *Valeriana sitchensis* Forest (CEGL002612)\$\$; ~*Abies lasiocarpa* / *Phyllodoce empetriformis* Woodland (CEGL000920)\$\$; and ~*Abies lasiocarpa* - *Pseudotsuga menziesii* / *Acer circinatum* Woodland (CEGL000921)\$\$\$. And should the following association be placed in G244: ~*Callitropsis nootkatensis* Subalpine Parkland Woodland (CEGL000350)\$\$\$.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G749 | Sierra-Cascade Red Fir - Mountain Hemlock Forest | |
| G241 | North Pacific Maritime Silver Fir - Western Hemlock Forest | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Needle-leaved trees (15-35 m tall) in dense to open forests or as clumps of 10-50 individual trees forming a closed canopy. Forests may be open patchy canopy, or clumps of trees surrounded by herbaceous vegetation aka "parkland."

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: *Tsuga mertensiana* is one of the dominant tree species throughout, and *Abies amabilis* becomes an important associated species in the southern portion of the range, and drops out completely for most of the Alaska portion of this group's range [this statement needs review]. *Tsuga heterophylla* often occurs at lower elevations in this group but is much less abundant than *Tsuga mertensiana*. *Callitropsis nootkatensis* (= *Chamaecyparis nootkatensis*) becomes less predominant with increasing distance from the coast, while *Abies lasiocarpa* is found inland and becomes increasingly common near the transition to the Subalpine Fir-Engelmann Spruce Zone in the Cascades and British Columbia. On the leeward side of the Cascades, this is usually a dense canopy composed of *Abies lasiocarpa* and *Tsuga mertensiana*, with some *Picea engelmannii* or *Abies amabilis*. In Alaska *Abies lasiocarpa* mixes with the canopy of *Tsuga mertensiana* in some locations. *Picea sitchensis* and *Thuja plicata* are occasionally present. Deciduous trees are rare. Common understory species include *Blechnum spicant*, *Elliottia pyroliflora*, *Empetrum nigrum*, *Geum calthifolium*, *Vaccinium ovalifolium*, *Gymnocarpium dryopteris*, *Harrimanella stelleriana*, *Luetkea pectinata*, *Menziesia ferruginea*, *Nephrophyllidium crista-galli*, *Phyllodoce aleutica* (or *Phyllodoce glanduliflora*), *Rubus pedatus*, *Streptopus lanceolatus*, *Tiarella trifoliata*, *Vaccinium membranaceum*, and *Vaccinium ovalifolium*.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Const-ancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|------------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Fire is very rare or absent across the northern and coastal influence portion of the range of the group. In the drier-summer climatic areas (eastern Cascades), occasional high-severity fires occur, with return intervals of 400-600 years (J. Kertis pers. comm. 2006, K. Kopper pers. comm. 2006). On drier sites, *Abies lasiocarpa* and *Pinus contorta* can be the first forests to develop after stand-replacing fire. These early-seral stages, with lodgepole pine dominant in the upper canopy, should be considered part of this group if *Tsuga mertensiana* and *Abies amabilis* are present, as it will succeed as a mixed pine type, then mountain hemlock becomes characteristic. Landfire VDDT models: R#ABAMup.

ENVIRONMENT

Environmental Description: *Climate:* The climate is generally characterized by short, cool summers, rainy autumns and long, cool, wet winters with heavy snow cover for 5-9 months. The heavy snowpack is ubiquitous, but at least in southern Oregon and perhaps the eastern Cascades, summer drought is more significant.

DISTRIBUTION

***Geographic Range:** This group occurs throughout the mountains of the North Pacific, from the central Cascades of Oregon north to the coast of Alaska to the Cook Inlet.

Nations: CA, US

States/Provinces: AK, BC, OR, WA

USFS Ecoregions (2007) [optional]: 242A:??, M242A:CC, M242B:CC, M242C:CC, M242D:CC, M261A:CC, M261D:C?, M261G:C?

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3728 | <i>Callitropsis nootkatensis</i> - <i>Tsuga mertensiana</i> - <i>Abies amabilis</i> Forest & Woodland Alliance |
| A3725 | <i>Tsuga mertensiana</i> Alaskan Tree Island Alliance |
| A3726 | <i>Abies amabilis</i> - <i>Tsuga mertensiana</i> - <i>Abies lasiocarpa</i> Cascadian Forest & Woodland Alliance |
| A3729 | <i>Abies lasiocarpa</i> - <i>Picea engelmannii</i> / <i>Rubus lasiococcus</i> Cascadian Forest Alliance |
| A3727 | <i>Tsuga mertensiana</i> - <i>Abies amabilis</i> - <i>Callitropsis nootkatensis</i> Tree Island Alliance |
| A3723 | <i>Tsuga mertensiana</i> - <i>Abies amabilis</i> Forest & Woodland Alliance |
| A3724 | <i>Tsuga mertensiana</i> - <i>Tsuga heterophylla</i> - <i>Callitropsis nootkatensis</i> Forest & Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------------|--|-----------------------|
| 2012-07-17 | G609 Alaskan <i>Tsuga mertensiana</i> Forest Group | G609 merged into G245 |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--|-------------------------------|------|
| > | Mountain Hemlock: 205 | Eyre 1980 | |
| > | MF Mountain Hemlock - Amabilis Fir Forested | Ecosystems Working Group 1998 | |
| > | EW Subalpine Fir - Mountain Hemlock Wet Forested | Ecosystems Working Group 1998 | |
| >< | SsHm - Reedgrass (MHwh1/03) | Banner et al. 1993 | |
| >< | HmSs -Blueberry (MHwh1/01) | Banner et al. 1993 | |
| >< | HmBa -Bramble (MHmm2/04) | Banner et al. 1993 | |
| >< | HmBa -Bramble (MHmm1/04) | Banner et al. 1993 | |
| >< | HmBa -Blueberry (MHmm2/01) | Banner et al. 1993 | |
| >< | HmBa -Blueberry (MHmm1/01) | Banner et al. 1993 | |
| >< | HmBa - Mountain-heather (MHmm2/02) | Banner et al. 1993 | |
| >< | HmBa - Mountain-heather (MHmm1/02) | Banner et al. 1993 | |
| >< | CwYc - Goldthread (CWHvm2/09) | Banner et al. 1993 | |
| >< | BIHm - Twistedstalk (ESSFmk/01) | Banner et al. 1993 | |
| >< | BIHm - Oak fern (ESSFmk/04) | Banner et al. 1993 | |
| >< | BIHm - Cladonia (ESSFmk/03) | Banner et al. 1993 | |
| >< | BaHm - Twistedstalk (MHmm2/05) | Banner et al. 1993 | |
| >< | BaHm - Twistedstalk (MHmm1/05) | Banner et al. 1993 | |
| >< | BaHm - Oak fern (MHmm2/03) | Banner et al. 1993 | |
| >< | BaHm - Oak fern (MHmm1/03) | Banner et al. 1993 | |

AUTHORSHIP

*Primary Concept Source [if applicable]: F.H. Eyre (1980)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

*Author of Description: G. Kittel

Acknowledgments [optional]:

Version Date: 09 Oct 2013

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*References [Required if used in text]:

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G749. Sierra-Cascade Red Fir - Mountain Hemlock Forest

Type Concept Sentence: This group includes high-elevation forests and woodlands of the Sierra Nevada north into southern Oregon, and are dominated by *Abies magnifica* var. *magnifica*, *Abies magnifica* var. *shastensis*, *Abies procera*, and/or *Tsuga mertensiana*.

OVERVIEW

*Hierarchy Level: Group

*Placement in Hierarchy: 1.B.2.Nd.4. Vancouverian Subalpine Forest (M025)

Elcode: G749

*Scientific Name: *Abies magnifica* var. *magnifica* - *Abies magnifica* var. *shastensis* - *Tsuga mertensiana* Forest Group

*Common (Translated Scientific) Name: California Red Fir - Shasta Red Fir - Mountain Hemlock Forest Group

*Colloquial Name: Sierra-Cascade Red Fir - Mountain Hemlock Forest

*Type Concept: This group includes high-elevation (1600-2700 m [4850-9000 feet]) forests and woodlands from the southern Sierra Nevada north and west into southern Oregon. These forests and woodlands are dominated by *Abies magnifica* var. *magnifica*, *Abies magnifica* var. *shastensis*, *Abies procera*, and/or *Tsuga mertensiana*. Other conifers that can occur in varying mixtures include *Pinus contorta* var. *murrayana*, *Pinus monticola*, *Pinus jeffreyi*, and *Pinus albicaulis*. *Pinus contorta* in Oregon indicates lower productivity where it intergrades with *Abies magnifica* var. *shastensis* (= *Abies x shastensis*). Associations range from mesic to moist, and some sites have mesic indicator species, such as *Ligusticum grayi* or *Thalictrum fendleri*. Common understory species include *Ceanothus cordulatus* (in seral stands), *Chrysolepis sempervirens*, *Quercus sadleriana*, *Quercus vacciniifolia*, *Ribes viscosissimum*, *Symphoricarpos mollis*, *Symphoricarpos rotundifolius*, and *Vaccinium membranaceum*. Characteristic forbs include *Eucephalus breweri*, *Pedicularis semibarbata*, and *Hieracium albiflorum*. Heavy snowpack is a major source of soil moisture throughout the growing season. The limiting factors can be either cold-air drainage or ponding, or coarser soils (pumice versus ash, for example). This group commonly occurs above mixed conifer forests with *Abies concolor* and overlaps in elevation with forests and woodlands of *Pinus contorta* var. *murrayana*. On volcanic sites of lower productivity, stands may be more open woodland in structure and with poor-site understory species such as *Wyethia mollis*. This group is typically found on deep, well-drained soils throughout this

elevational zone from the southern Sierra Nevada north into the southern Cascades, Klamath Mountains, North Coast Ranges of northern California and southern Oregon. Soils in the North Coast Ranges and Klamath Mountains are mainly derived from granitic and metasedimentary substrates. Driving ecological processes include occasional blowdown, insect outbreaks and stand-replacing fire.

***Diagnostic Characteristics:** Diagnostic characteristics are the dominance of *Abies magnifica* var. *magnifica*, *Abies magnifica* var. *shastensis*, and/or *Abies procera*.

***Classification Comments:** Former groups G242 and G244 have been merged into this group. These are the moist subalpine forests and woodlands of California, the southern Cascades of Oregon, and the Klamath Mountains. Exactly where geographically this group transitions to ~North Pacific Mountain Hemlock - Silver Fir Forest & Tree Island Group (G245) is not determined, but generally will be where *Abies amabilis* becomes a more significant component of the subalpine *Tsuga mertensiana* forests. Where associations dominated by *Abies procera* belong is still not clear. They are mentioned in this group, as well as two others. This will require some additional work to clarify, but since there are only one or two of them in the NVC, they are a minor issue. At warmer and lower sites of California, *Abies concolor* can codominate with *Abies magnifica*; these associations have been placed in ~Californian Montane Conifer Forest & Woodland Group (G344) on the advice of T. Keeler-Wolf (pers. comm. 2013).

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|--|
| G245 | North Pacific Mountain Hemlock - Silver Fir Forest & Tree Island | occurs on colder sites, generally further north, where the transition from G749 to this one is to be determined. |
| G344 | Californian Montane Conifer Forest & Woodland | occurs on warmer and drier sites with <i>Abies concolor</i> , but may have <i>Abies magnifica</i> codominant. |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group contains tall evergreen needle-leaved trees (15-30 m), forming a continuous canopy, more forest than woodland; however, some stands are open due to heavy late-lying snow drifts that limit tree in-filling. Shrub undergrowth is low-statured (<1 m) and open.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: In the high-elevation (1600-2700 m [4850-9000 feet]) region, stands are dominated by *Abies magnifica* var. *magnifica*, *Abies magnifica* var. *shastensis*, and/or *Abies procera*. The limiting factors can be either cold-air drainages or ponding, or coarser soils (pumice versus ash, for example). Other conifers that can occur in varying mixtures with *Abies magnifica* include *Pinus contorta* var. *murrayana*, *Pinus monticola*, *Tsuga mertensiana*, *Pinus jeffreyi*, and *Pinus albicaulis*. Stands in the central Sierra Nevada are dominated by *Tsuga mertensiana* and *Pinus contorta* var. *murrayana*; other important conifers and locally dominant species include *Abies magnifica*, *Pinus albicaulis*, and *Pinus monticola*. Important shrubs include *Phyllodoce breweri* and *Ribes montigenum*. Grasses and forbs include *Carex exserta*, *Carex rossii*, and *Poa wheeleri*. This group is generally found on moist sites and some sites have mesic indicator species, such as *Ligusticum grayi* or *Thalictrum fendleri*. Common understory species include *Quercus vacciniifolia*, *Ribes viscosissimum*, *Chrysolepis sempervirens*, *Ceanothus cordulatus* (in seral stands), *Vaccinium membranaceum*, *Symphoricarpos mollis*, and *Symphoricarpos rotundifolius*. Characteristic forbs include *Eucephalus breweri*, *Pedicularis semibarbata*, and *Hieracium albiflorum*. This group commonly occurs above mixed conifer forests with *Abies concolor* and overlaps in elevation with forests and woodlands of *Pinus contorta* var. *murrayana*. On volcanic sites of lower productivity, stands may be more open woodland in structure and with poor-site understory species such as *Wyethia mollis*.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Driving ecological processes include occasional blowdown, insect outbreaks and stand-replacing fire. Stand-replacing fire is important but so are moderately frequent (about once every 40 years) low- to moderate-severity fires. The group is characterized by a "moderate-severity fire regime" (Agee 1993), i.e., high variability in severity and moderate frequency of fires. See also Pitcher (1987), Taylor and Halpern (1991), and Chappell and Agee (1996) for documentation of fire regime in these forests.

ENVIRONMENT

Environmental Description: *Soil/substrate/hydrology:* Heavy snowpack is a major source of soil moisture throughout much of the growing season. This group includes high-elevation (1600-2700 m [4850-9000 feet]) forests and woodlands. Stands are typically found on deep, well-drained soils throughout this elevational zone from the southern Sierra Nevada north and west into southern Oregon. The limiting factors can be either cold-air drainages or ponding, or coarser soils (pumice versus ash, for example). Many stands are found on subalpine stream benches, slopes, and can be extensive on north-facing aspects and lake margins.

DISTRIBUTION

***Geographic Range:** This group occurs at subalpine elevations from the southern Sierra Nevada north into the southern Cascades, Klamath Mountains, North Coast Ranges of northern California and southern Oregon.

Nations: US

States/Provinces: CA, NV, OR

USFS Ecoregions (2007) [optional]: M261:C

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3620 | <i>Tsuga mertensiana</i> - <i>Pinus contorta</i> var. <i>murrayana</i> Sierran Forest Alliance |
| A3619 | <i>Abies magnifica</i> var. <i>magnifica</i> - <i>Abies magnifica</i> var. <i>shastensis</i> Forest Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------------|--|---------------------------------|
| 2013-03-12 | G244 <i>Tsuga mertensiana</i> - <i>Pinus contorta</i> var. <i>murrayana</i> Forest Group | G242 & G244 merged to form G749 |
| 2013-03-12 | G242 <i>Abies magnifica</i> - <i>Abies</i> x <i>shastensis</i> Forest Group | G242 & G244 merged to form G749 |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| = | Red Fir: 207 | Eyre 1980 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** F.H. Eyre (1980)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** M.S. Reid

Acknowledgments [optional]: P. Moore, J. Sawyer

Version Date: 09 Nov 2015

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1. Forest & Woodland

1.B.2.Nd. Vancouverian Forest & Woodland

G243. Sierra-Cascade Cold-Dry Subalpine Woodland

Type Concept Sentence: This group includes forests dominated by *Juniperus grandis*, *Pinus albicaulis*, and/or *Pinus contorta* var. *murrayana* that occur on ridges and rocky slopes around timberline in the Sierra Nevada and southern Cascades, where these trees often occur as krummholz growth forms. In more protected sites, they form full-height woodland physiognomy.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Nd.4. Vancouverian Subalpine Forest (M025)

Elcode: G243

***Scientific Name:** *Pinus contorta* var. *murrayana* Woodland Group

***Common (Translated Scientific) Name:** Sierra Lodgepole Pine Woodland Group

***Colloquial Name:** Sierra-Cascade Cold-Dry Subalpine Woodland

***Type Concept:** This forested group occurs on ridges and rocky slopes around timberline at (1800-2450 m [6000-8000 feet] in the north and 2450-3600 m [8000-11,800 feet] in the south) up to 3600 m (11,800 feet) in the Sierra Nevada, and 2450 m (8000 feet) in the southern Cascades. It also occurs on extensive broad ridges and pumice plateaus of the southern Cascades in Oregon. Tree species often occur as krummholz growth forms with a wind-pruned, prostrate, and/or shrub-like appearance, but in more protected sites they form full-height woodland physiognomy. Soils are often shallow and coarse-textured. Avalanches, tree mortality from insect outbreak and disease, drought, and associated wildfire are drivers of vegetation structure and composition. Stands are dominated by *Juniperus grandis* (= *Juniperus occidentalis* var. *australis*), *Pinus albicaulis*, and/or *Pinus contorta* var. *murrayana*; other important conifers and locally dominant species include *Pinus balfouriana* (only in the Klamath Mountains and southern Sierra Nevada where it may replace *Pinus albicaulis*), *Pinus flexilis* (but only in small patches on the eastern flank of the Sierra Nevada escarpment when it does occur), and *Pinus monticola* (not in Transverse or Peninsular ranges). *Juniperus grandis* occurs mostly in

the central and southern Sierra Nevada but not in the Klamath Mountains. Important shrubs include *Arctostaphylos nevadensis*, *Ceanothus cordulatus*, *Cercocarpus ledifolius*, *Chrysolepis sempervirens*, *Artemisia tridentata*, *Phyllodoce breweri*, *Ribes montigenum*, and *Holodiscus discolor* (= *Holodiscus microphyllus*). Grasses and forbs include *Carex exserta*, *Carex rossii*, *Carex filifolia*, *Poa wheeleri*, *Eriogonum incanum*, *Penstemon newberryi*, and *Penstemon davidsonii*. Due to landscape position and very thin soils, these are harsh sites exposed to desiccating winds with ice and snow blasts and rocky substrates. In addition, a short growing season limits plant growth. Understories are open, with scattered shrubs and herbaceous species, which do not provide a continuous fuel bed. Trees can be old and can attain diameters of 1.2 m (4 feet). The highest tree diversity occurs in the Klamath Mountains, with sometimes five or more conifers sharing codominance in one stand.

***Diagnostic Characteristics:** Coniferous trees on ridges and rocky slopes around upper timberline in the Sierra Nevada and southern Cascades; extensive broad ridges and pumice plateaus of the southern Cascades in Oregon. Dominance of *Juniperus grandis*, *Pinus albicaulis*, *Pinus balfouriana*, and/or *Pinus contorta* var. *murrayana*.

***Classification Comments:** Sawyer et al. (2009) treat *Juniperus occidentalis* var. *australis* as *Juniperus grandis*. Quote from Sawyer et al. (2009): "Traditionally, *Juniperus occidentalis* has involved two forms, var. *occidentalis* (western juniper) and var. *australis* (mountain juniper) (Hickman 1993). Using sequence and RAPD data, Adams et al. (2006) have shown the varieties to be distant, now called *Juniperus grandis* and *Juniperus occidentalis*. In addition, they differ in their essential oils (Adams 2004), and in dioecy. *Juniperus occidentalis* is monoecious while *Juniperus grandis* dioecious. Both species hybridize with *Juniperus osteosperma* in the Warner and White mountains (Dealy 1990, Tirmenstein 1999a). We follow Adams and use the name *Juniperus grandis*." This group includes the *Juniperus grandis* stands at high elevations of the Sierra Nevada. Stands in the Cascades lack the juniper. The range of *Juniperus grandis* stops in northern Sierra Nevada. *Juniperus grandis* grows in the Cascades, Oregon and the Klamath Mountains.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G220 | Rocky Mountain Lodgepole Pine Forest & Woodland | |
| G223 | Northern Rocky Mountain Whitebark Pine - Subalpine Larch Woodland | |
| G248 | Columbia Plateau Western Juniper Open Woodland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Evergreen needle-leaved tree-dominated open-canopy woodlands with a generally sparse understory at high elevations in the mountains.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Stands are dominated by *Juniperus grandis* (= *Juniperus occidentalis* var. *australis*) (mostly in the central and southern Sierra Nevada but not in the Klamath Mountains), *Pinus albicaulis*, and/or *Pinus contorta* var. *murrayana*; other important conifers and locally dominant species include *Pinus balfouriana* (only in the Klamath Mountains and southern Sierra Nevada where it may replace *Pinus albicaulis*), *Pinus flexilis* (but only in small patches on the eastern flank of the Sierra Nevada escarpment when it does occur), and *Pinus monticola* (not in Transverse or Peninsular ranges). Important shrubs include *Arctostaphylos nevadensis*, *Ceanothus cordulatus*, *Cercocarpus ledifolius*, *Chrysolepis sempervirens*, *Artemisia tridentata*, *Phyllodoce breweri*, *Ribes montigenum*, and *Holodiscus discolor* (= *Holodiscus microphyllus*). Grasses and forbs include *Carex exserta*, *Carex rossii*, *Carex filifolia*, *Poa wheeleri*, *Eriogonum incanum*, *Penstemon newberryi*, and *Penstemon davidsonii*.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Const-ancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|------------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Avalanches, tree mortality from insect outbreak and disease, drought, and associated wildfire are drivers of community structure and composition.

ENVIRONMENT

Environmental Description: *Soil/substrate/hydrology:* Due to landscape position, rocky substrates and very thin soils, these are harsh sites exposed to desiccating winds with ice and snow blasts. In addition, a short growing season limits plant growth.

Soil/substrate/hydrology: This forested group occurs on ridges and rocky slopes around upper timberline. It also occurs on extensive, broad ridges and pumice plateaus of the southern Cascades in Oregon. Soils are often shallow and coarse-textured.

DISTRIBUTION

***Geographic Range:** This group occurs in the southern Cascades, throughout the Sierra Nevada, and in the Transverse and Peninsular ranges. It also extends south into Baja California, Mexico, in the San Pedro Martir Mountains. Where present in Oregon, most likely locations are the southern Oregon Cascades. The broad ridges that form the Cascade Crest in southern Oregon tend to be dominated by extensive stands of lodgepole pine (south of Crater Lake and north maybe to Mount Bachelor). There are also relatively large areas of lodgepole pine along the broad crest from Mt. Jefferson to a little ways north of Olallie Butte. Group determination depends on the diversity of pine trees present. Stands dominated by *Pinus contorta* var. *latifolia* fit into the Rocky Mountain Lodgepole Pine Forest & Woodland Group (G220), while stands dominated by *Pinus contorta* var. *murrayana* belong to this group.

Nations: MX, US

States/Provinces: CA, MXBC, NV, OR

USFS Ecoregions (2007) [optional]: 322A:??, 341D:CC, 341F:CC, 342B:??, M242B:CC, M242C:CC, M261A:CC, M261D:CC, M261E:CC, M261G:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A0509 | <i>Pinus balfouriana</i> Woodland Alliance |
| A3622 | <i>Juniperus grandis</i> - <i>Pinus albicaulis</i> Woodland Alliance |
| A3621 | <i>Pinus contorta</i> var. <i>murrayana</i> Subalpine Forest & Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---|-----------------------------|------|
| > | Lodgepole Pine: 218 | Eyre 1980 | |
| >< | Lodgepole Pine Series | Sawyer and Keeler-Wolf 1995 | |
| >< | Whitebark Pine Series | Sawyer and Keeler-Wolf 1995 | |
| >< | Whitebark Pine-Mountain Hemlock Forest (#86210) | Holland 1986b | |
| >< | Whitebark Pine-Lodgepole Pine Forest (#86220) | Holland 1986b | |
| >< | Whitebark Pine Forest (#86600) | Holland 1986b | |

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--|----------------|---|
| >< | Whitebark Pine: 208 | Eyre 1980 | Whitebark pine stands are a component of this group. |
| >< | Western Juniper: 238 | Eyre 1980 | <i>Juniperus grandis</i> stands are an important component of this group. |
| >< | Western Juniper - Big Sagebrush - Bluebunch Wheatgrass (107) | Shiflet 1994 | <i>Juniperus grandis</i> woodlands are included in this group of the Sierra Nevada. |
| >< | California Mixed Subalpine: 256 | Eyre 1980 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** F.H. Eyre (1980)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** G. Kittel, M.S. Reid and D. Faber-Langendoen

Acknowledgments [optional]: J. Sawyer and P. Moore

Version Date: 09 Oct 2013

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1. Forest & Woodland

1.B.2.Nd. Vancouverian Forest & Woodland

1.B.2.Ne. North American Great Plains Forest & Woodland (D326)

M151. Great Plains Forest & Woodland

1. Forest & Woodland

1.B.2.Ne. North American Great Plains Forest & Woodland

G329. Great Plains Bur Oak Forest & Woodland

Type Concept Sentence: This group is dominated by *Quercus macrocarpa* and is found in upland areas in the northern part of the Great Plains.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Ne.1. Great Plains Forest & Woodland (M151)

Elcode: G329

***Scientific Name:** *Quercus macrocarpa* - *Corylus* spp. / *Carex* spp. Forest & Woodland Group

***Common (Translated Scientific) Name:** Bur Oak - Hazelnut species / Sedge species Forest & Woodland Group

***Colloquial Name:** Great Plains Bur Oak Forest & Woodland

***Type Concept:** This group is dominated by *Quercus macrocarpa* and is found in upland areas in the northern part of the Great Plains. *Quercus muehlenbergii* can be abundant in the southeastern portion of the group's range. Other species, such as *Tilia americana* (not in the Dakotas), *Populus tremuloides*, *Juniperus virginiana*, and *Fraxinus* spp., may be present. The herbaceous layer can vary from sparsely to moderately vegetated and is composed of prairie grasses or woodland *Carex* spp. Shrub associates can include *Prunus virginiana*, *Corylus cornuta*, *Amelanchier alnifolia*, or *Symphoricarpos* spp. Historically, higher cover of grass species occurred as these stands were more open due to more frequent fires. Few good examples of this group likely remain because of past timber harvesting and heavy grazing. Where it occurs at elevations above 915 m (3000 feet), *Pinus ponderosa* woodlands are probably adjacent. It often occurs as small to large patches on buttes, escarpments, and in foothill zones, usually on northerly-facing slopes. It can also occur in ravines and river valleys, though not where flooding is regular. Farther east it can occur on rolling topography, usually in fire-protected areas.

***Diagnostic Characteristics:** This group is characterized by an open to moderately closed forest dominated by *Quercus macrocarpa*. It is found in the Western Great Plains on buttes, escarpments, and in foothill zones, while in the central Great Plains it tends to be in ravines and other low areas on the landscape.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|--|
| G181 | Central Midwest Oak Openings & Barrens | occurs to the east of the range of this group. It can be similar in structure, ranging from very open to slightly closed because of to fire suppression. Unlike G329, which occurs in patches across its range, G181 historically occurred as a matrix type across the eastern tallgrass region of the Great Plains. |
| G145 | Great Plains Mesic Forest & Woodland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group is typified by moderately open to moderately closed woodlands. The understory can be sparse to moderately vegetated. Shrub and herbaceous cover vary widely from low to high cover, though high cover by one

stratum is usually associated with low cover by the other. Most shrubs are 1-2 m tall and deciduous. The herbaceous stratum is dominated by prairie grasses or woodland sedges.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This group is typified by the predominance of *Quercus macrocarpa* constituting at least 10% of the vegetation cover in any given example. Other tree species, such as *Fraxinus pennsylvanica*, *Juniperus virginiana*, *Ostrya virginiana*, *Populus tremuloides*, and *Tilia americana*, may be also present. Understory vegetation can range from sparsely vegetated to more dense. Common shrubs include *Amelanchier alnifolia*, *Cornus drummondii*, *Corylus americana*, *Corylus cornuta*, *Prunus virginiana*, *Ribes* spp., and *Symphoricarpos occidentalis*. The herbaceous layer often exemplifies the surrounding prairie grassland vegetation with species such as *Andropogon gerardii*, *Elymus canadensis*, *Hesperostipa spartea*, *Nassella viridula*, *Panicum virgatum*, *Pascopyrum smithii*, *Sorghastrum nutans*, and *Schizachyrium scoparium*. Species typical of woodlands can be common in some stands, among them *Aralia nudicaulis*, *Carex pensylvanica*, *Galium* spp., *Maianthemum canadense*, *Maianthemum stellatum*, *Sanicula marilandica*, and *Thalictrum dioicum*.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: This group is primarily driven by fire. Fire suppression within this group can lead to more closed canopies and a decrease in the cover of grass species in the understory. Grazing, conversion to agriculture, and past timber harvesting can impact this group. Overgrazing can also lead to a decrease in understory species, and timber harvesting can completely eliminate examples of this group.

ENVIRONMENT

Environmental Description: This group is found in upland areas that are protected from fire; sometimes these areas are also more mesic than the surrounding landscape due to receiving run-off from upslope. Often these are valleys or ravines but they can include hillslopes and escarpments. Sites may be in river or stream valleys but are high enough that they are not flooded except in exceptional years. Soils are predominately dry to mesic and can range from sands to loams.

DISTRIBUTION

***Geographic Range:** This group is found throughout the northern half of the Great Plains from Kansas and northern Missouri north and west to the southern Canadian Prairie Provinces and eastern Montana. In Wyoming, it occurs in the Bear Lodge Mountains and around Devils Tower National Monument. In North Dakota, it is most common in locally rough areas such as the Killdeer Mountains, Turtle Mountains, Pembina Hills, etc., and it may occur in the Pine Ridge region of Nebraska.

Nations: CA, US

States/Provinces: IA, KS, MB, MN, MO, MT, ND, NE, SD, SK, WY

USFS Ecoregions (2007) [optional]: 251B:CC, 251H:C?, 331C:CC, 331E:CC, 331F:CC, 331M:CP, 332B:CC, 332C:CC, 332D:CC, 332E:CC, M334A:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A1505 | <i>Quercus macrocarpa</i> / Mixedgrass Woodland Alliance |
| A0245 | <i>Quercus macrocarpa</i> Forest Alliance |

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A0620 | <i>Quercus macrocarpa</i> / <i>Corylus</i> spp. / Mixedgrass Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|--|
| > | Bur Oak: 236 | Eyre 1980 | |
| < | Bur Oak: 42 | Eyre 1980 | |
| < | Bur Oak: 216 | Eyre 1980 | |
| < | Aspen: 217 | Eyre 1980 | |
| < | Aspen: 16 | Eyre 1980 | Rare but possible where it might be adjacent to Aspen Parklands. |

AUTHORSHIP***Primary Concept Source [if applicable]:** S. Menard and K. Kindscher, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** S. Menard and J. Drake

Acknowledgments [optional]:

Version Date: 07 May 2015

REFERENCES***References [Required if used in text]:**

- Barbour, M. G., and W. D. Billings, editors. 1988. North American terrestrial vegetation. Cambridge University Press, New York. 434 pp.
- Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, M. Russo, K. Schulz, K. Snow, J. Teague, and R. White. 2003-present. Ecological systems of the United States: A working classification of U.S. terrestrial systems. NatureServe, Arlington, VA.
- Eyre, F. H., editor. 1980. Forest cover types of the United States and Canada. Society of American Foresters, Washington, DC. 148 pp.
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- Girard, M. M., H. Goetz, and A. J. Bjugstad. 1989. Native woodland habitat types of southwestern North Dakota. Research Paper RM-281. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 36 pp.
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1. Forest & Woodland

1.B.2.Ne. North American Great Plains Forest & Woodland

G145. Great Plains Mesic Forest & Woodland

Type Concept Sentence: This group is found in the northern Great Plains and has an open to closed tree canopy dominated by *Betula papyrifera*, *Fraxinus pennsylvanica*, *Populus tremuloides*, *Ulmus americana*, *Ulmus rubra*, and *Juniperus scopulorum* and sometimes the tall shrubs *Crataegus douglasii* and *Crataegus succulenta*. It is found in valleys, ravines, and mesic slopes.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.2.Ne.1. Great Plains Forest & Woodland (M151)

Elcode: G145

***Scientific Name:** *Fraxinus pennsylvanica* - *Ulmus americana* / *Prunus* spp. Forest & Woodland Group

***Common (Translated Scientific) Name:** Green Ash - American Elm / Cherry species Forest & Woodland Group

***Colloquial Name:** Great Plains Mesic Forest & Woodland

***Type Concept:** This group is dominated by trees and/or shrubs in a largely grassland landscape. Cover of woody species is variable and can range from just over 10% to nearly 100%. This group occurs in a semi-arid climate, but sites are more mesic than the surrounding areas. In general, shrubs dominate stands that receive less moisture from surrounding areas (e.g., higher on the landscape, steeper slopes, coarser soil), while sites that receive more moisture are dominated by trees and shrubs. The herbaceous layer is variable but tends to be less prominent under heavier woody canopies with deep litter deposition. Dominant trees include *Betula papyrifera*, *Fraxinus pennsylvanica*, *Populus tremuloides*, *Ulmus americana*, *Ulmus rubra*, and, in the western Great Plains, *Juniperus scopulorum*. *Quercus macrocarpa* is common but not dominant except in some stands in canyons. Common shrubs are *Amelanchier alnifolia*, *Cornus sericea*, *Crataegus douglasii*, *Crataegus chrysoarpa*, *Crataegus succulenta*, *Dasiphora fruticosa* ssp. *floribunda*, *Elaeagnus commutata*, *Juniperus horizontalis*, *Prunus virginiana*, *Rhus* spp., *Rosa woodsii*, *Shepherdia argentea*, *Symphoricarpos occidentalis*, and *Toxicodendron rydbergii*. Common graminoids can include *Calamagrostis stricta*, *Carex* spp., *Pascopyrum smithii*, *Piptatheropsis micrantha* (= *Piptatherum micranthum*), *Pseudoroegneria spicata*, or *Schizachyrium scoparium*. *Festuca* spp. can be abundant in the northwestern Great Plains. Typical sites are upper river terraces, protected slopes (often north-facing), ravines, and draws. Stands of this group that occur on upper terraces and toeslopes in riparian areas are rarely flooded but have root access to groundwater. Soils range from shallow to deep and fine to sandy loams.

***Diagnostic Characteristics:** This group occurs in a landscape dominated by grasslands but is distinguished from them by having >25% tree and/or shrub cover. Stands are typically found in more mesic settings than surrounding grasslands but do not occur on regularly inundated or well-developed floodplains.

***Classification Comments:** The northern limit of the distribution of this group is near or overlaps with parts of ~Northeastern Great Plains Aspen Woodland Group (G146)\$\$ and ~Northwestern Great Plains Aspen Woodland Group (G328)\$\$\$. *Betula papyrifera* and *Populus tremuloides* can be dominant canopy species in all three groups but this group (G145) is found on slopes or in valleys, tends to have higher tree cover, and has less cover by prairie grasses in the understory.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G146 | Northeastern Great Plains Aspen Woodland | |
| G329 | Great Plains Bur Oak Forest & Woodland | |
| G328 | Northwestern Great Plains Aspen Woodland | |
| G147 | Great Plains Cottonwood - Green Ash Floodplain Forest | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group is characterized by having more than 10% cover by trees and/or shrubs. Cover of woody species is variable and can range from just over 25% to nearly 100%. In general, shrubs dominate stands that receive less moisture from surrounding areas (e.g., higher on the landscape, steeper slopes, coarser soil), while sites that receive more moisture are dominated by trees and shrubs. The herbaceous layer is variable but tends to be less prominent under heavier woody canopies with a deep litter layer.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This group is dominated by trees and/or shrubs. The herbaceous layer is variable but tends to be less prominent under heavier woody canopies. Dominant trees include *Betula papyrifera*, *Fraxinus pennsylvanica*, *Populus tremuloides*, *Ulmus americana*, *Ulmus rubra*, and, in the western Great Plains, *Juniperus scopulorum*. *Quercus macrocarpa* is common but not dominant except in some stands in canyons. *Acer negundo* is commonly present in portions of the northwestern Great Plains. Common shrubs

are *Amelanchier alnifolia*, *Cornus sericea*, *Crataegus douglasii*, *Crataegus chrysocarpa*, *Crataegus succulenta*, *Dasiphora fruticosa* ssp. *floribunda*, *Elaeagnus commutata*, *Juniperus horizontalis*, *Prunus virginiana*, *Rhus* spp., *Rosa woodsii*, *Shepherdia argentea*, *Symphoricarpos occidentalis*, and *Toxicodendron rydbergii*. Common graminoids can include *Calamagrostis stricta*, *Carex* spp., *Pascopyrum smithii*, *Piptatheropsis micrantha* (= *Piptatherum micranthum*), *Pseudoroegneria spicata*, or *Schizachyrium scoparium*. *Festuca* spp. can be abundant in the northwestern Great Plains. Forbs, including a number that are more moisture-demanding than those in surrounding grasslands, may be prominent under more shaded conditions.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Fire, grazing, and hydrologic dynamics are the dominant factors affecting this group. It occurs in a landscape dominated by grasslands but is found in sites that have more moisture and less fire frequency than the surrounding grasslands. Even in the more mesic sites where this group occurs (ravines, riparian terraces, protected slopes), a decrease in moisture and/or an increase in fire frequency can result in transformation of the site to another group. Excessive grazing can have significant effects on the herbaceous component of this group, particularly by fostering invasion by exotic species, including *Euphorbia esula*, *Bromus inermis*, *Bromus arvensis*, *Poa pratensis*, and *Bromus tectorum*.

ENVIRONMENT

Environmental Description: This group occurs in a semi-arid climate, but sites are more mesic than the surrounding areas. Typical sites are upper river terraces, protected slopes (often north-facing), ravines, and draws. Stands of this group in riparian areas are rarely flooded but have root access to groundwater. Soils range from shallow to deep and fine to sandy loams.

DISTRIBUTION

***Geographic Range:** This group can be found from southern Saskatchewan, southwestern Manitoba, and possibly southeastern Alberta south through much of the northern Great Plains. It may extend into the lower foothills of the Rocky Mountains and the lower elevations of the Black Hills. It extends eastward to the eastern Dakotas and eastern Nebraska (excluding the Sandhills).

Nations: CA, US

States/Provinces: AB?, CO, MB, MT, ND, NE, SD, SK, WY

USFS Ecoregions (2007) [optional]: 331B:CC, 331C:CC, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 331H:C?, 331K:CC, 331L:CC, 331M:CP, 331N:CC, 332A:CC, 332B:CC, 332D:CC, 332E:CC, 342F:CC, M331B:??, M331I:??, M334A:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3211 | <i>Fraxinus pennsylvanica</i> - <i>Ulmus americana</i> Great Plains Forest Alliance |
| A3210 | <i>Juniperus scopulorum</i> - <i>Juniperus virginiana</i> Woodland Alliance |
| A3209 | <i>Betula papyrifera</i> - <i>Populus tremuloides</i> - <i>Quercus macrocarpa</i> Forest Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-----------------------------|----------------|------|
| < | Paper Birch: 18 | Eyre 1980 | |
| < | Cottonwood: 63 | Eyre 1980 | |
| < | Bur Oak: 42 | Eyre 1980 | |
| < | Bur Oak: 216 | Eyre 1980 | |
| >< | Rocky Mountain Juniper: 220 | Eyre 1980 | |
| >< | Bur Oak: 236 | Eyre 1980 | |

AUTHORSHIP

*Primary Concept Source [if applicable]: S. Menard and K. Kindscher, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

*Author of Description: J. Drake

Acknowledgments [optional]: C. Lea

Version Date: 07 May 2015

REFERENCES

*References [Required if used in text]:

Eyre, F. H., editor. 1980. Forest cover types of the United States and Canada. Society of American Foresters, Washington, DC. 148 pp.
 Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2017a. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

1.B.3.Na. Eastern North American-Great Plains Flooded & Swamp Forest (D011)

M028. Great Plains Flooded & Swamp Forest

1. Forest & Woodland

1.B.3.Na. Eastern North American-Great Plains Flooded & Swamp Forest

G147. Great Plains Cottonwood - Green Ash Floodplain Forest

Type Concept Sentence: This group is found across the Great Plains on floodplains of medium to small rivers where an open to moderately closed tree canopy is dominated by *Populus deltoides* or sometimes *Fraxinus pennsylvanica*, often with *Acer negundo*, *Salix amygdaloides*, *Salix nigra*, and, in the southern portion of the group's range, *Celtis laevigata* and *Platanus occidentalis*.

OVERVIEW

*Hierarchy Level: Group

*Placement in Hierarchy: 1.B.3.Na.4. Great Plains Flooded & Swamp Forest (M028)

Elcode: G147

*Scientific Name: *Populus deltoides* - *Fraxinus pennsylvanica* / *Pascopyrum smithii* Floodplain Forest Group

*Common (Translated Scientific) Name: Eastern Cottonwood - Green Ash / Western Wheatgrass Floodplain Forest Group

*Colloquial Name: Great Plains Cottonwood - Green Ash Floodplain Forest

*Type Concept: This group is composed of woodlands and forests found along medium and small rivers in the western and central Great Plains from southern Canada to the Texas panhandle. *Populus deltoides* is the most common tree and may be nearly the only species in the overstory in some stands. Other common trees are *Fraxinus pennsylvanica*, *Salix nigra*, *Salix amygdaloides*, and, in the southeastern portion of this group's range, *Celtis laevigata* and *Platanus occidentalis*. The shrub and herbaceous layers are much more diverse than the canopy across the range of this group with no single species common throughout. Typical shrubs include *Artemisia cana* ssp. *cana*, *Cornus* spp., *Salix* spp., and *Symphoricarpos occidentalis*. The herbaceous stratum is strongly influenced by

surrounding upland Great Plains grasslands and often contains mid and tallgrass species.

***Diagnostic Characteristics:** This group is dominated by trees and is found along medium and small rivers in the Great Plains. Its range in the drier central and western Great Plains and the presence of more Great Plains flora in the understory help to distinguish it from floodplain groups farther east.

***Classification Comments:** This group can be similar to ~Southern Ash - Elm - Willow Floodplain Forest Group (G759)\$ where their ranges adjoin in the central and eastern Great Plains. This group (G147) is found on smaller rivers with less extensive floodplains and tends to have more influence from Great Plains flora in the understory. However, both groups are typically dominated by *Populus deltoides* and both could occur on the same rivers, particularly the Missouri River and Arkansas River but also possibly the Platte River, Republican River, and Canadian River.

Where small tributaries or draws join with medium or small rivers, this group could be adjacent to ~Great Plains Mesic Forest & Woodland Group (G145)\$\$. This group (G147) is distinguished by being in floodplains where regular flooding occurs and often has *Populus deltoides* and/or *Salix* spp. as a dominant or significant component of the overstory and *Salix* spp. in the shrub layers.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G145 | Great Plains Mesic Forest & Woodland | |
| G337 | Great Plains Riparian Wet Meadow & Shrubland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Stands in this dynamic group can have a wide variety of physiognomies. The tree canopy can be open to closed (>25%) and can range from short to tall (10-25 m). The shrub and herbaceous strata can range from nearly absent to dense.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: *Populus deltoides* is the most common tree across the range of this group, and some stands may contain little else in the canopy. The tree canopy is not very diverse. Other tree species that can be present to even dominant in some stand are *Acer negundo*, *Fraxinus pennsylvanica*, *Salix nigra*, *Salix amygdaloides*, and, in the southeastern portion of this group's range, *Celtis laevigata* and *Platanus occidentalis*. The shrub and herbaceous layers are much more diverse than the canopy across the range of this group. Typical shrubs include *Artemisia cana* ssp. *cana*, *Cornus drummondii*, *Cornus sericea*, *Salix interior*, *Salix exigua*, and *Symphoricarpos occidentalis*. *Prunus* spp. can occur, especially along drier edges of these floodplains. The herbaceous stratum is strongly influenced by surrounding upland Great Plains grasslands and often contains mid and tallgrass species such as *Andropogon gerardii*, *Carex pellita*, *Pascopyrum smithii*, *Panicum virgatum*, *Schizachyrium scoparium*, *Spartina pectinata*, and *Sporobolus cryptandrus*.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Const-ancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|------------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Periodic flooding is important in establishing and maintaining stands of this group. Flooding regime (frequency, severity, duration) is also important in shaping the understory composition and structure. Scouring and deposition during flooding create areas of new bare mineral soil necessary for *Populus deltoides* regeneration. Fire may spread from surrounding uplands, particularly where the understory has a significant herbaceous component.

ENVIRONMENT

Environmental Description: This group is found in floodplains and riparian settings along medium and small rivers. Soils are primarily alluvial and range from sandy to clay. This group can occur in deep or shallow river valleys but slopes within stands of this group are typically gentle or nonexistent. Stands are flooded periodically but do not remain submerged for long periods.

DISTRIBUTION

***Geographic Range:** This group is found along permanent rivers throughout the western and central Great Plains from the southern Prairie Provinces of Canada to the panhandle of Texas and from the Rocky Mountains east to the eastern Dakotas, Nebraska and Kansas.

Nations: CA, US

States/Provinces: AB, CO, KS, MB, MT, ND, NE, NM, OK, SD, SK, TX, WY

USFS Ecoregions (2007) [optional]: 331B:CC, 331C:CC, 331D:C?, 331E:CC, 331F:CC, 331G:CC, 331H:C?, 331I:C?, 331K:CC, 331L:C?, 331M:CC, 331N:C?, 332A:CC, 332B:CC, 332C:CC, 332D:CC, 332E:CC, 332F:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3423 | <i>Populus deltoides</i> Floodplain Forest Alliance |
| A0636 | <i>Populus deltoides</i> Floodplain Woodland Alliance |
| A4131 | <i>Fraxinus pennsylvanica</i> - <i>Ulmus americana</i> - <i>Populus deltoides</i> Floodplain Forest Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---|----------------|------|
| > | Cottonwood - Willow: 235 | Eyre 1980 | |
| < | Cottonwood: 63 | Eyre 1980 | |
| < | Sugarberry - American Elm - Green Ash: 93 | Eyre 1980 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** S. Menard, K. Kindscher, P. Comer, G. Kittel, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** J. Drake

Acknowledgments [optional]:

Version Date: 19 May 2015

REFERENCES

***References [Required if used in text]:**

Eyre, F. H., editor. 1980. Forest cover types of the United States and Canada. Society of American Foresters, Washington, DC. 148 pp.
 Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2017a. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

1.B.3.Nc. Rocky Mountain-Great Basin Montane Flooded & Swamp Forest (D195)

M034. Rocky Mountain-Great Basin Montane Riparian & Swamp Forest

1. Forest & Woodland

1.B.3.Nc. Rocky Mountain-Great Basin Montane Flooded & Swamp Forest

G796. Northern Rocky Mountain Lowland-Foothill Riparian Forest

Type Concept Sentence: This group contains riparian forests dominated by *Populus balsamifera* along major streams and rivers throughout the northwestern United States.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.3.Nc.1. Rocky Mountain-Great Basin Montane Riparian & Swamp Forest (M034)

Elcode: G796

***Scientific Name:** Northern Rocky Mountain Lowland-Foothill Riparian Forest Group

***Common (Translated Scientific) Name:** Northern Rocky Mountain Lowland-Foothill Riparian Forest Group

***Colloquial Name:** Northern Rocky Mountain Lowland-Foothill Riparian Forest

***Type Concept:** Vegetation within this group is characterized by an open to moderately dense tree layer that is dominated by *Populus balsamifera* ssp. *trichocarpa* and *Populus balsamifera* ssp. *balsamifera*. Tree associates include *Populus deltoides*, *Populus angustifolia*, *Pinus ponderosa*, and *Picea* spp. A shrub layer is usually present and may be dominated by *Alnus incana*, *Betula papyrifera*, *Cornus sericea*, *Crataegus douglasii*, *Prunus virginiana*, *Ribes americanum*, *Salix exigua*, and *Symphoricarpos albus*. The herbaceous layer is usually relatively sparse and is dominated by either forbs or graminoids. Common species include *Actaea rubra*, *Cicuta douglasii*, *Equisetum sylvaticum*, *Mentha arvensis*, and *Symphyotrichum spathulatum* (= *Aster occidentalis*). This riparian forest group occurs on alluvial terraces along major streams and rivers throughout the northwestern United States. It can occur on alluvial terraces of major streams and rivers, margins of lakes, meadows, deltas, river mouths, and terraces. Stands can occupy broad floodplains or form narrow stringers adjacent to streams with a much steeper slope. Soils typically overlay river gravel and/or cobbles and are coarse-textured. Water tables may drop below 1 m of the soil surface in summer, but can remain moist due to capillary action.

***Diagnostic Characteristics:** Stands dominated by *Populus balsamifera* ssp. *trichocarpa* or *Populus balsamifera* ssp. *balsamifera*.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|-------------------------------|------|
| | | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group is characterized by a tall (<25 m) broad-leaved deciduous tree. The canopy is moderately dense with 50-80% cover on average, but in some stands can total over 90%. The tall- and short-shrub layers vary between 10-50% cover. The forb layer is sparse with up to 20% cover. Ferns can dominate the herbaceous layer with up to 40% cover. Graminoids can be dominant in some stands (particularly recently disturbed ones), or can be sparse.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This group is dominated by *Populus balsamifera* ssp. *trichocarpa* and/or *Populus balsamifera* ssp. *balsamifera*. Other trees present may include *Populus deltoides*, *Populus angustifolia*, *Pinus ponderosa*, and *Picea* spp. and can occur in the canopy with *Populus balsamifera* in Montana stands. The shrub layer is dominated by *Alnus incana*, *Betula papyrifera*, *Cornus*

sericea, *Prunus virginiana*, and *Ribes americanum*. The forb layer can be dominated by *Actaea rubra*, *Mentha arvensis*, and *Symphytotrichum spathulatum* (= *Aster occidentalis*). The graminoid cover is usually less than 10%, but can be up to 80%, and mainly consists of introduced hay grasses. *Equisetum sylvaticum* can dominate the fern layer with up to 40% cover.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: *Populus* species are dependent on flooding for successful sexual reproduction.

ENVIRONMENT

Environmental Description: This group occurs on alluvial terraces along major streams and rivers. It can occur on alluvial terraces of major streams and rivers, margins of lakes, meadows, deltas, river mouths, and terraces. Stands can occupy broad floodplains (1-3% slopes) or form narrow stringers adjacent to streams with a much steeper slope (10-15%). Soils are typically Entisols, usually up to 1 m of mineral soil overlying river gravel and/or cobbles. Soil texture varies from loam to coarse sand. Water tables usually drop below 1 m of the soil surface in summer, but can remain moist due to capillary action. A fluctuating water table in these soils is evidenced by the common presence of mottles.

DISTRIBUTION

***Geographic Range:** This group is found throughout the northern Interior West from the foothills of the Sierra Nevada to Montana, and from southern British Columbia to Nevada, Utah and western Wyoming.

Nations: CA, US

States/Provinces: BC, CA, ID, MT, NV, OR, UT, WA, WY

USFS Ecoregions (2007) [optional]:

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A0311 | <i>Populus balsamifera</i> ssp. <i>trichocarpa</i> Northern Rocky Mountain Riparian Forest Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** D. Culver

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** G. Kittel

Acknowledgments [optional]:

Version Date: 11 May 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2017a. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

G506. Rocky Mountain-Great Basin Montane Riparian & Swamp Forest

Type Concept Sentence: This riparian forest group includes seasonally flooded conifer-dominated forests found at montane to subalpine elevations of the Rocky Mountain cordillera, from southern New Mexico north into Montana, and west into the Intermountain West region and the Colorado Plateau. *Picea engelmannii*, *Picea pungens*, and/or *Populus angustifolia* dominate, and the understory is often dominated by forbs or graminoids with only a few shrubs. Soils are mineral and very well-oxygenated.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.3.Nc.1. Rocky Mountain-Great Basin Montane Riparian & Swamp Forest (M034)

Elcode: G506

***Scientific Name:** *Picea engelmannii* - *Picea pungens* - *Populus angustifolia* Riparian & Swamp Forest Group

***Common (Translated Scientific) Name:** Engelmann Spruce - Blue Spruce - Narrowleaf Cottonwood Riparian & Swamp Forest Group

***Colloquial Name:** Rocky Mountain-Great Basin Montane Riparian & Swamp Forest

***Type Concept:** This group contains woodlands dominated by cottonwood, conifer and aspen that line montane streams. Dominant tree species usually include *Abies lasiocarpa*, *Picea engelmannii*, *Pinus ponderosa*, *Juniperus scopulorum*, and/or *Populus angustifolia*; other important species include *Pseudotsuga menziesii*, *Picea pungens*, *Picea engelmannii* x *glauca*, and *Populus tremuloides*. Other trees possibly present but not usually dominant include *Alnus incana*, *Abies concolor*, *Abies grandis*, *Pinus contorta*, and *Juniperus osteosperma*. Shrub cover tends to be limited but may include *Alnus incana*, *Betula occidentalis*, *Cornus sericea*, *Crataegus rivularis*, *Forestiera pubescens* var. *pubescens*, *Ribes* spp., *Rosa woodsii*, *Salix* spp., and others. The herbaceous undergrowth can be lush to depauperate. Herbaceous species include *Calamagrostis canadensis*, *Carex aquatilis* var. *aquatilis*, *Carex obtusa*, *Carex pellita*, *Equisetum arvense*, *Heracleum maximum*, *Ranunculus alismifolius*, *Senecio bigelovii* var. *bigelovii*, *Streptopus amplexifolius*, and *Veratrum californicum*. This riparian group includes seasonally flooded forests found at montane to subalpine elevations of the Rocky Mountain cordillera, from southern New Mexico north into Montana, and west into the Intermountain West region and the Colorado Plateau. It occurs throughout the interior of British Columbia and the eastern slopes of the Cascade Range. These are communities tolerant of periodic flooding and high water tables. Snowmelt moisture may create shallow water tables or seeps for a portion of the growing season. Stands typically occur at elevations between 1500 and 3300 m (4920-10,830 feet); farther north, elevation ranges between 900 and 2000 m. This is confined to specific riparian environments occurring on floodplains or terraces of rivers and streams, in V-shaped, narrow valleys and canyons (where there is cold-air drainage). Less frequently, occurrences are found in moderately wide valley bottoms on large floodplains along broad, meandering rivers, and on pond or lake margins.

***Diagnostic Characteristics:** This group contains the conifer and aspen woodlands that line montane streams. These are communities tolerant of periodic flooding and high water tables.

***Classification Comments:** This group is restricted to montane riparian areas and avalanche chutes between lower and upper treeline.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|---|
| G505 | Rocky Mountain-Great Basin Swamp Forest | occurs on saturated, extremely poorly drained soil. |
| G507 | North Pacific Montane Riparian Woodland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Open to closed woodlands of tall conifer or deciduous trees with or without an understory of deciduous shrubs, generally forming linear bands following streams. These can blend into the surrounding upland forest, and often only the understory herbaceous species indicate the wet nature of the soils.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Dominant tree species usually include *Abies lasiocarpa*, *Abies grandis*, *Picea engelmannii*, *Picea pungens*, *Populus angustifolia*, *Pinus ponderosa*, *Pinus contorta*, and/or *Juniperus scopulorum*; other important species include *Pseudotsuga menziesii*, *Picea engelmannii* x *glauca*, and *Populus tremuloides*. Other trees possibly present and dominant or codominant include *Abies concolor*, *Abies grandis*, *Pinus contorta*, and *Juniperus osteosperma*. Shrub cover tends to be limited but may include *Alnus incana*, *Betula occidentalis*, *Cornus sericea*, *Crataegus rivularis*, *Forestiera pubescens* var. *pubescens*, *Ribes* spp., *Rosa woodsii*, *Salix* spp., and others. The herbaceous undergrowth can be lush to depauperate. Herbaceous species include *Calamagrostis canadensis*, *Carex aquatilis* var. *aquatilis*, *Carex obnupta*, *Carex pellita*, *Equisetum arvense*, *Heracleum maximum*, *Ranunculus alismifolius*, *Senecio bigelovii* var. *bigelovii*, *Streptopus amplexifolius*, and *Veratrum californicum*. Floristic information is compiled from several sources for eastern Washington and Oregon (Kovalchik 1987, 1993, Crowe and Clausnitzer 1997), Nevada (Manning and Padgett 1995), Colorado (Kittel et al. 1999b), Montana (Butler 1979, 1985, Malanson and Butler 1984, Hansen et al. 1989), British Columbia (MacKenzie and Moran 2004), Utah (Padgett et al. 1989, Tuhy et al. 2002), New Mexico and Arizona (Szaro 1989, Muldavin et al. 2000a), and Wyoming (Walford 1996, Walford et al. 2001).

*Floristics Table [Med - High Confidence]:

*Number of Plots:

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:

ENVIRONMENT

Environmental Description: *Climate:* Temperate cold. *Soil/substrate/hydrology:* Stands typically occur at elevations between 1500 and 3300 m (4920-10,830 feet); farther north, elevation ranges between 900 and 2000 m. This group is confined to specific riparian environments occurring on floodplains or terraces of rivers and streams, in V-shaped, narrow valleys and canyons (where there is cold-air drainage). Less frequently, occurrences are found in moderately wide valley bottoms on large floodplains along broad, meandering rivers, on pond or lake margins, and seeps on gentle slopes. Environmental information is compiled from several sources: for eastern Washington and Oregon (Kovalchik 1987, 1992, 2001, Crowe and Clausnitzer 1997); for Nevada (Manning and Padgett 1995); for Colorado (Baker 1988, 1989a, 1989b, 1990, Kittel et al. 1994, 1995, 1999a, 1999b); for Montana (Butler 1979, 1985, Malanson and Butler 1984, Hansen et al. 1989); for British Columbia (MacKenzie and Moran 2004); for Utah (Padgett et al. 1989, Tuhy et al. 2002); for New Mexico and Arizona (Szaro 1989, Muldavin et al. 2000a); and for Wyoming (Walford 1996, Walford et al. 2001).

DISTRIBUTION

***Geographic Range:** This group is found at montane to subalpine elevations of the Rocky Mountain cordillera, from southern New Mexico north into Montana, Alberta and British Columbia, and west into the Intermountain West region and the Colorado Plateau.

Nations: CA, US

States/Provinces: AB, AZ, BC, CA, CO, ID, MT, NM, NV, OR, SD, UT, WA, WY

USFS Ecoregions (2007) [optional]:

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3761 | <i>Picea pungens</i> Riparian Forest Alliance |
| A4154 | <i>Acer negundo</i> - <i>Alnus incana</i> ssp. <i>tenuifolia</i> - <i>Cornus sericea</i> Riparian Woodland Alliance |
| A3759 | <i>Populus angustifolia</i> Riparian Forest Alliance |
| A3797 | <i>Pinus ponderosa</i> - <i>Juniperus scopulorum</i> - <i>Abies concolor</i> Riparian Woodland Alliance |
| A3760 | <i>Populus tremuloides</i> Riparian Forest Alliance |
| A3762 | <i>Abies grandis</i> Rocky Mountain Riparian Forest Alliance |
| A3758 | <i>Pinus contorta</i> var. <i>murrayana</i> - <i>Pinus contorta</i> var. <i>latifolia</i> Swamp Forest Alliance |
| A3757 | <i>Abies lasiocarpa</i> - <i>Picea engelmannii</i> Swamp Forest Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---------------------------------------|-------------------------------|--|
| > | Riparian (422) | Shiflet 1994 | |
| > | Engelmann Spruce - Subalpine Fir: 206 | Eyre 1980 | Engelmann spruce occurs as a dominant in riparian zones. |
| = | ER Engelmann Spruce Riparian | Ecosystems Working Group 1998 | |
| = | Blue Spruce: 216 | Eyre 1980 | Blue spruce commonly occurs in riparian zones |

AUTHORSHIP***Primary Concept Source [if applicable]:** G. Kittel, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** G. Kittel

Acknowledgments [optional]:

Version Date: 11 May 2015

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1. Forest & Woodland

1.B.3.Nc. Rocky Mountain-Great Basin Montane Flooded & Swamp Forest

G505. Rocky Mountain-Great Basin Swamp Forest

Type Concept Sentence: This group is dominated by conifers such as *Thuja plicata* and/or *Picea engelmannii* with an obligate wetland herbaceous understory such as *Lysichiton americanus*, that generally occurs only on very poorly drained soils that are saturated year-round or may have seasonal flooding in the spring. It occurs in the northern Rocky Mountains from northwestern Wyoming north into the Canadian Rockies and west into eastern Oregon and Washington.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.3.Nc.1. Rocky Mountain-Great Basin Montane Riparian & Swamp Forest (M034)

Elcode: G505

***Scientific Name:** *Thuja plicata* - *Picea engelmannii* / *Lysichiton americanus* Swamp Forest Group

***Common (Translated Scientific) Name:** Western Red-cedar - Engelmann Spruce / American Skunk-cabbage Swamp Forest Group

***Colloquial Name:** Rocky Mountain-Great Basin Swamp Forest

***Type Concept:** This forested wetland/swamp group occurs in the northern Rocky Mountains from northwestern Wyoming north into the Canadian Rockies and west into eastern Oregon and Washington. It is dominated by conifers with diagnostic hydric undergrowth vegetation. Dominant conifers include *Abies grandis*, *Abies lasiocarpa*, *Picea engelmannii*, *Picea glauca* (and their hybrid), *Pinus contorta*, *Pseudotsuga menziesii*, *Thuja plicata*, and/or *Tsuga heterophylla*. Aquatic obligate herbs include *Alopecurus aequalis*, *Calamagrostis canadensis*, *Carex disperma*, *Carex vesicaria*, *Dryopteris* spp., *Eleocharis palustris*, *Lysichiton americanus*, *Mitella breweri*, *Mitella pentandra*, *Phalaris arundinacea*, *Senecio triangularis*, and/or *Streptopus amplexifolius*. Typical wetland shrubs such as *Alnus incana*, *Cornus sericea* (= *Cornus stolonifera*), *Rhamnus alnifolia*, and *Salix* spp. may also be present. These occur on poorly drained soils that are saturated year-round or may have seasonal flooding in the spring. These are primarily on flat to gently sloping lowlands, but also occur up to near the lower limits of continuous forest (below the subalpine parkland), and can occur on steeper slopes where soils are shallow over unfractured bedrock (aka on seeps). This group is indicative of poorly drained, mucky areas, and areas are often bathed in a mosaic of moving and stagnant water. It can also occur around vernal ponds (usually <1 m but can be as much as 2 m deep) that usually fill with water over the fall, winter and early spring, but then at least partially dry up towards the end of the growing season. Trees that ring these ponds shade the water and influence the hydrology of the ponds themselves. Soils can be woody peat, muck or mineral but tend toward mineral. Stands generally occupy sites on benches, toeslopes or valley bottoms along mountain streams. Stands are usually dominated by conifers, but can have hardwoods mixed or dominant. These wetland types are generally distinguishable from other upland forests and woodlands by shallow water tables.

***Diagnostic Characteristics:** This group is dominated by conifers with obligate wetland herbaceous understory on poorly drained soils that are saturated year-round or may have seasonal flooding in the spring.

***Classification Comments:** This is named and described as a conifer-dominated wetland, but it is noted that deciduous trees can be present and may solely dominate some stands. However, to date, there is no documentation or verification of deciduous-dominated swamps.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|--|
| G506 | Rocky Mountain-Great Basin Montane Riparian & Swamp Forest | is found in aerated, better drained areas. |

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|---|
| G256 | North Pacific Maritime Swamp Forest | is very similar but limited to the coastal maritime climates and lacks <i>Picea engelmannii</i> . |
| G610 | North Pacific Maritime Wooded Bog & Poor Fen | is a very similar group that occurs farther west and has Pacific Northwest Coastal indicator species. |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Wetlands dominated by tall conifer trees, tall deciduous hardwood trees or both, often surrounding a perennial or ephemeral water body. Herbaceous undergrowth is often very dense and ranges from 0.1-1.5 m in height.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Abundant conifer tree species include *Abies grandis*, *Abies lasiocarpa*, *Picea engelmannii*, *Picea glauca*, *Pinus contorta*, *Pseudotsuga menziesii*, *Thuja plicata*, and or *Tsuga heterophylla*. Deciduous broadleaf trees may also be present or dominant (but swamps dominated by deciduous trees have not yet been documented) such as *Betula papyrifera*, *Fraxinus latifolia*, *Larix occidentalis*, *Populus balsamifera ssp. trichocarpa* (= *Populus trichocarpa*), and/or *Populus tremuloides*. These wetland types are generally distinguishable from other upland forests and woodlands by shallow water table indicator, mesic or hydric undergrowth vegetation; some of the most typical herbaceous species include *Alopecurus aequalis*, *Athyrium filix-femina*, *Calamagrostis canadensis*, *Callitriche heterophylla*, *Carex disperma*, *Carex vesicaria*, *Dryopteris* spp., *Eleocharis palustris*, *Equisetum arvense*, *Lysichiton americanus*, *Mitella breweri*, *Mitella pentandra*, *Phalaris arundinacea*, *Senecio triangularis*, and *Streptopus amplexifolius*. Common shrubs include *Alnus incana*, *Cornus sericea* (= *Cornus stolonifera*), *Rhamnus alnifolia*, and *Salix* spp. Floristic descriptions are compiled from Crowe and Clausnitzer (1997), Canadian Rockies Ecoregional Plan (2002), MacKenzie and Moran (2004), and Mincemoyer (2005).

*Floristics Table [Med - High Confidence]:

*Number of Plots:

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: These forests have permanently saturated soils that rarely dry out.

ENVIRONMENT

Environmental Description: *Climate:* Temperate cool. *Soil/substrate/hydrology:* This group is dominated by conifers on poorly drained soils that are saturated year-round or may have seasonal flooding in the spring. These are primarily on flat to gently sloping lowlands, but also occur up to near the lower limits of continuous forest (below the subalpine parkland). It can occur on steeper slopes where soils are shallow over unfractured bedrock. This group is indicative of poorly drained, mucky areas, and areas are often a mosaic of moving and stagnant water. These wetland types are generally distinguishable from other upland forests and woodlands by shallow water tables and mesic or hydric undergrowth vegetation. It can also occur around vernal ponds (usually <1 m but can be as much as 2 m deep) that usually fill with water over the fall, winter and early spring, but then at least partially dry up towards the end of the growing season. Trees that ring these ponds shade the water and influence the hydrology of the ponds themselves. Soils can be woody peat, muck or mineral but tend toward mineral. Stands generally occupy sites on benches, toeslopes or valley bottoms along mountain streams. Environmental descriptions are compiled from Crowe and Clausnitzer (1997), NCC (2002), MacKenzie and Moran (2004), and Mincemoyer (2005).

DISTRIBUTION

***Geographic Range:** This group occurs in the northern Rocky Mountains from northwestern Wyoming and central Montana, north into the Canadian Rockies of Alberta and British Columbia and west into Idaho, eastern Oregon and Washington.

Nations: CA, US

States/Provinces: AB, BC, ID, MT, OR, WA, WY

USFS Ecoregions (2007) [optional]:

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

*Plot Analysis Summary [Med - High Confidence]:

*Plots Used to Define the Type [Med - High Confidence]:

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

*Lower Level NVC Types:

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3775 | <i>Picea engelmannii</i> Swamp Forest Alliance |
| A3776 | <i>Thuja plicata</i> - <i>Tsuga heterophylla</i> Rocky Mountain Swamp Forest Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

*Recent Concept Lineage [if applicable]:

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP

*Primary Concept Source [if applicable]: S. Shaw and C.G. Fredine (1971)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

*Author of Description: G. Kittel and M.S. Reid

Acknowledgments [optional]:

Version Date: 02 Dec 2015

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1. Forest & Woodland

1.B.3.Nc. Rocky Mountain-Great Basin Montane Flooded & Swamp Forest

1.B.3.Nd. Western North American Interior Flooded Forest (D013)

M036. Interior Warm & Cool Desert Riparian Forest

1. Forest & Woodland

1.B.3.Nd. Western North American Interior Flooded Forest

G797. **Western Interior Riparian Forest & Woodland**

Type Concept Sentence: This group consists of riparian woodlands dominated by trees and tall arborescent shrubs, with species such as *Acer negundo*, *Celtis laevigata* var. *reticulata*, *Cephalanthus occidentalis*, *Fraxinus velutina*, *Juglans major*, *Platanus wrightii*, *Populus deltoides*, *Populus fremontii*, *Platanus racemosa*, *Quercus lobata*, *Salix gooddingii*, *Salix laevigata*, *Sapindus saponaria*, and *Washingtonia filifera*. It is found throughout lowlands of the Interior West, including southwestern warm and cool deserts and Mediterranean California. In LANDFIRE EVT LUT this is called Warm Southwest Riparian Forest & Woodland; the concept is no longer "warm southwest".

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.3.Nd.2. Interior Warm & Cool Desert Riparian Forest (M036)

Elcode: G797

***Scientific Name:** Western Interior Riparian Forest & Woodland Group

***Common (Translated Scientific) Name:** Western Interior Riparian Forest & Woodland Group

***Colloquial Name:** Western Interior Riparian Forest & Woodland

***Type Concept:** This group consists of riparian woody vegetation. Dominant trees may include *Acer negundo*, *Celtis laevigata* var. *reticulata*, *Cephalanthus occidentalis*, *Fraxinus velutina*, *Juglans major*, *Platanus wrightii*, *Populus deltoides* ssp. *wislizeni*, *Populus deltoides* ssp. *monilifera*, *Populus fremontii*, *Platanus racemosa*, *Quercus lobata*, *Salix amygdaloides*, *Salix gooddingii*, *Salix laevigata*, *Sapindus saponaria*, and *Washingtonia filifera*. Dominant shrubs include *Alnus oblongifolia*, *Baccharis salicifolia*, *Prunus* spp., *Salix exigua*, *Salix lasiolepis*, *Shepherdia argentea*, and *Vitis californica*. Other dominants on serpentine substrates include *Aquilegia eximia*, *Carex serratodens*, *Cirsium fontinale*, *Hesperocyparis sargentii* (= *Cupressus sargentii*), *Frangula californica* ssp. *tomentella* (= *Rhamnus tomentella*), *Mimulus glaucescens*, *Mimulus guttatus*, *Packera clevelandii* (= *Senecio clevelandii*), *Salix breweri*, *Solidago* spp., *Stachys albens*, and *Umbellularia californica*. The variety of plant associations within this group reflects elevation, stream gradient, floodplain width, and flooding events. It also includes springs, seeps, and perennial and intermittent streams and riparian areas found on serpentine substrates. These are disturbance-driven systems that require flooding, scour and deposition for germination and maintenance. Periodic flooding and associated sediment scour are necessary to maintain growth and reproduction of vegetation. Flooding regimes have been significantly altered in all but a few tributaries that support this group. This group occurs throughout lowlands of the interior west, including southwest warm and cool deserts and Mediterranean California, generally below about 1800 m (6000 feet) elevation. Known occurrences include the following rivers and their tributaries: Colorado, Gila, Pecos, Rio Grande, Sacramento, San Joaquin, Santa Cruz, Salt, San Pedro, Truckee, Snake and others.

***Diagnostic Characteristics:** This group is wide-ranging in the western U.S. and occurs in the warm desert regions (Sonoran and Mojave) of the southwestern U.S. and adjacent Mexico, Mediterranean California, and the cool desert interior in riparian corridors along perennial and seasonally intermittent streams and spring-fed depressions. Diagnostic tree species trees include *Juglans major*, *Platanus racemosa*, *Platanus wrightii*, *Populus deltoides* ssp. *monilifera*, *Populus deltoides* ssp. *wislizeni*, *Populus fremontii*, *Salix amygdaloides*, *Salix laevigata*, and *Washingtonia filifera*. Shrubs are rich and varied. Stands are always adjacent to streams or their floodplains and have been observed to follow narrow tributaries. Seasonal flooding and soil saturation by a rising water table are necessary to maintain growth and reproduction of vegetation.

***Classification Comments:** This group combines warm southwestern deserts with cool interior lower elevation rivers, and occurs from sea level, but does not include montane elevations.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G510 | Interior West Ruderal Riparian Forest & Scrub | |
| G533 | North American Warm Desert Riparian Low Bosque & Shrubland | |
| G541 | Warm Semi-Desert Shrub & Herb Dry Wash & Colluvial Slope | |

Similar NVC Types General Comments [optional]:**VEGETATION**

Physiognomy and Structure Summary: Open to closed woodlands of tall cold-deciduous trees and shrubs, forming linear bands following stream and river courses and alluvial floodplains. Herbaceous undergrowth is variable depending on the amount of shading in the overstory.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: The vegetation is a mix of riparian woodlands dominated by trees and tall arborescent shrubs. Dominant trees include *Acer macrophyllum*, *Acer negundo*, *Alnus rhombifolia*, *Alnus rubra*, *Celtis laevigata* var. *reticulata*, *Cephalanthus occidentalis*, *Fraxinus velutina*, *Juglans major*, *Platanus racemosa*, *Platanus wrightii*, *Populus deltoides* ssp. *wislizeni*, *Populus deltoides* ssp. *monilifera*, *Populus fremontii*, *Pseudotsuga menziesii*, *Quercus agrifolia*, *Quercus lobata*, *Salix amygdaloides*, *Salix gooddingii*, *Salix laevigata*, *Salix lasiolepis*, *Sapindus saponaria*, and *Washingtonia filifera*. Shrub dominants include *Alnus oblongifolia*, *Baccharis salicifolia*, *Prunus* spp., *Salix exigua*, *Salix geyeriana*, *Salix lasiolepis*, and *Vitis californica*. Other dominants on serpentine substrates include *Aquilegia eximia*, *Carex serratodens*, *Cirsium fontinale*, *Hesperocyparis sargentii* (= *Cupressus sargentii*), *Frangula californica* ssp. *tomentella* (= *Rhamnus tomentella*), *Mimulus glaucescens*, *Mimulus guttatus*, *Packera clevelandii* (= *Senecio clevelandii*), *Salix breweri*, *Solidago* spp., *Stachys albens*, and *Umbellularia californica*. These are disturbance-driven systems that require flooding, scour and deposition for germination and maintenance. Exotic species that may be present include *Ailanthus altissima*, *Eucalyptus* spp., and *Tamarix* spp., and herbs such as *Arundo donax*.

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Vegetation is dependent upon annual or periodic flooding and associated sediment scour and/or annual rise in the water table for growth and reproduction. Permanent subsurface water is required to maintain *Washingtonia filifera*. Salinity is low in the root zone, but increases near the surface where evaporation leaves salt accumulations. Reproduction of *Washingtonia filifera* is limited by water supply, surface salinity, rainfall, and fire. Fan palms are fire-tolerant, while the understory species are not, and fires open up the understory allowing palm seedlings to establish. Removal of the understory also decreases competition for water. There are currently 24 known occurrences of *Washingtonia filifera* in Arizona, Nevada, and California (Sawyer et al. 2009).

ENVIRONMENT

Environmental Description: Stands occur on streambanks and floodplains. The variety of plant associations within this group reflects elevation, stream gradient, floodplain width, and flooding events. It also includes springs, seeps, and perennial and intermittent streams on serpentine substrates.

DISTRIBUTION

***Geographic Range:** The group occurs throughout Mediterranean California, California's Central Valley, the southern Coast Ranges of Oregon, the lower valleys of Nevada and southern Idaho and the Colorado Plateau south into the canyons and desert valleys of the Sonoran and Mojave deserts of southwestern United States and adjacent Mexico. Specifically, it is known in California, southern Oregon, Nevada, Utah, Colorado, southern Arizona, New Mexico, adjacent Mexico (Baja California, Baja California del Sur, Chihuahua), and western Texas. Elevation ranges from sea level up to 1800 m.

Nations: MX, US

States/Provinces: AZ, CA, CO, ID, MXBC?, MXBS, MXCH, MXSO, NM, NV, OR, UT

USFS Ecoregions (2007) [optional]:

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS***Plot Analysis Summary [Med - High Confidence]:*****Plots Used to Define the Type [Med - High Confidence]:****CONFIDENCE LEVEL****USNVC Confidence Level:** Moderate**USNVC Confidence Comments [optional]:****HIERARCHY*****Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A0953 | <i>Alnus oblongifolia</i> Riparian Forest Alliance |
| A3801 | <i>Platanus wrightii</i> Riparian Forest Alliance |
| A0957 | <i>Juglans major</i> - <i>Juglans microcarpa</i> Riparian Forest Alliance |
| A3796 | <i>Acer negundo</i> - <i>Fraxinus anomala</i> - <i>Celtis laevigata</i> var. <i>reticulata</i> Riparian Woodland Alliance |
| A0485 | <i>Washingtonia filifera</i> Wet Woodland Alliance |
| A3750 | <i>Platanus racemosa</i> - <i>Quercus agrifolia</i> - <i>Juglans californica</i> Riparian Woodland Alliance |
| A3803 | <i>Populus fremontii</i> - <i>Fraxinus velutina</i> - <i>Salix gooddingii</i> Riparian Forest & Woodland Alliance |
| A3752 | <i>Salix gooddingii</i> - <i>Salix laevigata</i> Riparian Forest Alliance |
| A0644 | <i>Populus fremontii</i> Great Basin Riparian Forest Alliance |
| A0945 | <i>Juglans microcarpa</i> Riparian Scrub Alliance |
| A3798 | <i>Populus deltoides</i> ssp. <i>wislizeni</i> - <i>Populus deltoides</i> ssp. <i>monilifera</i> - <i>Salix amygdaloides</i> Riparian Woodland Alliance |
| A3802 | <i>Populus deltoides</i> ssp. <i>wislizeni</i> - <i>Populus deltoides</i> ssp. <i>monilifera</i> Riparian Forest Alliance |
| A0618 | <i>Quercus lobata</i> Riparian Forest Alliance |

DISCUSSION**Discussion [optional]:****CONCEPT HISTORY*****Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------------|---|------------------------------|
| 2014-11-18 | G503 <i>Populus</i> (balsamifera, deltoides, fremontii) / <i>Salix</i> spp. Riparian Woodland Group | G503 mostly subsumed by G797 |
| 2014-11-18 | G509 <i>Populus fremontii</i> - <i>Salix gooddingii</i> - <i>Platanus racemosa</i> Riparian Woodland Group | G508 & G509 merged into G797 |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--|--------------------|---|
| > | Riparian Woodland (203) | Shiflet 1994 | Serpentine substrates are not specifically mentioned in Shiflet (1994). |
| >< | Port Orford-Cedar: 231 | Eyre 1980 | |
| >< | Cottonwood - Willow: 235 | Eyre 1980 | |
| >< | Arizona Cypress: 240 | Eyre 1980 | |
| >< | <i>Quercus lobata</i> (Valley oak woodland) Alliance | Sawyer et al. 2009 | 71.040.00 |

AUTHORSHIP***Primary Concept Source [if applicable]:** G. Kittel, P. Comer and T. Keeler-Wolf in Faber-Langendoen et al. (2015)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** G. Kittel**Acknowledgments [optional]:** Julie Evens, Todd Keeler-Wolf

Version Date: 29 Sep 2016

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1.B.3.Ng. Vancouverian Flooded & Swamp Forest (D193)**M035. Vancouverian Flooded & Swamp Forest**

1. Forest & Woodland

1.B.3.Ng. Vancouverian Flooded & Swamp Forest

G254. North Pacific Lowland Riparian Forest & Woodland

Type Concept Sentence: This lowland riparian forest and woodland group occurs throughout the Pacific Northwest from north-central California north to Alaska and is dominated by deciduous or conifer trees, or mixed, including *Abies grandis*, *Acer macrophyllum*, *Alnus rubra*, *Alnus rhombifolia*, *Fraxinus latifolia*, *Populus balsamifera ssp. trichocarpa*, *Picea sitchensis*, *Salix lucida ssp. lasiandra*, and/or *Thuja plicata*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.3.Ng.1. Vancouverian Flooded & Swamp Forest (M035)

Elcode: G254

***Scientific Name:** *Picea sitchensis* - *Populus balsamifera ssp. trichocarpa* - *Alnus rubra* Lowland Riparian Forest & Woodland Group

***Common (Translated Scientific) Name:** Sitka Spruce - Black Cottonwood - Red Alder Lowland Riparian Forest & Woodland Group

***Colloquial Name:** North Pacific Lowland Riparian Forest & Woodland

***Type Concept:** This lowland riparian forest and woodland group occurs throughout the Pacific Northwest, from north-central California to the Gulf of Alaska. The major broadleaf dominant species of these forests and woodlands are *Acer macrophyllum*, *Alnus rhombifolia*, *Alnus rubra*, *Populus balsamifera ssp. trichocarpa*, *Salix lucida ssp. lasiandra*, and *Fraxinus latifolia* (in southern part of range). Conifers tend to increase with succession in the absence of major disturbance. Conifer-dominated types include floodplain or riparian forests dominated by *Abies grandis*, *Calocedrus decurrens*, *Picea sitchensis*, and *Thuja plicata*. *Populus balsamifera* is much

less common on the islands of southeastern Alaska and is more commonly found on larger rivers with glacial input. The group is found on low-elevation, alluvial floodplains that are confined by valleys and inlets and are more abundant in the central and southern portions of the Pacific Northwest coast and foothills of the Sierra Nevada and Cascade Range. These forests are linear in character, occurring on floodplains or lower terraces of rivers and streams. Riverine flooding and the succession that occurs after major flooding events are the major natural processes that support this group. Along the Gulf of Alaska, glacial-fed rivers (uncommon on the islands) have frequent flooding, shifting channels, and significant sediment deposition, and *Picea sitchensis* is the dominant tree. Glacial outwash occurs near the terminus of glaciers, resulting in active proximal outwash with high flood frequency and high sediment input such that the channels are scoured and braided, and the substrate is well-drained to excessively well-drained gravel or cobble. Along these rivers the riparian forests are patchy and prone to disturbance. Low benches dominated by shrub seedlings and herbaceous species belong to another USNVC group. Mid benches have early-seral forests, and high benches have more mature forests with a more diverse shrub understory. Freshwater tidally-influenced rivers, with daily tidal flooding of freshwater and associated soil saturation, also support riparian forests along rivers where they may otherwise not occur, or support a more saturated type of forest association than may otherwise occur without the daily tidal input of freshwater. Regardless of physical setting, the range of species composition is similar among all these variations.

***Diagnostic Characteristics:** Diagnostic of this group is a combination of riparian/alluvial setting with moisture- and flooding-tolerant deciduous trees such as *Alnus rhombifolia*, *Alnus rubra*, *Acer macrophyllum*, *Fraxinus latifolia*, *Populus balsamifera ssp. trichocarpa* and/or *Salix lucida ssp. lasiandra*. Conifers may be present to codominant. In addition, key understory diagnostics include *Cornus sericea*, *Rubus spectabilis*, *Oplonanax horridus*, and *Maianthemum dilatatum*. Stands are found next to streams and rivers and depend on flooding or seasonal high water tables.

***Classification Comments:** While the dominant woody species composition is similar across the range of this group, additional information about the herbaceous species component is needed. Further review of species lists is needed to ensure riparian/floodplain species are emphasized; some species such as *Spiraea douglasii* and *Carex obnupta* may be more common in swamps.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|--|
| G507 | North Pacific Montane Riparian Woodland | includes forests higher in elevation that are dominated by <i>Tsuga mertensiana</i> , <i>Abies amabilis</i> , <i>Pinus contorta var. murrayana</i> , <i>Abies concolor</i> , <i>Abies magnifica</i> , and <i>Populus tremuloides</i> . |
| G256 | North Pacific Maritime Swamp Forest | |
| G548 | Alaskan-Yukon Boreal Flooded & Rich Swamp | |
| G610 | North Pacific Maritime Wooded Bog & Poor Fen | includes forests that have saturated to very poorly drained soils, occur in swales and depressions, and tend to be small patch in size. |
| G322 | Vancouverian Wet Shrubland | has shrub-dominated communities of low bench floodplains. |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Closed- to open-canopy forests of tall cold-deciduous trees, evergreen trees, or a mix of deciduous and evergreen trees, often with deciduous shrub undergrowth and/or an herbaceous undergrowth layer. The trees can be phreatophytic, whose taproots remain in contact with the water table year-round; other stands have only shallow-rooted trees. Stands often form somewhat parallel to streams and rivers on narrow to broad floodplains.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Trees occurring throughout most of the range of this group are *Alnus rhombifolia*, *Alnus rubra*, *Populus balsamifera* ssp. *trichocarpa*, *Picea sitchensis*, *Thuja plicata*, and *Tsuga heterophylla*. Additional trees in southern areas include *Acer macrophyllum*, *Salix lucida* ssp. *lasiandra*, *Fraxinus latifolia*, and *Abies grandis*. Conifer-dominated types are less common in the south and are not well-described. *Populus balsamifera* is much less common on the islands of southeastern Alaska and smaller islands off British Columbia due to a lack of larger floodplains. In southeastern Alaska, it is more commonly found on larger rivers with glacial input, whereas *Picea sitchensis* is a common dominant on non-glacially-fed rivers. Key understory diagnostics include *Cornus sericea*, *Rubus spectabilis*, *Oplopanax horridus*, and *Maianthemum dilatatum*. Several species may be present that are indicative of more swamp-like conditions such as *Spiraea douglasii* and *Carex obnupta* but can be present in floodplain settings, especially in the southern end of the range. Understory shrubs may include *Acer circinatum*, *Alnus rhombifolia*, *Alnus viridis* ssp. *sinuata*, *Corylus cornuta*, *Lonicera involucrata*, *Menziesia ferruginea*, *Morella californica*, *Physocarpus capitatus*, *Ribes bracteosum*, *Rubus parviflorus*, *Rubus ursinus*, *Salix fluviatilis*, *Salix hookeriana*, *Salix lasiolepis*, *Salix sitchensis*, *Sambucus racemosa*, *Symphoricarpos albus*, *Vaccinium alaskaense*, *Vaccinium ovalifolium*, *Vaccinium parvifolium*, and *Viburnum edule*. Herbaceous species include *Achlys triphylla*, *Athyrium filix-femina*, *Blechnum spicant*, *Carex leptopoda*, *Circaea alpina*, *Claytonia sibirica*, *Dryopteris expansa*, *Elymus glaucus*, *Equisetum arvense*, *Equisetum hyemale*, *Erechtites minimus*, *Gymnocarpium dryopteris*, *Impatiens capensis*, *Juncus patens*, *Oenanthe sarmentosa*, *Orthilia secunda*, *Oxalis oregana*, *Oxalis trilliifolia*, *Petasites frigidus*, *Polystichum munitum*, *Scrophularia californica*, *Stachys ajugoides*, *Stachys chamissonis* var. *cooleyae*, *Streptopus amplexifolius*, *Streptopus lanceolatus* var. *roseus* (= *Streptopus roseus*), *Tiarella trifoliata*, *Tolmiea menziesii*, *Trautvetteria caroliniensis*, *Trisetum canescens* (= *Trisetum cernuum*), and/or *Urtica dioica* ssp. *gracilis*. The bryophyte layer (in British Columbia) includes *Mnium* spp., *Rhizomnium glabrescens*, *Plagiomnium insigne*, *Leucolepis acanthoneuron* (= *Leucolepis menziesii*), *Hylocomium splendens*, *Eurhynchium praelongum* (= *Kindbergia praelonga*), *Eurhynchium oreganum* (= *Kindbergia oregana*), and *Rhytidiadelphus loreus*. Floristic information was compiled from several sources: Viereck et al. (1992) and Boggs (2000, 2002) from Alaska; Franklin and Dyrness (1973), Kunze (1994), Chappell and Christy (2004), and Christy 2004 from western Oregon and Washington; Banner et al. (1993), Green and Klinka (1994), and Mackenzie and Moran (2004) from British Columbia; and Potter (2000), Keeler-Wolf et al. (2003a), Schirokauer et al. (2003), and Sawyer et al. (2009) from California.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: This group is supported by glacial, snowmelt and/or rainfall hydrology, causing seasonal rise in soil water tables and is adapted to overbank flooding.

ENVIRONMENT

Environmental Description: *Climate:* Cool temperate. *Soil/substrate/hydrology:* This group consists of the forest and woodland vegetation found on low-elevation, alluvial floodplains that are confined by valleys and inlets and are more abundant in the central and southern portions of the Pacific Northwest Coast. Stands are found next to streams and rivers and depend on flooding or seasonal high water tables. These forests are usually long, thin bands found parallel to current or past direction of river flow, occurring on floodplains or lower terraces of rivers and streams. High bench systems experience seasonal water table fluctuations, with infrequent flood events; medium bench systems are subject to annual flooding, often with prolonged high water tables, limiting conifer development. Soils are often thin, poorly developed and coarse; silty or clay layers may be found within the soil profile. Parent material is usually Quaternary Alluvium. Along the Gulf of Alaska and coast of British Columbia, glacial-fed rivers (uncommon on the islands) have frequent flooding, shifting channels, and significant sediment deposition. Glacial outwash occurs near the terminus of glaciers, resulting in active proximal outwash with high flood frequency and high sediment input such that the channels are scoured and braided, and the substrate is well-drained to excessively well-drained gravel or cobbly. Along these rivers the riparian forests are patchy and prone to disturbance. Low benches dominated by shrub seedlings and herbaceous species belong to another NVC group. Mid benches have early-seral forests, and high benches have more mature forests (typically conifer-dominated) with a more diverse shrub understory. Non-glacially-fed floodplains occurring along the Gulf of Alaska are common on the Alexander Archipelago but also occur on the mainland of southeastern Alaska. *Picea sitchensis* is the dominant conifer. These floodplains tend to be smaller than the glacially-fed systems. Environmental information was compiled from several sources: Viereck et al. (1992) and Boggs (2000, 2002) from Alaska; Franklin and Dyrness (1973), Kunze (1994), Chappell and Christy (2004), and Christy 2004 from western Oregon and Washington; and Banner et al. (1993), Green and Klinka (1994), Mackenzie and Moran (2004) from British Columbia; and Potter (2000), Keeler-Wolf et al. (2003a), Schirokauer et al. (2003), and Sawyer et al. (2009) from California.

DISTRIBUTION

***Geographic Range:** This group occurs at lower elevations throughout the coastal regions of the Pacific Northwest from northern California (Point Reyes National Seashore and Yosemite National Park) north through British Columbia, Vancouver Island and Haida Gwaii to along the coast of the Gulf of Alaska, including central and southeastern Alaska.

Nations: CA, US

States/Provinces: AK, BC, CA, OR, WA

USFS Ecoregions (2007) [optional]: 242A:CC, 242B:CC, 342I:CC, M242A:CC, M242B:CC, M242C:CC, M242D:CC, M261A:CC, M261D:CP

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3745 | <i>Acer macrophyllum</i> - <i>Alnus rubra</i> Riparian Forest Alliance |
| A3744 | <i>Populus balsamifera</i> ssp. <i>trichocarpa</i> - <i>Picea sitchensis</i> - <i>Tsuga heterophylla</i> Riparian Forest Alliance |
| A3743 | <i>Fraxinus latifolia</i> - <i>Populus balsamifera</i> ssp. <i>trichocarpa</i> - <i>Alnus</i> spp. Riparian Forest Alliance |
| A3748 | <i>Salix lucida</i> Scrub Swamp Alliance |
| A3746 | <i>Picea sitchensis</i> - <i>Tsuga heterophylla</i> - <i>Alnus rubra</i> Riparian Forest Alliance |
| A3747 | <i>Picea sitchensis</i> Riparian Forest Alliance |
| A3777 | <i>Alnus rhombifolia</i> Riparian Forest Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** G. Kittel, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** G. Kittel, T. Boucher, C. Chappell, M.S. Reid, D. Meidinger

Acknowledgments [optional]: contributing author J. Christy

Version Date: 02 Dec 2015

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1. Forest & Woodland

1.B.3.Ng. Vancouverian Flooded & Swamp Forest

G507. North Pacific Montane Riparian Woodland

Type Concept Sentence: This riparian woodland group occurs throughout mountainous areas of the Pacific Northwest coast and Cascade Range into the Sierra Nevada foothills of California. Dominant species include *Abies amabilis*, *Abies concolor*, *Abies magnifica*, *Alnus rhombifolia*, *Alnus rubra*, *Pinus contorta* var. *murrayana*, *Pinus jeffreyi*, *Populus balsamifera* ssp. *trichocarpa*, *Populus tremuloides*, and *Tsuga mertensiana*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.3.Ng.1. Vancouverian Flooded & Swamp Forest (M035)

Elcode: G507

***Scientific Name:** *Tsuga mertensiana* - *Abies* spp. / *Salix* spp. Montane Riparian Woodland Group

***Common (Translated Scientific) Name:** Mountain Hemlock - Fir species / Willow species Montane Riparian Woodland Group

***Colloquial Name:** North Pacific Montane Riparian Woodland

***Type Concept:** This riparian woodland group occurs throughout mountainous areas of the Pacific Northwest coast from Oregon to northern British Columbia, and east into Idaho along the tributaries of the Columbia River and south into the Sierra Nevada foothills of California. Dominant species include *Abies amabilis*, *Abies concolor*, *Abies magnifica*, *Alnus rhombifolia*, *Alnus rubra*, *Pinus contorta* var. *murrayana*, *Pinus jeffreyi*, *Populus balsamifera* ssp. *trichocarpa*, *Populus tremuloides*, and *Tsuga mertensiana*. Shrubs include *Alnus viridis* ssp. *sinuata* (= *Alnus sinuata*), *Betula occidentalis*, *Crataegus douglasii*, *Frangula purshiana*, *Oplopanax horridus*, *Philadelphus lewisii*, *Salix* spp., *Spiraea douglasii*, and *Vaccinium uliginosum*. Herbaceous wetland indicator species include *Achlys triphylla*, *Athyrium filix-femina*, *Carex angustata*, *Carex disperma*, *Clintonia uniflora*, *Gymnocarpium dryopteris*, and others. It occurs on steep streams and narrow floodplains above foothills but below the alpine environments, e.g., above 1500 m (4550 feet) elevation in the Klamath Mountains and western Cascades of Oregon, between 2130 and 2440 m (7000-8000 feet) in Yosemite National Park in the Sierra Nevada, up as high as 3300 m (10,000 feet) in the southern Cascades, and above 610 m (2000 feet) in northern Washington. This group occurs for the most part on the west side of the Cascade crest, but also occurs around the Columbia Basin along the tributaries of the Columbia River. Surrounding habitats include subalpine parklands and montane forests. These woodlands are dependent on seasonally high water tables and frequent (once every 3-5 years) flooding to provide channel scour and deposition for germination and maintenance. They occur on streambanks and overflow channels, seeps and edges of waterbodies. They are distinguished from the surrounding forest by riparian/ wetland indicators, when dominated by deciduous tree species, are visually a sharp contrast to immediate upland conifer forests.

***Diagnostic Characteristics:** These woodlands occur along streambanks or narrow alluvial areas that are actively influenced by stream waters at montane elevations in Oregon, California's southern Cascades and Sierra Nevada, Washington and British Columbia. They are dominated by *Abies amabilis*, *Abies concolor*, *Abies magnifica*, *Pinus contorta* var. *murrayana*, *Pinus jeffreyi*, and *Tsuga mertensiana*.

***Classification Comments:** The concept for this group is new as it divides upper elevation from lower elevation riparian forests. Higher elevation riparian plant associations are well documented by several authors (McCain and Diaz 2002b, Crowe et al. 2004, Kovalchik and Clausnitzer 2004, and others). However, probably due to the lack of areal extent and the difficulty in mapping them, these montane riparian habitats have not been described as a group per se. Flood ecosystems are "infrequent at higher elevations where there are fewer topographic positions for floodplain development" (MacKenzie and Moran 2004). This group includes these streamside communities that may not have "floodplains" per se. Individual plant associations and sub-associations or site series have detailed floristics of units that are included in this group. More clarification is needed on the amount of woodland-dominated riparian areas at high altitudes in the Coast and Cascade ranges, for example the *Alnus viridis* ssp. *sinuata* types described from Prince Rupert Forest by Banner et al. (1993). There are other associations to consider including in this group that are labeled "herbaceous" but contain stands with up to 90% tree cover [see Christy (2004), p. 100].

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|---|
| G506 | Rocky Mountain-Great Basin Montane Riparian & Swamp Forest | also occurs at high elevations, but only in the colder interior mountains, and has Rocky Mountain, not Pacific Northwest Coastal, species. |
| G254 | North Pacific Lowland Riparian Forest & Woodland | occurs at lower elevations, is dominated by lower elevation conifer and deciduous tree species, and is not tolerant of snow. |
| G256 | North Pacific Maritime Swamp Forest | |
| G548 | Alaskan-Yukon Boreal Flooded & Rich Swamp | |
| G610 | North Pacific Maritime Wooded Bog & Poor Fen | |
| G527 | Western Montane-Subalpine Riparian & Seep Shrubland | currently houses the Pacific Northwest <i>Salix commutata</i> and <i>Salix farriae</i> low-statured montane shrublands that may be adjacent to forested riparian types in G507. |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Open to closed-canopy tall woodlands, often linear, following river courses and floodplains, dominated mostly by coniferous trees, but can be dominated by cold-deciduous trees or a mix of or conifer and deciduous trees.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Dominant species include *Abies amabilis*, *Abies concolor*, *Abies magnifica*, *Picea engelmannii*, *Pinus contorta* var. *murrayana*, *Pinus jeffreyi*, *Populus balsamifera*, *Tsuga mertensiana*, and, more rarely, *Populus tremuloides*. These woodlands are dependent on seasonally high water tables and frequent (once every 3-5 years) flooding to provide channel scour and deposition for germination and maintenance. These woodlands occur on streambanks and overflow channels and are distinguished from the surrounding uplands by riparian/wetland indicator species. When dominated by deciduous tree species, it can form a visually sharp contrast to immediate upland conifer forests. Common understory shrubs include *Alnus incana*, *Cornus sericea*, *Oplopanax horridus*, *Spiraea douglasii*, *Vaccinium uliginosum*, and others. Herbaceous understory can include *Allium bisceptrum*, *Calochortus superbus*, *Carex angustata*, *Carex disperma*, *Iris missouriensis*, *Maianthemum stellatum*, and/or *Wyethia mollis*. Floristic information was compiled from several sources: from Washington (Hemstrom et al. 1982, Brockway and Topik 1984, Franklin et al. 1988, Henderson et al. 1989, 1992, Kovalchik and Clausnitzer 2004); and from Oregon (McCain and Diaz 2002b, Christy 2004, Crowe et al. 2004).

*Floristics Table [Med - High Confidence]:

*Number of Plots:

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:

ENVIRONMENT

Environmental Description: *Climate:* Cool temperate. *Soil/substrate/hydrology:* This group occurs on steep streams and narrow floodplains above foothills but below the alpine environments, e.g., above 1500 m (4550 feet) elevation to as high as 3300 m (10,000 feet) in the south and central part of the range, between 2130 and 2440 m (7000-8000 feet) in Yosemite National Park in the Sierra Nevada, up as high as 3300 m (10,000 feet) in the southern Cascades, and above 610 m (2000 feet) in northern Washington. By the steep nature of the streams and adjacent slopes, these riparian forests are very narrow. Surrounding habitats include subalpine parklands and montane forests. These woodlands are dependent on seasonally high water tables and frequent (once every 3-5 years) flooding to provide channel scour and deposition for germination and maintenance. These woodlands occur on streambanks and overflow channels. They are distinguished from the surrounding forest by riparian/wetland understory species. When dominated by deciduous tree species, they are visually a sharp contrast to immediate upland conifer forests. Environmental information was compiled from several sources: from Washington (Hemstrom et al. 1982, Brockway and Topik 1984, Franklin et al. 1988, Henderson et al. 1989, 1992, Kovalchik and Clausnitzer 2004); and from Oregon (McCain and Diaz 2002b, Christy 2004, Crowe et al. 2004).

DISTRIBUTION

***Geographic Range:** This group is found throughout high mountainous areas of the Pacific Northwest coast, and south into the foothills of the Cascade Range and Sierra Nevada.

Nations: CA, US

States/Provinces: AK?, BC, CA, ID, OR, WA

USFS Ecoregions (2007) [optional]: 242A:CC, 242B:C?, M242A:CC, M242B:CC, M242C:CC, M242D:CC, M261A:CC, M261D:CP, M261G:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low

USNVC Confidence Comments [optional]:

HIERARCHY***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3767 | <i>Picea engelmannii</i> Cascadian Swamp Woodland Alliance |
| A0306 | <i>Alnus rhombifolia</i> Cascadian Riparian Woodland Alliance |
| A3766 | <i>Tsuga mertensiana</i> - <i>Abies amabilis</i> Swamp Woodland Alliance |
| A3768 | <i>Populus tremuloides</i> - <i>Alnus rubra</i> Swamp Forest Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP***Primary Concept Source [if applicable]:** G. Kittel, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** G. Kittel and C. Chappell

Acknowledgments [optional]:

Version Date: 02 Dec 2015

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1. Forest & Woodland

1.B.3.Ng. Vancouverian Flooded & Swamp Forest

G256. North Pacific Maritime Swamp Forest

Type Concept Sentence: These are permanently saturated forested swamps that occur from southern coastal Alaska south into coastal Oregon. They are dominated by one or more conifer and/or hardwood tree species such as *Alnus rubra*, *Betula papyrifera*, *Callitropsis nootkatensis*, *Fraxinus latifolia*, *Picea sitchensis*, *Pinus contorta*, *Tsuga heterophylla*, and/or *Tsuga mertensiana*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 1.B.3.Ng.1. Vancouverian Flooded & Swamp Forest (M035)

Elcode: G256

***Scientific Name:** *Tsuga heterophylla* - *Alnus rubra* / *Lysichiton americanus* Swamp Forest Group

***Common (Translated Scientific) Name:** Western Hemlock - Red Alder / Yellow Skunk-cabbage Swamp Forest Group

***Colloquial Name:** North Pacific Maritime Swamp Forest

***Type Concept:** This wetland forested swamp group occurs from southern coastal Alaska (Kenai Fjords), coastal British Columbia south into coastal Washington and Oregon, and west of the coastal mountain summits (not interior). It is dominated by one or more conifer and/or hardwood tree species such as *Alnus rubra*, *Betula papyrifera*, *Callitropsis nootkatensis* (= *Chamaecyparis nootkatensis*), *Fraxinus latifolia*, *Picea sitchensis*, *Pinus contorta*, *Tsuga heterophylla*, and/or *Tsuga mertensiana*. Overstory canopy is often less than 50% cover, but shrub understory can have high cover. Common shrubs include *Elliottia pyroliflora*, *Gaultheria shallon*, and *Vaccinium ovalifolium*. Common understory species include *Carex anthoxanthea*, *Carex pluriflora*, *Carex stylosa*, *Eriophorum* spp., *Lysichiton americanus*, *Nephrophyllidium crista-galli*, *Phegopteris connectilis*, *Thelypteris quelpaertensis*, and *Trichophorum cespitosum*. Dominant bryophytes include *Mnium* spp., *Plagiomnium* spp., and *Rhizomnium* spp. Treed swamps are common in southeastern Alaska, and become less so farther south. Forested swamps are mostly small-patch in size, occurring sporadically in glacial depressions, in river valleys, benches, around the edges of lakes and marshes, or on slopes with seeps that form subirrigated soils. These are primarily on flat to gently sloping lowlands up to 457 m (1500 feet) elevation but also occur up to near the lower limits of continuous forest (below the subalpine parkland). It can occur on steeper slopes where soils are shallow over unfractured bedrock. This group is indicative of poorly-drained, mucky areas, and areas are often a mosaic of moving and stagnant water. Soils can be organic or mineral, but are not deep peatlands. In the southern end of the range of this type, e.g., the southern Willamette Valley, it tends to have more hardwood-dominated stands (especially *Fraxinus latifolia*) and very little in the way of conifer-dominated stands. While the typical landscape context for the type is extensive upland forests, for the southern *Fraxinus latifolia* stands, landscapes were very often formerly dominated by prairies and now by agriculture. Many conifer-dominated stands have been converted to dominance by *Alnus rubra* due to timber harvest.

***Diagnostic Characteristics:** Wetlands with saturated, shallow organic (all but >40 cm deep peat) or mineral soils that are slightly acidic to slightly alkaline on flat to gently sloping lowlands up to 457 m (1500 feet) in the temperate Pacific Northwest with a tall to moderate height conifer (and sometimes deciduous) tree layer (dominated by *Tsuga heterophylla*, *Thuja plicata*, *Tsuga mertensiana*, *Picea sitchensis*, *Callitropsis nootkatensis*, *Alnus rubra*, *Fraxinus latifolia*, and/or *Betula papyrifera*) growing in saturated, very poorly drained mineral or organic, but not peaty, soils, usually with herbaceous indicators of the saturated soil conditions such as *Lysichiton americanus* and/or *Carex deweyana*.

***Classification Comments:** These are wetlands with poorly drained often organic soils but not deep peat soils that would be considered fens or bogs. The concept of treed swamps is not new and has been described by Cowardin et al. (1979) for the U.S. and by Warner and Rubec (1997) for Canada. The concept here is a refinement based on regional climate and regional characteristic vascular plant species.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|--|
| G505 | Rocky Mountain-Great Basin Swamp Forest | is a similar saturated, forested group, but occurs in the interior with Rocky Mountain indicator species, such as <i>Picea engelmannii</i> . |
| G507 | North Pacific Montane Riparian Woodland | has more aerated / less saturated, more well-drained soils, and lacks <i>Lysichiton americanus</i> . |
| G254 | North Pacific Lowland Riparian Forest & Woodland | has more aerated / less saturated, more well-drained soils, and lacks <i>Lysichiton americanus</i> . |
| G610 | North Pacific Maritime Wooded Bog & Poor Fen | has poorer, peaty organic or mineral soils and lacks <i>Lysichiton americanus</i> . |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Wooded swamp wetland with an open to closed canopy of conifer or deciduous trees (at least 5 m in height), abundant to sparse low deciduous shrubs, and often a dense cover of herbaceous plants.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Tree species may include *Alnus rubra*, *Betula papyrifera*, *Callitropsis nootkatensis* (= *Chamaecyparis nootkatensis*), *Fraxinus latifolia*, *Picea sitchensis*, *Pinus contorta*, *Tsuga heterophylla*, and/or *Tsuga mertensiana*, either singly or in various combinations, and not all species occur throughout the range of the group. Shrub species include *Cornus sericea*, *Elliotia pyroliflora*, *Gaultheria shallon* (southern portion of the Alaska distribution only), *Oplopanax horridus*, *Rubus spectabilis*, *Spiraea douglasii*, *Vaccinium ovalifolium*, and/or *Vaccinium uliginosum*. Herbaceous understory species include *Carex angustata*, *Carex anthoxantha*, *Carex aquatilis*, *Carex deweyana*, *Carex obnupta*, *Carex pluriflora*, *Carex stylosa*, *Deschampsia cespitosa*, *Eriophorum* spp., *Juncus patens*, *Lysichiton americanus*, *Nephrophyllidium crista-galli*, *Phegopteris connectilis*, *Thelypteris quelpaertensis*, and *Trichophorum cespitosum*. Dominant bryophytes include *Mnium* spp., *Plagiomnium* spp., and *Rhizomnium* spp. Floristic information is compiled from Alaska (DeMeo et al. 1992, Viereck et al. 1992, Martin et al. 1995, Shephard 1995, DeVelice et al. 1999, Boggs 2002, Boggs et al. 2008b), Washington (Chappell 1999, Chappell et al. 2001), Oregon and Washington (Franklin and Dyrness 1973), and British Columbia (Banner et al. 1993, Green and Klinka 1994, MacKenzie and Moran 2004).

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: This group represents a topo-edaphic climax which is relatively stable over time. Short-term succession occurs from single tree mortality from a variety of causes. Tree regeneration frequently occurs on raised organic microsites on the remains of previous trees. Tree growth is generally very slow. Longer-term succession is probably influenced by climatic patterns that dictate drainage, either favoring poorer drainage, increased tree mortality, and more open canopy; or improved drainage, greater tree growth, and a more closed canopy. These patterns can also favor individual tree species based on their tolerance or intolerance of wet soils. The

widespread yellow-cedar decline, which covers 200,000 ha in southeastern Alaska, is an example of a climate-induced tree death that has resulted in a composition shift away from yellow-cedar due to this mortality (Hennon et al. 2008).

ENVIRONMENT

Environmental Description: *Climate:* Cool temperate. *Soil/substrate/hydrology:* Forested swamps are mostly small-patch size, occurring sporadically in glacial depressions, in river valleys, benches, around the edges of lakes and marshes, or on slopes with seeps that form subirrigated soils. The soil water pH ranges from slightly acidic (5.5-6.5) or neutral (6.5-7.4) to alkaline (>7.4). These are primarily on flat to gently sloping lowlands up to 457 m (1500 feet) elevation but also occur up to near the lower limits of continuous forest (below the subalpine parkland). They can occur on steeper slopes where soils are shallow over unfractured bedrock. This group is indicative of poorly-drained, with at least slow-moving ground water. Soils can organic or mineral but are not deep peatlands, and the source of water is minerotrophic groundwater. The water table is below the ground surface, and the surface is often hummocky, allowing for patches of aerated or partly aerated soil that allow root growth of trees. Treed swamps may grade into drier upland forest on mineral soil, or grade into wetter treed fens, which are wetter with less tree canopy cover and a thicker peat soil layer. Environmental information is compiled from several sources: from Alaska (DeMeo et al. 1992, Viereck et al. 1992, Martin et al. 1995, Shephard 1995, DeVelice et al. 1999, Boggs 2002, Boggs et al. 2008b); from Washington (Chappell 1999, Chappell et al. 2001); from Oregon and Washington (Franklin and Dyrness 1973); from British Columbia (Banner et al. 1993, Green and Klinka 1994, MacKenzie and Moran 2004); and from all of Canada (Warner and Rubec 1997).

DISTRIBUTION

***Geographic Range:** This group is found in southern coastal Alaska (Kenai Fjords), coastal British Columbia south into coastal Washington and Oregon, and west of the coastal mountain summits (not interior).

Nations: CA, US

States/Provinces: AK, BC, CA, OR, WA

USFS Ecoregions (2007) [optional]:

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3755 | <i>Pinus contorta</i> Swamp Forest Alliance |
| A3756 | <i>Tsuga heterophylla</i> - <i>Picea sitchensis</i> / <i>Lysichiton americanus</i> Swamp Forest Alliance |
| A3753 | <i>Alnus rubra</i> - <i>Fraxinus latifolia</i> / <i>Lysichiton americanus</i> Swamp Woodland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** G. Kittel, K. Boggs, T. Boucher, and M.S. Reid, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

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Acknowledgments [optional]: Additional contributing authors include C. Chappell, P. Hennon, and P. Comer.

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2.B.1.Na. Californian Scrub & Grassland (D327)

M043. Californian Chaparral

2. Shrub & Herb Vegetation

2.B.1.Na. Californian Scrub & Grassland

G258. Californian Maritime Chaparral

Type Concept Sentence: This is a maritime chaparral group of mixed shrublands with characteristic species such as *Arctostaphylos bakeri*, *Arctostaphylos hookeri*, *Arctostaphylos montaraensis*, *Arctostaphylos nummularia*, *Arctostaphylos pajaroensis*, *Arctostaphylos silvicola*, *Arctostaphylos tomentosa ssp. crustacea*, *Arctostaphylos tomentosa*, *Ceanothus griseus*, *Ceanothus masonii*, *Ceanothus verrucosus*, *Cneoridium dumosum*, *Comarostaphylis diversifolia*, and *Quercus dumosa var. dumosa* that occur within the summer coastal fog belt of the California coast.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.1.Na.1. Californian Chaparral (M043)

Elcode: G258

***Scientific Name:** *Arctostaphylos tomentosa* - *Arctostaphylos nummularia* - *Ceanothus verrucosus* Maritime Chaparral Group

***Common (Translated Scientific) Name:** Woolly-leaf Manzanita - Glossyleaf Manzanita - Barranca Brush Maritime Chaparral Group

***Colloquial Name:** Californian Maritime Chaparral

***Type Concept:** This shrubland group includes chaparral in patches restricted by edaphic conditions (sands, sandstones, other marine sediments, and stabilized sand dunes) within the summer coastal fog belt in scattered locations in the southern, central and northern California coast. This group is characterized by a combination of locally endemic species of *Arctostaphylos* and *Ceanothus*, species that primarily reproduce by seed rather than resprouting. Shrubs vary in height (up to 3 m tall) and occur in variable densities. More open patches support herbaceous vegetation, while occurrences of high shrub density have no understory. Characteristic species include *Arctostaphylos tomentosa*, *Arctostaphylos nummularia* (= *Arctostaphylos sensitiva*), *Arctostaphylos tomentosa ssp. crustacea* (= *Arctostaphylos crustacea*), *Arctostaphylos hookeri*, *Arctostaphylos pajaroensis*, *Arctostaphylos montaraensis*, *Arctostaphylos bakeri*, *Arctostaphylos silvicola* (and others), *Ceanothus masonii*, *Ceanothus griseus*, and *Ceanothus verrucosus*. Southernmost stands (San Diego County) can include *Quercus dumosa var. dumosa*, *Cneoridium dumosum*, and *Comarostaphylis diversifolia*. Other common widespread woody taxa can include *Adenostoma fasciculatum*, *Eriogonum fasciculatum*, *Salvia mellifera*, *Frangula californica* (= *Rhamnus californica*), *Rhamnus crocea*, and *Quercus agrifolia*. Controlled burns sometimes have resulted in poor survivorship of the *Arctostaphylos* spp., and current theories are that they need long fire-free intervals to develop a viable seedbank that can reproduce following fire. This group often co-occurs with ~Californian Conifer Forest & Woodland Group (G198)\$\$ and may be replaced in part by *Quercus agrifolia* woodlands and other members of ~Californian Broadleaf Forest & Woodland Group (G195)\$\$.

***Diagnostic Characteristics:** This group is characterized by a combination of locally endemic species of *Arctostaphylos* and *Ceanothus*. Characteristic species include *Arctostaphylos tomentosa*, *Arctostaphylos nummularia*, *Arctostaphylos tomentosa ssp. crustacea*, *Arctostaphylos canescens*, *Arctostaphylos hookeri*, *Arctostaphylos pajaroensis*, *Arctostaphylos montaraensis* (and others), *Ceanothus masonii*, *Ceanothus griseus*, and *Ceanothus verrucosus*.

***Classification Comments:** Unique or rare stands of different species of *Arctostaphylos*, *Ceanothus*, and other scrub genera comprise this group, few of which have sufficiently broad distributions to represent the group as single diagnostic taxa. Boykin et al. (2005) suggest that a single clade of *Arctostaphylos* has undergone radiation adapting to these isolated coastal conditions, so in this case a group might be better characterized by a subgenus than a single or few species. However, endemic taxa of *Ceanothus* studied by Burge et al. (2011) are not phylogenetically clustered suggesting that the origin of endemism has occurred on multiple occasions in the members of *Ceanothus* endemic to maritime chaparral (Burge et al. 2011).

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|-------------------------------|------|
| | | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Dense shrublands 1-2 m tall dominated by evergreen sclerophyllous shrub, with little in the way of undergrowth.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This group is characterized by a combination of locally endemic species of *Arctostaphylos* and *Ceanothus*, species that primarily reproduce by seed rather than resprouting. Shrubs vary in height (up to 3 m tall) and occur in variable densities. More open patches support herbaceous vegetation, while occurrences of high shrub density have no understory. Characteristic species include *Arctostaphylos tomentosa*, *Arctostaphylos nummularia* (= *Arctostaphylos sensitiva*), *Arctostaphylos tomentosa ssp. crustacea* (= *Arctostaphylos crustacea*), *Arctostaphylos hookeri*, *Arctostaphylos pajaroensis*, *Arctostaphylos montaraensis* (and others), *Ceanothus masonii*, *Ceanothus griseus*, and *Ceanothus verrucosus*. Southernmost stands (San Diego County) can include *Quercus dumosa var. dumosa*, *Cneoridium dumosum*, *Xylococcus bicolor*, and *Comarostaphylys diversifolia*. Other common widespread woody taxa can include *Adenostoma fasciculatum*, *Eriogonum fasciculatum*, *Salvia mellifera*, *Frangula californica* (= *Rhamnus californica*), *Rhamnus crocea*, and *Quercus agrifolia*. Other coastal southern California stands dominated by *Malosma laurina* and *Rhus integrifolia* are also considered forms of southern maritime chaparral (Sawyer et al. 2009), but are less tied to oligotrophic soils and have more widespread coastal scrub, drought-deciduous associates, such as *Artemisia californica*, *Encelia californica*, *Salvia mellifera*, and *Eriogonum fasciculatum* (and others) as common associates.

*Floristics Table [Med - High Confidence]:

*Number of Plots:

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Const-ancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|------------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: These shrublands are characterized by species that primarily reproduce by seed rather than resprouting. Controlled burns have resulted in poor survivorship of the *Arctostaphylos* spp., and current theories are that they need long fire-free intervals to develop a viable seedbank that can reproduce following fire (Keeley and Davis 2005). Recent studies of many sites that have been fire-free for decades suggest that at least some of the species of *Ceanothus* may be able to germinate without fire and thus sustain populations for long fire-free intervals.

ENVIRONMENT

Environmental Description: Occurs in patches restricted by nutrient-poor edaphic conditions (sands, sandstones, other marine sediments, and stabilized sand dunes) within the fog belt throughout the central and northern California coast.

DISTRIBUTION

***Geographic Range:** This group occurs within the fog belt from southern California to the Mendocino coast of northern California. It extends north into coastal Oregon in very small patches.

Nations: MX?, US

States/Provinces: CA, OR

USFS Ecoregions (2007) [optional]: 261B:CC, 263A:CC, M242A:PP, M261A:PP, M261B:PP

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:** Much more work needs to be done comparing multiple isolated stands of this group.

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High

USNVC Confidence Comments [optional]:

HIERARCHY

*Lower Level NVC Types:

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3858 | <i>Arctostaphylos tomentosa ssp. crustacea</i> - <i>Arctostaphylos tomentosa</i> Central Coast & Island Chaparral Alliance |

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3461 | <i>Rhus integrifolia</i> Coastal Bluff Chaparral Alliance |
| A3856 | <i>Malosma laurina</i> - <i>Rhus integrifolia</i> Chaparral Alliance |
| A3859 | <i>Arctostaphylos nummularia</i> - <i>Arctostaphylos stanfordiana</i> - <i>Chrysolepis chrysophylla</i> var. <i>minor</i> North Coast Chaparral Alliance |
| A3857 | <i>Ceanothus papillosus</i> - <i>Ceanothus verrucosus</i> Post-fire Chaparral Alliance |
| A4242 | <i>Quercus dumosa</i> - <i>Quercus pacifica</i> Maritime Chaparral Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

*Recent Concept Lineage [if applicable]:

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---------------------------------|----------------|------|
| >< | Ceanothus Mixed Chaparral (208) | Shiflet 1994 | |
| >< | Chamise Chaparral (206) | Shiflet 1994 | |

AUTHORSHIP

*Primary Concept Source [if applicable]: T.N. Shiflet (1994)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

*Author of Description: G. Kittel and T. Keeler-Wolf

Acknowledgments [optional]: T. Keeler-Wolf

Version Date: 06 Sep 2013

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G261. Californian Mesic & Pre-montane Chaparral

Type Concept Sentence: This chaparral group consists of mesic shrublands characterized by a mix of species such as *Arctostaphylos glandulosa*, *Arctostaphylos pringlei* ssp. *drupacea*, *Ceanothus leucodermis*, *Ceanothus palmeri*, *Cercocarpus montanus* var. *glaber*, *Fraxinus dipetala*, *Garrya flavescens*, *Heteromeles arbutifolia*, *Prunus ilicifolia*, *Quercus berberidifolia*, *Rhamnus crocea*, and/or *Rhamnus ilicifolia*. It is found in southern California in mesic pockets (north-facing slopes, concavities, toeslopes) or at cooler elevations.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.1.Na.1. Californian Chaparral (M043)

Elcode: G261

***Scientific Name:** *Quercus berberidifolia* - *Arctostaphylos glandulosa* - *Fraxinus dipetala* Chaparral Group

***Common (Translated Scientific) Name:** Scrub Oak - Eastwood's Manzanita - California Ash Chaparral Group

***Colloquial Name:** Californian Mesic & Pre-montane Chaparral

***Type Concept:** This group includes both frost-intolerant mesic chaparrals at lower elevations and the "pre-montane" chaparrals with a composition including more frost-tolerant species. This shrubland group occurs in mesic site conditions, such as north-facing slopes, concavities, or toeslopes, with well-drained soils throughout Mediterranean California, mostly inland from the coastal fog belt. It also includes sclerophyllous scrub shrublands that are more frost-tolerant and found at higher, cooler and generally more mesic sites than ~Californian Xeric Chaparral Group (G257)\$. It occurs most often on north-facing slopes up to 1500 m (4550 feet) in elevation and up to 1830 m (6000 feet) in southern California. This group tends to be dominated by a variety of mixed or single-species, evergreen, sclerophyllous shrubs that resprout from lignotubers following fire, but also includes obligate seeding indicator shrubs. Some common and characteristic mesic chaparral species include *Quercus berberidifolia*, *Cercocarpus montanus* var. *glaber* (= *Cercocarpus betuloides*), *Fraxinus dipetala*, *Garrya flavescens*, *Heteromeles arbutifolia*, *Prunus ilicifolia*, *Rhamnus crocea*, and *Rhamnus ilicifolia*. Some winter-deciduous species include *Cercis canadensis* var. *texensis* (= *Cercis occidentalis*), *Lonicera* spp., *Styrax redivivus* (= *Styrax officinalis* var. *redivivus*), *Toxicodendron diversilobum*, *Ribes* spp., and *Sambucus nigra* ssp. *canadensis* (= *Sambucus mexicana*), and usually complement the predominant sclerophylls. Weakly resprouting or obligate seeders that also commonly occur in this group include arborescent *Ceanothus* spp., such as *Ceanothus spinosus*, *Ceanothus tomentosus*, and *Ceanothus leucodermis*. Although usually considered trees, *Umbellularia californica* and *Aesculus californica* can also occur as shrubs and, lacking disturbance, can grow to tree size, as do some of the other chaparral shrubs (some old-growth stands can reach 10.6 m [35 feet] in height!).

The pre-montane chaparrals are particularly well-developed in central and southern California mountains, occurring below montane chaparral/scrub types (which receive much more precipitation as snow and tend to be very cold-hardy) and the lower elevation mesic chaparrals described above (which contain species that are not as tolerant of freezing temperatures). Characteristic species include *Arctostaphylos pringlei* ssp. *drupacea*, *Arctostaphylos glandulosa*, *Ceanothus palmeri*, and *Ceanothus leucodermis*. Depending upon fire history, emergent conifers such as *Pinus sabiniana*, *Pinus ponderosa*, and *Pseudotsuga menziesii* may be present. Most chaparral species are fire-adapted, resprouting vigorously after burning or producing fire-resistant seeds. However, this is not a group that requires frequent fire for perpetuation.

***Diagnostic Characteristics:** This group tends to be dominated by a variety of mixed or single-species, evergreen, sclerophyllous or winter-deciduous shrubs that resprout from lignotubers following fire, although some are obligate seeders. Common species include *Quercus berberidifolia*, *Quercus wislizeni* var. *frutescens*, *Quercus chrysolepis*, *Cercocarpus montanus* var. *glaber*, *Fraxinus dipetala*, *Garrya flavescens*, *Heteromeles arbutifolia*, *Lonicera* spp., *Malosma laurina*, *Prunus ilicifolia*, *Rhamnus crocea*, *Rhamnus ilicifolia*, *Toxicodendron diversilobum*, *Ribes* spp., and *Sambucus* spp. Species of manzanita include *Arctostaphylos glandulosa*, *Arctostaphylos pringlei* ssp. *drupacea*, and *Ceanothus oliganthus*.

***Classification Comments:** The pre-montane chaparrals are not well-described in the literature. We need additional information regarding its species composition, range of distribution, environmental setting, and other characteristics.

*Similar NVC Types [if applicable]:

| Elcode | Scientific or Colloquial Name | Note |
|--------|-------------------------------|--|
| G257 | Californian Xeric Chaparral | has lower proportion of sprouter shrubs and is typically found in warmer settings where winter |

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|--|
| | | temperatures rarely drop below freezing for extended periods. |
| G282 | Western North American Montane Sclerophyll Scrub | occurs at higher and cooler sites, usually adjacent to coniferous forest and woodland of cool temperate climates. |
| G281 | Western Madrean Chaparral | may occur adjacent to stands of this group in the desert margins of southern California Peninsular Ranges, but tends to have more openly spaced shrubs with more drought-deciduous short shrubs. |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Dependent upon fire history and substrate, stands may be relatively tall shrublands with open herbaceous understories or dense thickets impenetrable by man or beast save rabbits and feral pigs, with generally no undergrowth.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This group tends to be dominated by a variety of mixed or single-species, evergreen, sclerophyllous shrubs that resprout from lignotubers following fire. Common species include *Quercus berberidifolia*, *Quercus wislizeni* var. *frutescens*, *Quercus chrysolepis*, *Quercus durata*, *Cercocarpus montanus* var. *glaber* (= *Cercocarpus betuloides*), *Arctostaphylos glandulosa*, *Arctostaphylos pringlei* ssp. *drupacea*, *Fraxinus dipetala*, *Garrya flavescens*, *Garrya elliptica*, *Heteromeles arbutifolia*, *Lonicera* spp., *Prunus ilicifolia*, *Rhamnus crocea*, *Rhamnus ilicifolia*, *Toxicodendron diversilobum*, *Ribes* spp., and *Sambucus* spp. Weakly resprouting or obligate seeders that also commonly occur in this group include arborescent *Ceanothus* spp., such as *Ceanothus spinosus*, *Ceanothus oliganthus*, *Ceanothus tomentosus*, and *Ceanothus leucodermis*. *Umbellularia californica* and *Aesculus californica* can also occur as shrubs and, lacking disturbance, can grow to tree size, as do some of the other chaparral shrubs (some old-growth stands can reach 10.6 m [35 feet] in height!).

*Floristics Table [Med - High Confidence]:

*Number of Plots:

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Lacking disturbance, shrubs in this group can grow to tree size (some old-growth stands can reach 10.6 m [35 feet] in height!). This is not a group that requires frequent fire for perpetuation.

ENVIRONMENT

Environmental Description: This shrubland group occurs in mesic site conditions, such as north-facing slopes, concavities, or toeslopes, with well-drained soils throughout Mediterranean California away from the coastal fog belt. It occurs most often on north-facing slopes up to 1500 m (4550 feet) in elevation and up to 1830 m (6000 feet) in southern California. This group consists of sclerophyllous scrub shrublands that are more frost-tolerant and found at higher, cooler and generally more mesic sites than ~Californian Xeric Chaparral Group (G257)\$. They are particularly well-developed in central and southern California mountains.

DISTRIBUTION

***Geographic Range:** This group occurs throughout Mediterranean California away from the coastal fog belt. It may occur as very small patches in southwestern Oregon, but it isn't clearly documented from there.

Nations: MX?, US

States/Provinces: CA, OR?

USFS Ecoregions (2007) [optional]: 261B:CC, 262A:??, 263A:CC, M261A:C?, M261B:CC, M261C:CC, M261D:CC, M261E:CC, M261F:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:** Data analysis summarized in Sawyer et al. (2009).

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3863 | <i>Prunus ilicifolia</i> - <i>Heteromeles arbutifolia</i> - <i>Ceanothus spinosus</i> Mesic Chaparral Alliance |
| A0587 | <i>Cercocarpus montanus</i> var. <i>glaber</i> Mesic Chaparral Alliance |
| A2673 | <i>Quercus berberidifolia</i> - <i>Adenostoma fasciculatum</i> Mesic Chaparral Alliance |
| A3861 | <i>Ceanothus oliganthus</i> - <i>Ceanothus leucodermis</i> - <i>Ceanothus tomentosus</i> Pre-montane Chaparral Alliance |
| A3860 | <i>Quercus wislizeni</i> var. <i>frutescens</i> - <i>Arctostaphylos glandulosa</i> Pre-montane Chaparral Alliance |
| A3862 | <i>Quercus durata</i> Ultramafic Chaparral Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------------|---|-----------------------|
| 2013-06-10 | G263 <i>Arctostaphylos pringlei</i> ssp. <i>drupacea</i> - <i>Ceanothus</i> spp. - <i>Quercus chrysolepis</i> Sclerophyll Scrub Group | G263 merged into G261 |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---|----------------|---------------------------------|
| > | Montane Shrubland (209) | Shiflet 1994 | |
| ? | Scrub Oak Chaparral (#37900) | Holland 1986b | |
| ? | Southern North Slope Chaparral (#37E20) | Holland 1986b | |
| ? | Northern North Slope Chaparral (#37E10) | Holland 1986b | |
| ? | Mesic North Slope Chaparral (#37E00) | Holland 1986b | |
| = | Scrub Oak Mixed Chaparral (207) | Shiflet 1994 | These are basically equivalent. |

AUTHORSHIP

***Primary Concept Source [if applicable]:** T.N. Shiflet (1994)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** T. Keeler-Wolf, G. Kittel and M. Reid

Acknowledgments [optional]: T. Keeler-Wolf

Version Date: 09 Sep 2013

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- Stout, D., J. Buck-Diaz, S. Taylor, and J. M. Evens. 2013. Vegetation mapping and accuracy assessment report for Carrizo Plain National Monument. California Native Plant Society, Vegetation Program, Sacramento, CA. 71 pp.

2. Shrub & Herb Vegetation

2.B.1.Na. Californian Scrub & Grassland

G257. Californian Xeric Chaparral

Type Concept Sentence: This chaparral group consists of xeric and fire-adapted shrublands characterized by a mix of several species such as *Adenostoma fasciculatum*, *Adenostoma sparsifolium*, *Arctostaphylos glandulosa*, *Arctostaphylos glauca*, *Arctostaphylos manzanita*, *Arctostaphylos stanfordiana*, *Arctostaphylos viscida*, *Ceanothus cordulatus*, *Ceanothus crassifolius*, *Ceanothus cuneatus*, *Ceanothus greggii*, *Ceanothus leucodermis*, *Ceanothus megacarpus*, *Cercocarpus montanus* var. *glaber*, *Cercocarpus montanus* var. *minutiflorus*, *Dendromecon rigida*, *Fremontodendron californicum*, *Malacothamnus fasciculatus*, *Pickeringia montana*, *Rhus ovata*, and/or *Xylococcus bicolor*. It is located inland from maritime chaparral from sea level up to 2200 m (7220 feet) elevation, from Baja Norte, Mexico, throughout California north into Oregon.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.1.Na.1. Californian Chaparral (M043)

Elcode: G257

***Scientific Name:** *Adenostoma fasciculatum* - *Ceanothus cuneatus* - *Arctostaphylos viscida* Xeric Chaparral Group

***Common (Translated Scientific) Name:** Chamise - Buckbrush - Sticky Whiteleaf Manzanita Xeric Chaparral Group

***Colloquial Name:** Californian Xeric Chaparral

***Type Concept:** This shrubland group includes chaparral typically located inland from maritime chaparral from sea level up to 2200 m (7220 feet) elevation. It ranges from inland portions of Baja Norte, Mexico, southern, central and northern California through the northern end of the Central Valley and north into Oregon. This group is made up of a mixture of mostly obligate seeders. Characteristic species include *Adenostoma fasciculatum*, *Adenostoma sparsifolium*, *Ceanothus cuneatus*, *Ceanothus megacarpus*, *Ceanothus crassifolius*, *Ceanothus leucodermis*, *Ceanothus cordulatus*, *Ceanothus greggii*, *Arctostaphylos viscida*, *Arctostaphylos manzanita*, *Arctostaphylos glauca*, *Arctostaphylos glandulosa*, *Arctostaphylos stanfordiana*, *Fremontodendron californicum*, *Malacothamnus fasciculatus*, *Dendromecon rigida*, *Pickeringia montana*, *Cercocarpus montanus* var. *glaber* (= *Cercocarpus betuloides*), *Cercocarpus montanus* var. *minutiflorus* (= *Cercocarpus minutiflorus*), *Rhus ovata*, and *Xylococcus bicolor*. Fire regimes are intense, stand-replacing crownfires. Scattered and young trees may occur, such as *Pinus ponderosa*, *Pinus sabiniana*, *Pseudotsuga menziesii*, *Juniperus californica*, *Quercus engelmannii*, and *Quercus wislizeni*.

***Diagnostic Characteristics:** Shrublands dominated by drought- and heat-tolerant seeders *Adenostoma fasciculatum*, *Adenostoma sparsifolium*, *Ceanothus cuneatus*, *Ceanothus megacarpus*, *Ceanothus crassifolius*, *Ceanothus leucodermis*, *Ceanothus cordulatus*, *Ceanothus greggii*, *Arctostaphylos viscida*, *Arctostaphylos manzanita*, *Arctostaphylos glauca*, *Arctostaphylos glandulosa*, *Arctostaphylos stanfordiana*, *Fremontodendron californicum*, *Malacothamnus fasciculatus*, *Dendromecon rigida*, *Pickeringia montana*, and *Rhus ovata*.

***Classification Comments:** Resprouter species include *Adenostoma fasciculatum*, *Adenostoma sparsifolium*, *Arctostaphylos glandulosa*, *Ceanothus cordulatus*, *Ceanothus leucodermis*, *Cercocarpus montanus*, *Malacothamnus fasciculatus*, *Fremontodendron californicum*, *Pickeringia montana*, and *Rhus ovata*.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G261 | Californian Mesic & Pre-montane Chaparral | |

Similar NVC Types General Comments [optional]: Some characteristic species in this group are also being used as indicators of the mesic group (G261), indicating the range of conditions tolerated by wide-ranging chaparral shrubs.

VEGETATION

Physiognomy and Structure Summary: Closed-canopy shrublands up to 5 m tall. The canopy is generally so dense it precludes the passage of any person or animal taller than a rabbit or fox. There is very little understory growth in mature stands, but there are abundant fire-following herbs within the first 3-5 years following fire.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This group is made up of a mixture of both obligate seeders and resprouters. Characteristic species include *Adenostoma fasciculatum*, *Adenostoma sparsifolium*, *Ceanothus cuneatus*, *Ceanothus megacarpus*, *Ceanothus crassifolius*, *Ceanothus leucodermis*, *Arctostaphylos viscida*, *Arctostaphylos manzanita*, *Arctostaphylos glauca*, *Arctostaphylos stanfordiana*, *Fremontodendron californicum*, *Malacothamnus fasciculatus*, *Dendromecon rigida*, *Pickeringia montana*, *Rhus ovata*, *Eriogonum fasciculatum*, and *Yucca whipplei*. Fire regimes are intense, stand-replacing crownfires. Scattered and young trees may occur, such as *Pinus ponderosa*, *Pinus sabiniana*, *Juniperus californica*, *Quercus engelmannii*, *Pseudotsuga menziesii*, and *Quercus wislizeni*.

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: In the southern portion of the range, Santa Ana winds drive late-summer, stand-replacing fires in these shrublands. These shrublands include extensive areas on coarse-grained soils with annual precipitation up to 75 cm (winter rain but not snow). Adjacent fine-textured soils support savanna under similar climatic regimes. These areas have supported extensive stand-replacing wildfires.

ENVIRONMENT

Environmental Description: This group is typically located inland from maritime chaparral from sea level up to 2200 m (7220 feet) elevation. *Climate:* Chaparral is closely associated with the Mediterranean climate pattern of winter rain and summer drought. Within that regime it can be found under a wide range of rainfall and temperature conditions, but over 60% of the current distribution is in areas that receive between 250 and 750 mm of annual precipitation, and where average January daily temperature falls between 5-15°C, indicating that summer drought stress may limit chaparral shrub seedling establishment and that injury to adult shrubs from winter freezes may impose species-specific distributional limits [need citations to back up this statement]. This type is found adjacent to grasslands on deeper soils and oak savannas on finer soils, and on all aspects. *Adenostoma fasciculatum* stands occur more on more southerly aspects.

DISTRIBUTION

***Geographic Range:** This group includes chaparral from sea level up to approximately 2200 m (7220 feet) elevation located inland from maritime chaparral. It ranges from inland portions of Baja Norte, Mexico, southern, central and northern California through the northern end of the Central Valley and north into Oregon.

Nations: MX, US

States/Provinces: CA, MXBC, OR

USFS Ecoregions (2007) [optional]: 242B:??, 261B:CC, 262A:CC, 263A:CC, 322A:PP, 322C:PP, M242A:P?, M242B:PP, M261A:CC, M261B:CC, M261C:CC, M261D:CC, M261E:CC, M261F:CC, M261G:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL**USNVC Confidence Level:** High**USNVC Confidence Comments [optional]:****HIERARCHY*****Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3866 | <i>Arctostaphylos glauca</i> Chaparral Alliance |
| A3869 | <i>Ceanothus cuneatus</i> Chaparral Alliance |
| A3864 | <i>Ceanothus crassifolius</i> - <i>Ceanothus megacarpus</i> Chaparral Alliance |
| A3868 | <i>Adenostoma fasciculatum</i> Chaparral Alliance |
| A3865 | <i>Arctostaphylos viscida</i> - <i>Arctostaphylos myrtifolia</i> - <i>Arctostaphylos manzanita</i> Chaparral Alliance |
| A3867 | <i>Salvia apiana</i> - <i>Salvia mellifera</i> - <i>Adenostoma fasciculatum</i> Chaparral Alliance |

DISCUSSION**Discussion [optional]:****CONCEPT HISTORY*****Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---------------------------------|----------------|---|
| > | Ceanothus Mixed Chaparral (208) | Shiflet 1994 | |
| > | Chamise Chaparral (206) | Shiflet 1994 | SRM groups all <i>Adenostoma</i> -dominated communities into one range type |

AUTHORSHIP***Primary Concept Source [if applicable]:** T.N. Shiflet (1994)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** G. Kittel, M.S. Reid and T. Keeler-Wolf**Acknowledgments [optional]:** T. Keeler-Wolf and P. Moore

Version Date: 09 Oct 2013

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2. Shrub & Herb Vegetation
 2.B.1.Na. Californian Scrub & Grassland

M044. Californian Coastal Scrub

2. Shrub & Herb Vegetation
 2.B.1.Na. Californian Scrub & Grassland

G782. Californian Coastal-Foothill Seral Scrub

Type Concept Sentence: This Californian coastal shrubland group proliferates after natural disturbance, where characteristic species include *Cleome isomeris*, *Diplacus aurantiacus*, *Dendromecon rigida*, *Eastwoodia elegans*, *Ericameria linearifolia*, *Ericameria palmeri*, *Eriodictyon californicum*, *Eriodictyon crassifolium*, *Eriodictyon trichocalyx*, *Gutierrezia californica*, *Hazardia squarrosa*, *Isocoma menziesii*, *Lotus scoparius*, *Lupinus albifrons*, *Malacothamnus fasciculatus*, and other *Malacothamnus* spp. These tend to occur in coastal and foothill settings from southern Oregon, through California, and south into Baja Norte, Mexico.

OVERVIEW

***Hierarchy Level:** Group
***Placement in Hierarchy:** 2.B.1.Na.2. Californian Coastal Scrub (M044)

Elcode: G782

***Scientific Name:** *Lotus scoparius* - *Eriodictyon* spp. - *Lupinus albifrons* Coastal-Foothill Seral Scrub Group
***Common (Translated Scientific) Name:** Common Deerweed - Yerba Santa species - Silver Lupine Coastal-Foothill Seral Scrub Group
***Colloquial Name:** Californian Coastal-Foothill Seral Scrub

***Type Concept:** This group includes a mixture of coastal and foothill shrublands from southern Oregon and California, south into Baja Norte, Mexico. It is dominated by drought-deciduous and evergreen shrubs that respond favorably and proliferate with natural disturbance including alluvial, colluvial, clearing, grazing, and fire. It occurs below 1500 m (4900 feet) elevation and occurs from coastal to inland sites (e.g., areas with 10-60 cm of annual precipitation). Soils vary from coarse gravels to mineral clays, that usually support plant-available moisture with winter and spring rains. Most predominant shrubs include *Cleome isomeris* (= *Isomeris arborea*), *Diplacus aurantiacus* (= *Mimulus aurantiacus*), *Dendromecon rigida*, *Eastwoodia elegans*, *Ericameria linearifolia*, *Ericameria palmeri*, *Eriodictyon californicum*, *Eriodictyon crassifolium*, *Eriodictyon trichocalyx*, *Gutierrezia californica*, *Hazardia squarrosa*, *Isocoma menziesii*, *Lotus scoparius*, *Lupinus albifrons*, *Malacothamnus fasciculatus*, and other *Malacothamnus* spp. are dominant. Stands of these shrubs are initiated by natural disturbance conditions, including dry alluvial terraces, steep colluvial slopes, recently burned areas, etc., and occur in a mosaic with other shrubland and grassland types. While the shrubs forming stands may not live longer than 10 to 25 years, their seeds collect in soil and duff as a seed bank, and they are obligate seeders and readily germinate and dominate areas following disturbance. Seeds also can be scarified with disturbance, e.g., heat from fire stimulating germination. Other coastal and chaparral shrubs and trees that are relatively longer lived become dominant over time, including *Adenostoma fasciculatum*, *Artemisia* spp., *Eriogonum* spp., and *Quercus* spp. However, with increasing fire frequency in recent years, especially in southern California and northern Baja California, due to adjacency to urban and suburban dwellings (e.g., as a result of arson or cigarette ignition), some larger acreages have become dominated by these seral scrub stands or other more ruderal types. Also, as seed-banking species in this group, abnormally high fire frequencies will eliminate seed banks of this and later seral shrub species. Shrubs of this group can be useful for post-fire recovery, erosion control, and habitat restoration in California because they readily germinate and quickly establish in disturbance conditions.

***Diagnostic Characteristics:** Most predominant shrubs include *Cleome isomeris*, *Dendromecon rigida*, *Diplacus aurantiacus*, *Eastwoodia elegans*, *Ericameria linearifolia*, *Ericameria palmeri*, *Eriodictyon californicum*, *Eriodictyon crassifolium*, *Eriodictyon trichocalyx*, *Gutierrezia californica*, *Hazardia squarrosa*, *Isocoma menziesii*, *Lotus scoparius*, *Lupinus albifrons*, *Malacothamnus fasciculatus*, and other *Malacothamnus* spp.

***Classification Comments:** This group has been split from ~Central & Southern Californian Coastal Sage Scrub Group (G264)\$\$.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|-------------------------------|------|
| | | |

Similar NVC Types General Comments [optional]:**VEGETATION**

Physiognomy and Structure Summary: It is dominated by drought-deciduous and evergreen shrubs 0.5-2 m in height that are adapted to Mediterranean climate. While the shrubs vary from open stands to dense thickets, it is possible to navigate through them as the branches are forgiving.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Most predominant shrubs include *Lotus scoparius*, *Lupinus albifrons*, *Eriodictyon californicum*, *Eriodictyon crassifolium*, *Eriodictyon trichocalyx*, *Lupinus albifrons*, *Diplacus aurantiacus* (= *Mimulus aurantiacus*), *Dendromecon rigida*, *Eastwoodia elegans*, *Ericameria linearifolia*, *Ericameria palmeri*, *Gutierrezia californica*, *Hazardia squarrosa*, *Isocoma menziesii*, *Cleome isomeris* (= *Isomeris arborea*), *Malacothamnus fasciculatus*, and other *Malacothamnus* spp.

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Fire, alluvial flooding and substrate movement, grazing, and other disturbance conditions are important in maintaining stands of this group, but too frequent disturbance can also deplete seed banks. Fire frequency in recent years, with adjacency to urban and suburban areas, has increased (e.g., as a result of arson or cigarette ignition) resulting in type conversion to non-native and ruderal annual grasslands. Shrubs of this group can be useful for post-fire recovery, erosion control, and habitat restoration in California because they readily germinate and quickly establish in disturbance conditions.

ENVIRONMENT

Environmental Description: This group occurs below 1500 m (4900 feet) elevation from the coast to inland (e.g., areas with 10-60 cm of annual precipitation). Soils vary from coarse gravels to mineral clays that usually support plant-available moisture with winter and spring rains.

DISTRIBUTION

***Geographic Range:** This group is found from southern Oregon and California, south into Baja Norte, Mexico. It occurs below 1500 m (4925 feet) elevation and occurs both in both inland and coastal settings in areas of recent disturbance, including alluvial, colluvial, clearing, grazing, and fire.

Nations: MX, US

States/Provinces: CA, MXBC, OR

USFS Ecoregions (2007) [optional]:

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A2671 | <i>Malacothamnus fasciculatus</i> - <i>Malacothamnus</i> spp. Scrub Alliance |
| A3886 | <i>Lotus scoparius</i> - <i>Lupinus albifrons</i> Scrub Alliance |
| A4101 | <i>Ericameria linearifolia</i> - <i>Cleome isomeris</i> Scrub Alliance |
| A3887 | <i>Hazardia squarrosa</i> - <i>Ericameria palmeri</i> Scrub Alliance |
| A2672 | <i>Dendromecon rigida</i> - <i>Diplacus aurantiacus</i> - <i>Eriodictyon californicum</i> Scrub Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------------|---|----------------------|
| 2014-04-09 | G264 Artemisia californica - Salvia mellifera - Salvia apiana Coastal Scrub Group | G782 split from G264 |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---|--------------------|-----------|
| < | <i>Lupinus albifrons</i> (Silver bush lupine scrub) Alliance | Sawyer et al. 2009 | 32.081.00 |
| < | <i>Eriodictyon crassifolium</i> (Thick leaf yerba santa scrub) Provisional Alliance | Sawyer et al. 2009 | 37.090.00 |
| < | <i>Eriodictyon californicum</i> (California yerba santa scrub) Alliance | Sawyer et al. 2009 | 37.080.00 |
| < | <i>Lotus scoparius</i> (Deer weed scrub) Alliance | Sawyer et al. 2009 | 52.240.00 |
| = | Coastal Sage Shrub (205) | Shiflet 1994 | |

AUTHORSHIP***Primary Concept Source [if applicable]:** J.O. Sawyer, T. Keeler-Wolf and J.M. Evens (2009)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** J. Evens

Acknowledgments [optional]:

Version Date: 11 Apr 2014

REFERENCES***References [Required if used in text]:**

- Barbour, M. G., T. Keeler-Wolf, and A. A. Schoenherr, editors. 2007a. Terrestrial vegetation of California, third edition. University of California Press, Berkeley.
- Buck-Diaz, J., S. Batiuk, and J. M. Evens. 2012. Vegetation alliances and associations of the Great Valley ecoregion, California. California Native Society, Sacramento, CA. [http://cnps.org/cnps/vegetation/pdf/great_valley_eco-vegclass2012.pdf]
- Buck-Diaz, J., and J. Evens. 2011b. Carrizo Plain National Monument vegetation classification and mapping project. Report to USDI, Bureau of Land Management, California Department of Fish and Game, and The Nature Conservancy. California Native Plant Society, Sacramento, CA.
- Buck-Diaz, J., and J. M. Evens. 2011a. Alluvial scrub vegetation of southern California, a focus on the Santa Ana River watershed in Orange, Riverside, and San Bernardino counties, California. Unpublished report to Riverside-Corona Resource Conservation District. California Native Society, Sacramento, CA.
- Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2017a. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]
- Holland, V. L., and D. J. Keil. 1995. California vegetation. Kendall/Hunt Publishing Company, Dubuque, IA. 516 pp.
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- Sawyer, J. O., T. Keeler-Wolf, and J. Evens. 2009. A manual of California vegetation. Second edition. California Native Plant Society, Sacramento CA. 1300 pp.
- Shiflet, T. N., editor. 1994. Rangeland cover types of the United States. Society for Range Management. Denver, CO. 152 pp.
- Stout, D., J. Buck-Diaz, S. Taylor, and J. M. Evens. 2013. Vegetation mapping and accuracy assessment report for Carrizo Plain National Monument. California Native Plant Society, Vegetation Program, Sacramento, CA. 71 pp.

VegCAMP and AIS [Vegetation Classification and Mapping Program and Aerial Information Systems, Inc.]. 2013. 2012 California desert vegetation map and accuracy assessment in support of the Desert Renewable Energy Conservation Plan. Unpublished report to California Department of Fish and Wildlife Renewable Energy Program and the California Energy Commission. California Department of Fish and Wildlife, Vegetation Classification and Mapping Program and Aerial Information Systems, Inc.

2. Shrub & Herb Vegetation

2.B.1.Na. Californian Scrub & Grassland

G662. Californian North Coastal & Mesic Scrub

Type Concept Sentence: This coastal mesic shrubland group is dominated by *Baccharis pilularis*, *Dudleya* spp., *Erigeron glaucus*, *Eriogonum parvifolium*, *Eriophyllum stoechadifolium*, *Hazardia squarrosa*, and/or *Plantago maritima*. It occurs on sea bluffs and rocky headlands well above the tidal zone throughout rugged portions of the Pacific Coast from Oregon to Baja Norte, Mexico, and including off-shore islands.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.1.Na.2. Californian Coastal Scrub (M044)

Elcode: G662

***Scientific Name:** Californian North Coastal & Mesic Scrub Group

***Common (Translated Scientific) Name:** Californian North Coastal & Mesic Scrub Group

***Colloquial Name:** Californian North Coastal & Mesic Scrub

***Type Concept:** These shrublands are dominated by *Baccharis pilularis*, *Dudleya* spp., *Hazardia squarrosa* (= *Haplopappus squarrosus*), *Eriogonum parvifolium*, *Erigeron glaucus*, *Eriophyllum stoechadifolium*, and *Plantago maritima*. They occur on sea bluffs and rocky headlands well above the tidal zone throughout rugged portions of the Pacific Coast. Plant communities along these often vertical slopes are typically sparse, with many succulents and prostrate shrubs, and species that readily withstand salt spray and saline soils, as well as seasonal drought. Slope instability and erosion result in severe conditions, setting back succession in this group. This group occurs in Oregon, California, Baja Norte, Mexico, and off-shore islands (e.g., Channel Islands).

***Diagnostic Characteristics:**

***Classification Comments:** This group excludes beach and dune scrub communities. Cliffs dominated by *Carpobrotus chilensis* and *Carpobrotus edulis*, introduced species from the South Africa, belong in the ruderal part of the USNVC, namely ~Californian Annual & Perennial Grassland Macrogroup (M045)\$\$, and ~Californian Ruderal Grassland, Meadow & Scrub Group (G497)\$\$.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|-------------------------------|------|
| | | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Evergreen scrub, semi-succulent scrub and perennial herbaceous vegetation <1 m in height.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: These shrublands are dominated by *Baccharis pilularis*, *Dudleya* spp., *Hazardia squarrosa* (= *Haplopappus squarrosus*), *Eriogonum parvifolium*, *Erigeron glaucus*, *Eriophyllum stoechadifolium*, and *Plantago maritima*.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Const-ancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|------------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:**ENVIRONMENT**

Environmental Description: Stands occur on sea bluffs and rocky headlands well above the tidal zone.

DISTRIBUTION

***Geographic Range:** This group is found on rocky headlands and cliffs along the Pacific Coast of Oregon, California and Mexico.

Nations: MX, US

States/Provinces: CA, MXBC, OR

USFS Ecoregions (2007) [optional]:

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A0741 | <i>Ceanothus thyrsiflorus</i> Scrub Alliance |
| A4089 | <i>Corylus cornuta</i> var. <i>californica</i> Scrub Alliance |
| A0836 | <i>Baccharis pilularis</i> Scrub Alliance |
| A2610 | <i>Toxicodendron diversilobum</i> Scrub Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------------|---|-----------------------------|
| 2012-07-24 | G266 <i>Baccharis pilularis</i> - <i>Diplacus aurantiacus</i> Coastal Scrub Group | G266 split into G662 & G663 |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** D. Faber-Langendoen, in D. Faber-Langendoen et al. (2012)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** G. Kittel

Acknowledgments [optional]:

Version Date: 21 May 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2017a. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Rodriguez, D., K. G. Sikes, T. Keeler-Wolf, G. Kittel, J. Curtis, C. Curley, and J. Evens. 2017. Vegetation classification of Channel Islands National Park. Report to the National Park Service, Fort Collins, CO.

G264. Central & Southern Californian Coastal Sage Scrub

Type Concept Sentence: This coastal sage scrub group includes coastal (fog-drenched) mixed shrublands below 1000 m (3000 feet) elevation with *Artemisia californica*, *Diplacus aurantiacus*, *Encelia californica*, *Eriogonum cinereum*, *Eriogonum fasciculatum*, *Lotus scoparius*, *Lupinus albifrons*, *Lycium brevipes*, *Lycium californicum*, *Malosma laurina*, *Opuntia littoralis*, *Rhus integrifolia*, *Salvia apiana*, *Salvia leucophylla*, and/or *Salvia mellifera*, found from Marin County, California, south into Baja Norte, Mexico.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.1.Na.2. Californian Coastal Scrub (M044)

Elcode: G264

***Scientific Name:** *Artemisia californica* - *Salvia mellifera* - *Salvia apiana* Coastal Scrub Group

***Common (Translated Scientific) Name:** Coastal Sagebrush - Black Sage - White Sage Coastal Scrub Group

***Colloquial Name:** Central & Southern Californian Coastal Sage Scrub

***Type Concept:** This group includes mixed coastal shrublands from Marin County, California, south into Baja Norte, Mexico. It is dominated by drought-deciduous shrubs but at times can have characteristic (constant but not dominant) resprouting, deep-rooted sclerophyllous shrubs. It occurs below 1000 m (3000 feet) elevation and may extend inland from the maritime zone in hotter, drier conditions than northern (less fog-drenched) shrublands (e.g., areas with 10-60 cm of annual precipitation). Soils vary from coarse gravels to clays but typically only support plant-available moisture with winter and spring rains. Most predominant shrubs include *Artemisia californica*, *Salvia mellifera*, *Salvia apiana*, *Salvia leucophylla*, *Encelia californica*, *Eriogonum fasciculatum*, *Eriogonum cinereum*, *Lycium brevipes*, *Lycium californicum*, and *Opuntia littoralis*. On recently disturbed sites, such as after fire, *Diplacus aurantiacus* (= *Mimulus aurantiacus*), *Lotus scoparius*, and *Lupinus albifrons* can be dominant. Characteristic (constant but not dominant) resprouting, deep-rooted sclerophyllous shrubs include *Malosma laurina*, *Rhus integrifolia*, and *Rhamnus crocea*. Fire frequency was historically low, but in recent years, with adjacency to urban and suburban areas, the fire frequency has increased (a result of arson or cigarette ignition) resulting in type conversion to non-native and ruderal annual grasslands. *Malosma laurina* and *Rhus integrifolia* are also increasing in abundance because they can continually resprout after repeated fires. In places, *Opuntia littoralis* may proliferate and cover entire slopes in dry rocky areas with repeated fires that have killed the scrub taxa, while *Opuntia littoralis* can resprout and spread to cover large patches.

***Diagnostic Characteristics:** Most predominant shrubs include *Artemisia californica*, *Salvia mellifera*, *Salvia apiana*, *Salvia leucophylla*, *Encelia californica*, *Eriogonum fasciculatum*, *Eriogonum cinereum*, and *Opuntia littoralis*.

***Classification Comments:** This group includes a number of other, early-seral shrublands identified by Sawyer et al. (2009), dominated by species such as *Eriodictyon californicum*, *Lupinus albifrons*, *Lotus scoparius*, *Malacothamnus fasciculatus*, *Hazardia squarrosa*, *Ericameria palmeri*, *Ericameria linearifolia*, *Gutierrezia californica*, *Keckiella antirrhinoides*, *Dendromecon rigida*, and *Isocoma menziesii*. The ecology/environmental parameters of these seral scrub types are different than the parameters of the alliances/associations in this group (G264). A separate seral scrub group may be needed instead of lumping them into this group. Also some of these seral scrub associations occur in the Sierra Nevada and Sierra Nevada foothills (along steep slopes, dry alluvial terraces, and areas where chaparral has recently burned), while these more coastal scrub types of this group do not. Especially since ~Californian Coastal Scrub Macrogroup (M044) only includes one group right now, it makes sense to have two groups with the disturbance scrub types in that the second group (J. Evens pers. comm. 2013).

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|-------------------------------|------|
| | | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: It is dominated by drought-deciduous shrubs 1-2 m in height but at times can have characteristic (constant but not dominant) resprouting, deep-rooted sclerophyllous shrubs. It is often called "soft" chaparral; while a dense thicket, it is possible to navigate through it as the branches are forgoing.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Most predominant shrubs include *Artemisia californica*, *Salvia mellifera*, *Salvia apiana*, *Salvia leucophylla*, *Encelia californica*, *Eriogonum fasciculatum*, *Eriogonum cinereum*, *Lycium brevipes*, *Lycium californicum*, and *Opuntia littoralis*. On recently disturbed sites, such as after fire, *Diplacus aurantiacus* (= *Mimulus aurantiacus*), *Lotus scoparius*, and *Lupinus albifrons* can be dominant. Characteristic (constant but not dominant) resprouting, deep-rooted sclerophyllous shrubs include *Malosma laurina*, *Rhus integrifolia*, and *Rhamnus crocea*.

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Fire frequency was historically low, but in recent years, with adjacency to urban and suburban areas, the fire frequency has increased (a result of arson or cigarette ignition) resulting in type conversion to non-native and ruderal annual grasslands and early-seral types. *Malosma laurina* and *Rhus integrifolia* are also increasing in abundance because they can continually resprout after repeated fires. In places, *Opuntia littoralis* may proliferate and cover entire slopes in dry rocky areas with repeated fires that have killed the scrub taxa, while *Opuntia littoralis* can resprout and spread to cover large patches.

ENVIRONMENT

Environmental Description: Occurs below 1000 m (3000 feet) elevation and may extend inland from the maritime zone in hotter, drier conditions than northern (less fog-drenched) shrublands (e.g., areas with 10-60 cm of annual precipitation). Soils vary from coarse gravels to clays but typically only support plant-available moisture with winter and spring rains.

DISTRIBUTION

***Geographic Range:** This group is found from Marin County, California, south into Baja Norte, Mexico. It occurs below 1000 m (3000 feet) elevation and may extend inland from the maritime zone.

Nations: MX, US

States/Provinces: CA, MXBC

USFS Ecoregions (2007) [optional]: 261B:CC, 262A:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3882 | <i>Encelia californica</i> - <i>Eriogonum cinereum</i> [Maritime] Scrub Alliance |
| A3883 | <i>Artemisia californica</i> - <i>Salvia leucophylla</i> Mesic Scrub Alliance |
| A3884 | <i>Eriogonum fasciculatum</i> - <i>Salvia apiana</i> Xeric Scrub Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--------------------------|----------------|------|
| = | Coastal Sage Shrub (205) | Shiflet 1994 | |

AUTHORSHIP

*Primary Concept Source [if applicable]: T.N. Shiflet (1994)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

*Author of Description: G. Kittel

Acknowledgments [optional]: J. Evens

Version Date: 09 Oct 2013

REFERENCES

*References [Required if used in text]:

- Barbour, M. G., T. Keeler-Wolf, and A. A. Schoenherr, editors. 2007a. Terrestrial vegetation of California, third edition. University of California Press, Berkeley.
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- Holland, V. L., and D. J. Keil. 1995. California vegetation. Kendall/Hunt Publishing Company, Dubuque, IA. 516 pp.
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- Shiflet, T. N., editor. 1994. Rangeland cover types of the United States. Society for Range Management. Denver, CO. 152 pp.
- Stout, D., J. Buck-Diaz, S. Taylor, and J. M. Evens. 2013. Vegetation mapping and accuracy assessment report for Carrizo Plain National Monument. California Native Plant Society, Vegetation Program, Sacramento, CA. 71 pp.

2. Shrub & Herb Vegetation

2.B.1.Na. Californian Scrub & Grassland

M045. Californian Annual & Perennial Grassland

2. Shrub & Herb Vegetation

2.B.1.Na. Californian Scrub & Grassland

G766. Californian Annual Grassland & Forb Meadow

Type Concept Sentence: This group of annual grasslands and annual forb-dominated meadows ranges from the coast to the lower foothills of the Sierra Nevada in California and is composed of native annual species *Amsinckia menziesii*, *Eschscholzia* spp., *Gayophytum diffusum*, *Lotus unifoliolatus*, *Plagiobothrys nothofulvus*, *Trifolium variegatum*, and *Vulpia microstachys*.

OVERVIEW

*Hierarchy Level: Group

*Placement in Hierarchy: 2.B.1.Na.3. Californian Annual & Perennial Grassland (M045)

Elcode: G766

*Scientific Name: Californian Annual Grassland & Forb Meadow Group

*Common (Translated Scientific) Name: Californian Annual Grassland & Forb Meadow Group

***Colloquial Name:** Californian Annual Grassland & Forb Meadow

***Type Concept:** This group encompasses annual grasslands and annual forb-dominated meadows of California, ranging from the coast to the lower foothills of the Sierra Nevada. This includes the native annual species *Amsinckia menziesii*, *Eschscholzia* spp., *Gayophytum diffusum*, *Lotus unifoliolatus* (= *Lotus purshianus*), *Plagiobothrys nothofulvus*, *Trifolium variegatum*, and *Vulpia microstachys*. Most occurrences have significant non-native species presence.

***Diagnostic Characteristics:** Dominance or at least >25% relative cover of native annual grass and annual forb species.

***Classification Comments:** This is a relictual group, with occurrences far and few between, and therefore difficult to study.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|-------------------------------|------|
| | | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Annual herbaceous cover <1 m in height.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Stands have a wide variation in the amount of native dominance both spatially and temporally from year to year as seed banks respond to rainfall events significant enough to trigger germination. Annuals that may be dominant include *Amsinckia menziesii*, *Amsinckia tessellata*, *Cistanthe umbellata*, *Eschscholzia* spp., *Eschscholzia californica* (not an annual but iconic and conspicuous), *Gayophytum diffusum*, *Lasthenia californica*, *Lotus unifoliolatus* (= *Lotus purshianus*), *Plagiobothrys nothofulvus*, *Plantago erecta*, *Trifolium variegatum*, and *Vulpia microstachys*.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:

ENVIRONMENT

Environmental Description: These annual grasslands and meadows occur on upland slopes, broad valleys, and ocean bluffs, from sea level to over 1200 m elevation. They may occupy dry, raised portions of meadow systems, forest edges, and pockets of sandy loams within montane meadow habitats. Slopes occur at all aspects. Soils are generally fine-textured from loam to clay soils, especially those of volcanic and serpentine parent materials. Most occurrences are upslope; however, some stands occur in more mesic settings, such as seasonally to intermittently flooded alluvial flats and stream terraces, or at the edges of vernal pools, in swales, seeps, and moist grassy flats.

DISTRIBUTION

***Geographic Range:** This group is found throughout California below 1200 m elevation.

Nations: US

States/Provinces: CA, NV

USFS Ecoregions (2007) [optional]:

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A4240 | <i>Eschscholzia californica</i> - <i>Lupinus nanus</i> Dry Meadow Alliance |
| A4171 | <i>Hemizonia fasciculata</i> Meadow Alliance |
| A4182 | <i>Amsinckia menziesii</i> - <i>Amsinckia tessellata</i> - <i>Phacelia</i> spp. Meadow Alliance |
| A4153 | <i>Lasthenia californica</i> - <i>Plantago erecta</i> - <i>Vulpia microstachys</i> Meadow Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---|--------------------|-----------|
| < | <i>Amsinckia (menziesii, tessellata)</i> (Fiddleneck fields) Alliance | Sawyer et al. 2009 | 42.110.00 |
| < | <i>Ambrosia psilostachya</i> (Western ragweed meadows) Provisional Alliance | Sawyer et al. 2009 | 33.065.00 |
| < | <i>Melica torreyana</i> (Torrey's melic grass patches) Provisional Alliance | Sawyer et al. 2009 | 41.275.00 |
| < | <i>Plagiobothrys nothofulvus</i> (Popcorn flower fields) Alliance | Sawyer et al. 2009 | 43.300.00 |
| < | <i>Lotus purshianus</i> (Spanish clover fields) Provisional Alliance | Sawyer et al. 2009 | 52.230.00 |
| < | <i>Eschscholzia (californica)</i> (California poppy fields) Alliance | Sawyer et al. 2009 | 43.200.00 |
| < | <i>Artemisia dracuncululus</i> (Wild tarragon patches) Alliance | Sawyer et al. 2009 | 35.160.00 |

AUTHORSHIP***Primary Concept Source [if applicable]:** M.G. Barbour, T. Keeler-Wolf, and A.A. Schoenherr (2007a)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** G. Kittel**Acknowledgments [optional]:**

Version Date: 10 Nov 2015

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2. Shrub & Herb Vegetation

2.B.1.Na. Californian Scrub & Grassland

G496. Californian Perennial Grassland

Type Concept Sentence: This perennial grassland group is characterized by native, cool-season bunchgrasses, especially *Leymus condensatus*, *Melica californica*, *Nassella cernua*, *Nassella lepida*, and *Nassella pulchra* with several other grasses and native forbs. Historically, it was common among oak savanna and woodland in Mediterranean California, but is now limited to small relictual, remnant and restored stands.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.1.Na.3. Californian Annual & Perennial Grassland (M045)

Elcode: G496

***Scientific Name:** *Nassella pulchra* - *Melica californica* - *Leymus condensatus* Grassland Group

***Common (Translated Scientific) Name:** Purple Needlegrass - California Melicgrass - Giant Wildrye Grassland Group

***Colloquial Name:** Californian Perennial Grassland

***Type Concept:** This perennial grassland group is found in Mediterranean California. Characteristic plant species include a dominance by native, cool-season bunchgrasses, especially *Leymus condensatus*, *Melica torreyana*, *Nassella cernua*, *Nassella lepida*, and *Nassella pulchra*. Other grasses may include *Aristida* spp., *Bromus carinatus*, *Elymus glaucus*, *Festuca californica*, *Festuca idahoensis*, *Melica californica*, and *Poa secunda* (= *Poa scabrella*). Native forbs include species of *Achillea*, *Achyrrachaena*, *Agoseris*, *Bloomeria*, *Brodiaea*, *Castilleja*, *Chlorogalum*, *Clarkia*, *Dodecatheon*, *Lomatium*, *Lotus*, *Sanicula*, *Trifolium*, and *Triteleia*. Stands range from 10-1200 m (30-3600 feet) elevation, with cool, wet winters and hot, dry summers, receiving on average 50 cm (range 25-100 cm) of precipitation per year, mainly as winter rain. It is found with fine-textured soils, moist or even waterlogged in winter, but very dry in summer. Historically, these grasslands were common among oak savanna and woodland and probably experienced similar frequent fire regimes. Today they are limited to small relictual, remnant and restored stands. These communities are best represented on xeric to mesic ultramafic sites where alien annual grasses are less well-adapted.

***Diagnostic Characteristics:** Native perennial bunchgrasses dominate the stands, where *Nassella* spp. have >10% relative cover of the herbaceous layer and >5% relative cover in the herbaceous layer. Woody plants, if present, are <10% absolute cover.

***Classification Comments:** Native species must be the characteristic and dominant foliar cover. A general rule of thumb is native species >30-50% relative cover, for most native species representative of native grassland associations (Sawyer et al. 2009). If native species are present but the dominant cover is by introduced annuals, please see ~Californian Ruderal Grassland, Meadow & Scrub Group (G497)\$. Regardless of composition, the native bunchgrass group demands dominant cover of native species. There are many native herbaceous species that may be dominant in this group, be they graminoid bunchgrass, sod-formers, stoloniferous or annual, or annual or perennial forbs.

The idea that these native grasslands were always characterized by bunchgrasses is disputed. The following paragraph is an excerpt from the *Nassella pulchra* Series description in *A Manual of California Vegetation. Second edition* by Sawyer et al. (2009): "The long-accepted conclusion that *N. pulchra* dominated the primeval California prairies and valley grasslands (Clements 1934, Küchler 1964, Heady 1977, Holland 1986b) has been revised (Wester 1981, Brown 1982, Keeley 1990, Hamilton 1997, Holstein 2001, Stromberg 2001, Bartolome et al. 2007). Currently, ecologists think that *N. pulchra* was not the overall dominant in grasslands but rather was the most opportunistic, widespread native bunchgrass in the state (Keeler-Wolf et al. 2007). Perennial grasses likely dominated the higher precipitation portions of the state's grasslands along the coast, the windward portions of the Coast Ranges, and some portions of the Central Valley near waterways and marshlands. Annuals likely dominated drier valley grassland habitats, including large portions of the Sierra Nevada foothills, interior drier portions of the coastal ranges, and broad terraces around the Central Valley (Schiffman 2007)."

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|--|
| G497 | Californian Ruderal Grassland, Meadow & Scrub | differs in the overwhelming dominance by non-native annual species; <i>Nassella</i> spp., if present, have <10% relative cover and <5% absolute cover. |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Grasslands dominated or characterized by native Mediterranean perennial bunchgrass or sod-forming graminoids. These grasslands have a low stature and are usually less than 1 m in height, although some non-native annuals may exceed the native grasses in height. Woody plants, if present, are <10% absolute cover. Soils are fine-textured and deep.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: *Leymus condensatus*, *Melica torreyana*, *Nassella cernua*, *Nassella lepida*, or *Nassella pulchra* is dominant or characteristically present in the herbaceous layer with other perennial grasses, including *Aristida ternipes*, *Calamagrostis koelerioides*, *Elymus glaucus*, *Festuca californica*, *Hordeum brachyantherum*, *Koeleria macrantha*, *Leymus triticoides*, *Lolium perenne*, *Melica californica*, *Melica imperfecta*, , and *Poa secunda*, and with perennial forbs, such as *Calochortus* spp., *Calystegia* spp., *Sanicula* spp., and *Sisyrinchium bellum*. Common annual herbs include *Astragalus* spp., *Avena barbata*, *Avena fatua*, *Bromus hordeaceus*, *Bromus rubens*, *Clarkia* spp., *Cryptantha* spp., *Croton setigerus* (= *Eremocarpus setigerus*), *Erodium* spp., *Hirschfeldia incana*, *Holocarpha virgata*, *Lasthenia* spp., *Lepidium nitidum*, *Lupinus* spp., *Plantago* spp., and *Trifolium* spp. Emergent *Artemisia californica*, *Eriogonum fasciculatum*, *Eriogonum cinereum*, *Hazardia squarrosa*, *Malosma laurina*, *Rhus integrifolia*, *Salvia leucophylla*, and other shrubs and trees may be present at low cover. Herbs are <1 m tall, and cover is open to intermittent to continuous. Exotic and invasive species can include *Avena barbata*, *Avena fatua*, *Bromus hordeaceus*, *Bromus rubens*, *Lolium perenne*, and others.

Wet ultramafic sites may contain stands of *Leymus triticoides* or *Muhlenbergia rigens*. Other characteristic plant species include a dominance by native, cool-season bunchgrasses *Nassella cernua*, *Nassella lepida*, and *Nassella pulchra*. Associated species may include *Achillea millefolium* var. *borealis* (= *Achillea borealis*), *Aristida* spp., *Agoseris heterophylla*, *Elymus glaucus*, *Festuca californica*, *Leymus triticoides*, *Melica californica*, and *Poa secunda* (= *Poa scabrella*), and native forbs such as *Achyrachaena mollis*, *Bloomeria crocea*, *Castilleja attenuata* (= *Orthocarpus attenuatus*), *Chlorogalum pomeridianum*, *Clarkia purpurea*, *Dodecatheon jeffreyi*, and *Triteleia ixioides* (= *Brodiaea lutea*). Floristic information is summarized from the following sources: Evens and San (2004, 2006), Klein and Evens (2005), Keeler-Wolf and Evens (2006), and Sawyer et al. (2009).

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Frequently burned, fire interval historically thought to be every 1-3 years.

ENVIRONMENT

Environmental Description: These grasslands occur on valley and foothill locations on all topographic locations, on usually rolling topography. Inland soils are deep, well-drained, fine-textured, usually loams with high clay content, while soils near the coast are more shallow and rocky. Elevation ranges from sea level to 1700 m. Grasslands on serpentine-rich parent material occur on deep serpentine soils and can be very moist to dry. Environmental information is summarized from the following sources: Evens and San (2004, 2006), Klein and Evens (2005), Keeler-Wolf and Evens (2006), and Sawyer et al. (2009).

DISTRIBUTION

***Geographic Range:** This group is found in Mediterranean California from sea level to 1700 m (0-5600 feet) elevation.

Nations: MX?, US

States/Provinces: CA

USFS Ecoregions (2007) [optional]: 261B:CC, 262A:CC, M261A:CP, M261B:CC, M261C:CP, M261E:CC, M261F:C?

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A1248 | <i>Nassella lepida</i> - <i>Melica torreyana</i> Grassland Alliance |
| A1247 | <i>Nassella cernua</i> Grassland Alliance |
| A2663 | <i>Leymus condensatus</i> Coastal Grassland Alliance |
| A1289 | <i>Nassella pulchra</i> Grassland Alliance |
| A4238 | <i>Corethrogyne filaginifolia</i> - <i>Eriogonum elongatum</i> - <i>Eriogonum nudum</i> Dry Meadow Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** P. Comer and T. Keeler-Wolf, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** G. Kittel, P. Comer, T. Keeler-Wolf, M.S. Reid and K.A. Schulz

Acknowledgments [optional]:

Version Date: 10 Nov 2015

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2.B.2.Na. Western North American Grassland & Shrubland (D022)

M049. Southern Rocky Mountain Montane Shrubland

2. Shrub & Herb Vegetation

2.B.2.Na. Western North American Grassland & Shrubland

G277. Southern Rocky Mountain Gambel Oak - Mixed Montane Shrubland

Type Concept Sentence: This group occurs in the mountains, plateaus and foothills of the southern Rocky Mountains and Colorado Plateau, and is typically dominated by *Quercus gambelii* alone or codominant with *Amelanchier alnifolia*, *Amelanchier utahensis*, *Artemisia tridentata*, *Cercocarpus montanus*, *Fraxinus anomala*, *Prunus virginiana*, *Purshia stansburiana*, *Purshia tridentata*, *Robinia neomexicana*, *Symphoricarpos oreophilus*, or *Symphoricarpos rotundifolius*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.2.Na.1. Southern Rocky Mountain Montane Shrubland (M049)

Elcode: G277

***Scientific Name:** *Quercus gambelii* - *Amelanchier* spp. - *Prunus virginiana* Southern Rocky Mountain Montane Shrubland Group

***Common (Translated Scientific) Name:** Gambel Oak - Serviceberry species - Chokecherry Southern Rocky Mountain Montane Shrubland Group

***Colloquial Name:** Southern Rocky Mountain Gambel Oak - Mixed Montane Shrubland

***Type Concept:** This group occurs in the mountains, plateaus and foothills of the southern Rocky Mountains and Colorado Plateau, including the Uinta and Wasatch ranges and the Mogollon Rim. The vegetation is typically dominated by *Quercus gambelii* alone or codominant with *Amelanchier alnifolia*, *Amelanchier utahensis*, *Artemisia tridentata*, *Cercocarpus montanus*, *Fendlera rupicola*, *Fraxinus anomala*, *Holodiscus dumosus*, *Jamesia americana*, *Prunus virginiana*, *Purshia stansburiana*, *Purshia tridentata*, *Robinia neomexicana*, *Symphoricarpos oreophilus*, or *Symphoricarpos rotundifolius*. There may be inclusions of other mesic montane shrublands with *Quercus gambelii* absent or as a relatively minor component. These shrublands are most commonly found along dry foothills, lower mountain slopes, and at the edge of the western Great Plains from approximately 2000 to 2900 m in elevation, and are often situated above pinyon-juniper woodlands. Substrates are variable and include soil types ranging from calcareous, heavy, fine-grained loams to sandy loams, gravelly loams, clay loams, deep alluvial sand, or coarse gravel. This group intergrades with ~Southern Rocky Mountain Mountain-mahogany - Mixed Foothill Shrubland Group (G276)\$\$ and shares many of the same site characteristics. However, this group includes more mesic communities. Density and cover of *Quercus gambelii* and *Amelanchier* spp. often increase after fire.

***Diagnostic Characteristics:** Stands of this group are typically dominated by broad-leaved, deciduous shrubs, which are typical of the montane zones of the southern Rocky Mountains. *Quercus gambelii* is the main species in most occurrences, although some may have equal amounts of (or only) *Amelanchier alnifolia*, *Amelanchier utahensis*, *Artemisia tridentata*, *Cercocarpus montanus*, *Ceanothus fendleri*, *Fendlera rupicola*, *Fraxinus anomala*, *Holodiscus dumosus*, *Jamesia americana*, *Prunus virginiana*, *Purshia stansburiana*, *Purshia tridentata*, *Rhus trilobata*, *Robinia neomexicana*, *Symphoricarpos oreophilus*, or *Symphoricarpos rotundifolius*. The herbaceous layer is not consistent, having sparse to moderately dense cover and mostly composed of graminoids, including *Carex geyeri*, *Carex inops*, *Festuca thurberi*, *Hesperostipa comata*, *Muhlenbergia montana*, and *Poa fendleriana*.

***Classification Comments:** Disjunct *Quercus gambelii*-dominated shrublands found in the Davis Mountains and probably the Guadalupe Range in the Trans-Pecos of Texas are included in the concept of ~Eastern Madrean Chaparral Group (G280)\$\$\$. *Quercus gambelii* apparently occurs as a significant component of a shrubland of the Trans-Pecos of Texas; however, most of the other species that codominate in this group do not occur in the Trans-Pecos. This group is not currently attributed to Texas, and it seems more appropriate to modify the description of ~Eastern Madrean Chaparral Group (G280)\$\$\$ to allow for the presence of *Quercus gambelii* as a significant component of some occurrences. However, ~*Quercus gambelii* / *Symphoricarpos oreophilus* Shrubland (CEGL001117)\$\$\$ is an association found in the Trans-Pecos. Also, there is a need to clarify the concept of ~Southern Rocky Mountain Mountain-mahogany - Mixed Foothill Shrubland Group (G276)\$\$\$.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G272 | Central Rocky Mountain Montane-Foothill Deciduous Shrubland | |
| G276 | Southern Rocky Mountain Mountain-mahogany - Mixed Foothill Shrubland | |

Similar NVC Types General Comments [optional]:**VEGETATION**

Physiognomy and Structure Summary: The vegetation may occur as sparse to dense broad-leaved deciduous shrublands composed of moderate to tall shrubs, or occasionally small trees. Occurrences may be multi-layered, with some short shrubby species occurring in the understory of the dominant overstory species. They can range from dense thickets with little understory to relatively mesic mixed shrublands with a rich understory of shrubs, grasses and forbs. These shrubs often have a patchy distribution with grass growing in between. Scattered trees are occasionally present in stands.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: In many occurrences of this group, the canopy is dominated by the broad-leaved deciduous shrub *Quercus gambelii*, which occasionally reaches small tree size. It may form dense thickets with little understory or be relatively open with a rich understory of shrubs, grasses and forbs. Scattered trees are occasionally present and typically include species of *Juniperus* or *Pinus*. Characteristic shrubs that may co-occur, or be singularly dominant, include *Amelanchier alnifolia*, *Amelanchier utahensis*, *Arctostaphylos patula*, *Artemisia tridentata*, *Ceanothus fendleri*, *Cercocarpus montanus*, *Fendlera rupicola*, *Fraxinus anomala*, *Holodiscus dumosus*, *Jamesia americana*, *Ptelea trifoliata*, *Prunus virginiana*, *Purshia stansburiana*, *Robinia neomexicana*, *Rosa* spp., *Symphoricarpos oreophilus*, and *Symphoricarpos rotundifolius*. The herbaceous layer is sparse to moderately dense, ranging from 1-40% cover. Perennial graminoids are the most abundant species, particularly *Bouteloua curtipendula*, *Bouteloua eriopoda*, *Bouteloua gracilis*, *Aristida* spp., *Carex inops*, *Carex geyeri*, *Elymus arizonicus*, *Eragrostis* spp., *Festuca* spp., *Koeleria macrantha*, *Muhlenbergia* spp., and *Hesperostipa* spp. Many forb and fern species can occur, but none have much cover. Commonly present forbs include *Achillea millefolium*, *Artemisia* spp., *Geranium* spp., *Maianthemum stellatum*, *Thalictrum fendleri*, and *Vicia americana*. Ferns include species of *Cheilanthes* and *Woodsia*. Annual grasses and forbs are seasonally present, and weedy annuals are often present, at least seasonally.

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Fire typically plays an important role, causing die-back of the dominant shrub species in some areas, promoting stump sprouting of the dominant shrubs in other areas, and controlling the invasion of trees into the shrubland system. Natural fires typically result in a mosaic of dense shrub clusters and openings dominated by herbaceous species. In some instances, these associations may be seral to the adjacent *Pinus ponderosa*, *Abies concolor*, and *Pseudotsuga menziesii* woodlands and forests. Ream (1964) noted that on many sites in Utah, Gambel oak may be successional and replaced by *Acer grandidentatum*.

ENVIRONMENT

Environmental Description: This group typically occupies the lower slope positions of the foothill and lower montane zones. Stands may occur on level to steep slopes, cliffs, escarpments, rimrock slopes, rocky outcrops, and scree slopes. Climate is semi-arid and characterized by mostly hot-dry summers with mild to cold winters and annual precipitation of 25 to 70 cm. Precipitation mostly occurs as winter snows but may also consist of some late-summer rains. Soils are typically poorly developed, rocky to very rocky, and well-drained. Parent materials include alluvium, colluvium, and residuum derived from igneous, metamorphic or sedimentary rocks such as granite, gneiss, limestone, quartz, monzonite, rhyolite, sandstone, schist, and shale.

Climate: Climate is semi-arid and characterized by mostly hot-dry summers with mild to cold winters and annual precipitation of 25 to 70 cm. Precipitation mostly occurs as winter snows but may also consist of some late-summer or monsoonal rains.

Soil/substrate/hydrology: Soils are typically poorly developed, rocky to very rocky, and well-drained. Parent materials include alluvium, colluvium, and residuum derived from igneous, metamorphic or sedimentary rocks such as granite, gneiss, limestone, quartz, monzonite, rhyolite, sandstone, schist, and shale.

DISTRIBUTION

***Geographic Range:** This group occurs in the mountains, plateaus and foothills of the southern Rocky Mountains and Colorado Plateau, including the Uinta and Wasatch ranges and the Mogollon Rim.

Nations: US

States/Provinces: AZ, CO, NM, NV?, UT, WY

USFS Ecoregions (2007) [optional]: 313A:CC, 313B:CC, 313C:C?, 313D:CC, 315A:CC, 315B:CC, 315H:CC, 321A:CC, 322A:CC, 331B:CC, 331F:CC, 331G:CC, 331I:CC, 331J:CC, 331M:CC, 341A:CC, 341B:CC, 341C:CC, 341F:CC, 342A:CC, 342E:CC, 342G:CC, 342J:CC, M313A:CC, M313B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M334A:??, M341A:CC, M341B:CC, M341C:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3737 | <i>Ceanothus fendleri</i> Shrubland & Shrub-Steppe Alliance |
| A3735 | <i>Quercus gambelii</i> - <i>Symphoricarpos oreophilus</i> Shrubland Alliance |
| A3738 | <i>Quercus gambelii</i> - <i>Robinia neomexicana</i> Shrubland Alliance |
| A3736 | <i>Fraxinus anomala</i> - <i>Rhus trilobata</i> - <i>Fendlera rupicola</i> Talus & Rock Outcrop Shrubland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| = | Gambel Oak (413) | Shiflet 1994 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** R.D. Ream (1960)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** M.E. Hall

Acknowledgments [optional]:

Version Date: 09 Nov 2015

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2. Shrub & Herb Vegetation

2.B.2.Na. Western North American Grassland & Shrubland

G276. Southern Rocky Mountain Mountain-mahogany - Mixed Foothill Shrubland

Type Concept Sentence: This foothills shrubland group occurs in the Rocky Mountains and Colorado Plateau from lower montane zone to canyons and breaks in the western Great Plains and is characterized by an open to closed shrub layer of nearly pure *Cercocarpus montanus* or a mixed shrub layer with *Amelanchier utahensis*, *Quercus x pauciloba*, *Purshia tridentata*, *Rhus trilobata*, *Ribes cereum*, or *Symphoricarpos oreophilus*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.2.Na.1. Southern Rocky Mountain Montane Shrubland (M049)

Elcode: G276

***Scientific Name:** *Cercocarpus montanus* - *Quercus x pauciloba* - *Rhus trilobata* Foothill Shrubland Group

***Common (Translated Scientific) Name:** Alderleaf Mountain-mahogany - Wavyleaf Oak - Skunkbush Sumac Foothill Shrubland Group

***Colloquial Name:** Southern Rocky Mountain Mountain-mahogany - Mixed Foothill Shrubland

***Type Concept:** This Rocky Mountain foothill shrubland group ranges from southern New Mexico north into Wyoming, and west into the Intermountain West region. *Cercocarpus montanus* dominates pure stands in parts of Wyoming and Colorado. The vegetation is typically dominated by a variety of shrubs, including *Amelanchier utahensis*, *Cercocarpus montanus*, *Quercus x pauciloba*, *Purshia tridentata*, *Rhus trilobata*, *Ribes cereum*, *Symphoricarpos oreophilus*, or *Yucca glauca*. Grasses and sedges are dominant in the understory and may include *Achnatherum scribneri*, *Bouteloua curtipendula*, *Carex geyeri*, *Elymus lanceolatus*, *Hesperostipa comata*, *Hesperostipa neomexicana*, *Leymus ambiguus*, *Muhlenbergia montana*, and *Pseudoroegneria spicata*. Scattered trees or inclusions of grassland patches or steppe may be present. Stands are found in the foothills, canyon slopes and lower mountains of the Rocky Mountains and on outcrops and canyon slopes in the western Great Plains. These shrublands occur between 1500 and 2900 m elevation and are usually associated with exposed sites, rocky substrates, and dry conditions, which limit tree growth. It is common where *Quercus gambelii* is absent, such as the northern Colorado Front Range and in drier foothills and prairie hills. This group is generally drier than ~Southern Rocky Mountain Gambel Oak - Mixed Montane Shrubland Group (G277)\$\$, but may include mesic montane shrublands where *Quercus gambelii* does not occur. Fires play an important role in this group as the dominant shrubs usually have a severe die-back, although some plants will stump sprout. *Cercocarpus montanus* requires a disturbance such as fire to reproduce, either by seed sprout or root-crown sprouting. Fire suppression may have allowed an invasion of trees into some of these shrublands, but in many cases, sites are too xeric for tree growth.

***Diagnostic Characteristics:** Open to dense broadleaf shrublands or shrub-grasslands where *Cercocarpus montanus* occurs as the most often dominant shrub, but may be a codominant or be absent in some stands. Other characteristic shrubs include *Amelanchier utahensis*, *Artemisia tridentata*, *Cercocarpus intricatus*, *Fallugia paradoxa*, *Fendlera rupicola*, *Glossopetalon spinescens*, *Purshia tridentata*, *Quercus x pauciloba*, *Ribes cereum*, and *Rhus trilobata*. The herbaceous layer is characterized by an open to dense layer of grasses and sedges. Typical species include *Achnatherum scribneri*, *Bouteloua curtipendula*, *Carex geyeri*, *Elymus lanceolatus*, *Hesperostipa comata*, *Hesperostipa neomexicana*, *Leymus ambiguus*, *Muhlenbergia montana*, and *Pseudoroegneria spicata*.

***Classification Comments:** While *Cercocarpus montanus* is the common dominant shrub in this group, it is not the only dominant, and in many occurrences is not found at all. In addition, in some occurrences, shrub cover is low, which allows for some stands to be graminoid-dominated. In Wyoming, stands where *Cercocarpus montanus* is a component of mixed shrublands are placed in ~Central Rocky Mountain Montane-Foothill Deciduous Shrubland Group (G272)\$\$.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G277 | Southern Rocky Mountain Gambel Oak - Mixed Montane Shrubland | |

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G272 | Central Rocky Mountain Montane-Foothill Deciduous Shrubland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Open to dense, broadleaf deciduous shrublands or shrub-grasslands with canopies 1-2 m tall. Occurrences are typically multi-layered shrub-dominated stands where grasses occur in canopy openings. In occurrences where shrub cover is open, grasses may attain higher cover than overstory shrubs.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This group consists of two major cover types: those most commonly dominated by *Cercocarpus montanus* or by *Purshia tridentata*. Within these communities, either nominal may be dominant, codominant or absent. Other shrubs include *Amelanchier utahensis*, *Artemisia tridentata*, *Cercocarpus intricatus*, *Fallugia paradoxa*, *Fendlera rupicola*, *Glossopetalon spinescens*, *Quercus x pauciloba*, *Rhus trilobata*, *Ribes cereum*, *Symphoricarpos oreophilus*, or *Yucca glauca*. Grasses are prominent and include *Andropogon gerardii*, *Achnatherum scribneri*, *Bouteloua curtipendula*, *Elymus lanceolatus ssp. lanceolatus*, *Hesperostipa comata*, *Hesperostipa neomexicana*, *Muhlenbergia montana*, and *Pseudoroegneria spicata*.

*Floristics Table [Med - High Confidence]:

*Number of Plots:

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:

ENVIRONMENT

Environmental Description: This group is found on gentle to extremely steep slopes (5-60%) on slopes, ridges, canyons, mesas, and less often sand dunes. Sites are often subject to drought stress. Elevations range from 1500 to 2700 m. Geologic substrates can include sandstone, shale, basalt, and limestone. Soils are generally poorly developed, rapidly drained and include sand, sandy loam, coarse gravels, loams, and clay loams.

DISTRIBUTION

***Geographic Range:** This group is found in the foothills, canyon slopes and lower mountains of the southern Rocky Mountains and on outcrops and canyon slopes in the western and southern Great Plains. It ranges from southern New Mexico, extending north into Wyoming, and west into the Intermountain West region.

Nations: US

States/Provinces: CO, MT, NE?, NM, NV?, SD, TX, UT, WY

USFS Ecoregions (2007) [optional]: 313A:CC, 313B:CC, 315A:CC, 315B:CC, 315H:CP, 321A:CC, 331B:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 331J:CC, 341B:CC, 341C:CC, 342E:CC, 342F:CC, 342G:CC, M313B:CC, M331A:CP, M331B:CP, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332G:??, M334A:??, M341B:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

*Lower Level NVC Types:

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3733 | <i>Cercocarpus montanus</i> - <i>Quercus x pauciloba</i> Shrubland Alliance |
| A3731 | <i>Purshia tridentata</i> - <i>Ribes cereum</i> Shrubland Alliance |

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3730 | <i>Fallugia paradoxa</i> - <i>Rhus trilobata</i> Shrubland Alliance |
| A3732 | <i>Amelanchier utahensis</i> - <i>Cercocarpus montanus</i> - <i>Cercocarpus intricatus</i> Shrubland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--|------------------|------|
| = | Mountain Mahogany - Mixed Shrub Series | Dick-Peddie 1993 | |

AUTHORSHIP***Primary Concept Source [if applicable]:** K. Hess and C.H. Wasser (1982)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** M.E. Hall and K.A. Schulz

Acknowledgments [optional]:

Version Date: 09 Nov 2015

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M048. Central Rocky Mountain Montane-Foothill Grassland & Shrubland

2. Shrub & Herb Vegetation

2.B.2.Na. Western North American Grassland & Shrubland

G273. Central Rocky Mountain Lower Montane, Foothill & Valley Grassland

Type Concept Sentence: This wide-ranging lower montane, foothill and valley grassland group is found in the central Rocky Mountains and extends north onto the Okanagan and Fraser plateaus, the valleys around the Fraser, Nicola, and Similkameen rivers in British Columbia, and foothills in Alberta and is dominated by cool-season perennial bunchgrasses, such as *Festuca campestris*, *Festuca idahoensis*, and *Pseudoroegneria spicata* with diverse forbs (>25% cover) and sometimes a sparse (<10% cover) shrub layer.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.2.Na.2. Central Rocky Mountain Montane-Foothill Grassland & Shrubland (M048)

Elcode: G273

***Scientific Name:** *Festuca campestris* - *Festuca idahoensis* - *Pseudoroegneria spicata* Central Rocky Mountain Foothill Grassland Group

***Common (Translated Scientific) Name:** Rough Fescue - Idaho Fescue - Bluebunch Wheatgrass Central Rocky Mountain Foothill Grassland Group

***Colloquial Name:** Central Rocky Mountain Lower Montane, Foothill & Valley Grassland

***Type Concept:** These grasslands of the northern Rocky Mountains are found at lower montane to foothill elevations in the mountains and large valleys of northwestern Wyoming and western Montana, west through Idaho into the Blue Mountains of Oregon, and north into the Okanagan and Fraser plateaus of British Columbia and the Canadian Rockies. They also occur to the east in the central Montana mountain "islands" foothills, as well as the Rocky Mountain Front and Big and Little Belt ranges. They also extend along the eastern slopes of the Alberta Rockies. The most important species are cool-season perennial bunchgrasses and forbs (>25% cover), sometimes with a sparse (<10% cover) shrub layer. *Festuca campestris* and *Festuca idahoensis* are dominants, and *Pseudoroegneria spicata* occurs as a codominant, as well as a diversity of other native grasses. To the north, *Danthonia parryi* becomes codominant. Forb diversity is typically high in both mesic and dry aspects of this group. A soil crust of lichen covers almost all open soil between clumps of grasses; *Cladonia* and *Peltigera* species are the most common lichens. Unvegetated mineral soil is commonly found between clumps of grass and the lichen cover. *Festuca campestris* is easily eliminated by grazing and does not occur in all areas of this group.

This group also includes grasslands commonly known as "Palouse Prairie." These northern lower montane and valley grasslands represent a shift in the precipitation regime from summer monsoons and cold snowy winters found in the Southern Rockies to predominantly dry summers and winter precipitation. The Palouse region is characterized by rolling topography composed of loess hills and plains over basalt plains. The climate of this region has warm-hot, dry summers and cool, wet winters. Annual precipitation is high, 38-76 cm (15-30 inches). The soils are typically deep, well-developed, and old.

Outside of the Palouse Prairie region, these grasslands are influenced by shorter summers, colder winters, and young soils derived from recent glacial and alluvial material. In the eastern portion of its range in Montana, winter precipitation is replaced by a huge spring peak in precipitation. Elevations range from 300 to 1650 m, ranging from small meadows to large open parks surrounded by conifers in the lower montane, to extensive foothill and valley grasslands below the lower treeline. Many of these valleys may have been primarily sage-steppe with patches of grassland in the past, but because of land-use history post-settlement (herbicide, grazing, fire suppression, pasturing, etc.), they have been converted to grassland-dominated areas. Soils are relatively deep, fine-textured, often with coarse fragments, and non-saline, often with a microphytic crust.

In Alberta, this group occurs along the lower and eastern flanks of the Foothills Geologic Belt, primarily in the Foothills Fescue Grassland and Foothills Parkland Natural subregions. Glaciation and bedrock topography in combination result in a complex physiography from sloping lower foothills to hummocky to rolling uplands, mainly on glacial till, with significant lacustrine materials in valleys. Elevation ranges from 500 to 1525 m. At upper elevations, stands may be small-patch grasslands on southern slopes between *Populus tremuloides* woodlands or *Salix bebbiana* shrublands becoming quite extensive on moister sites at lower elevation. Soils are deep, usually Black Chernozems.

***Diagnostic Characteristics:** Herbaceous communities dominated by cool-season bunchgrasses, found in the lower montane and foothill zones of the northern Rocky Mountains and in the inter-montane valleys. These are typically extensive grasslands, not grass-dominated patches within the sagebrush shrub-steppe group. *Festuca campestris*, *Pseudoroegneria spicata*, and *Festuca idahoensis* are the major grasses, although a number of other species occur, including *Hesperostipa comata*, *Achnatherum hymenoides*,

Achnatherum occidentale, *Achnatherum richardsonii*, *Achnatherum scribneri*, *Danthonia* species, *Elymus lanceolatus*, *Leymus condensatus*, *Leymus cinereus*, *Koeleria macrantha*, *Pascopyrum smithii*, or *Poa secunda*.

***Classification Comments:** This is the same as the Interior Plateau Grassland also called "Northern Plateau Grassland" of the Okanagan Ecoregional Plan. In Wyoming, this is distinguished from northwestern Great Plains mixedgrass prairies by the presence of *Festuca idahoensis* or *Carex rossii*, the lack of *Bouteloua gracilis* (which is common in mixedgrass prairie), or the presence of *Artemisia nova* or *Artemisia tripartita ssp. rupicola*, neither of which occur in mixedgrass prairie. This group is also similar to ~Central Rocky Mountain Montane Grassland Group (G267) in that some of the dominant grasses are shared between the lower and higher elevation grasslands, but the associated forbs shift, as do some of the other graminoid taxa.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G267 | Central Rocky Mountain Montane Grassland | |
| G271 | Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow | |
| G331 | Northern Great Plains Dry Mixedgrass Prairie | |
| G332 | Northern Great Plains Rough Fescue Prairie | |
| G141 | Northern Great Plains Mesic Mixedgrass Prairie | |
| G311 | Intermountain Semi-Desert Grassland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Herbaceous communities dominated by cool-season bunchgrasses, generally less than 1 m in height, and often dense in cover. Forb diversity is typically high in both mesic and dry aspects of this group. On slightly more mesic or protected sites (north slopes, toeslopes, swales), scattered or even dense patches of deciduous, broadleaf shrubs can occur (when the patches are large enough they can form associations that are included in one of the shrubland groups). A soil crust of lichen covers almost all open soil between clumps of grasses; *Cladonia* and *Peltigera* species are the most common lichens. Unvegetated mineral soil is commonly found between clumps of grass and the lichen cover.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: On pristine moist sites, *Festuca campestris* can form a nearly continuous cover and is interspersed with *Festuca idahoensis* and the rhizomatous ecotype of *Pseudoroegneria spicata*. *Danthonia parryi* becomes codominant moving north into the Alberta foothills. Other graminoids include *Achnatherum occidentale*, *Achnatherum richardsonii*, *Danthonia* spp., *Koeleria macrantha*, *Poa secunda*, *Pascopyrum smithii*, *Elymus lanceolatus*, and *Leymus cinereus*. These moister sites support a forb-rich community that includes species such as *Balsamorhiza sagittata*, *Achillea millefolium*, *Lupinus sericeus*, *Geranium viscosissimum*, *Lomatium triternatum*, *Potentilla glandulosa*, *Potentilla gracilis*, *Penstemon confertus*, *Delphinium bicolor*, *Oxytropis* spp., *Gentiana affinis*, *Fragaria virginiana*, and *Castilleja* spp. Endemic rare species such as *Silene spaldingii* inhabit the moister aspects of this group.

On drier sites dominated by *Festuca idahoensis* and the bunchgrass ecotype of *Pseudoroegneria spicata*, common forbs include *Achillea millefolium*, *Gaillardia aristata*, *Galium boreale*, *Geum triflorum*, *Arnica sororia*, *Antennaria microphylla*, *Potentilla gracilis*, *Lupinus argenteus*, *Lupinus sericeus*, *Lomatium macrocarpum*, *Phlox alyssifolia*, *Phlox hoodii*, *Liatris punctata*, *Lithospermum ruderales*, *Eriogonum* spp., *Penstemon eriantherus*, *Solidago missouriensis*, *Oxytropis* spp., *Heuchera* spp., *Pulsatilla patens*, *Opuntia fragilis*, *Artemisia ludoviciana*, *Artemisia frigida*, and *Erigeron* spp. Endemic species in the northwestern Great Plains, such as *Douglasia montana*, *Penstemon nitidus*, and *Penstemon albertinus*, are common in the drier, rocky sites of this group. Other graminoids present within this drier community include *Achnatherum scribneri*, *Achnatherum hymenoides*, *Danthonia intermedia*, *Koeleria macrantha*, *Poa secunda*, *Carex geyeri*, *Carex filifolia*, and *Carex petasata*. On pristine sites, *Selaginella densa* and a soil crust of lichen covers almost all open soil between clumps of grasses. *Cladonia* and *Peltigera* spp. are the most common lichens present. Important exotic grasses include *Phleum pratense*, *Bromus inermis*, and *Poa pratensis*.

Shrub species may be scattered or patchy, including *Dasiphora fruticosa ssp. floribunda*, *Rosa nutkana*, *Rosa woodsii*, *Rosa arkansana*, *Arctostaphylos uva-ursi*, *Symphoricarpos* spp., *Artemisia tridentata*, *Juniperus communis*, and in Wyoming *Artemisia tripartita ssp. rupicola*. Several species of *Eriogonum* are also common. *Amelanchier alnifolia*, *Crataegus douglasii*, and *Prunus virginiana* often occur as patches on north-facing slopes of foothills where snow persists longer into the growing season. *Salix bebbiana* copses form a unique groveland area in Alberta.

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: The natural fire regime of this group likely maintains patchy distribution of shrubs, so the general aspect of the vegetation is a grassland. The fire regime of this group maintains a grassland due to rapid fire return that retards shrub invasion or landscape isolation and fragmentation that limits seed dispersal of native shrub species. Fire frequency is presumed to be less than 20 years. These are extensive grasslands, not grass-dominated patches within the sagebrush shrub steppe group. Shrubs may increase following heavy grazing and/or with fire suppression. Microphytic crust is very important in this group. Summer overgrazing for 2 to 3 years can result in the loss of *Festuca campestris*, which is very grazing sensitive. Long-term heavy grazing on moister sites can result in a shift to a *Poa pratensis* - *Phleum pratense* type. *Pseudoroegneria spicata* shows an inconsistent reaction to grazing, increasing on some grazed sites while decreasing on others. It seems to recover more quickly from overgrazing than *Festuca campestris*, tolerates dormant-period grazing well but is sensitive to defoliation during the growing season. Light spring use or fall grazing can help retain plant vigor. Exotic species threatening this group through invasion and potential complete replacement of native species include *Bromus arvensis*, *Potentilla recta*, *Euphorbia esula*, and all manner of knapweed, especially *Centaurea stoebe* ssp. *micranthos*. In the Palouse Prairie, excessive grazing, past land use and invasion by introduced annual species have resulted in a massive conversion to agriculture or shrub-steppe and annual grasslands dominated by *Artemisia* spp. and *Bromus tectorum* or *Poa pratensis*. Remnant grasslands are now typically associated with steep and rocky sites or small and isolated sites within an agricultural landscape.

ENVIRONMENT

Environmental Description: These grasslands of the northern Rocky Mountains are found at lower montane to foothill elevations along the mountain flanks, in the mountains and in large intermountain valleys. This group also includes grasslands commonly known as Palouse Prairie. These northern lower montane and valley grasslands reflect a shift in the precipitation regime from summer monsoons and cold snowy winters found in the Southern Rockies to predominantly dry, cool summers and winter precipitation. The Palouse region is characterized by rolling topography composed of loess hills and plains over basalt plains. The climate of this region has warm-hot, dry summers and cool, wet winters. Annual precipitation is high, 38-76 cm (15-30 inches). The soils are typically deep, well-developed, and old. Outside of the Palouse Prairie region, these grasslands are influenced by shorter cooler summers, colder winters, and young soils derived from recent glacial and alluvial material. In the eastern portion of its range in Montana, winter precipitation is replaced by a huge spring peak in precipitation. Elevations range from 300 to 1650 m, ranging from small meadows to large open parks surrounded by conifers in the lower montane, to extensive foothill and valley grasslands below the lower treeline.

Climate: These northern lower montane and valley grasslands reflect a shift in the precipitation regime from summer monsoons and cold snowy winters found in the southern Rockies to predominantly dry summers and winter precipitation. In the Palouse region the climate has warm-hot, dry summers and cool, wet winters. Annual precipitation is high, 38-76 cm (15-30 inches). Outside of the Palouse Prairie region, these grasslands are influenced by shorter summers and colder winters. In the eastern portion of its range in Montana, winter precipitation is replaced by a huge spring peak in precipitation. *Soil/substrate/hydrology:* The Palouse region is characterized by rolling topography composed of loess hills and plains over basalt plains. The soils are typically deep, well-developed, and old. Outside of the Palouse Prairie region, these grasslands occur on young soils derived from recent glacial and alluvial material. Soils are relatively deep, fine-textured, often with coarse fragments, and non-saline, often with a microphytic crust.

DISTRIBUTION

***Geographic Range:** This lower montane, foothill and valley grassland group occurs throughout the southern interior and southern portion of the Fraser Plateau, as well as the valleys around the Fraser River in the Pavilion Ranges, the Nicola River and the Similkameen River in British Columbia. It includes high-elevation grasslands along the eastern mountain slopes down to rolling valleys in Alberta. It also occurs in the mountains and large valleys of northwestern Wyoming and western Montana, east to the central Montana Rocky Mountain Front and mountain "island" ranges, west through Idaho into the Blue Mountains of Oregon, mountains in northeastern California, and central Washington.

Nations: CA, US

States/Provinces: AB, BC, CA, ID, MT, NV?, OR, UT?, WA, WY

USFS Ecoregions (2007) [optional]: 331A:CC, 331D:CC, 331N:CC, 341G:CC, 342A:CC, 342B:CC, 342C:CC, 342D:CP, 342F:CP, 342H:CC, 342I:CC, 342J:CC, M242C:CC, M242D:CC, M331A:CP, M331B:CC, M331D:CP, M331J:CP, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CP, M333C:CC, M333D:CP, M341A:C?

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS***Plot Analysis Summary [Med - High Confidence]:*****Plots Used to Define the Type [Med - High Confidence]:****CONFIDENCE LEVEL****USNVC Confidence Level:** High**USNVC Confidence Comments [optional]:****HIERARCHY*****Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3985 | <i>Elymus lanceolatus</i> - <i>Hesperostipa comata</i> - <i>Phacelia hastata</i> Central Rocky Mountain Sand Deposit Grassland Alliance |
| A3987 | <i>Festuca idahoensis</i> - <i>Pseudoroegneria spicata</i> - <i>Poa secunda</i> Dry Grassland Alliance |
| A3989 | <i>Festuca idahoensis</i> - <i>Pseudoroegneria spicata</i> Palouse Grassland Alliance |
| A3988 | <i>Festuca idahoensis</i> - <i>Pseudoroegneria spicata</i> - <i>Pascopyrum smithii</i> Mesic Grassland Alliance |
| A4095 | <i>Arctostaphylos uva-ursi</i> / <i>Festuca</i> spp. - <i>Pseudoroegneria spicata</i> Steppe Alliance |
| A3986 | <i>Festuca campestris</i> - <i>Festuca idahoensis</i> Mesic Grassland Alliance |
| A4096 | <i>Dasiphora fruticosa</i> ssp. <i>floribunda</i> / <i>Festuca campestris</i> - <i>Festuca idahoensis</i> Shrub-steppe Alliance |

DISCUSSION**Discussion [optional]:****CONCEPT HISTORY*****Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---|----------------|------|
| < | Idaho Fescue - Western Wheatgrass (309) | Shiflet 1994 | |
| < | Rough Fescue - Bluebunch Wheatgrass (311) | Shiflet 1994 | |

AUTHORSHIP***Primary Concept Source [if applicable]:** E.W. Tisdale (1982)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** M.S. Reid, L. Allen and K.A. Schulz**Acknowledgments [optional]:**

Version Date: 09 Nov 2015

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2. Shrub & Herb Vegetation

2.B.2.Na. Western North American Grassland & Shrubland

G267. Central Rocky Mountain Montane Grassland

Type Concept Sentence: This central Rocky Mountains grassland group occurs in an upper montane to subalpine zone and is dominated by perennial grasses, particularly *Achnatherum nelsonii*, *Festuca idahoensis*, and *Leucopoa kingii*, with many other graminoid and forb species present to codominant.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.2.Na.2. Central Rocky Mountain Montane-Foothill Grassland & Shrubland (M048)

Elcode: G267

***Scientific Name:** *Leymus innovatus* - *Festuca idahoensis* - *Leucopoa kingii* Grassland Group

***Common (Translated Scientific) Name:** Downy Ryegrass - Idaho Fescue - Spike Fescue Grassland Group

***Colloquial Name:** Central Rocky Mountain Montane Grassland

***Type Concept:** This is an upper montane to subalpine grassland group is dominated by perennial grasses and forbs on relatively dry sites in the northern Rocky Mountains and Cascades, but is more extensive in the Rocky Mountains cordillera, from the Canadian Rockies south into western Montana, northern Wyoming, eastern Oregon, eastern Washington, and Idaho. The herbaceous layer is frequently composed of *Achnatherum nelsonii*, *Calamagrostis rubescens*, *Festuca idahoensis*, and *Leucopoa kingii* with many other perennial graminoid species present to codominant, such as *Achnatherum occidentale* (= *Stipa occidentalis*), *Achnatherum richardsonii* (= *Stipa richardsonii*), *Danthonia intermedia*, *Deschampsia cespitosa*, *Elymus trachycaulus*, *Koeleria macrantha*, *Leymus innovatus* (= *Elymus innovatus*), *Phleum alpinum*, *Poa fendleriana*, *Trisetum spicatum*, and a variety of Carices, such as *Carex filifolia*, *Carex hoodii*, *Carex elynoides*, *Carex obtusata*, and *Carex scirpoidea*. Important forbs include *Chamerion angustifolium* (= *Epilobium angustifolium*), *Eriogonum caespitosum*, *Fragaria virginiana*, *Lupinus argenteus* var. *laxiflorus*, *Lupinus sericeus*, *Oxytropis campestris*, *Phlox pulvinata*, *Potentilla diversifolia*, and *Potentilla flabellifolia*. The upper montane to subalpine dry grassland stands range from small meadows to large open parks surrounded by conifer trees but lack tree cover within them. In relatively mesic areas such as the northern Rocky Mountains and Cascades, it is found on drier sites, particularly south-facing slopes or ridgetops. In general, soil textures are much finer, and soils are often deeper under grasslands than in the neighboring forests. Although these grasslands are composed primarily of tussock-forming species, they do exhibit a dense sod that makes root penetration difficult for tree species. Disturbance such as fire also plays a role in maintaining these open grassy areas. This group is similar to ~Central Rocky Mountain Lower Montane, Foothill & Valley Grassland Group (G273)\$\$ but is found at higher elevations and is more often composed of species of *Festuca*, *Achnatherum*, and/or *Hesperostipa* with additional floristic components of more subalpine taxa. It is also similar to ~Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow Group (G271)\$\$, differing by occurring in drier settings and being predominantly grasslands rather than forby and grassy mesic meadows. Occurrences of this group are often more forb-rich than ~Southern Rocky Mountain Montane-Subalpine Grassland Group (G268)\$\$, which tends to be drier.

***Diagnostic Characteristics:** This meadow group is dominated by graminoids, typically forming 70 to 80% cover. Bunchgrasses are the major lifeform, and the important taxa include *Leymus innovatus*, *Koeleria macrantha*, *Festuca idahoensis*, *Achnatherum occidentale*, *Achnatherum richardsonii*, *Elymus trachycaulus*, and a variety of sedges such as *Carex hoodii*, *Carex obtusata*, and *Carex scirpoidea*.

***Classification Comments:** For now, this group is kept as a separate unit, but it is possible it should be merged with ~Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow Group (G271)\$\$\$. Another possibility is to consider this "grassland" group to contain what people refer to as "mesic grassy meadows," and the mesic herbaceous meadow group to contain predominantly forb meadows and tall forblands which in many cases are more seasonally wet than mesic. In addition, the Rockies

and Cascades support a number of forb types found on talus and rocky scree slopes, which are not sparsely vegetated, and which often have little to no grass component, though Carices may be abundant. These types often have heavy snow loading in winter, or are adjacent to snow fields, and sub-surface moisture below the rocks/scree is significant throughout the growing season. These forb types are poorly documented, and their group placement presently is in ~Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow Group (G271)\$\$.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G273 | Central Rocky Mountain Lower Montane, Foothill & Valley Grassland | |
| G271 | Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow | |
| G268 | Southern Rocky Mountain Montane-Subalpine Grassland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Structurally simple grasslands dominated by perennial bunch grasses and forbs on relatively dry sites.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Typical dominant species are *Achnatherum nelsonii*, *Festuca idahoensis*, and *Leucopoa kingii* with many other perennial graminoid species present to codominant such as *Achnatherum occidentale* (= *Stipa occidentalis*), *Achnatherum richardsonii* (= *Stipa richardsonii*), *Danthonia intermedia*, *Deschampsia cespitosa*, *Elymus trachycaulus*, *Koeleria macrantha*, *Leymus innovatus* (= *Elymus innovatus*), *Phleum alpinum*, *Poa fendleriana*, *Trisetum spicatum*, and a variety of Carices, such as *Carex filifolia*, *Carex hoodii*, *Carex elynoides*, *Carex obtusata*, and *Carex scirpoidea*. Important forbs include *Chamerion angustifolium* (= *Epilobium angustifolium*), *Eriogonum caespitosum*, *Fragaria virginiana*, *Lupinus argenteus* var. *laxiflorus*, *Lupinus sericeus*, *Oxytropis campestris*, *Phlox pulvinata*, *Potentilla diversifolia*, and *Potentilla flabellifolia*. Grasslands dominated by *Calamagrostis rubescens* are also in this group.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Disturbance such as fire plays a role in maintaining these open grassy areas in predominantly forested landscapes.

ENVIRONMENT

Environmental Description: This is an upper montane to subalpine grassland group dominated by perennial grasses and forbs on dry sites (in the context of the northern Rocky Mountains and Cascades), particularly south-facing slopes or ridgetops. Many occurrences are small patch in spatial character, and are often found in mosaics with woodlands, more dense shrublands, or just below alpine communities. Elevations range from 600 to 2011 m (2000-7500 feet) in the northern Rocky Mountains and up to 2286 to 2682 m (7500-8800 feet) in the mountains of southwestern Montana and Wyoming. These communities occur on gentle to moderate-gradient slopes, although occasionally on steep slopes. Soils are typically seasonally moist in the spring, but dry out later in the growing season. In general, soil textures are much finer, and soils are often deeper under grasslands than in the neighboring forests. Although these grasslands are composed primarily of tussock-forming species (bunchgrasses), they do exhibit a dense sod that makes root penetration difficult for tree species.

DISTRIBUTION

***Geographic Range:** This group is most extensive in the Canadian Rockies portion of the Rocky Mountains cordillera, extending south into western Montana, northwestern Wyoming, central and eastern Oregon, eastern Washington, and Idaho. It also occurs in the "island ranges" of central Montana, though it is not common, and is also found in the Bighorn Range of north-central Wyoming. A couple of associations in this group also occur in Colorado.

Nations: CA, US

States/Provinces: AB, BC, CO, ID, MT, OR, WA, WY

USFS Ecoregions (2007) [optional]: 331A:??, 341G:CC, 342A:CP, 342C:CC, 342D:CC, 342H:CC, 342I:C?, 342J:CC, M242B:C?, M242C:CP, M242D:CC, M331A:PP, M331B:PP, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CP, M333A:CC, M333B:CC, M333C:CC, M333D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3966 | <i>Festuca idahoensis</i> - <i>Calamagrostis rubescens</i> - <i>Achnatherum nelsonii</i> Central Rocky Mountain Montane Mesic Grassland Alliance |
| A3965 | <i>Festuca idahoensis</i> - <i>Carex scirpoidea</i> - <i>Danthonia intermedia</i> Central Rocky Mountain Subalpine Dry Grassland Alliance |
| A1323 | <i>Leucopoa kingii</i> - <i>Carex elynoides</i> - <i>Phlox pulvinata</i> Central Rocky Mountain Subalpine-Alpine Grassland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** W.F. Mueggler and W.L. Stewart (1980)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** M.S. Reid and K.A. Schulz

Acknowledgments [optional]:

Version Date: 09 Nov 2015

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Johnson, C. G. 2004. Alpine and subalpine vegetation of the Wallowa, Seven Devils and Blue mountains. R6-NR-ECOL-TP-0304. USDA Forest Service, Pacific Northwest Region, Portland, OR. 612 pp. plus appendices.

Mueggler, W. F., and W. L. Stewart. 1980. Grassland and shrubland habitat types of western Montana. General Technical Report INT-66. USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, UT. 154 pp.

2. Shrub & Herb Vegetation

2.B.2.Na. Western North American Grassland & Shrubland

G272. Central Rocky Mountain Montane-Foothill Deciduous Shrubland

Type Concept Sentence: This is a dry central Rocky Mountain shrubland group where dominant shrubs are *Amelanchier alnifolia*, *Holodiscus discolor*, *Physocarpus malvaceus*, *Prunus emarginata*, *Prunus virginiana*, *Rhus glabra*, *Rosa nutkana*, *Rosa woodsii*, *Symphoricarpos albus*, and/or *Symphoricarpos oreophilus*, and understory grasses and forbs are common. Stands occur across the western U.S. and Canada within the matrix of surrounding low-elevation grasslands and sagebrush shrublands of low to mid elevations of the Rocky Mountains.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.2.Na.2. Central Rocky Mountain Montane-Foothill Grassland & Shrubland (M048)

Elcode: G272

***Scientific Name:** *Amelanchier alnifolia* - *Symphoricarpos* spp. - *Rhus glabra* Central Rocky Mountain Shrubland Group

***Common (Translated Scientific) Name:** Saskatoon Serviceberry - Snowberry species - Smooth Sumac Central Rocky Mountain Shrubland Group

***Colloquial Name:** Central Rocky Mountain Montane-Foothill Deciduous Shrubland

***Type Concept:** This shrubland group is found in the lower montane and foothill regions around the Columbia Basin, and north and east into the Northern Rockies. The most common dominant shrubs are *Amelanchier alnifolia*, *Holodiscus discolor*, *Physocarpus malvaceus*, *Prunus emarginata*, *Prunus virginiana*, *Rhus glabra*, *Rosa nutkana*, *Rosa woodsii*, *Symphoricarpos albus*, and *Symphoricarpos oreophilus*, occurring alone or any combination. Stands in central and eastern Wyoming can include *Artemisia tridentata* ssp. *vaseyana* and *Cercocarpus montanus*, but neither of these species are dominant, and where they occur the stands are truly mixes of shrubs, often with *Amelanchier alnifolia*, *Prunus virginiana*, and others being the predominant taxa. *Aristida purpurea*, *Calamagrostis rubescens*, *Carex geyeri*, *Deschampsia cespitosa*, *Festuca campestris*, *Festuca idahoensis*, *Koeleria macrantha*, *Poa secunda*, and *Pseudoroegneria spicata* are the most important grasses. *Achnatherum thurberianum* and *Leymus cinereus* can be locally important. *Bromus tectorum* and *Phleum pratense* are common introduced grasses. *Balsamorhiza sagittata*, *Geum triflorum*, *Lomatium triternatum*, *Oenanthe sarmentosa*, *Potentilla gracilis*, *Xerophyllum tenax*, and species of *Eriogonum*, *Phlox*, and *Erigeron* are important forbs. These shrublands typically occur below treeline, within the matrix of surrounding low-elevation grasslands and sagebrush shrublands. They also occur in the ponderosa pine and Douglas-fir zones, but rarely up into the subalpine zone, where they are restricted to dry sites. The shrublands are usually found on steep slopes of canyons and in areas with some soil development, either loess deposits or volcanic clays; they occur on all aspects. Fire, flooding and erosion all impact these shrublands, but they typically will persist on sites for long periods. These communities also develop near talus slopes as garlands, at the heads of dry drainages, and toeslopes in the moist shrub-steppe and steppe zones.

***Diagnostic Characteristics:** Shrublands found in lower montane or foothill settings of the northern Rocky Mountains, typically in dry and warm settings.

***Classification Comments:** This group needs review from Northern Rockies ecologists. Its transition to ~Southern Rocky Mountain Mountain-mahogany - Mixed Foothill Shrubland Group (G276)\$\$ will need to be further clarified, but there are definitely distinct floristics separating the two groups. In addition, the southern Rocky Mountain group tends to be drier than this group.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G276 | Southern Rocky Mountain Mountain-mahogany - Mixed Foothill Shrubland | |
| G277 | Southern Rocky Mountain Gambel Oak - Mixed Montane Shrubland | |

Similar NVC Types General Comments [optional]:**VEGETATION**

Physiognomy and Structure Summary: These are variable shrublands composed of broad-leaved, cold-deciduous taxa, generally between 1 and 3 m in height. Shrub density will vary with substrate, fire and grazing history, and moisture, but these are rarely dense "thickets." They are typically found in small patches within the lower montane zone of Douglas-fir or ponderosa woodlands, or in a mosaic with sage shrub-steppe or valley grasslands. Grasses and forbs are the herbaceous component and can be abundant

to sparse.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: The most common dominant shrubs are *Amelanchier alnifolia*, *Holodiscus discolor*, *Physocarpus malvaceus*, *Prunus emarginata*, *Prunus virginiana*, *Rhus glabra*, *Rosa nutkana*, *Rosa woodsii*, *Symphoricarpos albus*, and *Symphoricarpos oreophilus* occurring alone or any combination. Occurrences in central and eastern Wyoming can include *Artemisia tridentata* ssp. *vaseyana* and *Cercocarpus montanus*, but neither of these species are dominant, and where they occur the stands are truly mixes of shrubs, often with *Amelanchier alnifolia*, *Prunus virginiana*, and others being the predominant taxa. The open to moderately dense herbaceous layer is dominated by bunchgrasses, especially *Festuca idahoensis* and *Pseudoroegneria spicata*. *Aristida purpurea*, *Festuca campestris*, *Calamagrostis rubescens*, *Carex geyeri*, *Deschampsia cespitosa*, *Koeleria macrantha*, and *Poa secunda* are other important grasses. *Achnatherum thurberianum* and *Leymus cinereus* can be locally important. *Bromus tectorum* and *Phleum pratense* are common introduced grasses. Important forbs are *Balsamorhiza sagittata*, *Geum triflorum*, *Lomatium triternatum*, *Oenanthe sarmentosa*, *Potentilla gracilis*, *Xerophyllum tenax* and species of *Eriogonum*, *Phlox*, and *Erigeron*.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:

ENVIRONMENT

Environmental Description: This small-patch shrubland group is found in foothill and lower montane sites around the Columbia Basin and Northern Rockies and extends into the northwestern Great Plains at elevations of 500-2500 m depending on latitude. These shrublands typically occur below treeline, within the matrix of surrounding low-elevation grasslands and sagebrush shrublands. They also occur in the ponderosa pine and Douglas-fir zones, but rarely up into the subalpine zone, where they are restricted to dry sites. The shrublands are usually found on steep slopes of canyons and in areas with some soil development, either loess deposits or volcanic clays; they occur on all aspects. Fire, flooding and erosion all impact these shrublands, but they typically will persist on sites for long periods. These communities also develop near talus slopes as garlands, at the heads of dry drainages, and toeslopes in the moist shrub-steppe and steppe zones.

DISTRIBUTION

***Geographic Range:** This group is found in the lower montane and foothill regions around the Columbia Basin, and north and east into the Northern Rockies, including east into central Montana around the "Sky Island" ranges. It also occurs farther south into central and eastern Wyoming, where it forms compositionally diverse shrublands. They also extend north into Alberta along the foothills of the Front Range.

Nations: CA, US

States/Provinces: AB, BC, CA?, CO, ID, MT, NV, OR, UT, WA, WY

USFS Ecoregions (2007) [optional]: 331A:CC, 331D:CP, 331N:CC, 341G:PP, 342A:CP, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342H:CC, 342I:CC, 342J:CC, M242C:CC, M242D:CC, M261D:PP, M261G:P?, M331A:CC, M331B:CC, M331D:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M334A:CC, M341A:PP

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3963 | <i>Amelanchier alnifolia</i> Central Rocky Mountain Montane-Foothill Shrubland Alliance |
| A3964 | <i>Rhus glabra</i> - <i>Rhus trilobata</i> Central Rocky Mountain Montane-Foothill Shrubland Alliance |
| A3967 | <i>Rosa nutkana</i> Central Rocky Mountain Shrubland Alliance |
| A3975 | <i>Physocarpus malvaceus</i> - <i>Symphoricarpos albus</i> Mesic Shrubland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--|-------------------------------|------|
| >< | Bittercherry (419) | Shiflet 1994 | |
| >< | Chokecherry - Serviceberry - Rose (421) | Shiflet 1994 | |
| > | MS Montane Shrub/Grassland Dry Subdivision sites | Ecosystems Working Group 1998 | |

AUTHORSHIP***Primary Concept Source [if applicable]:** E.W. Tisdale (1986)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** M.S. Reid and K.A. Schulz

Acknowledgments [optional]:

Version Date: 20 May 2015

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- Poulton, C. E. 1955. Ecology of the non-forested vegetation in Umatilla and Morrow counties, Oregon. Unpublished dissertation. State College of Washington, Pullman. 166 pp.

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Tisdale, E. W. 1986. Canyon grasslands and associated shrublands of west-central Idaho and adjacent areas. Bulletin No. 40. Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow. 42 pp.

2. Shrub & Herb Vegetation

2.B.2.Na. Western North American Grassland & Shrubland

G305. Central Rocky Mountain-North Pacific High Montane Mesic Shrubland

Type Concept Sentence: This central Rocky Mountain group consists of western mesic montane shrublands where common species include *Acer glabrum*, *Juniperus communis*, *Menziesia ferruginea*, *Ribes lacustre*, *Rubus parviflorus*, *Spiraea betulifolia*, *Spiraea splendens*, *Vaccinium cespitosum*, *Vaccinium membranaceum*, *Vaccinium myrtillus*, and/or *Vaccinium scoparium*, with mesic indicator understory species of *Chamerion angustifolium*, *Luzula glabrata* var. *hitchcockii*, *Pteridium aquilinum*, and/or *Xerophyllum tenax*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.2.Na.2. Central Rocky Mountain Montane-Foothill Grassland & Shrubland (M048)

Elcode: G305

***Scientific Name:** *Vaccinium* spp. - *Menziesia ferruginea* / *Xerophyllum tenax* Central Rocky Mountain-Vancouverian Mesic Shrubland Group

***Common (Translated Scientific) Name:** Blueberry species - Rusty Menziesia / Common Beargrass Central Rocky Mountain-Vancouverian Mesic Shrubland Group

***Colloquial Name:** Central Rocky Mountain-North Pacific High Montane Mesic Shrubland

***Type Concept:** This shrubland group is found within the zone of continuous forest in the upper montane and subalpine zones of the northern Rocky Mountains, from Wyoming north and west into British Columbia and Alberta. It is composed of a diverse mix of deciduous shrubs. Soils tend to be moist, but will typically dry out in late spring or summer. Stands are typically initiated by fires and will persist on sites for long periods because of repeated burns and changes in the presence of volatile oils in the soil which impedes tree regeneration. It also occurs as smaller patches of shrubland on dry sites that are marginal for tree growth and that have typically also experienced fire. Sites often are ridgetops and upper to middle mountain slopes and more commonly on sunny southern aspects. Vegetation is mostly deciduous broadleaf shrubs, sometimes mixed with shrub-statured trees or sparse evergreen needleleaf trees and *Populus tremuloides*. Common species include *Acer glabrum*, *Menziesia ferruginea*, *Ribes lacustre*, *Rubus parviflorus*, *Spiraea betulifolia*, *Spiraea splendens*, *Vaccinium cespitosum*, *Vaccinium myrtillus*, *Vaccinium scoparium*, and *Vaccinium membranaceum*, occurring alone or in any combination. *Juniperus communis* shrublands are found at high elevations in the eastern Cascades and are tentatively included here. Important graminoids and forbs include *Xerophyllum tenax*, *Luzula glabrata* var. *hitchcockii*, *Chamerion angustifolium*, and *Pteridium aquilinum*, reflecting the mesic nature of many of these shrublands.

***Diagnostic Characteristics:** Deciduous shrublands found in the high montane of the northern Rocky Mountains and northern Cascades. Composed of one of several *Vaccinium* species, *Menziesia ferruginea*, *Spiraea splendens*, and *Acer glabrum*. The graminoid/shrubby forb *Xerophyllum tenax* is a good indicator of these high montane, mesic settings in the Cascades and Northern Rockies.

***Classification Comments:** This group seems tenuous, but the best way to address these shrublands is unclear. The most distinguishing feature of this group floristically is the *Vaccinium* spp., almost all of which occur from lower montane into the high subalpine in the Rockies and the Cascades. A possible alternative treatment is to combine the subalpine mesic shrublands with the montane-foothill dry shrublands as one group. The wetter (avalanche slopes primarily) shrub types are combined into a yet-to-be-described northern Rocky Mountain montane riparian and wet slope shrubland. Floristically, this is what the avalanche and wet slope shrublands are most related to. The proposed split of the subalpine shrubland into mesic and wet is not substantiated by the association lists or floristics.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G317 | North Pacific Alpine-Subalpine Dwarf-shrubland & Heath | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Cold-deciduous shrublands, sometimes of dwarf stature (the *Vaccinium* spp. can be <0.5m), often with significant herbaceous cover, of both perennials graminoids, forbs and ferns.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Common species include mesic subalpine shrubs such as *Acer glabrum*, *Menziesia ferruginea*, *Ribes lacustre*, *Rubus parviflorus*, *Spiraea betulifolia*, *Spiraea splendens*, *Vaccinium cespitosum*, *Vaccinium myrtillus*, *Vaccinium scoparium*, and *Vaccinium membranaceum*, occurring alone or in any combination. *Juniperus communis* shrublands are found at high elevations in the eastern Cascades and are tentatively included here. Other common woody plants include *Paxistima myrsinites*, *Sorbus scopulina*, and *Sorbus sitchensis*. The ground cover is moderately dense to dense and forb-rich; important graminoids and forbs include *Athyrium filix-femina*, *Castilleja* spp., *Chamerion angustifolium*, *Erythronium grandiflorum*, *Luzula glabrata*, *Myosotis asiatica* (= *Myosotis alpestris*), *Pteridium aquilinum*, *Thalictrum occidentale*, *Urtica dioica*, and *Xerophyllum tenax*, reflecting the mesic nature of many of these shrublands. Mosses and ferns are often present. Occasional seedlings or saplings of conifers may be present, reflecting the occurrence of these shrublands within a predominantly forested landscape. In disturbance-maintained avalanche chute shrublands, stunted and broken trees may comprise significant cover. Species might include *Populus tremuloides* and conifers *Abies lasiocarpa*, *Picea engelmannii*, *Pseudotsuga menziesii*, *Pinus albicaulis*, or *Pinus flexilis*.

*Floristics Table [Med - High Confidence]:

*Number of Plots:

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Stands are typically initiated by fires and will persist on sites for long periods because of repeated burns and changes in the presence of volatile oils in the soil which impedes tree regeneration. It also occurs as smaller patches of shrubland on dry sites that are marginal for tree growth and that have typically also experienced fire.

ENVIRONMENT

Environmental Description: Cold, wet winters with plentiful snow are typical, along with wind desiccation in the subalpine-alpine transition. Soils tend to be moist, but will typically dry out in late spring or summer. Stands are typically initiated by fires and will persist on sites for long periods because of repeated burns and changes in the presence of volatile oils in the soil which impedes tree regeneration. These shrublands also occur as smaller patches of shrubland on dry sites that are marginal for tree growth and that have typically also experienced fire. Sites often are ridgetops and upper to middle mountain slopes and more commonly on sunny southern aspects.

DISTRIBUTION

***Geographic Range:** This group occurs in the mountains throughout the Northern Rockies, from Wyoming north and west into British Columbia and Alberta. It also occurs in the East Cascades, but how far south into the Sierra Nevada is as yet unclear.

Nations: CA, US

States/Provinces: AB, BC, CO, ID, MT, OR, WA, WY

USFS Ecoregions (2007) [optional]: M242B:CC, M242C:CC, M242D:CC, M331A:CP, M331B:CC, M331D:CP, M331E:CP, M331J:C?, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3968 | <i>Abies lasiocarpa</i> - <i>Populus tremuloides</i> / <i>Acer glabrum</i> Central Rocky Mountain Avalanche Chute Shrubland Alliance |
| A3970 | <i>Menziesia ferruginea</i> - <i>Spiraea betulifolia</i> Montane-Subalpine Shrubland Alliance |
| A3969 | <i>Vaccinium membranaceum</i> - <i>Vaccinium myrtillus</i> - <i>Vaccinium scoparium</i> Montane-Subalpine Shrubland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------------|--|-----------------------------|
| 2014-08-20 | G275 <i>Philadelphus lewisii</i> - <i>Physocarpus malvaceus</i> - <i>Symphoricarpos albus</i> Central Rocky Mountain Shrubland Group | G275 split into G527 & G305 |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP***Primary Concept Source [if applicable]:** M.S. Reid, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** M.S. Reid and K.A. Schulz

Acknowledgments [optional]:

Version Date: 20 May 2015

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State College of Washington, Pullman. 166 pp.

Shiflet, T. N., editor. 1994. Rangeland cover types of the United States. Society for Range Management. Denver, CO. 152 pp.

M168. Rocky Mountain-Vancouverian Subalpine-High Montane Mesic Meadow

2. Shrub & Herb Vegetation

2.B.2.Na. Western North American Grassland & Shrubland

G271. Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow

Type Concept Sentence: This Rocky Mountain, northern Vancouverian and Sierran group is typically lush meadow dominated by a diversity of taller forbs, including *Achillea millefolium*, *Agastache urticifolia*, *Balsamorhiza sagittata*, *Geranium viscosissimum*, *Ligusticum* spp., *Rudbeckia occidentalis*, *Thalictrum occidentale*, *Valeriana sitchensis*, and *Xerophyllum tenax*, typically with grasses intermingled in many of them. However, it includes stands dominated by grasses with relatively broad and soft blades and a few mesic Carices, such as *Calamagrostis breweri*, *Carex filifolia*, *Carex straminiformis*, *Elymus trachycaulus*, *Festuca viridula*, and *Phleum alpinum*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.2.Na.3. Rocky Mountain-Vancouverian Subalpine-High Montane Mesic Meadow (M168)

Elcode: G271

***Scientific Name:** *Festuca viridula* - *Deschampsia cespitosa* - *Ligusticum* spp. Rocky Mountain-Vancouverian Grassland & Meadow Group

***Common (Translated Scientific) Name:** Greenleaf Fescue - Tufted Hairgrass - Licorice-root species Rocky Mountain-Vancouverian Grassland & Meadow Group

***Colloquial Name:** Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow

***Type Concept:** This Rocky Mountain, northern Vancouverian and Sierran group is restricted to sites from lower montane to subalpine where finely textured soils, snow deposition, rocky substrates, or windswept dry conditions limit tree establishment. Many occurrences are small-patch in spatial character, and are often found in mosaics with woodlands, more dense shrublands, or just below alpine communities. These are typically lush meadows dominated by a diversity of tall forbs, with grasses intermingled in many of them. The vegetation is typically forb-rich, with forbs often contributing more to overall herbaceous cover than graminoids. However, some stands are composed of dense grasslands, these often being taxa with relatively broad and soft blades, such as *Elymus trachycaulus*, *Festuca viridula*, and *Phleum alpinum*, but where the moist habitat promotes a rich forb component. Important taxa includes *Achillea millefolium*, *Balsamorhiza sagittata*, *Rudbeckia occidentalis*, *Thalictrum occidentale*, *Valeriana sitchensis*, *Xerophyllum tenax*, and numerous species of Asteraceae, *Campanula*, *Erigeron*, *Ligusticum*, *Lomatium*, *Lupinus*, *Mertensia*, *Phlox*, *Penstemon*, *Solidago*, and *Wyethia*. Important graminoids include *Deschampsia cespitosa*, *Koeleria macrantha*, *Luzula glabrata*, perennial *Bromus* spp., and a number of *Carex* species. In the Cascades, this group includes *Festuca viridula* meadows. *Dasiphora fruticosa* ssp. *floribunda* and *Symphoricarpos* spp. are occasional but not abundant. In the Sierra Nevada *Calamagrostis breweri*, *Carex filifolia*, *Carex straminiformis*, *Juncus drummondii*, *Oreostemma alpinum*, *Solidago canadensis*, and *Trisetum spicatum* may dominate stands with diagnostic forbs *Oreostemma alpinum*, and *Solidago canadensis*. Dwarf-shrubs such as *Vaccinium cespitosum* may have significant cover. Burrowing mammals can increase the forb diversity. This group is typically found above 2000 m in elevation in the southern part of its range and above 600 m in the northern part. These upland communities occur on gentle to moderate-gradient slopes and relatively moist habitats. The soils are typically seasonally moist to saturated in the spring but, if so, will dry out later in the growing season. These sites are not as wet as those found in ~Vancouverian-Rocky Mountain Subalpine-Alpine Snowbed, Wet Meadow & Dwarf-Shrubland Group (G520)\$\$ and ~Vancouverian-Rocky Mountain Montane Wet Meadow & Marsh Group (G521)\$\$, although some species are certainly shared with wet meadows, such as *Deschampsia*.

***Diagnostic Characteristics:** Herbaceous communities found in the mountains of the Rockies and eastern Cascades, dominated by forbs and graminoids. These are relatively mesic or sometimes seasonally wet communities, and the combination of moisture and soil conditions results in forbs, often tall, being the predominant lifeform. Grasses and sedges are common, typically being taxa with broad and soft blades. Forb communities found on talus and scree slopes with subsurface moisture are included here, in particular when they are not sparsely vegetated.

***Classification Comments:** The Rockies and Cascades support a number of forb types found on talus and rocky scree slopes, which are not sparsely vegetated, and which often have little to no grass component, though Carices may be abundant. These types often have heavy snow loading in winter, or are adjacent to snowfields, and subsurface moisture below the rocks/scree is significant throughout the growing season. These forb types are poorly documented; for now they are placed in this group, as many of the taxa are also found in mesic grassy meadows. Splitting them into a separate group would be hard to justify floristically.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G267 | Central Rocky Mountain Montane Grassland | |
| G273 | Central Rocky Mountain Lower Montane, Foothill & Valley Grassland | |
| G268 | Southern Rocky Mountain Montane-Subalpine Grassland | |
| G520 | Vancouverian-Rocky Mountain Subalpine-Alpine Snowbed, Wet Meadow & Dwarf-shrubland | |
| G320 | North Pacific Alpine-Subalpine Tundra | |
| G317 | North Pacific Alpine-Subalpine Dwarf-shrubland & Heath | |
| G316 | Rocky Mountain-Sierran Alpine Dwarf-shrubland & Krummholz | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group includes herbaceous communities found in the montane and subalpine throughout much of the Rockies, eastern Cascades and Sierra Nevada, dominated by flowering forbs, often tall (but still <1 m in height usually). Grasses with broad, soft blades are common, but these are more typically forb-rich meadows with grasses or other graminoids not the dominant lifeform. Cover is generally dense or can be patchy. Burrowing mammals in places will disrupt the soil.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Species composition in this mesic meadow differs some between montane and subalpine elevations, but across its range, this is a very diverse group. Tall forb-dominated mesic meadows are typically composed of a wide diversity of genera and contribute more to overall herbaceous cover than graminoids. At montane elevations, important forbs include *Allium schoenoprasum*, *Angelica arguta*, *Arnica chamissonis*, *Athyrium filix-femina*, *Camassia quamash*, *Campanula rotundifolia*, *Chamerion angustifolium*, *Delphinium x occidentale*, *Erigeron speciosus*, *Eucephalus* spp., *Geum macrophyllum*, *Hackelia* spp., *Heracleum maximum*, *Ligusticum porteri*, *Ligusticum tenuifolium*, *Lupinus parviflorus*, *Mertensia* spp., *Osmorhiza occidentalis*, *Pteridium aquilinum*, *Senecio hydrophiloides*, *Senecio serra*, *Solidago canadensis*, *Symphotrichum* spp., *Thalictrum occidentale*, *Trollius laxus*, *Vicia americana* and *Zigadenus elegans*. Early-successional stages may be dominated by *Achillea millefolium*, *Agastache urticifolia*, *Chamerion angustifolium*, *Urtica dioica*, and small amounts of mesic grasses such as *Bromus carinatus* and *Deschampsia cespitosa*. At montane elevations, graminoids form a minor component and are usually taxa with relatively broad and soft blades such as *Bromus carinatus*, *Bromus sitchensis*, *Carex geyeri*, *Carex hoodii*, *Carex microptera*, *Carex raynoldsii*, *Deschampsia cespitosa*, *Elymus glaucus*, *Festuca rubra*, and *Melica spectabilis*. Broadleaf deciduous shrubs such as *Dasiphora fruticosa* ssp. *floribunda* and *Symphoricarpos* spp. are occasional, but not abundant.

At subalpine elevations, *Angelica* spp., *Arnica latifolia*, *Castilleja miniata*, *Erigeron peregrinus*, *Erythronium grandiflorum*, *Eucephalus ledophyllus*, *Ligusticum* spp., *Lupinus argenteus* var. *laxiflorus*, *Lupinus latifolius*, *Senecio triangularis*, *Valeriana* spp., and *Veratrum viride* are commonly the dominant forbs. Other locally abundant forbs include *Hydrophyllum fendleri*, *Phacelia hastata*, *Phlox diffusa*, *Saussurea americana*, and *Xerophyllum tenax*. Burrowing mammals can increase the forb diversity. Graminoids are typically a minor component of the canopy, with typically less than 20% cover. Common species include *Agrostis variabilis*, *Carex microptera*, *Carex paysonis*, *Carex spectabilis*, *Deschampsia cespitosa*, *Elymus trachycaulus*, *Juncus drummondii*, *Luzula glabrata*, *Luzula parviflora*, *Phleum alpinum*, *Poa alpina*, and *Vahlodea atropurpurea*. However, this group also includes *Festuca viridula*-dominated meadows in the Cascades. In the Sierra Nevada *Calamagrostis breweri*, *Carex filifolia*, *Carex straminiformis*, *Juncus drummondii*, and *Trisetum spicatum* may dominate stands with diagnostics forbs *Oreostemma alpigenum*, and *Solidago canadensis*. Dwarf-shrubs such as *Vaccinium cespitosum* may have moderate cover in some stands. Early-successional stages may be dominated by *Achillea millefolium*, *Hypericum scouleri*, *Sibbaldia procumbens*, and other forbs, and small amounts of mesic graminoids such as *Carex* spp., *Deschampsia cespitosa*, *Phleum alpinum*, and *Poa alpina*.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:**ENVIRONMENT**

Environmental Description: In the Rocky Mountains, these meadows occupy a wide variety of environments, including moderate to steep slopes and glacio-fluvial flats and swales that lose their snow cover relatively late in the season. Generally the group is restricted to sites from lower montane to subalpine where finely textured soils, snow deposition, rocky substrates, or windswept dry conditions limit tree establishment. Many occurrences are small-patch in spatial character, and are often found in mosaics with woodlands, more dense shrublands, or just below alpine communities. This group is typically found above 2000 m to 3700 m in elevation in the southern part of its range and above 600 m in the northern extent. These upland communities occur on gentle to moderate-gradient slopes and relatively moist habitats. The soils are typically seasonally moist to saturated in the spring but, if so, will dry out later in the growing season. At montane elevations, this group occurs within *Pinus-Pseudotsuga* or mixed conifer-dominated forests. At subalpine elevations, these meadows are found below treeline, usually within *Abies lasiocarpa-Picea* species-dominated forests.

Climate: Approximately two-thirds of the region's precipitation occurs in just half the year (October from March), with the remaining third occurring in late spring to early summer. Generally, the east slopes of the Cascades and Sierra Nevada ranges east to the northern Rocky Mountains of Montana and Wyoming receive greater than 100 cm of precipitation annually.

Soil/substrate/hydrology: Soils are typically seasonally moist to saturated during spring and early summer after snowmelt, but will dry out later in the growing season. At montane elevations, soils are usually clays or silt loams with an A horizon greater than 10 cm. Some sites may have inclusions of hydric soils in low, depressional areas within this group. At subalpine elevations, soils are derived from a variety of parent materials, and can be acidic or calcareous. The A horizon is typically less than 10 cm, and soils are usually rocky or gravelly with good aeration and drainage, but with a well-developed organic layer. A third setting includes talus or scree slopes, or colluvial fields of rocks and small boulders, where subsurface moisture is provided by melting snow throughout much of the growing season. Soils are developed from colluvium and more recently alluvium are often derived from limestone, sandstone, shale parent materials (Gregory 1983, Youngblood et al. 1985a), or weathered volcanic extrusives such as basalt, pumice and ash or loess deposits. Soil texture is variable and ranges from coarser-textured sandy loams to finer-textured silt loams, clay or clay loams with an average pH of 6.4 (Gregory 1983). Surface rock averages 46%, but varies from 1-90%. Bare ground cover is usually less than 15%.

DISTRIBUTION

***Geographic Range:** This group is very widespread in the Rocky Mountains cordillera from New Mexico (where it is uncommon) and Colorado north into Canada, and west into the eastern Cascades and Sierra Nevada. It also occurs in the mountain ranges of Nevada, northern Utah and Wyoming, and has been observed on the Snake River plain, as well as the "island ranges" of central Montana.

Nations: CA, US

States/Provinces: AB, BC, CA?, CO, ID, MT, NM, NV, OR, WA, WY

USFS Ecoregions (2007) [optional]: 341B:C?, 341E:CP, 341G:CC, 342B:CP, 342C:CC, 342D:CC, 342E:C?, 342H:CC, 342J:CC, M313A:PP, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M334A:??, M341A:CC, M341B:CC, M341C:CC, M341D:CP

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A4165 | <i>Poa secunda</i> - <i>Muhlenbergia richardsonis</i> - <i>Carex douglasii</i> Moist Meadow Alliance |
| A3951 | <i>Ligusticum</i> spp. - <i>Lupinus</i> spp. - <i>Delphinium</i> spp. Montane Mesic Meadow Alliance |
| A3950 | <i>Agastache urticifolia</i> - <i>Geranium viscosissimum</i> - <i>Pteridium aquilinum</i> Montane Mesic Meadow Alliance |
| A4119 | <i>Carex stramineiformis</i> - <i>Solidago canadensis</i> Meadow Alliance |

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3364 | <i>Calamagrostis breweri</i> Mesic Grassland Alliance |
| A3949 | <i>Phleum alpinum</i> - <i>Elymus trachycaulus</i> - <i>Agrostis variabilis</i> Subalpine Mesic Meadow Alliance |
| A1257 | <i>Festuca viridula</i> - <i>Carex hoodii</i> - <i>Lupinus</i> spp. Subalpine Mesic Meadow Alliance |
| A3948 | <i>Valeriana sitchensis</i> - <i>Luzula glabrata</i> var. <i>hitchcockii</i> - <i>Xerophyllum tenax</i> Subalpine Mesic Meadow Alliance |
| A1294 | <i>Carex filifolia</i> Mesic Grassland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

*Recent Concept Lineage [if applicable]:

| Date | Predecessor | Note |
|------------|--|-------------------------------------|
| 2014-11-18 | G363 <i>Calamagrostis breweri</i> - <i>Carex filifolia</i> - <i>Eriogonum incanum</i> Herbaceous Vegetation Group | G363 concept covered by G271 & G314 |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---------------------------------------|----------------|--|
| >< | Idaho Fescue - Tufted Hairgrass (308) | Shiflet 1994 | |
| >< | Tall Forb (409) | Shiflet 1994 | |
| >< | Tufted Hairgrass - Sedge (313) | Shiflet 1994 | Forb-rich portions of this SRM type overlap with this group. |

AUTHORSHIP

*Primary Concept Source [if applicable]: T.N. Shiflet (1994)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

*Author of Description: M.S. Reid, T. Luna, K.A. Schulz

Acknowledgments [optional]:

Version Date: 29 Sep 2016

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Shiflet, T. N., editor. 1994. Rangeland cover types of the United States. Society for Range Management. Denver, CO. 152 pp.

Starr, C. R. 1974. Subalpine meadow vegetation in relation to environment at Headquarters Park, Medicine Bow Mountains, Wyoming. Unpublished thesis, University of Wyoming, Laramie.

Youngblood, A. P., W. G. Padgett, and A. H. Winward. 1985a. Riparian community type classification of eastern Idaho-western Wyoming. R4-Ecol-85-01. USDA Forest Service, Intermountain Region, Ogden, UT. 78 pp.

G268. Southern Rocky Mountain Montane-Subalpine Grassland

Type Concept Sentence: This southern Rocky Mountains grassland group typically occurs between 2200 and 3000 m elevation on flat to rolling plains and parks or on lower sideslopes that are dry, and is characterized by an open to dense perennial graminoid layer dominated by *Blepharoneuron tricholepis*, *Danthonia intermedia*, *Danthonia parryi*, *Festuca arizonica*, *Festuca idahoensis*, *Festuca thurberi*, *Muhlenbergia filiculmis*, *Muhlenbergia montana*, *Pascopyrum smithii*, or *Pseudoroegneria spicata*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.2.Na.3. Rocky Mountain-Vancouverian Subalpine-High Montane Mesic Meadow (M168)

Elcode: G268

***Scientific Name:** *Festuca arizonica* - *Festuca thurberi* - *Muhlenbergia montana* Grassland Group

***Common (Translated Scientific) Name:** Arizona Fescue - Thurber's Fescue - Mountain Muhly Grassland Group

***Colloquial Name:** Southern Rocky Mountain Montane-Subalpine Grassland

***Type Concept:** This southern Rocky Mountains group extends west to high plateaus and mountains in the Colorado Plateau. Vegetation is characterized by an open to dense perennial graminoid layer. Larger occurrences usually consist of a mosaic of two or three plant associations with one of the following dominant grasses: *Blepharoneuron tricholepis*, *Danthonia parryi*, *Festuca arizonica*, *Muhlenbergia montana*, *Pascopyrum smithii*, or *Pseudoroegneria spicata* at lower elevation / warmer aspects, or *Danthonia intermedia*, *Festuca idahoensis*, *Festuca thurberi*, or *Muhlenbergia filiculmis* at subalpine elevation / cooler aspects. The common subdominants include *Bouteloua gracilis*, *Hesperostipa comata*, or *Poa secunda*. *Bouteloua gracilis* often dominates sites with warm aspects and heavy grazing history. Forb species such as *Potentilla hippiana* may be present to codominant. These large-patch grasslands are intermixed with matrix stands of spruce-fir, lodgepole pine, ponderosa pine, and aspen forests. In limited circumstances (e.g., South Park in Colorado), they form the "matrix" of high-elevation plateaus and inter-montane valleys. Stands typically occur between 2200 and 3000 m elevation on flat to rolling plains and parks or on lower sideslopes that are dry, but may extend up to 3350 m on warm aspects. Soils resemble prairie soils in that the A-horizon is dark brown, relatively high in organic matter, slightly acidic, and usually well-drained. Small-patch representations of this group do occur at high elevations of the Trans-Pecos where they present as occurrences of ~*Festuca arizonica* - *Blepharoneuron tricholepis* Grassland (CEGL004508)\$. These occurrences often occupy sites adjacent to ~Eastern Madrean Chaparral Group (G280)\$.

***Diagnostic Characteristics:** Vegetation is composed of an open to dense perennial graminoid layer that is generally less than 1 m tall. *Danthonia parryi*, *Festuca arizonica*, and *Muhlenbergia montana* are important species and typically dominate montane grasslands; *Danthonia intermedia* and *Festuca thurberi* are typical of subalpine grasslands in the southern Rocky Mountains. Other characteristic graminoid species that may be present to dominant include *Achnatherum lettermanii*, *Blepharoneuron tricholepis*, *Bouteloua gracilis*, *Carex duriuscula*, *Carex rossii*, *Carex siccata*, *Elymus lanceolatus*, *Festuca calligera*, *Festuca idahoensis*, *Hesperostipa comata*, *Muhlenbergia filiculmis*, *Poa fendleriana*, *Poa nervosa*, *Poa lettermanii*, and *Pseudoroegneria spicata*.

***Classification Comments:** Montane grasslands are very similar and intergrade with their montane and subalpine counterparts. The transition of this group to ~Central Rocky Mountain Montane Grassland Group (G267)\$ probably occurs somewhere in central Colorado or southern Wyoming. This Southern Rockies grassland group may co-occur with patches of the more mesic ~Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow Group (G271)\$, which is distinguished by dominance of mesic forb and grass species such as *Deschampsia cespitosa* and *Mertensia ciliata*. *Pascopyrum smithii*-dominated grasslands tend to be restricted to mesic swales within drier upland types.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G271 | Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow | |
| G267 | Central Rocky Mountain Montane Grassland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Vegetation is composed of an open to dense perennial graminoid layer that is generally less than 1 m tall. Forb cover is variable and may be present to codominant.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Vegetation in this group is characterized by an open to dense perennial graminoid layer. Larger occurrences usually consist of a mosaic of two or three plant associations with one of the following dominant grasses: *Blepharoneuron tricholepis*, *Danthonia parryi*, *Festuca arizonica*, *Muhlenbergia montana*, *Pascopyrum smithii*, or *Pseudoroegneria spicata* at lower elevation / warmer aspects, or *Danthonia intermedia*, *Festuca idahoensis*, *Festuca thurberi*, or *Muhlenbergia filiculmis* at subalpine elevation / cooler aspects. Other characteristic graminoid species that may be present to dominant include *Achnatherum lettermanii*, *Blepharoneuron tricholepis*, *Bouteloua gracilis*, *Carex duriuscula*, *Carex rossii*, *Carex siccata*, *Elymus lanceolatus*, *Festuca calligera*, *Hesperostipa comata*, *Poa fendleriana*, *Poa nervosa*, and *Poa lettermanii*. The common subdominants include *Bouteloua gracilis*, *Hesperostipa comata*, or *Poa secunda*. *Bouteloua gracilis* often dominates sites with warm aspects and heavy grazing history. Forb species such as *Achillea millefolium*, *Castilleja* spp., *Erigeron simplex*, *Erigeron ursinus*, *Eriogonum umbellatum*, *Geranium viscosissimum*, *Hymenoxys richardsonii*, *Lathyrus lanszwertii*, *Oxytropis oreophila*, *Penstemon secundiflorus*, *Potentilla hippiana*, *Solidago multiradiata*, and *Symphytotrichum foliaceum* (= *Aster foliaceus*) may be present to codominant. In disturbed stands, species such as *Heterotheca villosa* may codominant. These large-patch grasslands are intermixed with matrix stands of spruce-fir, lodgepole pine, ponderosa pine, and aspen forests. In limited circumstances (e.g., South Park in Colorado), they form the "matrix" of high-elevation plateaus and inter-montane valleys. Small-patch representations of this group do occur at high elevations of the Trans-Pecos where they present as occurrences of ~*Festuca arizonica* - *Blepharoneuron tricholepis* Grassland (CEGL004508)\$. These occurrences often occupy sites adjacent to ~Eastern Madrean Chaparral Group (G280)\$\$.

*Floristics Table [Med - High Confidence]:

*Number of Plots:

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Const-ancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|------------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:

ENVIRONMENT

Environmental Description: This Rocky Mountain grassland group typically occurs between 2200 and 3000 m elevation on flat to rolling plains and inter-montane parks or on lower sideslopes that are dry, but it may extend up to 3350 m on warm aspects. Soils resemble prairie soils in that the A-horizon is dark brown, relatively high in organic matter, slightly acidic, and usually well-drained.

DISTRIBUTION

***Geographic Range:** This grassland group occurs between 2200 and 3000 m elevation in the southern Rocky Mountains and extends west to high plateaus and mountains in the Colorado Plateau.

Nations: US

States/Provinces: AZ, CO, NM, NV, SD, UT, WY

USFS Ecoregions (2007) [optional]: 313A:CC, 313B:CC, 313C:CP, 313D:CP, 315A:CC, 315H:CP, 321A:PP, 322A:??, 331B:CC, 331G:CC, 331H:CC, 331I:CC, 331J:CC, 341A:CC, 341B:CC, 341C:CC, 341F:CP, 342A:CC, 342E:CC, 342F:CC, 342G:CC, 342J:CC, M313A:CC, M313B:CC, M331A:CP, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M341A:CC, M341B:CC, M341C:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3953 | <i>Festuca arizonica</i> - <i>Muhlenbergia montana</i> - <i>Poa fendleriana</i> Southern Rocky Mountain Montane Grassland Alliance |
| A3954 | <i>Festuca thurberi</i> - <i>Danthonia intermedia</i> - <i>Poa lettermanii</i> Southern Rocky Mountain Subalpine Grassland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---|-------------------|------|
| = | Rocky Mountain Alpine and Subalpine Grassland, Bunchgrass Series - 141.41 | Brown et al. 1979 | |

AUTHORSHIP***Primary Concept Source [if applicable]:** D.E. Brown, C.H. Lowe, and C.P. Pase (1979)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz

Acknowledgments [optional]:

Version Date: 09 Nov 2015

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2. Shrub & Herb Vegetation

2.B.2.Na. Western North American Grassland & Shrubland

M050. Southern Vancouverian Lowland Grassland & Shrubland

2. Shrub & Herb Vegetation

2.B.2.Na. Western North American Grassland & Shrubland

G488. Southern Vancouverian Shrub & Herbaceous Bald, Bluff & Prairie

Type Concept Sentence: This herbaceous to shrub-herbaceous group is found from Vancouver Island down the Pacific Coast to San Francisco, and is herbaceous grassland usually with some dwarf-shrubs mixed in but dominated by bunchgrasses such as *Calamagrostis nutkaensis*, *Festuca rubra*, *Festuca idahoensis ssp. roemerii*, or *Danthonia californica*, and dwarf-shrub species *Arctostaphylos uva-ursi*, *Arctostaphylos columbiana*, *Arctostaphylos nevadensis*, *Gaultheria shallon*, *Juniperus communis*, *Rubus spectabilis*, and *Vaccinium ovatum*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.2.Na.4. Southern Vancouverian Lowland Grassland & Shrubland (M050)

Elcode: G488

***Scientific Name:** *Arctostaphylos* spp. / *Festuca idahoensis ssp. roemerii* - *Danthonia californica* Shrubland & Grassland Group

***Common (Translated Scientific) Name:** Manzanita species / Roemer's Fescue - California Oatgrass Shrubland & Grassland Group

***Colloquial Name:** Southern Vancouverian Shrub & Herbaceous Bald, Bluff & Prairie

***Type Concept:** This herbaceous to shrub-herbaceous group is found from Vancouver Island down the Pacific Coast to San Francisco. The vegetation is grassland with some dwarf-shrubs which can occur as small patches but are usually in a matrix with the herbaceous vegetation. Bunchgrasses often dominate and include *Calamagrostis nutkaensis*, *Festuca rubra*, *Festuca idahoensis ssp. roemerii* (= *Festuca roemerii*), or *Danthonia californica*. Dwarf-shrub species imbedded in the herbaceous cover often include *Arctostaphylos uva-ursi*, *Arctostaphylos columbiana*, *Arctostaphylos nevadensis*, *Gaultheria shallon*, *Juniperus communis*, *Rubus spectabilis*, and *Vaccinium ovatum*. Occasionally scattered stunted trees, such as *Picea sitchensis*, *Pseudotsuga menziesii*, or *Quercus garryana*, may be present. It occurs along the coast on steep coastal terraces, headlands and bluffs, level ridgeline balds, and flat interior (leeward) meadows. The group includes many areas that are inland and do not have coastal exposure. Due to shallow soils, steep slopes, sunny aspect, and/or upper slope position, these sites are dry and marginal for tree establishment and growth except in favorable microsites. Fires, both lightning-ignited and those ignited by Native Americans, undoubtedly at least occasionally burn all these sites. Because of this fire history, the extent of this group has declined locally through tree invasion and growth, as areas formerly maintained as herbaceous by burning have filled in with trees. It occurs in the Coast Ranges, the Klamath Mountains and at low elevations on the lee side of the coastal mountains in the northern part of the range.

***Diagnostic Characteristics:** Grasslands are the most prevalent vegetation cover. Dwarf-shrubs occur commonly as small patches and usually in a matrix of herbaceous vegetation. Bunchgrasses often dominant include *Calamagrostis nutkaensis*, *Festuca rubra*, *Festuca idahoensis ssp. roemerii*, or *Danthonia californica*.

***Classification Comments:** This group combines former groups North Pacific Hypermaritime Shrub & Herbaceous Headland Group (G278) and North Pacific Shrub & Herbaceous Bald & Bluff Group (G279), with ~California Northern Coastal Grassland (CES206.941)\$. New (2009) associations from Mount Rainier National Park (aka Rex Crawford) nearly match Chris Chappell's description (2003) for the North Pacific bald and bluff system. ~Willamette Valley Upland Prairie and Savanna (CES204.858)\$\$, a closely aligned system, shares similar dominant grass species (*Festuca idahoensis ssp. roemerii* and *Danthonia californica*). Should we include it with this group?

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|-------------------------------|------|
| | | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Low-statured (<1.5 m) grassy area "balds," often openings in otherwise shrubby forested slopes. Dwarf-shrubs are often imbedded in the grass.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Grasslands are the most prevalent vegetation cover. Dwarf-shrubs occur commonly, especially in mountains or foothills, as very small patches for the most part, usually in a matrix of herbaceous vegetation, most often near edges. Bunch grasses often dominant include *Calamagrostis nutkaensis*, *Festuca rubra*, *Festuca idahoensis* ssp. *roemerii* (= *Festuca roemerii*), or *Danthonia californica*. Other grasses that may be present include *Achnatherum lemmonii*, *Koeleria macrantha*, *Agrostis* spp., *Bromus carinatus*, *Festuca idahoensis*, *Deschampsia cespitosa*, or *Trisetum canescens*. Dwarf-shrub species imbedded in the herbaceous cover include *Arctostaphylos uva-ursi*, *Arctostaphylos columbiana*, *Arctostaphylos nevadensis*, *Gaultheria shallon*, *Juniperus communis*, *Rubus spectabilis*, and *Vaccinium ovatum*. Occasionally scattered stunted trees such as *Picea sitchensis*, *Pseudotsuga menziesii* or *Quercus garryana* may be present. Perennial forbs may be present to abundant and include *Allium cernuum*, *Camassia quamash*, *Camassia leichtlinii*, *Grindelia hirsutula*, *Iris douglasiana*, *Lomatium martindalei*, *Mimulus guttatus* (in seeps), *Plectritis congesta*, *Phlox diffusa*, *Sisyrinchium bellum*, *Sanicula arctopoides*, or *Triteleia hyacinthina*. Significant portions of some balds, especially on rock outcrops, are dominated by bryophytes (mosses) and to a lesser degree lichens.

*Floristics Table [Med - High Confidence]:

*Number of Plots:

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Fires, both lightning-ignited and those ignited by Native Americans, undoubtedly at least occasionally burn all these sites. Lower elevation sites in the Georgia Basin, Puget Trough, and Willamette Valley probably were burned somewhat more frequently and, in some cases, intentionally. Because of this fire history, the extent of this group has declined locally through tree invasion and growth, as areas formerly maintained as herbaceous by burning have filled in with trees. In recent centuries, these were fire-dominated systems, and there is a known history of Native American use of fire in these areas. While still present, annual grasses and forbs are not as prevalent in these grasslands as elsewhere in California. With fire suppression, *Baccharis pilularis* and other shrub components of north coastal scrub often invade and can replace these grasslands with scrub-dominated systems.

ENVIRONMENT

Environmental Description: This group consists of mostly herbaceous-dominated areas located primarily on shallow soils and windy sites where wind and salt spray combine to limit tree growth, as well as dry well-drained bluffs that are not exposed to coastal influences directly. Steep slopes on coastal bluffs, headlands, or small islands are typical, though sometimes this group can be found on relatively level tops of headlands or islands. The group also includes flat meadows found on the lee side of the coastal mountains. Due to shallow soils, steep slopes, sunny aspect, and/or upper slope position, these sites are dry and marginal for tree establishment and growth except in favorable microsites. Rock outcrops are a typical small-scale feature within balds and are considered part of this group. The climate is relatively dry to wet (50.8 cm to perhaps 254 cm [20-100 inches] annual precipitation), always with a distinct dry summer season when these sites usually become droughty enough to limit tree growth and establishment. The relative prevalence of grasslands versus shrublands increases to the south. Soils can be shallow to bedrock or of glacial or marine sediment origin. Seeps can be found in some balds that dry out by summer.

DISTRIBUTION

***Geographic Range:** This herbaceous to shrub-herbaceous group is found from Vancouver Island down the coast to San Francisco. It occurs along the coast on coastal terraces and ridgeline balds in the Coast Ranges, Klamath Mountains, and at low elevations on the lee side of the coastal mountains in the northern part of the range. Small patches have been documented as far south as Santa Barbara and San Luis Obispo counties.

Nations: CA, US

States/Provinces: BC, CA, OR, WA

USFS Ecoregions (2007) [optional]: 242A:CC, 242B:C?, M242A:CC, M242B:CC, M242C:CP, M242D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS***Plot Analysis Summary [Med - High Confidence]:*****Plots Used to Define the Type [Med - High Confidence]:****CONFIDENCE LEVEL****USNVC Confidence Level:** Moderate**USNVC Confidence Comments [optional]:****HIERARCHY*****Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A4244 | <i>Bromus carinatus</i> - <i>Elymus glaucus</i> Mesic Meadow Alliance |
| A1647 | <i>Lomatium martindalei</i> Meadow Alliance |
| A3739 | <i>Festuca rubra</i> - <i>Calamagrostis nutkaensis</i> Exposed Coastal Headland Grassland Alliance |
| A4210 | <i>Festuca idahoensis</i> ssp. <i>roemeri</i> - <i>Danthonia californica</i> Interior Prairie, Bald & Bluff Grassland Alliance |

DISCUSSION**Discussion [optional]:****CONCEPT HISTORY*****Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------------|---|---|
| 2011-04-08 | G279 <i>Arctostaphylos</i> (<i>uva-ursi</i> , <i>columbiana</i>) / <i>Festuca roemeri</i> - <i>Lomatium martindalei</i> Shrub & Herbaceous Bald Group | G278 & G279 merged with CES206.941 to form G488 |
| 2011-04-08 | G278 <i>Vaccinium ovatum</i> - <i>Gaultheria shallon</i> / <i>Calamagrostis nutkaensis</i> - <i>Festuca rubra</i> Shrub & Grassland Group | G278 & G279 merged with CES206.941 to form G488 |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP***Primary Concept Source [if applicable]:** J.F. Franklin and C.T. Dyrness (1973)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** G. Kittel**Acknowledgments [optional]:**

Version Date: 09 Nov 2015

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2.B.2.Nb. Central North American Grassland & Shrubland (D023)

M051. Great Plains Mixedgrass & Fescue Prairie

2. Shrub & Herb Vegetation

2.B.2.Nb. Central North American Grassland & Shrubland

G331. Northern Great Plains Dry Mixedgrass Prairie

Type Concept Sentence: This group occurs largely in the northern Great Plains with some extensions into the central Great Plains. It is found on a variety of dry to dry-mesic upland settings where midgrasses, especially *Elymus lanceolatus*, *Hesperostipa comata*, *Hesperostipa curtiseta*, and *Pseudoroegneria spicata*, are mixed with shortgrasses and sedges, including *Bouteloua gracilis*, *Carex filifolia*, *Carex inops ssp. heliophila*, and *Koeleria macrantha*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.2.Nb.2. Great Plains Mixedgrass & Fescue Prairie (M051)

Elcode: G331

***Scientific Name:** *Hesperostipa comata* - *Bouteloua gracilis* Dry Mixedgrass Prairie Group

***Common (Translated Scientific) Name:** Needle-and-Thread - Blue Grama Dry Mixedgrass Prairie Group

***Colloquial Name:** Northern Great Plains Dry Mixedgrass Prairie

***Type Concept:** This dry mixedgrass prairie grassland is common in southeastern Alberta, southwestern Saskatchewan, south into the northern and central Great Plains of the United States. The vegetation is dominated by moderate to moderately dense medium-tall and short grasses and scattered shrubs. Dominant midgrass species include *Hesperostipa comata* (= *Stipa comata*), *Pascopyrum smithii*, *Pseudoroegneria spicata*, and *Elymus lanceolatus*. Short grasses, including *Bouteloua gracilis* and *Koeleria macrantha*, are common and become dominant in dry locations such as upper slopes. Upland sedges, such as *Carex inops ssp. heliophila* and *Carex filifolia*, may also be important components. *Calamovilfa longifolia* is often found with high cover values on sandier soils. *Pascopyrum smithii* and *Elymus lanceolatus* will decline in abundance with grazing pressure, while *Bouteloua gracilis* and *Koeleria macrantha* cover increases on degraded sites. Other common species include *Hesperostipa curtiseta*. Common woody species include *Artemisia cana*, *Symphoricarpos occidentalis*, *Rhus trilobata*, and *Sarcobatus vermiculatus*. Some examples may range into more of a shrub-steppe. Common forbs include *Opuntia polyacantha*, *Sphaeralcea coccinea*, and *Artemisia frigida*. Fire, drought, and grazing constitute the primary dynamics affecting this group. Its presence is generally correlated with arid areas that have mean precipitation of 350 mm per year or less. Stands occur on a wide variety of landforms, with flat to rolling topography and some low-relief hummocky areas. Surficial materials are predominantly glacial till in the Canadian areas, with some glacio-lacustrine areas. Glacio-fluvial sediments are common along major river valleys, and eolian materials are prevalent in some areas. Predominant soils are deep and well-drained to imperfectly drained, have a thick, dark A horizon and are classed as Brown Chernozems in the Canadian system. Textures are sandy loam to loam, medium- to coarser-textured soils. There are significant areas of Solonchic soils, characterized by a subsoil hardpan layer with a high proportion of sodium.

***Diagnostic Characteristics:** This group is separated from ~Northern Great Plains Mixedgrass Prairie Group (G141)\$\$ based on soil moisture and species composition. Stronger constancy and dominance of short grasses, including *Bouteloua gracilis* and *Koeleria macrantha*, mixed with the midgrasses *Hesperostipa comata*, *Pascopyrum smithii*, *Pseudoroegneria spicata*, and *Elymus lanceolatus* distinguish this type from related mesic mixedgrass types. Upland sedges such as *Carex inops ssp. heliophila*, and *Carex filifolia* may also be important components. Other common species include *Hesperostipa curtiseta* and *Opuntia polyacantha*. Strong grazing

pressures on mesic mixedgrass prairies, which increases the shortgrass component, can blur the distinction between the two types.

***Classification Comments:** Examples of this group may be found on xeric locations in adjacent groups, such as ~Northern Great Plains Mesic Mixedgrass Prairie Group (G141)\$. Because *Bouteloua gracilis* and *Koeleria macrantha* tend to increase under grazing pressure, overgrazed sites may superficially resemble some of the associations in this group. Sandy prairie stands in this region are probably placed in ~Great Plains Sand Grassland Group (G068)\$ or ~Great Plains Sand Shrubland Group (G069)\$. There are significant areas of Solonchic soils, characterized by a subsoil hardpan layer with a high proportion of sodium, and review is needed to determine if they fit here or elsewhere.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|---|
| G273 | Central Rocky Mountain Lower Montane, Foothill & Valley Grassland | |
| G144 | Great Plains Shortgrass Prairie | occurs south of the main distribution of this group, from Colorado to New Mexico. |
| G332 | Northern Great Plains Rough Fescue Prairie | |
| G069 | Great Plains Sand Shrubland | is found on sandy sites within the range of this type and elsewhere on sandy sites throughout the Great Plains. |
| G141 | Northern Great Plains Mesic Mixedgrass Prairie | is very similar to and often will occur adjacent to it or it may occur as moist inclusions in drier landscapes. |
| G068 | Great Plains Sand Grassland | is found on sandy sites within the range of this type and elsewhere on sandy sites throughout the Great Plains. |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The vegetation is characterized by a dense to sparse mixture of tall and short grasses interspersed with forbs and short shrubs.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Dominant grasses include both the mixedgrass species *Hesperostipa comata* (= *Stipa comata*), *Pascopyrum smithii*, *Pseudoroegneria spicata*, and *Elymus lanceolatus* and the shortgrasses *Bouteloua gracilis* and *Koeleria macrantha*. The latter become dominant in dry locations such as upper slopes. Upland sedges, such as *Carex inops ssp. heliophila* and *Carex filifolia*, may also be important components. *Calamovilfa longifolia* is often found with high cover values on sandier soils. *Pascopyrum smithii* and *Elymus lanceolatus* will decline in abundance with grazing pressure, while *Bouteloua gracilis* and *Koeleria macrantha* cover increases on degraded sites. Other common species include *Hesperostipa curtiseta*. Common woody species include *Artemisia cana*, *Symphoricarpos occidentalis*, *Rhus trilobata*, and *Sarcobatus vermiculatus*. Some examples may range into more of a shrub-steppe. Common forbs include *Opuntia polyacantha*, *Sphaeralcea coccinea*, and *Artemisia frigida* (Adams et al. 2013).

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Drought and grazing constitute the primary processes affecting stand dynamics in this group (Adams et al. 2013). The role of fire may be a third primary process. See Adams et al. (2013) for a discussion of the recovery of dry mixedgrass prairie following cultivation and abandonment.

ENVIRONMENT

Environmental Description: *Climate:* This type is generally found in arid areas that have mean precipitation of 350mm per year or less. *Soils/substrate:* Stands occur on flat to rolling topography with some low-relief hummocky areas. Surficial materials are predominantly glacial till in the Canadian areas, with some glacio-lacustrine areas. Glacio-fluvial sediments are common along major river valleys, and eolian materials are prevalent in some areas (Adams et al. 2013). Predominant soils are deep and well-drained to imperfectly drained, have a thick, dark A horizon and are classed as Brown Chernozems in the Canadian system. Textures are sandy loam to loam, medium- to coarser-textured soils. There are significant areas of Solonchic soils, characterized by a subsoil hardpan layer with a high proportion of sodium (Adams et al. 2013).

DISTRIBUTION

***Geographic Range:** This group is common in southeastern Alberta, southwestern Saskatchewan, south into the northern and central Great Plains of the United States in Montana, Wyoming and the northeast corner of Colorado (Scott 1995b) and east to western North Dakota, Nebraska, and Kansas.

Nations: CA, US

States/Provinces: AB, CO, KS, MT, ND, NE, SK, WY

USFS Ecoregions (2007) [optional]: 251A:CC, 251B:CC, 315A:PP, 331C:CC, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 332A:CP, 332C:CP, M331A:CP, M331B:CP, M331D:CP, M331I:CC, M332D:CP, M332E:CP, M332F:CP, M334A:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A4033 | <i>Hesperostipa comata</i> Northwestern Great Plains Grassland Alliance |
| A4032 | <i>Pseudoroegneria spicata</i> - <i>Pascopyrum smithii</i> - <i>Hesperostipa comata</i> Grassland Alliance |
| A4037 | <i>Festuca idahoensis</i> - <i>Carex inops</i> ssp. <i>heliophila</i> Great Plains Grassland Alliance |
| A4029 | <i>Hesperostipa curtisetata</i> - <i>Elymus lanceolatus</i> Grassland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** R.T. Coupland (1961)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** S. Menard, L. Allen and J. Drake

Acknowledgments [optional]:

Version Date: 07 May 2015

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2. Shrub & Herb Vegetation

2.B.2.Nb. Central North American Grassland & Shrubland

G141. Northern Great Plains Mesic Mixedgrass Prairie

Type Concept Sentence: This group is widespread in the northern Great Plains and has scattered occurrences in the western Great Plains; sites are dominated by a mixture of short, medium, and tall grasses, including *Andropogon gerardii*, *Carex inops* ssp. *heliophila*, *Carex filifolia*, *Nassella viridula*, *Panicum virgatum*, *Pascopyrum smithii*, *Schizachyrium scoparium*, and *Sorghastrum nutans*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.2.Nb.2. Great Plains Mixedgrass & Fescue Prairie (M051)

Elcode: G141

***Scientific Name:** *Pascopyrum smithii* - *Hesperostipa comata* - *Schizachyrium scoparium* Mixedgrass Prairie Group

***Common (Translated Scientific) Name:** Western Wheatgrass - Needle-and-Thread - Little Bluestem Mixedgrass Prairie Group

***Colloquial Name:** Northern Great Plains Mesic Mixedgrass Prairie

***Type Concept:** This mixedgrass group is widespread from northern Nebraska into southern Canada and westward to the Rocky Mountain Front Range in Montana and Wyoming, on both glaciated and non-glaciated substrates. It also extends south along the Front Range to northeastern New Mexico and western Oklahoma. The vegetation is dominated by moderate to moderately dense medium-tall grasses or sometimes, in the western Great Plains and Sandhills of Nebraska, a mix of tall and medium-tall grasses. Shrubs are usually scattered or absent but can form dense, local patches, particularly in swales or low areas. Dominant species include *Pascopyrum smithii*, *Schizachyrium scoparium*, *Carex inops* ssp. *heliophila*, and *Carex filifolia*. In Montana, this includes *Festuca idahoensis*. Sites with a strong component of *Nassella viridula* indicate a more favorable moisture balance and perhaps a favorable grazing regime as well because this is one of the most palatable of the midgrasses. *Calamovilfa longifolia* is often found with high cover values on sandier soils, and *Koeleria macrantha* cover increases on degraded sites. Common or dominant tallgrasses in the western Great Plains are *Andropogon gerardii*, *Panicum virgatum*, and *Sorghastrum nutans*. Other common species include *Bouteloua curtipendula*, *Bouteloua gracilis*, *Hesperostipa curtisetata*, *Hesperostipa neomexicana*, *Muhlenbergia montana*,

Pseudoroegneria spicata, *Sorghastrum nutans*, and *Sporobolus cryptandrus*. Common woody species include *Amelanchier alnifolia*, *Artemisia cana*, *Dasiphora fruticosa ssp. floribunda*, *Juniperus horizontalis*, *Prunus virginiana*, *Rhus trilobata*, and *Symphoricarpos occidentalis*. Some examples may range into more of a shrub-steppe. Fire and grazing constitute the primary dynamics affecting this group. Drought can also impact it, in general favoring the shortgrass component at the expense of the midgrasses. With intensive grazing, cool-season exotics such as *Poa pratensis*, *Bromus inermis*, and *Bromus arvensis* (= *Bromus japonicus*) can increase in dominance. Shrub species such as *Juniperus virginiana* can also increase in dominance with fire suppression. Conversion to agriculture likewise has decreased the range of this group. This group occurs on a wide variety of landforms (e.g., mesatops, stream terraces) and in proximity to a diversity of other groups. Soils range from fine-textured loams to sandy or gravelly soils.

***Diagnostic Characteristics:** This group is dominated by medium-tall graminoids, or tall and medium-tall grasses in the western Great Plains, particularly the midgrasses *Nassella viridula*, *Pascopyrum smithii*, and *Schizachyrium scoparium* and tallgrasses *Andropogon gerardii*, *Panicum virgatum*, and *Sorghastrum nutans*, and occurs in the northwestern Great Plains and along the Front Range south to northeastern New Mexico. The group also includes shrub-dominated sites with abundant *Amelanchier alnifolia*, *Dasiphora fruticosa ssp. floribunda*, *Juniperus horizontalis*, *Prunus americana*, *Prunus virginiana*, and *Symphoricarpos occidentalis*. Sites dominated by *Festuca* spp. are in a separate group with the exception of *Festuca idahoensis* stands in Great Plains of central Montana and Wyoming which are left here.

***Classification Comments:** This group originally included all mixedgrass prairies in the northwestern Great Plains, then was split into mesic and dry components (G331 was the dry mixedgrass prairie), was re-formed as a single group, and then re-split into ~Northern Great Plains Dry Mixedgrass Prairie Group (G331)\$\$ and this group (G141). The range of the group, as currently defined, extends into northeastern New Mexico in the form of western Great Plains tallgrass prairies. The Colorado and New Mexico stands should possibly be moved to a separate group [see ~*Andropogon gerardii* - *Schizachyrium scoparium* Western Great Plains Grassland (CEGL001463)\$\$].

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G273 | Central Rocky Mountain Lower Montane, Foothill & Valley Grassland | |
| G133 | Central Great Plains Mixedgrass Prairie | |
| G331 | Northern Great Plains Dry Mixedgrass Prairie | |
| G332 | Northern Great Plains Rough Fescue Prairie | |
| G068 | Great Plains Sand Grassland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The vegetation is characterized by a dense to sparse mixture of tall and short grasses interspersed with forbs. Dwarf-shrubs can be dominant in some stands in the northern part of the group's range and medium or tall shrubs (1-3 m tall) can be locally common to dense.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Dominant species include *Pascopyrum smithii*, *Schizachyrium scoparium*, *Carex inops ssp. heliophila*, and *Carex filifolia*. In Montana, this includes *Festuca idahoensis*. Sites with a strong component of *Nassella viridula* indicate a more favorable moisture balance and perhaps a favorable grazing regime as well because this is one of the most palatable of the midgrasses. *Calamovilfa longifolia* is often found with high cover values on sandier soils, and *Koeleria macrantha* cover increases on degraded sites. Common or dominant tallgrasses in the western Great Plains are *Andropogon gerardii*, *Panicum virgatum*, and *Sorghastrum nutans*. Other common species include *Bouteloua curtipendula*, *Bouteloua gracilis*, *Hesperostipa curtiseta*, *Hesperostipa neomexicana*, *Muhlenbergia montana*, *Pseudoroegneria spicata*, *Sorghastrum nutans*, and *Sporobolus cryptandrus*. *Hesperostipa comata* may be present but sites where it is abundant are usually too dry for this group. Common woody species include *Amelanchier alnifolia*, *Artemisia cana*, *Dasiphora fruticosa ssp. floribunda*, *Juniperus horizontalis*, *Prunus virginiana*, *Rhus trilobata*, and *Symphoricarpos occidentalis*.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Fire and grazing constitute the primary dynamics affecting this group. Drought can also impact it, in general favoring the shortgrass component at the expense of the midgrasses. With intensive grazing, cool-season exotics such as *Poa pratensis*, *Bromus inermis*, and *Bromus arvensis* can increase in dominance. Shrub species such as *Juniperus virginiana* can also increase in dominance with fire suppression. Conversion to agriculture likewise has decreased the range of this group.

ENVIRONMENT

Environmental Description: This group occurs on a wide variety of landforms and in proximity to a diversity of other groups. Climate and growing season length for the region in which it occurs are intermediate to the shortgrass regions to the west and southwest and the tallgrass regions to the east. Soils range from loams, clay loams, silty clays, and clays to more coarse-textured sandy or gravelly soils. Some examples may include an impermeable or slowly permeable claypan subsoil layer.

DISTRIBUTION

***Geographic Range:** This group occurs throughout the Western Great Plains from northern Nebraska into southern Canada, and west to central Montana. It also occurs in a narrow to broad transitional band between the Rocky Mountains and the Shortgrass Steppe ranging from the Rocky Mountain foothills and piedmont and adjacent plains, extending farther east on the Palmer Divide, north alongside the Chalk Bluffs near the Colorado-Wyoming border, and south on and below mesas and escarpments in southeastern Colorado, northeastern New Mexico, and the panhandles of Oklahoma and Texas.

Nations: CA, US

States/Provinces: AB, CO, KS, MB, MT, ND, NE, NM, OK, SD, SK, TX?, WY

USFS Ecoregions (2007) [optional]: 315A:CC, 315B:CC, 315H:CC, 331B:CC, 331C:CC, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 331J:CC, 331K:CC, 331L:CC, 331M:CC, 331N:CC, 332B:CC, 332C:CC, 332D:CC, 342A:CP, 342F:CC, 342G:CC, M313A:CP, M313B:CC, M331A:CP, M331B:CC, M331F:CC, M331G:CC, M331I:CC, M331J:C?, M334A:CC, M341A:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A0954 | <i>Crataegus douglasii</i> - <i>Crataegus succulenta</i> Shrubland Alliance |
| A4035 | <i>Juniperus horizontalis</i> - <i>Dasiphora fruticosa</i> ssp. <i>floribunda</i> / <i>Schizachyrium scoparium</i> Shrubland Alliance |
| A4036 | <i>Prunus virginiana</i> - <i>Symphoricarpos occidentalis</i> - <i>Amelanchier alnifolia</i> Great Plains Shrubland Alliance |
| A4034 | <i>Schizachyrium scoparium</i> Northwestern Great Plains Grassland Alliance |
| A4031 | <i>Pascopyrum smithii</i> - <i>Nassella viridula</i> Northwestern Great Plains Grassland Alliance |
| A1537 | <i>Rhus trilobata</i> / <i>Schizachyrium scoparium</i> - <i>Carex filifolia</i> Shrub Grassland Alliance |
| A4028 | <i>Andropogon gerardii</i> - <i>Sorghastrum nutans</i> Mixedgrass Western Plains Grassland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---|----------------|------|
| < | Wheatgrass - Needlegrass (607) | Shiflet 1994 | |
| < | Wheatgrass - Grama - Needlegrass (608) | Shiflet 1994 | |
| < | Wheatgrass - Grama (609) | Shiflet 1994 | |
| < | Wheatgrass (610) | Shiflet 1994 | |
| < | Bluestem Prairie (710) | Shiflet 1994 | |
| < | Bluestem Prairie (601) | Shiflet 1994 | |
| >< | Wheatgrass - Saltgrass - Grama (615) | Shiflet 1994 | |
| >< | Fescue Grassland (613) | Shiflet 1994 | |
| >< | Wheatgrass - Bluestem - Needlegrass (606) | Shiflet 1994 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** S. Menard, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** S. Menard and J. Drake

Acknowledgments [optional]:

Version Date: 07 May 2015

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M053. Western Great Plains Shortgrass Prairie

2. Shrub & Herb Vegetation

2.B.2.Nb. Central North American Grassland & Shrubland

G144. Great Plains Shortgrass Prairie

Type Concept Sentence: This semi-arid shortgrass grassland group occurs in the western half of the Western Great Plains and is usually composed of *Bouteloua gracilis* as the dominant or codominant species with associated graminoids *Aristida purpurea*, *Bouteloua curtipendula*, *Bouteloua hirsuta*, *Bouteloua dactyloides*, *Hesperostipa comata*, *Hesperostipa neomexicana*, *Pascopyrum smithii*, *Pleuraphis jamesii*, *Sporobolus cryptandrus*, and scattered shrubs, dwarf-shrubs and cacti.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.2.Nb.3. Western Great Plains Shortgrass Prairie (M053)

Elcode: G144

***Scientific Name:** *Bouteloua gracilis* - *Bouteloua dactyloides* - *Pleuraphis jamesii* Shortgrass Prairie Group

***Common (Translated Scientific) Name:** Blue Grama - Buffalograss - James' Galleta Shortgrass Prairie Group

***Colloquial Name:** Great Plains Shortgrass Prairie

***Type Concept:** This group occurs in the western half of the Western Great Plains Division in the rainshadow of the Rocky Mountains and forms the matrix grassland with *Bouteloua gracilis* as the typical dominant species. Associated graminoids may include *Aristida purpurea*, *Bouteloua curtipendula*, *Bouteloua hirsuta*, *Bouteloua dactyloides* (= *Buchloe dactyloides*), *Hesperostipa comata*, *Hesperostipa neomexicana*, *Koeleria macrantha* (= *Koeleria cristata*), *Pascopyrum smithii* (= *Agropyron smithii*), *Pleuraphis jamesii*, and *Sporobolus cryptandrus*. Although mid-height grass species may be present, especially on more mesic land positions and sandy soils, they are secondary in importance to the sod-forming short grasses. Scattered shrub and dwarf-shrub species such as *Artemisia filifolia*, *Artemisia frigida*, *Artemisia tridentata*, *Atriplex canescens*, *Eriogonum effusum*, *Gutierrezia sarothrae*, and *Lycium pallidum* may also be present. Also, because this group spans a wide range, there can be some differences in the relative dominance of some species from north to south and from east to west. This group occurs primarily on flat to rolling uplands with loamy, ustic soils ranging from sandy to clayey ranging from the Nebraska Panhandle south into Texas, Oklahoma and New Mexico, although grazing-impacted examples may reach as far north as southern Canada where it grades into ~Northern Great Plains Dry Mixedgrass Prairie Group (G331)\$. In eastern Colorado and western Kansas and Nebraska, it grades into ~Central Great Plains Mixedgrass Prairie Group (G133)\$.

Large-scale processes such as climate, fire and grazing influence this group. High variation in amount and timing of annual precipitation impacts the relative cover of cool- and warm-season herbaceous species. In contrast to other prairie groups, fire is less important, especially in the western range of this group. This is because the dry to xeric climate conditions produce less vegetation/fuel load, so relative fire frequency is lower within the group. However, historically, fires that did occur were often very expansive, especially after a series of years with above average precipitation when litter/fine fuels could build up. Currently, fire suppression and more extensive grazing in the region have likely decreased the fire frequency even more, and it is unlikely that these processes could occur at a natural scale. A large part of the range for this group (especially in the east and near rivers) has been converted to agriculture. Areas of the central and western range have been impacted by the unsuccessful attempts to develop dryland cultivation during the Dust Bowl of the 1930s. The short grasses that dominate this group are extremely drought- and grazing-tolerant. These species evolved with drought and large herbivores and, because of their stature, are relatively resistant to overgrazing. This group, in combination with the associated wetland groups, represents one of the richest areas for mammals and birds. Endemic bird species to the shortgrass group may constitute one of the fastest declining bird populations.

***Diagnostic Characteristics:** This group is characterized by a short, often discontinuous graminoid layer dominated or codominated by *Bouteloua gracilis*. Many other graminoids may be associated, including some medium-tall grasses; however, medium-tall and tall grasses will not dominate. *Gutierrezia sarothrae* is often present to codominant, especially in disturbed areas. Other woody plants may be present but characteristically do not form a layer, e.g., less than 10% cover. To the south, this group transitions to desert

grassland groups that are characterized by desert species.

***Classification Comments:** The dominant grass in this group, *Bouteloua gracilis*, is tolerant of heavy grazing and drought, which favor it over other taller and less xeric grass species (Weaver and Albertson 1956). Some ecologists consider stands in this group to be disclimax grassland of mixedgrass prairie resulting from overgrazing by livestock (Weaver and Albertson 1956). Because this group classifies existing vegetation, it includes both early-seral "disclimax" and late-seral "climax" stands extending from the northwestern mixedgrass region in Montana and Canada, south into the Texas Panhandle. The Shortgrass Prairie grassland type in Sims et al. (1978) is closest conceptually to this group. Many others, such as Singh et al. (1983), Lauenroth and Milchunas (1992), Dick-Peddie (1993), Sims and Risser (2000), and Lauenroth and Burke (2008), recognize only the central and southern portions of this group as shortgrass steppe or prairie as they are looking at climate or other environmental or geographic factors.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G487 | Madrean Juniper Open Woodland | |
| G130 | Hardwood - Loblolly Pine Nonriverine Wet Flatwoods | |
| G133 | Central Great Plains Mixedgrass Prairie | |
| G068 | Great Plains Sand Grassland | |
| G331 | Northern Great Plains Dry Mixedgrass Prairie | |
| G192 | Comanchian Mesquite - Mixed Scrub | |
| G069 | Great Plains Sand Shrubland | |
| G489 | Chihuahuan Semi-Desert Lowland Grassland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group is characterized by a short, often discontinuous herbaceous layer dominated by short perennial grasses.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This group spans a wide range and thus there can be some differences in the relative dominance of some species from north to south and from east to west. This group is primarily dominated by *Bouteloua gracilis* throughout its range with various associated graminoid species depending on precipitation, soils and management. Associated graminoids may include *Achnatherum hymenoides*, *Aristida purpurea*, *Bouteloua curtipendula*, *Bouteloua hirsuta*, *Bouteloua dactyloides* (= *Buchloe dactyloides*), *Carex filifolia*, *Hesperostipa comata*, *Koeleria macrantha* (= *Koeleria cristata*), *Muhlenbergia torreyi*, *Pascopyrum smithii* (= *Agropyron smithii*), *Pleuraphis jamesii*, *Sporobolus airoides*, and *Sporobolus cryptandrus*. Although mid-height grass species may be present, especially on more mesic land positions and soils, they are secondary in importance to the sod-forming short grasses. Sandy soils have higher cover of *Hesperostipa comata*, *Sporobolus cryptandrus*, and *Yucca* spp. Scattered shrub and dwarf-shrub species such as *Artemisia filifolia*, *Artemisia frigida*, *Artemisia tridentata*, *Atriplex canescens*, *Eriogonum effusum*, *Gutierrezia sarothrae*, *Lycium pallidum*, and *Rhus trilobata* may also be present. High annual variation in amount and timing of precipitation impacts relative cover of herbaceous species. Cover of cool-season grasses is dependent on winter and early spring precipitation whereas warm-season grasses respond to mid-summer thunderstorms). Floristic information was compiled from Weaver and Albertson (1956), Sims et al. (1978), Brown et al. (1980, 1998), Barbour and Billings (1988), Milchunas et al. (1989), Lauenroth and Milchunas (1992), Dick-Peddie (1993), Ricketts et al. (1999), Sims and Risser (2000), and Lauenroth and Burke (2008).

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Climate, fire and grazing constitute the primary processes impacting this group. Drought-tolerant shortgrass species have root systems that extend up near the soil surface where they can utilize low precipitation events (Sala and Lauenroth 1982). Fire is less important in this group compared to other Western Great Plains prairie systems, especially in the western portion of its range (Milchunas et al. 1989). Previous comments in the literature citing *Opuntia* spp. increasing with overgrazing may not be borne out by

more recent research (R. Rondeau pers. comm.). The Long expedition found extensive prickly-pear stands near the South Platt River above the forks in 1823 (Hart 2008). Milchunas et al. (2008) found that *Opuntia* spp. do not increase with grazing.

Upland *Prosopis glandulosa* shrublands have expanded in the shortgrass prairie in the last hundred years and most consider ~*Prosopis glandulosa* Prairie Ruderal Scrub Alliance (A3952) to be ruderal or novel vegetation. *Prosopis glandulosa* was reported in the Texas Panhandle in 1849 and along the Canadian River in New Mexico in 1715 prior to extensive cattle grazing (Hart 2008). However, conversion to agriculture and pastureland with subsequent irrigation has degraded and extirpated this group in some areas of its range.

Although *Prosopis glandulosa* has expanded in the shortgrass prairie in the last hundred years and some consider ~*Prosopis glandulosa* Prairie Ruderal Scrub Alliance (A3952) to be ruderal or novel vegetation, *Prosopis glandulosa* was reported in the Texas Panhandle in 1849 and along the Canadian River in New Mexico in 1715 prior to extensive cattle grazing (Hart 2008). However, conversion to agriculture and pastureland with subsequent irrigation has degraded and extirpated this group in some areas of its range.

ENVIRONMENT

Environmental Description: This group is located on primarily flat to rolling uplands. Soils typically are loamy and ustic and range from sandy to clayey. Climate is continental with mean annual precipitation generally about 300 mm ranging to 500 mm to the south in Texas. Most of the annual precipitation occurs during the growing season as thunderstorms (Sims et al. 1978). Precipitation events are mostly <10 cm with occasional larger events (Sala and Lauenroth 1982).

DISTRIBUTION

***Geographic Range:** This group is found primarily in the western half of the Western Great Plains Division east of the Rocky Mountains and ranges from the Nebraska Panhandle south into the panhandles of Oklahoma and Texas and New Mexico, although some examples may reach as far north as southern Canada.

Nations: CA, US

States/Provinces: CO, KS, NE, NM, OK, TX, WY

USFS Ecoregions (2007) [optional]: 315A:CC, 315B:CC, 315F:CC, 321A:CC, 331B:CC, 331C:CC, 331F:CC, 331H:CC, 331I:CC, 332C:CC, 332E:CC, 332F:CC, M313B:CC, M331F:CC, M331I:CC

Omernik Ecoregions L3, L4 [optional]: 9.4.2.27:C, 9.4.2.27d:C, 9.4.2.27g:C, 9.4.2.27h:C, 9.4.2.27i:C, 9.4.2.27k:C, 9.4.2.27l:C, 9.4.2.27n:C, 9.4.2.27o:C, 9.4.2.27r:C, 9.4.3.26:C, 9.4.3.26a:C, 9.4.3.26c:C, 9.4.6.30:C, 9.4.6.30a:C, 9.4.6.30d:C

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A4000 | <i>Bouteloua gracilis</i> - <i>Bouteloua dactyloides</i> Shortgrass Prairie Alliance |
| A4002 | <i>Bouteloua gracilis</i> - <i>Bouteloua hirsuta</i> - <i>Hesperostipa neomexicana</i> Shortgrass Prairie Alliance |
| A3999 | <i>Artemisia frigida</i> - <i>Dalea formosa</i> - <i>Gutierrezia sarothrae</i> Dwarf-shrubland Alliance |
| A4001 | <i>Bouteloua gracilis</i> - <i>Bouteloua hirsuta</i> - <i>Bouteloua curtipendula</i> Shortgrass Prairie Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------------|---|-----------------------|
| 2014-11-05 | G140 <i>Prosopis glandulosa</i> / <i>Bouteloua gracilis</i> Southern Great Plains Shrub Prairie Group | G140 merged into G144 |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---------------------------------------|-------------------|---|
| > | <i>Bouteloua-Buchloë</i> | Küchler 1964 | This potential natural vegetation type is broader than the NVC group existing vegetation. |
| >< | Shrub-Grass Disclimax Series - 142.15 | Brown et al. 1980 | |
| >< | Mixed "Shortgrass" Series - 142.14 | Brown et al. 1980 | |
| >< | Mixed "Shortgrass" Series - 142.13 | Brown et al. 1998 | |
| >< | Plains and Mesas Grasslands | Dick-Peddie 1993 | |
| = | Grama "Shortgrass" Series - 142.12 | Brown et al. 1980 | |
| = | Grama - Buffalo Grass Section (3113) | Bailey 1980 | |
| = | Grama "Shortgrass" Series - 142.12 | Brown et al. 1998 | |
| = | Shortgrass Steppe | Singh et al. 1983 | |
| = | Shortgrass Prairie | Sims et al. 1978 | |

AUTHORSHIP

*Primary Concept Source [if applicable]: P.L. Sims, J.S. Singh, and W.K. Lauenroth (1978)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

*Author of Description: K.A. Schulz

Acknowledgments [optional]:

Version Date: 10 Nov 2015

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M052. Great Plains Sand Grassland & Shrubland

2. Shrub & Herb Vegetation

2.B.2.Nb. Central North American Grassland & Shrubland

G068. Great Plains Sand Grassland

Type Concept Sentence: This sand prairie is most common in the north-central Great Plains but occurs in other parts of the western plains, as well. Medium and tall grasses dominate the sandy soils of this group, typically *Andropogon hallii*, *Calamovilfa longifolia*, *Hesperostipa comata*, and *Panicum virgatum*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.2.Nb.4. Great Plains Sand Grassland & Shrubland (M052)

Elcode: G068

***Scientific Name:** *Andropogon hallii* - *Calamovilfa longifolia* - *Hesperostipa comata* Sand Grassland Group

***Common (Translated Scientific) Name:** Sand Bluestem - Prairie Sandreed - Needle-and-Thread Sand Grassland Group

***Colloquial Name:** Great Plains Sand Grassland

***Type Concept:** The sand prairies constitute a very unique group within the Western Great Plains. These sand prairies are often considered part of the tallgrass or mixedgrass regions in the Western Great Plains but can contain elements from ~Great Plains Shortgrass Prairie Group (G144)\$\$, ~Central Great Plains Mixedgrass Prairie Group (G133)\$\$, and ~Northern Great Plains Mesic Mixedgrass Prairie Group (G141)\$\$\$. The largest expanse of sand prairies (approximately 5 million ha) can be found in the Sandhills of north-central Nebraska and southwestern South Dakota. These areas are relatively intact. The unifying and controlling feature for this group is that coarse-textured soils predominate and the dominant grasses are well-adapted to this condition. Graminoid species dominate the sand prairies, although relative dominance can change due to impacts of wind disturbance. *Andropogon hallii* and *Calamovilfa longifolia* are the most common species, but other grass and forb species such as *Hesperostipa comata*, *Carex inops* ssp. *heliophila*, and *Panicum virgatum* may be present. Apparently only *Calamovilfa longifolia* functions as a dominant throughout the range of the group. In the western extent, *Hesperostipa comata* becomes more dominant, and *Andropogon hallii* is less abundant but still present. Communities of *Artemisia cana* ssp. *cana* are included here in central and eastern Montana. Patches of *Quercus havardii* can also occur within this group in the southern Great Plains. Soils in the sand prairies can be relatively undeveloped and are highly permeable. Soil texture and drainage along with a species' rooting morphology, photosynthetic physiology, and mechanisms to avoid transpiration loss are highly important in determining the composition of the sand prairies. In the northwestern portion of its range, stand size corresponds to the area of exposed caprock sandstone; small patches predominate, but large patches are also found embedded in the encompassing ~Northern Great Plains Mesic Mixedgrass Prairie Group (G141)\$\$\$. Another important feature is their susceptibility to wind erosion. Blowouts and sand draws are some of the unique wind-driven disturbances in the sand prairies. In most of eastern Montana, substrates supporting this group have weathered in place from sandstone caprock; thus, the solum is relatively thin, and the wind-sculpted features present further east do not develop. In Colorado, examples of this group include active sand dunes in the shortgrass prairie and San Luis Valley with the largest occurrence occurring in Great Sand Dunes National Park and Preserve and surrounding dune field. Fire and grazing constitute the other major dynamic processes that can influence this group.

***Diagnostic Characteristics:** This group is distinguished by sparse to moderately dense graminoids. It occurs in semi-arid to arid areas of the Great Plains on somewhat excessively to excessively well-drained and deep sandy soils. The most characteristic example of this group occurs in the Nebraska Sandhills region.

***Classification Comments:** Overgrazing can decrease the dominance of some of the grass species, such as *Andropogon hallii*, *Calamovilfa gigantea*, and *Schizachyrium scoparium*, facilitating an increased abundance of shrubs such as *Artemisia filifolia* and a change in classification to ~Great Plains Sand Shrubland Group (G069)\$\$.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G144 | Great Plains Shortgrass Prairie | |
| G133 | Central Great Plains Mixedgrass Prairie | |
| G331 | Northern Great Plains Dry Mixedgrass Prairie | |
| G069 | Great Plains Sand Shrubland | |
| G141 | Northern Great Plains Mesic Mixedgrass Prairie | |
| G491 | Chihuahuan Sandy Plains Semi-Desert Grassland | |

Similar NVC Types General Comments [optional]: This group can contain elements of ~Great Plains Shortgrass Prairie Group (G144)\$\$, ~Central Great Plains Mixedgrass Prairie Group (G133)\$\$, and ~Northern Great Plains Mesic Mixedgrass Prairie Group (G141)\$\$. This group may occur in a mosaic with the ~Great Plains Sand Shrubland Group (G069)\$\$.

VEGETATION

Physiognomy and Structure Summary: The vegetation is characterized by a dense to sparse layer of tall grasses interspersed with forbs.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This group is distinguished by the dominance of graminoids such as *Andropogon hallii* and *Calamovilfa longifolia*. Other graminoids such as *Hesperostipa comata*, *Carex inops ssp. heliophila*, and *Panicum virgatum* may be present. Characteristic forbs differ by region, but species of *Psoralidium* and *Pediomelum* are a common feature. *Penstemon haydenii* (Federally listed endangered) is endemic to the sand prairie group and of special conservation concern because of its probable decline due to grazing and fire suppression. Very diffuse patches of *Rhus trilobata* are found on shallow sandy soils, often associated with breaklands; other shrubs occasionally occurring include *Artemisia cana ssp. cana*, *Betula occidentalis*, *Juniperus horizontalis*, and *Yucca glauca*. Many of the warm-season graminoids extend at least to the Rocky Mountain Front Range as dominant components on appropriate sites or as a response to disturbance. All the characteristic species mentioned for Nebraska and South Dakota are also found in Montana stands (and possibly Wyoming and perhaps the rest of the states cited). Some of the communities cited as part of the concept in Nebraska and South Dakota are only marginally present in Montana, but others are found throughout Montana's Great Plains region. In the southern range of this group, patches of *Quercus havardii* can also occur.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: The distribution, species richness and productivity of plant species within this group are controlled primarily by environmental conditions, in particular the temporal and spatial distribution of soil moisture and topography. Another important aspect of this group is its susceptibility to wind erosion. Blowouts and sand draws are some of the unique wind-driven disturbances in the sand prairies, particularly the Nebraska Sandhills, which can profoundly impact vegetation composition and succession within this group. Fire and grazing constitute the other major disturbances that can influence this group. Overgrazing, fire and trampling that leads to the removal of vegetation within those areas susceptible to blowouts can either instigate a blowout or perpetuate one already occurring. Overgrazing can also lead to significant erosion.

ENVIRONMENT

Environmental Description: The distribution, species richness and productivity of plant species within this group are controlled primarily by environmental conditions, in particular the temporal and spatial distribution of soil moisture and topography. Soil texture and drainage along with a species' rooting morphology, photosynthetic physiology, and mechanisms to avoid transpiration loss are highly important in determining the composition and distribution of communities/associations. This group is found primarily on sandy and sandy loam soils that can be relatively undeveloped and highly permeable. Another important aspect of soils in the sand prairies is their susceptibility to wind erosion. Blowouts and sand draws are some of the unique wind-driven disturbances which can profoundly impact vegetation composition and succession. This group is usually found in areas with a rolling topography and can occur on ridges, midslopes and/or lowland areas within a region. It often occurs on moving sand dunes, especially within the Sandhills region of Nebraska and South Dakota. In Montana, occurrences are intimately associated with ~Northern Great Plains Mixedgrass Prairie Group (G141)\$\$, usually occupying higher positions in local landscapes due to the fact that sandy members of some formations (that are predominantly marine shales) constitute the highest (and most weathering-resistant) points in the landscape.

DISTRIBUTION

***Geographic Range:** This group is found throughout the Western Great Plains Division ranging from North Dakota south to Texas. The largest and most intact example of this group is found within the Sandhills region of Nebraska and South Dakota. However, it is also common (though occurring in predominantly small patches) farther west into central and eastern Montana. Its western extent in Wyoming is still to be determined, but it does occur in the Wyoming Highlands (mapzone 29) on weathered-in-place sandy soils, where *Calamovilfa longifolia* is found, along with *Artemisia cana*.

Nations: CA, US

States/Provinces: CO, KS, MT, ND, NE, NM?, OK, SD, TX, WY

USFS Ecoregions (2007) [optional]: 251F:CC, 251H:CC, 255A:PP, 315A:CC, 315B:CC, 315F:CC, 321A:??, 331B:CC, 331C:CC, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 331H:CC, 331K:CC, 331L:CC, 331M:CP, 331N:C?, 332C:CC, 332D:CC, 332E:CC, 332F:CC

Omernik Ecoregions L3, L4 [optional]: 8.4.7.37:C, 8.4.7.37e:C, 9.2.4.40:C, 9.2.4.40b:C, 9.2.4.40d:C, 9.4.2.27:C, 9.4.2.27d:C, 9.4.2.27g:C, 9.4.2.27h:C, 9.4.2.27i:C, 9.4.2.27k:C, 9.4.2.27l:C, 9.4.2.27n:C, 9.4.2.27o:C, 9.4.2.27r:C, 9.4.5.29:C, 9.4.5.29b:C, 9.4.5.29d:C, 9.4.5.29g:C

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A1201 | <i>Calamovilfa longifolia</i> Sand Prairie Alliance |
| A1193 | <i>Andropogon hallii</i> Sand Prairie Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--------------------------------------|----------------|---|
| > | Bluestem - Dropseed (708) | Shiflet 1994 | |
| < | Prairie Sandreed - Needlegrass (603) | Shiflet 1994 | This SRM type is found in the more northerly and northwest portions of this |

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---|----------------|---|
| | | | group (as far west as central Montana). |
| < | Grama - Bluestem (714) | Shiflet 1994 | Soil texture ranges from sand to clay loam? Inclusions? |
| < | Sand Bluestem - Little Bluestem Plains (721) | Shiflet 1994 | |
| < | Sand Bluestem - Little Bluestem Dunes (720) | Shiflet 1994 | |
| < | Bluestem - Prairie Sandreed (602) | Shiflet 1994 | |
| < | Mohrs (Shin) Oak: 67 | Eyre 1980 | |
| >< | Wheatgrass - Grama - Needlegrass (608) | Shiflet 1994 | Sandy portions of this SRM type are included in this group. |
| >< | Blue Grama - Sideoats Grama - Black Grama (707) | Shiflet 1994 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** S. Menard and K. Kindscher, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** S. Menard and K. Kindscher

Acknowledgments [optional]:

Version Date: 17 Dec 2010

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***References [Required if used in text]:**

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G069. Great Plains Sand Shrubland

Type Concept Sentence: This group is found on sandy soils across most of the Great Plains where a sparse to dense shrub cover, mostly *Artemisia filifolia* but also *Amorpha canescens*, *Prosopis glandulosa*, *Prunus pumila* var. *besseyi*, *Rhus trilobata*, and *Yucca glauca*, occurs over medium-tall grasses.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.2.Nb.4. Great Plains Sand Grassland & Shrubland (M052)

Elcode: G069

***Scientific Name:** *Artemisia filifolia* / *Calamovilfa longifolia* - *Yucca glauca* Sand Shrubland Group

***Common (Translated Scientific) Name:** Sand Sagebrush / Prairie Sandreed - Soapweed Yucca Sand Shrubland Group

***Colloquial Name:** Great Plains Sand Shrubland

***Type Concept:** This group is found mostly in south-central areas of the Western Great Plains Division ranging from southwestern Wyoming and southwestern Nebraska up into the Nebraska Sandhill region, south through eastern Colorado, and New Mexico to central Texas, although some examples may reach as far north as the Badlands of South Dakota. Typically, this group is characterized by a sparse to moderately dense woody layer dominated by *Artemisia filifolia*, but other characteristic species may be present,

including *Amorpha canescens*, *Prosopis glandulosa* (southern stands), *Prunus angustifolia*, *Prunus pumila* var. *bessleyi* (northern stands), *Rhus trilobata*, and *Yucca glauca*. In the southern range of this group, *Quercus havardii* may also be present to dominant and represents one succession pathway that develops over time following disturbance. Associated herbaceous species can vary with geography, amount and season of precipitation, disturbance, and soil texture. The herbaceous layer typically has a moderate to dense canopy but can be sparse. Several mid- to tallgrass species characteristic of sand substrates are usually present to dominant, such as *Andropogon hallii*, *Calamovilfa gigantea*, *Calamovilfa longifolia*, *Schizachyrium scoparium*, *Sporobolus cryptandrus*, *Sporobolus giganteus*, or *Hesperostipa comata*. Overgrazing can lead to decreasing dominance of some of the grass species, such as *Andropogon hallii*, *Calamovilfa gigantea*, and *Schizachyrium scoparium*, and may result in a shift from the ~Great Plains Sand Grassland Group (G068)\$\$ to this group. In the western extent of this group in the shortgrass prairie, more xeric mid- and shortgrass species such as *Hesperostipa comata*, *Sporobolus cryptandrus*, and *Bouteloua gracilis* often dominate the herbaceous layer. The climate is semi-arid to arid for much of the region in which this group occurs. It occurs on somewhat excessively to excessively well-drained, deep sandy soils that are often associated with dune systems and ancient floodplains.

***Diagnostic Characteristics:** This group is distinguished by a sparse to moderately dense shrub layer dominated by *Artemisia filifolia*. It occurs in semi-arid to arid areas of the Great Plains on somewhat excessively to excessively well-drained and deep sandy soils.

***Classification Comments:** Overgrazing can lead to decreasing dominance of some of the grass species such as *Andropogon hallii*, *Calamovilfa gigantea*, and *Schizachyrium scoparium* and may result in a shift to this group from ~Great Plains Sand Grassland Group (G068)\$\$.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|---|
| G068 | Great Plains Sand Grassland | contains several of the same graminoid species and may occur in a mosaic with this group, especially if overgrazing has occurred. |
| G144 | Great Plains Shortgrass Prairie | |
| G331 | Northern Great Plains Dry Mixedgrass Prairie | |
| G491 | Chihuahuan Sandy Plains Semi-Desert Grassland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group is characterized by a sparse to moderately dense shrub layer interspersed with scattered to dense graminoids.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This group is distinguished by a sparse to moderately dense shrub layer dominated by *Artemisia filifolia*. Graminoid species, such as *Andropogon hallii*, *Calamovilfa longifolia*, *Calamovilfa gigantea*, *Hesperostipa comata*, *Schizachyrium scoparium*, *Sporobolus cryptandrus*, and *Bouteloua* spp., can also be found within this group. Other shrub species, such as *Yucca glauca*, *Rhus trilobata*, and *Prunus angustifolia*, may be present. The shrubs *Quercus havardii* and *Prosopis glandulosa* may also be present in the southern extent of this group, as can the grasses *Panicum havardii* and *Sporobolus giganteus*. In the extension of this group into the shortgrass prairie, more xeric mid- and shortgrass species such as *Hesperostipa comata*, *Sporobolus cryptandrus* and *Bouteloua gracilis* can dominate the herbaceous layer.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Fire and grazing constitute the most important processes impacting this group. Burning shrublands reduces cover of *Artemisia filifolia* for several years, resulting in grassland patches that form a mosaic pattern with shrublands. Composition of grasslands depends on precipitation and management. Drought stress can also influence this group in some areas.

ENVIRONMENT

Environmental Description: This group is found primarily in semi-arid to arid areas of the Great Plains. It occurs on somewhat excessively to excessively well-drained and deep sandy soils. This group is often found associated with dune systems and/or ancient floodplains but may occur in soils derived from sandstone residuum and/or occur on sandstone outcrop ridges and down associated slopes.

DISTRIBUTION

***Geographic Range:** This group is found primarily within the south-central areas of the Great Plains ranging from the Nebraska Sandhills south into central Texas. However, examples can be found north in the Badlands in South Dakota and parts of North Dakota and the southern Canadian Prairie Provinces and west into Wyoming and Montana.

Nations: CA, US

States/Provinces: AB, CO, KS, MB, MT, ND, NE, NM, OK, SD, SK, TX, WY

USFS Ecoregions (2007) [optional]: 315A:CC, 315B:CC, 315F:CC, 321A:CC, 331B:CC, 331C:CC, 331D:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 332C:CC, 332E:CC, 332F:CC, M313B:PP

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A0816 | <i>Artemisia filifolia</i> Great Plains Sand Prairie Scrub Alliance |
| A1540 | <i>Yucca glauca</i> Prairie Scrub Alliance |
| A4112 | <i>Quercus havardii</i> Prairie Scrub Alliance |
| A0627 | <i>Sapindus saponaria</i> Prairie Scrub Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---|----------------|------|
| > | Sandsage Prairie (605) | Shiflet 1994 | |
| > | Bluestem - Dropseed (708) | Shiflet 1994 | |
| < | Sand Shinnery Oak (730) | Shiflet 1994 | |
| < | Sand Bluestem - Little Bluestem Dunes (720) | Shiflet 1994 | |
| < | Mohrs (Shin) Oak: 67 | Eyre 1980 | |
| < | Mesquite (western type): 242 | Eyre 1980 | |
| < | Mesquite (southern type): 68 | Eyre 1980 | |
| >< | Blue Grama - Sideoats Grama - Black Grama (707) | Shiflet 1994 | |
| = | Sand Sagebrush - Mixed Prairie (722) | Shiflet 1994 | |

AUTHORSHIP

*Primary Concept Source [if applicable]: S. Menard and K. Kindscher, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

*Author of Description: S. Menard and J. Drake

Acknowledgments [optional]:

Version Date: 07 May 2015

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2. Shrub & Herb Vegetation

2.B.2.Nb. Central North American Grassland & Shrubland

2.B.2.Nd. Western North American Interior Chaparral (D061)

M094. Cool Interior Chaparral

2. Shrub & Herb Vegetation

2.B.2.Nd. Western North American Interior Chaparral

G282. Western North American Montane Sclerophyll Scrub

Type Concept Sentence: This western North American group consists of montane chaparral scrublands dominated by a variety of species, including *Arctostaphylos patula*, *Arctostaphylos mewukka*, *Arctostaphylos nevadensis*, *Arctostaphylos viscida*, *Ceanothus cordulatus*, *Ceanothus velutinus*, *Ceanothus integerrimus*, *Ceanothus martinii*, *Chrysolepis sempervirens*, *Holodiscus discolor*, *Prunus emarginata*, *Quercus garryana* var. *fruticosa*, *Quercus sadleriana*, and/or *Quercus vacciniifolia*, generally occurring on ridges and rocky slopes often with southerly aspects throughout the West.

OVERVIEW

*Hierarchy Level: Group

*Placement in Hierarchy: 2.B.2.Nd.1. Cool Interior Chaparral (M094)

Elcode: G282

*Scientific Name: *Arctostaphylos patula* - *Arctostaphylos nevadensis* - *Ceanothus velutinus* Montane Sclerophyll Scrub Group

*Common (Translated Scientific) Name: Greenleaf Manzanita - Pinemat Manzanita - Snowbrush Ceanothus Montane Sclerophyll Scrub Group

*Colloquial Name: Western North American Montane Sclerophyll Scrub

*Type Concept: This group consists of cool, mostly montane chaparral and sclerophyllous scrublands that occur in the western United States from the Sierra Nevada, Klamath-Siskiyou mountains and southern Cascade Range of California, Oregon and Washington east on the ranges of the Great Basin and plateaus of the Colorado Plateau into the Rocky Mountains extending out to the Black Hills. There are also occurrences extending as far west as the inner Coast Ranges in central California and the Peninsular and Transverse ranges. Stands are typically fairly open-canopied shrublands with open interspaces either bare or supporting patchy grasses and forbs. *Arctostaphylos patula* and *Ceanothus velutinus* are the most widespread dominant/diagnostic species. Other

dominant/diagnostic species include *Arctostaphylos mewukka*, *Arctostaphylos nevadensis*, *Arctostaphylos viscida*, *Ceanothus cordulatus*, *Ceanothus integerrimus*, *Ceanothus martinii*, *Chrysolepis sempervirens*, *Holodiscus discolor*, *Prunus emarginata*, *Quercus garryana* var. *fruticosa* (= var. *breweri*) (shrub form), *Quercus sadleriana*, and *Quercus vacciniifolia*. *Cercocarpus ledifolius* is generally absent. Most of the oaks and other chaparral species occur in the western extent. Understory varies with shrub density but is generally sparse. Occasional emergent conifers may be present. Higher elevation stands typically have higher species diversity. Stands in this group are typically montane shrublands found on the slopes of the Sierra Nevada and Cascades and into the western Great Basin, Colorado Plateau and the Black Hills of South Dakota in summer-dry habitats from 800 to 3000 m elevation. Stands in California are found at higher elevations than most other chaparral ranging from 300 to 3300 m elevation. They occur in the northern Coast Ranges, Klamath Mountains, Modoc Plateau, Sierra Nevada and foothills, and southern Cascades of California, Oregon and Washington. Climate is semi-arid to cool temperate. Yearly precipitation and temperature ranges are quite large. Much of the precipitation comes as winter snow at higher elevations, and summer drought-stress is characteristic. These shrublands occur on ridges and rocky slopes often with southerly aspects. Substrates are thin, well-drained skeletal soils with coarser texture loamy or sandy soils. Parent materials are varied and range from limestone and sandstone to granitics, mafic, and ultramafic substrates. These shrub communities established after stand-replacing fires or clearcut logging in *Pinus ponderosa* or *Pseudotsuga menziesii* forests or pinyon-juniper woodlands, and are seral to forest after several decades. Excessively rocky or droughty, fire-prone sites in the forest may support relatively persistent stands of this group. In the Rocky Mountains, stands are found within a matrix of montane conifer forest and woodland in limited, small-patch occurrences forming post-fire shrublands in areas previously dominated by woodlands. Typical fire regime in this group varies with the amount of organic accumulation. All characteristic species are fire-adapted.

***Diagnostic Characteristics:** Open-canopied broad-leaved evergreen shrublands dominated by diagnostic species *Arctostaphylos mewukka*, *Arctostaphylos nevadensis*, *Arctostaphylos patula*, *Arctostaphylos viscida*, *Ceanothus cordulatus*, *Ceanothus integerrimus*, *Ceanothus martinii*, *Ceanothus velutinus*, *Chrysolepis sempervirens*, *Holodiscus discolor*, *Prunus emarginata*, *Quercus garryana* var. *fruticosa* (shrub form), *Quercus sadleriana*, and *Quercus vacciniifolia*. *Cercocarpus ledifolius* is generally absent and herbaceous layer is typically sparse.

***Classification Comments:** This cool, mostly montane chaparral and sclerophyllous scrublands group occurs in the western United States and is frequently characterized by dominance of *Arctostaphylos patula* and *Ceanothus velutinus*. Other dominant/diagnostic species include *Arctostaphylos mewukka*, *Arctostaphylos nevadensis*, *Arctostaphylos viscida*, *Ceanothus cordulatus*, *Ceanothus integerrimus*, *Ceanothus martinii*, *Chrysolepis sempervirens*, *Holodiscus discolor*, *Prunus emarginata*, *Quercus garryana* var. *fruticosa* (shrub form), *Quercus sadleriana*, and *Quercus vacciniifolia*. *Cercocarpus ledifolius* is generally absent.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G261 | Californian Mesic & Pre-montane Chaparral | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Broad-leaved evergreen shrubland with open canopy and little to no undergrowth. Shrubs are typically 1-3 m tall.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Stands in this wide-ranging group are typically fairly open-canopied shrublands with open interspaces either bare or supporting patchy grasses and forbs. *Arctostaphylos patula* and *Ceanothus velutinus* are the most widespread dominant/diagnostic species. Other dominant/diagnostic species include *Arctostaphylos mewukka*, *Arctostaphylos nevadensis*, *Arctostaphylos viscida*, *Ceanothus cordulatus*, *Ceanothus integerrimus*, *Ceanothus martinii*, *Chrysolepis sempervirens*, *Holodiscus discolor*, *Prunus emarginata*, *Quercus garryana* var. *fruticosa* (= var. *breweri*) (shrub form), *Quercus sadleriana*, and *Quercus vacciniifolia*. *Cercocarpus ledifolius* is generally absent. Most of the oaks and other chaparral species occur in the western extent. Other shrubs may include *Amelanchier alnifolia*, *Amelanchier utahensis*, *Artemisia tridentata*, *Cercis canadensis* var. *texensis*, *Cercocarpus montanus*, *Garrya fremontii*, *Quercus berberidifolia*, *Prunus subcordata*, *Purshia stansburiana*, *Symphoricarpos* spp., and *Toxicodendron diversilobum*. Emergent conifers may be present, such as *Abies concolor*, *Pinus lambertiana*, *Pinus ponderosa*, *Pinus sabiniana*, *Pseudotsuga menziesii*, and tree oaks such as *Quercus chrysolepis*, *Quercus kelloggii*, or *Quercus wislizeni* may be present at sparse cover. Understory varies with shrub density but is generally sparse with *Elymus glaucus*, *Elymus elymoides*, *Eriogonum nudum*, *Festuca californica*, *Pyrola picta*, and *Stephanomeria lactucina* sometimes present in the herbaceous layer. Higher elevation

stands typically have higher species diversity.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Stands commonly occur post disturbance after fire or logging along ridges and upper slopes.

ENVIRONMENT

Environmental Description: Stands in this group are typically montane shrublands found on the slopes of the Sierra Nevada and Cascades and into the western Great Basin, Colorado Plateau and Black Hills of South Dakota in summer-dry habitats from 800 to 3000 m elevation. Stands in California are found at higher elevations than most other chaparral ranging from 300 to 3300 m elevation. They occur in the northern Coast Ranges, Klamath Mountains, Modoc Plateau, Sierra Nevada and foothills, and southern Cascades of California and southern Oregon. Climate is semi-arid to cool temperate. Yearly precipitation and temperature ranges are quite large. The northern portion of the Sierra Nevada and Klamath-Siskiyou mountains can receive 200 cm of rain per year, while southern stands may receive only 40 cm per year. These sclerophyllous shrubs are adapted to freezing temperatures and cold winters. However, lower elevation stands may never see freezing temperatures, while northern, high-elevation and northern stands may only have a 4-month growing season. Much of the precipitation comes as winter snow, and summer drought-stress is characteristic.

These shrublands occur on ridges and rocky slopes often with southerly aspects. Substrates are thin, well-drained skeletal soils with coarser texture loamy or sandy soils. Parent materials are varied and range from limestone and sandstone to granitics, mafic, and ultramafic substrates. These shrub communities are typically zonal disclimax or, occasionally, edaphic climax brushfields which occur in association with dry needle-leaved evergreen forests or woodlands. They typically established after stand-replacing fires or clear-cut logging in *Pinus ponderosa* or *Pseudotsuga menziesii* forests or pinyon-juniper woodlands, and are seral to forest after several decades. Excessively rocky or droughty, fire-prone sites in the forest may support relatively persistent stands of this group. In the Rocky Mountains, stands are found within a matrix of montane conifer forest and woodland in limited, small-patch occurrences forming post-fire shrublands in areas previously dominated by woodlands. Typical fire regime in this group varies with the amount of organic accumulation. All characteristic species are fire-adapted.

DISTRIBUTION

***Geographic Range:** This chaparral group occurs across much of the western United States from the Sierra Nevada, Klamath-Siskiyou mountains and southern Cascade Range of California, Oregon and Washington east across the ranges of the Great Basin and plateaus of the Colorado Plateau into the Rocky Mountains extending out to the Black Hills. There are occurrences extending as far west as the inner Coast Ranges in central California, the northern Coast Ranges in southeastern Oregon and the Peninsular and Transverse ranges in southern California.

Nations: CA?, US

States/Provinces: AB?, AZ, BC?, CA, CO, ID, MT, NM, NV, OR, SD, UT, WA?, WY

USFS Ecoregions (2007) [optional]: 313A:??, 341A:CP, 341D:CC, 341E:CC, 341F:CC, 341G:CC, 342B:CC, 342C:CC, 342J:CP, M261E:CC, M341A:CC, M341D:CP

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A4117 | <i>Quercus sadleriana</i> - <i>Notholithocarpus densiflorus</i> var. <i>echinoides</i> Shrubland Alliance |
| A3918 | <i>Prunus emarginata</i> - <i>Holodiscus discolor</i> Shrubland Alliance |
| A3919 | <i>Quercus garryana</i> var. <i>fruticosa</i> Shrubland Alliance |
| A3916 | <i>Quercus vacciniifolia</i> - <i>Chrysolepis sempervirens</i> Shrubland Alliance |
| A3917 | <i>Ceanothus cordulatus</i> - <i>Ceanothus integerrimus</i> Shrubland Alliance |

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A0788 | <i>Arctostaphylos patula</i> - <i>Arctostaphylos nevadensis</i> Shrubland Alliance |
| A3936 | <i>Ceanothus velutinus</i> Shrubland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------------|--|-----------------------|
| 2014-11-18 | G283 <i>Chrysolepis sempervirens</i> - <i>Quercus vacciniifolia</i> California Montane Chaparral Group | G283 merged into G282 |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|------------------------------------|----------------|------|
| >< | Littleleaf Mountain-Mahogany (417) | Shiflet 1994 | |
| >< | Snowbush (420) | Shiflet 1994 | |

AUTHORSHIP***Primary Concept Source [if applicable]:** T.N. Shiflet (1994)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz and M.S. Reid**Acknowledgments [optional]:**

Version Date: 06 Aug 2015

REFERENCES***References [Required if used in text]:**

Barbour, M. G., and J. Major, editors. 1977. Terrestrial vegetation of California. John Wiley and Sons, New York. 1002 pp.

Brown, D. E., editor. 1982a. Biotic communities of the American Southwest-United States and Mexico. Desert Plants Special Issue 4(1-4):1-342.

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Sawyer, J. O., T. Keeler-Wolf, and J. Evens. 2009. A manual of California vegetation. Second edition. California Native Plant Society, Sacramento CA. 1300 pp.

Shiflet, T. N., editor. 1994. Rangeland cover types of the United States. Society for Range Management. Denver, CO. 152 pp.

M091. Warm Interior Chaparral

2. Shrub & Herb Vegetation

2.B.2.Nd. Western North American Interior Chaparral

G281. Western Madrean Chaparral

Type Concept Sentence: This interior chaparral group is found across the southwestern U.S. from central New Mexico and southern Utah west to California and is characterized by a moderate to dense evergreen shrub layer dominated by sclerophyllous shrubs, especially *Adenostoma sparsifolium*, *Arctostaphylos pungens*, *Ceanothus greggii*, *Cercocarpus montanus*, *Garrya wrightii*, *Mortonia utahensis*, *Quercus cornelius-mulleri*, *Quercus john-tuckeri*, and *Quercus turbinella*, that occurs in foothills, xeric mountain slopes and canyons.

OVERVIEW***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.2.Nd.2. Warm Interior Chaparral (M091)

Elcode: G281

Scientific Name:** *Quercus turbinella* - *Ceanothus greggii* - *Arctostaphylos pungens* Chaparral GroupCommon (Translated Scientific) Name:** Sonoran Scrub Oak - Desert Ceanothus - Mexican Manzanita Chaparral Group***Colloquial Name:** Western Madrean Chaparral

***Type Concept:** This interior chaparral group is found across the southwestern U.S. from central New Mexico and southern Utah west to California. The moderate to dense evergreen shrub layer is dominated by sclerophyllous shrubs, especially *Ceanothus greggii* and *Quercus turbinella*. Other common shrubs from the eastern portion of its range (Arizona and New Mexico) include *Arctostaphylos pringlei* (higher elevations), *Arctostaphylos pungens*, *Cercocarpus montanus*, *Garrya wrightii*, *Purshia stansburiana*, *Quercus toumeyii*, and *Rhus trilobata*. In desert chaparral stands in the western extent *Arctostaphylos patula* (not dominant), *Arctostaphylos glauca*, *Cercocarpus montanus* var. *glaber* (= *Cercocarpus betuloides*), *Garrya flavescens*, *Juniperus californica*, *Nolina parryi*, *Quercus john-tuckeri*, *Quercus cornelius-mulleri*, *Quercus berberidifolia*, and *Rhus ovata* characterize this shrubland. Scattered remnant pinyon and juniper trees may be present; however, in the western Mojave, *Juniperus californica* sometimes forms an open, shrubby tree layer with the evergreen oaks and other shrubs. Stands occur prominently across central Arizona (Mogollon Rim) and western New Mexico, south into mountains in the northwestern Chihuahuan region and Madrean Occidentale in northern Mexico, and north into extreme southwestern Utah and southern Nevada. It also occurs in mountains in the Sonora and western Mojave deserts, and extends from northeast Kern County, California, and south into Baja Norte, Mexico. Stands are found on foothills, xeric mountain slopes and canyons in hotter and drier habitats and often dominate along the mid-elevation transition zone between desert scrub and montane woodlands (1000-2200 m). Sites are often steep and rocky. Parent materials are varied and include basalt, diabases, gneiss, schist, shales, slates, sandstones and, more commonly, limestone and coarse-textured granitic substrates. Occasional desert scrub species may be present in drier, rockier, more open transition sites. Most chaparral species are fire-adapted, sprouting vigorously after burning or producing abundant fire-resistant seeds. Stands occurring within montane woodlands are seral and a result of recent fires.

The similar ~Eastern Madrean Chaparral Group (G280)\$\$ has floristics mostly derived from the Sierra Madre Oriental, whereas floristics of this group are derived from the Sierra Madre Occidentale. However, this group is not matorral (thornscrub) as it is typically dominated by shrubby evergreen oaks and chaparral species, not thornscrub species. More survey is needed to determine if *Quercus turbinella*, common in this group, also codominates in ~Eastern Madrean Chaparral Group (G280)\$\$.

***Diagnostic Characteristics:** This upland shrubland is characterized by Sierra Madre Occidentale evergreen sclerophyllous indicator species that may be present to dominant. These diagnostic species include evergreen shrubby oaks such as *Quercus turbinella*, *Quercus toumeyii* and, in western Mojave stands, *Quercus cornelius-mulleri* and *Quercus john-tuckeri*, as well as many other diagnostic species, including *Arctostaphylos glauca*, *Arctostaphylos pringlei*, *Cercocarpus montanus* var. *glaber*, *Cercocarpus montanus* var. *paucidentatus*, *Ceanothus greggii*, *Garrya flavescens*, *Garrya wrightii*, and *Rhus ovata*. Additional characteristic species include *Arctostaphylos patula*, *Juniperus californica*, *Nolina parryi*, and *Rhus trilobata*.

***Classification Comments:** The similar ~Eastern Madrean Chaparral Group (G280)\$\$ has floristics mostly derived from the Sierra Madre Oriental, whereas floristics of this group are derived from the Sierra Madre Occidentale. For now, this group includes warm-desert interior chaparrals found in the western Mojave and western Sonoran regions of southern California, but review may suggest splitting it into two groups. Relatively little is known of the "Mogollon Rim" or "Arizona" chaparral types (Carmichael et al. 1978, Brown 1982), so that it's hard to ascertain the floristic patterns adequately. While the main oaks are different in California, the important associated species are more widely distributed, from California east into New Mexico.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G261 | Californian Mesic & Pre-montane Chaparral | |
| G280 | Eastern Madrean Chaparral | |

Similar NVC Types General Comments [optional]:**VEGETATION**

Physiognomy and Structure Summary: This upland shrubland is typically dominated by a moderate to dense evergreen sclerophyllous shrub canopy usually less than 3 m tall. Herbaceous layers may be present and are typically dominated by perennial graminoids.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: The vegetation is characterized by a moderate to dense evergreen shrub layer dominated by sclerophyllous shrubs such as *Quercus turbinella* and *Ceanothus greggii*. Other common shrubs from the eastern portion of its range (Arizona and New Mexico) include *Cercocarpus montanus* var. *paucidentatus*, *Garrya wrightii*, *Purshia stansburiana*, *Quercus toumeyi*, *Rhus trilobata* with *Arctostaphylos pringlei* and *Arctostaphylos pungens* at higher elevations. In desert chaparral stands in the western extent, *Adenostoma sparsifolium*, *Arctostaphylos glauca*, *Cercocarpus montanus* var. *glaber* (= *Cercocarpus betuloides*), *Fremontodendron californicum*, *Garrya flavescens*, *Juniperus californica*, *Quercus berberidifolia*, *Quercus cornelius-mulleri*, *Quercus john-tuckeri*, *Rhus virens* var. *choriophylla*, and *Rhus ovata* characterize this shrubland. Scattered remnant pinyon and juniper trees may be present; however, in the western Mojave, *Juniperus californica* sometimes forms an open, shrubby tree layer over the evergreen oaks and other shrubs. Occasional desert scrub species may be present in drier, rockier, more open transition sites. The herbaceous layer is generally composed of grasses, such as *Bouteloua curtipendula*, *Bouteloua hirsuta*, *Bothriochloa barbinodis*, *Eragrostis intermedia*, *Lycurus phleoides*, *Muhlenbergia emersleyi*, *Muhlenbergia pauciflora*, and several species of *Aristida*, which are largely restricted to rocky, protected areas because of past heavy livestock grazing (Brown 1982a).

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Many of the communities in this group are dominated by fire-adapted shrubs. *Quercus cornelius-mulleri* sprouts vigorously from root crowns after fire. Since *Quercus cornelius-mulleri* chaparral occurs in areas of lower rainfall and sparser vegetation cover, it typically has less frequent fire and slower recovery rates than typical cismontane chaparral types elsewhere in California. *Quercus turbinella* in Arizona and New Mexico is a fire-type; it sprouts vigorously from the root crown and rhizomes. Typical fire intervals in Arizona exceed 74 years (Reid et al. 1999, Tirmenstein 1999d). Plants in the New York Mountains of California are tree-like, suggesting that fires have been absent for perhaps greater than 100 years. Instead, flooding has initiated stem breakage and sprouting of some canyon bottom stands.

ENVIRONMENT

Environmental Description: Stands are found on foothills, xeric mountain slopes and canyons in hotter and drier habitats and often dominate along the mid-elevation (1000-2200 m) transition zone between desert scrub and montane woodlands (encinal, pine-oak, and ponderosa pine). Sites are variable but often steep and rocky. Sometimes this group occurs in thickets along upper canyon watercourses and northerly upland slopes within the pinyon-juniper woodland zone. **Climate:** This is a group of warm semi-desert regions in the southwestern U.S. The climate is hot and may have a somewhat bi-modal precipitation regime with spring rains and warm-season monsoonal rains as well. Frosts occur in winter, and even sometime snows, which will melt rapidly. **Soil/substrate/hydrology:** Parent materials are varied and include basalt, diabases, gneiss, schist, shales, slates, sandstones and, more commonly, limestone and coarse-textured granitic substrates.

DISTRIBUTION

***Geographic Range:** This group occurs prominently across central Arizona (Mogollon Rim) and western New Mexico, south into mountains in the northwestern Chihuahuan region and Madrean Occidentale in northern Mexico. It also occurs in mountains in the Sonora and western Mojave deserts, extends from northeast Kern County, California, into Baja Norte, Mexico, and often dominates along the mid-elevation (1000-2200 m) transition zone between desert scrub and montane woodlands.

Nations: MX, US

States/Provinces: AZ, CA, MXBC, MXSO, NM, NV, TX, UT

USFS Ecoregions (2007) [optional]: 313A:CC, 313B:CC, 313C:CC, 313D:CC, 315A:CC, 315H:CC, 321A:CC, 322A:CC, 322B:CC, 322C:CC, 341A:CP, 341F:CC, M261E:CC, M313A:CC, M341C:??

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low

USNVC Confidence Comments [optional]:

HIERARCHY

*Lower Level NVC Types:

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3791 | <i>Cercocarpus montanus</i> Madrean Montane Chaparral Alliance |
| A3790 | <i>Arctostaphylos pungens</i> - <i>Arctostaphylos pringlei</i> - <i>Ceanothus greggii</i> Chaparral Alliance |
| A0793 | <i>Quercus turbinella</i> Chaparral Alliance |
| A3793 | <i>Quercus john-tuckeri</i> - <i>Quercus cornelius-mulleri</i> - <i>Fremontodendron californicum</i> Chaparral Alliance |
| A3792 | <i>Cercocarpus montanus</i> - <i>Eriogonum fasciculatum</i> - <i>Adenostoma sparsifolium</i> Western Mojave Desert Chaparral Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

*Recent Concept Lineage [if applicable]:

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| = | "Arizona" Chaparral | Brown 1982a | |
| = | Arizona Chaparral (503) | Shiflet 1994 | |

AUTHORSHIP

*Primary Concept Source [if applicable]: D.E. Brown (1982a)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

*Author of Description: K.A. Schulz

Acknowledgments [optional]:

Version Date: 05 Nov 2015

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*References [Required if used in text]:

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2.B.4.Nb. Pacific North American Coastal Scrub & Herb Vegetation (D027)

M059. Pacific Coastal Beach & Dune

2. Shrub & Herb Vegetation

2.B.4.Nb. Pacific North American Coastal Scrub & Herb Vegetation

G663. Californian Coastal Beach & Dune

Type Concept Sentence: This Californian coastal group consists of short (<1 m tall) shrublands on coastal sand dunes and beaches where *Artemisia californica*, *Artemisia pycnocephala*, *Ephedra californica*, *Ericameria ericoides*, *Isocoma menziesii*, *Lupinus chamissonis*, *Lupinus arboreus*, *Opuntia littoralis* and/or *Rhus integrifolia* partially stabilize sandy slopes along the coast of California north of Point Conception.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.B.4.Nb.2. Pacific Coastal Beach & Dune (M059)

Elcode: G663

***Scientific Name:** Californian Coastal Beach & Dune Group

***Common (Translated Scientific) Name:** Californian Coastal Beach & Dune Group

***Colloquial Name:** Californian Coastal Beach & Dune

***Type Concept:** This group consists of shrubs and subshrubs typically less than 1 m tall dominated by species such as *Artemisia californica*, *Artemisia pycnocephala*, *Ephedra californica*, *Ericameria ericoides*, *Isocoma menziesii*, *Lupinus chamissonis*, and *Opuntia littoralis*. The low-shrub canopy can be quite dense and continuous, intermittent, to very open. Shrub species include low subshrubs *Lupinus arboreus*, *Isocoma menziesii*, and *Ericameria ericoides*, and taller shrubs such as *Rhus integrifolia* and *Artemisia californica*. The herbaceous component may be abundant or sparse. This group occurs in areas where coastal sand has accumulated, on partially stabilized backdune slopes of sand bars, ridges, flats, river mouths, and spits along the coastline. Persistent onshore winds and salt spray are typical. Soils are well-drained sands, with low organic matter and nutrients. The climate is Mediterranean with mostly fall and winter precipitation and summers that are typically warm and dry. Winter temperatures are mild. This group occurs along the coast of California north of Point Conception.

***Diagnostic Characteristics:** Coastal sand dunes dominated by *Lupinus chamissonis*, *Lupinus arboreus*, *Isocoma menziesii*, and/or *Abronia latifolia*.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|-----------------------------------|-----------------------------------|
| G664 | Warm Pacific Coastal Beach & Dune | occurs south of Point Conception. |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Broad-leaved evergreen subshrubs generally <1 m in height.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This group is dominated by shifting-sand obligate species. Low-shrub canopy is open to very closed with dominants such as *Artemisia pycnocephala*, *Ephedra californica*, *Ericameria ericoides*, *Isocoma menziesii*, *Lupinus arboreus*, *Lupinus chamissonis*, and/or *Opuntia littoralis*. Taller shrubs such as *Rhus integrifolia* and *Artemisia californica* may be present as emergents. The herbaceous component may be abundant or sparse.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Const-ancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|------------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Shifting sand is required to maintain this group.

ENVIRONMENT

Environmental Description: This group occurs in areas where coastal sand has accumulated, on partially stabilized backdune slopes of sand bars, ridges, flats, river mouths, and spits along the coastline. Persistent onshore winds and salt spray are typical. Soils are well-drained sands, with low organic matter and nutrients. The climate is Mediterranean with mostly fall and winter precipitation and summers that are typically warm and dry. Winter temperatures are mild.

DISTRIBUTION

***Geographic Range:** This group is found along the coast of California north of Point Conception.

Nations: MX?, US

States/Provinces: CA, OR

USFS Ecoregions (2007) [optional]:

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A1614 | <i>Abronia latifolia</i> - <i>Ambrosia chamissonis</i> Dune Grassland Alliance |
| A0822 | <i>Isocoma menziesii</i> - <i>Lupinus chamissonis</i> - <i>Ericameria ericoides</i> Shrubland Alliance |

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A4120 | <i>Lupinus arboreus</i> Dune Scrub Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------------|---|-----------------------------|
| 2012-07-24 | G266 Baccharis pilularis - Diplacus aurantiacus Coastal Scrub Group | G266 split into G662 & G663 |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP***Primary Concept Source [if applicable]:** Faber-Langendoen et al.

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** G. Kittel**Acknowledgments [optional]:** Michael Barbour, Todd Keeler-Wolf

Version Date: 20 May 2015

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2. Shrub & Herb Vegetation

2.B.4.Nb. Pacific North American Coastal Scrub & Herb Vegetation

G498. North Pacific Maritime Coastal Beach & Dune

Type Concept Sentence: This group consists of herbaceous and shrubby vegetation on coastal sandy and cobble-on-sand beaches, beach dunes, and sand spits that occur along the Pacific coast from central California to Alaska and includes salt-tolerant forb communities that occur just above mean high tide dominated or codominated by *Abronia latifolia*, *Achillea millefolium* var. *borealis*, *Cochlearia groenlandica*, *Equisetum variegatum*, *Honckenya peploides*, *Lathyrus japonicus* var. *maritimus*, or *Mertensia maritima* and grassland communities that occur as dunes become higher and further away from beach and are dominated by *Leymus mollis*, *Leymus arenarius*, or *Festuca rubra*.

OVERVIEW***Hierarchy Level:** Group***Placement in Hierarchy:** 2.B.4.Nb.2. Pacific Coastal Beach & Dune (M059)

Elcode: G498

Scientific Name:** *Leymus mollis* - *Leymus arenarius* - *Abronia latifolia* Dune Grassland & Beach GroupCommon (Translated Scientific) Name:** American Dunegrass - Sand Ryegrass - Coastal Sand-verbena Dune Grassland & Beach Group***Colloquial Name:** North Pacific Maritime Coastal Beach & Dune

***Type Concept:** This group consists of herbaceous and shrubby vegetation on coastal sandy and cobble-on-sand beaches, beach dunes, and sand spits that occur along the Pacific coast from central California to Alaska, including coastlines on the Gulf of Alaska, the Aleutian Islands and further north, encompassing the arctic coastlines along the Bering Sea of western Alaska. Processes that define the group include sand and salt deposition, wind and water erosion, and overwash from storm surges. Soils are usually sandy and well-drained, though dune slacks may be poorly drained. Beaches and dunes are dominated by a mosaic of barren sands, herbaceous and scrub vegetation. This group includes dunes that may occur as much as 2 km inland which may or may not experience salt spray or storm surges. Patch size is small to moderate and often linear. Vegetation within this group includes grasslands, salt-tolerant forb communities and dwarf-shrublands. Salt-tolerant forb communities occur just above mean high tide and are dominated or codominated by *Abronia latifolia*, *Achillea millefolium* var. *borealis*, *Cochlearia groenlandica*, *Equisetum variegatum*, *Honckenya peploides*, *Lathyrus japonicus* var. *maritimus* (= *Lathyrus maritimus*), or *Mertensia maritima*. Grasslands communities occur on cobble beaches and on dunes that become higher and further away from beach and are dominated by *Leymus mollis*, *Leymus arenarius* (= *Elymus arenarius*), or *Festuca rubra* and may include other graminoids such as *Poa eminens*, *Hordeum brachyantherum*, and *Deschampsia beringensis*, and forbs such as *Abronia latifolia*, *Achillea millefolium* var. *borealis*, *Angelica genuflexa*, *Angelica lucida*, *Claytonia sibirica*, *Fragaria chiloensis*, *Heracleum maximum*, *Honckenya peploides*, *Lathyrus japonicus* var. *maritimus*, *Ligusticum scoticum*, *Lupinus nootkatensis*, *Potentilla villosa*, and *Senecio pseudoarnica*. Dwarf-shrub communities occur on older dunes, usually behind grassland-dominated dunes and are dominated by *Empetrum nigrum*, *Gaultheria shallon*, *Vaccinium ovatum*, *Myrica gale*, or *Salix* spp. Herbaceous species intermixed with dwarf-shrubs include *Lathyrus japonicus* var. *maritimus*, *Conioselinum chinense*, *Cornus suecica*, and *Cnidium cnidiifolium*.

***Diagnostic Characteristics:** Graminoid or broad-leaved herbaceous vegetation <1 m in height, usually rhizomatous or stoloniferous; occurs on beaches, sand dunes and cobble-on-sand coastlines along the immediate coast or no more than 2 km inland. Exposed to salt spray and storm surges. Vegetation is tolerant of salt spray. Total cover can be very low.

***Classification Comments:** This group includes dry to moderately well-drained herbaceous and scrubby vegetation. Flat to gently sloping cobble-on-sand beaches are included. Interdune wetlands and forested dunes are not included in this group. Rocky shores of predominantly bedrock or cobble-on-rock belong to ~North Pacific Coastal Cliff & Bluff Group (G554)\$.

At this time, no open inland dunes are known to exist in the region. Sites may exist in Oregon and Alaska [see ~North Pacific Active Inland Dune (CES204.861)\$], but they are not sufficiently documented to be tracked at this time.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|---|
| G554 | North Pacific Coastal Cliff & Bluff | has denser vegetation and occurs on steep cliffs and bluffs that are also exposed to salt spray, but not on sand dune substrates. |
| G517 | Vancouverian Freshwater Wet Meadow & Marsh | is a wetland type that may occur as rings around ponds in sand dunes, but are reliant on high water table. |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Vegetation is comprised of creeping to low-statured (<1 m) perennial grass, forb and shrub on salt-spray exposed coastlines. Graminoid herbaceous and/or low shrubby vegetation is <1 m in height and usually rhizomatous or stoloniferous. It occurs on beaches, sand dunes and cobble-on-sand coastlines along the immediate coast or no more than 2 km inland. Stands are exposed to salt spray and storm surges. Vegetation is tolerant of salt spray. Total cover can be very low.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This group consists of forb- and graminoid-dominated communities. Salt-tolerant forb communities occur just above mean high tide and are dominated or codominated by *Abronia latifolia*, *Achillea millefolium* var. *borealis*, *Cochlearia groenlandica*, *Equisetum variegatum*, *Honckenya peploides*, *Lathyrus japonicus* var. *maritimus* (= *Lathyrus maritimus*), or *Mertensia maritima*. Grasslands communities occur as dunes become higher and further away from beach and are dominated by *Leymus*

mollis, *Leymus arenarius* (= *Elymus arenarius*), or *Festuca rubra* and may include other graminoids such as *Poa eminens*, *Hordeum brachyantherum*, and *Deschampsia beringensis*, and forbs such as *Achillea millefolium* var. *borealis*, *Angelica genuflexa*, *Angelica lucida*, *Claytonia sibirica*, *Fragaria chiloensis*, *Heracleum maximum*, *Lathyrus japonicus* var. *maritimus*, *Ligusticum scoticum*, *Lupinus nootkatensis*, and *Senecio pseudoarnica*. Dwarf-shrub communities occur on older dunes, usually behind grassland-dominated dunes and are dominated by *Empetrum nigrum*, *Gaultheria shallon*, *Vaccinium ovatum*, *Myrica gale*, or *Salix* species. Herbaceous species intermixed with dwarf-shrubs include *Lathyrus japonicus* var. *maritimus*, *Conioselinum chinense*, *Cornus suecica*, and *Cnidium cnidiifolium*. Floristic information is summarized from the following sources: Shacklette et al. (1969), Byrd (1984), Talbot et al. (1984, 2006), Viereck et al. (1992), Talbot and Talbot (1994), Shephard (1995), DeVelice et al. (1999), Boggs (2000), Boggs et al. (2003), Croll et al. (2005), and Fleming and Spencer (2007).

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Const-ancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|------------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Processes that define the group include sand deposition, salt spray, wind erosion, long-shore transport, dune formation, and water erosion such as overwash from storm surges. Herbaceous species stabilize the sand deposits (dunes, beaches), and the older deposits support dwarf-shrubs mixed with herbaceous species.

ENVIRONMENT

Environmental Description: This group occurs on sandy beaches and dunes, with and without salt spray, within 2 km of the coast. Soils are usually sandy and well-drained; some areas may have a cobble layer on top of sand. Environmental information is summarized from the following sources: Shacklette et al. (1969), Byrd (1984), Talbot et al. (1984, 2006), Viereck et al. (1992), Talbot and Talbot (1994), Shephard (1995), DeVelice et al. (1999), Boggs (2000), Boggs et al. (2003), Croll et al. (2005), and Fleming and Spencer (2007).

DISTRIBUTION

***Geographic Range:** This group is restricted to the immediate sandy coastline (within 2 km) from the Alaskan western arctic coast and Aleutian Islands south through Alaska central and southeast coastline (including Kodiak and other islands), British Columbia, and Washington to the central Oregon coast (roughly Coos Bay) and continues to southern California, although with diminishing abundance due to development.

Nations: CA, US

States/Provinces: AK, BC, OR, WA

USFS Ecoregions (2007) [optional]: 242A:CC, M242A:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A2066 | <i>Poa macrantha</i> - <i>Leymus mollis</i> - <i>Festuca rubra</i> Sand Dune Grassland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------------|---|-----------------------|
| 2013-08-21 | G618 Vancouverian Shrub & Herb Dune Group | G618 merged into G498 |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** G. Kittel, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** G. Kittel

Acknowledgments [optional]:

Version Date: 09 Nov 2015

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2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland (D031)

M888. Arid West Interior Freshwater Marsh

2. Shrub & Herb Vegetation

2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

G531. Arid West Interior Freshwater Marsh

Type Concept Sentence: These arid west freshwater marshes are found at all elevations below alpine throughout the western interior basins and mountains of western North America, with dominant species such as *Carex pellita*, *Carex praegracilis*, *Eleocharis palustris*, *Juncus arcticus ssp. littoralis*, *Paspalum distichum*, *Schoenoplectus americanus*, *Schoenoplectus pungens*, *Typha domingensis*, *Typha latifolia*, and species of *Bidens*, *Cicuta*, *Cyperus*, *Mimulus*, and *Phalaris*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.C.4.Nb.1. Arid West Interior Freshwater Marsh (M888)

Elcode: G531

***Scientific Name:** *Schoenoplectus* spp. - *Typha* spp. Interior Freshwater Marsh Group

***Common (Translated Scientific) Name:** Clubbrush species - Cattail species Interior Freshwater Marsh Group

***Colloquial Name:** Arid West Interior Freshwater Marsh

***Type Concept:** These arid west freshwater marshes are found at all elevations below timberline throughout the western interior basins and mountains of western North America. Vegetation is characterized by a lush, dense herbaceous layer with low diversity, sometimes occurring as a monoculture. Structure varies from emergent forbs which barely reach the water surface to tall graminoids that reach as tall as 4 m high. Dominant species include *Carex pellita* (= *Carex lanuginosa*), *Carex praegracilis*, *Eleocharis palustris*, *Juncus arcticus ssp. littoralis* (= *Juncus balticus*), *Paspalum distichum*, *Schoenoplectus americanus*, *Schoenoplectus pungens*, *Typha domingensis*, *Typha latifolia*, and species of *Bidens*, *Cicuta*, *Cyperus*, *Mimulus*, and *Phalaris*. This group includes shallow freshwater to brackish waterbodies found in bottomlands along drainages, in river floodplain depressions, cienegas, oxbow lakes, below seeps, frequently flooded gravel bars, low-lying sidebars, in-fill side channels, small ponds, stockponds, ditches and slow-moving streams, perennial streams in valleys and mountain foothills, as well as in small depressions gouged into basalt by Pleistocene floods, channeled scablands of the Columbia Plateau and within dune fields in the intermountain western U.S. These wetlands are mostly small-patch, confined to limited areas in suitable floodplain or basin topography. They are mostly semipermanently flooded, but some marshes have seasonal hydrologic flooding. Water is on or above the surface for most of the growing season. A consistent source of freshwater is essential to the function of these communities. Soils are muck or mineral or muck over a mineral soil, and water is high-nutrient. It is often found along the borders of ponds, lakes or reservoirs that have more open water. Some occurrences are interdunal wetlands in wind deflation areas, where sands are scoured down to the water table. The water table may be perched over an impermeable layer of caliche or clay or, in the case of the Great Sand Dunes of Colorado, a geologic dike that creates a closed basin that traps water.

***Diagnostic Characteristics:** Temperate continental, permanently saturated to seasonally flooded wetlands, often with standing water for much of the year, dominated by emergent graminoid herbaceous vegetation. Characteristic dominant species include *Typha* spp., *Schoenoplectus* spp., *Eleocharis palustris*, *Carex praegracilis*, *Carex pellita*, and *Cyperus* spp.

***Classification Comments:** This group does not include oceanic saline-influenced tidal areas (coastal saline marshes and brackish marshes) which belong to ~Temperate Pacific Salt Marsh Group (G499)\$\$. Marshes in saline waters located at the edge of the Great Salt Lake are included in ~North American Desert Alkaline-Saline Marsh & Playa Group (G538)\$\$.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G521 | Vancouverian-Rocky Mountain Montane Wet Meadow & Marsh | |
| G524 | Western North American Ruderal Marsh, Wet Meadow & Shrubland | |
| G538 | North American Desert Alkaline-Saline Marsh & Playa | |
| G544 | Western North American Temperate Freshwater Aquatic Vegetation | |

Similar NVC Types General Comments [optional]:**VEGETATION**

Physiognomy and Structure Summary: Vegetation is characterized by a lush, dense to open emergent herbaceous layer. The emergent vegetation is characterized by graminoids, annual or perennial forbs or a mixture of all three. Heights varies from low forbs that barely breaking the water surface to tall graminoids up to 4 m high. Sites are permanently or seasonally inundated which prevents the establishment of woody species. Ponds typically have concentric rings or zones of vegetation.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: These arid west interior marshes are dominated by emergent herbaceous species, mostly graminoids (*Carex*, *Scirpus* and/or *Schoenoplectus*, *Eleocharis*, *Juncus*, *Typha*,) but also some forbs. Stands vary in diversity, with some stands occurring as a monoculture of one of the dominant genera. Dominant species include *Carex pellita* (= *Carex lanuginosa*), *Carex praegracilis*, *Eleocharis palustris*, *Juncus arcticus* ssp. *littoralis* (= *Juncus balticus*), *Paspalum distichum*, *Schoenoplectus americanus*, *Schoenoplectus pungens*, *Typha domingensis*, *Typha latifolia*, and species of *Bidens*, *Cicuta*, *Cyperus*, *Mimulus*, and *Phalaris*.

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Sites are depressions, ponds, springs, and riparian areas that are heavily inundated for at least part of the growing season which impedes the establishment of woody species. Isolated marshes in dune systems are subject to changes in size and location of the wet swales as the sand dunes shift, due to active dune migration. Dune "blowouts" and subsequent stabilization through succession are characteristic processes of the active dunes which surround the interdunal swales.

ENVIRONMENT

Environmental Description: *Climate:* Temperate Continental climate. Environmental settings include bottomlands along drainages, in river floodplain depressions, cienegas, oxbow lakes, below seeps, frequently flooded gravel bars, low-lying sidebars, infilled side channels, small ponds, stockponds, ditches and slow-moving streams, perennial streams in valleys and mountain foothills. Elevations range from 890 to 1560 m (2930-5120 feet). *Soil/substrate/hydrology:* Substrates are variable but are generally fine-textured, alkaline, alluvial soil, coarse loam, sandy loam, sand, silt or peat. Hydrologic regimes vary from seasonal inundation followed by complete soil desiccation to year-round standing water. Water may be poorly oxygenated and nitrogen-rich. They are mostly semipermanently flooded, but some marshes have seasonal hydrologic flooding. Water is at or above the surface for most of the growing season. A consistent source of freshwater is essential to the function of these systems. Soils are muck or mineral or muck over a mineral soil, and water is high-nutrient. Environmental information compiled from Bowers (1982, 1984, 1986), Banner et al. (1986, 1993), Lloyd et al. (1990), MacKinnon et al. (1990), Cooper and Severn (1992), Viereck et al. (1992), Shiflet (1994), Holland and Keil (1995), Shephard (1995), Steen and Coupe (1997), Hammond (1998), Pineada et al. (1999), Boggs (2000), Pineda (2000), Rondeau (2001), Brand and Sanderson (2002), and Chappell and Christy (2004).

DISTRIBUTION

***Geographic Range:** This group is found throughout the temperate western North America interior (Columbia Basin, Great Basin, Colorado Plateau, and higher intermountain basins of western North America). It is also known to occur in dune fields across the intermountain western U.S., including the Great Sand Dunes in southern Colorado and the Pink Coral Dunes in Utah, and may also occur in dune fields in northeastern Arizona and the Great Basin, as well as in southwestern Wyoming in the Killpecker Dunes and Ferris Dunes, and southern Idaho.

Nations: CA, MX, US

States/Provinces: AZ, BC, CA, CO, ID, KS, NM, NV, OK, OR, SD, TX, UT, WA, WY

USFS Ecoregions (2007) [optional]:

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3891 | <i>Eleocharis palustris</i> - <i>Eleocharis macrostachya</i> Marsh Alliance |

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3894 | <i>Paspalum distichum</i> Marsh Alliance |
| A3895 | <i>Schoenoplectus americanus</i> - <i>Schoenoplectus acutus</i> - <i>Schoenoplectus californicus</i> Marsh Alliance |
| A3896 | <i>Typha domingensis</i> - <i>Typha latifolia</i> - <i>Phragmites australis ssp. americanus</i> Western Marsh Alliance |
| A3892 | <i>Equisetum fluviatile</i> - <i>Equisetum x ferrissii</i> Marsh Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

*Recent Concept Lineage [if applicable]:

| Date | Predecessor | Note |
|------------|--|-----------------------|
| 2013-06-26 | G518 <i>Schoenoplectus</i> spp. - <i>Typha</i> spp. Western North American Temperate Interior Freshwater Marsh Group | G518 merged into G531 |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------------|---------------------|------|
| > | III.A.3.d - Fresh sedge marsh | Viereck et al. 1992 | |
| > | III.B.3.a - Fresh herb marsh | Viereck et al. 1992 | |
| > | Wetlands (217) | Shiflet 1994 | |

AUTHORSHIP

*Primary Concept Source [if applicable]: C. Chappell, R. Crawford, K.A. Schulz, in D. Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

*Author of Description: M.E. Hall, G. Kittel and J. Christy

Acknowledgments [optional]: J. Christy

Version Date: 02 Dec 2015

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M075. Western North American Montane-Subalpine-Boreal Marsh, Wet Meadow & Shrubland

2. Shrub & Herb Vegetation

2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

G526. Rocky Mountain-Great Basin Lowland-Foothill Riparian Shrubland

Type Concept Sentence: This group consists of riparian shrublands dominated by low to tall shrubs such as *Acer glabrum*, *Artemisia* spp., *Cornus sericea*, *Crataegus* spp., *Dasiphora fruticosa* ssp. *floribunda*, *Forestiera pubescens*, *Oplopanax horridus*, *Philadelphus lewisii*, *Prunus virginiana*, *Rhus trilobata*, *Rosa* spp., *Salix* spp., *Shepherdia argentea*, and *Symphoricarpos* spp. They do not occur up in the mountains, but rather in between mountain valleys and lowlands of the Interior West.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.C.4.Nb.2. Western North American Montane-Subalpine-Boreal Marsh, Wet Meadow & Shrubland (M075)

Elcode: G526

***Scientific Name:** *Salix exigua* - *Crataegus* spp. - *Forestiera pubescens* Rocky Mountain-Great Basin Riparian Shrubland Group

***Common (Translated Scientific) Name:** Narrowleaf Willow - Hawthorn species - Stretchberry Rocky Mountain-Great Basin Riparian Shrubland Group

***Colloquial Name:** Rocky Mountain-Great Basin Lowland-Foothill Riparian Shrubland

***Type Concept:** These short to tall shrublands (0.5-5 m in height) occur along streams at and below lower treeline, that is, not up in the mountains, but in between mountain valleys and lowlands of the Interior West. Dominant shrubs include *Acer glabrum*, *Artemisia cana*, *Artemisia cana* ssp. *bolanderi*, *Artemisia cana* ssp. *viscidula*, *Artemisia tridentata* ssp. *tridentata*, *Cornus sericea*, *Crataegus douglasii*, *Crataegus rivularis*, *Dasiphora fruticosa* ssp. *floribunda*, *Forestiera pubescens*, *Oplopanax horridus*, *Philadelphus lewisii*, *Prunus virginiana*, *Rhus trilobata*, *Rosa nutkana*, *Rosa woodsii*, *Salix exigua*, *Salix irrorata*, *Salix melanopsis*, *Shepherdia argentea*, and *Symphoricarpos* spp. Herbaceous layers are often dominated by *Athyrium filix-femina*, *Carex flava* (= *Carex nevadensis*), *Carex* spp., *Elymus trachycaulus*, *Equisetum arvense*, *Deschampsia cespitosa*, *Festuca idahoensis*, *Galium triflorum*, *Glyceria striata*, *Gymnocarpium dryopteris*, *Heraclium maximum*, *Iris missouriensis*, *Juncus arcticus* ssp. *littoralis* (= *Juncus balticus*), *Juncus* spp., *Leymus cinereus*, *Maianthemum stellatum*, *Muhlenbergia filiformis*, *Muhlenbergia richardsonis*, *Pascopyrum smithii*, *Poa cusickii*, and *Poa secunda* (= *Poa nevadensis*). Introduced forage species such as *Agrastis stolonifera*, *Poa pratensis*, *Phleum pratense*, and the invasive annual *Bromus tectorum* are often present in disturbed stands. Streams are permanent, intermittent and ephemeral. Stands occur in steep-sided canyons or in broad flat valleys. They can be large, wide occurrences on mid-channel islands in larger rivers or narrow bands on small, rocky canyon tributaries and well-drained benches. They also are typically found in backwater channels and other perennially wet but less scoured sites, such as floodplain swales and irrigation ditches, and they can occur in depressional wetlands and non-alkaline playas. Stands may also occur on upper benches away from active channel movement. Willow-dominated shrublands require flooding and bare gravels for reestablishment. Stands are maintained by annual flooding and hydric soils throughout the growing season. Sites are subject to temporary flooding during spring runoff. The water table is often just below the ground surface. Occurrences are found within the flood zone of rivers, on islands, sand or cobble bars, and immediate streambanks and upper benches, and occasionally on hillslope springs. This group occurs throughout the Rocky Mountain and Colorado Plateau regions from approximately 780 to 1850 m (2560-6000 feet) in elevation, around the edges and between the mountain ranges of the Great Basin and along the lower eastern slope of the Sierra Nevada at about 1220 m (4000

feet) in elevation, at lowland and montane elevations in the Columbia Plateau, on the periphery of the mountains surrounding the Columbia River Basin, and along major tributaries and the main stem of the Columbia at relatively low elevations. It also occurs in the foothills of the northern Rocky Mountains and the east slopes of the Cascades in the lower montane and foothill zones. Climate is generally semi-arid.

***Diagnostic Characteristics:** Short to tall (0.5-5 m) riparian and wetland shrublands at foothill and lower elevations of the temperate interior West.

***Classification Comments:** This group represents a range of short to tall shrubs (0.5-5 m in height). This group also represents lower elevation and foothill elevations shrublands. Higher elevation shrublands belong to ~Western Montane-Subalpine Riparian & Seep Shrubland Group (G527)\$.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|--|
| G322 | Vancouverian Wet Shrubland | |
| G527 | Western Montane-Subalpine Riparian & Seep Shrubland | includes riparian shrublands that occur at high elevations and are dominated by more montane species, for example <i>Salix monticola</i> . |
| G545 | Colorado Plateau Hanging Garden Seep | |
| G568 | Great Plains Riverscours Vegetation | |
| G337 | Great Plains Riparian Wet Meadow & Shrubland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Wetland and mesic shrublands dominated by short to tall shrubs (0.5-5 m).

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Dominant shrubs include *Acer glabrum*, *Amelanchier alnifolia*, *Artemisia cana* ssp. *bolanderi*, *Artemisia cana* ssp. *viscidula*, *Artemisia cana*, *Artemisia tridentata* ssp. *tridentata*, *Cornus sericea*, *Crataegus douglasii*, *Crataegus rivularis*, *Dasiphora fruticosa* ssp. *floribunda*, *Forestiera pubescens*, *Oplopanax horridus*, *Philadelphus lewisii*, *Prunus virginiana*, *Rhus trilobata*, *Rosa nutkana*, *Rosa woodsii*, *Salix exigua* (= ssp. *exigua*), *Salix irrorata*, *Salix melanopsis*, *Shepherdia argentea*, and *Symphoricarpos* spp. Herbaceous layers are often dominated by *Athyrium filix-femina*, *Carex flava* (= *Carex nevadensis*), *Carex* spp., *Elymus trachycaulus*, *Equisetum arvense*, *Deschampsia cespitosa*, *Festuca idahoensis*, *Galium triflorum*, *Glyceria striata*, *Gymnocarpium dryopteris*, *Heracleum maximum*, *Iris missouriensis*, *Juncus arcticus* ssp. *littoralis* (= *Juncus balticus*), *Juncus* spp., *Leymus cinereus*, *Maianthemum stellatum*, *Muhlenbergia filiformis*, *Muhlenbergia richardsonis*, *Pascopyrum smithii*, *Poa cusickii*, and *Poa secunda* (= *Poa nevadensis*). Introduced forage species such as *Agrostis stolonifera*, *Poa pratensis*, *Phleum pratense*, and the invasive annual *Bromus tectorum* are often present in disturbed stands. Floristic information was compiled from the following sources: Daubenmire (1952), Johnson and Simon (1985), Kovalchik (1987, 1992), Hansen et al. (1989), Manning and Padgett (1989, 1995), Padgett et al. (1989), Szaro (1989), MacKinnon et al. (1990), Banner et al. (1993), DeLong et al. (1993), Sawyer and Keeler-Wolf (1995), Walford (1996), Crowe and Clausnitzer (1997), Steen and Coupe (1997), Walford et al. (1997, 2001), Kittel et al. (1999b), Muldavin et al. (2000a), DeLong (2003), MacKenzie and Moran (2004), and Sawyer et al. (2009).

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Willow-dominated associations are disturbance-driven systems that require flooding, scour and deposition for germination and maintenance. Livestock grazing is a major influence in altering structure, composition, and function of the community (Baker 1988, 1989a, Padgett et al. 1989).

ENVIRONMENT

Environmental Description: *Climate:* Climate is generally semi-arid continental with typically cold winters and hot summers. *Soil/substrate/hydrology:* These shrublands occur along all streams at and below lower treeline, that is, not up in the mountains, but in the between- mountain valleys and lowlands of the interior west. Streams are permanent, intermittent and ephemeral. Stands occur in steep-sided canyons or in broad flat valleys. They can be large, wide occurrences on mid-channel islands in larger rivers or narrow bands on small, rocky canyon tributaries and well-drained benches. They also are typically found in backwater channels and other perennially wet but less scoured sites, such as floodplain swales and irrigation ditches, and they can occur in depressional wetlands and non-alkaline playas, on hillside seeps and springs. These shrublands require flooding and bare gravels for reestablishment. Willow-dominated stands are maintained by annual flooding and hydric soils throughout the growing season. Sites are subject to temporary flooding during spring runoff. The water table is often just below the ground surface. Occurrences are found within the flood zone of rivers, on islands, sand or cobble bars, immediate streambanks and upper benches. Soils are typically alluvial deposits of sand, clays, silts and cobbles that are highly stratified with depth due to flood scour and deposition. Highly stratified profiles consist of alternating layers of clay loam and organic material with coarser sand or thin layers of sandy loam over very coarse alluvium. Soils are fine-textured with organic material over coarser alluvium. Some soils are more developed due to a slightly more stable environment and greater input of organic matter. Environmental information was compiled from the following sources: Daubenmire (1952), Johnson and Simon (1985), Kovalchik (1987, 1992), Hansen et al. (1989), Manning and Padgett (1989, 1995), Padgett et al. (1989), Szaro (1989), MacKinnon et al. (1990), Banner et al. (1993), Delong et al. (1993), Sawyer and Keeler-Wolf (1995), Walford (1996), Crowe and Clausnitzer (1997), Steen and Coupe (1997), Walford et al. (1997, 2001), Kittel et al. (1999b), Muldavin et al. (2000a), Delong (2003), MacKenzie and Moran (2004), and Sawyer et al. (2009).

DISTRIBUTION

***Geographic Range:** This group is found throughout the Rocky Mountain and Colorado Plateau regions from approximately 900 to 1850 m (3000-6000 feet) in elevation, in the mountain ranges of the Great Basin and along the eastern slope of the Sierra Nevada from about 1220 m (4000 feet) in elevation, at lowland and montane elevations in the Columbia Plateau, on the periphery of the mountains surrounding the Columbia River Basin, and along major tributaries and the main stem of the Columbia at relatively low elevations. It also occurs in the northern Rocky Mountains and the east slopes of the Cascades in the lower montane and foothill zones.

Nations: CA, US

States/Provinces: AB, AZ, BC, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY

USFS Ecoregions (2007) [optional]: 313A:CC, 313B:CC, 313D:CC, 315A:CC, 315H:CC, 321A:CC, 322A:CC, 331A:CC, 331B:CC, 331D:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 331J:CC, 331K:C?, 331N:CP, 341A:CC, 341B:CC, 341C:CC, 341D:CC, 341E:CC, 341F:CC, 341G:CC, 342A:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:CC, 342I:CC, 342J:CC, M242C:CC, M242D:CP, M261D:CC, M261E:CC, M261G:CC, M313A:CC, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M341A:CC, M341B:CC, M341C:CC, M341D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3800 | <i>Salix exigua</i> - <i>Salix irrorata</i> Shrubland Alliance |
| A2557 | <i>Artemisia cana</i> Wet Shrubland Alliance |
| A3799 | <i>Rhus trilobata</i> - <i>Crataegus rivularis</i> - <i>Forestiera pubescens</i> Shrubland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-----------------------------|----------------|--|
| > | Riparian (422) | Shiflet 1994 | |
| >< | Other Sagebrush Types (408) | Shiflet 1994 | Artemisia cana ssp. viscidula shrublands are included. |

AUTHORSHIP

*Primary Concept Source [if applicable]: G. Kittel, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

*Author of Description: G. Kittel

Acknowledgments [optional]: J. Nachlinger, K. Schulz, J. Kagan, M.S. Reid

Version Date: 02 Dec 2015

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2. Shrub & Herb Vegetation

2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

G521. Vancouverian-Rocky Mountain Montane Wet Meadow & Marsh

Type Concept Sentence: This group consists of wet meadows dominated by graminoids such as *Calamagrostis canadensis*, *Carex aquatilis*, *Carex utriculata*, and *Eleocharis palustris* or forbs such as *Camassia quamash*, *Cardamine cordifolia*, *Dodecatheon jeffreyi*, *Phippsia algida*, *Rorippa alpina*, *Senecio triangularis*, and *Veratrum californicum* found throughout low and high montane altitudes of the western U.S. and Canada.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.C.4.Nb.2. Western North American Montane-Subalpine-Boreal Marsh, Wet Meadow & Shrubland (M075)

Elcode: G521

***Scientific Name:** *Carex* spp. - *Calamagrostis* spp. Montane Wet Meadow & Marsh Group

***Common (Translated Scientific) Name:** Sedge species - Reedgrass species Montane Wet Meadow & Marsh Group

***Colloquial Name:** Vancouverian-Rocky Mountain Montane Wet Meadow & Marsh

***Type Concept:** This group contains the wet meadows found in low and high montane and subalpine elevations, occasionally reaching into the lower edges of the alpine elevations (about 1000-3600 m), from California's Transverse and Peninsular ranges north to British Columbia's Coastal Mountains and from throughout the Rocky Mountains of Canada and the U.S. (including the Black Hills of South Dakota) and mountain ranges of the intermountain Interior West. Varying dominant herbaceous species include graminoids *Calamagrostis canadensis*, *Calamagrostis stricta*, *Carex bolanderi*, *Carex exsiccata*, *Carex illota*, *Carex microptera*, *Carex scopulorum*, *Carex utriculata*, *Carex vernacula*, *Deschampsia cespitosa*, *Eleocharis quinqueflora*, *Glyceria striata* (= *Glyceria elata*), *Juncus drummondii*, *Juncus nevadensis*, and *Scirpus* and/or *Schoenoplectus* spp. Forb species include *Camassia quamash*, *Cardamine cordifolia*, *Dodecatheon jeffreyi*, *Phippsia algida*, *Rorippa alpina*, *Senecio triangularis*, *Trifolium parryi*, and *Veratrum californicum*. Common but sparse shrubs may include *Betula glandulosa*, *Salix* spp., *Vaccinium macrocarpon*, and *Vaccinium uliginosum*. Wet meadows occur in open wet depressions, basins and flats with low-velocity surface and subsurface flows. They can be large meadows in montane or subalpine valleys, or occur as narrow strips bordering ponds, lakes and streams, and along toeslope seeps. They are typically found on flat areas or gentle slopes, but may also occur on subirrigated sites with slopes up to 10%. In alpine regions, sites typically are small depressions located below late-melting snow patches. Sites are usually seasonally wet, often drying by late summer, and many occur in a tension zone between perennial wetlands and uplands, where water tables fluctuate in response to long-term climatic cycles. They may have surface water for part of the year, but depths rarely exceed a few centimeters. Wet meadows can be tightly associated with snowmelt and typically are not subjected to high velocity disturbance, but can be flooded by slow-moving waters. Soils are mostly mineral and show typical hydric soil characteristics such as low chroma and redoximorphic features; some areas may have high organic content as inclusions or pockets. Vegetation of this group can manifest as a mosaic of several plant associations, or be a monotypic stand of a single association which is dominated by graminoids or forbs.

***Diagnostic Characteristics:** Perennial herbaceous wet meadows found in the montane, subalpine and lower alpine elevations (about 1000-3600 m) of western mountain ranges. Sites are usually seasonally wet, often drying by late summer, and many occur in a tension zone between perennial wetlands and uplands, where water tables fluctuate in response to long-term climatic cycles.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|--|
| G520 | Vancouverian-Rocky Mountain Subalpine-Alpine Snowbed, Wet Meadow & Dwarf-shrubland | is more or less a strictly alpine group that occurs at higher elevations with different dominant species, and is restricted to alpine or upper subalpine environments; however, it may be adjacent to or even overlap with G521 in some areas. |
| G517 | Vancouverian Freshwater Wet Meadow & Marsh | occurs at lower elevations within 2 miles of coast. |
| G524 | Western North American Ruderal Marsh, Wet Meadow & Shrubland | |
| G531 | Arid West Interior Freshwater Marsh | |
| G545 | Colorado Plateau Hanging Garden Seep | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Open wet meadows dominated by perennial cold-dormant graminoids or forbs, usually less than 1 m in height, often a pocket surrounded by forests. Wet meadows may be large and carpet an entire valley floor, or they can be very small patches or narrow linear strips. They can also occur in complex mosaics of meadows intermixed with patches of dwarf- or tall shrublands.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Vegetation of this group can manifest as a mosaic of several plant associations, or be a monotypic stand of a single association which is dominated by graminoids or forbs. Varying dominant herbaceous species include graminoids *Calamagrostis canadensis*, *Calamagrostis stricta*, *Carex bolanderi*, *Carex utriculata*, *Carex illota*, *Carex exsiccata*, *Carex nigricans*, *Carex microptera*, *Carex scopulorum*, *Carex vernacula*, *Deschampsia cespitosa*, *Eleocharis quinqueflora*, *Glyceria striata* (= *Glyceria elata*), *Juncus drummondii*, *Juncus nevadensis*, and *Scirpus* and/or *Schoenoplectus* spp. Forb species may include *Camassia quamash*, *Cardamine cordifolia*, *Caltha leptosepala*, *Dodecatheon jeffreyi*, *Phippsia algida*, *Rorippa alpina*, *Senecio triangularis*, *Trifolium parryi*, *Trollius laxus*, and *Veratrum californicum*. Common but sparse shrubs may include *Salix* spp., *Vaccinium uliginosum*, *Betula glandulosa*, and *Vaccinium macrocarpon*. Floristic information compiled from Komarkova (1976, 1986), Nachlinger (1985), Kovalchik (1987, 1993), Barbour and Major (1988), Meidinger et al. (1988), Padgett et al. (1988a), Lloyd et al. (1990), Banner et al. (1993), DeLong et al. (1993), Manning and Padgett (1995), Sawyer and Keeler-Wolf (1995), Sanderson and Kettler (1996), Crowe and Clausnitzer (1997), Steen and Coupe (1997), Kittel et al. (1999b), and MacKenzie and Moran (2004).

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Const-ancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|------------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: This group has soils that may be flooded or saturated throughout the growing season. It may also occur on areas with soils that are only saturated early in the growing season, or intermittently. Typically these associations are tolerant of moderate-intensity surface fires and late-season livestock grazing (Kovalchik 1987). Most appear to be relatively stable types, although in some areas these may be impacted by intensive livestock grazing.

ENVIRONMENT

Environmental Description: Soil/substrate/hydrology: Wet meadows are typically found on flat areas or gentle slopes, but may also occur on subirrigated sites with slopes up to 10%. In alpine regions, sites typically are small depressions located below late-melting snow patches. Sites are usually seasonally wet, often drying by late summer, and many occur in a tension zone between perennial wetlands and uplands, where water tables fluctuate in response to long-term climatic cycles. They may have surface water for part of the year, but depths rarely exceed a few centimeters. Wet meadows can be tightly associated with snowmelt and typically are not subjected to high velocity disturbance, but can be flooded by slow-moving waters. Moisture for these wet meadow community types is acquired from groundwater, stream discharge, overland flow, overbank flow, and on-site precipitation. Salinity and alkalinity are generally low due to the frequent flushing of moisture through the meadow. Depending on the slope, topography, hydrology, soils and substrate, intermittent, ephemeral, or permanent pools may be present.

These areas may support species more representative of purely aquatic environments. Standing water may be present during some or all of the growing season, with water tables typically remaining at or near the soil surface. Fluctuations of the water table throughout the growing season are not uncommon, however. On drier sites supporting the less mesic types, the late-season water table may be 1 m or more below the surface.

Soils are mostly mineral and show typical hydric soil characteristics such as low chroma and redoximorphic features; some areas may have high organic content as inclusions or pockets. Soils may have organic soils inclusions. The presence and amount of organic matter may vary considerably depending on the frequency and magnitude of alluvial deposition (Kittel et al. 1999b). Organic composition of the soil may include a thin layer near the soil surface or accumulations of highly sapric material of up to 120 cm thick. Soils may exhibit gleying and/or mottling throughout the profile. Wet meadows provide important water filtration, flow attenuation, and wildlife habitat functions. Environmental information compiled from Komarkova (1976, 1986), Nachlinger (1985), Kovalchik (1987, 1993), Barbour and Major (1988), Meidinger et al. (1988), Padgett et al. (1988a), Lloyd et al. (1990), Banner et al. (1993), DeLong et al. (1993), Manning and Padgett (1995), Sawyer and Keeler-Wolf (1995), Sanderson and Kettler (1996), Crowe and Clausnitzer (1997), Steen and Coupe (1997), Kittel et al. (1999b), and MacKenzie and Moran (2004).

DISTRIBUTION

***Geographic Range:** This group occurs in the mountains in California's Transverse and Peninsular ranges north to British Columbia's coastal ranges and is found throughout the Rocky Mountains (including the Black Hills of South Dakota) of the U.S. and Canada as well as the intermountain ranges of the interior west, ranging in elevation from montane to alpine (1000-3600 m).

Nations: CA, MX?, US

States/Provinces: AB, AK?, AZ, BC, CA, CO, ID, MT, NM, NV, OR, SD, UT, WA, WY

USFS Ecoregions (2007) [optional]: 262A:PP, 263A:PP, 313A:CP, 313B:CC, 313D:C?, 315A:C?, 315B:C?, 315H:CC, 321A:??, 322A:CC, 331A:CP, 331H:CP, 331I:CP, 331J:CC, 341A:CC, 341B:CC, 341C:CC, 341D:CC, 341F:CP, 341G:CP, 342B:CC, 342C:CC, 342D:C?, 342E:CC, 342F:CP, 342G:CC, 342H:CC, 342I:CP, 342J:CP, M242A:CC, M242B:CC, M242C:CC, M242D:CP, M261A:CC, M261B:CC, M261D:CC, M261E:CC, M261F:CC, M261G:CC, M313A:CC, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M334A:PP, M341A:CP, M341B:CC, M341C:CC, M341D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

*Plot Analysis Summary [Med - High Confidence]:

*Plots Used to Define the Type [Med - High Confidence]:

CONFIDENCE LEVEL

USNVC Confidence Level: High

USNVC Confidence Comments [optional]:

HIERARCHY

*Lower Level NVC Types:

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A2584 | <i>Carex amplifolia</i> - <i>Carex interior</i> - <i>Carex sheldonii</i> Wet Meadow Alliance |
| A2564 | <i>Elymus glaucus</i> - <i>Carex pellita</i> - <i>Carex feta</i> Wet Meadow Alliance |
| A3815 | <i>Calamagrostis canadensis</i> - <i>Calamagrostis stricta</i> - <i>Poa palustris</i> Wet Meadow Alliance |
| A3810 | <i>Saxifraga odontoloma</i> - <i>Senecio triangularis</i> - <i>Mertensia ciliata</i> Wet Meadow Alliance |
| A3806 | <i>Carex praegracilis</i> - <i>Carex scopulorum</i> - <i>Eleocharis quinqueflora</i> Wet Meadow Alliance |
| A3807 | <i>Eleocharis palustris</i> - <i>Eleocharis acicularis</i> Marsh Alliance |
| A3809 | <i>Heracleum maximum</i> - <i>Veratrum californicum</i> - <i>Rorippa</i> spp. Wet Meadow Alliance |
| A3812 | <i>Mimulus</i> spp. - <i>Primula parryi</i> - <i>Dodecatheon redolens</i> Wet Meadow Alliance |
| A3814 | <i>Danthonia</i> spp. - <i>Camassia</i> spp. Wet Meadow Alliance |
| A3813 | <i>Carex densa</i> Wet Meadow Alliance |
| A2642 | <i>Argentina anserina</i> Wet Meadow Alliance |
| A3539 | <i>Equisetum arvense</i> - <i>Equisetum hyemale</i> - <i>Equisetum variegatum</i> Wet Meadow Alliance |
| A3804 | <i>Carex aquatilis</i> - <i>Carex utriculata</i> - <i>Deschampsia cespitosa</i> Wet Meadow Alliance |
| A1374 | <i>Juncus arcticus</i> ssp. <i>littoralis</i> - <i>Juncus mexicanus</i> Wet Meadow Alliance |
| A1361 | <i>Poa glauca</i> Wet Meadow Alliance |
| A3805 | <i>Carex nebrascensis</i> - <i>Carex vesicaria</i> - <i>Carex pellita</i> Wet Meadow Alliance |
| A3808 | <i>Glyceria grandis</i> - <i>Glyceria striata</i> - <i>Glyceria borealis</i> Wet Meadow Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

*Recent Concept Lineage [if applicable]:

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--------------------------------|----------------|--|
| > | Alpine Grassland (213) | Shiflet 1994 | SRM type 213 includes all alpine communities in Sierra, Klamath and California Cascades, both herbaceous and shrub-dominated, and wet meadows. |
| > | Montane Meadows (216) | Shiflet 1994 | |
| >< | Tufted Hairgrass - Sedge (313) | Shiflet 1994 | Wetter portions of this SRM type overlap with this group. |
| >< | Tall Forb (409) | Shiflet 1994 | Forb-dominated wet meadows are included in this group. |

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|---|
| >< | Alpine Rangeland (410) | Shiflet 1994 | Alpine wet meadows are included in this SRM type. |

AUTHORSHIP

***Primary Concept Source [if applicable]:** P. Comer and G. Kittel, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** P. Comer, G. Kittel and C. Chappell

Acknowledgments [optional]:

Version Date: 02 Dec 2015

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2. Shrub & Herb Vegetation

2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

G520. Vancouverian-Rocky Mountain Subalpine-Alpine Snowbed, Wet Meadow & Dwarf-shrubland

Type Concept Sentence: These alpine herbaceous and dwarf-shrub communities are found on wet sites throughout the western U.S. and Canada in high mountainous regions. They are dominated by graminoids such as *Carex illota*, *Carex lachenalii*, *Carex nigricans*, *Carex vernacula*, *Deschampsia cespitosa*, *Juncus drummondii*, or forbs *Caltha leptosepala*, *Trollius laxus*, *Phippisia algida*, *Rorippa alpina*, *Sibbaldia procumbens*, and *Trifolium parryi*, as well as dwarf-shrubs that may also be scattered to moderately dense, including *Dasiphora*, *Kalmia*, *Salix* or *Vaccinium* species.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.C.4.Nb.2. Western North American Montane-Subalpine-Boreal Marsh, Wet Meadow & Shrubland (M075)

Elcode: G520

***Scientific Name:** *Caltha leptosepala* - *Carex nigricans* - *Kalmia microphylla* Subalpine-Alpine Snowbed, Wet Meadow & Dwarf-shrubland Group

***Common (Translated Scientific) Name:** White Marsh-marigold - Black Alpine Sedge - Alpine Laurel Subalpine-Alpine Snowbed, Wet Meadow & Dwarf-shrubland Group

***Colloquial Name:** Vancouverian-Rocky Mountain Subalpine-Alpine Snowbed, Wet Meadow & Dwarf-shrubland

***Type Concept:** These are high-elevation communities found throughout the Rocky Mountains, Pacific Northwest and Intermountain West regions, dominated by herbaceous species found on wetter sites with very low-velocity surface and subsurface flows. They range in elevation from upper subalpine to alpine (1500-3600 m) depending on latitude. These types occur as large meadows in subalpine valleys, as narrow strips bordering ponds, lakes and streams, and along toeslope seeps. They are typically found on flat areas or gentle slopes, but may also occur on subirrigated sites with slopes up to 10%. In alpine regions, sites typically are small depressions located below late-melting snow patches or on snowbeds. Soils of this group are mineral or with a thin (<40 cm) organic layer over mineral layers (aka not peatland). Soils show hydric soil characteristics, including high organic content and/or low chroma and redoximorphic features. This group often occurs as a mosaic of several plant associations, often dominated by

graminoids such as *Carex illota*, *Carex lachenalii*, *Carex nigricans*, *Carex vernacula*, *Deschampsia cespitosa*, *Juncus drummondii*, and forbs *Caltha leptosepala*, *Trollius laxus*, *Phippsia algida*, *Rorippa alpina*, *Sibbaldia procumbens*, and *Trifolium parryi*. Often scattered to moderately dense dwarf-shrubs are present, especially *Dasiphora*, *Kalmia*, *Salix* or *Vaccinium*, which when present form alpine dwarf-shrublands. Wet meadows are tightly associated with snowmelt and typically not subjected to high disturbance events such as flooding.

***Diagnostic Characteristics:** This group includes open to closed-canopy herbaceous stands dominated by Rocky Mountain alpine wetland species as well as open to closed dwarf-shrublands. Wetland graminoids may include *Carex illota*, *Carex lachenalii*, *Carex nigricans*, *Carex vernacula*, *Deschampsia cespitosa*, *Juncus drummondii*, and *Juncus mertensianus*; forbs include *Caltha leptosepala*, *Trollius laxus*, *Parnassia fimbriata*, *Phippsia algida*, *Polygonum bistortoides*, *Rorippa alpina*, *Sibbaldia procumbens*, and *Trifolium parryi*. Scattered to moderately dense dwarf-shrubs may also be present, especially *Dasiphora fruticosa ssp. floribunda* and *Kalmia microphylla*, which form alpine dwarf-shrublands.

***Classification Comments:** This group includes sparsely vegetated alpine areas that nonetheless have lush wet meadows and dwarf-shrublands are included together in one group because the alpine mesic floristic composition is more diagnostic than vegetation structure. This might be confusing with ~Rocky Mountain-Sierran Alpine Dwarf-shrubland & Krummholz Group (G316)\$\$ because it includes mesic dwarf-shrublands; however, this group includes the true wetland associations.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|--|
| G271 | Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow | |
| G521 | Vancouverian-Rocky Mountain Montane Wet Meadow & Marsh | is lower in elevation (montane to subalpine) and may overlap slightly but has a different suite of dominant species than G520. |
| G320 | North Pacific Alpine-Subalpine Tundra | is similar in structure but does not contain wetland associations. |
| G316 | Rocky Mountain-Sierran Alpine Dwarf-shrubland & Krummholz | is similar in structure but does not contain wetland associations. |
| G317 | North Pacific Alpine-Subalpine Dwarf-shrubland & Heath | is similar in structure but does not contain wetland associations. |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group is variable structurally and includes open to closed-canopy, graminoid- and forb-dominated herbaceous stands as well as stands dominated by dwarf-shrublands. Sometimes rings of different plant communities form around a late-melting snowbed because of different soil moisture requirements (drier turf species on outside edges, wetland species near the middle and sometimes a sparsely vegetated center because of the extremely short growing season).

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This group often occurs as a mosaic of several plant associations, often dominated by graminoids, including *Carex illota*, *Carex lachenalii*, *Carex nigricans*, *Carex vernacula*, *Deschampsia cespitosa*, *Juncus drummondii*, *Juncus mertensianus*, and forbs *Caltha leptosepala*, *Trollius laxus*, *Parnassia fimbriata*, *Phippsia algida*, *Polygonum bistortoides*, *Rorippa alpina*, *Sibbaldia procumbens*, and *Trifolium parryi*. Often scattered to moderately dense dwarf-shrubs are present, especially *Dasiphora fruticosa ssp. floribunda*, *Kalmia microphylla*, or *Vaccinium uliginosum*, which form alpine dwarf-shrublands. Wet meadows are tightly associated with snowmelt and typically not subjected to high disturbance events such as flooding. Floristic information was compiled from Willard (1963), Komarkova (1976, 1986), Nachlinger (1985), Cooper (1986b), Kovalchik (1987, 1993), Padgett et al. (1988a), Reed (1988), Meidinger and Pojar (1991), Shiflet (1994), Manning and Padgett (1995), Sanderson and Kettler (1996), Zwinger and Willard

(1996), Cooper et al. (1997), Crowe and Clausnitzer (1997), and Kittel et al. (1999b).

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Associations in this group are adapted to soils that may be flooded or saturated throughout the growing season. They may also occur on areas with soils that are only saturated early in the growing season or intermittently. Typically these associations are tolerant of moderate-intensity surface fires and late-season livestock grazing (Kovalchik 1987). Most appear to be relatively stable types, although in some areas these may be impacted by intensive livestock grazing.

ENVIRONMENT

Environmental Description: These are high-elevation communities found throughout the Rocky Mountains, Pacific Northwest and Intermountain West regions, dominated by herbaceous species found on wetter sites with very low-velocity surface and subsurface flows. They range in elevation from upper subalpine to alpine (1500-3600 m) depending on latitude. These types occur as large meadows in subalpine valleys, as narrow strips bordering ponds, lakes and streams, and along toeslope seeps. They are typically found on flat areas or gentle slopes, but may also occur on subirrigated sites with slopes up to 10%. In alpine regions, sites typically are small depressions located below late-melting snow patches or on snowbeds. Soils of this group are mineral or with a thin (<40 cm) organic layer over mineral layers (aka not peatland).

Moisture for these wet meadow community types is acquired from groundwater, stream discharge, overland flow, overbank flow, and on-site precipitation. Salinity and alkalinity are generally low due to the frequent flushing of moisture through the meadow. Depending on the slope, topography, hydrology, soils and substrate, intermittent, ephemeral or permanent pools may be present. These areas may support species more representative of purely aquatic environments. Standing water may be present during some or all of the growing season, with water tables typically remaining at or near the soil surface. Fluctuations of the water table throughout the growing season are not uncommon, however. On drier sites supporting the less mesic types, the late-season water table may be 1 m or more below the surface.

Soil/substrate/hydrology: Soils typically possess a high proportion of organic matter, but this may vary considerably depending on the frequency and magnitude of alluvial deposition (Kittel et al. 1999b). Organic composition of the soil may include a thin layer near the soil surface or accumulations of highly sapric material up to 30 cm thick (aka not peatland). Soils may exhibit gleying and/or mottling throughout the profile. Wet meadow ecological systems provide important water filtration, flow attenuation, and wildlife habitat functions. Environmental information was compiled from Willard (1963), Komarkova (1976, 1986), Nachlinger (1985), Cooper (1986b), Kovalchik (1987, 1993), Padgett et al. (1988a), Reed (1988), Meidinger and Pojar (1991), Shiflet (1994), Manning and Padgett (1995), Sanderson and Kettler (1996), Zwinger and Willard (1996), Cooper et al. (1997), Crowe and Clausnitzer (1997), and Kittel et al. (1999b).

DISTRIBUTION

***Geographic Range:** This group is found throughout the Rocky Mountains, Pacific Northwest and Intermountain West regions, ranging in elevation from upper subalpine to alpine (1500-3600 m) depending on latitude.

Nations: CA, US

States/Provinces: AB, AZ, BC, CA, CO, ID, MT, NM, NV, OR, SD, UT, WA, WY

USFS Ecoregions (2007) [optional]: 313A:CP, 313B:CC, 313D:C?, 315A:C?, 315B:C?, 315H:CC, 321A:??, 322A:CC, 331H:CP, 331I:CP, 331J:CC, 341A:CC, 341B:CC, 341C:CC, 341F:CP, 341G:CP, 342B:CC, 342C:CC, 342D:C?, 342E:CC, 342F:CP, 342G:CC, 342H:CC, 342J:CP, M242D:PP, M313A:CC, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M334A:PP, M341A:CP, M341B:CC, M341C:CC, M341D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High

USNVC Confidence Comments [optional]:

HIERARCHY***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3831 | <i>Kalmia microphylla</i> - <i>Cassiope mertensiana</i> - <i>Dryas drummondii</i> Wet Dwarf-shrubland Alliance |
| A3832 | <i>Carex nigricans</i> - <i>Sibbaldia procumbens</i> - <i>Trollius laxus</i> Wet Meadow Alliance |
| A1309 | <i>Carex vernacula</i> - <i>Phippsia algida</i> - <i>Ptilagrostis kingii</i> Wet Meadow Alliance |
| A0958 | <i>Dasiphora fruticosa</i> ssp. <i>floribunda</i> Wet Shrubland Alliance |
| A1424 | <i>Carex lachenalii</i> - <i>Carex capillaris</i> - <i>Carex illota</i> Wet Meadow Alliance |
| A1698 | <i>Caltha leptosepala</i> - <i>Rhodiola rhodantha</i> Wet Meadow Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--------------------------------|----------------|---|
| >< | Alpine Rangeland (410) | Shiflet 1994 | Alpine wet meadows are included in this SRM type. |
| >< | Tall Forb (409) | Shiflet 1994 | Forb-dominated wet meadows are included in this group. |
| >< | Tufted Hairgrass - Sedge (313) | Shiflet 1994 | Wetter portions of this SRM type overlap with this group. |

AUTHORSHIP***Primary Concept Source [if applicable]:** K.A. Schulz, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz**Acknowledgments [optional]:**

Version Date: 02 Dec 2015

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- Padgett, W. G., A. P. Youngblood, and A. H. Winward. 1988a. Riparian community type classification of Utah and southeastern Idaho. Research Paper R4-ECOL-89-0. USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, UT.
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2. Shrub & Herb Vegetation

2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

G527. Western Montane-Subalpine Riparian & Seep Shrubland

Type Concept Sentence: These are montane to subalpine riparian shrublands ranging from short to tall (0.5-15 m) that occur in steep and narrow to wide, low-gradient valley bottoms and floodplains as well as steep moist avalanche chutes. They are generally dominated by any or a mix of the following: *Alnus incana*, *Alnus oblongifolia*, *Alnus viridis*, *Betula occidentalis*, *Betula glandulosa*, *Betula occidentalis*, *Cornus sericea*, *Salix bebbiana*, *Salix boothii*, *Salix brachycarpa*, *Salix drummondiana*, *Salix eriocephala*, *Salix geyeriana*, *Salix monticola*, *Salix planifolia*, and/or *Salix wolfii*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.C.4.Nb.2. Western North American Montane-Subalpine-Boreal Marsh, Wet Meadow & Shrubland (M075)

Elcode: G527

***Scientific Name:** *Salix* spp. - *Alnus* spp. - *Betula occidentalis* Riparian & Seep Shrubland Group

***Common (Translated Scientific) Name:** Willow species - Alder species - Water Birch Riparian & Seep Shrubland Group

***Colloquial Name:** Western Montane-Subalpine Riparian & Seep Shrubland

***Type Concept:** These are montane to subalpine riparian shrublands occurring as narrow bands or broad shrublands and are found throughout the Rocky Mountain cordillera from New Mexico north into Montana and northwestern Alberta. They also occur in mountainous areas of the interior Intermountain West and on the Colorado Plateau. This group often occurs as part of a mosaic of multiple communities that are shrub- and herb-dominated and includes above-treeline, willow-dominated, snowmelt-fed basins that feed into streams. Shrubs range from short to tall (0.5-15 m). The shrub species that can be dominant reflect the large elevational gradient of this group and include *Alnus incana*, *Alnus oblongifolia*, *Alnus viridis*, *Betula occidentalis*, *Betula glandulosa*, *Betula occidentalis*, *Cornus sericea*, *Salix bebbiana*, *Salix boothii*, *Salix brachycarpa*, *Salix drummondiana*, *Salix eriocephala*, *Salix geyeriana*, *Salix monticola*, *Salix planifolia*, and *Salix wolfii*. Generally the upland vegetation surrounding these wet shrublands is either conifer or aspen forest. Stands occur on streambanks, stream benches and alluvial terraces in steep narrow to wide, low-gradient valley bottoms and floodplains with sinuous stream channels, as well as steep moist avalanche chutes. This group is generally found at

higher elevations, but can be found anywhere from 1500-3475 m, and may occur at even lower elevations in the Canadian Rockies. Occurrences can also be found around seeps, fens, and isolated springs on hillslopes away from valley bottoms. Many of the plant associations found within this group are associated with beaver activity.

***Diagnostic Characteristics:** Montane wet shrublands of the Rocky Mountains of Canada and the U.S., and mountain ranges in the Intermountain West. These shrublands line streams and valley bottoms and are often associated with beaver activity.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|---|
| G507 | North Pacific Montane Riparian Woodland | |
| G322 | Vancouverian Wet Shrubland | occurs at lower elevations along the Pacific Northwest coast. |
| G526 | Rocky Mountain-Great Basin Lowland-Foothill Riparian Shrubland | occurs at lower elevations and may overlap with G527. |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Montane wetlands dominated by short to tall (0.5-15 m) cold-deciduous shrubs with multiple stems, occurring as narrow bands of shrubs lining streambanks and alluvial terraces in narrow to wide, low-gradient valley bottoms and floodplains with sinuous stream channels.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: The dominant shrubs reflect the large elevational gradient and include *Alnus incana*, *Betula glandulosa*, *Betula occidentalis*, *Cornus sericea*, *Salix bebbiana*, *Salix boothii*, *Salix brachycarpa*, *Salix drummondiana*, *Salix eriocephala*, *Salix geyeriana*, *Salix monticola*, *Salix planifolia*, and *Salix wolfii*. Generally the upland vegetation surrounding these riparian systems is either conifer or aspen forest. Floristic information was compiled from Padgett (1982), Kovalchik (1987, 1993, 2001), Baker (1988, 1989a, 1989b, 1990), Padgett et al. (1988a, 1988b), Kittel (1993, 1994), Manning and Padgett (1995), Kittel et al. (1996, 1999a, 1999b), Walford (1996), Crowe and Clausnitzer (1997), Steen and Coupe (1997), and Muldavin et al. (2000a).

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: These shrublands are very tolerant of soil saturation, flooding and flooding disturbance. They require moist to saturated soils throughout the growing season, and regrow quickly after damage to tissue from flood and debris flows or avalanches.

ENVIRONMENT

Environmental Description: Soil/substrate/hydrology: These are montane to subalpine riparian shrublands occurring as narrow bands lining streambanks and alluvial terraces in narrow to wide, low-gradient valley bottoms and floodplains with sinuous stream channels. Generally, the group is found at higher elevations, but can be found anywhere from 1500-3475 m, and may occur at even lower elevations in the Canadian Rockies. Occurrences can also be found around seeps, fens, and isolated springs on hillslopes away from valley bottoms. They occur on mineral soils or, if on organic soil, these are not deep (not >30-40 cm). Environmental information was compiled from Padgett (1982), Kovalchik (1987, 1993, 2001), Baker (1988, 1989a, 1989b, 1990), Padgett et al. (1988a, 1988b), Kittel (1993, 1994), Manning and Padgett (1995), Kittel et al. (1996, 1999a, 1999b), Walford (1996), Crowe and Clausnitzer (1997), Steen and Coupe (1997), and Muldavin et al. (2000a).

DISTRIBUTION

***Geographic Range:** This group is found throughout the Rocky Mountain cordillera from New Mexico north into Montana and the Canadian Rockies of Alberta and British Columbia (including the isolated "island" mountain ranges of central and eastern Montana), and in mountainous areas of the Intermountain West and on the Colorado Plateau.

Nations: CA, US

States/Provinces: AB, AZ, BC, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY

USFS Ecoregions (2007) [optional]: 313A:CC, 313B:CC, 313D:CC, 315A:P?, 315H:PP, 321A:PP, 331A:C?, 331B:C?, 331J:CC, 341A:CP, 341B:CP, 341C:CP, 341D:CP, 341F:CC, 342A:CC, 342B:CP, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:CC, 342J:CC, M242C:CP, M242D:CC, M261E:CC, M313A:CC, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M341B:CC, M341C:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A0977 | <i>Salix lasiolepis</i> Wet Shrubland Alliance |
| A1003 | <i>Salix commutata</i> Wet Shrubland Alliance |
| A3774 | <i>Salix eastwoodiae</i> - <i>Salix lemmonii</i> Wet Shrubland Alliance |
| A0981 | <i>Salix monticola</i> Wet Shrubland Alliance |
| A3770 | <i>Salix wolfii</i> - <i>Salix brachycarpa</i> - <i>Betula glandulosa</i> Wet Shrubland Alliance |
| A2563 | <i>Salix orestera</i> Wet Shrubland Alliance |
| A3974 | <i>Crataegus douglasii</i> / <i>Symphoricarpos albus</i> Wet Shrubland Alliance |
| A3973 | <i>Celtis laevigata</i> var. <i>reticulata</i> / <i>Philadelphus lewisii</i> Wet Scrub Alliance |
| A3771 | <i>Alnus incana</i> - <i>Alnus viridis</i> Wet Shrubland Alliance |
| A3769 | <i>Salix boothii</i> - <i>Salix geyeriana</i> - <i>Salix lutea</i> Montane Wet Shrubland Alliance |
| A3773 | <i>Cornus sericea</i> - <i>Dasiphora fruticosa</i> ssp. <i>floribunda</i> - <i>Ribes</i> spp. Wet Shrubland Alliance |
| A3772 | <i>Betula occidentalis</i> Wet Shrubland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------------|--|-----------------------------|
| 2014-08-20 | G275 <i>Philadelphus lewisii</i> - <i>Physocarpus malvaceus</i> - <i>Symphoricarpos albus</i> Central Rocky Mountain Shrubland Group | G275 split into G527 & G305 |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| > | Riparian (422) | Shiflet 1994 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** G. Kittel, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** G. Kittel

Acknowledgments [optional]:

Version Date: 02 Dec 2015

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M073. Vancouverian Lowland Marsh, Wet Meadow & Shrubland

2. Shrub & Herb Vegetation

2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

G322. Vancouverian Wet Shrubland

Type Concept Sentence: This group includes alder, willow, and non-willow wet shrub swamps occurring on poorly drained, well-drained seasonally wet or saturated soils that may dry out completely during the growing season, on mineral or shallow (<30 cm) organic soils over mineral substrates. Stands may be dominated by *Alnus viridis ssp. sinuata*, *Cornus sericea*, *Malus fusca*, *Rubus spectabilis*, *Salix hookeriana*, *Salix sitchensis*, *Spiraea douglasii*, and/or *Vaccinium uliginosum* and are found west of the Pacific coastal mountain summits from Alaska to California.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.C.4.Nb.4. Vancouverian Lowland Marsh, Wet Meadow & Shrubland (M073)

Elcode: G322

***Scientific Name:** *Alnus* spp. - *Salix* spp. - *Spiraea* spp. Wet Shrubland Group

***Common (Translated Scientific) Name:** Alder species - Willow species - Meadowsweet species Wet Shrubland Group

***Colloquial Name:** Vancouverian Wet Shrubland

***Type Concept:** This group includes shrublands that occur on poorly drained or well-drained seasonally wet to saturated soils that may dry out completely during the growing season, mostly on mineral or shallow (<30 cm) organic or muck soils over mineral substrates. Stands may be dominated by *Alnus viridis ssp. sinuata*, *Cornus sericea*, *Malus fusca*, *Rubus spectabilis*, *Salix hookeriana*, *Salix sitchensis*, *Spiraea douglasii*, and/or *Vaccinium uliginosum*, singly or in various combinations. They may occur in mosaics with marshes or forested swamps, being on average more wet than forested swamps and more dry than marshes. However, it is also frequent for them to dominate entire wetland systems. Wetland species, including *Carex aquatilis var. dives* (= *Carex sitchensis*), *Carex utriculata*, *Equisetum fluviatile*, and *Lysichiton americanus*, dominate the understory. On some sites, *Sphagnum* spp. are common in the understory. This group includes wet shrublands found throughout the Pacific Northwest coast, from Cook Inlet and Prince William Sound, Alaska, to the northern coast of California. These are deciduous broadleaf tall shrublands that are located in depressions, around lakes or ponds, or river terraces where water tables fluctuate seasonally (mostly seasonally flooded regime), in areas that receive nutrient-rich waters. These depressions are poorly drained with fine-textured organic, muck or mineral soils and standing water common throughout the growing season.

***Diagnostic Characteristics:** Shrublands that occur on poorly drained or well-drained seasonally wet to saturated soils that may dry out completely during the growing season, mostly on mineral or shallow (<30 cm) organic or muck soils over mineral substrates.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|--|
| G254 | North Pacific Lowland Riparian Forest & Woodland | |
| G354 | Vancouverian Alder - Salmonberry - Willow Shrubland | |
| G527 | Western Montane-Subalpine Riparian & Seep Shrubland | |
| G526 | Rocky Mountain-Great Basin Lowland-Foothill Riparian Shrubland | has similar physiognomy and wetland hydrology but is comprised of Rocky Mountain and other inland species. |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These are deciduous broadleaf tall shrublands that are located in depressions, around lakes or ponds, or river terraces where water tables fluctuate seasonally (mostly seasonally flooded regime), in areas that receive nutrient-rich waters. They occur as linear bands or stringers, and can form small patches around springs and seeps.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Wet shrub swamps are dominated by one of several species, singly or in various combinations. Dominant shrub species include *Alnus incana ssp. tenuifolia* (= *Alnus tenuifolia*), *Alnus viridis ssp. crispa* (= *Alnus crispa*), *Alnus viridis ssp. sinuata* (= *Alnus sinuata*), *Cornus sericea*, *Malus fusca*, *Rubus spectabilis*, *Salix hookeriana*, *Salix sitchensis*, *Spiraea douglasii*, *Vaccinium cespitosum*, and/or *Vaccinium uliginosum*. The shrub layer can have many dead stems. Wetland species, including *Carex aquatilis var. dives* (= *Carex sitchensis*), *Carex utriculata*, *Equisetum fluviatile*, and *Lysichiton americanus*, dominate the understory. On some sites, *Sphagnum* spp. are common in the understory. Floristic information was compiled from Franklin and Dyrness (1973), Eyre (1980), Meidinger et al. (1988), Lloyd et al. (1990), MacKinnon et al. (1990), Viereck et al. (1992), Banner et al. (1993), DeLong et al. (1993, 1994), Steen and Coupe (1997), Ecosystems Working Group (1998), DeVelice et al. (1999), Boggs (2002), DeLong (2003), Chappell and Christy (2004), and Boggs et al. (2008b).

*Floristics Table [Med - High Confidence]:

*Number of Plots:

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:

ENVIRONMENT

Environmental Description: Stands that belong to this group are located in depressions, around lakes or ponds, or river terraces where water tables fluctuate seasonally (mostly seasonally flooded regime), in areas that receive nutrient-rich waters. These depressions are poorly drained with fine-textured organic, muck or mineral soils and standing water common throughout the growing season. Environmental information was compiled from Franklin and Dyrness (1973), Eyre (1980), Meidinger et al. (1988), Lloyd et al. (1990), MacKinnon et al. (1990), Viereck et al. (1992), Banner et al. (1993), DeLong et al. (1993, 1994), Steen and Coupe (1997), Ecosystems Working Group (1998), DeVelice et al. (1999), Boggs (2002), DeLong (2003), Chappell and Christy (2004), and Boggs et al. (2008b).

DISTRIBUTION

***Geographic Range:** This group occurs throughout the Pacific Northwest coast, from Cook Inlet basin and Prince William Sound, Alaska, to the northern coast of California.

Nations: CA, US

States/Provinces: AK, BC, CA, OR, WA

USFS Ecoregions (2007) [optional]: 242A:CC, 242B:C?, M242A:CC, M242B:CC, M242C:CC, M242D:CC, M261A:CC, M261D:CP, M261G:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

*Lower Level NVC Types:

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A2577 | <i>Malus fusca</i> Shrub Swamp Alliance |

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3833 | <i>Alnus viridis ssp. sinuata</i> - <i>Alnus viridis ssp. fruticosa</i> - <i>Acer circinatum</i> Shrub Swamp Alliance |
| A1123 | <i>Vaccinium uliginosum</i> - <i>Vaccinium cespitosum</i> Wet Shrubland Alliance |
| A2609 | <i>Rubus spectabilis</i> Wet Shrubland Alliance |
| A3834 | <i>Cornus sericea</i> Pacific Slope Shrub Swamp Alliance |
| A3835 | <i>Salix hookeriana</i> - <i>Salix sitchensis</i> - <i>Spiraea douglasii</i> Wet Shrubland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

*Recent Concept Lineage [if applicable]:

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP

*Primary Concept Source [if applicable]: G. Kittel, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

*Author of Description: G. Kittel, K. Boggs, C. Chappell, P. Comer, M.S. Reid

Acknowledgments [optional]:

Version Date: 02 Dec 2015

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2.C.4.Nc. Southwestern North American Warm Desert Freshwater Marsh & Bosque (D032)

M076. Warm Desert Lowland Freshwater Marsh, Wet Meadow & Shrubland

2. Shrub & Herb Vegetation

2.C.4.Nc. Southwestern North American Warm Desert Freshwater Marsh & Bosque

G533. North American Warm Desert Riparian Low Bosque & Shrubland

Type Concept Sentence: This low-elevation (<1100 m) desert riparian vegetation is dominated by scrub *Prosopis glandulosa* and/or *Prosopis velutina*, and/or shrubs *Baccharis salicifolia*, *Pluchea sericea*, *Salix geyeriana*, *Shepherdia argentea*, and/or *Salix exigua*. It is found along perennial and intermittent streams and rivers of the southwestern U.S. and adjacent Mexico.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.C.4.Nc.1. Warm Desert Lowland Freshwater Marsh, Wet Meadow & Shrubland (M076)

Elcode: G533

***Scientific Name:** *Prosopis glandulosa* - *Prosopis velutina* - *Baccharis* spp. North American Warm Desert Riparian Low Bosque & Shrubland Group

***Common (Translated Scientific) Name:** Honey Mesquite - Velvet Mesquite - False Willow species North American Warm Desert Riparian Low Bosque & Shrubland Group

***Colloquial Name:** North American Warm Desert Riparian Low Bosque & Shrubland

***Type Concept:** This group consists of riparian scrub found along low-elevation (<1100 m) perennial or intermittent streams and rivers throughout the warm desert regions of the southwestern U.S. and adjacent Mexico. The vegetation is low scrub or shrubland, not tall trees. Dominants include scrub *Prosopis glandulosa* and *Prosopis velutina*, and shrubs *Baccharis salicifolia*, *Pluchea sericea*, *Salix geyeriana*, *Shepherdia argentea*, and/or *Salix exigua*. Woody cover is relatively dense, especially when compared to drier

washes. Dominant species, especially the mesquites, tap groundwater below the streambed when surface flows stop. Vegetation is dependent upon annual rise in the water table or annual/periodic flooding and associated sediment scour for growth and reproduction.

***Diagnostic Characteristics:** Desert climes of the southwestern U.S., intermittent and perennial streambanks, riverbanks and floodplains with native woody tree and shrub species.

***Classification Comments:** Addition characteristic taxa to be added.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G797 | Western Interior Riparian Forest & Woodland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Scrubby growth of short bosque or thickets of shrubs that are winter-deciduous along lower elevation stream courses.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Dominant scrub/trees include *Prosopis glandulosa* and *Prosopis velutina*. Dominants of shrub communities include *Baccharis salicifolia*, *Pluchea sericea*, *Salix geyeriana*, *Shepherdia argentea*, and *Salix exigua*. Understorey species include low shrubs *Celtis ehrenbergiana* (= *Celtis pallida*) or *Prunus serotina*; forbs *Amaranthus palmeri* and *Eustoma exaltatum*; and graminoid species such as *Bouteloua curtipendula*, *Distichlis spicata*, *Juncus arcticus* ssp. *littoralis* (= *Juncus balticus*), *Leymus condensatus*, *Muhlenbergia asperifolia*, *Muhlenbergia rigens*, *Phragmites australis*, *Schoenoplectus pungens*, *Sorghum halepense*, and *Sporobolus airoides*. Floristic information was compiled from Eyre (1980), Brown (1982), Barbour and Major (1988), Szaro (1989), Dick-Peddie (1993), Holland and Heil (1995), Muldavin et al. (2000a, 2000b), and Griffith et al. (2004).

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Vegetation is dependent upon annual rise in the water table or annual/periodic flooding and associated sediment scour and/or annual rise in the water table for growth and reproduction (Szaro 1989, Muldavin et al. 2000b).

ENVIRONMENT

Environmental Description: *Climate:* Low-elevation arid southwestern deserts. *Soil/substrate/hydrology:* Low-elevation (<1100 m) riparian corridors along small, medium and large perennial and intermittent streams and rivers throughout canyons and desert valleys with alluvial soils. Environmental information was compiled from Eyre (1980), Brown (1982), Barbour and Major (1988), Szaro (1989), Dick-Peddie (1993), Holland and Heil (1995), Muldavin et al. (2000a, 2000b), and Griffith et al. (2004).

DISTRIBUTION

***Geographic Range:** This group encompasses riparian corridors along small, medium and large perennial and intermittent streams and rivers throughout canyons and desert valleys of the warm desert regions of the southwestern U.S. and adjacent Mexico. Rivers include the lower Colorado (into the Grand Canyon), Gila, Santa Cruz, Salt, lower Rio Grande (below Elephant Butte Reservoir in New Mexico to the Coastal Plain of Texas), and the lower Pecos (up to near its confluence with Rio Hondo in southeastern New Mexico) and their tributaries that occur in the desert portions of their range.

Nations: MX, US

States/Provinces: AZ, CA, MXBC, MXCH, MXSO, NM, NV, TX, UT

USFS Ecoregions (2007) [optional]: 313A:CC, 313C:CC, 315A:CC, 315B:CC, 321A:CC, 322A:CC, 322B:CC, 322C:CC, 341F:PP, M261E:CC, M313A:PP, M313B:PP

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3874 | <i>Baccharis emoryi</i> - <i>Baccharis sergiloides</i> Wet Shrubland Alliance |
| A3875 | <i>Cephalanthus occidentalis</i> - <i>Rosa californica</i> Wet Shrubland Alliance |
| A3876 | <i>Juglans microcarpa</i> Wet Scrub Alliance |
| A3877 | <i>Prosopis glandulosa</i> - <i>Prosopis velutina</i> - <i>Prosopis pubescens</i> Wet Scrub Alliance |
| A0933 | <i>Baccharis salicifolia</i> Wet Shrubland Alliance |
| A0947 | <i>Salix exigua</i> Warm Desert Wet Shrubland Alliance |
| A1033 | <i>Celtis laevigata</i> - <i>Rhus trilobata</i> Wet Shrubland Alliance |
| A3878 | <i>Salix lasiolepis</i> Warm Desert Wet Shrubland Alliance |
| A4162 | <i>Vitis arizonica</i> - <i>Vitis girdiana</i> Wet Shrubland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** D.E. Brown (1982a)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** G. Kittel

Acknowledgments [optional]:

Version Date: 02 Dec 2015

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- Muldavin, E., P. Durkin, M. Bradley, M. Stuever, and P. Mehlhop. 2000a. Handbook of wetland vegetation communities of New Mexico. Volume I: Classification and community descriptions. Final report to the New Mexico Environment Department and the Environmental Protection Agency prepared by the New Mexico Natural Heritage Program, University of New Mexico, Albuquerque.
- Muldavin, E., Y. Chauvin, and G. Harper. 2000b. The vegetation of White Sands Missile Range, New Mexico: Volume I. Handbook of vegetation communities. Final report to Environmental Directorate, White Sands Missile Range. New Mexico Natural Heritage Program, University of New Mexico, Albuquerque. 195 pp. plus appendices
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2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland (D323)

M071. Great Plains Marsh, Wet Meadow, Shrubland & Playa

2. Shrub & Herb Vegetation

2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

G325. Great Plains Freshwater Marsh

Type Concept Sentence: This herbaceous wetland group is found in much of the Great Plains in permanently flooded sites, and is often dominated by *Typha* spp. and *Schoenoplectus* spp., though other species may be dominant in some sites.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.C.4.Nd.5. Great Plains Marsh, Wet Meadow, Shrubland & Playa (M071)

Elcode: G325

***Scientific Name:** *Typha* spp. - *Schoenoplectus americanus* - *Scolochloa festucacea* Great Plains Freshwater Marsh Group

***Common (Translated Scientific) Name:** Cattail species - Chairmaker's Bulrush - Common Rivergrass Great Plains Freshwater Marsh Group

***Colloquial Name:** Great Plains Freshwater Marsh

***Type Concept:** This herbaceous wetland group is found in the semi-arid and parts of the temperate zones of the Great Plains from southern Canada to northern Texas. Herbaceous species, typically between 1 and 2 m tall, dominate. Cover can vary from fairly open to very dense. Woody cover is sparse to absent. *Typha* spp. and *Schoenoplectus* spp. are the most common, though many other species can be locally abundant. Sites are usually in basins but can be found along slow-moving streams or rivers. Most sites are flooded with 0.2 to 1 m of water most or all of the growing season except in very dry or wet years.

***Diagnostic Characteristics:** This group consists of herbaceous marshes on sites that are flooded for much of the growing season in all but the driest years.

***Classification Comments:** This group has a lot of overlap with ~Eastern North American Freshwater Marsh Group (G125)\$\$. They share a dominance by *Typha* spp. and *Schoenoplectus* spp. and have similar physiognomic and environmental characteristics. Possibly this group (G325) can be distinguished by a higher abundance of associated species such as *Beckmannia syzigachne*, *Calamagrostis stricta*, *Scolochloa festucacea*, *Schoenoplectus americanus* (particularly in the south), and others?

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|------------------------------------|------|
| G556 | Eastern Ruderal Wet Meadow & Marsh | |

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|--|
| G336 | Great Plains Wet Prairie, Wet Meadow & Seepage Fen | is drier, with little <i>Typha</i> spp., often on the upland side of G325. |
| G125 | Eastern North American Freshwater Marsh | |
| G595 | Eastern North American Ruderal Aquatic Vegetation | |
| G114 | Eastern North American Freshwater Aquatic Vegetation | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This is an herbaceous wetland. Woody plants are sparse to absent, but height and cover of herbaceous plants can vary greatly among sites and even at a given site over time. Herbaceous cover can vary from sparse to complete, and height can vary from short (<0.5 m) to tall (2 m), though most sites have an herbaceous canopy between 1 and 2 m tall. If there is a deep water edge (water deeper than will support these marshes), then the vegetation is typically fairly open and sparse along that edge.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: These marshes have a variety of species present though *Typha* spp. (*Typha latifolia*, *Typha angustifolia*, or, in the south, *Typha domingensis*) and *Schoenoplectus* spp. (most commonly *Schoenoplectus acutus*, *Schoenoplectus americanus*, *Bolboschoenus fluviatilis* (= *Schoenoplectus fluviatilis*), *Bolboschoenus maritimus* (= *Schoenoplectus maritimus*), and *Schoenoplectus tabernaemontani*) are by far the most common species throughout the range. Within individual marshes there may be zonation where different species grow. Some favor the deeper, more permanently flooded sections, while others can tolerate or even prefer the shallower sections that dry out more frequently. Other species common locally or in parts of this group's range include *Carex* spp. (especially *Carex aquatilis* and *Carex atherodes*), *Eleocharis palustris*, *Eleocharis compressa*, *Leersia oryzoides*, *Polygonum pennsylvanicum*, *Polygonum lapathifolium*, *Sagittaria* spp. (in wetter areas), *Scolochloa festucacea*, *Sparganium* spp., and *Triglochin maritima*. On drier margins or when water levels are low, *Calamagrostis stricta*, *Equisetum hyemale*, *Glyceria* spp., and *Spartina pectinata* can sometimes be found though these are more common in other vegetation types. Species abundance can change from year to year at a given site depending on water levels.

*Floristics Table [Med - High Confidence]:

*Number of Plots:

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Hydrologic changes are the main natural dynamic affecting this group. These marshes are fed by larger drainage basins, and sometimes also by groundwater sources, and are thus more hydrologically stable than other basin wetlands in the Great Plains, but they still occur in a climate that is semi-arid or the dry end of temperate so water can evaporate quickly. This group occurs on sites flooded for most or all of the growing season, and these conditions need to persist at any given site for multiple years for this group to become established, but longer-term precipitation cycles result in longer-term changes in water levels that can change the vegetation at any given site from wet meadow to the deeper marshes in this group and back (Kantrud et al. 1989a). Fire can spread from adjacent uplands, particularly in late summer or fall, and dense *Typha* spp. or *Schoenoplectus* spp. can provide abundant fuel. Fires can affect the composition of these marshes by removing standing and fallen litter which allows more light to reach the surface but also reduces the amount of snow trapped during the winter (in the northern parts of the range of this group) and thus can reduce water levels the following year. Many sites have been affected by agricultural practices either through draining and conversion to cropland or through trampling and grazing by livestock. Herbivory by muskrats (*Ondatra zibethicus*) can alter vegetation cover and composition.

ENVIRONMENT

Environmental Description: Examples of this group are found in basins, along lakeshores, and sometimes along slow-moving creeks or in the backwaters of rivers. Water depth is typically between 0.2 and 1 m except in very wet or dry years. Soils are usually fine-textured though some sites are on sands. Soils are also usually high in organic material and tend toward mucks. Some sites can have moderately saline water and soils, particularly if water levels have dropped. *Climate:* Semi-arid to temperate.

DISTRIBUTION

***Geographic Range:** This group occurs from the southern Canadian Prairie Provinces of Alberta, Saskatchewan, and Manitoba south through western Minnesota, eastern Kansas, central Oklahoma, and the panhandle of Texas. The distribution of this group extends west to north-central Montana, eastern Wyoming, and eastern Colorado.

Nations: CA, US

States/Provinces: AB, CO, IA, KS, MB, MN, MT, ND, NE, OK, SD, SK, TX, WY

USFS Ecoregions (2007) [optional]: 251A:CC, 251B:CC, 251C:CC, 251F:C?, 331B:CC, 331C:CC, 331D:CC, 331E:CC, 331F:CC, 331G:CP, 331H:CP, 332A:CC, 332B:CC, 332C:CC, 332D:CC, 332E:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3488 | <i>Sagittaria latifolia</i> - <i>Sagittaria cuneata</i> - <i>Leersia oryzoides</i> Great Plains Marsh Alliance |
| A3486 | <i>Schoenoplectus acutus</i> - <i>Bolboschoenus maritimus</i> - <i>Schoenoplectus tabernaemontani</i> Marsh Alliance |
| A3487 | <i>Typha angustifolia</i> - <i>Typha latifolia</i> - <i>Schoenoplectus</i> spp. Marsh Alliance |
| A3485 | <i>Schoenoplectus americanus</i> Marsh Alliance |
| A3484 | <i>Carex atherodes</i> - <i>Carex aquatilis</i> - <i>Scolochloa festucacea</i> Marsh Alliance |
| A3490 | <i>Polygonum pensylvanicum</i> - <i>Polygonum lapathifolium</i> Marsh Alliance |
| A3489 | <i>Eleocharis palustris</i> Great Plains Marsh Alliance |
| A3665 | <i>Zizania texana</i> Marsh Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|-----------------|------|
| > | Prairie Potholes | Richardson 2000 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** C.J. Richardson, in Barbour and Billings (2000)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** J. Drake

Acknowledgments [optional]:

Version Date: 08 May 2015

REFERENCES

***References [Required if used in text]:**

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2. Shrub & Herb Vegetation

2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

G136. Great Plains Playa & Rainwater Basin Wetland

Type Concept Sentence: This group is composed of intermittently or temporarily flooded grasslands found mostly in shallow basins in the central and southern Great Plains, and is often dominated by *Bouteloua dactyloides*, *Panicum obtusum*, *Panicum virgatum*, *Pascopyrum smithii*, and sometimes annual graminoids and forbs.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.C.4.Nd.5. Great Plains Marsh, Wet Meadow, Shrubland & Playa (M071)

Elcode: G136

***Scientific Name:** *Pascopyrum smithii* - *Panicum obtusum* - *Bouteloua dactyloides* Playa & Rainwater Basin Wetland Group

***Common (Translated Scientific) Name:** Western Wheatgrass - Vine-mesquite - Buffalograss Playa & Rainwater Basin Wetland Group

***Colloquial Name:** Great Plains Playa & Rainwater Basin Wetland

***Type Concept:** Communities within this group are associated with the playa lakes and rainwater basins in the central Great Plains south to New Mexico and the Edwards Plateau in Texas. Perennial grasses <1 m tall dominate most examples of this group, sometimes forming dense sod cover. Where the duration of flooding is longer and kills or inhibits the perennial grasses, annuals can be common when the ground dries. Typical perennial grasses are *Bouteloua dactyloides* (= *Buchloe dactyloides*), *Panicum obtusum*, *Panicum virgatum*, and *Pascopyrum smithii* while annuals may include *Cyperus* spp., *Echinochloa* spp., and *Polygonum* spp. Dominant species typifying examples in the Edwards Plateau may include *Bouteloua dactyloides*, *Chaetopappa bellidifolia*, *Paronychia* spp., *Pleuraphis mutica*, *Sedum nuttallianum*, *Sedum pulchellum*, *Sporobolus vaginiflorus*, and the alga *Nostoc commune*. The group is primarily found in upland depressional basins. Sites are typified by the presence of an impermeable layer, such as a dense clay, hydric soil, and is usually recharged by rainwater and nearby runoff. They are rarely linked to outside groundwater sources and do not have an extensive watershed.

***Diagnostic Characteristics:** Mesic, small, typically temporarily flooded herbaceous sites found in shallow depressions or, rarely, floodplains. Dominant species in the Great Plains usually include *Bouteloua dactyloides*, *Panicum obtusum*, *Panicum virgatum*, and *Pascopyrum smithii* while in the Edwards Plateau *Bouteloua dactyloides*, *Chaetopappa bellidifolia*, *Paronychia* spp., *Pleuraphis mutica*, *Sedum nuttallianum*, *Sedum pulchellum*, *Sporobolus vaginiflorus*, and the alga *Nostoc commune* are typical.

***Classification Comments:** This group was originally defined to include both drier and wetter parts of playas throughout the Great Plains. Currently all of the component associations are flooded or wet for only part of the growing season so it is temporarily flooded, at best, and it is limited to the central and southern Great Plains.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G336 | Great Plains Wet Prairie, Wet Meadow & Seepage Fen | |

Similar NVC Types General Comments [optional]:**VEGETATION**

Physiognomy and Structure Summary: Perennial herbaceous graminoids and forbs typically <1 m tall dominate the group, though annuals or a mix of annuals and perennials can dominate some areas. Composition varies depending on the depth and duration of flooding and on substrate, with stands occurring over limestone bedrock in the Edwards Plateau often having some differences from those on deep soils in the Great Plains.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Species richness varies considerably among individual examples of this group. Common perennials are *Pascopyrum smithii*, *Panicum obtusum*, *Panicum virgatum*, and *Bouteloua dactyloides* (= *Buchloe dactyloides*); the first two in particular may form lush stands in some cases. Sites that are dry most of the growing season but where flooding duration is too long for the upland perennials to thrive typically have more annuals. These include *Cyperus* spp., *Echinochloa* spp., *Mollugo verticillata*, and *Polygonum* spp. Those examples in the Edwards Plateau typically are dominated by *Bouteloua dactyloides*, *Chaetopappa bellidifolia*, *Paronychia* spp., *Pleuraphis mutica*, *Sedum nuttallianum*, *Sedum pulchellum*, *Sporobolus vaginiflorus*, and the alga *Nostoc commune*.

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Playas have a large change in hydrologic status over much of their areas. That is, most of the area of an individual playa is wet or flooded at one point in the growing season but dries out for much of the growing season. Some do have deeper areas that are wet or flooded for nearly the entire growing season but those do not fit within this group (they likely fall within ~Great Plains Freshwater Marsh Group (G325)\$\$ or ~Arid West Interior Freshwater Marsh Group (G531)\$\$). Multiple wet-dry cycles during one growing season in response to rain and dry periods is more common. This rapid change in available moisture and in exposed soil limits the species that can grow. This often results in strong dominance by a few perennial species able to tolerate these conditions or by annuals that can go through their life cycle before conditions change (Haukos and Smith 1993). However, the unconnected nature of playas combined with the variable environmental conditions throughout the year favors the formation of differing assemblages of vegetation at any one time on playas across the landscape. This contributes to regional diversity of plant and animal habitats throughout the year (Haukos and Smith 1994). Fire can spread into this system from surrounding grasslands but it is uncommon. The surrounding grasslands are typically short to mid grasses and do not have sufficient fuel to carry fire well and, while playas usually have more dense vegetation cover than the adjacent uplands, they may be wet.

ENVIRONMENT

Environmental Description: This group is typified by upland depressional basins with an impermeable layer such as dense clay, hydric soils. Most examples of this group occur in shallow basins where a small change in water depth spreads over a relatively large area. Soils are dense silts and clays, occasionally loess-derived, that flood in winter or after heavy rains but dry out for much of the growing season. Examples in the Edwards Plateau of Texas occur in shallow depressions over limestone. Rainwater and runoff primarily recharge this group, and it is rarely linked to outside groundwater sources. Sites can be moderately saline. A small number of stands in this group occur on floodplains.

DISTRIBUTION

***Geographic Range:** This group can be found throughout the eastern portion of the Western Great Plains Division; however, it is most prevalent in the central states of Nebraska, Kansas and Oklahoma. In addition, it does occur farther to the west, in central and eastern Montana and eastern Wyoming, and south into the Edwards Plateau of Texas and New Mexico.

Nations: MX?, US

States/Provinces: CO, KS, NE, NM, OK, TX

USFS Ecoregions (2007) [optional]: 251F:CC, 251H:CC, 315D:CC, 315F:CP, 331B:CP, 331C:CC, 331D:C?, 331E:CC, 331F:CC, 331G:CP, 331H:CC, 331K:CP, 331L:CP, 331M:CP, 332B:CC, 332C:CC, 332D:CC, 332E:CC, 332F:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A1348 | <i>Polygonum</i> spp. - <i>Echinochloa</i> spp. - <i>Distichlis spicata</i> Wet Meadow Alliance |
| A1238 | <i>Panicum obtusum</i> Wet Meadow Alliance |
| A3597 | <i>Pascopyrum smithii</i> Wet Meadow Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** S. Menard and K. Kindscher, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** S. Menard, K. Kindscher, J. Drake

Acknowledgments [optional]:

Version Date: 08 May 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2017a. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

Haukos, D. A., and L. M. Smith. 1993. Seed-bank composition and predictive ability of field vegetation in playa lakes. *Wetlands* 13(1):32-40.

G337. Great Plains Riparian Wet Meadow & Shrubland

Type Concept Sentence: This group consists of shrub- and herbaceous-dominated stands along perennial or intermittent rivers in the Great Plains; a wide variety of shrub and herbaceous species can be dominant.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.C.4.Nd.5. Great Plains Marsh, Wet Meadow, Shrubland & Playa (M071)

Elcode: G337

***Scientific Name:** *Cornus* spp. - *Prunus virginiana* / *Pascopyrum smithii* Great Plains Riparian Wet Meadow & Shrubland Group

***Common (Translated Scientific) Name:** Dogwood species - Chokecherry / Western Wheatgrass Great Plains Riparian Wet Meadow & Shrubland Group

***Colloquial Name:** Great Plains Riparian Wet Meadow & Shrubland

***Type Concept:** This group consists of shrub- and herbaceous-dominated stands along perennial or intermittent rivers in the Great Plains. This riparian group can be found throughout most of the Great Plains from the U.S. border in central Montana and North Dakota to Oklahoma. Sites are found on raised islands and terraces above the main channel that experience periodic flooding. Shrubs or herbaceous plants can dominate. Common species include *Cornus drummondii*, *Cornus sericea*, *Symphoricarpos occidentalis*, *Prunus virginiana*, *Pascopyrum smithii*, *Schizachyrium scoparium* (in the west and south), and the exotics *Poa pratensis* and *Melilotus* spp. Scattered trees may be present, and examples of this group may occur on a floodplain interspersed with ~Great Plains Cottonwood - Green Ash Floodplain Forest Group (G147)\$.

***Diagnostic Characteristics:** Shrubby or herbaceous riparian areas found above active channels in the Great Plains. Often these occur on terraces or islands.

***Classification Comments:** Diagnostics to differentiate this group (G337) and ~Rocky Mountain-Great Basin Lowland-Foothill Riparian Shrubland Group (G526)\$ along the junction of the Great Plains and Rocky Mountain foothills need to be better established. The current list of associations assigned to this group does not extend south of Nebraska (with one very minor exception). There should be riparian shrub and herb associations in the southern Great Plains.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G147 | Great Plains Cottonwood - Green Ash Floodplain Forest | |
| G526 | Rocky Mountain-Great Basin Lowland-Foothill Riparian Shrubland | |
| G568 | Great Plains Riverscours Vegetation | |
| G336 | Great Plains Wet Prairie, Wet Meadow & Seepage Fen | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group is composed of both deciduous shrublands and herbaceous vegetation. Sites can be dominated by short, medium, or tall shrubs (up to approximately 2-3 m) or can lack significant shrub cover and be dominated by mid or tall grasses. Vegetation cover is usually moderate to high, though it can be less, particularly in the drier, western portion of the range of this group or on sites that have experienced recent severe flooding.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Dominants in this physiognomically and geographically wide-ranging group can vary substantially. Typical shrub dominants include *Cornus drummondii*, *Cornus sericea*, *Amorpha fruticosa*, *Symphoricarpos occidentalis*, *Prunus virginiana*, *Artemisia cana* ssp. *cana* (in the northwest portion of the range), *Artemisia tridentata* (in the northwest portion of the range), and the exotic *Elaeagnus angustifolia*. Common herbaceous species are *Andropogon gerardii*, *Sporobolus cryptandrus*, *Pascopyrum smithii*, *Spartina pectinata*, *Sporobolus heterolepis*, *Schizachyrium scoparium*, *Hesperostipa spartea*, *Solidago canadensis*, and the exotics *Melilotus* spp., *Poa pratensis*, and *Bromus tectorum* (in the western portion of the range).

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Flooding and other hydrologic events strongly affect this group. Examples are typically found near enough to streams to be flooded at some point in the growing season but far enough away from larger streams that the flooding is not of a long duration. Fire can spread into stands of this group from surrounding upland prairies, particularly in the central and eastern Great Plains where fire is more common.

ENVIRONMENT

Environmental Description: Examples of this group are found on alluvial soils on terraces, raised islands, and banks near streams and rivers. Sites are typically flooded in the spring or after heavy rains but flooding is not of long duration. Sites are generally lower than much of the surrounding landscape, and this combined with proximity to watercourses makes these sites relatively mesic.

DISTRIBUTION

***Geographic Range:** This group is found in much of the Great Plains from the U.S.-Canadian border region to Oklahoma.

Nations: CA, US

States/Provinces: AB, CO, KS, MB, MT, ND, NE, OK, SD, SK, WY

USFS Ecoregions (2007) [optional]: 251C:C?, 251F:CP, 251H:CC, 315F:PP, 331B:CC, 331C:CC, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 331H:CC, 331J:CC, 331K:CC, 331L:CC, 331M:CC, 331N:CC, 332A:CC, 332B:CC, 332C:CC, 332D:CC, 332E:CC, 332F:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3590 | <i>Shepherdia argentea</i> Wet Shrubland Alliance |
| A3587 | <i>Schoenoplectus</i> spp. - <i>Poa palustris</i> Marsh Alliance |
| A3588 | <i>Cornus drummondii</i> - <i>Amorpha fruticosa</i> Wet Shrubland Alliance |
| A3589 | <i>Salix interior</i> Wet Shrubland Alliance |
| A0942 | <i>Alnus maritima</i> ssp. <i>oklahomensis</i> Wet Shrubland Alliance |
| A3586 | <i>Artemisia cana</i> ssp. <i>cana</i> Wet Shrubland Alliance |
| A0918 | <i>Elaeagnus commutata</i> Wet Shrubland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** J. Drake, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** J. Drake

Acknowledgments [optional]:

Version Date: 08 May 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2017a. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

2. Shrub & Herb Vegetation

2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

G336. Great Plains Wet Prairie, Wet Meadow & Seepage Fen

Type Concept Sentence: This group of seasonally flooded herbaceous wetlands is found in the northern and central Great Plains, usually in basins but sometimes on the margins of floodplains; most sites have abundant *Calamagrostis stricta*, *Carex* spp., and *Spartina pectinata*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.C.4.Nd.5. Great Plains Marsh, Wet Meadow, Shrubland & Playa (M071)

Elcode: G336

***Scientific Name:** *Spartina pectinata* - *Calamagrostis stricta* - *Carex* spp. Great Plains Wet Prairie, Wet Meadow & Seepage Fen Group

***Common (Translated Scientific) Name:** Prairie Cordgrass - Slimstem Reedgrass - Sedge species Great Plains Wet Prairie, Wet Meadow & Seepage Fen Group

***Colloquial Name:** Great Plains Wet Prairie, Wet Meadow & Seepage Fen

***Type Concept:** This group includes herbaceous wetlands and fens in the eastern and central Great Plains. Examples occur in basins or along slow-moving streams or rivers. Sites are flooded or saturated for part of the growing season but often dry out in late summer. These wet meadows and wet prairies typically have moderate to dense cover of herbaceous vegetation 1-2 m tall. *Calamagrostis stricta*, *Carex* spp., and *Spartina pectinata* are common dominants, though several other species are common locally or in some parts of the range. Soils are fine-textured and may be mineral or mucky in most sites. In fens, soils are muck or peat.

***Diagnostic Characteristics:** Shallow, seasonally flooded or sometimes saturated herbaceous wetlands that are found in the Great Plains. Woody species are rare or absent. Some sites have moderate levels of salinity.

***Classification Comments:** This group is similar in concept to ~Midwest Wet Prairie & Wet Meadow Group (G770)\$\$, which occurs further east, but there is substantial overlap in species composition and physiognomic and environmental characteristics. *Carex nebrascensis* might help distinguish from it Eastern North American Wet Meadow Group (it occurs in the western U.S. but not east of Great Plains).

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|---|
| G325 | Great Plains Freshwater Marsh | is similar but wetter and has more species tolerant of long-term flooding such as <i>Typha</i> spp. |
| G337 | Great Plains Riparian Wet Meadow & Shrubland | |
| G136 | Great Plains Playa & Rainwater Basin Wetland | |
| G556 | Eastern Ruderal Wet Meadow & Marsh | |
| G770 | Midwest Wet Prairie & Wet Meadow | |
| G324 | Great Plains Saline Wet Meadow & Marsh | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These wet meadows and wet prairies are dominated by herbaceous plants, usually graminoids. Vegetation cover is typically moderate to dense and between 1 and 2 m tall.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This group is dominated by medium to tall herbaceous species. Abundant species include *Spartina pectinata*, *Calamagrostis stricta*, *Calamagrostis canadensis*, *Carex* spp. (including *Carex atherodes*, *Carex pellita*, *Carex nebrascensis*), *Glyceria* spp., *Juncus* spp., *Lycopus americanus*, *Panicum virgatum*, *Schoenoplectus tabernaemontani*, and *Triglochin maritima*. *Pascopyrum smithii* often occurs on the drier edges of this group in the western parts of its range. Fens in the Great Plains are included in this group. In those sites, some species rarely found elsewhere in this group occur. These include *Rhynchospora capillacea*, *Lobelia kalmii*, *Dulichium arundinaceum*, *Carex prairea*, and *Onoclea sensibilis*. In more saline areas, common species can include *Carex sartwellii*, *Carex praegracilis*, *Plantago eriopoda*, and *Schoenoplectus pungens*.

*Floristics Table [Med - High Confidence]:

*Number of Plots:

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Hydrologic changes (flooding and drought) affect sites in this group significantly. In drier years, sites can be invaded by species from adjacent prairies, while in wetter years, species typical of more permanently flooded marshes do well. Also, fire spreading from adjacent upland prairies can sweep through examples of this group. Many sites have been affected by agricultural practices and either converted to row crops or affected by grazing and trampling by livestock.

ENVIRONMENT

Environmental Description: This group occurs on poorly drained nearly level sites with few exceptions. Most sites are in basins or along slow-moving streams or rivers and have seasonally flooded fine-textured soils. Some sites can be moderately saline: these are more common in the western parts of the distribution of this group. Fens in the Great Plains are included in this group. The fens occur where minerotrophic groundwater emerges at the surface, typically on the lower slopes of a hill or cliff or in floodplains. Marl or peat can form in these fens.

DISTRIBUTION

***Geographic Range:** This group is found throughout the eastern and central Great Plains from the southern Prairie Provinces of Canada to Oklahoma. It probably does not extend west into the shortgrass prairie beyond eastern Montana, eastern Wyoming, and western Kansas or east beyond western Minnesota, central Iowa, and northwestern Missouri.

Nations: CA, US

States/Provinces: CO, IA, KS, MB, MN, MO, MT, ND, NE, OK, SD, SK, WY

USFS Ecoregions (2007) [optional]: 251A:CC, 251B:CC, 251C:CC, 331B:CC, 331C:CC, 331D:CC, 331E:CC, 331F:CC, 331H:C?, 332A:CC, 332B:CC, 332C:CC, 332D:CC, 332E:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

*Lower Level NVC Types:

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3495 | <i>Carex</i> spp. - <i>Triglochin maritima</i> - <i>Eleocharis quinqueflora</i> Alkaline Fen Alliance |
| A3493 | <i>Spartina pectinata</i> Great Plains Wet Meadow Alliance |
| A3492 | <i>Panicum virgatum</i> - <i>Pascopyrum smithii</i> Wet Meadow Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|-----------------|------|
| > | Prairie Potholes | Richardson 2000 | |

AUTHORSHIP***Primary Concept Source [if applicable]:** C.J. Richardson, in Barbour and Billings (2000)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** J. Drake

Acknowledgments [optional]:

Version Date: 08 May 2015

REFERENCES***References [Required if used in text]:**

- Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2017a. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]
- Lauver, C. L., K. Kindscher, D. Faber-Langendoen, and R. Schneider. 1999. A classification of the natural vegetation of Kansas. The Southwestern Naturalist 44:421-443.
- Richardson, C. J. 2000. Freshwater wetlands. Pages 448-499 in: M. G. Barbour and W. D. Billings, editors. North American terrestrial vegetation. Second edition. Cambridge University Press, New York. 434 pp.
- Steinauer, G., and S. Rolfmeier. 2000. Terrestrial natural communities of Nebraska. Unpublished report of the Nebraska Game and Parks Commission. Lincoln, NE. 143 pp.
- Stewart, R. E., and H. A. Kantrud. 1971. Classification of natural ponds and lakes in the glaciated prairie region. USDI Bureau of Sport Fisheries and Wildlife Resources, Publication 92. Washington, DC. 77 pp.

2. Shrub & Herb Vegetation

2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

2.C.5.Na. North American Great Plains Saline Marsh (D033)**M077. Great Plains Saline Wet Meadow & Marsh**

2. Shrub & Herb Vegetation

2.C.5.Na. North American Great Plains Saline Marsh

G534. Western Great Plains Saline Wet Meadow

Type Concept Sentence: This wetland group consists of alkaline grasslands with and without an open shrub layer with dominant grasses that include *Distichlis spicata*, *Muhlenbergia porteri*, *Panicum obtusum*, *Puccinellia nuttalliana*, *Scleropogon brevifolius*, and/or *Sporobolus airoides*, and found in the Great Plains and Rocky Mountain foothills.

OVERVIEW***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.C.5.Na.1. Great Plains Saline Wet Meadow & Marsh (M077)

Elcode: G534

***Scientific Name:** Western Great Plains Saline Wet Meadow Group

***Common (Translated Scientific) Name:** Western Great Plains Saline Wet Meadow Group

***Colloquial Name:** Western Great Plains Saline Wet Meadow

***Type Concept:** This saline wet meadow group is found in the northern, southern and western Great Plains and in the Rocky Mountain foothills. Dominant grasses include *Distichlis spicata*, *Muhlenbergia porteri*, *Panicum obtusum*, *Puccinellia nuttalliana*, *Scleropogon brevifolius*, and/or *Sporobolus airoides*. Scattered shrubs may include *Allenrolfea occidentalis*, *Artemisia frigida*, *Artemisia tridentata*, *Atriplex canescens*, *Chrysothamnus* spp., *Gutierrezia sarothrae*, and *Sarcobatus vermiculatus*. Stands occur in a wide variety of lowland sites, such as stream terraces, swales, interdune basins, and alluvial flats. This group has a high water table because of land position and impermeable subsurface horizons. Soils are moderately saline and usually alkaline. Soil surface textures are sandy to clayey. The soils morphology often includes a claypan, caliche layer or other subsurface horizon that impedes water movement. Soils are saline or alkaline, but salt crusts on the surface are absent. Although periodic flooding is rare, stands of this group receive more water than the surrounding uplands through runoff.

***Diagnostic Characteristics:** Moderately saline stands dominated by *Sporobolus airoides*, *Sarcobatus vermiculatus*, and/or *Puccinellia nuttalliana*.

***Classification Comments:** Recently split from a wider ranging group, this group is limited to the Great Plains.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G537 | North American Desert Alkaline-Saline Wet Scrub | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Perennial grassland <1 m in height, shrubs and dwarf shrubs often present with generally <25% cover.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Dominant grasses include *Distichlis spicata*, *Muhlenbergia porteri*, *Panicum obtusum*, *Puccinellia nuttalliana*, *Scleropogon brevifolius*, and/or *Sporobolus airoides*. Scattered shrubs may include *Allenrolfea occidentalis*, *Artemisia frigida*, *Artemisia tridentata*, *Atriplex canescens*, *Chrysothamnus* spp., *Gutierrezia sarothrae*, and *Sarcobatus vermiculatus*. Other common grasses are *Bouteloua dactyloides* (= *Buchloe dactyloides*), *Hordeum jubatum*, *Hordeum pusillum*, *Pascopyrum smithii*, and *Sporobolus cryptandrus*. Forbs and shrubs are typically sparse. Common forb associates are *Chaetopappa ericoides*, *Grindelia squarrosa*, *Helianthus* spp., *Machaeranthera* spp., *Plantago* spp., *Ratibida* spp., *Sphaeralcea* spp., *Symphytotrichum ericoides* (= *Aster ericoides*), and *Salicornia rubra* (on more saline inclusions).

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Const-ancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|------------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Periodic subsurface irrigation is needed to maintain this group.

ENVIRONMENT

Environmental Description: This group is not defined by a flood regime so much as that the soil often has a high water table because of land position and impermeable subsurface horizons. Soils are moderately saline and usually alkaline, but salt crusts on the surface are absent (Thilenius et al. 1995). Soil surface textures are sandy to clayey. The soils morphology often includes a claypan, caliche layer or other subsurface horizon that impedes water movement. Parent material is typically alluvium derived from limestone, shale, or sandstone.

DISTRIBUTION

***Geographic Range:** This group is found in the Great Plains, generally western portions, but ranges from north to south throughout.

Nations: CA, US

States/Provinces: MT, ND, SD, SK?, WY

USFS Ecoregions (2007) [optional]:

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3904 | <i>Sporobolus airoides</i> Great Plains Marsh Alliance |
| A3905 | <i>Sarcobatus vermiculatus</i> Great Plains Wet Shrubland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** Faber-Langendoen et al.

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** G. Kittel

Acknowledgments [optional]:

Version Date: 03 Dec 2015

REFERENCES

***References [Required if used in text]:**

Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2017a. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

2.C.5.Nc. Temperate & Boreal Pacific Coastal Salt Marsh (D035)

M081. North American Pacific Coastal Salt Marsh

2. Shrub & Herb Vegetation

2.C.5.Nc. Temperate & Boreal Pacific Coastal Salt Marsh

G499. Temperate Pacific Salt Marsh

Type Concept Sentence: This group consists of intertidal salt and brackish marshes found throughout the North American Pacific Coast, with representative dominant plant species such as *Batis maritima*, *Carex lyngbyei*, *Carex ramenskii*, *Distichlis spicata*, *Eleocharis palustris*, *Glaux maritima*, *Salicornia depressa*, *Suaeda* spp., *Triglochin maritima*, and/or *Triglochin* spp.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.C.5.Nc.1. North American Pacific Coastal Salt Marsh (M081)

Elcode: G499

***Scientific Name:** *Carex lyngbyei* - *Bolboschoenus maritimus* - *Glaux maritima* Salt Marsh Group

***Common (Translated Scientific) Name:** Lyngbye's Sedge - Cosmopolitan Bulrush - Sea-milkwort Salt Marsh Group

***Colloquial Name:** Temperate Pacific Salt Marsh

***Type Concept:** This group consists of the intertidal salt marshes and brackish marshes found throughout the North American Pacific Coast. Vegetation ranges from very dense thickets to open and sparse. Dominant plant species change from north to south, but communities have many species in common, including *Batis maritima*, *Carex lyngbyei*, *Carex ramenskii*, *Distichlis spicata*, *Eleocharis palustris*, *Glaux maritima*, *Hippuris tetraphylla*, *Honckenya peploides*, *Jaumea carnosa*, *Limonium californicum*, *Monanthochloe littoralis*, *Puccinellia* spp., *Salicornia depressa* (= *Salicornia virginica*), *Salicornia* spp., *Spergularia canadensis*, *Suaeda* spp., *Triglochin maritima*, and/or *Triglochin* spp. Primarily associated with estuaries or coastal lagoons, salt marshes are limited to bays, behind sand spits or other locations protected from wave action. These occur from Kodiak Island and south-central Alaska, south along the coast throughout British Columbia, Washington, Oregon, California, Baja California and the Sonoran coast along the Gulf of California, including coastal marshes along the Colorado River delta and other river deltas such as the Rio Yaqui.

***Diagnostic Characteristics:** Coastal herbaceous intertidal salt marshes and brackish marshes primarily associated with estuaries or coastal lagoons, salt marshes are limited to bays, behind sand spits or other locations protected from wave action.

***Classification Comments:** This type has a very extensive distribution, from cold temperate Alaska to subtropical Mexico. It also spans the low to high marsh. The following grouping of associations corresponds to the major environmental zones. These should be compared with the alliances. **Low Tidal Marsh- Regularly Flooded Daily** - CEGLO02882, CEGLO02920, CEGLO02923, CEGLO03123, CEGLO03286, CEGLO03287, CEGLO03329, CEGLO03366, CEGLO03380, CEGLO03381, CEGLO03462, CEGLO03466, CEGLO03471. **Hypersaline High Marsh** - CEGLO03356, CEGLO03120, CEGLO02885. **Brackish High Marsh** - CEGLO03285, CEGLO03288, CEGLO03289, CEGLO03357, CEGLO03367, CEGLO03369, CEGLO03382, CEGLO03383, CEGLO03384, CEGLO03421, CEGLO03424, CEGLO03469.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|--|
| G517 | Vancouverian Freshwater Wet Meadow & Marsh | upper parts of salt marsh have some similarities to freshwater marshes. |
| G535 | North American Arctic Coastal Salt Marsh | occurs further north along the Aleutian Islands and in the arctic and boreal climes. |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Graminoid-dominated herbaceous wetlands flooded daily by saltwater tidal influx. May contain low scattered shrubs.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Dominant plant species change from north to south, but communities have many species in common which include *Jaumea carnosa*, *Carex lyngbyei*, *Distichlis spicata*, *Salicornia depressa* (= *Salicornia virginica*), and *Salicornia* spp. High salt marsh and other short-inundation and regularly drying salt marsh or marsh-like settings have much in common with each other. For example, *Distichlis spicata*, *Allenrolfea occidentalis*, *Frankenia salina*, *Arthrocnemum subterminale*, *Cressa truxillensis*, *Glaux*

maritima, and many other "high marsh" species in California may also be found in the interior saline and alkaline basins and moist bottomlands far from the coast.

A study at Humboldt Bay (northwestern California) by Pickart (2006) suggests that there are different alliances based on saline, brackish, and fresh to slightly brackish marsh. The only types that would be considered saline marsh are *Distichlis spicata*, *Bolboschoenus maritimus* (= *Scirpus maritimus*), *Atriplex prostrata*, *Salicornia*, and *Spergularia*. Many species considered as salt marsh indicators or differential types in this treatment such as *Deschampsia cespitosa*, *Argentina anserina* (= *Potentilla anserina*), and *Eleocharis* occur in brackish conditions. Another suite of species, including *Juncus arcticus*, *Hydrocotyle ranunculoides*, *Typha latifolia*, and *Oenanthe sarmentosa*, are only slightly to moderately brackish in Na-based and electrical conductivity salinity classes.

Low marshes are located in areas that flood every day and are dominated by a variety of low-growing forbs and low to medium-height graminoids, especially *Carex lyngbyei*, *Carex ramenskii*, *Glaux maritima*, *Hippuris tetraphylla*, *Honckenya peploides*, *Puccinellia* spp., *Salicornia depressa*, *Schoenoplectus americanus*, *Bolboschoenus maritimus*, *Spergularia canadensis*, and *Triglochin maritima*. High marshes are located in areas that flood infrequently and are dominated by medium-tall graminoids and low forbs, especially *Argentina egedii*, *Deschampsia cespitosa*, *Festuca rubra*, *Juncus arcticus* ssp. *littoralis* (= *Juncus balticus*), *Poa eminens* and *Symphotrichum subspicatum* (= *Aster subspicatus*). Transition zone (slightly brackish) marshes are often dominated by *Atriplex prostrata* (= *Atriplex triangularis*), *Cordylanthus* spp., *Juncus mexicanus*, *Lilaeopsis masonii*, *Phragmites* spp., *Schoenoplectus acutus*, and *Typha* spp. The invasive species *Lepidium latifolium* is a problem in many of these marshes. Rare plant species include *Cordylanthus maritimus* ssp. *maritimus*.

In the warm summer-dry climates of central California to Baja California and the Sonoran coast, marshes can be sparsely vegetated and are composed of halophytic species such as *Allenrolfea occidentalis*, *Arthrocnemum subterminale*, *Atriplex* spp., *Monanthochloe littoralis*, *Distichlis spicata*, *Frankenia* spp., *Limonium californicum*, *Pluchea* spp., *Salicornia* spp., and *Suaeda* spp. Floristic data were compiled from Shreve and Wiggins (1964), Sparks et al. (1977), Brown (1982), Barbour and Major (1988), National Wetlands Working Group (1988), Viereck et al. (1992), Holland and Keil (1995), Sawyer and T. Keeler-Wolf (1995), and Boggs (2000).

*Floristics Table [Med - High Confidence]:

*Number of Plots:

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:

ENVIRONMENT

Environmental Description: *Climate:* Ranges from temperate to Mediterranean to warm desert. *Soil/substrate/hydrology:* The frequency of tidal flooding and salinity vary widely. Soils are usually fine-textured and saturated. Primarily associated with estuaries or coastal lagoons, salt marshes are limited to bays, behind sand spits or other locations protected from wave action. These marshes form when there is a freshwater source that mixes with coastal ocean saltwater. Occurrences can be small or large patch, and individual associations are confined to specific environments defined by ranges of salinity, tidal inundation regime, and soil texture. Summer-dry periods result in decreased freshwater inputs from inland. Hypersaline environments within salt marshes occur in "salt pans" where tidal water collects and evaporates, and the vegetation can be sparse. Substrates are typically fine-textured and saline alluvium. Vegetation ranges from very dense thickets to open and sparse. Sharp gradients and abrupt shifts in species composition across complex moisture and salinity gradients make for fine-scale patches or bands of vegetation.

Most cool temperate and warm temperate coastal salt marshes are influenced by daily tides and also by seasonal or unpredictable inundations at highest elevation levels of the marsh. Gradients in elevation influence gradients in moisture and in salinity, with highest portions being drier and having higher surface concentrations of salt. High marshes in the warm temperate to subtropical zones have more in common with interior saline and alkaline systems such as playa margins, alkali seeps, and springs.

"High" salt marshes in cooler areas with higher summer precipitation (e.g., the Pacific Northwest) tend to have more in common with brackish or even freshwater meadows, while high marshes in warm temperate Mediterranean or subtropical dry coasts tend to have more in common with desert alkaline or saline settings. Tidal fluctuation is very important and maintains constant moderate salinity and moisture conditions. The species that are indicative of this tidal salt marsh environment are the core of this group. They tend to sort based on moisture and water depth and not on salinity gradients.

Low marshes are located in areas that flood every day and are dominated by a variety of low-growing forbs and low to medium-height graminoids.

In the warm summer-dry climates of central California to Baja California and the Sonoran coast, marshes can be sparsely vegetated and are composed of halophytic species.

Environmental data were compiled from Shreve and Wiggins (1964), Sparks et al. (1977), Brown (1982), Barbour and Major (1988), National Wetlands Working Group (1988), Viereck et al. (1992), Holland and Keil (1995), Sawyer and T. Keeler-Wolf (1995), and Boggs (2000).

DISTRIBUTION

***Geographic Range:** This group is found throughout the Pacific Coast, from Kodiak Island and south-central Alaska, south along the coast throughout British Columbia, Washington, Oregon, California, Baja California and the Sonoran coast along the Gulf of California, including coastal marshes along the Colorado River Delta and other river deltas such as the Rio Yaqui. Tidal marshes have a limited distribution along the Gulf of Alaska and British Columbia coastline due to the topography and geomorphology of the coast, which features steep slopes and deep fjords and offers limited protection from wave action (National Wetlands Working Group 1988).

Nations: CA, MX, US

States/Provinces: AK, BC, CA, MXBC, MXBS, MXSO, OR, WA

USFS Ecoregions (2007) [optional]: 242A:CC, 261B:CC, 263A:CC, M242A:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A2622 | <i>Carex lyngbyei</i> Brackish Salt Marsh Alliance |
| A3903 | <i>Bolboschoenus maritimus</i> - <i>Schoenoplectus californicus</i> Salt Marsh Alliance |
| A3902 | <i>Sarcocornia pacifica</i> - <i>Spartina foliosa</i> - <i>Glaux maritima</i> Salt Marsh Alliance |
| A3898 | <i>Argentina egedii</i> - <i>Calamagrostis nutkaensis</i> - <i>Juncus arcticus</i> ssp. <i>littoralis</i> Salt Marsh Alliance |
| A3899 | <i>Deschampsia cespitosa</i> - <i>Festuca rubra</i> Brackish Salt Marsh Alliance |
| A3900 | <i>Distichlis spicata</i> Salt Marsh Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| > | Wetlands (217) | Shiflet 1994 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** K. Boggs, C. Chappell, G. Kittel, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** G. Kittel

Acknowledgments [optional]: K. Boggs, C. Chappell, T. Keeler-Wolf, M.S. Reid

Version Date: 02 Dec 2015

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2.C.5.Nd. North American Western Interior Brackish Marsh, Playa & Shrubland (D036)

M082. Warm & Cool Desert Alkali-Saline Marsh, Playa & Shrubland

2. Shrub & Herb Vegetation

2.C.5.Nd. North American Western Interior Brackish Marsh, Playa & Shrubland

G538. North American Desert Alkaline-Saline Marsh & Playa

Type Concept Sentence: This group contains alkaline-saline marshes found in non-coastal and non-tidal areas of the Intermountain West. Marshes can be densely vegetated emergent or barren and sparsely vegetated playas where soils and water (if present) are alkaline. Characteristic species may include *Allenrolfea occidentalis*, *Atriplex* spp., *Distichlis spicata*, *Grayia spinosa*, *Leymus cinereus*, *Leymus triticoides*, *Muhlenbergia* spp., *Poa secunda*, *Puccinellia lemmonii*, *Salicornia* spp., *Sarcobatus vermiculatus*, and *Triglochin maritima*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.C.5.Nd.1. Warm & Cool Desert Alkali-Saline Marsh, Playa & Shrubland (M082)

Elcode: G538

***Scientific Name:** *Distichlis spicata* - *Puccinellia lemmonii* - *Salicornia* spp. Alkaline-Saline Marsh & Playa Group

***Common (Translated Scientific) Name:** Saltgrass - Lemmon's Alkali Grass - Saltwort species Alkaline-Saline Marsh & Playa Group

***Colloquial Name:** North American Desert Alkaline-Saline Marsh & Playa

***Type Concept:** This group is found in the intermountain western U.S. Associations are composed of densely vegetated seasonal wetlands, saltwater emergent marshes to barren and sparsely vegetated playas (generally <10% plant cover). Characteristic species may include *Allenrolfea occidentalis*, *Atriplex* spp., *Distichlis spicata*, *Grayia spinosa*, *Leymus cinereus*, *Leymus triticoides* (= *Elymus triticoides*), *Muhlenbergia* spp., *Poa secunda*, *Puccinellia lemmonii*, *Salicornia* spp., *Sarcobatus vermiculatus*, and *Triglochin maritima*. Soils and standing water (if present) are alkaline. Salt crusts are common where there are actively drying ponds, that can have saltgrass beds in depressions and sparse shrubs around the margins. Playa flats are intermittently, seasonally to semipermanently flooded, usually retaining water into the growing season and drying completely only in drought years. Many are associated with hot

and cold springs, located in basins with internal drainage. Soils are alkaline to saline clays with hardpans. Seasonal drying exposes mudflats colonized by annual wetland vegetation. Water is prevented from percolating through the soil by an impermeable soil subhorizon and is left to evaporate. Soil salinity varies greatly with soil moisture and greatly affects species composition. During exceptionally wet years, increased precipitation can dilute soil salt concentrations which may allow less salt-tolerant species to become established or more abundant. Some stands occur on floodplains, along the margins of perennial lakes, and in alkaline closed basins, with extremely low-gradient shorelines.

***Diagnostic Characteristics:** Salt-tolerant herbs that are seasonally or intermittently wet on barren to sparsely vegetated playas, lake margins, closed basins, and low-gradient shorelines.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|---|
| G531 | Arid West Interior Freshwater Marsh | |
| G324 | Great Plains Saline Wet Meadow & Marsh | also includes salt-tolerant herbaceous wetlands, but occurs east of the Continental Divide on the Great Plains. |
| G537 | North American Desert Alkaline-Saline Wet Scrub | also occurs in cold desert regions but is dominated by shrub species. |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Open shrub and/or herb vegetation.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Characteristic species may include *Allenrolfea occidentalis*, *Atriplex* spp., *Distichlis spicata*, *Grayia spinosa*, *Leymus cinereus*, *Leymus triticoides* (= *Elymus triticoides*), *Muhlenbergia* spp., *Poa secunda*, *Puccinellia lemmonii*, *Salicornia* spp., *Schoenoplectus americanus*, *Bolboschoenus maritimus* (= *Schoenoplectus maritimus*), and *Triglochin maritima*.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Playas are shallow, seasonal wetlands that lie in the lowest point of a closed watershed. Their basins are lined with clay soils, which collect and hold water from rainfall and runoff events. Water evaporates, leaving high salt concentrations in the soils. Some playas will only flood with water during years with high precipitation, sometimes only once or twice in a decade. Others will have standing water every spring, except in the driest of years. During flooded years, some salt-tolerant marsh plant species may grow, such as cattails (*Typha* spp.) or bulrush (*Scirpus* and/or *Schoenoplectus* spp.) (Knight 1994).

ENVIRONMENT

Environmental Description: *Climate:* Cold desert. *Soil/substrate/hydrology:* This group is found on barren and sparsely vegetated playas (generally <10% plant cover). Salt crusts are common throughout, with small saltgrass beds in depressions and sparse shrubs around the margins. The flats are intermittently, seasonally to semipermanently flooded, usually retaining water into the growing season and drying completely only in drought years. Many are associated with hot and cold springs, located in basins with internal drainage. Soils are alkaline to saline clays with hardpans. Seasonal drying exposes mudflats colonized by annual wetland vegetation. Water is prevented from percolating through the soil by an impermeable soil subhorizon and is left to evaporate. Soil salinity varies greatly with soil moisture and greatly affects species composition. During exceptionally wet years, increased precipitation can dilute soil salt concentrations which may allow less salt-tolerant species to become established or more abundant. Some stands occur on

floodplains, along the margins of perennial lakes, and in alkaline closed basins, with extremely low-gradient shorelines. Environmental information compiled from individual associations and Knight (1994).

DISTRIBUTION

***Geographic Range:** This group is found throughout the intermountain western U.S.

Nations: CA, MX, US

States/Provinces: CA, CO, ID, MT, NM, NV, OR, TX, UT, WA?, WY

USFS Ecoregions (2007) [optional]: 313A:CP, 313B:CP, 313D:CC, 322A:??, 331J:CC, 341A:CC, 341B:CC, 341C:CC, 341D:CC, 341E:CC, 341F:CC, 341G:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CP, 342F:CC, 342G:CC, 342H:CC, 342I:C?, 342J:CC, M242C:CC, M261D:P?, M261G:PP, M313A:CC, M331D:??, M331E:??, M332G:CC, M341A:CC, M341B:C?, M341D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: High

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A1334 | <i>Sporobolus airoides</i> - <i>Muhlenbergia asperifolia</i> - <i>Spartina gracilis</i> Alkaline Wet Meadow Alliance |
| A4241 | <i>Frankenia salina</i> Salt Marsh & Playa Alliance |
| A4164 | <i>Cladium californicum</i> Alkaline Seep Alliance |
| A3930 | <i>Eleocharis palustris</i> - <i>Eleocharis rostellata</i> Alkaline-Saline Marsh Alliance |
| A3932 | <i>Hordeum jubatum</i> Alkaline Wet Meadow Alliance |
| A1332 | <i>Distichlis spicata</i> Alkaline Wet Meadow Alliance |
| A1329 | <i>Leymus cinereus</i> - <i>Leymus triticooides</i> Alkaline Wet Meadow Alliance |
| A4247 | <i>Anemopsis californica</i> - <i>Helianthus nuttallii</i> - <i>Solidago spectabilis</i> Alkaline Wet Meadow Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------------|---|-----------------------------|
| 2014-04-09 | G672 North American Warm Desert Alkaline Scrub & Herb Playa & Wet Flat Group | G672 covered by G537 & G538 |
| 2014-04-09 | G540 <i>Allenrolfea occidentalis</i> - <i>Suaeda moquinii</i> - <i>Salicornia rubra</i> Alkaline Herb Marsh & Seep Vegetation Group | G672 covered by G537 & G538 |
| 2014-04-09 | G539 <i>Allenrolfea occidentalis</i> - <i>Suaeda</i> spp. - <i>Distichlis spicata</i> Scrub & Herb Playa & Wet Flat Herbaceous Vegetation Group | G672 covered by G537 & G538 |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** G. Kittel, in Faber-Langendoen et al.

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** G. Kittel

Acknowledgments [optional]: J. Kagan and P. Comer

Version Date: 02 Dec 2015

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2. Shrub & Herb Vegetation

2.C.5.Nd. North American Western Interior Brackish Marsh, Playa & Shrubland

G537. North American Desert Alkaline-Saline Wet Scrub

Type Concept Sentence: This group consists of saline scrub wetlands of the Intermountain West. Characteristic species include *Atriplex* spp., *Allenrolfea occidentalis*, *Salicornia rubra*, *Sarcobatus vermiculatus*, *Sesuvium verrucosum*, and/or *Suaeda moquinii*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 2.C.5.Nd.1. Warm & Cool Desert Alkali-Saline Marsh, Playa & Shrubland (M082)

Elcode: G537

***Scientific Name:** *Sarcobatus vermiculatus* - *Atriplex* spp. Alkaline-Saline Wet Scrub Group

***Common (Translated Scientific) Name:** Greasewood - Saltbush species Alkaline-Saline Wet Scrub Group

***Colloquial Name:** North American Desert Alkaline-Saline Wet Scrub

***Type Concept:** This group occurs throughout much of the western U.S. in intermountain basins. Stands typically occur near drainages on stream terraces and flats or may form rings around more sparsely vegetated playas. Sites typically have saline soils, a shallow water table and flood intermittently, but remain dry for most growing seasons. The water table remains high enough to maintain vegetation, despite salt accumulations. This group consists of open to moderately dense shrublands dominated by *Atriplex lentiformis*, *Atriplex parryi*, *Atriplex polycarpa*, *Atriplex spinifera*, *Allenrolfea occidentalis*, *Salicornia rubra*, *Sarcobatus vermiculatus*, *Sesuvium verrucosum*, and/or *Suaeda moquinii*. Stands may be monotypic or have lesser abundance of other shrubs such as *Atriplex canescens*, *Atriplex confertifolia*, *Atriplex gardneri*, *Artemisia tridentata ssp. wyomingensis*, *Artemisia tridentata ssp. tridentata*, *Artemisia cana ssp. cana*, *Baccharis* spp., *Krascheninnikovia lanata*, and others. The herbaceous layer, if present, is usually dominated by graminoids. There may be inclusions of *Calamovilfa longifolia*, *Distichlis spicata* (where water remains ponded the longest), *Eleocharis palustris*, *Pascopyrum smithii*, *Poa pratensis*, *Puccinellia nuttalliana*, or *Sporobolus airoides* herbaceous types.

***Diagnostic Characteristics:** Salt-tolerant shrublands with a shallow water table.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|--|
| G534 | Western Great Plains Saline Wet Meadow | occurs in the northern and western Great Plains and is also dominated by <i>Sarcobatus vermiculatus</i> with more Great Plains herbaceous species. |
| G538 | North American Desert Alkaline-Saline Marsh & Playa | includes salt communities in the cold desert that are dominated by herbaceous species. |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Shrubland.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: These shrublands are dominated by *Atriplex lentiformis*, *Atriplex parryi*, *Atriplex polycarpa*, *Atriplex spinifera*, *Allenrolfea occidentalis*, *Salicornia rubra*, *Sarcobatus vermiculatus*, *Sesuvium verrucosum*, and/or *Suaeda moquinii*. Codominant shrubs include *Ambrosia dumosa*, *Artemisia californica*, *Atriplex canescens*, *Baccharis pilularis*, *Baccharis salicifolia*, *Encelia californica*, *Eriogonum fasciculatum*, *Gutierrezia sarothrae*, *Hymenoclea salsola*, *Bassia americana* (= *Kochia americana*), *Larrea tridentata*, *Malosma laurina*, *Myoporum laetum*, *Pluchea sericea*, *Prosopis glandulosa*, *Rhus integrifolia*, and/or *Suaeda taxifolia* plus several others. The herbaceous layer, if present, is usually dominated by graminoids. There may be inclusions of *Calamovilfa longifolia*, *Distichlis spicata* (where water remains ponded the longest), *Eleocharis palustris*, *Pascopyrum smithii*, *Poa pratensis*, *Puccinellia nuttalliana*, or *Sporobolus airoides* herbaceous types (West 1983b, Knight 1994).

*Floristics Table [Med - High Confidence]:

*Number of Plots:

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:

ENVIRONMENT

Environmental Description: *Climate:* Cold interior desert. *Soil/substrate/hydrology:* Sites are generally flat to gently sloping and moderately saline, but some sites do occur on rolling to hilly fans and slopes. Sites typically have saline soils, a shallow water table and flood intermittently, on margins of intermittently flooded desert playas, and usually remain dry for most growing seasons. The water table remains high enough to maintain vegetation, despite salt accumulations, often with fine soils such as clays (West 1983b, Knight 1994).

DISTRIBUTION

***Geographic Range:** This group occurs throughout much of the western U.S. in intermountain basins.

Nations: US

States/Provinces: AZ, CA, CO, ID, MT, NM, NV, OR, TX, UT, WA, WY

USFS Ecoregions (2007) [optional]: 313A:CC, 313B:CC, 313D:CC, 315A:CC, 315H:CC, 321A:??, 322A:CC, 331B:CC, 331C:CP, 331D:CP, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 331J:CC, 331K:CP, 331L:C?, 341A:CC, 341B:CC, 341C:CC, 341D:CC, 341E:CC, 341F:CC, 341G:CC, 342A:CC, 342B:CC, 342C:CC, 342D:CC, 342F:CC, 342G:CC, 342H:CC, 342I:C?, 342J:CC, M242C:??, M261D:CC, M261E:CP, M261G:CC, M313A:CC, M313B:CC, M331A:C?, M331B:CP, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CP, M331J:C?, M332A:C?, M332D:CP, M332E:C?, M332G:CC, M341A:CC, M341B:CC, M341C:CC, M341D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

*Lower Level NVC Types:

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A0798 | <i>Pluchea sericea</i> Wet Shrubland Alliance |
| A3173 | <i>Atriplex lentiformis</i> Wet Shrubland Alliance |
| A1046 | <i>Sarcobatus vermiculatus</i> Intermountain Wet Shrubland Alliance |
| A0866 | <i>Allenrolfea occidentalis</i> Wet Shrubland Alliance |

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3880 | <i>Suaeda moquinii</i> - <i>Salicornia rubra</i> - <i>Isocoma acradenia</i> Alkaline Wet Scrub Alliance |
| A2507 | <i>Atriplex parryi</i> Wet Shrubland Alliance |
| A0865 | <i>Atriplex spinifera</i> Wet Shrubland Alliance |
| A3879 | <i>Sesuvium verrucosum</i> Desert Salt Mudflat Scrub Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

*Recent Concept Lineage [if applicable]:

| Date | Predecessor | Note |
|------------|---|-----------------------------|
| 2014-04-09 | G672 North American Warm Desert Alkaline Scrub & Herb Playa & Wet Flat Group | G672 covered by G537 & G538 |
| 2014-04-09 | G540 <i>Allenrolfea occidentalis</i> - <i>Suaeda moquinii</i> - <i>Salicornia rubra</i> Alkaline Herb Marsh & Seep Vegetation Group | G672 covered by G537 & G538 |
| 2014-04-09 | G539 <i>Allenrolfea occidentalis</i> - <i>Suaeda</i> spp. - <i>Distichlis spicata</i> Scrub & Herb Playa & Wet Flat Herbaceous Vegetation Group | G672 covered by G537 & G538 |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-----------------------------|----------------|------|
| > | Salt Desert Shrub (414) | Shiflet 1994 | |
| >< | Saltbush - Greasewood (501) | Shiflet 1994 | |

AUTHORSHIP

*Primary Concept Source [if applicable]: G. Kittel, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

*Author of Description: G. Kittel

Acknowledgments [optional]:

Version Date: 02 Dec 2015

REFERENCES

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3.A.2.Na. North American Warm Desert Scrub & Grassland (D039)**M086. Chihuahuan Desert Scrub**

3. Desert & Semi-Desert

3.A.2.Na. North American Warm Desert Scrub & Grassland

G288. Chihuahuan Creosotebush - Mixed Desert Scrub

Type Concept Sentence: This desert scrub group forms the extensive desert scrub that occurs in the broad desert basins and plains extending up onto dissected gravelly alluvial fans and piedmonts and foothills in the Chihuahuan Desert and is characterized by a moderate to sparse shrub layer (<10% cover on extremely xeric sites) that is dominated by *Larrea tridentata* sometimes with other species such as *Acacia constricta*, *Acacia neovernicosa*, *Agave lechuguilla*, *Bernardia obovata*, *Dasyllirion leiophyllum*, *Flourensia cernua*, *Fouquieria splendens*, *Lycium* spp., *Mimosa aculeaticarpa* var. *biuncifera*, *Mortonia scabrella*, *Opuntia engelmannii*, *Parthenium incanum*, *Viguiera stenoloba*, and *Yucca* spp.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 3.A.2.Na.2. Chihuahuan Desert Scrub (M086)

Elcode: G288

***Scientific Name:** *Larrea tridentata* - *Flourensia cernua* - *Acacia neovernicosa* Chihuahuan Mixed Desert Scrub Group

***Common (Translated Scientific) Name:** Creosotebush - American Tarwort - Viscid Acacia Chihuahuan Mixed Desert Scrub Group

***Colloquial Name:** Chihuahuan Creosotebush - Mixed Desert Scrub

***Type Concept:** This group is the extensive desert scrub that occurs in the broad desert basins and plains extending up onto dissected gravelly alluvial fans and piedmonts (bajadas), and foothills in the Chihuahuan Desert below the chaparral zone. The vegetation has a moderate to sparse shrub layer (<10% cover on extremely xeric sites). *Larrea tridentata* is the most common dominant, often covering entire landscapes in near monotypic stands. Stands can also be codominated or dominated by a mix of thornscrub or other desert scrub species such as *Agave lechuguilla*, *Bernardia obovata*, *Dasyllirion leiophyllum*, *Flourensia cernua*, *Fouquieria splendens*, *Lycium* spp., *Mimosa aculeaticarpa* var. *biuncifera*, *Mortonia scabrella* (= *Mortonia sempervirens* ssp. *scabrella*), *Opuntia engelmannii*, *Parthenium incanum*, *Rhus microphylla* (in ephemeral washes), *Viguiera stenoloba*, and *Yucca* spp. Stands of thornscrub dominated by *Acacia constricta* or *Acacia neovernicosa* are included in this group, and can be especially prolific on limestone substrates (but not always). If present, *Prosopis glandulosa* does not dominate the shrub layer, but may codominate in a mixed stand with *Larrea tridentata*. Grasses are common but generally have lower cover than shrubs. Common species may include *Bouteloua eriopoda*, *Bouteloua ramosa*, *Dasyochloa pulchella*, *Muhlenbergia porteri*, *Pleuraphis mutica*, and *Scleropogon brevifolius*. Some shrublands have a sparse understory, sometimes with a pebbly desert pavement on the soil surface. It has recently expanded into former desert grasslands in the northern portion of its range. Substrates are typically coarse-textured loams on gravelly plains and slopes. Soils are alluvial, typically non-saline, and frequently calcareous, sometimes with a petrocalcic layer and are often derived from limestone and, to a lesser degree, igneous rocks. Stands can extend upslope on to colluvial slopes with cobbly skeletal soils.

***Diagnostic Characteristics:** The moderate to sparse shrub layer is typically strongly dominated or codominated by *Larrea tridentata*, often with *Flourensia cernua*. Other desert scrubs may dominate some stands, but *Larrea tridentata* is usually present. This group also includes thornscrub dominated by *Acacia constricta*, *Acacia neovernicosa*, and *Acacia greggii*.

***Classification Comments:** This broadly defined group forms the matrix vegetation of the Chihuahuan Desert.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G490 | Chihuahuan Desert Foothill-Piedmont & Lower Montane Grassland | |
| G819 | North American Warm Desert Ruderal Scrub | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The vegetation has a moderate to sparse (<10% cover on extremely xeric sites), xeromorphic evergreen short-shrub layer (<2 m tall). Understory dwarf-shrub and herbaceous layers and emergent tall shrubs may be absent or present.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This Chihuahuan Desert scrub group has a moderate to sparse shrub layer (<10% cover on extremely xeric sites). *Larrea tridentata* is the most common dominant, often covering entire landscapes in near monotypic stands. Stands can also be codominated or dominated by a mix of thornscrub or other desert scrub species such as *Agave lechuguilla*, *Aloysia wrightii*, *Baccharis pteronioides*, *Bernardia obovata*, *Dasyliirion leiophyllum*, *Fouquieria splendens*, *Jatropha dioica*, *Koeberlinia spinosa*, *Krameria erecta*, *Leucophyllum minus*, *Lycium* spp., *Mimosa aculeaticarpa* var. *biuncifera*, *Mortonia scabrella* (= *Mortonia sempervirens* ssp. *scabrella*), *Opuntia engelmannii*, *Parthenium incanum*, *Rhus microphylla* (in ephemeral washes), *Viguiera stenoloba*, and *Yucca* spp. (Brown 1982b, MacMahon and Wagner 1985, Henrickson and Johnston 1986, MacMahon 1988, Dick-Peddie 1993). In the southern Chihuahuan Desert, stands are dominated by *Larrea tridentata* with *Agave parryi* (= *Agave scabra*), *Cylindropuntia kleiniae* (= *Opuntia kleiniae*), *Cylindropuntia imbricata* (= *Opuntia imbricata*), and *Yucca filifera* (Huerta-Martínez et al. 2004). Stands of thornscrub dominated by *Acacia constricta*, *Acacia neovernicosa*, or *Acacia greggii* are included in this group, and can be especially prolific on limestone substrates (but not always). If present, *Prosopis glandulosa* does not dominate the shrub layer, but may codominate in a mixed stand with *Larrea tridentata*. Grasses are common but generally have lower cover than shrubs. Common species may include *Bouteloua curtipendula*, *Bouteloua eriopoda*, *Bouteloua gracilis*, *Bouteloua hirsuta*, *Bouteloua ramosa*, *Dasyochloa pulchella*, *Muhlenbergia porteri*, *Pleuraphis mutica*, and *Scleropogon brevifolius*. Some shrublands have a sparse understory, sometimes with a pebbly desert pavement on the soil surface.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: In the U.S., much of this scrubland is thought to be a result of recent expansion of *Larrea tridentata* into former desert grasslands and steppe in the last 150 years as a result of drought, overgrazing by livestock, and/or decreases in fire over the last 70-250 years (Buffington and Herbel 1965, Ahlstrand 1979, Donart 1984, Dick-Peddie 1993, Gibbens et al. 2005). This group includes vast areas of loamy plains that have been converted from *Pleuraphis mutica* and *Bouteloua eriopoda* desert grasslands to *Larrea tridentata* scrub. This group also includes invasive *Flourensia cernua* shrublands that occur in former (degraded) tobosa (*Pleuraphis mutica*) flats and loamy plains. Presence of *Scleropogon brevifolius* is common in these invasive stands. Dick-Peddie (1993) suggested that absence of *Flourensia cernua* as codominant and presence of *Dasyochloa pulchella*, *Acourtia nana*, and *Yucca elata* may be indicators of recent conversion of desert grasslands into desert scrub, but more research is needed. Conversely, sparse understory *Larrea tridentata* shrublands on remnant early Holocene erosional surfaces often with shallow calcareous soils and desert pavement may indicate pre-historic distributions of *Larrea tridentata* desert scrub in the Chihuahuan Desert (Stein and Ludwig 1979, Muldavin et al. 2000b).

ENVIRONMENT

Environmental Description: This group is the extensive desert scrub that occurs in the broad desert basins and plains extending up onto dissected gravelly alluvial fans and piedmonts (bajadas), and foothills in the Chihuahuan Desert below the chaparral zone. It has recently expanded into former desert grasslands in the northern portion of its range. Stands occur in flat to gently sloping desert basins and on alluvial plains to moderately steep piedmont slopes below the chaparral zone. *Soil/substrate/hydrology:* Substrates are typically coarse-textured loams on gravelly plains and slopes. Soils are alluvial, typically non-saline, and frequently calcareous, often with a petrocalcic layer and derived from limestone, or to a lesser degree igneous rocks (Brown 1982b, MacMahon and Wagner 1985, Henrickson and Johnston 1986, MacMahon 1988, Dick-Peddie 1993). Stands can extend upslope on to colluvial slopes with cobbly skeletal soils.

DISTRIBUTION

***Geographic Range:** This desert scrub group forms the matrix vegetation in the in the Chihuahuan Desert.

Nations: MX, US

States/Provinces: AZ, MXCH, MXSO, NM, TX

USFS Ecoregions (2007) [optional]: 313B:CP, 313C:CC, 315A:CC, 315B:CC, 315H:CC, 321A:CC, 322B:CC, M313A:CC, M313B:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3165 | <i>Flourensia cernua</i> Upland Desert Scrub Alliance |
| A3164 | <i>Larrea tridentata</i> Chihuahuan Desert Scrub Alliance |
| A3189 | <i>Mortonia scabrella</i> - <i>Viguiera stenoloba</i> - <i>Bernardia obovata</i> Chihuahuan Desert Scrub Alliance |
| A3167 | <i>Fouquieria splendens</i> - <i>Calliandra eriophylla</i> - <i>Parthenium incanum</i> Desert Scrub Alliance |
| A3166 | <i>Acacia constricta</i> - <i>Acacia neovernicosa</i> Thornscrub Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---|------------------------------|------|
| = | Chihuahuan Desertscrub, Creosotebush-Tarbrush Series - 153.21 | Brown et al. 1979 | |
| = | Chihuahuan Desert Scrub (<i>Larrea</i> Scrub Phase) | Henrickson and Johnston 1986 | |
| = | Chihuahuan Desert Scrub (Mixed Desert Scrub Phase) | Henrickson and Johnston 1986 | |

AUTHORSHIP***Primary Concept Source [if applicable]:** D.E. Brown, C.H. Lowe, and C.P. Pase (1979)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz and E. Muldavin**Acknowledgments [optional]:** E. Muldavin

Version Date: 05 Nov 2015

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3. Desert & Semi-Desert

3.A.2.Na. North American Warm Desert Scrub & Grassland

G299. Chihuahuan Desert Lowland Basin Scrub

Type Concept Sentence: This Chihuahuan Desert shrubland group forms extensive open-canopied shrublands of lowland, often somewhat saline basins and is characterized by *Atriplex canescens* or *Flourensia cernua*, and under more saline conditions, *Allenrolfea occidentalis*, *Sarcocornia utahensis*, or *Suaeda moquinii*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 3.A.2.Na.2. Chihuahuan Desert Scrub (M086)

Elcode: G299

***Scientific Name:** *Atriplex canescens* - *Flourensia cernua* Lowland Basin Scrub Group

***Common (Translated Scientific) Name:** Fourwing Saltbush - American Tarwort Lowland Basin Scrub Group

***Colloquial Name:** Chihuahuan Desert Lowland Basin Scrub

***Type Concept:** This desert scrub group occurs extensively as open-canopied shrublands in the alkaline, often somewhat saline basins and lowlands in the Chihuahuan Desert. It commonly includes stands dominated by *Atriplex canescens* or *Flourensia cernua*, but under more saline conditions, *Allenrolfea occidentalis*, *Sarcocornia utahensis*, *Suaeda moquinii*, or other halophytic plants may be present to codominant. The widespread, invasive *Prosopis glandulosa* may also be present to dominant in these lowland sites. While sites are often barren in the inter-shrub spaces, others can have high graminoid cover dominated by *Sporobolus airoides*, *Pleuraphis mutica*, *Scleropogon brevifolius*, or *Distichlis spicata*. It occurs as extensive open-canopied shrublands of lowland, often somewhat saline basins in the Chihuahuan Desert. Stands often occur on alluvial flats and around playas, as well as in floodplains along the Rio Grande and Pecos River, possibly also extending into the San Simon of southeastern Arizona. Substrates are generally fine-textured, often saline soils.

***Diagnostic Characteristics:** These open-canopied shrublands are dominated by saltbush or other saline habitat species with characteristic species of the Chihuahuan Desert such as *Flourensia cernua*. The widespread, invasive *Prosopis glandulosa* may also be present to dominant in these lowland sites, typically with saline or alkaline indicators in the herbaceous layer such as *Sporobolus*

airoides, *Pleuraphis mutica*, or *Distichlis spicata*.

***Classification Comments:** This warm-season group is similar to ~Intermountain Shadscale - Saltbush Scrub Group (G300)\$ and shares dominant saltbush species and some widespread herbaceous species. The presence of Chihuahuan Desert indicator species will floristically distinguish these groups.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G300 | Intermountain Shadscale - Saltbush Scrub | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These shrublands have a sparse to moderately dense, short-shrub canopy with 10-40% cover and less than <1 m tall. The herbaceous layer has variable cover ranging from sparse (<10% cover) to fairly dense (>50% cover) and is often patchy. It is usually dominated by perennial graminoids especially bunch grasses with low cover of forbs.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This group includes extensive open-canopied shrublands most commonly dominated by *Atriplex canescens* or *Flourensia cernua*, but under more saline conditions, *Allenrolfea occidentalis*, *Sarcocornia utahensis*, *Suaeda moquinii*, *Tidestromia carnosa*, or other halophytic plants may be present to codominant. The widespread, invasive *Prosopis glandulosa* may also be present to dominant in these lowland sites. Graminoid species may include *Sporobolus airoides*, *Panicum obtusum*, *Pleuraphis mutica*, *Scleropogon brevifolius*, or *Distichlis spicata* at varying densities. Occasional riparian species may be present near watercourses, such as *Prosopis pubescens* or *Populus deltoides ssp. wislizeni*.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:

ENVIRONMENT

Environmental Description: This group includes extensive open-canopied shrublands of lowland, often somewhat saline basins in the Chihuahuan Desert. Stands often occur on alluvial flats and around playas, as well as in floodplains along the Rio Grande and Pecos River, possibly also extending into the San Simon of southeastern Arizona. Sites are flat to gently sloping with slopes up to 3%. Elevation ranges from 1000-1300 m (3300-4300 feet). Substrates are generally fine-textured, often saline soils (silts, clay loams and clays) but may include moderately coarse-textured alluvium in the floodplains. Water tables are generally shallow but fluctuate within reach of deep-rooted plants, and in most places are high enough that salts accumulate on the surface of the soil.

DISTRIBUTION

***Geographic Range:** This group occurs in saline basins in the Chihuahuan Desert. Stands often occur around playas and on alluvial flats, as well as in floodplains along the Rio Grande and Pecos River, possibly also extending into the San Simon of southeastern Arizona.

Nations: MX, US

States/Provinces: AZ, MXCH, MXCO, MXDU, MXNU, MXSO, NM, TX

USFS Ecoregions (2007) [optional]: 313C:CC, 315A:CC, 315B:CC, 315H:CC, 321A:CC, 322B:CC, M313A:CC, M313B:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL**USNVC Confidence Level:** Low**USNVC Confidence Comments [optional]:****HIERARCHY*****Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3152 | <i>Flourensia cernua</i> Lowland Basin Desert Scrub Alliance |
| A3153 | <i>Prosopis glandulosa</i> Lowland Basin Chihuahuan Desert Scrub Alliance |
| A3151 | <i>Atriplex canescens</i> Lowland Basin Desert Scrub Alliance |

DISCUSSION**Discussion [optional]:****CONCEPT HISTORY*****Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--|-------------------|------|
| = | Chihuahuan Desertscrub, Saltbush Series - 153.27 | Brown et al. 1979 | |

AUTHORSHIP***Primary Concept Source [if applicable]:** D.E. Brown, C.H. Lowe, and C.P. Pase (1979)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz and E. Muldavin**Acknowledgments [optional]:** E. Muldavin

Version Date: 05 Nov 2015

REFERENCES***References [Required if used in text]:**

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3. Desert & Semi-Desert

3.A.2.Na. North American Warm Desert Scrub & Grassland

G287. Chihuahuan Desert Sand Scrub

Type Concept Sentence: This scrub group occurs on sandsheets and sandy plains in the Chihuahuan Desert and has an open canopy (10-30% total vegetation cover) that is frequently dominated by *Artemisia filifolia* or *Psoralea scoparius* often with *Atriplex canescens*, *Ephedra torreyana*, *Ephedra trifurca*, *Poliomintha incana*, *Rhus microphylla*, or *Larrea tridentata* present to codominant.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 3.A.2.Na.2. Chihuahuan Desert Scrub (M086)

Elcode: G287

***Scientific Name:** *Artemisia filifolia* - *Psoralea scoparius* Sand Scrub Group

***Common (Translated Scientific) Name:** Sand Sagebrush - Broom Smokebush Sand Scrub Group

***Colloquial Name:** Chihuahuan Desert Sand Scrub

***Type Concept:** This group includes the open desert scrub of vegetated coppice dunes and sandy plains found in the Chihuahuan Desert. Stands are usually dominated by *Artemisia filifolia* or *Psoralea scoparius* that anchor coppice dunes or occur on open sandsheet flats. They may also be dominated or codominated by *Atriplex canescens*, *Ephedra torreyana*, *Ephedra trifurca*, *Poliomintha incana*, *Rhus microphylla*, and *Larrea tridentata*, usually with 10-30% total vegetation cover. *Yucca elata*, *Gutierrezia sarothrae*, *Bouteloua eriopoda*, and *Sporobolus flexuosus* are commonly present. This group includes degraded sandy desert plains grasslands now dominated by *Artemisia filifolia* and *Prosopis glandulosa*.

***Diagnostic Characteristics:** A sparse to moderately dense (5-30% cover), low-statured shrubland (<2 m tall) dominated by *Psoralea scoparius* or *Artemisia filifolia* on sandy substrate. *Atriplex canescens*, *Ephedra torreyana*, *Ephedra trifurca*, *Poliomintha incana*, and *Rhus microphylla* may also dominate or codominate this coppice dune and sandsheet scrub.

***Classification Comments:** Heavy grazing in the late 1800s and early 1900s may have caused this shrubland to increase through degradation of semi-desert grassland on sandy plains. *Artemisia filifolia*, a dominant and diagnostic species of this group, is a widespread psammophilous shrub that extends into other biogeographic regions, including the Western Great Plains and the Colorado Plateau. Occurrence within the Chihuahuan Desert biogeographic area or presence of Chihuahuan Desert indicator species is diagnostic of stands in this group.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G819 | North American Warm Desert Ruderal Scrub | |
| G491 | Chihuahuan Sandy Plains Semi-Desert Grassland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group is an extremely xeromorphic, deciduous, desert shrubland generally without succulents. It has a sparse to moderately dense (5-30% cover), short-shrub layer (<2 m tall). The understory and inter-shrub spaces are generally sparse or absent of vegetation, but perennial grasses may be moderately abundant on stable sandsheets.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Vegetation in this group is usually dominated by *Artemisia filifolia* or *Psoralea scoparius* that anchor coppice dunes or occur on sandsheets or sandy flats. They may also be dominated or codominated by *Atriplex canescens*, *Ephedra torreyana*, *Ephedra trifurca*, *Poliomintha incana*, *Rhus microphylla*, and *Larrea tridentata*, usually with 10-30% total vegetation cover. *Yucca elata*, *Gutierrezia sarothrae*, *Bouteloua eriopoda*, and *Sporobolus flexuosus* are commonly present. Other common herbaceous species include *Abronia* spp., *Achnatherum hymenoides*, *Heliotropium convolvulaceum*, *Muhlenbergia pungens*, and *Penstemon ambiguus*. In northern stands, *Prosopis glandulosa* becomes less common or absent. This group includes degraded sandy desert plains grasslands now dominated by *Artemisia filifolia* and *Prosopis glandulosa*.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: *Artemisia filifolia* is common on sites with coarse, deep sand (S. Yanoff pers. comm. 2007). These sites are also more susceptible to grazing pressure. It is important to differentiate between (1) coppice dunes / associated interdune and (2) sandsheets. Invasive mesquite dominates on coppice dunes, especially where the interdune contains an argillic horizon layer with increased clay content. Mesquite produces large taproots and long lateral roots which enable it to extract moisture from deeper depths and the associated interdune. On sandsheets, as noted by Steven Yanoff (pers. comm.), sandsage dominates. These soils are typically deeper and coarser textured (sand and loamy sand). The coarse texture allows rapid infiltration and helps decrease wicking of soil moisture to the surface via capillary rise. Most associations listed in this group are common on sandsheets (*Artemisia filifolia*, *Psoralea scoparius*, and *Rhus microphylla*) with invasive ~*Prosopis glandulosa* / *Atriplex canescens* Ruderal Shrubland (CEGL001382)\$\$ occurring on coppice dunes / interdune areas and ~*Prosopis glandulosa* / *Sporobolus flexuosus* Ruderal Shrubland (CEGL001386)\$\$ occurring in both habitats.

ENVIRONMENT

Environmental Description: This group includes the open desert scrub of vegetated coppice dunes and sandsheets found in the Chihuahuan Desert. It often occurs on the lee sides of large playas in basins where sand accumulates, but may include deep sandy plains.

DISTRIBUTION

***Geographic Range:** This desert scrub group occurs on dunes and sandsheets found in the Chihuahuan Desert.

Nations: MX, US

States/Provinces: MXCH, NM, TX

USFS Ecoregions (2007) [optional]: 313C:CC, 315A:CC, 315B:CC, 315H:CP, 321A:CC, 322B:??, M313A:CP, M313B:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3137 | <i>Psoralea scoparius</i> - <i>Poliomintha incana</i> - <i>Rhus microphylla</i> Desert Sand Scrub Alliance |
| A3136 | <i>Artemisia filifolia</i> Desert Sand Scrub Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--|----------------|------|
| > | MLRA 42 - Southern Desertic Basin (SD-2) Sandy | NRCS 2006a | |
| > | MLRA 42 - Southern Desertic Basin (SD-2) Deep Sand | NRCS 2006a | |
| > | MLRA 42 - Southern Desertic Basin (SD-1) Sandy | NRCS 2006a | |
| > | MLRA 42 - Southern Desertic Basin (SD-1) Deep Sand | NRCS 2006a | |

AUTHORSHIP

*Primary Concept Source [if applicable]: D.E. Brown, C.H. Lowe, and C.P. Pase (1979)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

*Author of Description: K.A. Schulz and E. Muldavin

Acknowledgments [optional]: E. Muldavin

Version Date: 05 Nov 2015

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3. Desert & Semi-Desert

3.A.2.Na. North American Warm Desert Scrub & Grassland

G286. Chihuahuan Desert Succulent Scrub

Type Concept Sentence: This Chihuahuan Desert scrub group occurs on rocky sites and has a relatively high cover and rich flora of succulents such as *Agave lechuguilla*, *Euphorbia antisiphilitica*, *Echinocereus* spp., *Escobaria* spp., *Fouquieria splendens*, *Ferocactus* spp., *Opuntia engelmannii*, *Cylindropuntia imbricata*, *Grusonia schottii*, *Cylindropuntia spinosior*, or *Yucca torreyi* with low cover of perennial grasses.

OVERVIEW

*Hierarchy Level: Group

***Placement in Hierarchy:** 3.A.2.Na.2. Chihuahuan Desert Scrub (M086)

Elcode: G286

Scientific Name:** *Agave lechuguilla* - *Euphorbia antisiphilitica* - *Opuntia engelmannii* Chihuahuan Desert Succulent Scrub GroupCommon (Translated Scientific) Name:** Lechuguilla - Candelilla - Cactus-apple Chihuahuan Desert Succulent Scrub Group***Colloquial Name:** Chihuahuan Desert Succulent Scrub

***Type Concept:** This rocky site Chihuahuan Desert scrub group is characterized by the relatively high cover and rich flora of succulents such as *Agave lechuguilla*, *Euphorbia antisiphilitica*, *Echinocereus* spp., *Escobaria* spp., *Fouquieria splendens*, *Ferocactus* spp., *Opuntia engelmannii*, *Cylindropuntia imbricata* (= *Opuntia imbricata*), *Grusonia schottii* (= *Opuntia schottii*), *Cylindropuntia spinosior* (= *Opuntia spinosior*), *Yucca torreyi*, and many others. Perennial grass cover is generally low. The abundance of succulents is diagnostic of this desert scrub group, but desert shrubs and subshrubs are usually present but not codominant, except for the near ubiquitous desert shrubs *Larrea tridentata* and *Parthenium incanum*. It is found in the Chihuahuan Desert on alluvial fans and fan piedmonts (bajadas), colluvial foothill slopes and ridges, and mesas. Sites are hot and dry, typically with southerly aspects. Gravel and rock are often abundant on the ground surface and the highest cover often occurs on limestones. Stands in rolling topography may form a mosaic with more mesic desert scrub or desert grassland groups. *Agave lechuguilla* is more abundant in stands in the southern part of the range. This group does not include desert grasslands or shrub-steppe with a significant cacti component, such as yucca or cholla grassland with a high grass cover.

***Diagnostic Characteristics:** This generally sparse desert scrub group has relatively high cover and a rich flora of succulent species such as *Agave lechuguilla*, *Euphorbia antisiphilitica*, *Fouquieria splendens*, *Ferocactus* spp., *Opuntia engelmannii*, *Cylindropuntia imbricata*, *Grusonia schottii*, *Cylindropuntia spinosior*, and *Yucca torreyi*, and low cover of non-succulent desert scrub such as *Acacia constricta* or *Mimosa aculeaticarpa* var. *biuncifera* and perennial grasses. However, the near ubiquitous desert shrubs *Larrea tridentata* and *Parthenium incanum* may codominate with succulents. There is typically high cover of surface rock and gravel, and vegetation cover is most often highest on limestones.

***Classification Comments:** Although 242 plots were sampled by Natural Heritage New Mexico (NHNM) and classified to three NVC associations and 29 provisional types, this information was not available for review to be included in the concept of this group. Review of the NHNM information is needed to fully characterize it and separate it from matrix desert scrub types with succulents present or treat as an alliance(s) of desert scrub group(s).

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|-------------------------------|------|
| | | |

Similar NVC Types General Comments [optional]:**VEGETATION**

Physiognomy and Structure Summary: This extremely xeromorphic evergreen succulent shrubland group is dominated by a sparse to moderately dense layer of succulent species especially cacti, yucca, and agave. Cover of woody shrubs such as *Larrea tridentata* is generally very low, and there is typically high cover of surface rock and gravel.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This desert scrub vegetation is generally sparse and characterized by the relatively high cover and rich flora of succulents such as *Agave lechuguilla*, *Echinocereus* spp., *Escobaria* spp., *Euphorbia antisiphilitica*, *Fouquieria splendens*, *Ferocactus* spp., *Opuntia engelmannii*, *Cylindropuntia imbricata* (= *Opuntia imbricata*), *Grusonia schottii* (= *Opuntia schottii*), *Cylindropuntia spinosior* (= *Opuntia spinosior*), *Yucca torreyi*, and many others. Perennial grass cover is generally low. The abundance of succulents is diagnostic of this desert scrub group, but desert shrubs are usually present. The near ubiquitous desert shrub *Larrea tridentata* and *Parthenium incanum* may codominate with succulents. Other non-succulent shrubs include *Acacia constricta*, *Acacia neovernicosa*, *Parthenium incanum*, *Petrophytum caespitosum*, and *Prosopis glandulosa*. Stands in rolling topography may form a mosaic with more mesic desert scrub or desert grassland groups. *Agave lechuguilla* is more abundant in stands in the southern part of the range. This group does not include desert grasslands or shrub-steppe with a significant cacti component, such as yucca or cholla grassland with a high grass cover.

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:**ENVIRONMENT**

Environmental Description: This desert scrub group is found in the Chihuahuan Desert on alluvial fans and fan piedmonts (bajadas), colluvial foothill slopes and ridges, and mesas. Sites are hot and dry, typically with southerly aspects. Gravel and rock are often abundant on the ground surface and the highest cover often occurs on limestones.

DISTRIBUTION

***Geographic Range:** This Chihuahuan Desert desert scrub group occurs on alluvial fans and fan piedmonts (bajadas), colluvial foothill slopes and ridges and mesas. It extends from Devils River in Texas, west into southeastern Arizona and south into northern Mexico.

Nations: MX, US

States/Provinces: AZ, MXCH, NM, TX

USFS Ecoregions (2007) [optional]: 313C:CC, 315A:CC, 321A:CC, 322B:CC, M313A:CC, M313B:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3158 | <i>Opuntia engelmannii</i> - <i>Cylindropuntia imbricata</i> - <i>Grusonia schottii</i> Chihuahuan Desert Succulent Scrub Alliance |
| A3159 | <i>Fouquieria splendens</i> Chihuahuan Desert Succulent Scrub Alliance |
| A3157 | <i>Agave lechuguilla</i> - <i>Euphorbia antisyphilitica</i> Chihuahuan Desert Succulent Scrub Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---|-------------------|------|
| = | Chihuahuan Desertscrub, Succulent Series - 153.25 | Brown et al. 1979 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** D.E. Brown, C.H. Lowe, and C.P. Pase (1979)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz and E. Muldavin

Acknowledgments [optional]: E. Muldavin

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M087. Chihuahuan Semi-Desert Grassland

3. Desert & Semi-Desert

3.A.2.Na. North American Warm Desert Scrub & Grassland

G490. Chihuahuan Desert Foothill-Piedmont & Lower Montane Grassland

Type Concept Sentence: This Chihuahuan Desert group is a broadly defined grassland/shrub-steppe characterized by an open to dense herbaceous layer dominated by a diverse mixture of perennial desert grasses such as *Bouteloua eriopoda*, *Bouteloua ramosa*, *Bouteloua rothrockii*, *Muhlenbergia emersleyi* (higher elevations), *Muhlenbergia porteri*, and *Muhlenbergia setifolia* (higher elevations) with scattered shrubs and succulents typically present.

OVERVIEW

Hierarchy Level:** GroupPlacement in Hierarchy:** 3.A.2.Na.3. Chihuahuan Semi-Desert Grassland (M087)

Elcode: G490

Scientific Name:** *Bouteloua eriopoda* - *Bouteloua ramosa* - *Muhlenbergia porteri* Semi-Desert Grassland GroupCommon (Translated Scientific) Name:** Black Grama - Chino Grama - Bush Muhly Semi-Desert Grassland Group***Colloquial Name:** Chihuahuan Desert Foothill-Piedmont & Lower Montane Grassland

***Type Concept:** This group is a broadly defined desert grassland (shrub-steppe) that is typical of the Borderlands of Arizona, New Mexico and northern Mexico and extending throughout much of the Chihuahuan Desert west to the Sonoran Desert, and north to the Mogollon Rim. The vegetation is characterized by an open to dense herbaceous layer dominated by a diverse mixture of perennial desert grasses. Scattered shrubs and succulents are usually present, but usually have lower total cover than the herbaceous layer. Common species include desert grasses such as *Bouteloua eriopoda*, *Bouteloua ramosa*, *Bouteloua rothrockii*, *Muhlenbergia porteri*, as well as widespread species *Bouteloua curtipendula*, *Bouteloua gracilis*, *Bouteloua hirsuta*, and *Eragrostis intermedia*. Also typical are succulents such as *Agave lechuguilla*, rosetophyllous shrubs such as species of *Nolina*, *Dasyllirion*, and *Yucca*, and short (dwarf) shrubs including species of *Calliandra*, *Mimosa*, and *Parthenium*. Scattered tall shrubs and short trees such as species of *Acacia*, *Prosopis*, and various oaks may be present but with low cover. In upper foothills and lower montane zones

Muhlenbergia emersleyi and *Muhlenbergia setifolia* are characteristic species. Sites occur on gently sloping alluvial erosional fans and piedmonts (bajadas) that lie along mountain fronts of the isolated basin ranges (e.g., Sky Island mountain archipelago) extending onto foothill slopes up to 1670 m elevation in the Chihuahuan Desert.

Many of the historical desert grassland and savanna areas have been converted through intensive grazing and other land uses, some to ~North American Warm Desert Ruderal Scrub Group (G819)\$\$ (*Prosopis* spp.-dominated) or ~Chihuahuan Creosotebush - Mixed Desert Scrub Group (G288)\$\$ (*Larrea tridentata*-dominated).

***Diagnostic Characteristics:** This group is characterized by an open to dense herbaceous layer dominated by a diverse mixture of perennial desert grasses. Scattered shrubs and succulents are usually present, but have lower total cover than the herbaceous layer. Diagnostic of this grassland is the presence of desert and foothill piedmont and lower montane grassland indicator species. Desert grassland indicator species include *Bothriochloa barbinodis*, *Bouteloua chondrosioides*, *Bouteloua eriopoda*, *Bouteloua hirsuta*, *Bouteloua radicata*, *Bouteloua ramosa*, *Bouteloua rothrockii*, *Digitaria californica*, *Hilaria belangeri*, *Muhlenbergia porteri*, *Muhlenbergia setifolia*, or *Schizachyrium cirratum* and/or desert scrub indicator species (*Agave lechuguilla*, *Calliandra eriophylla*, *Dasyllirion* spp., *Fouquieria splendens*, *Mimosa* spp., *Nolina* spp., *Yucca torreyi*). Foothill and lower montane indicator species such as *Muhlenbergia emersleyi* and *Muhlenbergia pauciflora* often occur with widespread species such as *Bouteloua curtipendula* or *Hesperostipa neomexicana*. *Pleuraphis mutica* may be present but is characteristic of ~Chihuahuan Semi-Desert Lowland Grassland Group (G489)\$\$\$. If present, *Prosopis* spp. are not dominant.

***Classification Comments:** This group currently includes foothill semi-desert shrub-steppe in the northern Chihuahuan Desert composed of mixed grasses and scattered succulents, dwarf-shrubs, shrubs and trees typically forming a shrub-steppe. Sites are typically colluvial slopes not alluvial; substrates include granitics, rhyolitics (volcanics), and sedimentary limestones and sandstones. It is characterized by diverse matrix of perennial grasses mixed with scattered shrubs that include *Dasyllirion leiophyllum*, *Dasyllirion wheeleri*, *Fouquieria splendens*, *Nolina* spp., *Yucca baccata*, and *Yucca torreyi*. *Bouteloua curtipendula* is often diagnostic, but other grass species may codominate or dominate and include *Bouteloua eriopoda*, *Bouteloua hirsuta*, *Bouteloua gracilis*, *Eragrostis intermedia*, *Erioneuron pilosum*, *Muhlenbergia emersleyi*, *Muhlenbergia porteri*, *Muhlenbergia setifolia*, *Bouteloua chondrosioides*, and *Tridens muticus*. Succulents include *Agave lechuguilla*, *Opuntia* spp., and other cacti. Dwarf-shrubs, shrubs and trees include *Dalea formosa*, *Thymophylla* spp., *Acacia constricta*, *Acacia neovernicosa*, *Aloysia wrightii*, *Atriplex canescens*, *Mimosa aculeaticarpa* var. *biuncifera*, *Parthenium incanum*, *Viguiera stenoloba*, *Rhus trilobata*, and *Rhus microphylla*. *Pleuraphis mutica*-dominated semi-desert grasslands often with *Bouteloua eriopoda* or *Bouteloua gracilis* occurring on lowlands and loamy plains in the Chihuahuan Desert are classified as ~Chihuahuan Semi-Desert Lowland Grassland Group (G489)\$\$\$.

Chihuahuan grassland types that are currently included in this group are: (1) Chino grasslands of mountain slopes on acidic igneous, limestone, or deeper gravelly soils at elevations less than 1070 m (3500 feet). These sites are dominated by *Bouteloua ramosa* with *Euphorbia antisyphilitica*, *Hechtia texensis* (= *Hechtia scariosa*), *Fouquieria splendens*, *Jatropha dioica*, and *Agave lechuguilla*. (2) Desert mountain grasslands on mountain slopes between 1070 and 1370 m (3500-4500 feet) elevation on acidic igneous substrates, but also sometimes on limestone. *Bouteloua eriopoda* and *Bouteloua curtipendula* are constituents of this system. (3) Gravelly piedmont slope grasslands between 1370 and 1670 m (4500-5500 feet) elevation on Perdiz conglomerate or Tascotal tuff. These grasslands have *Bouteloua eriopoda*, *Bouteloua gracilis*, and *Nolina* and *Dasyllirion* as common components. Input from fire ecologist at a Landfire modeling workshop in 2006 suggests a fire-return interval that is generally long (about 10 years), with high rainfall periods providing conditions leading to more rapid fuel development that can sustain fires.

Additional work is needed to clarify grasslands in the transitional zone with southwestern Great Plains and the Plains-Mesa Grasslands of Dick-Peddie (1993).

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G487 | Madrean Juniper Open Woodland | |
| G819 | North American Warm Desert Ruderal Scrub | |
| G491 | Chihuahuan Sandy Plains Semi-Desert Grassland | |
| G288 | Chihuahuan Creosotebush - Mixed Desert Scrub | |
| G489 | Chihuahuan Semi-Desert Lowland Grassland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group is characterized by an open to dense herbaceous layer dominated by a diverse mixture of perennial desert grasses and with a rich assortment of scattered shrubs; succulents forbs are usually present. Shrubs and succulents usually have lower total cover than the herbaceous layer.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This broadly defined semi-desert grassland group includes a variety of grasslands from foothill piedmont to lower montane grassland. Characteristic species include desert grasses such as *Bouteloua chondrosioides*, *Bouteloua eriopoda*, *Bouteloua ramosa*, *Bouteloua rothrockii*, *Hilaria belangeri*, *Lycurus* spp., *Muhlenbergia porteri*, *Muhlenbergia setifolia*, *Pleuraphis rigida*, as well as widespread species *Bouteloua curtipendula*, *Bouteloua gracilis*, *Chloris virgata*, and *Eragrostis intermedia*. In upper foothills and lower montane zones *Muhlenbergia emersleyi* and *Muhlenbergia setifolia* are characteristic species. Succulents include *Agave lechuguilla* and rosetophyllous *Dasyilirion*, *Nolina*, *Mimosa*, and *Yucca*, and short shrubs such as species of *Calliandra* and *Parthenium incanum*. Scattered tall shrubs and short trees, including species of *Acacia constricta*, *Acacia neovernicosa*, and *Prosopis glandulosa* may be present with low cover. Many of the historical desert grassland and savanna areas have been converted through intensive grazing and other land uses, some to ~North American Warm Desert Ruderal Scrub Group (G819)\$§ (*Prosopis* spp.-dominated) or ~Chihuahuan Creosotebush - Mixed Desert Scrub Group (G288)\$§ (*Larrea tridentata*-dominated).

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: During the last century, the area occupied by this desert grassland and steppe decreased through conversion of desert grasslands as a result of drought, overgrazing and *Prosopis glandulosa* seed dispersion by livestock, and/or decreases in fire frequency (Buffington and Herbel 1965, Brown and Archer 1987). It is believed that mesquite formerly occurred in relatively minor amounts and was largely confined to drainages until cattle distributed seed upland into desert grasslands (Brown and Archer 1987, 1989). Shrublands dominated by *Prosopis* spp. have replaced large areas of desert grasslands, especially those formerly dominated by *Bouteloua eriopoda*, in Trans-Pecos Texas, southern New Mexico and southeastern Arizona (York and Dick-Peddie 1969, Hennessy et al. 1983). Studies on the Jornada Experimental Range suggest that combinations of drought, overgrazing by livestock, wind and water erosion, seed dispersal by livestock, fire suppression, shifting dunes, and changes in the seasonal distribution of precipitation have caused this recent, dramatic shift in vegetation physiognomy (Buffington and Herbel 1965, Herbel et al. 1972, Humphrey 1974, McLaughlin and Bowers 1982, Gibbens et al. 1983, Hennessy et al. 1983, Schlesinger et al. 1990, McPherson 1995).

ENVIRONMENT

Environmental Description: This group is a broadly defined desert grassland /shrub-steppe that is typical of the Borderlands of Arizona, New Mexico and northern Mexico but extends west to the Sonoran Desert, north into the Mogollon Rim and occurs throughout much of the Chihuahuan Desert. It is found on gently sloping alluvial erosional fans and piedmonts (bajadas) that lie along mountain fronts of the isolated basin ranges (e.g., the Sky Islands mountain archipelago) extending onto foothill and desert mountain slopes into the lower montane zone in the Chihuahuan Desert and Sierra Madre. Elevation ranges up to 1670 m for foothill grasslands and up to 2200 m in lower montane grasslands. Substrates are variable, ranging from fine- to coarse-textured soils depending on site.

DISTRIBUTION

***Geographic Range:** This desert grassland group is prominent in the Borderlands of Arizona, New Mexico and northern Mexico but occurs throughout much of the Chihuahuan Desert. From the northern Chihuahuan Desert, it extends west to the Sonoran Desert with scattered occurrences northward to the Mogollon Rim in central Arizona and east into the Trans-Pecos of West Texas.

Nations: MX, US

States/Provinces: AZ, CO, MXCH, MXCO, MXSO, NM, OK?, TX

USFS Ecoregions (2007) [optional]: 313B:CC, 313C:CC, 315A:CC, 315B:CC, 315H:CC, 321A:CC, 322A:CC, 322B:CC, M313A:CC, M313B:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low

USNVC Confidence Comments [optional]:

HIERARCHY***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3204 | <i>Bouteloua eriopoda</i> - <i>Bouteloua ramosa</i> Piedmont Desert Grassland Alliance |
| A3205 | <i>Dasyllirion</i> spp. / <i>Bouteloua curtipendula</i> - <i>Muhlenbergia setifolia</i> Foothill Desert Grassland Alliance |
| A3206 | <i>Muhlenbergia emersleyi</i> - <i>Muhlenbergia setifolia</i> - <i>Hesperostipa neomexicana</i> Madrean Lower Montane Grassland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--------------------------------|----------------|------|
| > | Apacherian mixed shrub savanna | Burgess 1995 | |

AUTHORSHIP***Primary Concept Source [if applicable]:** D.E. Brown (1982c)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz and E. Muldavin**Acknowledgments [optional]:** E. Muldavin

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3. Desert & Semi-Desert

3.A.2.Na. North American Warm Desert Scrub & Grassland

G492. Chihuahuan Gypsophilous Grassland

Type Concept Sentence: This Chihuahuan Desert group is composed of typically sparse to open grasslands, steppes or dwarf-shrublands that are restricted to gypsum outcrops, gypsiferous soils and gypsum dunes and is characterized by a variety of gypsophilous plants such as *Bouteloua breviseta*, *Calylophus hartwegii*, *Frankenia jamesii*, *Mentzelia perennis*, *Nama carnosum*, *Sartwellia flaveriae*, *Selinocarpus lanceolatus*, *Sporobolus nealleyi*, *Tidestromia carnosus*, and *Tiquilia hispidissima*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 3.A.2.Na.3. Chihuahuan Semi-Desert Grassland (M087)

Elcode: G492

***Scientific Name:** *Tiquilia hispidissima* / *Bouteloua breviseta* - *Sporobolus nealleyi* Grassland Group

***Common (Translated Scientific) Name:** Hairy Crinklemat / Gypsum Grama - Gyp Dropseed Grassland Group

***Colloquial Name:** Chihuahuan Gypsophilous Grassland

***Type Concept:** This group is restricted to gypsum outcrops, gypsiferous soils and gypsum dunes in the Chihuahuan Desert. Vegetation is composed of typically sparse to open grasslands, steppes or dwarf-shrublands that are characterized by a variety of gypsophilous plants, many of which are endemic to these habitats. Characteristic species include such as *Bouteloua breviseta*, *Calylophus hartwegii* (= *Oenothera hartwegii*), *Frankenia jamesii*, *Gaillardia multiceps*, *Mentzelia perennis*, *Nama carnosum*, *Sartwellia flaveriae*, *Selinocarpus lanceolatus*, *Sporobolus nealleyi*, *Tidestromia carnosus*, *Tiquilia hispidissima*, and other gypsophilous species. Additionally, several wide-ranging associates such as *Achnatherum hymenoides*, *Andropogon hallii*, *Artemisia filifolia*,

Atriplex canescens, *Atriplex obovata*, *Dalea lanata*, *Fouquieria splendens*, *Larrea tridentata*, *Muhlenbergia pungens*, *Psoralea scoparius*, and *Schizachyrium scoparium* that appear to tolerate gypsiferous soils may be present to codominate in some stands. Stands occur in basins and slopes ranging from 1100 to 2000 m elevation.

***Diagnostic Characteristics:** This group is defined and generally dominated by a variety of gypsophilous plants, many of which are endemic to these habitats, such as *Bouteloua breviseta*, *Calylophus hartwegii*, *Kallstroemia grandiflora*, *Nama carnosum*, *Sartwellia flaveriae*, *Selinocarpus lanceolatus*, *Sporobolus nealleyi*, *Tidestromia carnosus*, and *Tiquilia hispidissima*.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|-------------------------------|------|
| | | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group ranges from a sparse to moderately dense herbaceous layer, dwarf-shrub and/or shrub layer that forms open grasslands, shrub-steppes and shrublands. It often has low cover because the gypsum substrate is a harsh medium for growth of most plant species. The presence of gypsophilous species is a more important indicator than vegetation structure.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This group occurs as typically sparse or open grasslands, dwarf-shrublands or shrub-steppes. The presence of gypsophilous plants, many of which are endemic to these habitats, is diagnostic of this group. Characteristic species include *Bouteloua breviseta*, *Calylophus hartwegii* (= *Oenothera hartwegii*), *Frankenia jamesii*, *Kallstroemia grandiflora*, *Mentzelia perennis*, *Nama carnosum*, *Selinocarpus lanceolatus*, *Sporobolus nealleyi*, *Sartwellia flaveriae*, *Tidestromia carnosus*, and *Tiquilia hispidissima*. In addition, several wide-ranging associates such as *Achnatherum hymenoides*, *Andropogon hallii*, *Artemisia filifolia*, *Atriplex canescens*, *Atriplex obovata*, *Dalea lanata*, *Fouquieria splendens*, *Larrea tridentata*, *Muhlenbergia pungens*, *Psoralea scoparius*, *Schizachyrium scoparium* and *Sporobolus airoides* that appear to tolerate gypsiferous soils may be present to codominant in some stands.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Burgess and Northington (1977) report *Sporobolus nealleyi* is dominant with *Tiquilia hispidissima* and *Opuntia polyacantha* on crusted gypsum ridges, but not on unstable gypsum dunes. The eolian processes and sand substrate on gypsum dunes may be as important ecologically as the chemical properties of the gypsum parent material as seen by presence of sand-loving plant species such as *Achnatherum hymenoides*, *Andropogon hallii*, *Artemisia filifolia*, *Muhlenbergia pungens*, and *Psoralea scoparius* on gypsum dunes.

ENVIRONMENT

Environmental Description: This group is restricted to gypsum outcrops, gypsiferous soils, and soils or gypsum dunes that occur in basins and slopes in the Chihuahuan Desert. Dune processes may promote the presence of sand-loving species. Elevation ranges from 1100-2000 m.

DISTRIBUTION

***Geographic Range:** This group is found on basins and slopes in the Chihuahuan Desert at elevations ranging from 1100-2000 m.

Nations: MX, US

States/Provinces: AZ, MXCH, NM, TX

USFS Ecoregions (2007) [optional]: 315A:CC, 315B:CC, 315H:CP, 321A:CC, M313B:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS***Plot Analysis Summary [Med - High Confidence]:*****Plots Used to Define the Type [Med - High Confidence]:****CONFIDENCE LEVEL**

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3243 | <i>Tiquilia hispidissima</i> / <i>Sporobolus nealleyi</i> - <i>Tidestromia carnosa</i> Gypsum Outcrop & Alluvial Flat Desert Scrub Alliance |
| A3242 | <i>Artemisia filifolia</i> / <i>Andropogon hallii</i> - <i>Bouteloua breviseta</i> Gypsum Dune Desert Grassland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--|------------------------|------|
| > | MLRA 42 - Southern Desertic Basin (SD-3) Gyp Uplands | NRCS 2006a | |
| > | MLRA 42 - Southern Desertic Basin (SD-2) Gyp Uplands | NRCS 2006a | |
| > | MLRA 42 - Southern Desertic Basin (SD-1) Gyp Uplands | NRCS 2006a | |
| = | Gypsophilous Scrub | Henrickson et al. 1985 | |

AUTHORSHIP***Primary Concept Source [if applicable]:** J. Henrickson, M.C. Johnston, and D.H. Riskind (1985)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz

Acknowledgments [optional]: E. Muldavin

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3. Desert & Semi-Desert

3.A.2.Na. North American Warm Desert Scrub & Grassland

G491. Chihuahuan Sandy Plains Semi-Desert Grassland

Type Concept Sentence: This grassland group occurs on sandy soils across the Chihuahuan Desert and is characterized by dominance of *Bouteloua eriopoda* and *Sporobolus flexuosus* with other psammophilous species such as *Artemisia filifolia*, *Ephedra torreyana*, *Muhlenbergia arenicola*, *Sporobolus cryptandrus*, and *Yucca elata*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 3.A.2.Na.3. Chihuahuan Semi-Desert Grassland (M087)

Elcode: G491

***Scientific Name:** *Yucca elata* / *Bouteloua eriopoda* - *Sporobolus flexuosus* Semi-Desert Grassland Group

***Common (Translated Scientific) Name:** Soaptree Yucca / Black Grama - Mesa Dropseed Semi-Desert Grassland Group

***Colloquial Name:** Chihuahuan Sandy Plains Semi-Desert Grassland

***Type Concept:** This dry grassland group occurs on sandy sites across the Chihuahuan Desert with the graminoid layer typically dominated or codominated by *Bouteloua eriopoda* and *Sporobolus flexuosus*. Other common species are *Aristida purpurea*, *Bouteloua gracilis*, *Hesperostipa neomexicana* (minor), *Muhlenbergia arenicola*, *Sporobolus airoides*, *Sporobolus contractus*, and *Sporobolus cryptandrus*. Typically, there are scattered desert shrubs and stem succulents present, such as *Ephedra torreyana*, *Ephedra trifurca*, *Opuntia phaeacantha*, *Yucca elata*, and *Yucca torreyi*, that may form a layer. The widespread shrub *Artemisia filifolia* is also present in some stands, especially in the northern extent. Stands occur across the Chihuahuan Desert where soils have a high sand content such as on sandy plains and on sandy mesatops. They are often associated with alluvial or eolian deposits and sandstone substrates.

***Diagnostic Characteristics:** This dry grassland or steppe group is found on sandy substrates and is dominated or codominated by sandy-site species *Bouteloua eriopoda* and *Sporobolus flexuosus* with characteristic Chihuahuan Desert species with scattered but highly constant *Yucca elata* and/or *Ephedra torreyana*.

***Classification Comments:** When degraded, this grassland will convert to open to dense shrublands frequently dominated by *Prosopis glandulosa* or *Artemisia filifolia*. This degraded type is classified as ~Chihuahuan Desert Sand Scrub Group (G287)\$\$.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|-------------------------------|------|
| G069 | Great Plains Sand Shrubland | |
| G068 | Great Plains Sand Grassland | |
| G287 | Chihuahuan Desert Sand Scrub | |

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G490 | Chihuahuan Desert Foothill-Piedmont & Lower Montane Grassland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This dry grassland group has an open to moderately dense herbaceous layer dominated by perennial graminoids. Scattered shrubs are often present.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This group is characterized by an open to moderately dense herbaceous layer dominated or codominated by perennial graminoids *Bouteloua eriopoda* and *Sporobolus flexuosus*, the former characteristic Chihuahuan species (although it can range into the Colorado Plateau and southern Great Plains). Other common species are *Achnatherum hymenoides*, *Aristida purpurea*, *Bouteloua gracilis*, *Hesperostipa neomexicana* (minor), *Muhlenbergia arenicola*, *Paspalum setaceum*, *Sporobolus airoides*, *Sporobolus contractus*, and *Sporobolus cryptandrus*. Typically, there are scattered desert shrubs and stem succulents present, such as *Ephedra torreyana*, *Ephedra trifurca*, *Opuntia phaeacantha*, *Yucca elata*, and *Yucca torreyi*, that are characteristic of the Chihuahuan Desert. The widespread shrub *Artemisia filifolia* is also present in some stands, especially in the northern extent.

*Floristics Table [Med - High Confidence]:

*Number of Plots:

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:

ENVIRONMENT

Environmental Description: This group occurs across the Chihuahuan Desert where soils have a high sand content. These dry grasslands or steppe are found on sandy plains and on sandy mesatops where sandy soils are stabilized by desert grasses and scattered shrubs. Substrates range from deep sand to sandy loam soils and are frequently associated with alluvial or eolian deposits and sandstone substrates.

DISTRIBUTION

***Geographic Range:** This Chihuahuan Desert group extends into the southern Great Plains where soils have a high sand content.

Nations: MX, US

States/Provinces: AZ, MXCH, NM, TX

USFS Ecoregions (2007) [optional]: 313B:CC, 315A:CC, 315B:CC, 315H:CC, 321A:CC, 322B:??, M313A:CC, M313B:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3244 | <i>Yucca elata</i> - <i>Ephedra torreyana</i> / <i>Bouteloua eriopoda</i> Sandy Plains Semi-Desert Grassland Alliance |
| A3245 | <i>Sporobolus flexuosus</i> Sandy Plains Semi-Desert Grassland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--|-----------------------|---|
| > | Grama Grass - Scrub Series - 143.11 | Brown et al. 1979 | |
| < | Black Grama/Soapstone Yucca PA | Muldavin et al. 2000b | (<i>Bouteloua eriopoda</i> / <i>Yucca elata</i> : BOUERI/YUCELA) |
| < | Black Grama/Torrey's Jointfir PA | Muldavin et al. 2000b | (<i>Bouteloua eriopoda</i> / <i>Ephedra torreyana</i> : BOUERI/EPHTOR) |
| = | Grama Grass - Scrub Series, <i>Bouteloua eriopoda</i> - <i>Yucca elata</i> Association - 143.111 | Brown et al. 1979 | |

AUTHORSHIP***Primary Concept Source [if applicable]:** D.E. Brown, C.H. Lowe, and C.P. Pase (1979)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz and E. Muldavin

Acknowledgments [optional]: E. Muldavin

Version Date: 05 Nov 2015

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3. Desert & Semi-Desert

3.A.2.Na. North American Warm Desert Scrub & Grassland

G489. Chihuahuan Semi-Desert Lowland Grassland

Type Concept Sentence: This lowland group is characterized by a moderately dense to dense graminoid layer of perennial grasses that are typically dominated by *Panicum obtusum*, *Pleuraphis mutica*, *Sporobolus airoides*, and/or *Sporobolus wrightii* occurring in mesic swales and depressions and along drainages across the Chihuahuan Desert and adjacent Sky Islands and Sonoran Desert, extending into limited areas of the southern Great Plains, generally on deep, fine-textured soils.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 3.A.2.Na.3. Chihuahuan Semi-Desert Grassland (M087)

Elcode: G489

***Scientific Name:** *Pleuraphis mutica* - *Sporobolus airoides* - *Panicum obtusum* Semi-Desert Lowland Grassland Group

***Common (Translated Scientific) Name:** Tobosa Grass - Alkali Sacaton - Vine-mesquite Semi-Desert Lowland Grassland Group

***Colloquial Name:** Chihuahuan Semi-Desert Lowland Grassland

***Type Concept:** This is the common lowland grassland group that occurs in the northern Chihuahuan Desert, adjacent southwestern Great Plains, and Sky Islands west to the Sonoran Desert. Vegetation in this group is characterized by a moderately dense to dense graminoid layer of perennial grasses that is typically dominated by *Pleuraphis mutica* and/or *Sporobolus airoides* with *Panicum obtusum* often present. Dense stands can occur in mesic swales and depressions and along drainages, where *Sporobolus wrightii* and *Pleuraphis mutica* (tobosa swales) dominate, sometimes with other mesic graminoids such as *Pascopyrum smithii*, *Panicum hallii*, *Panicum hirsutum*, or *Panicum obtusum*. *Sporobolus airoides* is more common in alkaline soils. In degraded stands, *Scleropogon brevifolius* or *Aristida* spp. may codominate. *Bouteloua gracilis* or *Bouteloua dactyloides* (= *Buchloe dactyloides*) may become important in northern stands transitioning into the Great Plains and on degraded stands. Scattered shrub or succulent species may be present, especially on degraded sites and along drainages and in depressions. Stands are found on alluvial flats, loamy plains and basins, sometimes extending up into lower piedmont slopes and on broad mesas. This group includes mesic grasslands that occur in relatively small depressions or swales and along drainages that receive runoff from adjacent areas. Occupying low topographic positions, these sites generally have deep, fine-textured soils that are neutral to slightly or moderately saline/alkaline.

***Diagnostic Characteristics:** This group is characterized by a moderately dense to dense graminoid layer dominated by perennial grasses. Dominant species are *Pleuraphis mutica* and /or *Sporobolus airoides* often with *Panicum obtusum* present. *Bouteloua gracilis* may codominate on broad alluvial plains and flats in northern transition areas. In mesic swales and depressions and along drainages, *Sporobolus wrightii* or other mesic graminoids such as *Pascopyrum smithii* or *Panicum obtusum* may be codominant or sometimes dominant. Scattered shrubs and succulents may be present, but do not have higher cover than perennial grasses.

***Classification Comments:** This grassland group grades into ~Chihuahuan Desert Foothill-Piedmont & Lower Montane Grassland Group (G490)\$\$ in the foothills and piedmont desert grasslands and into ~Great Plains Shortgrass Prairie Group (G144)\$\$ in similar loamy plains land positions in the Great Plains where *Bouteloua gracilis*, *Bouteloua dactyloides*, or *Pleuraphis jamesii* are dominant grasses.

NRCS Ecological Site Description MLRA 42 SD-2 Loamy Ecological Site (NRCS 2006) describes this group on the Jornada Experimental Range with State-and-Transition Model showing shifts in species composition with land use. Degraded stands often have scattered desert scrubs such as *Larrea tridentata*, *Flourensia cernua*, and *Prosopis glandulosa* present.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G144 | Great Plains Shortgrass Prairie | |
| G490 | Chihuahuan Desert Foothill-Piedmont & Lower Montane Grassland | |

Similar NVC Types General Comments [optional]:**VEGETATION**

Physiognomy and Structure Summary: This group is characterized by a moderately dense to dense herbaceous layer dominated by perennial grasses, sometimes with scattered shrub and succulent species present with low cover.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This group is characterized by a moderately dense to dense graminoid layer dominated by perennial grasses. Dominant grasses are *Pleuraphis mutica* and/or *Sporobolus airoides* with *Panicum obtusum* often present. In mesic swales and depressions and along drainages, *Sporobolus airoides*, *Sporobolus wrightii*, *Schizachyrium scoparium* var. *scoparium*, and *Pleuraphis mutica* (tobosa swales) dominate, sometimes with other mesic graminoids such as *Pascopyrum smithii*, *Panicum hallii*, *Panicum hirsutum*, or *Panicum obtusum*. *Sporobolus airoides* is often associated with more alkaline (to gypsic), poorly drained areas and *Sporobolus wrightii* with less alkaline, better drained areas. If present, *Distichlis spicata*, *Allenrolfea occidentalis*, and *Suaeda* spp. are characteristic of more saline and alkaline sites. In degraded stands, *Scleropogon brevifolius* or *Aristida* spp. may codominate (Brown et al. 1979, Brown 1982a, Brown 1982c, Muldavin et al. 2000b, 2013b). In northern and transitional areas with the Great Plains, *Bouteloua gracilis* or *Bouteloua dactyloides* (= *Buchloe dactyloides*) may become important (Muldavin et al. 2000b, 2013b). With tobosa swales, sand-adapted species such as *Yucca elata* may grow at the swale's edge in the deep sandy alluvium that is deposited there from upland slopes (Dick-Peddie 1993). In degraded stands, *Scleropogon brevifolius* or *Aristida* spp. may codominate. Scattered shrubs such as *Atriplex canescens*, *Ephedra torreyana*, *Ericameria nauseosa*, *Fallugia paradoxa*, *Flourensia cernua*, *Gutierrezia sarothrae*, *Krascheninnikovia lanata*, *Larrea tridentata*, *Cylindropuntia imbricata* (= *Opuntia imbricata*), *Prosopis glandulosa*, *Rhus microphylla*, and *Yucca* spp. may be present, especially on degraded sites and along drainages and in depressions.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Const-ancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|------------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Impermeable caliche and argillic horizons are common on these sites. These layers restrict deep percolation of soil water and may favor the shallower rooted grasses over more deeply rooted shrubs like *Larrea tridentata* and *Prosopis* spp. (McAuliffe 1995). *Pleuraphis mutica* is relatively tolerant of livestock grazing. In west-central Arizona, livestock have nearly eliminated all native grasses except *Pleuraphis mutica* from semi-desert grassland (Brown 1982a). Stands codominated by *Scleropogon brevifolius* are characteristic of sites with past heavy grazing by livestock (Whitfield and Anderson 1938).

ENVIRONMENT

Environmental Description: This group occurs in the northern Chihuahuan Desert and adjacent Sky Islands and Sonoran Desert, extending into limited areas of the southern Great Plains on alluvial flats, loamy plains and basins sometimes extending up into lower piedmont slopes and on broad mesas. Included in this group are the mesic grasslands that occur in relatively small depressions or swales and along drainages that receive runoff from adjacent areas. Occupying low topographic positions, these sites generally have deep, fine-textured soils (loams or clay loams) that are neutral to slightly or moderately saline/alkaline. During summer rainfall events, precipitation generally does not rapidly run off and ponding is common in depressions on the typically flat or gently sloping sites. Sites may be relatively mesic if they receive runoff from adjacent areas.

DISTRIBUTION

***Geographic Range:** This grassland group is found from the northern to central Chihuahuan Desert and extends into Trans-Pecos Texas, north into the southwestern Great Plains and extends into southeastern Arizona. Stands are described from Jornada del Muerto Basin, Marfa grasslands and Marathon Basin, south to central Chihuahua and Coahuila, Mexico.

Nations: MX, US

States/Provinces: AZ, MXCH, MXCO, MXSO, NM, TX

USFS Ecoregions (2007) [optional]: 313C:CC, 315A:CC, 321A:CC, 322B:CC, M313A:CC, M313B:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3186 | <i>Sporobolus airoides</i> - <i>Sporobolus wrightii</i> - <i>Panicum obtusum</i> Lowland Desert Grassland Alliance |
| A3185 | <i>Pleuraphis mutica</i> Lowland Desert Grassland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

*Recent Concept Lineage [if applicable]:

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--------------------------------------|-------------------|------|
| = | Tobosa Grass - Scrub Series - 143.12 | Brown et al. 1979 | |
| = | Alkali Sacaton - Tobosagrass (701) | Shiflet 1994 | |

AUTHORSHIP

*Primary Concept Source [if applicable]: D.E. Brown, C.H. Lowe, and C.P. Pase (1979)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

*Author of Description: K.A. Schulz and E. Muldavin

Acknowledgments [optional]: E. Muldavin

Version Date: 05 Nov 2015

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Whitfield, C. L., and H. L. Anderson. 1938. Secondary succession in the desert plains grassland. *Ecology* 19:171-180.

M088. Mojave-Sonoran Semi-Desert Scrub

3. Desert & Semi-Desert

3.A.2.Na. North American Warm Desert Scrub & Grassland

G298. Baja Semi-Desert Coastal Succulent Scrub

Type Concept Sentence: This succulent scrub group is variable and restricted in extent, ranging from succulent-rich coastal scrub types found along the central Baja California coast to a depauperate extension north into southern California and the more southerly Channel Islands. It is dominated by succulent species, including herbaceous succulents (*Dudleya* spp.), leaf succulents (*Agave deserti*, *Agave shawii*, *Yucca valida*), cacti of moderate to tall stature, and pachycaulus woody species (*Euphorbia misera*, *Pachycormus discolor*) with additional regionally common species.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 3.A.2.Na.4. Mojave-Sonoran Semi-Desert Scrub (M088)

Elcode: G298

***Scientific Name:** *Agave shawii* - *Fouquieria columnaris* - *Yucca valida* / *Dudleya* spp. Coastal Succulent Scrub Group

***Common (Translated Scientific) Name:** Coastal Agave - Boojum Tree - Tree Yucca / Live-forever species Coastal Succulent Scrub Group

***Colloquial Name:** Baja Semi-Desert Coastal Succulent Scrub

***Type Concept:** This succulent scrub group is highly variable and fairly restricted in extent, ranging from succulent-rich coastal scrub types found along the central Baja California coast to a depauperate extension north into southern California and the more southerly Channel Islands. Stands are dominated by succulent species, which may be herbaceous (*Dudleya* spp.), leaf succulents (*Agave* spp., *Yucca* spp.), cacti of moderate to tall stature, or pachycaulus woody species (*Euphorbia misera*, *Pachycormus discolor*). These California and Baja plant species include *Agave deserti*, *Agave shawii*, *Berberocactus emoryi*, *Ferocactus viridescens*, *Lycium californicum*, *Cylindropuntia californica* var. *parkeri* (= *Opuntia parryi*), *Opuntia littoralis*, *Cylindropuntia prolifera* (= *Opuntia prolifera*), *Simmondsia chinensis*, *Yucca schidigera*, and *Yucca valida*. The central Baja stands are dominated by arborescent xeromorphic species, including *Fouquieria columnaris* (= *Idria columnaris*), *Pachycereus pringlei*, *Pachycormus discolor*, and *Yucca valida*. Most stands also have a component of smaller drought-deciduous shrubs, some of which are shared with ~Californian Coastal Scrub Macrogroup (M044)\$. These include such species as *Artemisia californica*, *Encelia californica*, *Eriogonum fasciculatum*, and *Viguiera laciniata*. Sites in northern Baja and southern California are isolated on maritime coastal bluffs and terraces, surrounded by more extensive stands of chaparral or coastal sage scrub [see ~Californian Chaparral Macrogroup (M043)\$ and ~Californian Coastal Scrub Macrogroup (M044)\$]. These areas are frost-free and receive the majority of their rainfall in the winter, unlike most other parts of the Sonoran Desert. This group receives the least annual precipitation of the California and Baja California coastal shrublands; a significant proportion is augmented by summer fog drip. Extended drought is common, which favors plants with water storage capabilities. Substrates range from coarse- to fine-textured soils.

***Diagnostic Characteristics:** This group is dominated by succulent species. California and Baja stands include many *Opuntia* species and woody shrubs *Lycium californicum* and *Rhus integrifolia*. Many different succulent species may be present such as *Cylindropuntia californica* var. *parkeri*, *Cylindropuntia prolifera*, *Opuntia littoralis*, *Yucca schidigera*, *Ferocactus viridescens*, *Agave shawii*, *Euphorbia misera*, *Berberocactus emoryi*, and *Simmondsia chinensis*. The Sonoran stands are dominated by columnar cacti *Carnegiea gigantea*, *Pachycereus schottii*, *Pachycereus pecten-aboriginum*, *Stenocereus alamosensis*, and *Stenocereus thurberi* with a xeromorphic tree layer dominated by *Prosopis glandulosa* var. *torreyana*, *Parkinsonia praecox*, *Bursera microphylla*, *Bursera fagaroides* var. *elongata*, *Bursera laxiflora*, and a shrub layer dominated by *Atriplex canescens*, *Atriplex polycarpa*, and *Suaeda*

moquinii.

***Classification Comments:** This group is dominated by succulent species and occurs near coastal areas. The California and Baja del Norte stands include many *Opuntia* species and woody shrubs, whereas Sonoran stands are characterized by species of tall columnar cacti, and xeromorphic tree and shrub layers.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|-------------------------------|------|
| | | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group has an open, mixed physiognomy and is dominated by succulent species, especially cacti. In southern California and Baja del Norte, there is an open, mostly evergreen shrub layer sometimes with emergent tall columnar cacti. This group is dominated by succulent species. Sonoran stands are dominated by columnar cacti with xeromorphic tree and shrub layers.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This scrub vegetation is dominated by succulent species which may be herbaceous (*Dudleya* spp.), leaf succulents (*Agave shawii*, *Agave deserti*, *Yucca valida*), cacti of moderate to tall stature, or pachycaulus arborescent xeromorphic woody species, including *Euphorbia misera*, *Fouquieria columnaris* (= *Idria columnaris*), *Pachycereus pringlei*, and *Pachycormus discolor* in central Baja stands. Other California and Baja plant species include *Artemisia californica*, *Bergerocactus emoryi*, *Coreopsis gigantea*, *Dudleya greenei*, *Encelia californica*, *Ericameria ericoides*, *Eriogonum cinereum*, *Ferocactus viridescens*, *Lycium californicum*, *Cylindropuntia californica* var. *parkeri* (= *Opuntia parryi*), *Opuntia littoralis*, *Opuntia oricola*, *Cylindropuntia prolifera* (= *Opuntia prolifera*), *Simmondsia chinensis*, and *Yucca schidigera*. Additional species mentioned by Peinado et al. (1994a) include *Ambrosia camphorata*, *Ambrosia chenopodiifolia*, *Artemisia californica*, *Dudleya lanceolata*, *Echinocereus maritimus*, *Eriogonum fasciculatum* var. *flavoviride* (= *Eriogonum flavoviride*), *Ferocactus fordii*, *Lotus scoparius*, *Nassella lepida* (= *Stipa lepida*), *Rhus integrifolia*, *Rosa minutifolia*, and *Viguiera laciniata*. Floristic information was compiled from Shreve and Wiggins (1964), Brown (1982a), Turner and Brown (1982), Barbour and Major (1988), MacMahon (1988), Peinado et al. (1994a), Holland and Keil (1995), Sawyer and Keeler-Wolf (1995), and Sawyer et al. (2009).

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:

ENVIRONMENT

Environmental Description: This group is fairly restricted and includes succulent-rich coastal scrub types found along the Baja del Norte and southern California coasts, north to Anacapa Island and the Santa Monica Mountains, California. Sites in northern Baja and southern California are isolated maritime coastal bluffs and terraces. Sites reach several km inland in the Vizcaino Region of central Baja California. These areas are frost-free and receive the least annual precipitation of the California and Baja California coastal shrublands, most of which falls in winter. Precipitation is augmented by summer fog drip. Sonoran stands are extremely arid with mean annual precipitation of less than 100 mm, which occurs mostly in the summer-early fall season (monsoon). Extended drought is common which favors plants with water storage. Substrates are typically coarse-textured (Turner and Brown 1982). *Climate:* Sites are extremely arid with mean annual precipitation of less than 100 mm, which occurs mostly in the summer-early fall season (monsoon).

DISTRIBUTION

***Geographic Range:** This group is very localized and patchy, ranging from San Diego County, California, where it occurs intermittently on isolated maritime coastal bluffs and xeric slopes and terraces, south into central Baja California, Mexico, where

stands are more extensive. Stands also occur on the more southerly Channel Islands (San Clemente, Catalina, Santa Barbara, and Anacapa) and in the flat coastal plain along the Central Gulf Coast of Sonora between Empalme and Potam, Mexico.

Nations: MX, US

States/Provinces: CA, MXBC, MXSO

USFS Ecoregions (2007) [optional]:

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3460 | <i>Lycium californicum</i> Desert Scrub Alliance |
| A4237 | <i>Deinandra clementina</i> - <i>Eriogonum giganteum</i> Coastal Shrubland Alliance |
| A3885 | <i>Opuntia littoralis</i> - <i>Opuntia oricola</i> - <i>Cylindropuntia prolifera</i> Succulent Scrub Alliance |
| A3459 | <i>Coreopsis gigantea</i> Coastal Bluff Desert Scrub Alliance |
| A4239 | <i>Eriogonum arborescens</i> - <i>Eriogonum grande</i> Island Scrub Alliance |
| A4144 | <i>Dudleya greenei</i> - <i>Dudleya</i> spp. Succulent Scrub Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------------|---|--|
| 2014-12-11 | G555 <i>Baccharis pilularis</i> - <i>Dudleya</i> spp. - <i>Abronia</i> spp. Dune & Bluff Vegetation Group | G555 split into G664 & G665 (DFL 7-24-12); subsequently G665 was determined to be a duplicate of G298. |
| 2014-12-11 | G665 Warm Pacific Maritime Succulent Scrub Group | G665 merged into G298 |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--|-------------------|------|
| > | Sonoran Desertscrub, Copal-Torote ("Central Gulf Coast") Series - 154.14 | Brown et al. 1979 | |
| > | Sonoran Desertscrub, Agave-Bursage ("Vizcaino") Series - 154.15 | Brown et al. 1979 | |
| > | Central Gulf Coast Subdivision | Turner 1982a | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** R.M. Turner (1982a)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz and T. Keeler-Wolf

Acknowledgments [optional]: T. Keeler-Wolf

Version Date: 05 Nov 2015

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3. Desert & Semi-Desert

3.A.2.Na. North American Warm Desert Scrub & Grassland

G295. Mojave-Sonoran Bajada & Valley Desert Scrub

Type Concept Sentence: This Mojave-Sonoran desert scrub group is characterized by *Larrea tridentata* and *Ambrosia dumosa* along with several other shrubs, and is found in the warm southwestern deserts of the U.S. and northern Mexico.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 3.A.2.Na.4. Mojave-Sonoran Semi-Desert Scrub (M088)

Elcode: G295

***Scientific Name:** *Larrea tridentata* - *Ambrosia dumosa* - *Encelia farinosa* Desert Scrub Group

***Common (Translated Scientific) Name:** Creosotebush - Burrobush - Brittlebush Desert Scrub Group

***Colloquial Name:** Mojave-Sonoran Bajada & Valley Desert Scrub

***Type Concept:** This desert scrub vegetation group forms the vegetation matrix in broad valleys, lower bajadas, plains and low hills in the Mojave, western Sonoran and Lower Colorado deserts where winter (cool-season) precipitation prevails. This desert scrub is characterized by a sparse to moderately dense layer (2-50% cover) of xeromorphic, microphyllous and broad-leaved shrubs. *Larrea tridentata* and *Ambrosia dumosa* typically dominate and are diagnostic of this group, but many different shrubs, dwarf-shrubs, and cacti may codominate or form typically sparse understory layers. Associated species may include *Encelia farinosa*, *Ephedra aspera* (= *Ephedra fasciculata*), *Ephedra nevadensis*, *Fouquieria splendens*, *Lycium andersonii*, *Opuntia basilaris*, and *Cylindropuntia bigelovii* (=

Opuntia bigelovii). The herbaceous layer is typically sparse, but may be seasonally abundant with ephemerals. Herbaceous species such as *Aristida* spp., *Chamaesyce* spp., *Cryptantha* spp., *Dasyochloa pulchella*, *Eriogonum inflatum*, *Nama* spp., and *Phacelia* spp. are common. On sandy sites, perennial grass *Pleuraphis rigida* may be abundant with *Ambrosia dumosa*. Stands can often appear as very open sparse vegetation, with the mostly barren ground surface being the predominant feature.

***Diagnostic Characteristics:** This desert scrub vegetation group is characterized by a sparse to moderately dense layer (2-50% cover) of xeromorphic, microphyllous and broad-leaved shrubs. Diagnostic species *Larrea tridentata* and *Ambrosia dumosa* typically dominate, but many different shrubs, dwarf-shrubs, and cacti may codominate or form typically sparse understory layers. Associated species may include *Encelia farinosa*, *Ephedra nevadensis*, *Fouquieria splendens*, *Lycium andersonii*, *Opuntia basilaris*, and *Cylindropuntia bigelovii*. *Cylindropuntia bigelovii*, *Encelia farinosa*, and *Fouquieria splendens* can dominate scrub locally. The herbaceous layer is typically sparse, but may be seasonally abundant with ephemerals.

***Classification Comments:** This desert scrub vegetation group forms the vegetation matrix in broad valleys, lower bajadas, plains and low hills in the Mojave, western Sonoran and Lower Colorado deserts where winter (cool-season) precipitation prevails. This desert scrub is characterized by a sparse to moderately dense layer (2-50% cover) of xeromorphic, microphyllous and broad-leaved shrubs.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|-------------------------------|------|
| | | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This desert scrub vegetation group is characterized by a sparse to moderately dense layer (2-50% cover) of xeromorphic, microphyllous and broad-leaved shrubs less than 2 m tall. Stands can often appear as very open sparse vegetation, with the mostly barren ground surface being the predominant feature.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This desert scrub vegetation group forms the vegetation matrix in broad desert valleys, lower bajadas, desert plains and low hills. It is characterized by a sparse to moderately dense layer (2-50% cover) of xeromorphic, microphyllous and broad-leaved shrubs. Diagnostic species *Larrea tridentata* and *Ambrosia dumosa* are typically dominant, but many different shrubs, dwarf-shrubs, and cacti may codominate or form typically sparse understory layers. Associated species may include *Echinocactus polycephalus*, *Encelia farinosa*, *Ephedra funerea*, *Ephedra aspera* (= *Ephedra fasciculata*), *Ephedra nevadensis*, *Fouquieria splendens*, *Grayia spinosa*, *Krameria grayi*, *Krameria erecta*, *Lycium andersonii*, *Opuntia basilaris*, *Cylindropuntia bigelovii* (= *Opuntia bigelovii*), *Psoralea arborescens*, *Psoralea fremontii*, *Salazaria mexicana*, and *Senna armata*. *Cylindropuntia bigelovii*, *Encelia farinosa*, and *Fouquieria splendens* can dominate scrub locally. The herbaceous layer is typically sparse, but may be seasonally abundant with ephemerals. Herbaceous species such as *Aristida* spp., *Chamaesyce* spp., *Cryptantha* spp., *Dasyochloa pulchella*, *Eriogonum inflatum*, *Nama* spp., and *Phacelia* spp. are common. On sandy sites, perennial grass *Pleuraphis rigida* may be abundant with *Ambrosia dumosa*. This group can often appear as very open sparse vegetation, with the mostly barren ground surface being the predominant feature.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:

ENVIRONMENT

Environmental Description: This widespread desert scrub vegetation group forms the vegetation matrix in broad valleys, lower bajadas, plains and low hills in the Mojave, western Sonoran and Lower Colorado deserts. Elevation ranges from -75 to 1200 m. Stands occur on alluvial fans, bajadas, upland slopes and minor washes. Sites are gentle to moderately sloping. Substrates are typically well-drained, sandy soils derived from colluvium or alluvium, and are often calcareous with a caliche hardpan and/or a

pavement surface. Precipitation is markedly unimodal with most falling in the winter months associated with winter storm tracks reaching the desert from the Pacific Ocean. Summer thunder showers associated with monsoonal storms from the south are irregular and less important than those in ~Sonoran Paloverde - Mixed Cacti Desert Scrub Group (G293)\$. The lack of arborescent cacti, and microphyllous tall shrubs and trees in uplands are one indicator of unreliable summer precipitation.

DISTRIBUTION

***Geographic Range:** This desert scrub vegetation group occupies broad valleys, lower bajadas, plains and low hills in the Mojave, western Sonoran and Lower Colorado deserts.

Nations: MX, US

States/Provinces: AZ, CA, MXBC, MXSO, NV, UT

USFS Ecoregions (2007) [optional]: 313A:CC, 313C:CC, 321A:CC, 322A:CC, 322B:CC, 322C:CC, 341F:CC, M261E:PP, M341A:PP

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A4215 | <i>Encelia farinosa</i> Desert Scrub Alliance |
| A3279 | <i>Ambrosia dumosa</i> Desert Dwarf Scrub Alliance |
| A3277 | <i>Larrea tridentata</i> - <i>Ambrosia dumosa</i> Bajada & Valley Desert Scrub Alliance |
| A3278 | <i>Larrea tridentata</i> - <i>Fouquieria splendens</i> Upper Bajada & Rock Outcrop Desert Scrub Alliance |
| A3146 | <i>Cylindropuntia bigelovii</i> Cacti Scrub Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--|-------------------------|------|
| > | Creosote Bush Scrub | Holland and Keil 1995 | |
| < | Mohave Desertscrub, Creosotebush Series, <i>Larrea divaricata</i> - <i>Ambrosia dumosa</i> Association - 153.112 | Brown et al. 1979 | |
| < | Mohave Desertscrub, Creosotebush Series, <i>Larrea divaricata</i> Association - 153.111 | Brown et al. 1979 | |
| < | Creosotebush-Bursage Desert Scrub Natural Community | Hall et al. 2001 | |
| < | Creosotebush-Big Galleta Scrub Natural Community | Hall et al. 2001 | |
| < | Creosotebush - Bursage (506) | Shiflet 1994 | |
| < | Creosote Bush Scrub (211) | Shiflet 1994 | |
| = | Mohave Desertscrub, Creosotebush Series - 153.11 | Brown et al. 1979 | |
| = | Lower Colorado River Valley: <i>Larrea-Franseria</i> region | Shreve and Wiggins 1964 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** D.E. Brown, C.H. Lowe, and C.P. Pase (1979)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz

Acknowledgments [optional]: T. Keeler-Wolf

Version Date: 16 Apr 2015

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3. Desert & Semi-Desert

3.A.2.Na. North American Warm Desert Scrub & Grassland

G675. North American Warm Semi-Desert Dune & Sand Flats

Type Concept Sentence: This group occurs on dunes and sandsheets in the Mojave, Colorado, Sonoran and Chihuahuan deserts of southwestern North America and consists of sparse to low cover of vegetation (<15% total cover) and includes woody vegetation, perennial grasses and/or psammophilic herbs.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 3.A.2.Na.4. Mojave-Sonoran Semi-Desert Scrub (M088)

Elcode: G675

***Scientific Name:** North American Warm Semi-Desert Dune & Sand Flats Group

***Common (Translated Scientific) Name:** North American Warm Semi-Desert Dune & Sand Flats Group

***Colloquial Name:** North American Warm Semi-Desert Dune & Sand Flats

***Type Concept:** This vegetated group occurs on dunes and sandsheets across the warm deserts of North America. Stands typically have low total vegetation cover (<15%) that is often patchy or scattered and is composed of a variety of plant species across the group's range. Stands include woody vegetation, perennial grasses and/or psammophilic herbs. In the Chihuahuan Desert dunes along the Rio Grande in Trans-Pecos Texas, characteristic species include *Chamaesyce carunculata* (= *Euphorbia carunculata*), *Helianthus neglectus*, *Helianthus petiolaris*, *Heliotropium convolvulaceum*, *Heliotropium racemosum*, *Mentzelia* sp., *Panicum*

havardii, *Polanisia jamesii*, and *Psoralidium lanceolatum*. This vegetation composition varies a great deal from year to year, depending on moisture. In the Mojave, Colorado, and Sonoran deserts, stands may be characterized by stoloniferous grasses and/or psammophilic herbs such as *Abronia villosa*, *Achnatherum hymenoides* (= *Oryzopsis hymenoides*), *Cleome sparsifolia*, *Croton californicus*, *Dicoria canescens*, *Geraea canescens*, *Oenothera deltoides*, *Panicum urvilleanum*, *Pleuraphis rigida* (= *Hilaria rigida*), *Rumex hymenosepalus*, and *Swallenia alexandrae*. Individual emergent desert shrubs such as *Ambrosia dumosa*, *Atriplex canescens*, *Eriogonum deserticola*, and *Larrea tridentata* may be present. Other stands are dominated by the semi-woody perennial grass *Pleuraphis rigida*, sometimes with up to 35% total cover. Other associates in the herbaceous layer include *Achnatherum hymenoides*, *Bouteloua eriopoda*, *Dalea mollissima*, *Gutierrezia sarothrae*, *Panicum urvilleanum*, and *Sphaeralcea ambigua*. Scattered shrubs such as *Larrea tridentata*, *Yucca brevifolia*, or other desert shrubs may be present with low cover. Stands occur on flat ridges, lower slopes, and partially stabilized sand dunes. Elevations range from 10-1400 m. The group occurs in warm, semi-arid to arid climate. Annual precipitation totals are between 0 and 250 mm. There is much year-to-year variation in precipitation. The summers are extremely hot. Winter temperatures, particularly at higher elevations and latitudes, can get quite cold; however, stands in southern latitudes never freeze. Stands occur on sandy substrates found on flat ridges, lower slopes, stabilized sand dunes and sandsheets, and sandy plains.

***Diagnostic Characteristics:** This vegetated group occurs on dunes and sandsheets and may be composed of a variety of plant species across the group's range. Stands include woody vegetation, perennial grasses and/or psammophilic herbs. In the Chihuahuan Desert, characteristic species include *Chamaesyce carunculata*, *Helianthus neglectus*, *Helianthus petiolaris*, *Heliotropium convolvulaceum*, *Heliotropium racemosum*, *Mentzelia* sp., *Panicum havardii*, *Polanisia jamesii*, and *Psoralidium lanceolatum*. In the Mojave, Colorado, and Sonoran deserts, stands may be characterized by stoloniferous grasses and/or psammophilic herbs such as *Abronia villosa*, *Achnatherum hymenoides*, *Cleome sparsifolia*, *Croton californicus*, *Dicoria canescens*, *Geraea canescens*, *Oenothera deltoides*, *Panicum urvilleanum*, *Pleuraphis rigida*, *Rumex hymenosepalus*, and *Swallenia alexandrae*. Individual emergent desert shrubs such as *Ambrosia dumosa*, *Atriplex canescens*, *Eriogonum deserticola*, and *Larrea tridentata* may be present. Other stands are dominated by the semi-woody perennial grass *Pleuraphis rigida*, sometimes with up to 35% total cover.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|--|
| G775 | Intermountain Sparsely Vegetated Dune Scrub & Grassland | also occurs on dunes and sandsheets, but in cool, semi-arid climate. |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Vegetation has a sparse cover of xeromorphic shrubs and dwarf-shrubs less than 2 m tall and/or a short herbaceous layer is typically sparse and is dominated by perennial graminoids, with ephemeral forbs and grasses present seasonally.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This vegetated group typically has low total vegetation cover (<15%) that is often patchy or scattered and is composed of a variety of plant species across the group's range. Stands include woody vegetation, perennial grasses and/or psammophilic herbs. In the Chihuahuan desert dunes along the Rio Grande in Trans-Pecos Texas, characteristic species include *Chamaesyce carunculata* (= *Euphorbia carunculata*), *Helianthus neglectus*, *Helianthus petiolaris*, *Heliotropium convolvulaceum*, *Heliotropium racemosum*, *Mentzelia* sp., *Panicum havardii*, *Polanisia jamesii*, and *Psoralidium lanceolatum*. This vegetation composition varies a great deal from year to year, depending on moisture. In the Mojave, Colorado, and Sonoran deserts, stands may be characterized by stoloniferous grasses and/or psammophilic herbs such as *Abronia villosa*, *Achnatherum hymenoides* (= *Oryzopsis hymenoides*), *Cleome sparsifolia*, *Croton californicus*, *Dicoria canescens*, *Geraea canescens*, *Oenothera deltoides*, *Panicum urvilleanum*, *Palafoxia arida*, *Pleuraphis rigida* (= *Hilaria rigida*), *Rumex hymenosepalus*, and *Swallenia alexandrae*. Individual emergent desert shrubs such as *Ambrosia dumosa*, *Atriplex canescens*, *Croton wigginsii*, *Ephedra trifurca*, *Eriogonum deserticola*, and *Larrea tridentata* may be present. Other stands are dominated by the semi-woody perennial grass *Pleuraphis rigida*, sometimes with up to 35% total cover. Other associates in the herbaceous layer include *Achnatherum hymenoides*, *Bouteloua eriopoda*, *Dalea mollissima*, *Gutierrezia sarothrae*, *Panicum urvilleanum*, and *Sphaeralcea ambigua*. Scattered shrubs such as *Larrea tridentata*, *Yucca*

brevifolia, or other desert shrubs may be present with low cover.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Active dune communities have a high number of endemic plants (Thorne 1982, Bowers 1984). These species' adaptations to moving sand have resulted in the endemism (Bowers 1982). The active dune endemic *Eriogonum deserticola* avoids burial by drifting sand by rapid growth of shoots. *Pleuraphis rigida* is a common grass on sandy plains and dunes. Unlike most grasses, it has a woody structure and elevated renewal buds (Brown 1982b). Several years of above-average annual precipitation can increase the cover of *Pleuraphis rigida* and other grasses to where they resemble a desert grassland (Thorne 1982). These dune systems are shaped by abiotic factors and move too rapidly to be stabilized by plants establishing on them. Plant cover is therefore very sparse. Subsurface water is held for long periods of time so shrubs that can survive long enough to get rooted can persist through long droughts.

ENVIRONMENT

Environmental Description: This vegetated group occurs on dunes and sandsheets across the warm deserts of North America. Stands occur on flat ridges, lower slopes, and partially stabilized sand dunes. Elevations range from 10-1400 m. Stands are often found on sand ramps, dune aprons, stabilized dunes near playas, or wide washes adjacent to desert scrub.

Climate: The group occurs in warm, semi-arid to arid climate. The summers are extremely hot. Winter temperatures, particularly at higher elevations and latitudes, can get quite cold, but southern latitude stands never freeze. Annual precipitation totals are between 0 and 250 mm. Precipitation has a bimodal distribution in the eastern extent with almost half occurring from July to September and the rest occurring during the winter months. Further west precipitation occurs almost entirely in the winter. Average annual precipitation at nearby Yuma, Arizona, is 70 mm. Annual precipitation varies greatly year to year.

Soil/substrate/hydrology: Stands occur on sandy substrates ranging from deep sands of partially stabilized sand dunes and sandsheets, and shallower sandy plains.

DISTRIBUTION

***Geographic Range:** This vegetated group occurs on dunes and sandsheets in the Mojave, Colorado, Sonoran and Chihuahuan deserts of southwestern North America and northern Mexico.

Nations: MX, US

States/Provinces: AZ, CA, MXCH?, MXCO?, MXSO?, NM, NV?, TX

USFS Ecoregions (2007) [optional]:

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3170 | <i>Pleuraphis rigida</i> Desert Grassland Alliance |
| A4027 | <i>Heliotropium convolvulaceum</i> - <i>Heliotropium racemosum</i> Chihuahuan Dune Alliance |
| A4026 | <i>Dicoria canescens</i> - <i>Abronia villosa</i> - <i>Panicum urvilleanum</i> Dune Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP

*Primary Concept Source [if applicable]: Faber-Langendoen et al. (2015)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

*Author of Description: K.A. Schulz

Acknowledgments [optional]:

Version Date: 16 Apr 2015

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G293. Sonoran Paloverde - Mixed Cacti Desert Scrub

Type Concept Sentence: This Sonoran Desert group is characterized by a diagnostic sparse, emergent tree layer of *Carnegiea gigantea* (3-16 m tall) and/or a sparse to moderately dense canopy codominated by xeromorphic, summer-deciduous tall shrub *Parkinsonia microphylla* and evergreen *Larrea tridentata*, with *Prosopis* sp., *Olneya tesota*, and *Fouquieria splendens* less prominent. It occurs on hillsides, mesas and upper bajadas in southern Arizona and extreme southeastern California.

OVERVIEW

*Hierarchy Level: Group

*Placement in Hierarchy: 3.A.2.Na.4. Mojave-Sonoran Semi-Desert Scrub (M088)

Elcode: G293

*Scientific Name: *Carnegiea gigantea* - *Parkinsonia microphylla* - *Ambrosia deltoidea* Mixed Cacti Desert Scrub Group

*Common (Translated Scientific) Name: Saguaro - Yellow Paloverde - Triangle Bur-ragweed Mixed Cacti Desert Scrub Group

*Colloquial Name: Sonoran Paloverde - Mixed Cacti Desert Scrub

*Type Concept: This group occurs on hillsides, mesas and upper bajadas in southern Arizona and extreme southeastern California. The vegetation is characterized by a diagnostic sparse, emergent tree layer of *Carnegiea gigantea* (3-16 m tall) and/or a sparse to moderately dense canopy codominated by xeromorphic, summer deciduous tall shrub *Parkinsonia microphylla* and evergreen *Larrea tridentata*, with *Prosopis* sp., *Olneya tesota*, and *Fouquieria splendens* less prominent. Other common shrubs and dwarf-shrubs include *Acacia greggii*, *Ambrosia deltoidea*, *Ambrosia dumosa* (in drier sites), *Calliandra eriophylla*, *Jatropha cardiophylla*, *Krameria erecta*, *Lycium* spp., *Menodora scabra*, *Simmondsia chinensis*, and many cacti, including *Ferocactus* spp., *Echinocereus* spp., and *Opuntia* spp. (both cholla and prickly-pear). The sparse herbaceous layer is composed of perennial grasses and forbs with annuals seasonally present and occasionally abundant. On slopes, plants are often distributed in patches around rock outcrops where

suitable habitat is present. Outliers of this succulent-dominated group occur as "Cholla Gardens" in the southern and eastern Mojave Desert in California. In this area, the group is characterized by *Cylindropuntia bigelovii* (= *Opuntia bigelovii*), *Fouquieria splendens*, and other succulents, but it lacks *Carnegiea gigantea* and *Parkinsonia microphylla*, which are typical farther east.

***Diagnostic Characteristics:** This tropical/subtropical vegetation group is characterized by a number of species representing Shreve's "Arizona Upland." *Carnegiea gigantea*, *Olneya tesota*, *Cylindropuntia bigelovii*, *Parkinsonia microphylla*, and *Ambrosia deltoidea* are diagnostic of this vegetation group, although, with the exception of *Parkinsonia microphylla* and *Ambrosia deltoidea*, generally do not typically dominate the shrub layer. Species sensitive to frost such as *Ferocactus* spp. and many other cacti are typically present and characterize this tropical/subtropical group. *Larrea tridentata* is generally present to dominant, but is nearly ubiquitous in the warm southwestern deserts. Common desert shrubs *Prosopis* spp. and *Fouquieria splendens* are characteristic, but also occur widely across the southwestern warm desert in other groups.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|-------------------------------|------|
| | | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This vegetation group is characterized by an open to moderately dense tropical/subtropical, xeromorphic evergreen and deciduous shrub layer with mixed cacti present to dominant, and sometimes with emergent tree cacti. The herbaceous layer is usually sparse.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This wooded shrubland group includes the iconic saguaro cacti "forests" of the Sonoran Desert that are characterized by a diagnostic, emergent tree layer of *Carnegiea gigantea* (3-16 m tall) with sparse to moderately dense, xeromorphic, deciduous and evergreen shrub layers dominated by *Parkinsonia microphylla* or *Larrea tridentata*. Often *Prosopis* sp., *Olneya tesota*, and *Fouquieria splendens* are present, although usually less prominently. There are typically many cacti present, including species of *Echinocereus*, *Escobaria*, *Ferocactus*, *Mammillaria*, and *Opuntia* (both cholla and prickly-pear). These mixed cacti are diagnostic even when saguaro is sparse or absent. Other common shrubs and dwarf-shrubs include *Acacia greggii*, *Ambrosia deltoidea*, *Ambrosia dumosa* (in drier sites), *Calliandra eriophylla*, *Jatropha cardiophylla*, *Krameria erecta*, *Lycium* spp., *Menodora scabra*, and *Simmondsia chinensis*. The sparse herbaceous layer is composed of perennial grasses and forbs with annuals seasonally present and occasionally abundant. On slopes, plants are often distributed in patches around rock outcrops where suitable habitat is present. Outliers of this succulent-dominated group occur as "Cholla Gardens" in the southern Mojave Desert in California. In this area, the group is characterized by *Cylindropuntia bigelovii* (= *Opuntia bigelovii*), *Fouquieria splendens*, and other succulents, but it lacks the *Carnegiea gigantea* and *Parkinsonia microphylla* which are typical farther east.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:

ENVIRONMENT

Environmental Description: This Sonoran Desert group occurs on lower slopes of mountains, foothills, hillsides, mesas, upper bajadas, and less commonly in valleys and plains in southern Arizona and extreme southeastern California. Elevations range from 150-1070 m (Shreve and Wiggins 1964). Climate is arid. Summers are hot and winters rarely have freezing temperatures. Freezing winter temperatures limit the elevation and northern extent of these stands. The northern stands are restricted to the warmer southern and southwestern slopes; in the southern extent in Mexico, *Carnegiea gigantea* is restricted to northern slopes and ephemeral drainages (Benson 1982). Mean annual precipitation is 28 cm at Tucson, Arizona, but can vary greatly from year to year. Annual precipitation has bimodal distribution with about half of the rain falling during July to September and a third falling from

December to March. Farther west, the proportion of summer precipitation decreases until there is not enough summer moisture to sustain *Carnegiea gigantea* (Barbour and Major 1977). Sites have gentle to steep slopes. Substrates are generally shallow, well-drained, gravelly, coarse-textured soils. Parent material is usually gravelly alluvium and colluvium, derived from basalt and other igneous or metamorphic rocks.

DISTRIBUTION

***Geographic Range:** This warm desert scrub group is found in southern Arizona, southeastern California and Sonora, Mexico. Outlier stands occur in the eastern Whipple Mountains of California near Parker Dam.

Nations: MX, US

States/Provinces: AZ, CA, MXSO

USFS Ecoregions (2007) [optional]: 313C:CC, 321A:CC, 322A:CC, 322B:CC, 322C:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3283 | <i>Simmondsia chinensis</i> - <i>Canotia holacantha</i> - <i>Eriogonum fasciculatum</i> Desert Scrub Alliance |
| A3282 | <i>Carnegiea gigantea</i> - <i>Parkinsonia microphylla</i> - <i>Prosopis velutina</i> Desert Scrub Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------------|--|-----------------------|
| 2013-04-12 | G294 <i>Oleña tesota</i> - <i>Parkinsonia microphylla</i> - <i>Prosopis</i> spp. Desert Scrub Group | G294 merged into G293 |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---|-------------------------|------|
| < | Paloverde-Mixed Cacti-Mixed Scrub on Rocky Slopes Natural Community | Hall et al. 2001 | |
| < | Paloverde-Mixed Cacti-Mixed Scrub on Bajadas Natural Community | Hall et al. 2001 | |
| < | Paloverde-Mixed Cacti ("Arizona Upland") Series, Mixed scrub- <i>Cercidium microphyllum</i> - <i>Oleña tesota</i> mixed scrub Association - 154.127 | Brown et al. 1979 | |
| = | Paloverde-Mixed Cacti ("Arizona Upland") Series - 154.12 | Brown et al. 1979 | |
| = | Palo Verde - Cactus (507) | Shiflet 1994 | |
| = | Arizona Upland: <i>Cercidium-Opuntia</i> region | Shreve and Wiggins 1964 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** D.E. Brown, C.H. Lowe, and C.P. Pase (1979)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz

Acknowledgments [optional]: T. Keeler-Wolf

Version Date: 05 Nov 2015

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3. Desert & Semi-Desert

3.A.2.Na. North American Warm Desert Scrub & Grassland

M117. North American Warm Semi-Desert Cliff, Scree & Rock Vegetation

3. Desert & Semi-Desert

3.A.2.Na. North American Warm Desert Scrub & Grassland

G569. North American Warm Semi-Desert Cliff, Scree & Pavement Sparse Vegetation

Type Concept Sentence: This wide-ranging group consists of sparsely vegetated substrates from a variety of landscapes and parent material found across the southwestern U.S. and northern Mexico from rock outcrop to desert pavement with diverse and variable species composition.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 3.A.2.Na.6. North American Warm Semi-Desert Cliff, Scree & Rock Vegetation (M117)

Elcode: G569

Scientific Name:** *Fouquieria splendens* - *Nolina* spp. - *Atriplex hymenelytra* Rock Vegetation GroupCommon (Translated Scientific) Name:** Ocotillo - Bear-grass species - Desert-holly Rock Vegetation Group***Colloquial Name:** North American Warm Semi-Desert Cliff, Scree & Pavement Sparse Vegetation

***Type Concept:** This group consists of barren and sparsely vegetated substrates from a variety of landscapes across the southwestern U.S. and northern Mexico in the Chihuahuan, Sonoran, and Mojave deserts, extending south along coastal areas around the Gulf of California. Vegetation is variable depending on environmental factors of the sites, which range from sea level to subalpine elevations. Lower elevation sites often have herbaceous or shrub species present, whereas foothill, montane and subalpine sites may also include trees. Most of the species also occur in non-sparse vegetation groups. Common coastal species include *Amaranthus watsonii*, *Eucnide rupestris*, *Ficus* spp., *Hofmeisteria* spp., *Nicotiana obtusifolia* (= *Nicotiana trigonophylla*), *Maytenus phyllanthoides*, and *Pleurocoronis laphamioides*. In the foothills and low mountains, *Bursera microphylla*, *Fouquieria splendens*, *Juniperus deppeana*, *Nolina bigelovii*, *Cylindropuntia bigelovii* (= *Opuntia bigelovii*), and *Pinus discolor* are often present. On harsh shaly substrates, *Atriplex hymenelytra* is common. The nearly ubiquitous *Eriogonum fasciculatum* and *Larrea tridentata* are often present. High mountain cliffs and outcrops will often have scattered *Abies concolor* and *Pseudotsuga menziesii* trees growing. Nonvascular (lichens) plants are the predominant lifeform in some areas. Sites occur on a variety of landforms, including cliffs, narrow canyons, and smaller rock outcrops in desert mountains; pebbly pavement in xeric basins and alluvial fans; and upland areas around playas and washes. Geology is variable and includes igneous, sedimentary, and metamorphic rock types. Sparse vegetation also occurs on special substrates such as shale or mudstone outcrops in badlands and volcanic deposits such as tuff and basal lava. Rock substrates include bedrock and unstable talus and scree slopes in mountains. Some substrates, such as marine shales, are strongly alkaline and/or saline which chemically limits plant growth. Active substrates such as scree slopes are difficult sites for plants to grow. Physical properties of substrates may also limit plant growth. Badland sites often have heavy clay soils that reduce water infiltration increasing erosion rates and reducing soil moisture for plants.

***Diagnostic Characteristics:** Diagnostic characteristics of this lithomorphic group are barren to sparsely vegetated substrates and its geographic location, which is the southwestern U.S. and northern Mexico. However, it is often composed of a mix of woody vegetation, especially shrubs and herbs (particularly cushion plants), although either may be absent on a given site. Nonvascular species, especially lichens, but also mosses, are important. Current nominals for associations in this group include *Aloysia wrightii*, *Chorizanthe rigida*, *Cleome isomeris*, *Ephedra californica*, *Ephedra nevadensis*, *Ericameria linearifolia*, *Geraea canescens*, *Pericome caudata*, *Perityle staurophylla*, and *Peucephyllum schottii*.

***Classification Comments:** This group is very diverse floristically and so it is difficult to determine indicator species. More diagnostic is the sparse cover of vascular plants and/or presence and sometimes dominance of nonvascular (lichen) species. This broadly defined lithomorphic group was developed by NatureServe. This probably needs to be elevated to a macrogroup, with groups identified for rockland and cliffs, pavements, and badlands or clay hills. The concept of including coastal sea cliffs needs review as those could be expected to have different floristics due to proximity of salt spray.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G570 | Intermountain Basins Cliff, Scree & Badland Sparse Vegetation | |
| G567 | Great Plains Cliff, Scree & Rock Vegetation | |
| G565 | Rocky Mountain Cliff, Scree & Rock Vegetation | |

Similar NVC Types General Comments [optional]:**VEGETATION**

Physiognomy and Structure Summary: This lithomorphic group may be composed of woody plants, including both trees and shrubs, herbaceous plants, and/or nonvascular plants. Shrubs are especially common and were chosen as indicator species, however, herbs (especially cushion plants) and nonvasculars such as mosses or lichens may be more common.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Vegetation is variable depending on environmental factors of the sites, which range from sea level to subalpine elevations. Lower elevation sites often have herbaceous or shrub species present, whereas foothill, montane and subalpine sites may also include trees. Most of the species also occur in non-sparse vegetation groups. Common coastal species include *Amaranthus*

watsonii, *Eucnide rupestris*, *Ficus* spp., *Hofmeisteria* spp., *Nicotiana obtusifolia* (= *Nicotiana trigonophylla*), *Maytenus phyllanthoides*, and *Pleurocoronis laphamioides*. In the deserts, foothills and low mountains, *Aloysia wrightii*, *Bursera microphylla*, *Chorizanthe rigida*, *Cleome isomeris*, *Ephedra californica*, *Ephedra nevadensis*, *Ericameria linearifolia*, *Fouquieria splendens*, *Geraea canescens*, *Juniperus deppeana*, *Nolina bigelovii*, *Cylindropuntia bigelovii* (= *Opuntia bigelovii*), *Pericome caudata*, *Perityle staurophylla*, *Peucephyllum schottii* and *Pinus discolor* are often present. On harsh shaly substrates, *Atriplex hymenelytra* is common. The nearly ubiquitous *Eriogonum fasciculatum* and *Larrea tridentata* are often present. High mountain cliffs and outcrops will often have scattered *Abies concolor* and *Pseudotsuga menziesii* trees growing. Nonvascular (lichens) plants are the predominant lifeform in some areas. Floristic information was compiled from Shreve and Wiggins (1964), Brown (1982), Barbour and Major (1988), MacMahon (1988), Dick-Peddie (1993), Sawyer and Keeler-Wolf (1995), Barbour et al. (2007), Keeler-Wolf (2007), Schoenherr and Burk (2007), and Sawyer et al. (2009).

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:

ENVIRONMENT

Environmental Description: This group consists of barren and sparsely vegetated substrates from a variety of landscapes across the southwestern U.S. and northern Mexico in the Chihuahuan, Sonoran, and Mojave deserts, extending south along coastal areas around the Gulf of California. Landforms include cliffs, narrow canyons, and smaller rock outcrops in desert mountains; pebbly pavement in xeric basins and alluvial fans; and upland areas around playas and washes. Geology is variable and includes igneous, sedimentary, and metamorphic rock types. Sparse vegetation also occurs on special substrates such as shale or mudstone outcrops in badlands and volcanic deposits such as tuff and basal lava. Rock substrates include bedrock and unstable talus and scree slopes in mountains. Some substrates, such as marine shales, are strongly alkaline and/or saline which chemically limits plant growth. Active substrates such as scree slopes are difficult sites for plants to grow. Physical properties of substrates may also limit plant growth. Badland sites often have heavy clay soils that reduce water infiltration increasing erosion rates and reducing soil moisture for plants.

DISTRIBUTION

***Geographic Range:** This group occurs in scattered locations across the southwestern U.S. and northern Mexico in the Chihuahuan, Sonoran, and Mojave deserts extending south along coastal areas around the Gulf of California.

Nations: MX, US

States/Provinces: AZ, CA, MXBC, MXBS, MXCH, MXSO, NM, NV, TX

USFS Ecoregions (2007) [optional]: 313A:CC, 313B:CC, 313C:CC, 313D:CC, 315A:CC, 315B:CC, 315H:CC, 321A:CC, 322A:CC, 322B:CC, 322C:CC, 341F:CC, M313A:CC, M313B:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A0872 | <i>Atriplex hymenelytra</i> Scrub Alliance |
| A3143 | <i>Peucephyllum schottii</i> - <i>Pleurocoronis pluriseta</i> Scrub Alliance |
| A4025 | <i>Aloysia wrightii</i> - <i>Pericome caudata</i> - <i>Ephedra nevadensis</i> Sparsely Vegetated Bedrock Cliff & Lava Field Alliance |
| A4023 | <i>Cleome isomeris</i> - <i>Ephedra californica</i> - <i>Ericameria linearifolia</i> Sparsely Vegetated Clay Flats, Hills & Badlands Alliance |
| A4024 | <i>Chorizanthe rigida</i> - <i>Geraea canescens</i> Desert Pavement Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP***Primary Concept Source [if applicable]:** K.A. Schulz, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz and M.S. Reid

Acknowledgments [optional]:

Version Date: 06 Nov 2015

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- Keeler-Wolf, T. 2007. Mojave Desert scrub vegetation. Pages 609-656 in: M. G. Barbour, T. Keeler-Wolf, and A. A. Schoenherr, editors. Terrestrial vegetation of California. Third edition. University of California Press, Berkeley.
- MacMahon, J. A. 1988. Warm deserts. Pages 232-264 in: M. G. Barbour and W. D. Billings, editors. North American terrestrial vegetation. Cambridge University Press, New York.
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- Schoenherr, A. A., and J. H. Burk. 2007. Colorado Desert vegetation. Pages 657-682 in: M. G. Barbour, T. Keeler-Wolf, and A. A. Schoenherr, editors. 2007. Terrestrial vegetation of California. Third edition. University of California Press, Berkeley.
- Shreve, F., and I. L. Wiggins. 1964. Vegetation and flora of the Sonoran Desert. Stanford University Press, Stanford, CA. 840 pp.

M092. North American Warm-Desert Xeric-Riparian Scrub

3. Desert & Semi-Desert

3.A.2.Na. North American Warm Desert Scrub & Grassland

G541. Warm Semi-Desert Shrub & Herb Dry Wash & Colluvial Slope

Type Concept Sentence: These are fluvial-driven shrublands and herbaceous communities that line washes in the warm deserts of the western U.S. and northwestern Mexico and may be dominated by *Chilopsis linearis*, *Fallugia paradoxa*, *Prunus fasciculata*, or other shrub species.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 3.A.2.Na.7. North American Warm-Desert Xeric-Riparian Scrub (M092)

Elcode: G541

Scientific Name:** *Chilopsis linearis* - *Fallugia paradoxa* - *Prunus fasciculata* Desert Wash & Colluvial Slope GroupCommon (Translated Scientific) Name:** Desert-willow - Apache Plume - Desert Almond Desert Wash & Colluvial Slope Group***Colloquial Name:** Warm Semi-Desert Shrub & Herb Dry Wash & Colluvial Slope

***Type Concept:** This group is restricted to intermittently flooded washes or arroyos that dissect bajadas, mesas, plains and basin floors throughout the warm deserts of the western U.S. and northwestern Mexico. A woody layer is usually present and is typically scattered clumps to very open and may be dominated by shrubs and small trees such as *Acacia greggii*, *Brickellia laciniata*, *Baccharis sarothroides*, *Chilopsis linearis*, *Ephedra californica*, *Ericameria paniculata*, *Fallugia paradoxa*, *Forestiera pubescens*, *Hymenoclea salsola*, *Hymenoclea monogyra*, *Hyptis emoryi*, *Juglans microcarpa*, *Lepidospartum squamatum*, *Olneya tesota*, *Parkinsonia florida*, *Prosopis* spp., *Psoralea spinosus*, *Prunus fasciculata*, *Rhus microphylla*, *Salazaria mexicana*, *Sarcobatus vermiculatus*, or *Viguiera reticulata*. A few known herbaceous communities dominate intermittent drainages and washes with woody vegetation absent or only with scattered individuals present. Dominant species include *Panicum bulbosum*, *Alopecurus aequalis*, or *Lycurus phleoides*. Although often dry, the intermittent fluvial processes are characteristic of this group, which are often associated with rapid sheet and gully flow. This group is restricted to drainages in upland areas or ramaderos that are intermittently flooded and occur as linear or sometimes broader braided strips within desert scrub-or desert grassland-dominated landscapes. The vegetation of desert washes is quite variable in species composition and structure, ranging from sparse and patchy to moderately dense, and typically occurs along the banks, but may occur within the channel.

***Diagnostic Characteristics:** Characteristic species of shrubs and small trees may include *Acacia greggii*, *Brickellia laciniata*, *Baccharis sarothroides*, *Chilopsis linearis*, *Ephedra californica*, *Ericameria paniculata*, *Fallugia paradoxa*, *Forestiera pubescens*, *Hymenoclea salsola*, *Hymenoclea monogyra*, *Hyptis emoryi*, *Juglans microcarpa*, *Lepidospartum squamatum*, *Olneya tesota*, *Parkinsonia florida*, *Prosopis* spp., *Psoralea spinosus*, *Prunus fasciculata*, *Rhus microphylla*, *Salazaria mexicana*, *Sarcobatus vermiculatus*, and *Viguiera reticulata*.

***Classification Comments:** This intermittently flooded desert wash group is wide-ranging with diverse species. There is some species overlap with desert riparian groups that are seasonally or permanently flooded, although cover of these riparian species such as *Juglans microcarpa* is lower in dry washes than in riparian shrublands and woodlands. Stands may also be dominated by denser cover of upland and facultative wetland (semi-riparian) species such as *Acacia greggii*, *Fallugia paradoxa*, *Psoralea spinosus*, *Rhus microphylla*, and *Salazaria mexicana*. Also complicating the species composition of this group is the wide soil moisture gradients across its range. In extremely dry area such as found in the Lower Colorado Desert, uplands are sparsely vegetated with non-sparse upland vegetation restricted to dendritic intermittently flooded drainage channels. In other areas, upland dry washes flood so infrequently that they have only upland vegetation present (although sometime denser and more robust). However, if there is no floristic difference between upland area and a dry wash that bisects it, then it is not a distinct wash community.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G797 | Western Interior Riparian Forest & Woodland | |
| G559 | Great Basin-Intermountain Shrub & Herb Wash-Arroyo | |

Similar NVC Types General Comments [optional]:**VEGETATION**

Physiognomy and Structure Summary: This group is typically characterized by an intermittently open to dense woody layer, but includes stands lacking a woody layer that may be dominated by herbaceous vegetation or sparsely vegetated.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: The vegetation of this group is quite variable in species composition and structure, ranging from sparse and patchy to moderately dense, and typically occurs along the banks, but may occur within the channel. A woody layer is usually present and is typically intermittent to open and may be dominated by shrubs and small trees such as *Acacia greggii*, *Brickellia laciniata*, *Baccharis sarothroides*, *Chilopsis linearis*, *Ephedra californica*, *Ericameria paniculata*, *Fallugia paradoxa*, *Forestiera pubescens*, *Hymenoclea salsola*, *Hymenoclea monogyra*, *Hyptis emoryi*, *Juglans microcarpa*, *Lepidospartum squamatum*, *Olneya tesota*, *Parkinsonia florida*, *Prosopis pubescens*, *Psoralea spinosus*, *Prunus fasciculata*, *Rhus microphylla*, *Salazaria mexicana*, *Sarcobatus vermiculatus*, or *Viguiera reticulata*. Additional species characteristic of Tamaulipan stands are *Vachellia farnesiana* (=

Acacia farnesiana), *Celtis ehrenbergiana* (= *Celtis pallida*), *Haematoxylum brasiletto*, *Prosopis glandulosa*, or *Tecoma stans*. *Prosopis glandulosa* is not dominant. Sometimes herbaceous vegetation dominates the wash with woody vegetation absent or only with scattered individuals present. Dominance by *Panicum bulbosum*, *Alopecurus aequalis*, or *Lycurus phleoides* is typical of some herbaceous stands, although it is variable. Floristic information was compiled from Shreve and Wiggins (1964), Brown (1982a), Barbour and Major (1988), Jahrsdoerfer and Leslie (1988), MacMahon (1988), Szaro (1989), Dick-Peddie (1993), Sawyer and Keeler-Wolf (1995), Barbour et al. (2007), Schoenherr and Burk (2007), and Sawyer et al. (2009).

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: This group is associated with intermittent fluvial processes, which affect the vegetation enough to distinguish it from surrounding upland vegetation. Sites are often associated with rapid sheet and gully flow that scours the channel bottoms.

ENVIRONMENT

Environmental Description: This group is restricted to intermittently flooded washes or arroyos that dissect bajadas, mesas, plains and basin floors throughout the warm deserts and subtropical Tamaulipan region of North and Central America. Although often dry, the intermittent fluvial processes are characteristic of this group, which are often associated with rapid sheet and gully flow. This group is restricted to drainages in upland areas or ramaderos that are intermittently flooded and occur as linear or sometimes broader braided strips within desert scrub-or desert grassland-dominated landscapes. *Soil/substrate/hydrology:* This group is restricted to drainages in upland areas or ramaderos (isolated strips of dense brush associated with arroyos) that are intermittently flooded.

DISTRIBUTION

***Geographic Range:** This group is restricted to intermittently flooded washes or arroyos that dissect bajadas, mesas, plains and basin floors throughout the warm deserts of North America and northern Central America.

Nations: MX, US

States/Provinces: AZ, CA, MXBC, MXCH, MXCO, MXNU, MXSO, MXTM, NM, NV, TX

USFS Ecoregions (2007) [optional]: 261B:CC, 313A:CC, 313B:CP, 313C:CC, 313D:C?, 315A:CC, 315B:CC, 315H:CC, 321A:CC, 322A:CC, 322B:CC, 322C:CC, 341E:C?, 341F:CC, M261E:PP, M313A:CC, M313B:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3259 | <i>Fallugia paradoxa</i> Desert Wash Scrub Alliance |
| A0588 | <i>Parkinsonia florida</i> - <i>Olnya tesota</i> Desert Wash Scrub Alliance |
| A4163 | <i>Encelia actonii</i> - <i>Encelia virginensis</i> - <i>Viguiera reticulata</i> Desert Scrub Alliance |
| A1356 | <i>Panicum bulbosum</i> Intermittent Desert Wash Grassland Alliance |
| A4187 | <i>Acacia greggii</i> - <i>Hyptis emoryi</i> - <i>Justicia californica</i> Desert Wash Scrub Alliance |
| A3262 | <i>Hymenoclea monogyra</i> - <i>Brickellia laciniata</i> Chihuahuan-Sonoran Desert Wash Alliance |
| A1044 | <i>Chilopsis linearis</i> - <i>Psoralea spinosus</i> Desert Wash Scrub Alliance |
| A2536 | <i>Ephedra californica</i> - <i>Ephedra trifurca</i> Desert Wash Scrub Alliance |
| A2509 | <i>Ericameria paniculata</i> Mojave Desert Wash Scrub Alliance |
| A4188 | <i>Hymenoclea salsola</i> - <i>Bebbia juncea</i> Mojave-Sonoran Desert Wash Scrub Alliance |
| A4185 | <i>Prunus fasciculata</i> - <i>Salazaria mexicana</i> Northern Mojave Desert Wash Scrub Alliance |
| A4186 | <i>Psoralea fremontii</i> - <i>Psoralea polydenius</i> Desert Wash Scrub Alliance |
| A3258 | <i>Baccharis salicina</i> Southern Great Plains Wash Scrub Alliance |
| A0303 | <i>Sapindus saponaria</i> Desert Wash Scrub Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP***Primary Concept Source [if applicable]:** K.A. Schulz, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz and E. Muldavin**Acknowledgments [optional]:** E. Muldavin

Version Date: 06 Nov 2015

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3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland (D040)

M171. Great Basin-Intermountain Dry Shrubland & Grassland

3. Desert & Semi-Desert

3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland

G312. Colorado Plateau Blackbrush - Mormon-tea Shrubland

Type Concept Sentence: This semi-arid shrubland group occurs in the Colorado Plateau on sandy substrates and is characterized by extensive, typically open shrublands dominated by *Artemisia filifolia*, *Coleogyne ramosissima*, *Ephedra cutleri*, *Ephedra torreyana*, *Ephedra viridis*, *Poliomintha incana*, *Quercus havardii* var. *tuckeri*, or *Vanclavea stylosa*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 3.B.1.Ne.1. Great Basin-Intermountain Dry Shrubland & Grassland (M171)

Elcode: G312

***Scientific Name:** *Coleogyne ramosissima* - *Ephedra cutleri* - *Ephedra torreyana* Colorado Plateau Shrubland Group

***Common (Translated Scientific) Name:** Blackbrush - Cutler's Joint-fir - Torrey's Joint-fir Colorado Plateau Shrubland Group

***Colloquial Name:** Colorado Plateau Blackbrush - Mormon-tea Shrubland

***Type Concept:** This semi-arid Colorado Plateau shrubland group is characterized by extensive, typically open shrublands dominated by *Coleogyne ramosissima* or one of three species of *Ephedra*: *Ephedra cutleri*, *Ephedra torreyana*, or *Ephedra viridis*. *Ephedra cutleri* and *Ephedra viridis* often assume a distinctive matty growth form. Other dominant /diagnostic shrubs that occur either singly or in mixed stands include *Artemisia filifolia* (often on deep-sand sites), *Poliomintha incana*, *Quercus havardii* var. *tuckeri*, and *Vanclavea stylosa*. Other more widespread shrubs, such as *Ericameria nauseosa* and *Grayia spinosa*, may be present to dominant locally. The herbaceous layer is sparse and composed of graminoids such as *Achnatherum hymenoides*, *Hesperostipa comata*, *Pleuraphis jamesii*, or *Sporobolus cryptandrus*. The general aspect of occurrences is an open low shrubland but may include small blowouts and dunes. Occasionally grasses may be moderately abundant locally and form a distinct layer. Stands occur on windswept mesas, benchlands, colluvial slopes, pediments, alluvial fans, broad basins and plains. Elevation ranges from 560-1800 m. Substrates are shallow, typically calcareous, non-saline and gravelly or sandy soils over sandstone bedrock or limestone bedrock (less common), caliche or limestone alluvium. It also occurs in deeper soils on sandy plains and stabilized sandsheets and may form small hummocks or small coppice dunes. Disturbance may be important in maintaining the woody component. Eolian processes are evident, such as pediceled plants, occasional blowouts or small dunes, but the generally higher vegetative cover and less prominent geomorphic features distinguish this group from active and stabilized dune complexes.

***Diagnostic Characteristics:** *Coleogyne ramosissima* is an indicator species for this shrubland group in the northern portion of its range and often dominates or codominates with species of *Ephedra*. *Ephedra* species are typically present to dominant throughout the range of this group with *Ephedra cutleri* largely restricted to the southern portions. *Artemisia filifolia* may also be present to dominant, but is a widespread western shrub on sandy substrates and is not a good indicator of this Colorado Plateau group.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G296 | Mojave Mid-Elevation Mixed Desert Scrub | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group is composed of a typically open evergreen, microphyllous semi-desert scrub with succulents, half-shrubs, and scattered deciduous shrubs. Occasionally shrub cover can be moderately dense. Herbaceous species are

typically sparse and composed of perennial graminoids.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This semi-arid shrubland group is characterized by extensive, typically open shrublands dominated by *Coleogyne ramosissima* or one of several different species of *Ephedra*: *Ephedra cutleri*, *Ephedra torreyana*, or *Ephedra viridis*. *Ephedra cutleri* and *Ephedra viridis* often assume a distinctive matty growth form. *Artemisia filifolia* is often present and may be codominant to dominant on deep-sand sites. *Poliomintha incana*, *Quercus havardii* var. *tuckeri*, and *Vanceleva stylosa* may also dominant stands in either singly or in mixed stands. Other more widespread shrubs may be present, including *Atriplex canescens*, *Atriplex confertifolia*, *Ericameria nauseosa*, and *Grayia spinosa*, but not dominant. The herbaceous layer is sparse and composed of perennial graminoids such as *Achnatherum hymenoides*, *Bouteloua gracilis*, *Hesperostipa comata*, *Pleuraphis jamesii*, or *Sporobolus cryptandrus*. The general aspect of occurrences is an open low shrubland but may include small blowouts and dunes. Occasionally grasses may be moderately abundant locally and form a distinct layer.

*Floristics Table [Med - High Confidence]:

*Number of Plots:

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Fire does not appear to play a role in maintenance of shrublands within this group. Topographic breaks dissect the landscape, and isolated pockets of vegetation are separated by rockwalls or steep canyons. Blackbrush is fire-intolerant (Loope and West 1979). Following fires, these communities are often colonized by non-native grasses, which serve to encourage recurrent fires and delay shrub regeneration (Reid et al. 1999). In shallow regolith situations, secondary succession, in the sense of site preparation by seral plants, may not occur at all (Loope and West 1979). When this vegetation group (especially *Artemisia filifolia*-dominated stands) occurs on deeper loessal soils, some consider this shrub invasion of semi-desert shrub-steppe (Loope 1977).

Disturbance may be important in maintaining the woody component. Eolian processes are typically evident, such as pediceled plants, occasional blowouts or small dunes, but the generally higher vegetative cover and less prominent geomorphic features distinguish this group from active and stabilized dune complexes.

ENVIRONMENT

Environmental Description: This semi-arid shrubland group occurs in the Colorado Plateau on windswept mesas, benchlands, colluvial slopes, pediments, alluvial fans, broad basins and plains. Elevation ranges from 560-1800 m. Substrates are shallow, typically calcareous, non-saline and gravelly or sandy soils over sandstone bedrock and, less commonly, limestone bedrock (regolith), caliche (petrocalcic layer) or limestone alluvium. Stands also occur in deeper soils on extensive sandy plains and stabilized sandsheets and may form small hummocks or small coppice dunes. Disturbance may be important in maintaining the woody component. Eolian processes are evident, such as pediceled plants, occasional blowouts or small dunes, but the generally higher vegetative cover and less prominent geomorphic features distinguish this group from active and stabilized dune complexes.

Climate: This shrubland group occurs in an arid to semi-arid climate with annual precipitation in the form of summer monsoons and winter storms averaging approximately 20 cm. **Soil/substrate/hydrology:** This group typically occurs on gentle to steep, bouldery or rocky slopes of mountains, canyons, and mesas with varying aspects, but includes extensive sandy plains and basin in the southern portion of the Colorado Plateau. Soils are highly variable, and parent materials may include shale, sandstone, limestone, quartzites, and igneous rocks. Soils are generally coarse-textured, often rocky, shallow and well-drained. Effective soil moisture appears to be primarily controlled by depth of regolith (layer of loose, heterogeneous material covering solid rock) and position in relation to the water table. In most sites the regolith is uniformly shallow. In association with blackbrush (*Coleogyne ramosissima*) sites, the soil moisture is concentrated on top of impermeable bedrock at a shallow depth. This perching effect allows for gradual uptake of moisture by the plants roots (Loope and West 1979). This permits growth of plants with more mesic habitat requirements (Warren et al. 1982). On sites with deep soil, blackbrush may occur in almost pure stands with only a few associated species (Warren et al. 1982). Dark-colored cryptogamic soil crusts, composed of lichens, mosses, fungi, and algae, are often present in this group in fairly undisturbed areas. Sandy soils may have more cryptogamic crusts than clayish or silty soil surfaces. This group also occurs in deeper soils on sandy plains and stabilized sandsheets and may form small hummocks or small coppice dunes. Eolian processes are evident, such as pediceled plants, occasional blowouts or small dunes, but the generally higher vegetative cover and less prominent geomorphic features distinguish this group from active and stabilized dune complexes.

DISTRIBUTION

***Geographic Range:** This group occurs in the Colorado Plateau on benchlands, colluvial slopes, pediments or alluvial fans common in Canyonlands portion in central Utah and extends south into southern Utah and northeastern Arizona where it occurs on vast sandy plains and mesatops.

Nations: US

States/Provinces: AZ, CO, NM, NV, UT

USFS Ecoregions (2007) [optional]: 313A:CC, 313B:CC, 313D:CC, 322A:CC, 341B:CC, 341C:C?, 341F:CP, M313A:CC, M331E:PP, M331H:PP, M341B:CC, M341C:CP

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3220 | <i>Coleogyne ramosissima</i> Colorado Plateau Shrubland Alliance |
| A0862 | <i>Poliomintha incana</i> Shrubland Alliance |
| A3201 | <i>Ephedra viridis</i> Colorado Plateau Shrubland Alliance |
| A3181 | <i>Artemisia filifolia</i> Colorado Plateau Shrubland Alliance |
| A2572 | <i>Ephedra torreyana</i> Shrubland Alliance |
| A2654 | <i>Quercus havardii</i> var. <i>tuckeri</i> Shrubland Alliance |
| A2644 | <i>Ephedra cutleri</i> Shrubland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---|----------------|------|
| = | Colorado Plateau - Mohavian Blackbush Semi-Desert | West 1983d | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** N.E. West (1983d)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz

Acknowledgments [optional]:

Version Date: 06 Nov 2015

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3. Desert & Semi-Desert

3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland

G311. Intermountain Semi-Desert Grassland

Type Concept Sentence: This widespread semi-arid to arid grassland group occurs throughout the intermountain western U.S. that are composed of dominant drought-resistant perennial bunchgrasses such as *Achnatherum* spp., *Bouteloua gracilis*, *Hesperostipa comata*, *Pleuraphis jamesii*, *Poa cusickii*, *Poa secunda*, and *Pseudoroegneria spicata* often with scattered shrubs, especially *Artemisia tridentata*, *Atriplex* spp., *Coleogyne ramosissima*, *Ephedra* spp., *Gutierrezia sarothrae*, and *Krascheninnikovia lanata*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 3.B.1.Ne.1. Great Basin-Intermountain Dry Shrubland & Grassland (M171)

Elcode: G311

***Scientific Name:** *Pleuraphis jamesii* - *Achnatherum hymenoides* - *Hesperostipa comata* Semi-Desert Grassland Group

***Common (Translated Scientific) Name:** James' Galleta - Indian Ricegrass - Needle-and-Thread Semi-Desert Grassland Group

***Colloquial Name:** Intermountain Semi-Desert Grassland

***Type Concept:** This widespread group includes semi-arid to arid grasslands found throughout the intermountain western U.S. The dominant perennial bunchgrasses and shrubs within this group are all drought-resistant plants. Dominant or codominant species are *Achnatherum hymenoides*, *Achnatherum lettermanii*, *Achnatherum nelsonii*, *Achnatherum speciosum*, *Bouteloua gracilis*, *Hesperostipa comata*, *Pleuraphis jamesii*, *Poa cusickii*, *Poa secunda*, *Pseudoroegneria spicata*, and *Sporobolus cryptandrus*. Scattered shrubs and dwarf-shrubs often are present, especially *Artemisia tridentata* ssp. *tridentata*, *Artemisia tridentata* ssp. *wyomingensis*, *Atriplex* spp., *Coleogyne ramosissima*, *Ephedra* spp., *Gutierrezia sarothrae*, and *Krascheninnikovia lanata*, which are the typical dominant species of adjacent shrublands. Stands occur on sites on a variety of landforms, including swales, playas, mesas, alluvial flats, and plains over an elevational range of approximately 1100 to 3290 m in most of its range and 350 to 425 m in the Columbia Basin. This group may constitute the matrix over large areas of intermountain basins, and also may occur as large patches in mosaics with semi-desert shrublands. Grasslands in areas of higher precipitation, at higher elevation, typically belong to other groups. Substrates are often well-drained sandy or loam soils derived from sedimentary parent materials but are quite variable and may include fine-textured soils derived from igneous and metamorphic rocks.

***Diagnostic Characteristics:** This group consists of semi-arid to arid grasslands often creating the matrix over large areas. Characteristic graminoids include *Achnatherum hymenoides*, *Bouteloua eriopoda*, *Bouteloua gracilis*, *Hesperostipa comata*, *Pleuraphis jamesii*, *Poa cusickii*, *Poa secunda*, and *Pseudoroegneria spicata*.

***Classification Comments:** This group was merged with former Columbia Basin Foothill & Canyon Dry Grassland Group (G274), which was very similar compositionally and a northern variant of this intermountain group. Communities dominated by *Achnatherum lettermanii*, *Achnatherum nelsonii*, and *Agrostis variabilis* are poorly understood and require further documentation. The only occurrence of a community dominated by *Agrostis variabilis* is known from Utah and may be the result of disturbance. *Achnatherum speciosum* is a southern Great Basin species, which extends in distribution into the Mojave and Colorado deserts, for now its communities are included here. Occurrences of this semi-desert grassland group in the relatively high-elevation basins of Wyoming and south-central Montana resemble in species composition the foothill grasslands that grow at slightly higher elevations and in the Columbia Plateau.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G273 | Central Rocky Mountain Lower Montane, Foothill & Valley Grassland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Medium to tall bunchgrass-dominated group occurring with scattered shrubs as a matrix community or interspersed among shrub-dominated communities. Cover within this group is variable from dense to less than 25% cover.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: The dominant perennial bunchgrasses and shrubs within this group are all drought-resistant plants. Dominant or codominant species are *Achnatherum hymenoides*, *Achnatherum lettermanii*, *Achnatherum nelsonii*, *Achnatherum speciosum*, *Bouteloua eriopoda*, *Bouteloua gracilis*, *Hesperostipa comata*, *Pleuraphis jamesii*, *Poa cusickii*, *Poa secunda*, and *Pseudoroegneria spicata*. Other graminoids may include *Aristida purpurea*, *Carex filifolia*, *Elymus elymoides*, *Koeleria macrantha*, *Leymus salinus*, or *Sporobolus cryptandrus*. Scattered shrubs and dwarf-shrubs often are present, especially *Artemisia tridentata ssp. tridentata*, *Artemisia tridentata ssp. wyomingensis*, *Atriplex* spp., *Coleogyne ramosissima*, *Ephedra* spp., *Gutierrezia sarothrae*, and *Krascheninnikovia lanata*. Forb cover is also sparse but can be relatively diverse. Common forbs are *Gaura coccinea*, *Balsamorhiza sagittata*, *Hymenopappus filifolius*, *Machaeranthera canescens*, *Sphaeralcea coccinea*, *Vicia americana*, *Lappula occidentalis* (= *Lappula redowskii*), *Lithophragma glabrum*, *Lupinus pusillus*, *Opuntia aurea* (= *Opuntia basilaris* var. *aurea*), *Opuntia polyacantha*, *Plantago patagonica*, *Pediomelum argophyllum*, *Artemisia campestris*, *Artemisia dracunculus*, *Artemisia ludoviciana*, and species of *Antennaria*, *Astragalus*, *Cryptantha*, *Eriogonum*, *Gilia*, and *Lappula*. Cryptogams are important in some stands with up to 40% ground cover on sites in the Colorado Plateau. Exotic species such as *Bromus tectorum*, *Draba verna*, *Lactuca serriola*, *Salsola tragus*, *Bassia scoparia* (= *Kochia scoparia*), *Onopordum acanthium*, *Poa pratensis*, *Sisymbrium altissimum*, and *Tragopogon dubius* are present in many of these stands.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: *Achnatherum hymenoides* is one of the most drought-tolerant grasses in the western U.S. (USFS 1937). It is also a valuable forage grass in arid and semi-arid regions. Improperly managed livestock grazing could increase soil erosion, decrease cover of this palatable plant species and increase weedy species (USDA 1937). *Hesperostipa comata* is a deep-rooted grass that uses soil moisture below 0.5 m during the dry summers. Burning generally kills or severely damages *Hesperostipa comata* plants. After fire, regeneration of this non-rhizomatous bunchgrass is through seed and may take many years to reach prefire densities. *Pleuraphis jamesii* is both drought- and grazing-resistant (USFS 1937, Weaver and Albertson 1956, West et al. 1972). In parts of its range it increases under grazing, and in others parts it decreases. The grass is favored in mixedgrass stands because it is only moderately palatable to livestock, but decreases when heavily grazed during drought and in the more arid portions of its range where it is the

dominant grass (West et al. 1972). This grass reproduces extensively from scaly rhizomes. These rhizomes make the plant resistant to trampling by livestock and have good soil binding properties (USFS 1937, Weaver and Albertson 1956, West et al. 1972). The cool-season annual grass *Bromus tectorum* can be an effective competitor for winter soil moisture because it can germinate in the fall, over-winter, then begin re-growing in the early spring before it is warm enough for many perennial grasses, completing its lifecycle and depleting soil moisture before the dry summer weather begins. This annual species also produces abundant fine fuels that carry fire well and increase the frequency of fires (FEIS 1998).

ENVIRONMENT

Environmental Description: Low-elevation grasslands in the Intermountain West region occur in semi-arid to arid climates at approximately 1450 to 2320 m (4750-7610 feet) elevation, but can reach as low as 350 m in the Columbia Basin. These grasslands occur in lowland and upland areas and may occupy swales, playas, mesatops, plateau parks, alluvial flats, plains and extend into dry foothills. In the Columbia Plateau stands extend up into the Columbia and Snake river canyons on stream terraces and dry, rocky slopes. These grasslands typically occur on relatively xeric sites. This group experiences cold temperate conditions. Hot summers and cold winters with freezing temperatures and snow are common. Annual precipitation is usually from 20-40 cm (7.9-15.7 inches). A significant portion of the precipitation falls in July through October during the summer monsoon storms, with the rest falling as snow during the winter and early spring months. These grasslands occur on a variety of aspects and slopes. Sites may range from flat to moderately steep. Soils supporting this group also vary from deep to shallow, and from sandy to finer-textured. The substrate is typically derived from sandstone or shale. Some occurrences on sandy soils have a high cover of cryptogams on the soil surface. These cryptogams tend to increase the stability of the highly erodible sandy soils of these grasslands during torrential summer rains and heavy wind storms (Kleiner and Harper 1977).

DISTRIBUTION

***Geographic Range:** This group occurs throughout the intermountain western U.S. on dry plains, foothills and mesas, at approximately 1450 to 2320 m (4750-7610 feet) elevation. Stands extend up into the Columbia and Snake river canyons on stream terraces and dry, rocky slopes. In the Bighorn Basin of north-central Wyoming, there may be some semi-desert grasslands, but this is uncertain.

Nations: MX?, US

States/Provinces: AZ, CA, CO, ID, MT?, NM, NV, OR, UT, WA, WY

USFS Ecoregions (2007) [optional]: 313A:CC, 313B:CC, 313C:CC, 313D:CC, 315A:CC, 315H:CC, 321A:CC, 322A:CC, 331A:CC, 331J:CC, 341A:CC, 341B:CC, 341C:CC, 341D:CC, 341E:CC, 341F:CC, 341G:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:CC, 342I:CC, 342J:CC, M242C:CC, M242D:CP, M261E:CC, M261G:CC, M313A:CC, M313B:CC, M331A:CC, M331B:C?, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CP, M331J:CP, M332G:CC, M333A:??, M341A:CC, M341B:CC, M341C:CC, M341D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A1290 | <i>Achnatherum speciosum</i> Grassland Alliance |
| A3976 | <i>Pseudoroegneria spicata</i> - <i>Opuntia polyacantha</i> Dry Canyon Slope Grassland Alliance |
| A4216 | <i>Sphaeralcea ambigua</i> - <i>Sphaeralcea coccinea</i> - <i>Sphaeralcea parvifolia</i> Dry Meadow Alliance |
| A1262 | <i>Achnatherum hymenoides</i> - <i>Pseudoroegneria spicata</i> - <i>Muhlenbergia pungens</i> Grassland Alliance |
| A1287 | <i>Pleuraphis jamesii</i> Grassland Alliance |
| A1270 | <i>Hesperostipa comata</i> Grassland Alliance |
| A3977 | <i>Sporobolus cryptandrus</i> - <i>Aristida purpurea</i> var. <i>longiseta</i> - <i>Poa secunda</i> Sandy Stream Terrace Grassland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------------|--|-----------------------|
| 2014-08-19 | G274 Sporobolus cryptandrus - Poa secunda Columbia Basin Dry Grassland Group | G274 merged into G311 |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---|----------------|------|
| < | Gramma - Galleta (502) | Shiflet 1994 | |
| = | Southeastern Utah galleta-threeawn shrub steppe | West 1983e | |

AUTHORSHIP***Primary Concept Source [if applicable]:** N.E. West (1983e)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** M.E. Hall and M.S. Reid

Acknowledgments [optional]:

Version Date: 06 Nov 2015

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3. Desert & Semi-Desert

3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland

G310. Intermountain Semi-Desert Steppe & Shrubland

Type Concept Sentence: This widespread dwarf-shrubland, shrubland and shrub-steppe group occurs throughout the semi-arid western U.S. on a variety of sites and disturbance regimes and is characterized by an open to moderately dense woody layer composed of diverse woody species such as *Chamaebatiaria millefolium*, *Chrysothamnus albidus*, *Chrysothamnus viscidiflorus*, *Ericameria nauseosa*, *Ephedra viridis*, *Ephedra torreyana*, *Glossopetalon spinescens*, *Gutierrezia sarothrae*, *Gutierrezia microcephala*, *Ericameria nana*, *Ericameria parryi*, *Ericameria teretifolia*, *Krascheninnikovia lanata*, *Mahonia fremontii*, *Opuntia polyacantha*, and *Tetradymia canescens* with or without an herbaceous layer.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 3.B.1.Ne.1. Great Basin-Intermountain Dry Shrubland & Grassland (M171)

Elcode: G310

***Scientific Name:** *Chrysothamnus viscidiflorus* - *Ericameria nauseosa* - *Krascheninnikovia lanata* Steppe & Shrubland Group

***Common (Translated Scientific) Name:** Yellow Rabbitbrush - Rubber Rabbitbrush - Winterfat Steppe & Shrubland Group

***Colloquial Name:** Intermountain Semi-Desert Steppe & Shrubland

***Type Concept:** This group occurs throughout the semi-arid western U.S., including areas in the western Great Plains. This group can either be shrub-, dwarf-shrub-, or grass-dominated with an open (5-25% cover) woody layer. Stands dominated by *Chrysothamnus viscidiflorus*, *Ericameria nauseosa*, *Gutierrezia microcephala*, and *Gutierrezia sarothrae* are often associated with disturbance. Other common shrubs may include *Chamaebatiaria millefolium*, *Chrysothamnus albidus*, *Ephedra viridis*, *Ephedra torreyana*, *Glossopetalon spinescens*, *Ericameria nana*, *Ericameria parryi*, *Ericameria teretifolia*, *Krascheninnikovia lanata*, *Mahonia fremontii*, *Opuntia fragilis*, *Opuntia polyacantha*, *Opuntia phaeacantha*, and *Tetradymia canescens*. Herbaceous species include *Achnatherum hymenoides*, *Aristida purpurea*, *Hesperostipa comata*, and *Pleuraphis jamesii*. Scattered *Juniperus* spp. are common, but rarely attain more than 5% cover. Landforms include alluvial flats and fans, talus slopes, plateaus, and bluffs. Slopes range from gentle to steep, and substrates are variable and include sandstone talus, fine-textured alluvium, sand, clay, loams, cinder, cobbles, and coarse gravels. Disturbance and grazing have impacted many occurrences, and in some cases may be important in maintaining these communities.

***Diagnostic Characteristics:** This group occurs as open shrub, dwarf-shrub, or shrub herbaceous communities. Shrub canopy ranges from 10-60% shrub cover with herbaceous layer usually sparse but ranging from dense to absent. Dominant/diagnostic shrubs in this group include *Chamaebatiaria millefolium*, *Chrysothamnus albidus*, *Chrysothamnus viscidiflorus*, *Ephedra viridis*, *Ephedra torreyana*, *Ericameria nauseosa*, *Ericameria nana*, *Ericameria parryi*, *Ericameria teretifolia*, *Glossopetalon spinescens*, *Gutierrezia sarothrae*, *Gutierrezia microcephala*, *Krascheninnikovia lanata*, *Mahonia fremontii*, *Opuntia fragilis*, *Opuntia phaeacantha*, *Opuntia polyacantha*, *Tetradymia canescens*, and *Tetradymia tetrameres*. Characteristic herbaceous species may include *Achnatherum hymenoides*, *Aristida purpurea*, *Bouteloua curtipendula*, *Bouteloua eriopoda*, *Bouteloua gracilis*, *Hesperostipa comata*, *Pleuraphis jamesii*, *Poa secunda*, *Sphaeralcea coccinea*, and *Sporobolus cryptandrus*. Scattered *Juniperus* spp. are common, but rarely attain more than 5% cover.

***Classification Comments:** This group encompasses a somewhat broad range of semi-desert shrublands in the Intermountain West. Many of these communities are somewhat disturbance-maintained, early-seral types. Additional data and analysis are needed to clarify the associations that should be placed here. Shrub communities occurring over talus included in this group are part of a continuum and can be highly variable, and some dwarf-shrub communities can technically be defined as herbaceous types.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|-------------------------------|------|
| | | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Open shrub, dwarf-shrub, or shrub herbaceous communities dominated by cold-deciduous, broad-leaved shrub, dwarf-shrub species, or perennial grasses with an open shrub layer.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: The most important, widespread shrubs in this group include *Chrysothamnus viscidiflorus*, *Ericameria nauseosa*, *Gutierrezia sarothrae*, *Gutierrezia microcephala*, *Krascheninnikovia lanata*, *Opuntia polyacantha*, and *Opuntia phaeacantha*. Other dominant/diagnostic shrubs with narrower ranges are *Chrysothamnus albidus*, *Chamaebatiaria millefolium*, *Ericameria nana*, *Ericameria parryi*, *Ericameria teretifolia*, *Glossopetalon spinescens*, *Mahonia fremontii*, *Opuntia phaeacantha*, and *Opuntia polyacantha*. Other commonly present to codominant species include *Artemisia* spp., *Ephedra torreyana*, *Ephedra viridis*, *Coleogyne ramosissima*, *Fallugia paradoxa*, *Isocoma drummondii*, *Eriogonum* spp., *Grayia spinosa*, *Holodiscus dumosus*, *Lycium pallidum*, *Opuntia fragilis*, *Purshia tridentata*, *Tetradymia canescens*, and *Tetradymia tetrameres*. Semi-desert grasses are common, including *Achnatherum hymenoides*, *Aristida purpurea*, *Bouteloua curtipendula*, *Bouteloua eriopoda*, *Bouteloua gracilis*, *Elymus elymoides*, *Hesperostipa comata*, *Leymus salinus*, *Muhlenbergia pungens*, *Pascopyrum smithii*, *Pleuraphis jamesii*, *Poa secunda*, *Pseudoroegneria spicata*, *Sporobolus airoides*, and *Sporobolus cryptandrus*. Perennial forbs may include *Achillea millefolium*, *Astragalus purshii*, *Calochortus macrocarpus*, *Chamaesyce* spp., *Erigeron* spp., *Penstemon deustus*, *Phlox hoodii*, *Sphaeralcea coccinea*, and *Sphaeralcea munroana*. Annuals may be seasonally present to abundant depending on precipitation and disturbance. Exotic annuals such as *Bromus tectorum* or *Salsola kali* can be abundant.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:

ENVIRONMENT

Environmental Description: This group occurs throughout the Intermountain West from the western Great Basin to the Northern Rocky Mountains and Colorado Plateau at elevations ranging from 300 m up to 2500 m. The climate where this group occurs is generally hot in summers and cold in winters with low annual precipitation, ranging from 18-40 cm and high inter-annual variation. Much of the precipitation falls as snow, and growing-season drought is characteristic. Temperatures are continental with large annual and diurnal variations. Sites are generally alluvial fans and flats with moderate to deep soils. Some sites can be flat, poorly drained and intermittently flooded with a shallow or perched water table often within 1 m depth (West 1983e). Substrates are generally shallow, calcareous, fine-textured soils (clays to silt-loams), derived from alluvium; deep, fine to medium-textured alluvial soils with some source of subirrigation during the summer season, or sandstone talus over shale. Soils may be alkaline and typically moderately saline (West 1983e).

DISTRIBUTION

***Geographic Range:** This group occurs throughout the semi-arid western U.S., including areas in the western Great Plains.

Nations: CA?, US

States/Provinces: AZ, CA, CO, ID, KS, MT, NM, NV, OR, SD, TX, UT, WY

USFS Ecoregions (2007) [optional]: 313A:CC, 313B:CC, 313C:CC, 313D:CC, 315A:CC, 315B:CC, 315H:CC, 321A:CC, 322A:CC, 331B:CC, 331H:CC, 331I:CC, 331J:CC, 341A:CC, 341B:CC, 341C:CC, 341D:CC, 341E:CC, 341F:CC, 341G:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:CC, 342I:CP, 342J:CC, M242C:CC, M261E:CC, M261G:CC, M313A:CC, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332E:CP, M332G:CC, M333A:??, M341A:CC, M341B:CC, M341C:CC, M341D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A2650 | <i>Opuntia</i> spp. Colorado Plateau Shrubland Alliance |
| A2540 | <i>Ericameria teretifolia</i> Shrubland Alliance |
| A3197 | <i>Ericameria parryi</i> Shrubland Alliance |
| A3196 | <i>Ericameria nauseosa</i> Steppe & Shrubland Alliance |

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3203 | <i>Gutierrezia sarothrae</i> - <i>Gutierrezia microcephala</i> Dwarf-shrubland Alliance |
| A1032 | <i>Glossopetalon spinescens</i> Shrubland Alliance |
| A0834 | <i>Chrysothamnus albidus</i> Shrubland Alliance |
| A3202 | <i>Krascheninnikovia lanata</i> Steppe & Dwarf-shrubland Alliance |
| A3195 | <i>Chrysothamnus viscidiflorus</i> Steppe & Shrubland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

*Recent Concept Lineage [if applicable]:

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---|----------------|------|
| = | Southeastern Utah galleta-threeawn shrub steppe | West 1983e | |

AUTHORSHIP

*Primary Concept Source [if applicable]: N.E. West (1983e)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

*Author of Description: M.E. Hall, M.S. Reid, K.A. Schulz

Acknowledgments [optional]: P. Comer

Version Date: 06 Nov 2015

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- West, N. E. 1983e. Southeastern Utah galleta-threeawn shrub steppe. Pages 413-421 in: N. E. West, editor. Temperate deserts and semi-deserts. *Ecosystems of the World, Volume 5*. Elsevier Publishing Company, Amsterdam.

3. Desert & Semi-Desert

3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland

G775. Intermountain Sparsely Vegetated Dune Scrub & Grassland

Type Concept Sentence: This shrubby and herbaceous group occurs on sandy sites in the intermountain western U.S. and is characterized by a sparse to open vegetation layer composed of shrubs *Ericameria nauseosa*, *Eriogonum leptocladon*, or *Tetradymia tetrameres* and herbaceous species *Achnatherum hymenoides*, *Leymus flavescens*, *Psoralidium lanceolatum*, and *Redfieldia flexuosa*, which may dominate solely or in a combination on active and stable dunes and sandsheets.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 3.B.1.Ne.1. Great Basin-Intermountain Dry Shrubland & Grassland (M171)

Elcode: G775

***Scientific Name:** Intermountain Sparsely Vegetated Dune Scrub & Grassland Group

***Common (Translated Scientific) Name:** Intermountain Sparsely Vegetated Dune Scrub & Grassland Group

***Colloquial Name:** Intermountain Sparsely Vegetated Dune Scrub & Grassland

***Type Concept:** This group occurs on sandy sites in the intermountain western U.S. from the Columbia Basin, Great Basin, and Centennial Valley in Montana, Wyoming Basins, Colorado Plateau and the San Luis Valley of southern Colorado. This group is characterized by open to sparse (<15% total cover) shrub and/or herbaceous vegetation. Characteristic shrubs include *Ericameria nauseosa*, *Eriogonum leptocladon*, or *Tetradymia tetrameres*. Diagnostic herbaceous species are *Achnatherum hymenoides*, *Leymus flavescens*, *Muhlenbergia pungens*, *Psoralidium lanceolatum*, and *Redfieldia flexuosa*, which may dominate solely or in a combination. There are several associated species, including graminoids such as *Calamovilfa gigantea*, *Hesperostipa comata* (= *Stipa comata*), *Schizachyrium scoparium*, and forbs *Heliotropium convolvulaceum*, *Machaeranthera canescens* (= *Aster canescens*), *Oxytheca dendroidea* (= *Eriogonum dendroideum*), *Polanisia dodecandra* ssp. *trachysperma*, *Polanisia jamesii*, *Reverchonnia arenaria*, *Sophora stenophylla*, *Scabrethia scabra* (= *Wyethia scabra*), and the annual forb *Eriogonum deflexum*. Stands occur on active and stable dunes and sandsheets. Elevations range from 1500-2400 m. All sites have cool, semi-arid continental climates. Substrates are eolian sand.

***Diagnostic Characteristics:** This group is characterized by a sparse to open shrub and/or herbaceous layer composed of shrubs *Ericameria nauseosa*, *Eriogonum leptocladon*, *Tetradymia tetrameres*, and perennial grasses and forbs *Achnatherum hymenoides*, *Leymus flavescens*, *Psoralidium lanceolatum*, and *Redfieldia flexuosa*, which may dominate solely or in a combination on rapidly drained sands.

***Classification Comments:** The majority of this group occurs in the intermountain western U.S.; however, two of the associations may extend out into the shortgrass region of the western Great Plains. These associations need further review as far as floristic composition and range such as on "blowout" sites where sandy plains or stabilized dunes have been disturbed (Ramaley 1939b). Shrubby semi-arid dune communities in this group need further review.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|--|
| G675 | North American Warm Semi-Desert Dune & Sand Flats | also occurs on dunes and sandsheets, but in warm, semi-arid climate. |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Vegetation has a sparse cover of xeromorphic shrubs and dwarf-shrubs less than 2 m tall and/or a short herbaceous layer that is typically sparse and is dominated by perennial graminoids, with ephemeral forbs and grasses present seasonally.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This group occurs on sandy sites in the intermountain western U.S. from the Columbia Basin, Great Basin, and Centennial Valley in Montana, Wyoming Basins, Colorado Plateau and the San Luis Valley of southern Colorado. This group is characterized by open to sparse (<15% total cover) shrub and/or herbaceous vegetation. Dominant shrubs include *Ericameria nauseosa*, *Eriogonum leptocladon*, or *Tetradymia tetrameres*. Diagnostic herbaceous species are *Achnatherum hymenoides*, *Leymus flavescens*, *Muhlenbergia pungens*, *Psoralidium lanceolatum*, and *Redfieldia flexuosa*, which may dominate solely or in a combination. There are several associated species, including graminoids such as *Calamovilfa gigantea*, *Hesperostipa comata* (= *Stipa comata*), *Schizachyrium scoparium*, and forbs *Heliotropium convolvulaceum*, *Machaeranthera canescens* (= *Aster canescens*), *Oxytheca dendroidea* (= *Eriogonum dendroideum*), *Polanisia dodecandra* ssp. *trachysperma*, *Polanisia jamesii*, *Reverchonnia arenaria*, *Sophora stenophylla*, *Scabrethia scabra* (= *Wyethia scabra*), and the annual forb *Eriogonum deflexum*. On the Colorado Plateau,

active dune sites have codominants such as *Calamovilfa gigantea*, *Psoralidium lanceolatum*, *Reverchonnia arenaria*, *Sophora stenophylla*, and *Scabrethia scabra* (Castle 1954, Bowers 1982).

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Const-ancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|------------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: *Achnatherum hymenoides* is one of the most drought-tolerant grasses in the western U.S. and occurs on a variety of xeric sites (USFS 1937). It is also a valuable forage grass in arid and semi-arid regions. Improperly managed livestock grazing could increase soil erosion, decrease cover of this palatable plant species and increase weedy species (USFS 1937).

Dunes gradually become smaller and reach a threshold of size, below which they become stabilized by vegetation. This vegetation occurs on recent sand deposits, but over time, if deposition slows, it will succeed to shrubland or grassland vegetation types.

ENVIRONMENT

Environmental Description: This group occurs on sandy sites in the intermountain western U.S. from the Columbia Basin, Great Basin, and Centennial Valley in Montana, Wyoming Basins, Colorado Plateau and the San Luis Valley of southern Colorado. Elevations range from 1500-2400 m. Stands occur on active and stable dunes and sandsheets. In the San Luis Valley in Colorado, at approximately 2400 m elevation, stands occur on a sandsheet on the windward side of dunes (R. Rondeau, CONHP, pers. comm.). In semi-arid dune systems in the Colorado Plateau and Great Basin, stands occur in active dunes (Van Pelt 1978, Bowers 1982). They are early-seral communities that colonize bare sand in interdune valleys. The plants adapt to sand deposition by stem elongation but eventually will be buried or dug up as the dunes move. On dune margins, stabilization may occur as other sand-adapted species colonize, eventually succeeding into the adjacent desert scrub community. In the Colorado Plateau of southeastern Utah and western Colorado, this vegetation is often limited to small stands on sandy point bars, islands or terraces in the beds of intermittent streams. These stands are subject to periodic flooding but are usually isolated from the water table. A few Colorado Plateau stands occupy unconsolidated sands in areas with active dunes. Additional review is needed to characterize the environments in its full range.

Climate: This group occurs in a cool, semi-arid continental climate. *Soil/substrate/hydrology:* Substrates are eolian sands.

DISTRIBUTION

***Geographic Range:** This group occurs on sandy sites in the intermountain western U.S. from the Columbia Basin, Great Basin, Centennial Valley in Montana, Wyoming Basins, Colorado Plateau and the San Luis Valley of southern Colorado.

Nations: US

States/Provinces: AZ, CO, ID, MT, NV, OR, UT, WA, WY

USFS Ecoregions (2007) [optional]:

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A4011 | <i>Redfieldia flexuosa</i> - <i>Leymus flavescens</i> - <i>Achnatherum hymenoides</i> Grassland Alliance |
| A4149 | <i>Ericameria nauseosa</i> - <i>Eriogonum leptocladon</i> - <i>Tetradymia tetrameres</i> Sparse Scrub Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** Faber-Langendoen et al. (2015)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz**Acknowledgments [optional]:**

Version Date: 16 Apr 2015

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***References [Required if used in text]:**

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G296. Mojave Mid-Elevation Mixed Desert Scrub

Type Concept Sentence: This group represents the extensive desert scrub in the transition zone above *Larrea tridentata* - *Ambrosia dumosa* desert scrub and below the lower montane woodlands (at mid-elevations of 700-1800 m) that occurs in the eastern and central Mojave Desert and transition zone into the southern Great Basin. Stands are dominated by a variety characteristic species such as *Coleogyne ramosissima*, *Ericameria cooperi*, *Eriogonum fasciculatum*, *Ephedra* spp., *Eriogonum corymbosum*, *Grayia spinosa*, *Lycium andersonii*, *Menodora spinescens*, *Nolina* spp., *Cylindropuntia acanthocarpa*, *Purshia glandulosa*, *Purshia stansburiana*, *Salazaria mexicana*, *Thamnosma montana*, *Yucca brevifolia*, or *Yucca schidigera*.

OVERVIEW

Hierarchy Level:** GroupPlacement in Hierarchy:** 3.B.1.Ne.1. Great Basin-Intermountain Dry Shrubland & Grassland (M171)

Elcode: G296

Scientific Name:** *Yucca brevifolia* - *Eriogonum fasciculatum* - *Ephedra aspera* Mixed Desert Scrub GroupCommon (Translated Scientific) Name:** Joshua Tree - Eastern Mojave Buckwheat - Rough Joint-fir Mixed Desert Scrub Group***Colloquial Name:** Mojave Mid-Elevation Mixed Desert Scrub

***Type Concept:** This group represents the extensive desert scrub in the transition zone above *Larrea tridentata* - *Ambrosia dumosa* desert scrub and below the lower montane woodlands at mid-elevations in the eastern and central Mojave Desert. It is also common on lower piedmont slopes in the transition zone into the southern Great Basin. The vegetation in this group is quite variable. *Larrea tridentata* may be absent or present to codominant in some examples, but typically does not dominate. Characteristic and dominant species include *Ambrosia eriocentra*, *Arctostaphylos patula*, *Coleogyne ramosissima*, *Ericameria cooperi*, *Eriogonum fasciculatum*, *Ephedra californica*, *Ephedra nevadensis*, *Ephedra torreyana*, *Ephedra viridis*, *Eriogonum corymbosum*, *Grayia spinosa*, *Lycium andersonii*, *Menodora spinescens*, *Nolina bigelovii*, *Nolina microcarpa*, *Nolina parryi*, *Cylindropuntia acanthocarpa* (= *Opuntia acanthocarpa*), *Purshia glandulosa*, *Purshia stansburiana*, *Salazaria mexicana*, *Thamnosma montana*, *Viguiera parishii*, *Yucca brevifolia*, or *Yucca schidigera*. Less common are stands with scattered *Yucca brevifolia* and a saltbush short-shrub layer dominated by *Atriplex canescens*, *Atriplex confertifolia*, or *Artemisia tridentata*. In some areas in the western Mojave, shrubby *Juniperus californica* is common with the yuccas. *Grayia spinosa* is a common codominant shrub in disturbed stands. Desert grasses, including *Achnatherum hymenoides*, *Achnatherum speciosum*, *Muhlenbergia porteri*, *Pleuraphis jamesii*, *Pleuraphis rigida*, *Poa secunda*, or *Pseudoroegneria spicata*, may form an herbaceous layer. Scattered *Juniperus osteosperma* or warm desert scrub species may also be

present. This shrubland group is found in the Mojave Desert of southeastern California and southern Nevada and forms a cool-temperate elevational belt on desert ranges (700-1800 m) elevation. It also occurs at the longitudinal transition zone between the Mojave and southern Great Basin, generally at mid-elevations. Landforms include valleys, bajadas, mountain slopes, ridges, mesas or alluvial fans bordering intermountain basins. The climate is semi-arid and characterized by hot, dry summers and cold winters with precipitation ranging from 5-30 cm annually. Temperatures are continental, with large annual and diurnal ranges. Soils are highly variable across the large range of this vegetation type and are generally shallow, well-drained, coarse-textured loams or sand with rock fragments, but include finer-textured substrates such as silt.

***Diagnostic Characteristics:** The presence of *Eriogonum fasciculatum*, *Ephedra aspera*, *Yucca brevifolia*, or *Yucca schidigera* is diagnostic of this type, as is *Coleogyne ramosissima*, which is often a dominant species. The widespread desert shrub *Larrea tridentata* may be absent or present to codominant in some stands, but typically does not dominate here as it does at lower elevations. This is a diverse group, and stands may also be dominated or codominated by *Ambrosia eriocentra*, *Ericameria cooperi*, *Ephedra californica*, *Ephedra nevadensis*, *Ephedra torreyana*, *Ephedra viridis*, *Grayia spinosa*, *Lycium andersonii*, *Juniperus californica*, *Menodora spinescens*, *Nolina bigelovii*, *Nolina microcarpa*, *Nolina parryi*, *Cylindropuntia acanthocarpa*, *Purshia glandulosa*, *Purshia stansburiana*, and *Salazaria mexicana*.

***Classification Comments:** Diagnostics needs to be rewritten to solidify how this group differs from ~Colorado Plateau Blackbrush - Mormon-tea Shrubland Group (G312)\$\$ (T. Keeler-Wolf pers. comm. 2013). TKW recommends the following species be removed from diagnostics: *Coleogyne ramosissima*, *Peucephyllum schottii*. Former Sonoran Mid-elevation Desert Scrub Group (G291) was merged into this group. TKW recommends moving ~*Chrysothamnus albidus* / *Puccinellia nuttalliana* Shrubland (CEGL001328)\$\$ to an "alkali" group, perhaps G537 or G672. Colloquial name of the group changed per TKW recommendation, from Mojave Mid-Elevation Mixed Desert Scrub Group to Mojavean-Sonoran Rocky Upland Desert Scrub Group. Also, need to revisit placement of the *Grayia spinosa* associations; *Grayia* alliance is generally considered in this group in California, but may belong in a Great Basin group (cold desert) in Nevada Idaho, Utah, and elsewhere in Great Basin (T. Keeler-Wolf pers. comm. 2013).

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|--|
| G312 | Colorado Plateau Blackbrush - Mormon-tea Shrubland | shares several dominant species such as <i>Coleogyne ramosissima</i> and species of <i>Ephedra</i> . |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group is an extremely xeromorphic evergreen shrubland sometimes with a sparse tree layer of evergreen sclerophyllous trees. The herbaceous layer is generally sparse, but may have significant perennial grass cover.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: The vegetation in this group is quite variable. *Larrea tridentata* may be absent or present to codominant in some stands, but typically does not dominate. Characteristic and dominant species include *Ambrosia eriocentra*, *Arctostaphylos patula*, *Coleogyne ramosissima*, *Ericameria cooperi*, *Eriogonum fasciculatum*, *Ephedra californica*, *Ephedra nevadensis*, *Ephedra torreyana*, *Ephedra viridis*, *Eriogonum corymbosum*, *Grayia spinosa*, *Lycium andersonii*, *Menodora spinescens*, *Nolina bigelovii*, *Nolina microcarpa*, *Nolina parryi*, *Cylindropuntia acanthocarpa* (= *Opuntia acanthocarpa*), *Purshia glandulosa*, *Purshia stansburiana*, *Salazaria mexicana*, *Thamnosma montana*, *Viguiera parishii*, *Yucca brevifolia*, or *Yucca schidigera*. Less common are stands with scattered *Yucca brevifolia* and a saltbush short-shrub layer dominated by *Atriplex canescens*, *Atriplex confertifolia*, or *Artemisia tridentata*. In some areas in the western Mojave, shrubby *Juniperus californica* is common with the yuccas. *Grayia spinosa* is a common codominant shrub in disturbed stands. Desert grasses, including *Achnatherum hymenoides*, *Achnatherum speciosum*, *Muhlenbergia porteri*, *Pleuraphis jamesii*, *Pleuraphis rigida*, *Poa secunda*, *Pseudoroegneria spicata*, or *Sporobolus cryptandrus*, may form an herbaceous layer. Scattered *Juniperus osteosperma* or warm desert scrub species may also be present.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:**ENVIRONMENT**

Environmental Description: This shrubland group is found in the Mojave Desert of southeastern California and southern Nevada and forms a cool-temperate elevational belt on desert ranges. It also occurs at the longitudinal transition zone between the Mojave and southern Great Basin at mid-elevation (800-1800 m) (Sawyer et al. 2009). Landforms include valleys, bajadas, mountain slopes, ridges, mesas or alluvial fans bordering intermountain basins. Some authors regard this group as delimiting the upper elevational boundary of the Mojave Desert in the transition between the Mojave and Great Basin deserts (Mozingo 1987). Full elevation ranges from 50-2500 m, with stands regularly occurring above 900 m. The climate is semi-arid and characterized by hot, dry summers and cold winters with precipitation ranging from 5-30 cm annually. Winter precipitation dominates in the western portions, with summer rain becoming more important eastward. Year-to-year precipitation variability can be quite large. Temperatures are continental, with large annual and diurnal ranges. Soils are highly variable across the large range of this vegetation type and are generally shallow, well-drained, coarse-textured loams or sand with rock fragments, but include finer-textured substrates such as silt. Soils are derived from bedrock or alluvial deposits from granitic and sedimentary rocks (Keeler-Wolf and Thomas 2000, Thomas et al. 2004, Sawyer et al. 2009). These communities are more drought-tolerant than *Artemisia tridentata*-dominated communities of the Great Basin but less tolerant of drought than either *Larrea tridentata* or *Atriplex* spp. shrublands. Adjacent vegetation is typically *Artemisia* shrublands at the upper elevational margin and *Larrea tridentata* or *Atriplex* - *Sarcobatus* shrublands where these communities grade into lower-elevation deserts or heavy alkaline soils.

DISTRIBUTION

***Geographic Range:** This desert scrub group is found in the eastern and central Mojave Desert and on lower piedmont slopes in the transition zone into the southern Great Basin.

Nations: MX?, US

States/Provinces: AZ, CA, NV, UT

USFS Ecoregions (2007) [optional]: 313A:CC, 322A:CC, 322B:CC, 322C:CC, 341D:CP, 341E:C?, 341F:CC, 342B:PP, M261E:CC, M341A:CC, M341D:C?

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3139 | <i>Ephedra aspera</i> Scrub Alliance |
| A4167 | <i>Eriogonum wrightii</i> - <i>Eriogonum heermannii</i> - <i>Buddleja utahensis</i> Scrub Alliance |
| A4156 | <i>Cylindropuntia acanthocarpa</i> / <i>Pleuraphis rigida</i> Scrub Alliance |
| A4157 | <i>Ephedra funerea</i> Scrub Alliance |
| A3150 | <i>Eriogonum fasciculatum</i> - <i>Viguiera parishii</i> Desert Scrub Alliance |
| A4159 | <i>Amphipappus fremontii</i> - <i>Salvia funerea</i> Scrub Alliance |
| A3148 | <i>Yucca brevifolia</i> Wooded Scrub Alliance |
| A3144 | <i>Coleogyne ramosissima</i> Mojave Desert Scrub Alliance |
| A0502 | <i>Juniperus californica</i> Mojave Scrub Alliance |
| A3147 | <i>Yucca schidigera</i> Scrub Alliance |
| A4245 | <i>Ephedra nevadensis</i> - <i>Lycium andersonii</i> - <i>Grayia spinosa</i> Scrub Alliance |
| A3145 | <i>Nolina parryi</i> - <i>Nolina microcarpa</i> Scrub Alliance |
| A2515 | <i>Menodora spinescens</i> Scrub Alliance |
| A0833 | <i>Purshia stansburiana</i> Scrub Alliance |
| A4158 | <i>Mortonia utahensis</i> Scrub Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------------|--|-----------------------|
| 2012-07-20 | G291 Canotia holacantha - Simmondsia chinensis - Eriogonum fasciculatum Desert Scrub Group | G291 merged into G296 |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---|-------------------|------|
| < | Mohave Desertscrub, Joshuatree Series, <i>Yucca brevifolia-Larrea divaricata</i> Association - 153.153 | Brown et al. 1979 | |
| < | Mohave Desertscrub, Joshuatree Series, <i>Yucca brevifolia-Coleogyne ramosissima</i> Association - 153.152 | Brown et al. 1979 | |
| < | Mohave Desertscrub, Joshuatree Series, <i>Yucca brevifolia-Acamptopappus sphaerocephalus-Larrea divaricata</i> -Mixed Scrub Association - 153.151 | Brown et al. 1979 | |
| < | Mohave Desertscrub, Joshuatree Series - 153.15 | Brown et al. 1979 | |
| < | Mohave Desertscrub, Bladdersage Series, <i>Salazaria mexicana</i> Association - 153.141 | Brown et al. 1979 | |
| < | Mohave Desertscrub, Bladdersage Series - 153.14 | Brown et al. 1979 | |
| < | Mohave Desertscrub, Blackbrush Series, Blackbrush Series, <i>Coleogyne ramosissima</i> Association - 153.121 (Brown, et al. 1979) | Brown et al. 1979 | |
| < | Mohave Desertscrub, Blackbrush Series, Blackbrush Series, <i>Coleogyne ramosissima-Yucca</i> spp. Association - 153.122 | Brown et al. 1979 | |
| < | Mohave Desertscrub, Blackbrush Series - 153.12 | Brown et al. 1979 | |

AUTHORSHIP***Primary Concept Source [if applicable]:** D.E. Brown, C.H. Lowe, and C.P. Pase (1979)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz, M.S. Reid and T. Keeler-Wolf**Acknowledgments [optional]:** T. Keeler-Wolf

Version Date: 06 Nov 2015

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3. Desert & Semi-Desert

3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland

M170. Great Basin-Intermountain Dwarf Sagebrush Steppe & Shrubland

3. Desert & Semi-Desert

3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland

G307. Columbia Plateau Scabland Dwarf-shrubland

Type Concept Sentence: This group is found in the Columbia Plateau region and forms extensive low shrublands dominated by diagnostic dwarf-shrub, *Artemisia rigida* along with other species, particularly diagnostic *Eriogonum* spp. such as *Eriogonum compositum*, *Eriogonum douglasii*, *Eriogonum microthecum*, *Eriogonum niveum*, *Eriogonum sphaerocephalum*, *Eriogonum strictum*, and *Eriogonum thymoides*, which sometimes dominate the dwarf-shrub layer without *Artemisia rigida*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 3.B.1.Ne.2. Great Basin-Intermountain Dwarf Sagebrush Steppe & Shrubland (M170)

Elcode: G307

***Scientific Name:** *Artemisia rigida* - *Eriogonum* spp. Dwarf-shrubland & Steppe Group

***Common (Translated Scientific) Name:** Scabland Sagebrush - Buckwheat species Dwarf-shrubland & Steppe Group

***Colloquial Name:** Columbia Plateau Scabland Dwarf-shrubland

***Type Concept:** This scabland group is found in the Columbia Plateau region and forms extensive low shrublands. Total vegetation cover is typically low, generally less than 50% and often much less than that. Vegetation is characterized by an open dwarf-shrub canopy dominated by *Artemisia rigida* or *Salvia dorrii* along with other dwarf-shrub and suffrutescent species, particularly diagnostic *Eriogonum* spp. such as *Eriogonum compositum*, *Eriogonum douglasii*, *Eriogonum microthecum*, *Eriogonum niveum*, *Eriogonum sphaerocephalum*, *Eriogonum strictum*, and *Eriogonum thymoides*, which sometimes dominate the dwarf-shrub layer without *Artemisia rigida* or *Salvia dorrii*. Other shrubs, especially shrubby *Artemisia* spp., are uncommon in this group. These stands are characterized by low cover of perennial bunchgrasses, primarily *Poa secunda*, but may include *Danthonia unispicata*, *Elymus elymoides*, *Festuca idahoensis*, or *Pseudoroegneria spicata*, as well as scattered forbs, including species of *Allium*, *Antennaria*, *Balsamorhiza*, *Lomatium*, *Phlox*, and *Sedum*. Individual sites can be dominated by grasses and semi-woody forbs, such as *Physaria oregona* or *Nestotus stenophyllus* (= *Stenotus stenophyllus*). Annuals may be seasonally abundant, and cover of moss and lichen is often high in undisturbed areas (1-60% cover). These xeric shrublands occur under relatively extreme soil-moisture conditions. Substrates are typically shallow lithic soils with limited water-holding capacity over fractured basalt. Because of poor drainage through basalt, these soils are often saturated from fall to spring by winter precipitation but typically dry out completely to bedrock by midsummer.

***Diagnostic Characteristics:** This group is characterized by an open dwarf-shrub canopy dominated or codominated by diagnostic species *Artemisia rigida*, *Eriogonum compositum*, *Eriogonum douglasii*, *Eriogonum microthecum*, *Eriogonum niveum*, *Eriogonum sphaerocephalum*, *Eriogonum strictum*, *Eriogonum thymoides*, and/or *Salvia dorrii*. *Poa secunda* and other dry-site grasses and forbs may be present usually with low cover.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|-------------------------------|------|
| | | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Vegetation structure is a sparse to moderately dense dwarf-shrub canopy (10-25% cover and <0.5 m tall). Occasionally, woody cover may exceed 25%. If present, the herbaceous layer typically has low cover.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This group is found in the Columbia Plateau region and forms extensive low shrublands. These xeric shrublands occur under relatively extreme soil-moisture conditions. Vegetation is characterized by an open dwarf-shrub canopy dominated by *Artemisia rigida* or *Salvia dorrii* along with other dwarf-shrub species, particularly *Eriogonum* spp. which sometimes dominates the dwarf-shrub layer without *Artemisia rigida* or *Salvia dorrii*. Diagnostic species of *Eriogonum* include *Eriogonum compositum*, *Eriogonum douglasii*, *Eriogonum microthecum*, *Eriogonum niveum*, *Eriogonum sphaerocephalum*, *Eriogonum strictum*, and *Eriogonum thymoides*. Other shrubs are uncommon. This group does not include mixed stands codominated by *Artemisia rigida* and other *Artemisia* species such as *Artemisia tridentata*. Low cover of perennial bunchgrasses, such as *Danthonia unispicata*, *Elymus elymoides*, *Festuca idahoensis*, or primarily *Poa secunda*, as well as scattered forbs, including species of *Allium*, *Antennaria*, *Balsamorhiza*, *Lomatium*, *Phlox*, and *Sedum*, characterize these sites. Individual sites can be dominated by grasses and semi-woody forbs, such as *Nestotus stenophyllus* (= *Stenotus stenophyllus*). Annuals may be seasonally abundant, and cover of moss and lichen is often high in undisturbed areas (1-60% cover).

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:

ENVIRONMENT

Environmental Description: This scabland group is found in the Columbia Plateau region and forms extensive low shrublands. These xeric shrublands occur under relatively extreme soil-moisture conditions. Substrates are typically shallow lithic soils with limited water-holding capacity over fractured basalt. Because of poor drainage through basalt, these soils are often saturated from fall to spring by winter precipitation but typically dry out completely to bedrock by midsummer. Total vegetation cover is typically low, generally less than 50% and often much less than that.

DISTRIBUTION

***Geographic Range:** This group occurs in the Columbia Plateau region of southern Idaho, eastern Oregon and eastern Washington, and extreme northern Nevada.

Nations: US

States/Provinces: CA, ID, NV, OR, UT?, WA

USFS Ecoregions (2007) [optional]: 331A:CC, 341E:C?, 341G:CC, 342B:CC, 342C:CC, 342D:CC, 342H:CC, 342I:CC, 342J:CC, M242C:CC, M242D:CC, M261D:C?, M261G:CC, M332G:CC, M333A:PP, M341A:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS***Plot Analysis Summary [Med - High Confidence]:*****Plots Used to Define the Type [Med - High Confidence]:****CONFIDENCE LEVEL****USNVC Confidence Level:** Moderate**USNVC Confidence Comments [optional]:****HIERARCHY*****Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A1568 | <i>Eriogonum</i> spp. / <i>Poa secunda</i> Dwarf-shrub Steppe Alliance |
| A1129 | <i>Salvia dorrii</i> Dwarf-shrubland Alliance |
| A1574 | <i>Artemisia rigida</i> Steppe & Shrubland Alliance |
| A1107 | <i>Eriogonum microthecum</i> Dwarf-shrubland Alliance |

DISCUSSION**Discussion [optional]:****CONCEPT HISTORY*****Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|----------------------------|-----------------|------|
| = | Edaphic Series - Lithosols | Daubenmire 1970 | |

AUTHORSHIP***Primary Concept Source [if applicable]:** R.F. Daubenmire (1970)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz**Acknowledgments [optional]:**

Version Date: 06 Nov 2015

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3. Desert & Semi-Desert

3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland

G308. Intermountain Low & Black Sagebrush Steppe & Shrubland

Type Concept Sentence: This broadly defined semi-arid sagebrush dwarf-shrubland and steppe occurs throughout much of the intermountain western U.S. and is characterized by an open to moderately dense shrub or dwarf-shrub layer that is typically dominated by one of the following: *Artemisia arbuscula ssp. arbuscula*, *Artemisia arbuscula ssp. longicaulis*, *Artemisia arbuscula ssp. longiloba*, *Artemisia arbuscula ssp. thermopola*, *Artemisia bigelovii*, *Artemisia frigida*, *Artemisia nova*, or *Artemisia tripartita ssp. rupicola* depending on environment and range of species.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 3.B.1.Ne.2. Great Basin-Intermountain Dwarf Sagebrush Steppe & Shrubland (M170)

Elcode: G308

***Scientific Name:** *Artemisia arbuscula* - *Artemisia bigelovii* - *Artemisia nova* Steppe & Shrubland Group

***Common (Translated Scientific) Name:** Little Sagebrush - Bigelow's Sagebrush - Black Sagebrush Steppe & Shrubland Group

***Colloquial Name:** Intermountain Low & Black Sagebrush Steppe & Shrubland

***Type Concept:** This broadly defined semi-arid dwarf-shrubland and steppe occurs throughout much of the intermountain western U.S. The vegetation in this broadly defined shrubland and steppe group includes an open to moderately dense shrub or dwarf-shrub layer with a sparse to dense herbaceous layer. Several different taxa of sagebrush may dominate depending on location and by habitat. *Artemisia nova* is most widespread, occurring throughout most of the region on mid- to low-elevation, gravelly, calcareous soils. *Artemisia arbuscula ssp. arbuscula* occurs on low- to high-elevation sites often on shallow, fine-textured soils with a dense clay layer that impedes drainage in spring. *Artemisia arbuscula ssp. longiloba* is widespread in the Columbia Basin and Great Basin into southwestern Wyoming and badlands in the western Great Plains. It occurs on shallow, alkaline, calcareous soils derived from shale. *Artemisia bigelovii* occurs throughout much of the Colorado Plateau and extends across northern New Mexico and southeastern Colorado on shallow soils on limestone hills and shale outcrops. Several other more restricted taxa include *Artemisia tripartita ssp. rupicola*, *Artemisia arbuscula ssp. longicaulis*, *Artemisia arbuscula ssp. thermopola*, and *Artemisia frigida*. Other shrubs present to codominant may include *Artemisia tridentata ssp. wyomingensis*, *Artemisia tridentata ssp. vaseyana*, *Ephedra torreyana*, *Ephedra viridis*, *Grayia spinosa*, or *Purshia tridentata*, depending on habitat. The herbaceous layer, if present, ranges from sparse cushion plants such as *Arenaria hookeri*, *Eriogonum brevicaule*, and *Phlox hoodii* to moderate to dense cover of perennial grasses. Characteristic grasses include *Achnatherum hymenoides*, *Bouteloua gracilis*, *Elymus lanceolatus*, *Festuca idahoensis*, *Hesperostipa comata*, *Pascopyrum smithii*, *Pleuraphis jamesii*, *Poa fendleriana*, *Poa secunda*, and *Pseudoroegneria spicata*. Some stands have significant biological crust formation on the soil surface. Sites are generally xeric and may be wind-blown ridges and benches, gravelly alluvial fans, hilltops, canyons, gravelly draws, and dry flats. Substrates are typically shallow, gravelly or finer-textured alkaline, calcareous soils. Most stands occur from 1000 to 3000 m elevation with some extending to 3800 m in subalpine and alpine habitats of the Sierra Nevada. Substrates are variable, but are typically alluvium derived from limestone, shale, basalt, rhyolite or volcanic.

***Diagnostic Characteristics:** This group has an open to moderately dense shrub or dwarf-shrub layer with a sparse to dense herbaceous layer. Several different taxa of sagebrush are diagnostic depending on location and by habitat: *Artemisia nova*, *Artemisia arbuscula ssp. arbuscula*, *Artemisia arbuscula ssp. longiloba*, *Artemisia arbuscula ssp. longicaulis*, *Artemisia bigelovii*, *Artemisia tripartita ssp. rupicola*, *Artemisia arbuscula ssp. longicaulis*, *Artemisia arbuscula ssp. thermopola*, and *Artemisia frigida*. In all cases, these sagebrush taxa tend to occur in shallow, rocky, calcareous or alkaline soils, often fine-textured and sometimes with a claypan impeding drainage. Associated herbaceous taxa are semi-desert grasses and forbs.

***Classification Comments:** Alliances in this group are distinguished largely by the predominant species: *Artemisia nova*, *Artemisia bigelovii*, and the nominal subspecies of *Artemisia arbuscula*, and by the importance of the perennial graminoid layer (>20% cover) in the shrub herbaceous alliances. The *Artemisia arbuscula* subspecies are distinguished by the nominal subspecies taxonomically and by the different environments which they occupy. ~*Artemisia arbuscula ssp. longicaulis* Shrubland Alliance (A2548)\$ occurs in more alkaline and less stony settings than ~*Artemisia arbuscula ssp. arbuscula* Steppe & Shrubland Alliance (A3219)\$\$. ~*Artemisia arbuscula ssp. thermopola* - *Artemisia papposa* / *Festuca idahoensis* Steppe & Shrubland Alliance (A4122)\$ occurs in more calcareous soils and has a restricted distribution. Beetle and Johnson (1982) report that *Artemisia arbuscula ssp. arbuscula* grows in

soils with a high volume of gravel (even though soil may be in clay textural class, or contain a clay-rich layer that impedes drainage), and that *Artemisia arbuscula* ssp. *longiloba* grows in clay soils, often alkaline, that contain no gravels.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|-------------------------------|------|
| | | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The vegetation is this broadly defined shrubland and steppe group includes an open to moderately dense shrub or dwarf-shrub layer dominated by microphyllous evergreen shrubs with a sparse to dense herbaceous layer usually dominated by perennial graminoids (often bunch grasses).

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This broadly defined shrubland and steppe group includes an open to moderately dense shrub or dwarf-shrub layer with a sparse to dense herbaceous layer. Several different taxa of sagebrush may dominate depending on location and by habitat. *Artemisia nova* is most widespread, occurring throughout most of the region on mid- to low-elevation, gravelly, calcareous soils. *Artemisia arbuscula* ssp. *arbuscula* occurs on low- to high-elevation sites often on shallow, fine-textured soils with a dense clay layer that impedes drainage in spring. *Artemisia arbuscula* ssp. *longiloba* is widespread in the Columbia Basin and Great Basin into southwestern Wyoming and badlands in the western Great Plains. It occurs on shallow, alkaline, calcareous soils derived from shale. *Artemisia bigelovii* occurs throughout much of the Colorado Plateau and extends across northern New Mexico and southeastern Colorado on shallow soils on limestone hill and shale outcrops. Several other more restricted taxa may dominate, including *Artemisia tripartita* ssp. *rupicola* (central Wyoming), *Artemisia arbuscula* ssp. *longicaulis* (Lahontan Basin of northwestern Nevada, southeastern Oregon, and northeastern California), *Artemisia arbuscula* ssp. *thermopola* (ridgetops and benches in mountains at 1830 to 2690 m in southern Idaho), and *Artemisia frigida* (described from sites in the Rocky Mountains). Other shrubs present to codominant may include *Artemisia tridentata* ssp. *wyomingensis*, *Artemisia tridentata* ssp. *vaseyana*, *Ephedra torreyana*, *Ephedra viridis*, *Grayia spinosa*, or *Purshia tridentata*, depending on habitat. The herbaceous layer is variable. If present, it ranges from sparse cushion plants such as *Arenaria hookeri*, *Astragalus bisulcatus*, *Astragalus jejunus*, *Eriogonum brevicaulis*, *Minuartia nuttallii* (= *Arenaria nuttallii*), *Phlox hoodii*, *Stenotus acaulis*, and *Trifolium gymnocarpon* to moderate to dense cover of perennial grasses. Characteristic grasses may include *Achnatherum hymenoides*, *Achnatherum thurberianum*, *Bouteloua gracilis*, *Elymus elymoides*, *Elymus lanceolatus*, *Festuca idahoensis*, *Hesperostipa comata*, *Leymus salinus*, *Pascopyrum smithii*, *Pleuraphis jamesii*, *Poa fendleriana*, *Poa secunda*, and *Pseudoroegneria spicata*. Some stands have significant biological crust formation on soil surface.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: This broadly defined semi-arid dwarf-shrubland and steppe group occurs throughout much of the intermountain western U.S. Sites are generally xeric and may be on wind-blown, shallow, gravelly or finer-textured alkaline soils. Throughout eastern Oregon, northern Nevada, southern Idaho, western Montana, western Wyoming, and western Colorado, stands typically occur on mountain ridges and flanks and broad terraces, ranging from 1000 to 3000 m in elevation with stands extending to 3800 m elevation in subalpine and alpine habitats of the Sierra Nevada. Substrates are shallow, fine-textured soils, poorly drained clays, shallow-soiled areas, almost always very stony, characterized by recent rhyolite or basalt or are alkaline soils derived from shale (Zamora and Tueller 1973, Baker and Kennedy 1985). In central and southern Wyoming, typical sites are very windy, gently rolling hills and long, gently sloping pediments and fans with shallow, often rocky soils where this group forms the matrix vegetation and large patches on the margins of high-elevation basins. In higher elevation areas, it forms a mosaic with ~Intermountain Mountain Big Sagebrush Steppe & Shrubland Group (G304) and is restricted to wind-blown ridges. In the Colorado Plateau, Tavaputs Plateau and Uinta Basin, stands occur in canyons, gravelly draws, hilltops, and dry flats at elevations generally below 1800 m. Soils are often rocky, shallow, and alkaline. This group also extends across northern New Mexico and Wyoming into the western Great Plains on limestone hills and shale outcrops.

ENVIRONMENT

Environmental Description: This broadly defined semi-arid dwarf-shrubland and steppe group occurs throughout much of the intermountain western U.S. Sites are generally xeric and may be on wind-blown, shallow, gravelly or finer-textured alkaline soils. Throughout eastern Oregon, northern Nevada, southern Idaho, western Montana, western Wyoming, and western Colorado, stands typically occur on mountain ridges and flanks and broad terraces, ranging from 1000 to 3000 m in elevation with stands extending to 3800 m elevation in subalpine and alpine habitats of the Sierra Nevada. Substrates are shallow, fine-textured soils, poorly drained clays, shallow-soiled areas, almost always very stony, characterized by recent rhyolite or basalt or are alkaline soils derived from shale (Zamora and Tueller 1973, Baker and Kennedy 1985). In central and southern Wyoming, typical sites are very windy, gently rolling hills and long, gently sloping pediments and fans with shallow, often rocky soils where this group forms the matrix vegetation and large patches on the margins of high-elevation basins. In higher elevation areas, it forms a mosaic with ~Intermountain Mountain Big Sagebrush Steppe & Shrubland Group (G304)\$\$ and is restricted to wind-blown ridges. In the Colorado Plateau, Tavaputs Plateau and Uinta Basin, stands occur in canyons, gravelly draws, hilltops, and dry flats at elevations generally below 1800 m. Soils are often rocky, shallow, and alkaline. This group also extends across northern New Mexico and Wyoming into the western Great Plains on limestone hills and shale outcrops.

DISTRIBUTION

***Geographic Range:** This broadly defined semi-arid dwarf-shrubland and steppe group occurs throughout much of the intermountain western U.S.

Nations: US

States/Provinces: AZ, CA, CO, ID, MT, NM, NV, OR, UT, WY

USFS Ecoregions (2007) [optional]: 313A:CC, 313B:CC, 313D:CC, 315A:C?, 315B:CC, 315H:CC, 321A:CC, 331A:CC, 331B:CC, 331F:CC, 331G:CC, 331K:CP, 331L:C?, 331N:CP, 341A:CC, 341B:CC, 341C:CC, 341E:CP, 341G:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CP, 342F:CC, 342G:CC, 342H:CC, 342I:CC, 342J:CC, M242C:CC, M242D:CC, M261D:CC, M261G:CC, M313A:CC, M313B:CC, M331A:C?, M331B:CC, M331D:CC, M331E:CC, M331F:CP, M331G:CC, M331H:CC, M331I:CC, M332A:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:??, M341A:CC, M341B:CC, M341C:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3221 | <i>Artemisia arbuscula</i> ssp. <i>longiloba</i> Steppe & Shrubland Alliance |
| A3223 | <i>Artemisia bigelovii</i> Steppe & Shrubland Alliance |
| A3222 | <i>Artemisia nova</i> Steppe & Shrubland Alliance |
| A2548 | <i>Artemisia arbuscula</i> ssp. <i>longicaulis</i> Shrubland Alliance |
| A3219 | <i>Artemisia arbuscula</i> ssp. <i>arbuscula</i> Steppe & Shrubland Alliance |
| A2565 | <i>Artemisia frigida</i> Dwarf-shrubland Alliance |
| A4122 | <i>Artemisia arbuscula</i> ssp. <i>thermopola</i> - <i>Artemisia papposa</i> / <i>Festuca idahoensis</i> Steppe & Shrubland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--|----------------|------|
| = | Great Basin-Colorado Plateau sagebrush semi-desert | West 1983a | |

AUTHORSHIP

*Primary Concept Source [if applicable]: N.E. West (1983a)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

*Author of Description: K.A. Schulz

Acknowledgments [optional]:

Version Date: 06 Nov 2015

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M169. Great Basin-Intermountain Tall Sagebrush Steppe & Shrubland

3. Desert & Semi-Desert

3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland

G303. Intermountain Dry Tall Sagebrush Steppe & Shrubland

Type Concept Sentence: This widely distributed, matrix-forming shrubland group is concentrated in the drier, more southerly portions of the interior western U.S., but extends into more xeric portions of the Columbia Plateau, Rocky Mountains, across Wyoming, then northeast into the northwestern Great Plains. Vegetation is typically dominated by *Artemisia tridentata ssp. wyomingensis* and *Artemisia tridentata ssp. tridentata*, sometimes codominated by xeric shrubs such as *Atriplex* spp., with a typically sparse to open herbaceous layer dominated by dry-site graminoids.

OVERVIEW

*Hierarchy Level: Group

***Placement in Hierarchy:** 3.B.1.Ne.3. Great Basin-Intermountain Tall Sagebrush Steppe & Shrubland (M169)

Elcode: G303

***Scientific Name:** *Artemisia tridentata ssp. wyomingensis* - *Artemisia tridentata ssp. tridentata* Steppe & Shrubland Group

***Common (Translated Scientific) Name:** Wyoming Big Sagebrush - Basin Big Sagebrush Steppe & Shrubland Group

***Colloquial Name:** Intermountain Dry Tall Sagebrush Steppe & Shrubland

***Type Concept:** This widely distributed, matrix-forming shrubland group is concentrated in the drier, more southerly portions of the interior western U.S., especially in the Great Basin and Colorado Plateau, but extends into more xeric portions of the Columbia Plateau, Wyoming steppe, Rocky Mountains, and northeast into the northwestern Great Plains. Stands are dominated by *Artemisia tridentata ssp. wyomingensis* and *Artemisia tridentata ssp. tridentata* and, in some cases, codominated by xeric shrubs such as *Atriplex canescens*, *Atriplex confertifolia*, *Ephedra nevadensis*, *Ephedra viridis*, *Ericameria nauseosa*, *Grayia spinosa*, or *Sarcobatus vermiculatus*. Other common shrubs include *Amelanchier utahensis*, *Artemisia frigida*, *Atriplex gardneri*, *Chrysothamnus* spp., *Ericameria* spp., *Peraphyllum ramosissimum*, *Purshia tridentata*, and *Tetradymia* spp. If present, the herbaceous layer ranges from sparse and patchy to moderately dense and is typically dominated by dry-site graminoids with low cover of forbs. Characteristic graminoids include *Achnatherum hymenoides*, *Achnatherum lettermanii* (= *Stipa lettermanii*), *Achnatherum pinetorum*, *Achnatherum thurberianum*, *Bouteloua gracilis*, *Bromus tectorum*, *Carex filifolia*, *Distichlis spicata*, *Elymus albicans*, *Elymus elymoides*, *Hesperostipa comata* (= *Stipa comata*), *Leymus ambiguus*, *Leymus salinus*, *Pleuraphis jamesii*, *Poa fendleriana*, *Poa secunda*, *Pseudoroegneria spicata*, *Sporobolus airoides*, and *Sporobolus cryptandrus*. A sparse layer of cold-deciduous needle-leaved or scale-leaved evergreen trees may occasionally be emergent over the shrubs. This group occurs on flat to steeply sloping upland slopes on alluvial fans and terraces, toeslopes, lower and middle slopes, draws, badlands, and foothills. Stands are found at elevations as low as 500 m in the northwestern Great Plains to 2500 m in the Rocky Mountains and Colorado Plateau. Sites with little slope tend to have deep soils, while those with steeper slopes have shallow to moderately deep soils. Climate is mostly semi-arid but ranges from semi-arid in the western Great Basin to subhumid in the northern Great Plains and Rocky Mountains with much of the precipitation falling primarily as snow. The amount and reliability of growing-season moisture increase eastward and with increasing elevation.

***Diagnostic Characteristics:** Stands are dominated by *Artemisia tridentata ssp. wyomingensis* or *Artemisia tridentata ssp. tridentata* and, in some cases, codominated by dry-site shrubs such as *Atriplex canescens*, *Ephedra nevadensis*, *Ephedra viridis*, *Ericameria nauseosa*, or *Sarcobatus vermiculatus*. If present, the herbaceous component layer ranges from sparse and patchy to moderately dense and is typically dominated by dry-site graminoids with low cover of forbs. Characteristic graminoids include *Achnatherum hymenoides*, *Achnatherum lettermanii*, *Achnatherum pinetorum*, *Achnatherum thurberianum*, *Bouteloua gracilis*, *Bromus tectorum*, *Carex filifolia*, *Distichlis spicata*, *Elymus albicans*, *Elymus elymoides*, *Hesperostipa comata*, *Leymus ambiguus*, *Leymus salinus*, *Pleuraphis jamesii*, *Poa fendleriana*, *Poa secunda*, *Pseudoroegneria spicata*, *Sporobolus airoides*, and *Sporobolus cryptandrus*. Associated species tend to include more semi-desert taxa with core distribution in the Great Basin and Colorado Plateau regions. Warm-season grasses are common in the southern and eastern portions of its range.

***Classification Comments:** This group tends to occur in drier biophysical settings than the two similar tall sagebrush groups (G302, G304). Hence, it tends to have a less abundant herbaceous component, with the predominant grasses being more adapted to drier conditions. In addition, the co-occurring shrub taxa will include more desert species as well as cacti. This is a slid group in concept, but the specific associations included in it need to be reviewed and will require some adjustment.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G302 | Intermountain Mesic Tall Sagebrush Steppe & Shrubland | |
| G304 | Intermountain Mountain Big Sagebrush Steppe & Shrubland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This deciduous scrub and grassland group is structurally characterized by open to dense sagebrush with associated shrubs interspersed and/or a moderately dense understory of perennial grasses.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Stands are dominated by *Artemisia tridentata* ssp. *wyomingensis* and *Artemisia tridentata* ssp. *tridentata* and, in some cases, codominated by *Atriplex canescens*, *Atriplex confertifolia*, *Ephedra nevadensis*, *Ephedra viridis*, *Ericameria nauseosa*, *Grayia spinosa*, or *Sarcobatus vermiculatus*. Other common shrubs include *Artemisia frigida*, *Atriplex gardneri*, *Chrysothamnus* spp., *Ericameria* spp., *Krascheninnikovia lanata*, *Peraphyllum ramosissimum*, *Prunus virginiana*, *Purshia tridentata*, *Symphoricarpos longiflorus*, and *Tetradymia* spp. A sparse layer of cold-deciduous needle-leaved or scale-leaved evergreen trees may occasionally be emergent over the shrubs. The herbaceous layer may be sparse to strongly dominated by graminoids, including *Achnatherum hymenoides*, *Achnatherum lettermanii* (= *Stipa lettermanii*), *Achnatherum pinetorum*, *Achnatherum thurberianum*, *Bouteloua gracilis*, *Bromus tectorum*, *Carex filifolia*, *Elymus albicans*, *Elymus elymoides*, *Elymus lanceolatus*, *Festuca idahoensis*, *Hesperostipa comata* (= *Stipa comata*), *Leymus ambiguus*, *Pleuraphis jamesii*, *Poa fendleriana*, *Poa secunda*, *Pseudoroegneria spicata*, *Sporobolus airoides*, and *Sporobolus cryptandrus*. Trees found across the range include *Cercocarpus ledifolius*, *Juniperus monosperma*, *Juniperus occidentalis*, *Juniperus osteosperma*, *Juniperus scopulorum*, *Pinus edulis*, *Pinus flexilis*, *Pinus jeffreyi*, *Pinus monophylla*, *Pinus ponderosa*, *Populus tremuloides*, *Quercus gambelii*, *Quercus garryana*, and *Yucca brevifolia*.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: The natural fire regime of this group likely maintains patchy distribution of shrubs, so the general aspect of the vegetation is that of a grassland. Shrubs may increase following heavy grazing and/or with fire suppression, particularly in moist portions of the northern Columbia Plateau where it forms a landscape mosaic pattern with shallow-soil scabland shrublands. Response to grazing can be variable depending on the type of grazer and the season in which grazing occurs. *Hesperostipa comata* can increase in abundance in response to either grazing or fire. Microphytic crust is very important in this group.

ENVIRONMENT

Environmental Description: This shrubland group is widely distributed in the western U.S., at elevations as low as 500 m in the northwestern Great Plains to 2500 m in the Rocky Mountains and Colorado Plateau. This group occurs on flat to steeply sloping upland slopes on alluvial fans and terraces, toeslopes, lower and middle slopes, draws, badlands, and foothills. *Climate:* Climate ranges from arid in the western Great Basin to subhumid in the northern plains and Rocky Mountains with much of the precipitation falling primarily as snow. The amount and reliability of growing-season moisture increase eastward and with increasing elevation. *Soil/substrate/hydrology:* Sites with little slope tend to have deep soils while those with steeper slopes have shallow to moderately deep soils. Soil texture is loamy sand, loam, sandy loam, or clay loam (Hansen and Hoffman 1988), and there is often a significant amount of coarse fragments in the soil profile.

DISTRIBUTION

***Geographic Range:** This widely distributed, matrix-forming shrubland group is concentrated in the drier, more southerly portions of the interior western U.S., especially in the Great Basin and Colorado Plateau, but extends into more xeric portions of the Columbia Plateau, Wyoming steppe, Rocky Mountains, and northeast into the northwestern Great Plains.

Nations: CA, US

States/Provinces: BC, CA, CO, ID, MT, ND, NV, OR, SD?, UT, WY

USFS Ecoregions (2007) [optional]: 313A:CC, 313B:CC, 322A:CC, 331A:CP, 331D:CC, 331F:CC, 331G:CC, 331H:CC, 331J:C?, 341A:CC, 341B:CC, 341C:CC, 342A:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:CC, 342I:CC, M242C:CC, M261G:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333D:CC, M334A:CC, M341A:CC, M341B:CC, M341C:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3194 | <i>Artemisia tridentata</i> ssp. <i>tridentata</i> - <i>Artemisia tridentata</i> ssp. <i>xericensis</i> Dry Steppe & Shrubland Alliance |

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3198 | <i>Artemisia tridentata</i> - Mixed Shrub Dry Steppe & Shrubland Alliance |
| A3184 | <i>Artemisia tridentata ssp. wyomingensis</i> Dry Steppe & Shrubland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--|----------------|------|
| >< | Basin Big Sagebrush (401) | Shiflet 1994 | |
| >< | Wyoming Big Sagebrush (403) | Shiflet 1994 | |
| = | Great Basin-Colorado Plateau sagebrush semi-desert | West 1983a | |

AUTHORSHIP***Primary Concept Source [if applicable]:** N.E. West (1983a)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** M.E. Hall and K.A. Schulz**Acknowledgments [optional]:**

Version Date: 06 Nov 2015

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- West, N. E. 1983c. Western Intermountain sagebrush steppe. Pages 351-374 in: N. E. West, editor. Temperate deserts and semi-deserts. Ecosystems of the world, Volume 5. Elsevier Publishing Company, Amsterdam.

3. Desert & Semi-Desert

3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland

G302. Intermountain Mesic Tall Sagebrush Steppe & Shrubland

Type Concept Sentence: This widespread matrix-forming sagebrush steppe and shrubland group occurs throughout the interior western U.S., Wyoming and the northwestern Great Plains and is characterized by an open to sparse shrub layer of *Artemisia tridentata* (*ssp. tridentata*, *ssp. xericensis*) or *Artemisia tripartita ssp. tripartita* with an often dense herbaceous layer dominated by perennial bunchgrasses such as *Achnatherum occidentale*, *Festuca campestris*, *Festuca idahoensis*, *Leymus cinereus*, *Poa secunda*, and *Pseudoroegneria spicata*.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 3.B.1.Ne.3. Great Basin-Intermountain Tall Sagebrush Steppe & Shrubland (M169)

Elcode: G302

***Scientific Name:** *Artemisia tridentata* - *Artemisia tripartita* - *Purshia tridentata* Big Sagebrush Steppe & Shrubland Group

***Common (Translated Scientific) Name:** Basin Big Sagebrush - Threetip Sagebrush - Antelope Bitterbrush Big Sagebrush Steppe & Shrubland Group

***Colloquial Name:** Intermountain Mesic Tall Sagebrush Steppe & Shrubland

***Type Concept:** This widespread matrix-forming sagebrush steppe group occurs throughout much of the western U.S. in the Great Basin, Columbia Plateau, northwestern Great Plains, eastern Sierra Nevada, Wyoming Basins, Rocky Mountains, and Colorado Plateau between elevations of 1200 and 2400 m. Stands are characterized by open to sparse shrublands dominated by *Artemisia tridentata* (*ssp. tridentata*, *ssp. xericensis*) or *Artemisia tripartita ssp. tripartita* which tend to occupy more mesic sites with well-developed soil, and *Purshia tridentata* which tends to occupy drier, rockier soils and positions, as well as sandy dune areas. Some *Artemisia tridentata ssp. wyomingensis* associations are included here, where they occur in biophysical settings conducive to an abundant herbaceous layer, and more mesic-indicator species. Herbaceous layers are often dense and dominated by perennial bunchgrasses, especially as *Festuca idahoensis* and *Pseudoroegneria spicata*. Other common graminoids include *Achnatherum hymenoides*, *Achnatherum occidentale*, *Carex pensylvanica*, *Festuca campestris*, *Hesperostipa comata*, *Leymus cinereus*, *Pascopyrum smithii*, and *Poa secunda*. In some cases scattered trees may form an emergent layer of individual trees; species include *Cercocarpus ledifolius*, *Juniperus occidentalis*, *Juniperus osteosperma*, *Juniperus scopulorum*, or *Pinus ponderosa*. Many perennial forb species are important in these shrublands, and microphytic crust is very important in this group. This group may occur on stream terraces, point bars, valley floors, alluvial fans, floodplains, washes, gullies, stabilized dunes, swales, and rocky slopes. Soils vary from deep and well-developed to shallow, rocky and poorly developed sandy loams, loamy sands, sand, silt loams, and clay loams derived from alluvium, loess, shale, and sandstone.

***Diagnostic Characteristics:** Stands are characterized by open to sparse shrublands dominated by *Artemisia tridentata* (*ssp. tridentata*, *ssp. xericensis*) or *Artemisia tripartita ssp. tripartita* which tend to occupy more mesic sites with well-developed soil, and *Purshia tridentata* which tends to occupy drier, rockier soils and positions, as well as sandy dune areas. Herbaceous layers are often dense and dominated by perennial bunchgrasses and a significant perennial graminoid layer is diagnostic of this group. Common graminoids include *Achnatherum hymenoides*, *Achnatherum occidentale*, *Achnatherum thurberianum*, *Carex pensylvanica*, *Elymus lanceolatus*, *Festuca campestris*, *Festuca idahoensis*, *Hesperostipa comata*, *Koeleria macrantha*, *Leymus cinereus*, *Pascopyrum*

smithii, *Poa secunda*, and *Pseudoroegneria spicata*.

***Classification Comments:** This group is a solid concept at its core, although the associations considered "mesic tall sagebrush" probably need adjustment. These communities tend to occur in the northern Great Basin and Northern Rockies, or on somewhat more mesic settings than the dry tall sagebrush group. Slightly higher precipitation and less evapotranspiration stress combined with deeper soils allow for the significant bunchgrass and perennial forb component of the shrublands in this group.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G303 | Intermountain Dry Tall Sagebrush Steppe & Shrubland | |
| G304 | Intermountain Mountain Big Sagebrush Steppe & Shrubland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: These are microphyllous evergreen or deciduous scrublands, with a significant component of perennial grasses. The group is structurally characterized by open to dense sagebrush or bitterbrush with associated shrubs interspersed and/or a dense understory of perennial bunch grasses.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This shrub and shrub herbaceous group is characterized by communities dominated by *Artemisia tridentata* ssp. *tridentata*, *Artemisia tridentata* ssp. *xericensis*, *Artemisia tridentata* ssp. *wyomingensis*, *Artemisia tripartita* ssp. *tripartita*, and *Purshia tridentata*. Other associated shrubs and dwarf-shrubs may include *Arctostaphylos uva-ursi*, *Artemisia frigida*, *Chrysothamnus viscidiflorus*, *Ericameria* spp., *Peraphyllum ramosissimum*, *Philadelphus lewisii*, *Prunus virginiana*, *Ribes cereum*, *Symphoricarpos longiflorus*, and *Symphoricarpos rotundifolius*. Herbaceous layers are often dense and dominated by perennial bunchgrasses. Common graminoids include *Achnatherum hymenoides*, *Achnatherum nelsonii*, *Achnatherum occidentale*, *Achnatherum thurberianum*, *Carex pensylvanica*, *Elymus lanceolatus*, *Festuca campestris*, *Festuca idahoensis*, *Hesperostipa comata*, *Koeleria macrantha*, *Leymus cinereus*, *Muhlenbergia montana*, *Pascopyrum smithii*, *Poa secunda*, and *Pseudoroegneria spicata*. Forbs are often diverse and have moderate to low cover. Species may include *Balsamorhiza sagittata*, *Eriogonum umbellatum*, or *Penstemon deustus*. In some cases scattered trees may form an emergent layer of individual trees; species include *Cercocarpus ledifolius*, *Juniperus occidentalis*, *Juniperus osteosperma*, *Juniperus scopulorum*, or *Pinus ponderosa*.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: The natural fire regime of this group likely maintains a patchy distribution of shrubs so that the general aspect of the vegetation is a grassland. Shrubs may increase following heavy grazing and/or with fire suppression, particularly in moist portions in the northern Columbia Plateau where it forms a landscape mosaic pattern with shallow-soil scabland shrublands. Response to grazing can be variable depending on the type of grazer and the season in which grazing occurs. *Hesperostipa comata* can increase in abundance in response to either grazing or fire. In central and eastern Montana (and possibly elsewhere), complexes of prairie dog towns are common in this group. Microphytic crust is very important in this group.

ENVIRONMENT

Environmental Description: This widespread matrix-forming group occurs throughout much of the western U.S. between elevations of 600 m in the northern extents to 2500 m in southern range limits. This group may occur on stream terraces, point bars, valley floors, alluvial fans, floodplains, washes, gullies, stabilized dunes, mesic uplands, swales, and rocky slopes. Slopes are variable from gentle to very steep. *Climate:* The climate where this group occurs is semi-arid with annual precipitation ranging from 18-40 cm and high inter-annual variation. Much of the precipitation falls as snow, and growing-season drought is characteristic. Temperatures are continental with large annual and diurnal variations. *Soil/substrate/hydrology:* Soils vary from deep and well-developed to rocky and poorly developed sandy loams, loamy sands, sand, silt loams, and clay loams derived from alluvium, loess, shale, and sandstone. In drier regions, these shrublands are usually associated with perennial or ephemeral stream drainages with water tables less than 3 m from the soil surface.

DISTRIBUTION

***Geographic Range:** This widespread matrix-forming sagebrush steppe group occurs throughout much of the western U.S. in the Columbia Plateau, Great Basin, eastern Sierra Nevada, Colorado Plateau, Wyoming Basins, Rocky Mountains, and northwestern Great Plains.

Nations: CA, US

States/Provinces: BC, CA, CO, ID, MT, ND, NV, OR, SD?, UT, WA, WY

USFS Ecoregions (2007) [optional]: 313A:CC, 331D:CC, 331G:CC, 341A:CC, 341B:CC, 342A:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:C?, 342I:CC, M242C:CC, M261G:CC, M331A:CC, M331D:CC, M331E:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:C?, M332D:CC, M332E:CC, M332F:CC, M332G:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3179 | <i>Purshia tridentata</i> - <i>Artemisia tridentata</i> Mesic Steppe & Shrubland Alliance |
| A3183 | <i>Artemisia tridentata</i> ssp. <i>tridentata</i> - <i>Artemisia tridentata</i> ssp. <i>xericensis</i> Mesic Steppe & Shrubland Alliance |
| A1528 | <i>Artemisia tripartita</i> ssp. <i>tripartita</i> - <i>Artemisia tridentata</i> Mesic Steppe & Shrubland Alliance |
| A3182 | <i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> Mesic Steppe & Shrubland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--|----------------|------|
| = | Western Intermountain sagebrush steppe | West 1983c | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** N.E. West (1983c)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** M.E. Hall and K.A. Schulz

Acknowledgments [optional]:

Version Date: 06 Nov 2015

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***References [Required if used in text]:**

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- Shiflet, T. N., editor. 1994. Rangeland cover types of the United States. Society for Range Management. Denver, CO. 152 pp.
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- West, N. E. 1983c. Western Intermountain sagebrush steppe. Pages 351-374 in: N. E. West, editor. *Temperate deserts and semi-deserts. Ecosystems of the world, Volume 5*. Elsevier Publishing Company, Amsterdam.

3. Desert & Semi-Desert

3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland

G304. Intermountain Mountain Big Sagebrush Steppe & Shrubland

Type Concept Sentence: This sagebrush shrubland and shrub-steppe group is found at montane and subalpine elevations across the western U.S. where the open to dense shrub layer is composed primarily of *Artemisia tridentata ssp. vaseyana*, *Artemisia cana ssp. bolanderi*, *Artemisia cana ssp. viscidula*, and related taxa such as *Artemisia tridentata ssp. spiciformis* and *Artemisia rothrockii* with *Symphoricarpos* spp. often codominant and there is usually an abundant perennial herbaceous layer (over 25% cover).

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 3.B.1.Ne.3. Great Basin-Intermountain Tall Sagebrush Steppe & Shrubland (M169)

Elcode: G304

***Scientific Name:** *Artemisia tridentata ssp. spiciformis* - *Artemisia tridentata ssp. vaseyana* - *Artemisia cana ssp. viscidula* Steppe & Shrubland Group

***Common (Translated Scientific) Name:** Spiked Big Sagebrush - Mountain Big Sagebrush - Mountain Silver Sagebrush Steppe & Shrubland Group

***Colloquial Name:** Intermountain Mountain Big Sagebrush Steppe & Shrubland

***Type Concept:** This group includes sagebrush communities occurring at foothills (in Wyoming) to montane and subalpine elevations across the western U.S. from 1000 m in eastern Oregon and Washington to over 3000 m in the Southern Rockies. In Montana, it occurs on mountain "islands" in the north-central portion of the state and possibly along the Boulder River south of Absarokee and at higher elevations. In British Columbia, it occurs between 450 and 1650 m in the southern Fraser Plateau and the Thompson and Okanagan basins. Across its range of distribution, this is a compositionally diverse group. It is composed primarily of *Artemisia tridentata ssp. vaseyana*, and related taxon *Artemisia tridentata ssp. spiciformis* often with *Symphoricarpos* spp. present to codominant. Also included, but less common, are stands dominated by *Artemisia cana ssp. bolanderi*, *Artemisia cana ssp. viscidula*, and *Artemisia rothrockii* (a California endemic). Additionally there are mixed shrub stands codominated by *Amelanchier* spp., *Chamaebatiaria millefolium*, *Chrysothamnus viscidiflorus*, *Ericameria nauseosa*, *Peraphyllum ramosissimum*, *Purshia tridentata*, and *Ribes cereum*. *Artemisia tridentata ssp. wyomingensis* may be present to codominant if the stand is clearly montane as indicated by montane indicator species such as *Artemisia tridentata ssp. vaseyana*, *Danthonia intermedia*, *Festuca thurberi*, or *Leucopoa kingii*.

Most stands have an abundant perennial herbaceous layer (over 25% cover, and in many cases over 50% cover), but this group also includes *Artemisia tridentata ssp. vaseyana* shrublands that lack a significant herbaceous layer. Other common graminoids include *Achnatherum lettermanii*, *Achnatherum occidentale*, *Achnatherum pinetorum*, *Bromus carinatus*, *Calamagrostis rubescens*, *Carex geyeri*, *Elymus trachycaulus*, *Festuca arizonica*, *Festuca campestris*, *Festuca idahoensis*, *Hesperostipa comata*,

Leucopoa kingii, *Muhlenbergia montana*, *Pascopyrum smithii*, *Poa fendleriana*, *Poa secunda*, and *Pseudoroegneria spicata*. In many areas, wildfires can maintain an open herbaceous-rich steppe condition, although at most sites, shrub cover can be unusually high for a steppe system (>40%), with the moisture providing equally high grass and forb cover.

***Diagnostic Characteristics:** This montane and subalpine sagebrush shrubland and shrub-steppe group is dominated by diagnostic shrub species *Artemisia tridentata ssp. vaseyana*, *Artemisia cana ssp. bolanderi*, *Artemisia cana ssp. viscidula*, and related taxa such as *Artemisia tridentata ssp. spiciformis* and *Artemisia rothrockii* (a California endemic). *Symphoricarpos* spp. are often codominant, but other shrubs may be present, forming a mixed canopy. There is usually an abundant perennial herbaceous layer (over 25% cover). Characteristic montane and subalpine herbaceous species include *Achnatherum lettermanii*, *Achnatherum occidentale*, *Achnatherum pinetorum*, *Bromus carinatus*, *Calamagrostis rubescens*, *Carex geyeri*, *Carex exserta*, *Danthonia intermedia*, *Danthonia parryi*, *Elymus trachycaulus*, *Festuca arizonica*, *Festuca campestris*, *Festuca idahoensis*, *Festuca thurberi*, *Leucopoa kingii*, and *Muhlenbergia montana*.

***Classification Comments:** *Artemisia cana* is often found in mesic to wet swales and toeslopes. Some *Artemisia cana ssp. viscidula* communities are included in this group, when they are not composed of more obligate wetland taxa, such as *Juncus*, wetland Carices, and such.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G303 | Intermountain Dry Tall Sagebrush Steppe & Shrubland | |
| G302 | Intermountain Mesic Tall Sagebrush Steppe & Shrubland | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Microphyllous-leaved evergreen and broad-leaved, cold-deciduous shrub-steppe group with open to dense cover of sagebrush species and an abundant perennial herbaceous layer of graminoid and forb species.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Vegetation types within this group are usually less than 1.5 m tall and dominated by *Artemisia tridentata ssp. vaseyana*, *Artemisia tridentata ssp. spiciformis*, or *Artemisia cana ssp. viscidula*, often with *Symphoricarpos* spp. present to codominant. Also included, but less common, are stands dominated by *Artemisia cana ssp. bolanderi*, *Artemisia cana ssp. viscidula*, and *Artemisia rothrockii* (a California endemic). Additionally, there are mixed shrub stands codominated by *Amelanchier* spp., *Chamaebatiaria millefolium*, *Peraphyllum ramosissimum*, and *Purshia tridentata*. A variety of other shrubs can be found in some occurrences, but these are seldom dominant. They include *Amelanchier alnifolia*, *Artemisia arbuscula*, *Ceanothus velutinus*, *Chrysothamnus viscidiflorus*, *Ericameria nauseosa*, *Ribes cereum*, and *Rosa woodsii*. *Artemisia tridentata ssp. wyomingensis* may be present to codominant if the stand is clearly montane to subalpine as indicated by montane indicator species such as *Artemisia tridentata ssp. vaseyana*, *Danthonia intermedia*, *Festuca thurberi*, or *Leucopoa kingii*. The shrub canopy cover ranges from 10 to 80%. The herbaceous layer is usually well-represented (over 25% cover, and in many cases over 50% cover), but bare ground may be common in particularly arid or disturbed occurrences. Additional characteristic graminoids may include *Achnatherum lettermanii*, *Achnatherum occidentale*, *Achnatherum pinetorum*, *Bromus carinatus*, *Calamagrostis rubescens*, *Carex geyeri*, *Carex exserta*, *Danthonia parryi*, *Elymus trachycaulus*, *Festuca arizonica*, *Festuca campestris*, *Festuca idahoensis*, *Hesperostipa comata*, *Muhlenbergia montana*, *Pascopyrum smithii*, *Poa fendleriana*, *Poa secunda*, and *Pseudoroegneria spicata*. Forbs are often numerous and an important indicator of health. Common forbs include *Achillea millefolium*, *Antennaria rosea*, *Artemisia ludoviciana*, *Balsamorhiza sagittata*, *Eriogonum umbellatum*, *Fragaria virginiana*, *Hymenoxys hoopesii* (= *Helenium hoopesii*), and several species of *Astragalus*, *Castilleja*, *Erigeron*, *Geum*, *Lupinus*, *Penstemon*, *Phlox*, and *Potentilla*.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Healthy sagebrush shrublands are very productive, are often grazed by domestic livestock, and are strongly preferred during the growing season (Padgett et al. 1989). Prolonged livestock use can cause a decrease in the abundance of native bunch grasses and increase in the cover of shrubs and non-native grass species such as *Poa pratensis*. *Artemisia cana* resprouts vigorously following spring fire, and prescribed burning may increase shrub cover. Conversely, fire in the fall may decrease shrub abundance (Hansen et al. 1995). *Artemisia tridentata* is generally killed by fires and may take over ten years to form occurrences of some 20% cover or more. The condition of most sagebrush steppe has been degraded due to fire suppression and heavy livestock grazing. It is unclear how long restoration will take to restore degraded occurrences.

ENVIRONMENT

Environmental Description: This group occurs in many of the western United States, usually at middle elevations (1000-2500 m). The climate regime is cool, semi-arid to subhumid, with yearly precipitation ranging from 25 to 90 cm/year. Much of this precipitation falls as snow. Temperatures are continental with large annual and diurnal variation. In general, this group shows an affinity for mild topography, fine soils, and some source of subsurface moisture. Soils generally are moderately deep to deep, well-drained, and of loam, sandy loam, clay loam, or gravelly loam textural classes; soils often have a substantial volume of coarse fragments, and are derived from a variety of parent materials. This group primarily occurs on deep-soiled to stony flats, ridges, nearly flat ridgetops, and mountain slopes. All aspects are represented, but the higher elevation occurrences may be restricted to south- or west-facing slopes.

DISTRIBUTION

***Geographic Range:** This group is found at montane and subalpine elevations across the western U.S. from 1000 m in eastern Oregon and Washington to over 3000 m in the Southern Rockies. In British Columbia, it occurs in the southern Fraser Plateau and the Thompson and Okanagan basins. This group also occurs in central Montana in the Rocky Mountain island ranges

Nations: CA, US

States/Provinces: AZ?, BC, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY

USFS Ecoregions (2007) [optional]: 313A:CC, 313B:CP, 315A:CC, 315H:CC, 321A:??, 322A:CC, 331B:C?, 331F:CC, 331G:CC, 331J:CC, 331M:C?, 331N:CP, 341A:CC, 341B:CC, 341C:CC, 341D:CC, 341E:CC, 341F:CC, 341G:CC, 342A:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:CC, 342I:CC, 342J:CC, M242C:CC, M242D:CC, M261A:CC, M261D:CC, M261E:CC, M261F:C?, M261G:CC, M313A:CP, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M341A:CC, M341B:CC, M341C:CC, M341D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3208 | <i>Artemisia tridentata ssp. vaseyana</i> - Mixed Steppe & Shrubland Alliance |
| A1098 | <i>Artemisia rothrockii</i> Shrubland Alliance |
| A3200 | <i>Artemisia cana ssp. bolanderi</i> - <i>Artemisia cana ssp. viscidula</i> Steppe & Shrubland Alliance |
| A3207 | <i>Artemisia tridentata ssp. spiciformis</i> - <i>Artemisia tridentata ssp. vaseyana</i> Steppe & Shrubland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|--|----------------|------|
| = | Mountain Big Sagebrush (402) | Shiflet 1994 | |
| = | Western Intermountain sagebrush steppe | West 1983c | |

AUTHORSHIP

*Primary Concept Source [if applicable]: N.E. West (1983c)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

*Author of Description: M.E. Hall and K.A. Schulz

Acknowledgments [optional]:

Version Date: 06 Nov 2015

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M093. Great Basin Saltbush Scrub

3. Desert & Semi-Desert

3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland

G301. Intermountain Dwarf Saltbush - Sagebrush Scrub

Type Concept Sentence: This dwarf-shrub scrub group occurs on gentle slopes and rolling plains in the Colorado Plateau and Uinta Basin on Mancos shale and arid, windswept basins and plains across parts of Wyoming and Montana. It is characterized by an open canopy of dwarf-shrubs composed of relatively pure stands of *Artemisia pedatifida*, *Atriplex corrugata*, or *Atriplex gardneri* sometimes with *Artemisia longifolia*, *Artemisia pygmaea*, or *Picrothamnus desertorum* dominant or codominant.

OVERVIEW

*Hierarchy Level: Group

*Placement in Hierarchy: 3.B.1.Ne.5. Great Basin Saltbush Scrub (M093)

Elcode: G301

*Scientific Name: *Atriplex corrugata* - *Atriplex gardneri* - *Artemisia pedatifida* Dwarf-Scrub Group

*Common (Translated Scientific) Name: Mat Saltbush - Gardner's Saltbush - Birdfoot Sagebrush Dwarf-Scrub Group

*Colloquial Name: Intermountain Dwarf Saltbush - Sagebrush Scrub

***Type Concept:** This semi-arid dwarf-shrub scrub group occurs in the interior western U.S. and is found on windswept basins and plains, often on marine shales. The vegetation is characterized by an open canopy of dwarf-shrubs composed of relatively pure stands of *Artemisia pedatifida* (important in Wyoming), *Atriplex corrugata* (western Colorado and Utah), or *Atriplex gardneri* (Wyoming and Montana into Canada). Other dominant or codominant dwarf-shrubs may include *Artemisia longifolia*, *Artemisia pygmaea*, or *Picrothamnus desertorum*, sometimes with a mix of other low shrubs, such as *Krascheninnikovia lanata* or *Tetradymia spinosa*. Occasional individuals or small clumps of *Atriplex confertifolia*, *Atriplex canescens*, or *Artemisia tridentata ssp. wyomingensis* may be present in some stands within this group but do not codominate. The herbaceous layer is typically sparse. Scattered perennial forbs occur, such as *Xylorhiza glabriuscula* and *Sphaeralcea grossulariifolia*; perennial grasses *Achnatherum hymenoides*, *Bouteloua gracilis* (not in Wyoming), *Elymus elymoides*, *Elymus lanceolatus ssp. lanceolatus*, *Pascopyrum smithii*, *Poa secunda*, or *Sporobolus airoides* may dominate the herbaceous layer. In less saline areas, there may be inclusions of grasslands dominated by *Hesperostipa comata*, *Leymus salinus*, *Pascopyrum smithii*, or *Pseudoroegneria spicata*. Stands occur on gentle slopes and rolling plains. Substrates are shallow, typically saline, alkaline, fine-textured soils developed from shale or alluvium that may be associated with shale badlands. Infiltration rate is typically low. In Wyoming and possibly elsewhere, inclusions of non-saline, gravelly barrens or rock outcrops dominated by cushion plants such as *Arenaria hookeri* and *Phlox hoodii* without dwarf-shrubs may be present (these are not restricted to this group and larger patches would likely be classified in a sparse vegetation group).

***Diagnostic Characteristics:** This open dwarf-shrubland is typically dominated by relatively pure stands of *Atriplex corrugata* (in Colorado and Utah) or *Atriplex gardneri* (Wyoming and Montana into Canada). Other dominant or codominant dwarf-shrubs may include *Artemisia longifolia*, *Artemisia pedatifida* (very important in Wyoming, rare in Colorado stands), or *Artemisia pygmaea*, sometimes with a mix of other low shrubs, such as *Krascheninnikovia lanata* or *Tetradymia spinosa*. Occasional individuals or small clumps of *Atriplex confertifolia*, *Atriplex canescens*, or *Artemisia tridentata ssp. wyomingensis* may be present in some stands within this group but do not codominate.

***Classification Comments:** This group is more broadly defined than just low, mat-forming saltbush on shaly sites (*Atriplex corrugata*, *Atriplex gardneri*), but includes few dwarf sagebrush species that occur with similar habits and in similar habitats. Generally, it does not include stands mixed with taller species of saltbush or sagebrush. Stands in this group may grade into sparse vegetation groups on shale barrens/badlands. Welsh (1957) observed that *Atriplex corrugata* stands were restricted to north and east aspects on Mancos shale, with south and west aspects nearly barren. In Montana, *Atriplex gardneri* also occurs associated with badlands, and determining which group it falls into may be difficult. Scrub stands dominated by *Picrothamnus desertorum* are placed in ~Intermountain Shadscale - Saltbush Scrub Group (G300) because they often codominate with the widespread shrub *Atriplex confertifolia*. However, *Picrothamnus desertorum* is often short (10-25 cm tall) so it could also be classified as a dwarf-shrubland.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|-------------------------------|------|
| | | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group is a facultatively deciduous, subdesert dwarf-shrubland. It typically has an open woody canopy of clumps of low, mat-forming dwarf-shrubs and a sparse herbaceous layer.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This dwarf-shrubland group is characterized by an open canopy of dwarf-shrubs typically composed of relatively pure stands of *Atriplex* spp., such as *Atriplex corrugata* (in Colorado and Utah), *Atriplex gardneri* (Wyoming and Montana into Canada), or *Artemisia pedatifida* (very important in Wyoming, rare in Colorado stands). Other dominant or codominant dwarf-shrubs may include *Artemisia longifolia*, *Artemisia pygmaea*, or *Picrothamnus desertorum*, sometimes with a mix of other low shrubs, such as *Krascheninnikovia lanata* or *Tetradymia spinosa*. Occasional individuals or small clumps of *Atriplex confertifolia*, *Atriplex canescens*, or *Artemisia tridentata ssp. wyomingensis* may be present in some stands within this group but do not codominate. The herbaceous layer is typically sparse. Scattered perennial forbs occur, such as *Xylorhiza glabriuscula* and *Sphaeralcea grossulariifolia*; perennial grasses *Achnatherum hymenoides*, *Bouteloua gracilis* (not in Wyoming), *Elymus elymoides*, *Elymus lanceolatus ssp. lanceolatus*, *Pascopyrum smithii*, *Poa secunda*, or *Sporobolus airoides* may dominate the herbaceous layer. In less saline areas, there may be inclusions of grasslands dominated by *Hesperostipa comata*, *Leymus salinus*, *Pascopyrum smithii*, or *Pseudoroegneria spicata*. In Wyoming and possibly elsewhere, inclusions of non-saline, gravelly barrens or rock outcrops dominated by cushion plants

such as *Arenaria hookeri* and *Phlox hoodii* without dwarf-shrubs may be present (these are not restricted to this group and larger patches would likely be classified in a sparse vegetation group). Annuals are seasonally present and may include *Eriogonum inflatum*, *Plantago tweedyi*, *Monolepis nuttalliana*, and the introduced annual grass *Bromus tectorum*.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Const-ancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|------------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: *Atriplex corrugata*-dominated shrublands are the most saline-tolerant of the Mancos shale plant communities studied by Branson et al. (1976). *Atriplex corrugata* can completely dominate these extremely saline sites (Branson et al. 1976). It is a true evergreen dwarf-shrub retaining leaves for several years, and branches are capable of rooting at the nodes. This plant utilizes winter soil moisture, beginning new growth in March when the soils are relatively warm and moist. It flowers in April, and by mid-July fruits are shattered (Branson et al. 1976). If the soils dry out in mid-summer, it can go dormant until the late-summer monsoon rains begin. Large areas of *Atriplex corrugata* died during the extreme drought of 2002 in the Four Corners area. By 2004, new seedlings were established and spreading; shrub cover recovered to approximately 50% of what it was before the drought. *Atriplex gardneri*-dominated vegetation is another saline/drought-tolerant example of the Mancos Shale plant communities studied by Branson et al. (1976). Although very slow-growing, it can completely dominate these extremely saline sites (Branson et al. 1976).

ENVIRONMENT

Environmental Description: This group occurs on gentle slopes and rolling plains in the northern Colorado Plateau and Uinta Basin on Mancos shale and arid, windswept plains and basins across parts of Wyoming. On Mancos shale (and possibly other saline marine shales), stands may be restricted to gentler slopes and cooler north and east aspects, with steeper south and west aspects nearly barren (Welsh 1957). *Climate:* Climate is temperate and semi-arid. Summers are generally hot, and freezing temperatures are common in the winter. Mean annual precipitation ranges from 13-33 cm. In Montana and Wyoming, approximately two-thirds of the annual precipitation falls in spring and early summer. In Colorado and Utah, over half the precipitation occurs in the late-summer monsoons as high-intensity thunderstorms. *Soil/substrate/hydrology:* Substrates are typically saline, alkaline, fine-textured soils developed from shale or alluvium and may be associated with shale badlands. Infiltration rate is typically low. In Wyoming and possibly elsewhere, inclusions of non-saline, gravelly barrens or rock outcrops may be present.

DISTRIBUTION

***Geographic Range:** This group occurs on gentle slopes and rolling plains in the Colorado Plateau and Uinta Basin on Mancos shale and arid, windswept basins and plains across parts of Wyoming and Montana, and into Canada.

Nations: CA, US

States/Provinces: AZ, CO, MT, NM, NV, UT, WY

USFS Ecoregions (2007) [optional]: 313A:CC, 313B:CC, 341B:CC, 341C:CC, 342E:C?, 342F:C?, 342G:CC, 342J:C?, M331B:CC, M331D:C?, M331E:CC, M331G:CC, M331H:CC, M331J:C?, M341B:CC, M341C:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A1127 | <i>Artemisia pedatifida</i> Low Scrub Alliance |
| A1110 | <i>Atriplex gardneri</i> Low Scrub Alliance |
| A1109 | <i>Atriplex corrugata</i> Low Scrub Alliance |
| A1106 | <i>Artemisia pygmaea</i> Low Scrub Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|----------------------------------|----------------|------|
| >< | Saltbush - Greasewood (501) | Shiflet 1994 | |
| >< | Other Sagebrush Types (408) | Shiflet 1994 | |
| = | Vegetation on Manco Shale | Welsh 1957 | |
| = | Mat- <i>Atriplex</i> Association | Graham 1937 | |

AUTHORSHIP***Primary Concept Source [if applicable]:** S.L. Welsh (1957)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz

Acknowledgments [optional]:

Version Date: 06 Nov 2015

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3. Desert & Semi-Desert

3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland

G300. Intermountain Shadscale - Saltbush Scrub

Type Concept Sentence: This widespread semi-arid scrub group is found in basins, plains, alluvial flats and slopes in the intermountain western U.S. and western Great Plains and is characterized by a typically open to moderately dense shrub layer dominated or codominated by *Atriplex canescens*, *Atriplex confertifolia*, *Atriplex cuneata*, *Atriplex hymenelytra*, *Atriplex obovata*, *Atriplex polycarpa*, *Grayia spinosa*, and/or *Picrothamnus desertorum* often with other shrubs present to codominant.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 3.B.1.Ne.5. Great Basin Saltbush Scrub (M093)

Elcode: G300

***Scientific Name:** *Atriplex confertifolia* - *Atriplex canescens* - *Grayia spinosa* Scrub Group

***Common (Translated Scientific) Name:** Shadscale Saltbush - Fourwing Saltbush - Spiny Hopsage Scrub Group

***Colloquial Name:** Intermountain Shadscale - Saltbush Scrub

***Type Concept:** This extensive group includes open-canopied shrublands of typically saline basins, alluvial slopes and plains across the intermountain western U.S. and western Great Plains. The vegetation is characterized by a typically open to moderately dense shrubland composed of one or more *Atriplex* species, such as *Atriplex canescens*, *Atriplex confertifolia*, *Atriplex cuneata*, *Atriplex hymenelytra*, *Atriplex obovata*, or *Atriplex polycarpa*. Other shrubs present to codominant may include *Artemisia tridentata* ssp. *wyomingensis*, *Chrysothamnus viscidiflorus*, *Ericameria nauseosa*, *Ephedra nevadensis*, *Krascheninnikovia lanata*, *Grayia spinosa*, *Lycium* spp., *Picrothamnus desertorum*, or *Tetradymia* spp. Northern occurrences lack *Atriplex* species and are typically dominated by *Grayia spinosa*. In Wyoming, occurrences are typically a mix of *Artemisia tridentata* ssp. *wyomingensis*, *Atriplex confertifolia*, *Grayia spinosa*, *Krascheninnikovia lanata*, *Sarcobatus vermiculatus*, and various *Ericameria* or *Chrysothamnus* species. Some places are a mix of *Atriplex confertifolia* and *Artemisia tridentata* ssp. *wyomingensis*. In the Great Basin, *Sarcobatus vermiculatus* is generally absent but, if present, does not codominate. The herbaceous layer varies from sparse to moderately dense and is dominated by perennial graminoids such as *Achnatherum hymenoides*, *Bouteloua gracilis*, *Elymus lanceolatus* ssp. *lanceolatus*, *Pascopyrum smithii*, *Pleuraphis jamesii*, *Pleuraphis rigida*, *Poa secunda*, or *Sporobolus airoides*. Various forbs are also present. Substrates are often saline and calcareous, medium- to fine-textured, alkaline soils, but include some coarser-textured soils.

***Diagnostic Characteristics:** The vegetation is characterized by a typically open to moderately dense shrubland composed of one or more shrub species, such as *Atriplex canescens*, *Atriplex confertifolia*, *Atriplex cuneata*, *Atriplex hymenelytra*, *Atriplex obovata*, *Atriplex polycarpa*, *Grayia spinosa*, and/or *Picrothamnus desertorum*.

***Classification Comments:** Some *Grayia spinosa*-dominated stands tends to occur on coppice dunes that have a silty component to them. If they occur on deep sand or dunes, then consider a dune group. Scrub stands dominated by *Picrothamnus desertorum* are placed in this group because *Picrothamnus desertorum* is frequently present to codominant with the widespread shrub *Atriplex confertifolia* in the Great Basin (Mozingo 1987). However, *Picrothamnus desertorum* is often short (10-25 cm tall) so could also be classified as ~Intermountain Dwarf Saltbush - Sagebrush Scrub Group (G301)\$\$.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---------------------------------------|------|
| G299 | Chihuahuan Desert Lowland Basin Scrub | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group is a facultatively deciduous, extremely xeromorphic, subdesert short shrubland with a typically open shrub canopy and sparse to moderately dense herbaceous layer dominated by perennial graminoids.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This widespread cool semi-desert scrub group is highly variable and ranges from almost pure occurrences of a single species to fairly complex mixtures. The characteristic mix of low shrubs and grasses is sparse, with large open spaces between the plants (Blaisdell and Holmgren 1984). Occurrences have a sparse to moderately dense cover of woody species that is often dominated by one of several shrubs such as *Atriplex canescens* (also codominated by *Artemisia tridentata*, *Ephedra viridis*, or *Krascheninnikovia lanata*), *Atriplex confertifolia* (also codominated by several species of *Lycium* and *Ephedra*, *Picrothamnus desertorum*, or *Sarcobatus vermiculatus*), *Atriplex cuneata*, *Atriplex obovata*, *Atriplex hymenelytra*, *Atriplex polycarpa*, *Grayia spinosa*, or *Picrothamnus desertorum* (= *Artemisia spinescens*). Other shrubs may be present, especially in transition areas with desert or montane scrub. Species include *Acacia greggii*, *Artemisia frigida*, *Chrysothamnus* spp., *Encelia frutescens*, *Ericameria nauseosa*, *Ephedra nevadensis*, *Frankenia salina*, *Larrea tridentata*, *Lycium andersonii*, *Lycium pallidum*, *Parthenium confertum*, *Psoralea polydenius*, *Purshia stansburiana*, *Suaeda* spp., *Tetradymia glabrata*, *Tetradymia spinosa*, *Tiquilia latior*, and *Yucca glauca*. Dwarf-shrubs include *Gutierrezia sarothrae* and several species of *Eriogonum*, but generally do not form a distinct layer as the main shrub layer is often >0.5 m tall.

Warm-season medium-tall and short perennial grasses dominate in the sparse to moderately dense graminoid layer. The species present depend on the geographic range of the grasses, soil alkalinity/salinity, and past land use. Species may include *Achnatherum hymenoides*, *Bouteloua gracilis*, *Distichlis spicata*, *Elymus elymoides*, *Hesperostipa comata*, *Leymus ambiguus*, *Leymus salinus*, *Muhlenbergia torreyi*, *Pascopyrum smithii*, *Pleuraphis jamesii*, *Poa secunda*, *Pseudoroegneria spicata*, *Sporobolus airoides*, and *Sporobolus cryptandrus*. A number of annual species may also grow in association with the shrubs and grasses, although they

are usually rare and confined to areas of recent disturbance (Blaisdell and Holmgren 1984). Forb cover is generally sparse. Perennial forbs that might occur include *Chaetopappa ericoides*, *Descurainia* spp., *Mentzelia* spp., *Sphaeralcea coccinea*, and *Xylorhiza venusta*. Annual natives include *Monolepis nuttalliana*, *Plantago* spp., or *Vulpia octoflora*. Associated halophytic annuals include *Salicornia bigelovii*, *Salicornia rubra*, and *Suaeda* species. Exotic annuals that may occur include *Salsola kali*, *Bromus rubens*, and *Bromus tectorum*. Cacti such as species of *Opuntia* and *Echinocereus* may be present in some occurrences. Trees are not usually present but some scattered *Juniperus* spp. may be found.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: West (1982) stated that "salt desert shrub vegetation occurs mostly in two kinds of situations that promote soil salinity, alkalinity, or both. These are either at the bottom of drainages in enclosed basins or where marine shales outcrop." However, salt-desert shrub vegetation may be an indication of climatically dry as well as physiologically dry soils (Blaisdell and Holmgren 1984). Not all salt-desert shrub soils are salty, and their hydrologic characteristics may often be responsible for the associated vegetation (Naphan 1966). Species of the salt-desert shrub complex have different degrees of tolerance to salinity and aridity, and they tend to sort themselves out along a moisture/salinity gradient (West 1982). Species and communities are apparently sorted out along physical, chemical, moisture, and topographic gradients through complex relations that are not understood and are in need of further study (Blaisdell and Holmgren 1984).

The winter months are a good time for soil moisture accumulation and storage within stands in this group. There is generally at least one good snowstorm per season that will provide sufficient moisture to the vegetation. The winter moisture accumulation amounts will affect spring plant growth. Plants may grow as little as a few inches to 1 m. Unless more rains come in the spring, the soil moisture will be depleted in a few weeks, growth will slow and ultimately cease, and the perennial plants will assume their various forms of dormancy (Blaisdell and Holmgren 1984). If effective rain comes later in the warm season, some of the species will renew their growth from the stage at which it had stopped. Others, having died back, will start over as if emerging from winter dormancy (Blaisdell and Holmgren 1984). *Atriplex confertifolia* shrubs often develop large leaves in the spring, which increase the rate of photosynthesis. As soil moisture decreases, the leaves are lost, and the plant takes on a dead appearance. During late fall, very small overwintering leaves appear which provide some photosynthetic capability through the remainder of the year. Other communities are maintained by intra- or inter-annual cycles of flooding followed by extended drought, which favor accumulation of transported salts. The moisture supporting these intermittently flooded wetlands is usually derived off-site, and they are dependent upon natural watershed function for persistence (Reid et al. 1999).

In summary, desert communities of perennial plants are dynamic and changing. The composition within this group may change dramatically and may be both cyclic and unidirectional. Superimposed on the compositional change is great variation from year to year in growth of all the vegetation, the sum of varying growth responses of individual species to specific conditions of different years (Blaisdell and Holmgren 1984). Desert plants grow when temperature is satisfactory, but only if soil moisture is available at the same time. Because the amount of moisture is variable from year to year and because different species flourish under different seasons of soil moisture, seldom do all components of the vegetation thrive in the same year (Blaisdell and Holmgren 1984).

ENVIRONMENT

Environmental Description: This salt-desert shrubland group is matrix-forming in the Intermountain West. This group composes arid to semi-arid shrublands on lowland and upland sites usually at elevations between 1520 and 2200 m (4987-7218 feet). Sites can be found on all aspects and include valley bottoms, alluvial and alkaline flats, mesas and plateaus, playas, drainage terraces, washes and interdune basins, bluffs, and gentle to moderately steep sandy or rocky slopes. Slopes are typically gentle to moderately steep but are sometimes unstable and prone to surface movement. Many areas within this group are degraded due to erosion and may resemble "badlands." Soil surface is often very barren and interspaces between the characteristic plant clusters are commonly covered by a microphytic crust (West 1982).

Climate: This is typically a vegetation group of extreme climatic conditions, with warm to hot summers and freezing winters. Annual precipitation ranges from approximately 13-33 cm. In much of the group, the period of greatest moisture will be mid to late summer, although in the more northern areas, a moist period is to be expected in the cold part of the year. However, plotted seasonality of occurrence is probably of less importance on this desert vegetation than in other types because desert precipitation comes with an extreme irregularity that does not appear in graphs of long-term seasonal or monthly averages (Blaisdell and Holmgren 1984). **Soil/substrate/hydrology:** Soils are shallow to moderately deep, poorly developed, and a product of an arid climate and little precipitation. Soils are often alkaline or saline. Vegetation within this group is tolerant of these soil conditions but not restricted to it. The shallow soils of much of the area are poorly developed Entisols. Vegetation within this group can occur on level pediment remnants where coarse-textured and well-developed soil profiles have been derived from sandstone gravel and are alkaline, or on Mancos shale badlands, where soil profiles are typically fine-textured and non-alkaline throughout (West and Ibrahim

1968). They can also occur in alluvial basins where parent materials from the other habitats have been deposited over Mancos shale and the soils are heavy-textured and saline-alkaline throughout the profile (West and Ibrahim 1968).

DISTRIBUTION

***Geographic Range:** The distribution of this widespread group centers in the Intermountain West of the U.S., and extends in limited distribution across northern New Mexico into the southern Great Plains. In Wyoming, this group occurs in the Great Divide and Bighorn basins.

Nations: MX?, US

States/Provinces: AZ, CA, CO, ID, KS, MT, NM, NV, OR, TX, UT, WA, WY

USFS Ecoregions (2007) [optional]: 313A:CC, 313B:CC, 313D:CC, 315A:CC, 315B:CP, 315H:CC, 321A:CC, 322A:CC, 331A:CP, 331B:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 331J:CC, 341A:CC, 341B:CC, 341C:CC, 341D:CC, 341E:CC, 341F:CC, 341G:CC, 342A:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:CC, 342I:CC, 342J:CC, M242C:PP, M261D:CP, M261E:CP, M261G:CC, M313A:CC, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:C?, M332A:CP, M332E:CC, M332F:CC, M332G:CP, M341A:CC, M341B:CC, M341C:CC, M341D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3174 | <i>Atriplex polycarpa</i> Scrub Alliance |
| A0869 | <i>Atriplex canescens</i> Scrub Alliance |
| A3180 | <i>Atriplex obovata</i> - <i>Atriplex cuneata</i> Scrub Alliance |
| A0870 | <i>Atriplex confertifolia</i> Scrub Alliance |
| A3171 | <i>Grayia spinosa</i> Scrub Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---|----------------|------|
| > | Biotic Matrix of the Shadscale and Associated Communities | Fautin 1946 | |
| = | Intermountain salt desert shrublands | West 1983b | |
| > | Salt Desert Shrub (414) | Shiflet 1994 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** N.E. West (1983b)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz

Acknowledgments [optional]:

Version Date: 06 Nov 2015

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M118. Intermountain Basins Cliff, Scree & Badland Sparse Vegetation

3. Desert & Semi-Desert

3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland

G570. Intermountain Basins Cliff, Scree & Badland Sparse Vegetation

Type Concept Sentence: This group consists of barren and sparsely vegetated cliffs, scree slopes, badlands and other similar harsh habitats from low to high elevations, with a wide variety of trees or shrubs, such as species of *Artemisia*, *Atriplex*, *Cercocarpus*, *Eriogonum*, *Fallugia*, *Grayia*, *Juniperus*, *Pinus*, *Purshia*, and others, distributed throughout the interior western U.S.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 3.B.1.Ne.6. Intermountain Basins Cliff, Scree & Badland Sparse Vegetation (M118)

Elcode: G570

***Scientific Name:** *Atriplex* spp. - *Cercocarpus* spp. - *Ephedra* spp. Intermountain Basins Sparse Vegetation Group

***Common (Translated Scientific) Name:** Saltbush species - Mountain-mahogany species - Joint-fir species Intermountain Basins Sparse Vegetation Group

***Colloquial Name:** Intermountain Basins Cliff, Scree & Badland Sparse Vegetation

***Type Concept:** This group consists of barren and sparsely vegetated cliffs, scree slopes, badlands and other similar areas from a variety of landscapes in the interior western U.S. from eastern Washington and Oregon, the Columbia Plateau south to the Great Basin and Colorado Plateau, east into Wyoming basins and plains. Characteristic shrub species in lower elevation semi-desert, lava field, and badland areas include *Artemisia pedatifida*, *Artemisia tridentata*, *Atriplex canescens*, *Atriplex confertifolia*, *Atriplex corrugata*, *Atriplex gardneri*, *Ephedra* spp., *Eriogonum corymbosum*, *Eriogonum heermannii*, *Eriogonum ovalifolium*, *Fallugia paradoxa*, *Grayia spinosa*, *Purshia tridentata*, *Salvia dorrii*, and *Sarcobatus vermiculatus*. Characteristic herbs include species of *Achnatherum*, *Comissonia*, *Cleome*, *Eriogonum*, and *Mentzelia*. Foothill sites include *Pinus edulis* and *Pinus ponderosa* (Colorado Plateau), *Pinus monophylla*, *Pinus longaeva* (Great Basin), *Juniperus osteosperma*, *Cercocarpus intricatus*, and *Cercocarpus ledifolius*. At montane and subalpine elevations, scattered trees may be present, such as *Abies concolor*, *Picea engelmannii*, *Pinus flexilis*, *Pinus ponderosa*, and *Pseudotsuga menziesii*. Shrubs may include *Arctostaphylos patula*, *Artemisia tridentata*, *Cercocarpus ledifolius*, *Ephedra* spp., *Holodiscus* spp., *Ivesia* sp., and *Purshia tridentata*. Landforms include cliffs and canyon sides, mesas and plateaus, and mountains. Sparse vegetation also occurs on special substrates such as shale outcrops, badlands and volcanic deposits such as lava, cinder, ash, tuff and basalt dikes. Rock substrates include bedrock, slickrock, and unstable talus and scree slopes. Some substrates, such as marine shales, are strongly alkaline and/or saline which chemically limits plant growth. Active substrates such as scree slopes are difficult sites for plants to grow. Physical properties of substrates may also limit plant growth. Some massive rock substrates lack cracks where vascular plants can root. Badland sites often have heavy clay soils that reduce water infiltration increasing erosion rates and reducing soil moisture for plants. Vegetation is variable depending on environmental variables of the sites, which range from relatively low-elevation semi-desert to subalpine cliffs and rock outcrops. Lower elevation sites often have herbaceous or shrub species present, whereas foothill, montane and subalpine sites may also include trees. Most of the species also occur in non-sparse vegetation groups. However, some of the sites with harsh soil properties have a high number of endemic perennial species.

***Diagnostic Characteristics:** Diagnostic characteristics of this lithomorphic group are barren to sparsely vegetation substrates and its geographic location, which is the intermountain western U.S. However, it is often composed of a mix of woody vegetation, especially shrubs and herbs (particularly cushion plants), although either may be absent on a given site.

***Classification Comments:** This group is very diverse floristically and so it is difficult to determine indicator species. More diagnostic is the sparse cover of vascular plants and/or presence and sometimes dominance of nonvascular (lichen) species. This broadly defined lithomorphic group was developed by NatureServe. M. Reid (9-13): I am removing dune communities from this group; they are now placed in ~Intermountain Sparsely Vegetated Dune Scrub & Grassland Group (G775)\$. We need to revisit and get clear on criteria for differentiating this group from other vegetated groups. Generally this group is conceived of as sparsely vegetated associations occurring on rocky or badland substrates.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G569 | North American Warm Semi-Desert Cliff, Scree & Pavement Sparse Vegetation | |
| G567 | Great Plains Cliff, Scree & Rock Vegetation | |
| G565 | Rocky Mountain Cliff, Scree & Rock Vegetation | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This lithomorphic group may be composed of woody plants, including both trees and shrubs, herbaceous plants, and/or nonvascular plants. Shrubs are especially common and were chosen as indicator species, however, herbs, especially cushion plants, and nonvasculars such as mosses or lichens may be more common.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This group consists of sparsely vegetated substrates which are variable depending on environmental factors of the sites. Sites range from relatively low-elevation semi-desert to subalpine cliffs and rock outcrops. Lower elevation sites often have herbaceous or shrub species present, whereas foothill, montane and subalpine sites may also include trees. Most of the species also occur in non-sparse vegetation groups. However, some of the sites with harsh soil properties have a high number of endemic perennial species (Welsh 1979, Welsh and Chatterly 1985). Characteristic shrub species in lower elevation semi-desert, lava field, and badland areas include *Artemisia pedatifida*, *Artemisia tridentata*, *Atriplex canescens*, *Atriplex confertifolia*, *Atriplex corrugata*, *Atriplex gardneri*, *Ephedra* spp., *Eriogonum corymbosum*, *Eriogonum heermannii*, *Eriogonum ovalifolium*, *Fallugia paradoxa*, *Grayia spinosa*, *Purshia tridentata*, *Salvia dorrii*, and *Sarcobatus vermiculatus*. Characteristic herbs include species of *Achnatherum*, *Camissonia*, *Cleome*, *Eriogonum*, and *Mentzelia*. Foothill sites include *Pinus edulis* and *Pinus ponderosa* (Colorado Plateau), *Pinus monophylla*, *Pinus longaeva* (Great Basin), *Juniperus osteosperma*, *Cercocarpus intricatus*, *Cercocarpus ledifolius*, and *Ephedra* spp. At montane and subalpine elevations, scattered trees may be present, such as *Pinus ponderosa*, *Pinus flexilis*, *Abies concolor*, *Pseudotsuga menziesii*, and *Picea engelmannii*. Shrubs may include *Arctostaphylos patula*, *Artemisia tridentata*, *Cercocarpus ledifolius*, *Ephedra* spp., *Holodiscus* spp., and *Purshia tridentata*.

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Following wildfire, various associations which are typically woodland and shrubland will have transitional stages that are sparsely vegetated. *Populus tremuloides* will slowly re-colonize steep, unstable talus and scree slopes following ten-year-old forest fires in Great Basin National Park, although the seral community is transitional.

ENVIRONMENT

Environmental Description: This group consists of barren and sparsely vegetated substrates from a variety of landscapes in the interior western U.S. from the Columbia Plateau south to the Great Basin and Colorado Plateau, east into Wyoming basins and plains. Landforms include cliffs and canyon sides, mesas and plateaus, and mountains. Sparse vegetation also occurs on special substrates such as shale outcrops, active sand dunes, badlands and volcanic deposits such as lava, cinder, ash, tuff and basalt dikes. Rock substrates include bedrock and unstable talus and scree slopes. Some substrates, such as marine shales, are strongly alkaline and/or saline which chemically limits plant growth. Active substrates such as scree slopes are difficult sites for plants to grow. Physical properties of substrates may also limit plant growth. Some massive rock substrates lack cracks where vascular plants can root. Badland sites often have heavy clay soils that reduce water infiltration increasing erosion rates and reducing soil moisture for plants.

DISTRIBUTION

***Geographic Range:** This sparsely vegetated group occurs in the interior western U.S. from the Columbia Plateau south to the Great Basin and Colorado Plateau, east into Wyoming basins and plains.

Nations: US

States/Provinces: AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY

USFS Ecoregions (2007) [optional]:

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:** Cover values are strongly dependent on plot placement and size and could benefit from sampling with plot sizes larger than 0.5 hectare. Minimum mapping unit requirements in national parks tend to differentially select larger patches of vegetation in otherwise sparsely vegetated bedrock, talus and scree slopes. The resulting stands may fall into sparse shrubland, shrubland, wooded shrubland, sparse woodland, wooded herbaceous vegetation and shrub herbaceous vegetation physiognomic groups, but actually represent patches of higher cover in what is predominately a sparsely vegetated landscape.

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low

USNVC Confidence Comments [optional]:

HIERARCHY

*Lower Level NVC Types:

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A4053 | <i>Eriogonum ovalifolium</i> - <i>Fallugia paradoxa</i> - <i>Andropogon hallii</i> Lava & Cinder Sparse Vegetation Alliance |
| A4051 | <i>Pinus ponderosa</i> - <i>Cercocarpus intricatus</i> Bedrock Cliff & Canyon Wooded Scrub Alliance |
| A4052 | <i>Ephedra</i> spp. - <i>Leymus salinus</i> - <i>Eriogonum corymbosum</i> Badlands Cold Desert Sparse Vegetation Alliance |
| A4050 | <i>Ephedra viridis</i> - <i>Chrysothamnus viscidiflorus</i> - <i>Rhus trilobata</i> Talus Sparse Scrub Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

*Recent Concept Lineage [if applicable]:

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|------------------------------------|----------------|------|
| >< | Pinyon - Juniper: 239 | Eyre 1980 | |
| >< | Littleleaf Mountain-Mahogany (417) | Shiflet 1994 | |

AUTHORSHIP

*Primary Concept Source [if applicable]: K.A. Schulz, in Faber-Langendoen et al.

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

*Author of Description: K.A. Schulz, M.S. Reid and G. Kittel

Acknowledgments [optional]:

Version Date: 06 Nov 2015

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Welsh, S. L., and L. M. Chatterly. 1985. Utah's rare plants. *Great Basin Naturalist* 45(2):173-236.

4.B.1.Nb. Western North American Alpine Tundra (D043)

M099. Rocky Mountain-Sierran Alpine Tundra

4. Polar & High Montane Scrub, Grassland & Barrens

4.B.1.Nb. Western North American Alpine Tundra

G316. Rocky Mountain-Sierran Alpine Dwarf-shrubland & Krummholz

Type Concept Sentence: This widespread group occurs above upper timberline throughout the Rocky Mountains cordillera and includes alpine areas of mountain ranges in Utah and Nevada, the Sierra Nevada in California, eastern Cascade Range in eastern Oregon and Washington, and north into Canada, but is more prominent in the northern extent. It is composed of low-statured shrubs such as *Cassiope mertensiana*, *Dryas integrifolia*, *Dryas octopetala*, *Phyllodoce empetriformis*, *Salix arctica*, *Salix reticulata*, or *Salix vestita* with or without an herbaceous component.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 4.B.1.Nb.2. Rocky Mountain-Sierran Alpine Tundra (M099)

Elcode: G316

***Scientific Name:** *Dryas octopetala* - *Phyllodoce* spp. - *Salix arctica* Alpine Dwarf-shrubland & Krummholz Group

***Common (Translated Scientific) Name:** Eight-petal Mountain-avens - Mountain-heath species - Arctic Willow Alpine Dwarf-shrubland & Krummholz Group

***Colloquial Name:** Rocky Mountain-Sierran Alpine Dwarf-shrubland & Krummholz

***Type Concept:** This widespread group occurs above upper timberline throughout the Rocky Mountains cordillera and includes alpine areas of ranges in Utah and Nevada, Sierra Nevada in California, eastern Cascade Range, eastern Oregon and Washington, and north into Canada, but is more prominent in the northern extent. The vegetation is characterized by a semi-continuous layer of ericaceous dwarf-shrubs or dwarf willows which form a heath type ground cover less than 0.5 m in height. Dense tufts of graminoids and scattered forbs are usually present. *Dryas integrifolia*- and *Dryas octopetala*-dominated communities occur on more windswept and drier sites than the heath communities. Within the heath communities *Cassiope mertensiana*, *Phyllodoce empetriformis*, *Salix arctica*, *Salix reticulata*, or *Salix vestita* can be dominant shrubs. Other common shrub associates include *Arctostaphylos uva-ursi*, *Dasiphora fruticosa* ssp. *floribunda*, *Ericameria discoidea*, *Kalmia microphylla*, *Ledum glandulosum*, *Phyllodoce glanduliflora*, *Ribes montigenum*, and *Vaccinium* spp. The herbaceous layer is a mixture of forbs and graminoids, especially sedges, including *Antennaria lanata*, *Caltha leptosepala*, *Carex spectabilis*, *Carex nigricans*, *Castilleja* spp., *Deschampsia cespitosa*, *Erigeron* spp., *Erythronium* spp., *Juncus parryi*, *Luetkea pectinata*, *Luzula piperi*, *Oreostemma alpigenum* (= *Aster alpigenuus*), *Pedicularis* spp., *Polemonium viscosum*, and *Polygonum bistortoides*. This group occurs in areas of level or concave glacial topography, with late-lying snow and subirrigation from surrounding slopes. Elevations are above 3360 m in the Colorado Rockies but drop to less than 2100 m in northwestern Montana and in the mountains of Alberta. Soils have become relatively stabilized in these sites, are moist but well-drained, strongly acidic, and often with substantial peat layers. Vegetation in these areas is controlled by snow retention, wind desiccation, permafrost, and a short growing season.

***Diagnostic Characteristics:** This alpine group is characterized by a semi-continuous layer of ericaceous dwarf-shrubs or dwarf willows which form a heath type ground cover less than 0.5 m in height. Characteristic species include drier site *Dryas integrifolia* and *Dryas octopetala* to the more typical mesic heath communities dominated by *Cassiope mertensiana*, *Phyllodoce empetriformis*, *Ribes montigenum*, *Salix arctica*, *Salix reticulata*, or *Salix vestita* with *Arctostaphylos uva-ursi*, *Kalmia microphylla*, *Ledum glandulosum*, *Phyllodoce glanduliflora*, and *Vaccinium* spp. present to codominant. Wider-ranging shrubs will be codominated by

diagnostic alpine herbaceous species.

***Classification Comments:** This group is more distinct in the mesic northern extent than in the southern and drier ranges in the Great Basin and Colorado Plateau. In the northern extent, the dwarf-shrub layers tend to be denser and characterized by distinctive alpine heath species *Cassiope mertensiana*, *Phyllodoce empetriformis*, *Salix glauca*, and *Salix reticulata*. In the southern extent, stands dominated by *Salix arctica*, *Salix reticulata*, or *Salix nivalis* are less distinctive and occur as patches within the alpine turf or mesic bands around snowbeds (Cooper et al. 1997).

The diagnostic species in this physiognomically defined alpine group occur on a variety of sites. *Dryas octopetala* and *Dryas integrifolia* often occur on harsh wind-blown sites on dry turf, cushion plant fell-fields or unstable scree slopes, whereas the heath types of *Cassiope mertensiana*, *Salix reticulata*, or *Phyllodoce empetriformis* occur as snowbed or wetland communities (Cooper et al. 1997). Some of the dwarf *Salix* species, such as *Salix arctica*, form mesic patches within the larger alpine turf communities (Lewis 1970, Zwinger and Willard 1996, Cooper et al. 1997).

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G271 | Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow | |
| G520 | Vancouverian-Rocky Mountain Subalpine-Alpine Snowbed, Wet Meadow & Dwarf-shrubland | |
| G320 | North Pacific Alpine-Subalpine Tundra | |
| G317 | North Pacific Alpine-Subalpine Dwarf-shrubland & Heath | |
| G314 | Rocky Mountain-Sierran Alpine Turf & Fell-field | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group is characterized by a semi-continuous layer of ericaceous dwarf-shrubs or dwarf willows which form a heath type ground cover less than 0.5 m in height. Dense tufts of graminoids and scattered forbs may occur forming an herbaceous layer.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: The vegetation is characterized by a semi-continuous layer of ericaceous dwarf-shrubs or dwarf willows which form a heath type ground cover less than 0.5 m in height. Dense tufts of graminoids and scattered forbs are usually present. *Dryas integrifolia*- and *Dryas octopetala*-dominated communities occur on more windswept and drier sites than the heath communities. Within the heath communities *Cassiope mertensiana*, *Phyllodoce empetriformis*, *Salix arctica*, *Salix reticulata*, or *Salix vestita* can be dominant shrubs. Other common shrub associates include *Arctostaphylos uva-ursi*, *Dasiphora fruticosa ssp. floribunda*, *Ericameria discoidea*, *Kalmia microphylla*, *Ledum glandulosum*, *Phyllodoce glanduliflora*, *Ribes montigenum*, and *Vaccinium* spp. The herbaceous layer is a mixture of forbs and graminoids, especially sedges, including *Antennaria lanata*, *Calamagrostis breweri*, *Caltha leptosepala*, *Carex spectabilis*, *Carex nigricans*, *Carex rupestris*, *Castilleja* spp., *Deschampsia cespitosa*, *Erigeron* spp., *Erythronium* spp., *Geum rossii*, *Juncus parryi*, *Luetkea pectinata*, *Luzula piperi*, *Oreostemma alpigenum* (= *Aster alpigenus*), *Pedicularis* spp., *Polemonium viscosum*, *Polygonum bistortoides*, *Polygonum viviparum*, and *Sibbaldia procumbens*. Floristic information was compiled from Bamberg (1961), Willard (1963), Bamberg and Major (1968), Lewis (1970), Komarkova (1976, 1980), Zwinger and Willard (1996), Cooper et al. (1997), and Billings (2000).

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:

ENVIRONMENT

Environmental Description: This widespread group occurs above upper timberline throughout the Rocky Mountain cordillera, including alpine areas of ranges in Utah and Nevada, and north into Canada, but is more prominent in the northern extent. Elevations are above 3360 m in the Colorado Rockies but drop to less than 2100 m in northwestern Montana and in the mountains

of Alberta. This group occurs in areas of level or concave glacial topography, with late-lying snow and subirrigation from surrounding slopes. Soils have become relatively stabilized in these sites, are moist but well-drained, strongly acidic, and often have substantial peat layers.

DISTRIBUTION

***Geographic Range:** This group occurs above upper timberline throughout the Rocky Mountain cordillera, including alpine areas of ranges in Utah and Nevada, eastern Cascade Range, eastern Oregon and Washington, and north into Canada.

Nations: CA, US

States/Provinces: AB, BC, CO, ID, MT, NM, NV, OR, UT, WA, WY

USFS Ecoregions (2007) [optional]: 331J:CC, 341G:PP, 342J:PP, M242B:CC, M242C:C?, M242D:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CP, M332E:CC, M332F:CC, M332G:CP, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M341A:PP, M341B:PP, M341C:PP

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3175 | <i>Ribes cereum</i> - <i>Ribes montigenum</i> - <i>Dasiphora fruticosa</i> ssp. <i>floribunda</i> Alpine Shrubland Alliance |
| A3177 | <i>Phyllodoce empetriformis</i> - <i>Phyllodoce glanduliflora</i> / <i>Sibbaldia procumbens</i> Alpine Snowbed Dwarf-shrubland Alliance |
| A3640 | <i>Abies lasiocarpa</i> - <i>Picea engelmannii</i> - <i>Pinus flexilis</i> Dry-Mesic Rocky Mountain Krummholz Alliance |
| A3178 | <i>Dryas integrifolia</i> - <i>Dryas octopetala</i> - <i>Arctostaphylos uva-ursi</i> Rocky Mountain Fell-field Dwarf-shrubland Alliance |
| A3176 | <i>Salix arctica</i> - <i>Salix nivalis</i> - <i>Salix reticulata</i> Alpine Dwarf-shrubland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| > | Alpine Rangeland (410) | Shiflet 1994 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** K.A. Schulz, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz

Acknowledgments [optional]:

Version Date: 09 Nov 2015

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***References [Required if used in text]:**

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- Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2017a. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]
- Komarkova, V. 1976. Alpine vegetation of the Indian Peaks Area, Front Range, Colorado Rocky Mountains. Unpublished dissertation, University of Colorado, Boulder. 655 pp.
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- Lewis, M. E. 1970. Alpine rangelands of the Uinta Mountains, Ashley and Wasatch national forests, Region 4 of the USDA Forest Service. Unpublished report mimeographed for USDA Forest Service, Region IV, Ogden, UT. 75 pp.
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- Willard, B. E. 1963. Phytosociology of the alpine tundra of Trail Ridge, Rocky Mountain National Park, Colorado. Unpublished dissertation, University of Colorado, Boulder.
- Zwinger, A. H., and B. E. Willard. 1996. *Land above the trees: A guide to American alpine tundra*. Johnson Books, Boulder, CO. 425 pp.

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4. Polar & High Montane Scrub, Grassland & Barrens
4.B.1.Nb. Western North American Alpine Tundra

G314. Rocky Mountain-Sierran Alpine Turf & Fell-field

Type Concept Sentence: This wide-ranging group includes both wind-scoured fell-fields and dry turf in alpine sites throughout the Rocky Mountains cordillera, high mountain ranges and plateaus in Utah and Nevada, the Sierra Nevada in California, high mountains of eastern Oregon and Washington, and isolated alpine sites in the northeastern Cascades. It is composed of open to moderately dense or dense herbaceous cover dominated by cushion plants (fell-fields), graminoids (turf), or a mixture of forbs and graminoids.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 4.B.1.Nb.2. Rocky Mountain-Sierran Alpine Tundra (M099)

Elcode: G314

***Scientific Name:** *Carex elynoides* - *Kobresia myosuroides* - *Phlox pulvinata* Alpine Turf & Fell-field Group

***Common (Translated Scientific) Name:** Blackroot Sedge - Bellardi Bog Sedge - Cushion Phlox Alpine Turf & Fell-field Group

***Colloquial Name:** Rocky Mountain-Sierran Alpine Turf & Fell-field

***Type Concept:** This wide-ranging, alpine group includes both wind-scoured fell-fields and dry turf in alpine sites throughout the Rocky Mountains cordillera, high mountain ranges and plateaus in Utah and Nevada, the Sierra Nevada in California, high mountains of eastern Oregon and Washington, and isolated alpine sites in the northeastern Cascades. The vegetation is generally composed of low-growing perennial forbs and graminoids. On fell-field sites, total vegetation cover ranges from sparse to moderate cover dominated by cushion plants, whereas on turf sites, it ranges from open to moderately dense or dense cover dominated by graminoids or a mixture of graminoids and forbs (especially cushion plants). The graminoids are typically rhizomatous, sod-forming sedges such as *Carex elynoides*, *Carex helleri*, *Carex scirpoidea*, *Carex siccata*, *Carex nardina*, *Carex rupestris*, *Kobresia myosuroides*, and *Linanthus pungens* (= *Leptodactylon pungens*). Common fell-field species include *Arenaria capillaris*, *Erigeron pygmaeus*, *Eriogonum incanum*, *Geum rossii*, *Hulsea algida*, *Minuartia obtusiloba*, *Myosotis asiatica*, *Paronychia pulvinata*, *Phacelia hastata* var. *compacta*, *Phlox covillei*, *Phlox pulvinata*, *Saxifraga tolmiei*, *Silene acaulis*, *Trifolium dasyphyllum*, and *Trifolium parryi*. Many other graminoids, forbs, and prostrate shrubs can also be found, including *Calamagrostis purpurascens*, *Deschampsia cespitosa*, *Dryas octopetala*, *Ericameria discoidea*, *Festuca brachyphylla*, *Festuca idahoensis*, *Leucopoa kingii*, *Luzula spicata*, *Poa arctica*, *Poa glauca*, *Poa secunda* (Great Basin), *Podistera nevadensis*, *Polygonum bistortoides*, *Saxifraga* spp., *Selaginella densa*, and *Solidago* spp. Fell-fields are usually found within or adjacent to alpine dry turf with many of the same prostrate and mat-forming plants found in both, frequently with broad transition zones. Great Basin alpine areas tend to be drier with smaller turf patches and include some species common in desert scrub such as *Elymus elymoides* and *Poa secunda*. Vegetation in these areas is controlled by snow retention, wind

desiccation, permafrost, and a short growing season. Fell-fields are typically free of snow during the winter as they are found on ridgetops, upper slopes and exposed saddles, whereas dry turf is found on gentle to moderate slopes, flat ridges, valleys, and basins where the soil has become relatively stabilized and the water supply is more-or-less constant. Fell-field substrates are generally shallow, stony, low in organic matter, and poorly developed with wind deflation often resulting in a gravelly pavement. Alpine turf sites have deeper, more developed soils, although there may be moderately high cover of cobbles and boulders present. Although alpine dry turf may form the matrix or large patches of the alpine zone, it typically intermingles with alpine bedrock and scree, ice field, fell-field, alpine dwarf-shrubland, and alpine/subalpine wet meadow systems.

***Diagnostic Characteristics:** This alpine group is characterized by dominance of low-growing herbaceous perennial plants, including graminoids *Carex elynoides*, *Carex helleri*, *Carex scirpoidea*, *Carex siccata*, *Carex nardina*, *Carex rupestris*, *Festuca brachyphylla*, *Kobresia myosuroides*, *Leptodactylon pungens*, *Luzula spicata*, *Poa arctica*, and *Poa glauca*, forbs such as *Arenaria capillaris*, *Erigeron pygmaeus*, *Eriogonum incanum*, *Geum rossii*, *Hulsea algida*, *Minuartia obtusiloba*, *Myosotis asiatica*, *Paronychia pulvinata*, *Phacelia hastata* var. *compacta*, *Phlox covillei*, *Phlox pulvinata*, *Podistera nevadensis*, *Polygonum bistortoides*, *Raillardella argentea*, *Saxifraga tolmiei*, *Selaginella densa*, *Silene acaulis*, *Solidago* spp., *Trifolium dasyphyllum*, and *Trifolium parryi*. Scattered low shrubs may be present such as *Dryas octopetala* and *Ericameria discoidea*.

***Classification Comments:** Alpine turf and fell-field are included together for several reasons. Although these types can be quite different and can have relatively abrupt boundaries in saddles, there is often a long transition on broad alpine slopes.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G317 | North Pacific Alpine-Subalpine Dwarf-shrubland & Heath | |
| G316 | Rocky Mountain-Sierran Alpine Dwarf-shrubland & Krummholz | |
| G320 | North Pacific Alpine-Subalpine Tundra | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The vegetation is a sparse to dense, low-growing herbaceous layer dominated by perennial forbs and/or graminoids.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: On fell-field sites, total vegetation cover ranges from sparse to moderate cover (15-50%) and is dominated by cushion plants, whereas on turf sites, it ranges from open to moderately dense or dense cover dominated by graminoids or a mixture of graminoids and forbs (especially cushion plants). The graminoids are typically rhizomatous, sod-forming sedges such as *Carex elynoides*, *Carex helleri*, *Carex scirpoidea*, *Carex siccata*, *Carex nardina*, *Carex rupestris*, *Kobresia myosuroides*, and *Linanthus pungens* (= *Leptodactylon pungens*). Most fell-field plants are cushioned or matted, frequently succulent, flat to the ground in rosettes, and often densely haired and thickly cutinized. Common species include *Arenaria capillaris*, *Erigeron pygmaeus*, *Eriogonum incanum*, *Geum rossii*, *Hulsea algida*, *Minuartia obtusiloba*, *Myosotis asiatica*, *Paronychia pulvinata*, *Phacelia hastata* var. *compacta*, *Phlox covillei*, *Phlox pulvinata*, *Saxifraga tolmiei*, *Silene acaulis*, *Trifolium dasyphyllum*, and *Trifolium parryi*. Many other graminoids, forbs, and prostrate shrubs can also be found, including *Calamagrostis purpurascens*, *Deschampsia cespitosa*, *Dryas octopetala*, *Ericameria discoidea*, *Festuca brachyphylla*, *Festuca idahoensis*, *Leucopoa kingii*, *Luzula spicata*, *Poa arctica*, *Poa glauca*, *Poa secunda* (Great Basin), *Podistera nevadensis*, *Polygonum bistortoides*, *Raillardella argentea*, *Saxifraga* spp., *Selaginella densa*, and *Solidago* spp. Fell-fields are usually found within or adjacent to alpine dry turf with many of the same prostrate and mat-forming plants found in both, frequently with broad transition zones. Great Basin alpine areas tend to be drier with smaller turf patches and include some species common in desert scrub such as *Elymus elymoides* and *Poa secunda*. Although alpine dry tundra is the matrix of the alpine zone, it typically intermingles with alpine bedrock and scree, ice field, fell-field, alpine dwarf-shrubland, and alpine/subalpine wet meadow systems. Floristic information was compiled from Bamberg (1961), Willard (1963), Bamberg and Major (1968), Komarkova (1976, 1980), Baker (1980a), Zwinger and Willard (1996), Cooper et al. (1997), and Billings (2000).

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:**ENVIRONMENT**

Environmental Description: This widespread group occurs at and above upper treeline throughout the Rocky Mountains cordillera and alpine areas of mountain ranges in Utah and Nevada, Sierra Nevada in California, and in isolated alpine sites in the northeastern Cascades. It includes both wind-scoured fell-fields and dry turf. Fell-fields are typically free of snow during the winter as they are found on ridgetops, upper slopes and exposed saddles, whereas dry turf is found on gentle to moderate slopes, flat ridges, valleys, and basins where the soil has become relatively stabilized and the water supply is more-or-less constant. Vegetation in these areas is controlled by snow retention, wind desiccation, permafrost, and a short growing season. Fell-field substrates are generally shallow, stony, low in organic matter, and poorly developed with wind deflation often resulting in a gravelly pavement. Alpine turf sites have deeper, more developed soils, although there may be moderately high cover of cobbles and boulders present.

DISTRIBUTION

***Geographic Range:** This group occurs above upper treeline throughout the North American Rocky Mountain cordillera, including alpine areas of ranges in the Great Basin, and isolated alpine sites in the northeastern Cascades, and high mountains of eastern Oregon and Washington.

Nations: CA, US

States/Provinces: AB, AZ, BC, CO, ID, MT, NM, NV, OR, UT, WA, WY

USFS Ecoregions (2007) [optional]: 331J:CC, 341E:PP, 341G:PP, 342B:PP, 342J:PP, M242B:CP, M242C:CC, M242D:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CP, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M341A:CC, M341B:CP, M341C:CC, M341D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3363 | <i>Phlox covillei</i> - <i>Ericameria discoidea</i> Alpine Fell-field Alliance |
| A3365 | <i>Carex helleri</i> Alpine Meadow Alliance |
| A3155 | <i>Carex elynoides</i> - <i>Carex rupestris</i> - <i>Kobresia myosuroides</i> Rocky Mountain Alpine Turf Alliance |
| A3154 | <i>Minuartia obtusiloba</i> - <i>Paronychia pulvinata</i> - <i>Silene acaulis</i> Alpine Fell-field Alliance |
| A3172 | <i>Juncus drummondii</i> - <i>Juncus parryi</i> - <i>Sibbaldia procumbens</i> Rocky Mountain Alpine Snowbed Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------------|---|-------------------------------------|
| 2014-11-18 | G363 Calamagrostis breweri - Carex filifolia - Eriogonum incanum Herbaceous Vegetation Group | G363 concept covered by G271 & G314 |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| > | Alpine Rangeland (410) | Shiflet 1994 | |

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|---------------------------------------|-------------------------------|------|
| > | AT Alpine Tundra (mesic to dry sites) | Ecosystems Working Group 1998 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** K.A. Schulz, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz

Acknowledgments [optional]:

Version Date: 09 Nov 2015

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***References [Required if used in text]:**

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- Bamberg, S. A., and J. Major. 1968. Ecology of the vegetation and soils associated with calcareous parent materials in three alpine regions of Montana. *Ecological Monographs* 38(2):127-167.
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- Komarkova, V. 1976. Alpine vegetation of the Indian Peaks Area, Front Range, Colorado Rocky Mountains. Unpublished dissertation, University of Colorado, Boulder. 655 pp.
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4. Polar & High Montane Scrub, Grassland & Barrens

4.B.1.Nb. Western North American Alpine Tundra

G571. Rocky Mountain & Sierran Alpine Bedrock & Scree

Type Concept Sentence: This barren and sparsely vegetated alpine group consists of exposed rock and rubble at or above the upper treeline in the Rocky Mountains, from Alberta and British Columbia, Canada, south into New Mexico, and west into the highest mountain ranges of the Great Basin, eastern Oregon and Washington, and the Sierra Nevada.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 4.B.1.Nb.2. Rocky Mountain-Sierran Alpine Tundra (M099)

Elcode: G571

***Scientific Name:** *Dryas octopetala* - *Saxifraga* spp. Rocky Mountain Alpine Bedrock & Scree Group

***Common (Translated Scientific) Name:** Eight-petal Mountain-avens - Saxifrage species Rocky Mountain Alpine Bedrock & Scree Group

***Colloquial Name:** Rocky Mountain & Sierran Alpine Bedrock & Scree

***Type Concept:** This alpine group consists of exposed rock and rubble at or above the upper treeline in the Rocky Mountains, from Alberta and British Columbia, Canada, south into New Mexico, and west into the highest mountain ranges of the Great Basin, eastern Oregon and Washington, and the Sierra Nevada. It is composed of barren and sparsely vegetated alpine substrates, typically including bedrock outcrops, talus and scree slopes, upper mountain slopes, and summits. Vascular plants growing on loose substrates typically have either an extensive shallow root and rhizome system or a massive taproot that anchors the plant. Sparse cover of forbs, grasses, low shrubs and small trees may be present with total vascular plant cover typically less than 25% due to the high cover of exposed rock. Many species are tiny, growing in cracks in rock outcrops. Nonvascular (lichen)-dominated communities are common and may greatly exceed 25% cover in some areas. The lower elevational limit for the alpine zone varies with latitude ranging from near 3660 m (12,000 feet) in the southern extent to near 2286 m (7500 feet) in the northern extent. Exposure to desiccating winds, rocky and sometimes unstable substrates, and a short growing season limit vascular plant growth.

***Diagnostic Characteristics:**

***Classification Comments:** This group is composed of sparse cover of alpine plants sometimes with abundant nonvascular (lichen) cover. Because it occurs on rock outcrops, it may occur as inclusions within the more extensive ~Rocky Mountain-Sierran Alpine Turf & Fell-Field Group (G314)\$\$.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G319 | North Pacific Alpine-Subalpine Bedrock & Scree | |
| G565 | Rocky Mountain Cliff, Scree & Rock Vegetation | |
| G318 | North Vancouverian Montane Bedrock, Cliff & Talus Vegetation | |

Similar NVC Types General Comments [optional]:**VEGETATION**

Physiognomy and Structure Summary: This group includes sparsely vegetated and nonvascular-dominated rocks growing above upper treeline.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This group is composed of barren and sparsely vegetated alpine substrates. Exposure to desiccating winds, rocky and sometimes unstable substrates, and a short growing season limit vascular plant growth. Vascular plants growing on loose substrates typically have either an extensive shallow root and rhizome system or a massive taproot that anchors the plant. Sparse cover of forbs, grasses, low shrubs and small trees may be present with total vascular plant cover typically less than 25% due to the high cover of exposed rock. Many species are tiny, growing in cracks in rock outcrops. Some characteristic species include *Dryas octopetala*, *Astragalus kentrophyta*, *Astragalus molybdenus* (= *Astragalus plumbeus*), *Collomia larsenii*, *Noccaea fendleri ssp. glauca* (= *Thlaspi alpestre*), *Townsendia leptotes*, *Townsendia rothrockii*, *Trisetum spicatum*, and alpine species of *Eriogonum* and *Phlox*. Other associated species include *Achillea millefolium*, *Besseyia alpina*, *Campanula rotundifolia*, *Festuca brachyphylla*, *Geum rossii*, *Heuchera parvifolia var. nivalis*, *Ionactis alpina*, *Luzula spicata*, *Minuartia nuttallii*, *Phacelia sericea*, *Poa lettermanii*, *Ranunculus pygmaeus*, *Saxifraga caespitosa ssp. delicatula*, *Senecio fremontii*, *Silene acaulis*, *Trifolium dasyphyllum*, and *Trisetum spicatum*. Characteristic species in the Sierra Nevada include *Achnatherum swallenii*, *Athyrium americanum*, *Carex perglobosa*, *Castilleja nana*, *Cirsium scopulorum*, *Hulsea algida*, *Ivesia cryptocaulis*, *Oxyria digyna*, *Polemonium viscosum*, *Saxifraga bronchialis*, *Saxifraga chrysantha*, *Saxifraga mertensiana*, *Saxifraga rivularis*, *Selaginella watsonii*, *Senecio taraxacoides*, *Silene acaulis*, and *Sphaeromeria argentea*. *Ericameria discoidea*, *Juniperus communis*, and *Ribes montigenum* are common shrub associates.

Nonvascular (lichen)-dominated communities are common and may greatly exceed 25% in cover in some areas. Lichens are diverse. Common lichens on boulderfields are *Buellia* sp., *Candelaria* sp., *Cladonia pyxidata*, *Lecidea atrobrunnea*, *Rhizocarpon geographicum*, *Rhizoplaca chrysoleuca* (= *Lecanora rubina*), *Umbilicaria proboscidea*, *Umbilicaria anthracina*, *Umbilicaria proboscidea*, *Xanthoparmelia conspersa* (= *Parmelia conspersa*), *Xanthoria elegans* (= *Caloplaca elegans*), and on late-melting snowbeds sites *Solorina crocea* (Zwinger and Willard 1996). Common and abundant bryophytes may include *Aulacomnium palustre*, *Bryum* spp., *Hypnum revolutum*, *Philonotis fontana*, *Pohlia* sp., *Polytrichastrum alpinum*, *Polytrichum piliferum*, and *Philonotis fontana var. pumila* (= *Philonotis tomentella*). Floristic information was compiled from Willard (1963), Komarkova (1976, 1980),

Zwinger and Willard (1996), and Cooper et al. (1997).

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Const-ancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|------------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Stands in the more xeric alpine in the Great Basin and southern Sierra Nevada include lower elevation semi-desert species such as *Poa secunda* and *Petrophyton caespitosum*.

ENVIRONMENT

Environmental Description: This alpine group consists of exposed rock and rubble at or above the upper treeline in the Rocky Mountains, from Alberta and British Columbia, Canada, south into New Mexico, and west into the highest mountain ranges of the Great Basin and the Sierra Nevada. The lower elevational limit for the alpine zone varies with latitude ranging from near 3660 m (12,000 feet) in the southern extent to near 2286 m (7500 feet) in the northern extent. The alpine zone in the Sierra Nevada begins at 3200 m (10,500) in the south and lower to 2895 m (9500 feet) in the northern extent (Zwinger and Willard 1996). The alpine zone extends further downslope on cooler north aspects. Exposure to desiccating winds, rocky and sometimes unstable substrates, and a short growing season limit vascular plant growth.

DISTRIBUTION

***Geographic Range:** This group is restricted to the highest elevations of the Rocky Mountains, from Alberta and British Columbia, Canada, south into New Mexico, and west into the highest mountain ranges of the Great Basin, eastern Oregon and Washington, and the Sierra Nevada.

Nations: CA, US

States/Provinces: AB, AZ, BC, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY

USFS Ecoregions (2007) [optional]: 331G:PP, 331J:P?, 341A:C?, 341B:CC, 341E:CP, 341F:CP, 341G:CC, 342A:CC, 342B:C?, 342C:C?, 342D:CP, 342H:C?, 342J:CP, M242D:PP, M313A:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CP, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M334A:??, M341A:CC, M341B:CC, M341C:CC, M341D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A4088 | <i>Polemonium</i> spp. - <i>Castilleja</i> spp. - <i>Trisetum</i> spp. Alpine Rock Alliance |
| A4022 | Rocky Mountain Alpine Nonvascular Bedrock & Scree Alliance |
| A4021 | Rocky Mountain Alpine Sparse Herb Bedrock & Scree Alliance |
| A3786 | Sierran Alpine Nonvascular Bedrock & Scree Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------------|---|-----------------------|
| 2014-11-17 | G572 <i>Arabis</i> spp. - <i>Draba</i> spp. Alpine Cliff, Scree & Rock Vegetation Group | G572 merged into G571 |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|--------------------------|------|
| >< | Alpine Rangeland (410) | Shiflet 1994 | |
| < | Talus and Scree Slopes | Zwinger and Willard 1996 | |
| < | Boulder Fields | Zwinger and Willard 1996 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** B.E. Willard (1963)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz

Acknowledgments [optional]:

Version Date: 09 Nov 2015

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M101. Vancouverian Alpine Tundra

4. Polar & High Montane Scrub, Grassland & Barrens
 4.B.1.Nb. Western North American Alpine Tundra

G317. North Pacific Alpine-Subalpine Dwarf-shrubland & Heath

Type Concept Sentence: This alpine dwarf-shrubland group occurs in the coastal mountains of the Pacific Northwest north into southeastern Alaska. The vegetation ranges from a sparse to near continuous cover of dwarf-shrubs (alpine heath) or dwarf-shrub-herbaceous meadows.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 4.B.1.Nb.3. Vancouverian Alpine Tundra (M101)

Elcode: G317

***Scientific Name:** *Empetrum nigrum* - *Phyllodoce empetriformis* - *Cassiope mertensiana* Alpine-Subalpine Dwarf-shrubland & Heath Group

***Common (Translated Scientific) Name:** Black Crowberry - Pink Mountain-heath - Western Moss-heather Alpine-Subalpine Dwarf-shrubland & Heath Group

***Colloquial Name:** North Pacific Alpine-Subalpine Dwarf-shrubland & Heath

***Type Concept:** This alpine dwarf-shrubland group occurs in the coastal mountains of the Pacific Northwest north into southeastern Alaska. The vegetation ranges from a sparse to near continuous cover of dwarf-shrubs (alpine heath) or dwarf-shrub-herbaceous meadows. Dominant dwarf-shrub species include *Cassiope mertensiana*, *Cassiope tetragona*, *Empetrum nigrum*, *Harrimanella stelleriana*, *Luetkea pectinata*, *Phyllodoce aleutica*, *Phyllodoce empetriformis*, and *Phyllodoce glanduliflora*. Other common species may include *Arctostaphylos uva-ursi*, *Dryas octopetala*, *Loiseleuria procumbens*, *Vaccinium uliginosum*, and *Vaccinium vitis-idaea*. Ericaceous species typically dominate, but sites dominated by *Salix arctica*, *Salix nivalis*, and *Salix reticulata* are included in this group. Scattered tall shrubs and dwarf trees may also be present. Common herbaceous species include *Aconitum delphinifolium*, *Anemone narcissiflora*, *Artemisia arctica*, *Carex macrochaeta*, *Castilleja unalaschcensis*, *Geranium erianthum*, *Lupinus nootkatensis*, *Sanguisorba canadensis*, *Saxifraga tolmiei*, *Valeriana sitchensis*, and *Viola* spp. On slopes on the outer coast and also in Kenai Fjords and Prince William Sound, *Nephrophyllidium crista-galli* is common. This group occurs above 2350 m (7200 feet) in the Klamath Mountains and Cascade Range north into the Coast Mountains of British Columbia where it is confined to the coldest, wind-blown areas above treeline and above the subalpine parkland. It occurs on slopes and depressions where snow lingers, the soil has become relatively stabilized, and the water supply is more-or-less constant, as well as on exposed summits, windswept ridges, and fell-fields that are much drier. Slopes vary from steep to flat. These sites are characterized by harsh environmental conditions.

***Diagnostic Characteristics:** This Pacific Northwest to Alaskan alpine dwarf-shrubland group is dominated or codominated by *Cassiope mertensiana*, *Cassiope tetragona*, *Empetrum nigrum*, *Harrimanella stelleriana*, *Luetkea pectinata*, *Phyllodoce aleutica*, *Phyllodoce empetriformis*, and *Phyllodoce glanduliflora*.

***Classification Comments:** This is a wide-ranging and variable alpine-subalpine dwarf-shrubland group.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G305 | Central Rocky Mountain-North Pacific High Montane Mesic Shrubland | |
| G271 | Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow | |
| G520 | Vancouverian-Rocky Mountain Subalpine-Alpine Snowbed, Wet Meadow & Dwarf-shrubland | |
| G316 | Rocky Mountain-Sierran Alpine Dwarf-shrubland & Krummholz | |
| G320 | North Pacific Alpine-Subalpine Tundra | |
| G314 | Rocky Mountain-Sierran Alpine Turf & Fell-field | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: This group is characterized by an open to closed dwarf-shrub canopy frequently dominated by Ericaceous species.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: The vegetation ranges from a sparse to moderately dense dwarf-shrub layer (alpine heath) or herbaceous meadows that may have some heath mixed in; however, in some areas dwarf-shrub cover is continuous. Vegetation is controlled by snow retention, wind desiccation, permafrost, and a short growing season. Dominant dwarf-shrub species include *Cassiope mertensiana*, *Cassiope tetragona*, *Empetrum nigrum*, *Harrimanella stelleriana*, *Luetkea pectinata*, *Phyllodoce aleutica*, *Phyllodoce empetriformis*, and *Phyllodoce glanduliflora*. Other common species may include *Loiseleuria procumbens*, *Vaccinium cespitosum*, *Vaccinium deliciosum*, *Vaccinium membranaceum*, *Vaccinium uliginosum*, and *Vaccinium vitis-idaea*. Ericaceous species typically dominate, but sites dominated by *Salix arctica*, *Salix nivalis*, and *Salix reticulata* are included in this group. Scattered tall shrubs and dwarf trees may also be present. Common herbaceous species include *Aconitum delphinifolium*, *Anemone narcissiflora*, *Artemisia arctica*, *Carex filifolia*, *Carex macrochaeta*, *Castilleja unalaschcensis*, *Festuca brachyphylla*, *Geranium erianthum*, *Lupinus latifolius*, *Lupinus nootkatensis*, *Oreostemma alpigenum*, *Sanguisorba canadensis*, *Saxifraga tolmiei*, *Valeriana sitchensis*, and *Viola* spp. On slopes on the outer coast and also in Kenai Fjords and Prince William Sound, *Nephrophyllidium crista-galli* is common. Dwarf-shrubs that typically occur on exposed summits, windswept ridges, and fell-fields are *Empetrum nigrum*, *Vaccinium uliginosum*, *Loiseleuria procumbens*, *Phyllodoce aleutica*, *Harrimanella stelleriana*, and *Luetkea pectinata*. Lichens may be common. Total vegetation cover ranges from 10 to 25%. Floristic information was compiled from Franklin and Dyrness (1973), Viereck et al. (1992), DeVelice et al. (1999), Billings (2000), and Boggs et al. (2008a).

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:**ENVIRONMENT**

Environmental Description: This group occurs above the environmental limit of trees, at the highest elevations of the mountain regions of the Pacific Northwest coast north to southeastern, maritime Alaska primarily on alpine and subalpine sites, but it can also be found at lower elevations (e.g., Kenai Fjords and Prince William Sound). It occurs above 2350 m (7200 feet) in the Klamath Mountains and Cascade Range north into the Coast Mountains of British Columbia where it is confined to the coldest, wind-blown areas above treeline and above the subalpine parkland. It occurs on slopes and depressions where snow lingers, the soil has become relatively stabilized, and the water supply is more or less constant. Vegetation in these areas is controlled by snow retention, wind desiccation, permafrost, and a short growing season. In Alaska, stands occur on sideslopes, shoulder slopes, and low summits, and the terrain varies from gently sloping to steep. This group also includes sparsely vegetated alpine stands that occur on exposed summits, windswept ridges, and fell-fields. These sites are characterized by harsh environmental conditions. Slopes vary from moderately sloped to flat.

DISTRIBUTION

***Geographic Range:** This alpine group occurs in the mountains of the Pacific Northwest coast north to southeastern, maritime Alaska primarily on alpine and subalpine sites, but it can also be found at lower elevations (e.g., Kenai Fjords and Prince William Sound).

Nations: CA, US

States/Provinces: AK, BC, CA, OR, WA

USFS Ecoregions (2007) [optional]: M242A:CC, M242B:CC, M242C:CC, M242D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3334 | <i>Phyllodoce aleutica</i> - <i>Harrimanella stelleriana</i> Alpine Dwarf-shrubland Alliance |
| A3332 | <i>Salix cascadenis</i> - <i>Salix nivalis</i> - <i>Salix reticulata</i> Alpine Dwarf-shrubland Alliance |
| A3330 | <i>Vaccinium cespitosum</i> - <i>Vaccinium membranaceum</i> - <i>Vaccinium scoparium</i> Cascadian Alpine Dwarf-shrubland Alliance |
| A4086 | <i>Arctostaphylos uva-ursi</i> Cascadian Alpine Dwarf-shrubland Alliance |
| A3333 | <i>Salix rotundifolia</i> - <i>Salix setchelliana</i> Alpine Dwarf-shrubland Alliance |
| A3335 | <i>Dryas drummondii</i> - <i>Dryas integrifolia</i> Alpine Dwarf-shrubland Alliance |
| A1078 | <i>Empetrum nigrum</i> Alpine Dwarf-shrubland Alliance |
| A3331 | <i>Phyllodoce empetriformis</i> - <i>Cassiope mertensiana</i> - <i>Vaccinium deliciosum</i> Alpine Dwarf-shrubland Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** K.A. Schulz, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz

Acknowledgments [optional]:

Version Date: 09 Nov 2015

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- Viereck, L. A., C. T. Dyrness, A. R. Batten, and K. J. Wenzlick. 1992. The Alaska vegetation classification. General Technical Report PNW-GTR286. USDA Forest Service, Pacific Northwest Research Station, Portland, OR. 278 pp.

4. Polar & High Montane Scrub, Grassland & Barrens

4.B.1.Nb. Western North American Alpine Tundra

G320. North Pacific Alpine-Subalpine Tundra

Type Concept Sentence: This mesic alpine and subalpine herbaceous meadow group occurs in the mountain regions of the Pacific Northwest coast north to the maritime and boreal transition regions of Alaska where the vegetation is characterized by a moderately dense to dense herbaceous layer, often composed of a mixture of graminoids such as *Calamagrostis canadensis*, *Carex* spp., *Festuca* spp. and many forbs.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 4.B.1.Nb.3. Vancouverian Alpine Tundra (M101)

Elcode: G320

***Scientific Name:** *Carex macrochaeta* - *Carex spectabilis* - *Phlox diffusa* ssp. *longistylis* Alpine-Subalpine Tundra Group

***Common (Translated Scientific) Name:** Longawn Sedge - Showy Sedge - Spreading Phlox Alpine-Subalpine Tundra Group

***Colloquial Name:** North Pacific Alpine-Subalpine Tundra

***Type Concept:** This mesic alpine and subalpine herbaceous meadow group occurs in the mountain regions of the Pacific Northwest coast north to the maritime and boreal transition regions of Alaska. The vegetation is characterized by a moderately dense to dense herbaceous layer, often composed of a mixture of graminoids such as *Calamagrostis canadensis* (often present but not dominant), *Carex breweri*, *Carex capitata*, *Carex macrochaeta*, *Carex nardina*, *Carex proposita*, *Carex spectabilis*, *Festuca brachyphylla*, *Festuca idahoensis ssp. roemerii* (= *Festuca roemerii*), and forbs such as *Arenaria capillaris*, *Aconitum delphiniifolium*, *Anemone narcissiflora*, *Artemisia arctica*, *Athyrium filix-femina*, *Castilleja unalaschcensis*, *Chamerion* spp., *Eriogonum pyrolifolium*, *Fritillaria camschatcensis*, *Geranium erianthum*, *Lupinus* spp., *Nephrophyllidium crista-galli*, *Packera cana*, *Pedicularis contorta*, *Phlox diffusa*, *Polemonium acutiflorum*, *Polygonum bistortoides*, *Sanguisorba canadensis*, *Saxifraga tolmiei*, *Senecio triangularis*, *Valeriana sitchensis*, and *Veratrum viride*. Some stands have an open herbaceous layer. Scattered dwarf-shrubs may be present with low cover. Stands occur above 2350 m (7200 feet) elevation in the Klamath Mountains and Cascade Range north into the Coast Mountains of British Columbia where it is confined to the coldest, wind-blown areas above treeline and above the subalpine parkland. The slope shape is usually straight to concave (depressions) where snow lingers, the soil has become relatively stabilized, and the water supply is more-or-less constant. Vegetation in these areas is controlled by snow retention, wind desiccation, permafrost, and a short growing season. The substrate is colluvium, residuum, or glacial till. The dominant disturbances are snow avalanche, soil creep and freeze-thaw action.

***Diagnostic Characteristics:** The group is characterized by a moderately dense to dense herbaceous layer, often composed of a mixture of mesic to wet alpine and subalpine graminoids and forbs from the Pacific Northwest and Alaska.

***Classification Comments:**

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G271 | Rocky Mountain-North Pacific Subalpine-Montane Mesic Grassland & Meadow | |
| G520 | Vancouverian-Rocky Mountain Subalpine-Alpine Snowbed, Wet Meadow & Dwarf-shrubland | |
| G314 | Rocky Mountain-Sierran Alpine Turf & Fell-field | |
| G317 | North Pacific Alpine-Subalpine Dwarf-shrubland & Heath | |
| G316 | Rocky Mountain-Sierran Alpine Dwarf-shrubland & Krummholz | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: The group is characterized by a moderately dense to dense herbaceous layer, often composed of a mixture perennial graminoids and forbs.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: The vegetation is characterized by a moderately dense to dense herbaceous layer, often composed of a mixture of graminoids such as *Calamagrostis canadensis* (often present but not dominant), *Carex breweri*, *Carex capitata*, *Carex macrochaeta*, *Carex nardina*, *Carex proposita*, *Carex spectabilis*, *Festuca brachyphylla*, *Festuca idahoensis ssp. roemerii* (= *Festuca roemerii*), and forbs such as *Arenaria capillaris*, *Aconitum delphiniifolium*, *Anemone narcissiflora*, *Artemisia arctica*, *Athyrium filix-femina*, *Castilleja unalaschcensis*, *Chamerion angustifolium* (= *Epilobium angustifolium*), *Chamerion latifolium*, *Eriogonum pyrolifolium*, *Fritillaria camschatcensis*, *Geranium erianthum*, *Lupinus arcticus*, *Lupinus nootkatensis*, *Lupinus sellulus*, *Nephrophyllidium crista-galli*, *Packera cana*, *Pedicularis contorta*, *Phlox diffusa*, *Polemonium acutiflorum*, *Polygonum bistortoides*, *Sanguisorba canadensis*, *Saxifraga tolmiei*, *Senecio triangularis*, *Valeriana sitchensis*, and *Veratrum viride*. Overall species composition is diverse, and species richness is often very high; typically no single species is dominant. However, some stands have a more open herbaceous layer. Scattered dwarf-shrubs may be present with low cover such as *Cassiope mertensiana*, *Phyllodoce empetriformis*, *Phyllodoce glanduliflora*, and *Luetkea pectinata*. Floristic information was compiled from Franklin and Dyrness (1973), Viereck et al. (1992), DeVelice et al. (1999), Billings (2000), and Boggs et al. (2008a).

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: The dominant disturbances are snow avalanche, soil creep and freeze-thaw action.

ENVIRONMENT

Environmental Description: This mesic alpine and subalpine herbaceous meadow group occurs above the environmental limit of trees, at the highest elevations of the mountain regions of the Pacific Northwest coast and extends north to maritime and boreal transition regions of Alaska where it is found on mountain sideslopes. Stands occur above 2350 m (7200 feet) elevation in the Klamath Mountains and Cascade Range north into the Coast Mountains of British Columbia where they are confined to the coldest, wind-blown areas above treeline and above the subalpine parkland. The slope shape is usually straight to concave (depressions) where snow lingers, the soil has become relatively stabilized, and the water supply is more-or-less constant. Vegetation in these areas is controlled by snow retention, wind desiccation, permafrost, and a short growing season. The substrate is colluvium, residuum, or glacial till.

DISTRIBUTION

***Geographic Range:** This mesic alpine and subalpine herbaceous meadow group occurs in the mountains of the Pacific Northwest coast and extends north to maritime and boreal transition regions of Alaska and from Kodiak Island through southeastern Alaska.

Nations: CA, US

States/Provinces: AK, BC, CA, OR, WA

USFS Ecoregions (2007) [optional]: M242A:CC, M242B:CC, M242C:CC, M242D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3336 | <i>Eriogonum</i> spp. - <i>Luzula</i> spp. Alpine Snowbed Alliance |
| A3338 | <i>Minuartia obtusiloba</i> - <i>Lupinus sellulus</i> var. <i>lobbii</i> Cascade Alpine Fell-field Alliance |
| A3337 | <i>Festuca idahoensis</i> ssp. <i>roemeri</i> - <i>Festuca saximontana</i> Alpine Meadow Alliance |
| A1300 | <i>Carex spectabilis</i> Subalpine Meadow Alliance |
| A1640 | <i>Antennaria lanata</i> - <i>Juncus parryi</i> Alpine Meadow Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** K.A. Schulz, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** K.A. Schulz

Acknowledgments [optional]:

Version Date: 09 Nov 2015

REFERENCES

***References [Required if used in text]:**

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- Billings, W. D. 2000. Alpine vegetation of North America. Pages 537-572 in: M. G. Barbour and W. D. Billings, editors. North American terrestrial vegetation. Second edition. Cambridge University Press, New York. 434 pp.
- Boggs, K., S. C. Klein, J. Grunblatt, G. P. Streveler, and B. Koltun. 2008a. Landcover classes and plant associations of Glacier Bay National Park and Preserve. Natural Resource Technical Report NPS/KEFJ/NRTR-2008/093. National Park Service, Fort Collins, CO. 255 pp.
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- Franklin, J. F., and C. T. Dyrness. 1973. Natural vegetation of Oregon and Washington. General Technical Report PNW-8. USDA Forest Service, Pacific Northwest Forest and Range Experiment Station, Portland, OR. 417 pp.
- Shiflet, T. N., editor. 1994. Rangeland cover types of the United States. Society for Range Management. Denver, CO. 152 pp.
- Viereck, L. A., C. T. Dyrness, A. R. Batten, and K. J. Wenzlick. 1992. The Alaska vegetation classification. General Technical Report PNW-GTR286. USDA Forest Service, Pacific Northwest Research Station, Portland, OR. 278 pp.

4. Polar & High Montane Scrub, Grassland & Barrens

4.B.1.Nb. Western North American Alpine Tundra

G319. North Pacific Alpine-Subalpine Bedrock & Scree

Type Concept Sentence: This group consists of communities dominated by *Artemisia arctica*, *Astragalus alpinus*, *Carex microchaeta*, *Lomatium* spp., *Luina hypoleuca*, *Minuartia arctica*, *Paxistima myrsinites*, *Phlox* spp., *Salix rotundifolia*, *Saxifraga bronchialis*, *Saxifraga sibirica*, *Sibbaldia procumbens*, and/or *Silene acaulis*, as well as a variety of nonvascular (lichen) species. It is found on barren and sparsely vegetated alpine rocky environments of the North Pacific.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 4.B.1.Nb.3. Vancouverian Alpine Tundra (M101)

Elcode: G319

***Scientific Name:** *Racomitrium* spp. - *Stereocaulon* spp. - *Phlox* spp. North Pacific Alpine-Subalpine Bedrock & Scree Group

***Common (Translated Scientific) Name:** Racomitrium Moss species - Snow Lichen species - Phlox species North Pacific Alpine-Subalpine Bedrock & Scree Group

***Colloquial Name:** North Pacific Alpine-Subalpine Bedrock & Scree

***Type Concept:** This group consists of exposed rock and rubble above the forestline (subalpine parkland and above) in the North Pacific mountain ranges and is restricted to the highest elevations in the Cascade Range, from southwestern British Columbia south into northern California, and also north into southeastern Alaska. It is composed of barren and sparsely vegetated alpine substrates, typically including bedrock outcrops, scree slopes, rock crevices, upper mountain slopes, summits and nunataks. Species composition is variable and may include *Artemisia arctica*, *Astragalus alpinus*, *Carex microchaeta*, *Carex* spp., *Minuartia arctica*, *Paxistima myrsinites*, *Saxifraga* spp., *Lomatium* spp., *Luina hypoleuca*, *Phlox* spp., *Salix rotundifolia*, *Saxifraga sibirica* (= *Saxifraga bracteata*), *Saxifraga bronchialis*, *Sibbaldia procumbens*, and *Silene acaulis*. Nonvascular (lichen)-dominated communities are common. Common nonvascular genera include *Racomitrium* and *Stereocaulon*. Exposure to desiccating winds, rocky and sometimes

unstable substrates, and a short growing season limit plant growth. In Alaska, this group usually occurs above alpine dwarf-shrub, herbaceous meadow, and dwarf-shrub-herbaceous systems typically at elevations higher than 915 m (3000 feet) (possibly higher in southeastern Alaska). There can be sparse cover of forbs, grasses, lichens, shrubs and small trees, but the total vascular plant cover is typically less than 25% due to the high cover of exposed rock.

***Diagnostic Characteristics:**

***Classification Comments:**

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|---|
| G571 | Rocky Mountain & Sierran Alpine Bedrock & Scree | occurs in the Rocky Mountains. |
| G318 | North Vancouverian Montane Bedrock, Cliff & Talus Vegetation | occurs below upper treeline in montane elevations. |
| G565 | Rocky Mountain Cliff, Scree & Rock Vegetation | occurs below upper treeline at montane elevations in the Rocky Mountains. |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Nonvascular-dominated rocks and vascular-dominated scree and rock crevices above treeline in the Pacific Northwest.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: There can be sparse cover of forbs, grasses, lichens, shrubs and small trees, but the total vascular plant cover is typically less than 25% due to the high cover of exposed rock. Species composition is variable and may include *Artemisia arctica*, *Astragalus alpinus*, *Carex microchaeta*, *Carex* spp., *Lomatium* spp., *Luina hypoleuca*, *Minuartia arctica*, *Paxistima myrsinites*, *Phlox* spp., *Salix rotundifolia*, *Saxifraga bronchialis*, *Saxifraga sibirica* (= *Saxifraga bracteata*), *Sibbaldia procumbens*, and *Silene acaulis*. Common nonvascular genera include *Racomitrium* and *Stereocaulon*. Floristic information compiled from Meidinger and Pojar (1991) and Viereck et al. (1992).

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:

ENVIRONMENT

Environmental Description: Soil/substrate/hydrology: It is composed of barren and sparsely vegetated alpine substrates, typically including bedrock outcrops, scree slopes, rock crevices, upper mountain slopes, summits and nunataks. Nonvascular (lichen)-dominated communities are common. Exposure to desiccating winds, rocky and sometimes unstable substrates, and a short growing season limit plant growth. Environmental information compiled from Meidinger and Pojar (1991) and Viereck et al. (1992).

DISTRIBUTION

***Geographic Range:** This group is restricted to the highest elevations in the North Pacific ranges, from southeastern Alaska south into northern Oregon.

Nations: CA, US

States/Provinces: AK, BC, CA, OR, WA

USFS Ecoregions (2007) [optional]: 3421:PP, M242A:CC, M242B:CC, M242C:CC, M242D:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS***Plot Analysis Summary [Med - High Confidence]:*****Plots Used to Define the Type [Med - High Confidence]:****CONFIDENCE LEVEL****USNVC Confidence Level:** Moderate**USNVC Confidence Comments [optional]:****HIERARCHY*****Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3781 | <i>Paxistima myrsinites</i> - <i>Saxifraga</i> spp. - <i>Luina hypoleuca</i> Alpine Rock Crevice Alliance |
| A3780 | <i>Phlox</i> spp. - <i>Lomatium</i> spp. - <i>Carex</i> spp. Alpine Talus & Scree Sparse Alliance |
| A4087 | <i>Rhizocarpon geographicum</i> Sparsely Vegetated Alpine Nonvascular Alliance |

DISCUSSION**Discussion [optional]:****CONCEPT HISTORY*****Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|------------------------------|-------------------------------|------|
| = | AN Alpine Sparsely Vegetated | Ecosystems Working Group 1998 | |

AUTHORSHIP***Primary Concept Source [if applicable]:** R. Crawford, M.S. Reid et al., in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** R. Crawford, M.S. Reid, C. Chappell, T. Boucher, G. Kittel**Acknowledgments [optional]:**

Version Date: 20 May 2015

REFERENCES***References [Required if used in text]:**

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6.B.1.Na. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation (D051)

M115. Great Plains Badlands Vegetation

6. Open Rock Vegetation

6.B.1.Na. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation

G566. Great Plains Badlands Vegetation

Type Concept Sentence: This group is relatively distinct from others due to the sparse vegetation and unique substrate within the Northern Great Plains. Sites with vegetation cover near the cut-off between sparse vegetation and vegetated types could be confusing as could patches with higher vegetation cover within a badlands area.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 6.B.1.Na.3. Great Plains Badlands Vegetation (M115)

Elcode: G566

***Scientific Name:** *Sarcobatus vermiculatus* / *Eriogonum pauciflorum* - *Gutierrezia sarothrae* Badlands Group

***Common (Translated Scientific) Name:** Greasewood / Few-flower Buckwheat - Broom Snakeweed Badlands Group

***Colloquial Name:** Great Plains Badlands Vegetation

***Type Concept:** This group includes badlands vegetation in the Northern Great Plains of the United States and Canada. Examples are found on slopes of easily erodible clay and poorly consolidated shale interspersed with sandstone, lignite lenses, and occasional scoria outcrops. Vegetation cover is typically sparse but can be moderate in small areas with shallower slopes. The dominant vegetation is a mix of shrubs, forbs and grasses with each dominating some areas. There is typically zonation of vegetation from the top of a slope to the bottom with different groups of species most common in certain zones. Typical species found in Great Plains badlands are *Sarcobatus vermiculatus*, *Atriplex* spp., *Artemisia longifolia*, *Artemisia tridentata*, *Gutierrezia sarothrae*, *Eriogonum pauciflorum*, and *Pseudoroegneria spicata*.

***Diagnostic Characteristics:** Examples are found on relatively unique sites with sparse vegetation, badlands topography, and badlands parent material.

***Classification Comments:** This group is relatively distinct from others due to the sparse vegetation and unique substrate within the Northern Great Plains. Sites with vegetation cover near the cut-off between sparse vegetation and vegetated types could be confusing.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|-------------------------------|------|
| | | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Great Plains Badlands are typically sparsely vegetated (<10% total vegetation cover). The sloping, eroding sites, lack of soil development, and lack of available moisture for plants limits the species that can grow. Small areas with shallower slopes, including step-in-slopes, toeslopes, etc., may have moderate vegetation cover. Dominant plants are usually shrubs and forbs, though grasses can dominate some areas. Dominant plants rarely grow more than about 1 m tall.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Dominant species can be shrubs, grasses or forbs. Common shrubs include *Sarcobatus vermiculatus*, *Artemisia tridentata*, *Atriplex confertifolia*, and *Ericameria nauseosa*; common grasses include *Achnatherum hymenoides*, *Pseudoroegneria spicata*, and *Pascopyrum smithii* (on more mesic sites); common forbs include *Arenaria hookeri*, *Artemisia longifolia*, *Eriogonum*

pauciflorum, *Gutierrezia sarothrae*, and *Grindelia squarrosa*.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Examples of this group are affected by erosion and drought.

ENVIRONMENT

Environmental Description: A combination of factors, such as elevation, rainfall, carving action of streams and parent material, can contribute to the development of this group. Sites that harbor it are primarily a type of mature dissection with finely textured drainage patterns and steep slopes. This group contains extremely dry and easily erodible, consolidated clayey soils with bands of sandstone or isolated consolidates. This group is found within an arid to semi-arid climate with infrequent, but torrential, rains that cause erosion.

DISTRIBUTION

***Geographic Range:** This group is found in the Northern Great Plains region of the United States and Canada with some of the best developed examples in western North Dakota, southwestern South Dakota, and southeastern Montana.

Nations: CA, US

States/Provinces: AB, CO, MB?, MT, ND, NE, SD, SK, WY

USFS Ecoregions (2007) [optional]: 331E:CP, 331F:CC, 331G:CC, 331K:CC, 331L:CC, 331M:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3979 | <i>Eriogonum pauciflorum</i> - <i>Gutierrezia sarothrae</i> Badlands Alliance |
| A3978 | <i>Sarcobatus vermiculatus</i> Great Plains Badlands Alliance |
| A1642 | <i>Arenaria hookeri</i> Rock Alliance |
| A1874 | <i>Artemisia longifolia</i> Badlands Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** S. Menard and K. Kindscher, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** J. Drake

Acknowledgments [optional]:

Version Date: 03 Jan 2011

REFERENCES

***References [Required if used in text]:**

- Brown, R. W. 1971. Distribution of plant communities in southeastern Montana badlands. *The American Midland Naturalist* 85(2):458-477.
- Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, M. Russo, K. Schulz, K. Snow, J. Teague, and R. White. 2003-present. Ecological systems of the United States: A working classification of U.S. terrestrial systems. NatureServe, Arlington, VA.
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M116. Great Plains Cliff, Scree & Rock Vegetation

6. Open Rock Vegetation

6.B.1.Na. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation

G567. Great Plains Cliff, Scree & Rock Vegetation

Type Concept Sentence: This group is composed of cliffs, bluffs, and rock outcrops in the Great Plains from the U.S.-Canadian border area south to Texas where vascular vegetation cover is sparse or nonexistent.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 6.B.1.Na.2. Great Plains Cliff, Scree & Rock Vegetation (M116)

Elcode: G567

***Scientific Name:** *Rhus trilobata* / *Bouteloua gracilis* - *Opuntia* spp. Great Plains Cliff, Scree & Rock Vegetation Group

***Common (Translated Scientific) Name:** Skunkbush Sumac / Blue Grama - Prickly-pear species Cliff, Scree & Rock Vegetation Group

***Colloquial Name:** Great Plains Cliff, Scree & Rock Vegetation

***Type Concept:** This group is composed of cliffs, bluffs, and rock outcrops in the Great Plains from the U.S.-Canadian border area south to Texas. It is defined by having sparse vegetation and the abundance of exposed bedrock. The bedrock exposure can be vertical, sloping, or horizontal along rivers, at the tops of buttes, in dry canyons, or, rarely, large, low bedrock outcrops. The bedrock is usually sedimentary (sandstone, limestone, shale, gypsum, siltstone), but an area of quartzite outcrops in southwestern Minnesota is included in this group. Vegetation is generally sparse except where soil accumulates in pockets or ledges. Dominant species vary greatly depending on geology of the bedrock, climate, aspect, slope, and slope position. Common species are able to tolerate the dry to xeric conditions and poor soil development found in this group. These include *Bouteloua eriopoda* (in the southwest), *Bouteloua gracilis*, *Cercocarpus montanus*, *Juniperus* spp., *Opuntia* spp., and *Rhus trilobata*.

***Diagnostic Characteristics:** This group is characterized by sparse vegetation (generally less than 10% cover) on rock outcrops in the Great Plains.

***Classification Comments:** The concept of this group is fairly distinct within the Great Plains though individual sites may have enough vegetation to be confused with dry prairie or dry woodland groups. At the edges of the distribution of this group, there could be confusion with the sparse vegetation bedrock groups in the East, i.e., ~Laurentian-Acadian-Great Lakes Cliff & Rock Vegetation Group (G839)\$\$, ~Appalachian Cliff & Rock Vegetation Group (G840)\$\$, ~Central Midwest-Interior Cliff & Rock Vegetation Group (G841)\$\$, and ~Southeast Coastal Plain Cliff & Rock Vegetation Group (G842)\$\$, and the West, i.e., ~Rocky Mountain Cliff, Scree & Rock Vegetation Group (G565)\$\$\$. Characteristics of this group may overlap with that of ~Comanchian Barrens & Glade Group (G598)\$\$\$, and review is needed to clarify the limits of the two concepts.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|------|
| G598 | Comanchian Barrens & Glade | |
| G569 | North American Warm Semi-Desert Cliff, Scree & Pavement Sparse Vegetation | |
| G570 | Intermountain Basins Cliff, Scree & Badland Sparse Vegetation | |
| G841 | Central Midwest-Interior Cliff & Rock Vegetation | |
| G840 | Appalachian Cliff & Rock Vegetation | |
| G839 | Laurentian-Acadian-Great Lakes Cliff & Rock Vegetation | |
| G842 | Southeast Coastal Plain Cliff & Rock Vegetation | |
| G565 | Rocky Mountain Cliff, Scree & Rock Vegetation | |

Similar NVC Types General Comments [optional]:**VEGETATION**

Physiognomy and Structure Summary: Examples of this group have sparse vegetation. The most abundant species at a site tend to be small trees, shrubs, or grasses but can be forbs in a few cases. Trees and shrubs are typically short, and mixedgrass species dominate the herbaceous stratum.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: This group has scattered vascular species found in cracks, depressions, or ledges in the bedrock where some soil can accumulate. Dominant species vary greatly depending on geology of the bedrock, climate, aspect, slope, and slope position. Common trees and shrubs are *Juniperus monosperma* (in the southwest), *Juniperus scopulorum* (in the west), *Juniperus virginiana* (in the east and north), *Artemisia longifolia*, *Cercocarpus montanus*, and *Rhus trilobata*. Common grasses include *Bouteloua eriopoda* (in the southwest), *Bouteloua gracilis*, *Calamovilfa longifolia*, and *Schizachyrium scoparium*. Forbs tend not to be as abundant as woody vegetation and grasses but are scattered. *Eriogonum* spp., *Gutierrezia sarothrae*, and *Opuntia* spp. are typical. Nonvascular species, especially lichens, can be very common on exposed rock.

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Drought and erosion, both from wind and water, are important in maintaining sites in this group.

ENVIRONMENT

Environmental Description: Sites in this group have significant exposure of bedrock. The bedrock can be vertical, sloping, or horizontal along rivers, at the tops of buttes, in dry canyons, or, rarely, large, low bedrock outcrops. The bedrock is usually sedimentary (sandstone, limestone, shale, gypsum, siltstone), but an area of quartzite outcrops in southwestern Minnesota is included in this group. Soil development is usually limited to cracks, ledges, or depressions in the bedrock.

DISTRIBUTION

***Geographic Range:** This group is found in the Great Plains from near the U.S.-Canadian border south to northern Texas and from the Rocky Mountain foothills to southwestern Minnesota, eastern Kansas and possibly northwestern Iowa and Missouri. The granitic, igneous, and metamorphic formations in the Black Hills and nearby are not included in this group.

Nations: CA, US

States/Provinces: CO, IA?, KS, MB, MN, MO?, MT, ND, NE, NM, OK, SD, TX, WY

USFS Ecoregions (2007) [optional]: 251B:CC, 251C:C?, 251E:CP, 251F:CC, 251H:CC, 315A:CC, 315B:CC, 315F:CC, 331B:CC, 331C:CC, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 331K:CP, 331L:CC, 331M:CC, 331N:CC, 332A:CP, 332B:CC, 332C:CC, 332D:CC, 332E:CP, 332F:CC, 342F:PP, M313B:PP, M331B:PP, M331F:PP, M331I:PP

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3981 | Great Plains Acidic Cliff Alliance |
| A3982 | Great Plains Acidic Rock Outcrop Alliance |
| A3980 | Great Plains Alkaline Cliff Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** S. Menard and K. Kindscher, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** J. Drake

Acknowledgments [optional]:

Version Date: 08 May 2015

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Faber-Langendoen, D., J. Drake, S. Gawler, M. Hall, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, K. Schulz, J. Teague, M. Russo, K. Snow, and P. Comer, editors. 2010-2017a. Divisions, Macrogroups and Groups for the Revised U.S. National Vegetation Classification. NatureServe, Arlington, VA. plus appendices. [in preparation]

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6.B.1.Nb. Western North American Temperate & Boreal Cliff, Scree & Rock Vegetation (D052)

M887. Western North American Cliff, Scree & Rock Vegetation

6. Open Rock Vegetation

6.B.1.Nb. Western North American Temperate & Boreal Cliff, Scree & Rock Vegetation

G563. Californian Cliff, Scree & Rock Vegetation

Type Concept Sentence: This cliff, scree and rock vegetation is scattered across California's Coast, Transverse, and Peninsular ranges, Klamath Mountains, southern Sierra Nevada, and the northern coast of Baja California.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 6.B.1.Nb.1. Western North American Cliff, Scree & Rock Vegetation (M887)

Elcode: G563

***Scientific Name:** *Pinus contorta* var. *murrayana* / *Ceanothus megacarpus* - *Cercocarpus montanus* var. *minutiflorus* Cliff, Scree & Rock Vegetation Group

***Common (Translated Scientific) Name:** Sierra Lodgepole Pine / Bigpod Ceanothus - Smooth Mountain-mahogany Cliff, Scree & Rock Vegetation Group

***Colloquial Name:** Californian Cliff, Scree & Rock Vegetation

***Type Concept:** This group is scattered across California's Coast, Transverse, and Peninsular ranges, Klamath Mountains, southern Sierra Nevada, and the northern coast of Baja California. Sites include barren and sparsely vegetated areas of steep cliff faces, narrow canyons, smaller rock outcrops of various igneous, sedimentary, serpentinite, and metamorphic bedrock. This group also includes unstable scree and talus slopes typically occurring below cliff faces. Scattered vegetation may include trees such as *Pseudotsuga menziesii*, *Pinus contorta* var. *murrayana*, *Pinus ponderosa*, and *Pinus jeffreyi*. Shrubs may include *Ceanothus megacarpus*, *Ceanothus leucodermis*, *Cercocarpus montanus* var. *glaber* (= *Cercocarpus betuloides*), *Cercocarpus montanus* var. *minutiflorus* (= *Cercocarpus minutiflorus*), *Arctostaphylos glauca*, and *Xylococcus bicolor*. Soil development is limited as is herbaceous cover, but may include *Allium falcifolium*, *Allium cratericola*, *Streptanthus* spp., *Hesperolinon* spp., *Asclepias solanoana*, *Eriogonum ursinum*, *Eriogonum nudum*, *Eriogonum luteolum*, *Erigeron* spp., *Dudleya cymosa*, *Dudleya lanceolata*, *Lewisia rediviva*, *Pentagramma triangularis*, *Selaginella bigelovii*, *Bromus rubens*, *Vulpia* spp., and others. Moss and lichen can be well-developed, and needs better characterization.

***Diagnostic Characteristics:** This is a sparsely vegetated and barren group characterized by patchy vegetation that does not exceed 10% total cover. Species occupying these sites may be opportunistic and/or adapted to such conditions. Woody species may include *Pseudotsuga menziesii*, *Pinus contorta* var. *murrayana*, *Pinus ponderosa*, *Pinus jeffreyi*, *Ceanothus megacarpus*, *Ceanothus leucodermis*, *Cercocarpus montanus* var. *minutiflorus*, *Arctostaphylos glauca*, and *Xylococcus bicolor*. Soil development is limited as is herbaceous cover, but may include *Allium falcifolium*, *Allium cratericola*, *Streptanthus* spp., *Hesperolinon* spp., *Asclepias solanoana*, *Eriogonum ursinum*, *Eriogonum nudum*, *Eriogonum luteolum*, *Erigeron* spp., *Dudleya cymosa*, *Dudleya lanceolata*, *Lewisia rediviva*, *Pentagramma triangularis*, *Selaginella bigelovii*, *Bromus rubens*, *Vulpia* spp., and others. Moss and lichen can be well-developed.

***Classification Comments:** This type may overlap with ~Western North American Cliff, Scree & Rock Vegetation Macrogroup (M887)\$\$, especially ~Southern Vancouverian Cliff, Scree & Rock Vegetation Group (G573)\$\$\$. Further review is needed.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G573 | Southern Vancouverian Cliff, Scree & Rock Vegetation | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Vegetation of the group is variable in physiognomy and structure due to harsh substrate conditions and exposure, but is composed of a patchy assemblage of needleleaf trees, broadleaf deciduous shrubs, and sporadic herbaceous cover.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Scattered vegetation may include trees such as *Pseudotsuga menziesii*, *Pinus contorta* var. *murrayana*, *Pinus ponderosa*, and *Pinus jeffreyi*. Shrubs may include *Ceanothus megacarpus*, *Ceanothus leucodermis*, *Cercocarpus montanus* var. *minutiflorus* (= *Cercocarpus minutiflorus*), *Arctostaphylos glauca*, and *Xylococcus bicolor*. Herbaceous cover is limited but may

include *Streptanthus* spp., *Hesperolinon* spp., *Allium falcifolium*, *Allium cratericola*, *Asclepias solanoana*, *Eriogonum ursinum*, *Eriogonum nudum*, *Eriogonum luteolum*, *Erigeron* spp., *Dudleya cymosa*, *Dudleya lanceolata*, *Lewisia rediviva*, *Pentagramma triangularis*, *Selaginella bigelovii*, *Bromus rubens*, *Vulpia* spp., and others. Moss and lichen can be well-developed, and needs better characterization.

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Const-ancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|------------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Poor, rocky, loosely consolidated soils help maintain stands of this group by limiting the establishment of species from adjacent communities. Not all serpentinite outcrops support distinct vegetation. Only those with very low Ca:Mg ratio impact biotic composition.

ENVIRONMENT

Environmental Description: This group is known from California's Coast, Transverse, and Peninsular ranges, Klamath Mountains, southern Sierra Nevada, and the northern coast of Baja California. Sites include barren and sparsely vegetated areas of steep cliff faces, narrow canyons, smaller rock outcrops of various igneous, sedimentary, serpentinite, and metamorphic bedrock. This group also includes unstable scree and talus slopes typically occurring below cliff faces. *Soil/substrate/hydrology:* Soils are poorly developed, rocky, and loosely consolidated. Parent materials include igneous, sedimentary, serpentinite, and metamorphic bedrock and scree.

DISTRIBUTION

***Geographic Range:** This group is known from California's Coast, Transverse, and Peninsular ranges, Klamath Mountains, southern Sierra Nevada, and the northern coast of Baja California.

Nations: MX, US

States/Provinces: CA, MXBC

USFS Ecoregions (2007) [optional]: 261B:PP, 262A:PP, 322C:PP, M261A:CC, M261B:CC, M261C:CC, M261D:CC, M261E:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3784 | <i>Sedum spathulifolium</i> Sparse Rock Vegetation Alliance |
| A3785 | <i>Selaginella bigelovii</i> Rock Alliance |
| A3782 | <i>Pinus jeffreyi</i> / <i>Arctostaphylos glauca</i> - <i>Ceanothus leucodermis</i> Sparse Shrubland Alliance |
| A4073 | <i>Dudleya cymosa</i> - <i>Dudleya lanceolata</i> - Lichen/Moss Sparse Rock Vegetation Alliance |
| A3783 | <i>Allium</i> spp. - <i>Streptanthus</i> spp. - <i>Hesperolinon</i> spp. Serpentinite Sparse Rock Vegetation Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** P. Comer and T. Keeler-Wolf, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** M.E. Hall and J. Evens

Acknowledgments [optional]: J. Evens

Version Date: 08 Oct 2014

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- Kittel, G., E. Reyes, J. Evens, J. Buck, and D. Johnson. 2012a. Vegetation classification and mapping project report, Pinnacles National Monument. Natural Resource Report NPS/SFAN/NRR-2012/574. National Park Service, Fort Collins, CO. 428 pp.
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6. Open Rock Vegetation

6.B.1.Nb. Western North American Temperate & Boreal Cliff, Scree & Rock Vegetation

G565. Rocky Mountain Cliff, Scree & Rock Vegetation

Type Concept Sentence: This group consists of dry barren and sparsely vegetated rock outcrops and cliff faces of the Rocky Mountains and Cascade Range in North America, where there is often very high cover of nonvascular lichens and, in wetter places, mosses.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 6.B.1.Nb.1. Western North American Cliff, Scree & Rock Vegetation (M887)

Elcode: G565

***Scientific Name:** Nonvascular Rocky Mountain Cliff, Scree & Rock Vegetation Group

***Common (Translated Scientific) Name:** Nonvascular Rocky Mountain Cliff, Scree & Rock Vegetation Group

***Colloquial Name:** Rocky Mountain Cliff, Scree & Rock Vegetation

***Type Concept:** This group consists of barren and sparsely vegetated rock outcrops and cliff faces located throughout the Rocky Mountains and northeastern Cascade Range in North America. These sparsely vegetated surfaces (generally <10% plant cover) are found from foothill to subalpine elevations on steep cliff faces, narrow canyons, and smaller rock outcrops of various igneous (intrusives), sedimentary, and metamorphic bedrock types. It also occurs on unstable scree and talus slopes that can occur below cliff faces. In general these are the dry, sparsely vegetated places. The biota reflects what is surrounding them, unless it is an extreme parent material. There is often very high cover of nonvascular lichens and, in wetter places, mosses. There may be small patches of dense vascular vegetation and can include scattered trees and/or shrubs. Characteristic trees include species from the surrounding landscape, such as *Pseudotsuga menziesii*, *Pinus ponderosa*, *Pinus flexilis*, *Populus tremuloides*, *Abies concolor*, *Abies*

lasiocarpa, or *Pinus edulis* and *Juniperus* spp. at lower elevations. There may be scattered shrubs present, such as species of *Holodiscus*, *Ribes*, *Physocarpus*, *Rosa*, *Juniperus*, and *Jamesia americana*, *Mahonia repens*, *Rhus trilobata*, or *Amelanchier alnifolia*. Soil development is limited, as is herbaceous cover. Characteristic nonvascular species information is not available

***Diagnostic Characteristics:** Dense covering of mosses and/or nonvasculars and sparse cover of herbaceous and woody vascular plants on exposed bedrock or talus.

***Classification Comments:** Need moss and other nonvascular species information. Cliff, scree and rock vegetation in Alaska is placed into ~North Vancouverian Montane Bedrock, Cliff & Talus Vegetation Group (G318)\$\$, ~Western North American Boreal Cliff & Rock Vegetation Group (G822)\$\$, or ~North American Arctic Cliff, Scree & Rock Vegetation Group (G375)\$\$.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|---|
| G569 | North American Warm Semi-Desert Cliff, Scree & Pavement Sparse Vegetation | |
| G570 | Intermountain Basins Cliff, Scree & Badland Sparse Vegetation | |
| G571 | Rocky Mountain & Sierran Alpine Bedrock & Scree | occurs above treeline. |
| G319 | North Pacific Alpine-Subalpine Bedrock & Scree | occurs above treeline in the Pacific Northwest mountains. |
| G567 | Great Plains Cliff, Scree & Rock Vegetation | |
| G318 | North Vancouverian Montane Bedrock, Cliff & Talus Vegetation | occurs in the Pacific Northwest mountains. |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Nonvascular, woody and herbaceous vascular plants.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Herbaceous cover is limited. Characteristic trees include species from the surrounding landscape, such as *Pseudotsuga menziesii*, *Pinus ponderosa*, *Pinus flexilis*, *Populus tremuloides*, *Abies concolor*, *Abies lasiocarpa*, or *Pinus edulis* and *Juniperus* spp. at lower elevations. There may be scattered shrubs present, such as species of *Holodiscus*, *Ribes*, *Physocarpus*, *Rosa*, *Juniperus*, and *Jamesia americana*, *Mahonia repens*, *Rhus trilobata*, or *Amelanchier alnifolia*. Characteristic nonvascular species information is not available. Floristic information compiled from Hess and Wasser (1982), Andrews and Righter (1992), Ecosystem Working Group (1998), and Larson et al. (2000).

***Floristics Table [Med - High Confidence]:**

***Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:

ENVIRONMENT

Environmental Description: *Climate:* Temperate. *Soil/substrate/hydrology:* Foothill to subalpine elevations on steep cliff faces, narrow canyons, and smaller rock outcrops of various igneous (intrusives), sedimentary, and metamorphic bedrock types. Also included are unstable scree and talus slopes that typically occur below cliff faces. In general these are the dry, sparsely vegetated places. Soil development is limited. Environmental information compiled from Hess and Wasser (1982), Andrews and Righter (1992), Ecosystem Working Group (1998), and Larson et al. (2000).

DISTRIBUTION

***Geographic Range:** This group is located throughout the Rocky Mountain, including the isolated island ranges of central Montana, and northeastern Cascade Ranges in North America.

Nations: CA, US

States/Provinces: AB, AZ, BC, CO, ID, MT, NM, NV, OR, SD, UT, WA, WY

USFS Ecoregions (2007) [optional]: 313A:CC, 313B:CC, 313D:CC, 315A:CC, 315H:CC, 321A:CC, 331A:C?, 331B:CC, 331D:C?, 331G:CC, 331H:CC, 331I:CP, 331J:CC, 331K:CP, 331N:CP, 341A:CC, 341B:CC, 341C:CC, 341F:CC, 341G:CC, 342A:CP, 342B:CC, 342C:CC, 342D:CP, 342E:CC, 342F:CP, 342G:CP, 342H:CP, 342I:CP, 342J:CC, M242B:CP, M242C:CC, M242D:CC, M313A:CC, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M334A:CC, M341A:CC, M341B:CC, M341C:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Moderate

USNVC Confidence Comments [optional]:

HIERARCHY

***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|---|
| A3742 | Black Hills Cliff, Scree & Rock Alliance |
| A0556 | <i>Picea engelmannii</i> Rock Alliance |
| A3740 | <i>Aletes anisatus</i> - <i>Holodiscus dumosus</i> - <i>Rubus idaeus</i> Cliff, Scree & Rock Alliance |
| A4146 | <i>Sullivantia hapemanii</i> - <i>Mimulus</i> spp. Wet Rock Alliance |
| A3741 | <i>Aquilegia flavescens</i> - <i>Phacelia hastata</i> Cliff, Scree & Rock Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY

***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|-------------------------------|------|
| > | CL Cliff | Ecosystems Working Group 1998 | |
| > | RO Rock | Ecosystems Working Group 1998 | |
| > | TA Talus | Ecosystems Working Group 1998 | |

AUTHORSHIP

***Primary Concept Source [if applicable]:** G. Kittel, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** G. Kittel and M.S. Reid

Acknowledgments [optional]:

Version Date: 21 Dec 2010

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***References [Required if used in text]:**

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- Ecosystems Working Group. 1998. Standards for broad terrestrial ecosystem classification and mapping for British Columbia. Prepared by the Ecosystems Working Group, Terrestrial Ecosystem Task Force, Resources Inventory Committee, for the Province of British Columbia. 174 pp. plus appendices. [<http://srmwww.gov.bc.ca/risc/pubs/teecolo/tem/indextem.htm>]
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6. Open Rock Vegetation

6.B.1.Nb. Western North American Temperate & Boreal Cliff, Scree & Rock Vegetation

G318. North Vancouverian Montane Bedrock, Cliff & Talus Vegetation

Type Concept Sentence: This group consists of sparsely vegetated rock outcrops and cliff faces from Alaska south into northern California. It occurs as small patches of dense vegetation, typically scattered trees and/or shrubs, such as trees *Abies* spp., *Callitropsis nootkatensis*, *Pseudotsuga menziesii* (not in Alaska), *Thuja plicata*, or *Tsuga* spp., and shrubs *Acer circinatum*, *Alnus viridis*, and *Ribes* spp.; mosses or lichens may be very dense.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 6.B.1.Nb.1. Western North American Cliff, Scree & Rock Vegetation (M887)

Elcode: G318

***Scientific Name:** North Vancouverian Montane Bedrock, Cliff & Talus Vegetation Group

***Common (Translated Scientific) Name:** North Vancouverian Montane Bedrock, Cliff & Talus Vegetation Group

***Colloquial Name:** North Vancouverian Montane Bedrock, Cliff & Talus Vegetation

***Type Concept:** This group consists of sparsely vegetated rock outcrops and cliff faces where fractures in the rock surface and colluvial slopes may be occupied by small patches of dense vegetation, typically scattered trees and/or shrubs. This group is found on the Alaska Peninsula and Aleutian Islands, Coast Mountains of British Columbia, as well as in the Cascade Range in Washington and Oregon, south to just inside northern California. Characteristic trees include *Abies* spp., *Callitropsis nootkatensis* (= *Chamaecyparis nootkatensis*), *Pseudotsuga menziesii* (not in Alaska), *Thuja plicata*, or *Tsuga* spp. There may be scattered shrubs present, such as *Acer circinatum*, *Alnus viridis*, and *Ribes* spp. Soil development is limited as is herbaceous cover. Mosses or lichens may be very dense, well-developed and display cover well over 10%. Substrates include active volcanic areas dominated by ash, pyroclastic deposits, lava, landslides and other exposed bare mineral and rock of various igneous, sedimentary, and metamorphic bedrock types. Periodic eruptions and earthquakes are the primary processes maintaining a primarily barren environment. Decades of inactivity slowly provide opportunity for vegetation development as primary successional stages. Elevation ranges from foothill to subalpine, and includes steep cliff faces, narrow canyons, larger rock outcrops, unstable scree and talus slopes. The dominant process is the extreme growing conditions created by exposed rock or unstable slopes, with drought becoming more of an issue in the southern part of the range. Alaskan montane rock and talus is not drought-limited.

***Diagnostic Characteristics:** Greater than 10% dense covering of mosses and/or nonvascular plants and sparse cover of herbaceous and woody vascular plants on exposed bedrock or talus.

***Classification Comments:** Need information on moss and other nonvascular species.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|---|---|
| G571 | Rocky Mountain & Sierran Alpine Bedrock & Scree | occurs above treeline. |
| G319 | North Pacific Alpine-Subalpine Bedrock & Scree | occurs above treeline in the Pacific Northwest mountains. |
| G565 | Rocky Mountain Cliff, Scree & Rock Vegetation | |

Similar NVC Types General Comments [optional]:**VEGETATION**

Physiognomy and Structure Summary: Dense patches of moss and nonvascular cover and sparse herbaceous and woody vascular plant cover.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Scattered, stunted characteristic trees include *Abies* spp., *Callitropsis nootkatensis* (= *Chamaecyparis nootkatensis*) (not southern range), *Pseudotsuga menziesii* (not in Alaska), *Pinus contorta*, *Thuja plicata*, or *Tsuga* spp., and the broadleaf tree species *Arbutus menziesii* and *Quercus garryana*. There may be scattered shrubs as well, such as *Arctostaphylos columbiana*, *Arctostaphylos uva-ursi*, *Rosa gymnocarpa*, *Holodiscus discolor*, *Acer circinatum*, *Alnus viridis*, and *Ribes* spp. Herbaceous cover is limited and may include species such as *Selaginella wallacei*, *Polypodium glycyrrhiza*, *Cryptogramma acrostichoides*, and graminoids such as *Festuca idahoensis* ssp. *roemerii* (= *Festuca roemerii*), *Danthonia* spp., *Koeleria macrantha*, and forbs such as *Collinsia parviflora*, *Eriophyllum lanatum*, *Heuchera glabra*, *Heuchera micrantha*, *Phlox diffusa*, *Saxifraga ferruginea*, *Saxifraga rufidula*, and *Sedum spathulifolium*. Mosses or lichens may be very dense, well-developed and display cover well over 10%. *Racomitrium* spp., *Polytrichum juniperinum*, *Dicranum scoparium*, *Amphidium lapponicum*, *Cladina portentosa*, and *Cystocoleus ebeneus* are characteristic mosses and lichens in the Georgia Basin. Characteristic moss and nonvascular species information is not available.

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics:**ENVIRONMENT**

Environmental Description: *Soil/substrate/hydrology:* Substrates include active volcanic areas dominated by ash, pyroclastic deposits, lava, landslides and other exposed bare mineral and rock of various igneous, sedimentary, and metamorphic bedrock types. Periodic eruptions and earthquakes are the primary processes maintaining a primarily barren environment. Decades of inactivity slowly provide opportunity for vegetation development. Elevation ranges from foothill to subalpine and includes steep cliff faces, narrow canyons, larger rock outcrops, stable scree and talus slopes. The dominant process is substrate drought, especially farther south in its distribution, and other extreme growing conditions created by exposed rock or unstable slopes typically associated with steep slopes. Soil development is limited.

DISTRIBUTION

***Geographic Range:** This group consists of sparsely vegetated rock outcrops and cliff faces found on the Alaska Peninsula and Aleutian Islands, Coast Mountains of British Columbia, as well as in the Cascade Range of Washington and Oregon, south to just inside northern California (Mount Lassen and Mount Shasta, but does not include the Sierra Nevada or Klamath Mountains).

Nations: CA, US

States/Provinces: AK, BC, CA, OR, WA

USFS Ecoregions (2007) [optional]: 242A:CC, 242B:C?, 342D:C?, 342H:CP, 342I:CC, M242A:CC, M242B:C?, M242C:CC, M242D:CP, M261A:CC, M261D:CP

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS***Plot Analysis Summary [Med - High Confidence]:**

Plots Used to Define the Type [Med - High Confidence]:*CONFIDENCE LEVEL**

USNVC Confidence Level: Low

USNVC Confidence Comments [optional]:

HIERARCHY***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3779 | North Pacific Nonvascular Rock Vegetation Alliance |
| A4145 | <i>Sullivantia oregana</i> - <i>Adiantum pedatum</i> Wet Rock Alliance |
| A3778 | <i>Veronica wormskjoldii</i> var. <i>stelleri</i> - <i>Carex circinata</i> Sparse Rock Vegetation Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS**Supporting Concepts [optional]:**

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP***Primary Concept Source [if applicable]:** Crawford et al., in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** R. Crawford, G. Kittel, M.S. Reid, C. Cadrin**Acknowledgments [optional]:** C. Cadrin

Version Date: 09 Nov 2015

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[http://a100.gov.bc.ca/appsdata/acat/documents/r2124/SEI_4206_rpt1_1111625239116_8be42252200c4f0283b18cac66eed366.pdf]
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G573. Southern Vancouverian Cliff, Scree & Rock Vegetation

Type Concept Sentence: This group is found on steep slopes, cliff faces, and rock outcrops, where the vegetation is highly variable, sparse and scattered, and dominated by mosses and lichens, and occasionally woody species. It occurs in the eastern Cascades, subalpine elevations of the Sierra Nevada, and the Klamath Mountains.

OVERVIEW

***Hierarchy Level:** Group

***Placement in Hierarchy:** 6.B.1.Nb.1. Western North American Cliff, Scree & Rock Vegetation (M887)

Elcode: G573

***Scientific Name:** *Pinus monticola* / *Arctostaphylos nevadensis* Vancouverian Cliff, Scree & Rock Vegetation Group

***Common (Translated Scientific) Name:** Western White Pine / Pinemat Manzanita Cliff, Scree & Rock Vegetation Group

***Colloquial Name:** Southern Vancouverian Cliff, Scree & Rock Vegetation

***Type Concept:** This group is known from the Wenatchee Mountains in the east Cascades, subalpine elevations throughout the Sierra Nevada, and Klamath Mountains. Sites include steep slopes, steep cliff faces, narrow canyons, and rock outcrops. Substrates include thin rocky, ultramafic (peridotite, serpentinite) soils in the Cascades, and unstable scree below cliff faces in the Sierra Nevada and Klamath Range. Parent materials are derived from various igneous, sedimentary, and metamorphic bedrock. Vegetation is highly variable and typically sparse and scattered, varying from areas dominated by mosses and lichens to occasional closed forests in the Cascades. Species in the Cascades may include *Pseudotsuga menziesii*, *Pinus ponderosa*, and *Pinus monticola* trees with a sparse ground cover with *Aspidotis densa*, *Arctostaphylos nevadensis*, and *Pseudoroegneria spicata* at low-elevation sites. Higher elevations have *Pinus contorta* var. *latifolia*, *Pinus albicaulis*, *Abies lasiocarpa*, and *Tsuga mertensiana* with *Juniperus communis*, *Ledum glandulosum*, *Vaccinium scoparium*, *Poa curtifolia*, and *Festuca viridula*. Scattered vegetation in the Sierra Nevada and Klamath Mountains may include *Abies magnifica*, *Pseudotsuga menziesii*, *Pinus contorta* var. *murrayana*, *Pinus ponderosa*, *Pinus jeffreyi*, *Populus tremuloides*, or *Pinus monophylla*, *Juniperus osteosperma*, and *Cercocarpus ledifolius* at lower elevations. There may be shrubs, including species of *Arctostaphylos* or *Ceanothus*. Soil development is limited as is herbaceous cover.

***Diagnostic Characteristics:** Sparsely vegetated to rarely forested mixed shrub and tree vegetation occupying cliffs, steep cliff faces, bald ridgetops and shoulder outcrops, narrow canyons, smaller rock outcrops and scree slopes of the Sierra Nevada, Cascade Range and Klamath Mountains. The importance of nonvascular species such as mosses and lichens are one of the defining characteristics which distinguish this group from surrounding shrub or treed groups.

***Classification Comments:** This group (G573) and ~North Vancouverian Montane Bedrock, Cliff & Talus Vegetation Group (G318) both represent Vancouverian cliff, scree and rock vegetation. They are distinguished as northern and southern analogs; this group being the latter. However, more work is required to delineate a more accurate geographic distribution between the two. This group, as well as other lithomorphic types of vegetation, may be better defined by nonvascular species. However, insufficient information is available to validate this possibility.

***Similar NVC Types [if applicable]:**

| Elcode | Scientific or Colloquial Name | Note |
|--------|--|------|
| G563 | Californian Cliff, Scree & Rock Vegetation | |

Similar NVC Types General Comments [optional]:

VEGETATION

Physiognomy and Structure Summary: Highly variable structure and physiognomy ranging from sparse woody vegetation consisting of open tree and shrub strata or exclusively shrubs to closed canopy forests. Herbs contribute little cover.

Physiognomy and Structure Table [optional]:

| Physiognomy-Structure Category | Prevailing Height (m) | Height Range (opt.) | Mean % Cover | Cover Range (opt.) |
|--------------------------------|-----------------------|---------------------|--------------|--------------------|
| | | | | |

Floristics Summary: Vegetation is highly variable and typically sparse and scattered with occasional closed forests in the Cascades. Species in the Cascades may include *Pseudotsuga menziesii*, *Pinus ponderosa*, and *Pinus monticola* trees with a sparse ground cover with *Aspidotis densa*, *Arctostaphylos nevadensis*, and *Pseudoroegneria spicata* at low-elevation sites. Higher elevations have *Pinus contorta* var. *latifolia*, *Pinus albicaulis*, *Abies lasiocarpa*, and *Tsuga mertensiana* with *Juniperus communis*, *Ledum glandulosum*, *Vaccinium scoparium*, *Poa curtifolia*, and *Festuca viridula*. Vegetation in the Sierra Nevada and Klamath Mountains may include *Abies magnifica*, *Pseudotsuga menziesii*, *Pinus contorta* var. *murrayana*, *Pinus ponderosa*, *Pinus jeffreyi*, *Populus tremuloides*, or *Pinus monophylla*, *Juniperus osteosperma*, and *Cercocarpus ledifolius* at lower elevations. There may be shrubs, including species of *Arctostaphylos* or *Ceanothus*. Herbaceous cover is limited.

Floristics Table [Med - High Confidence]:**Number of Plots:**

| Physiognomy-Structure Category | Taxon Name | Specific Growth Form (opt.) | Constancy | Mean % Cover | Cover Range (opt.) | Diagnostic |
|--------------------------------|------------|-----------------------------|-----------|--------------|--------------------|------------|
| | | | | | | |

Dynamics: Poor soil development, high levels of exposure and steep sites impede the establishment of species from surrounding communities and maintain occurrences of this group.

ENVIRONMENT

Environmental Description: This group is known from the Wenatchee Mountains in the east Cascades, subalpine elevations throughout the Sierra Nevada, and Klamath Mountains. Sites include steep slopes, steep cliff faces, narrow canyons, and rock outcrops. *Soil/substrate/hydrology:* Substrates include thin rocky, ultramafic (peridotite, serpentinite) soils in the Cascades, and unstable scree below cliff faces in the Sierra Nevada and Klamath Mountains. Parent materials are derived from various igneous, sedimentary, and metamorphic bedrock. Soil development is limited.

DISTRIBUTION

***Geographic Range:** This group is known from the Wenatchee Mountains in the east Cascades, subalpine elevations throughout the Sierra Nevada, and Klamath Mountains.

Nations: CA, US

States/Provinces: CA, OR

USFS Ecoregions (2007) [optional]: 322A:??, 341D:CC, 341E:CC, 341F:CC, 342B:CC, M242A:CC, M242B:C?, M242C:CP, M242D:CP, M261A:CC, M261B:CC, M261D:CC, M261E:CC, M261F:CC

Omernik Ecoregions L3, L4 [optional]:

MLRAs [optional]:

PLOT SAMPLING AND ANALYSIS

***Plot Analysis Summary [Med - High Confidence]:**

***Plots Used to Define the Type [Med - High Confidence]:**

CONFIDENCE LEVEL

USNVC Confidence Level: Low

USNVC Confidence Comments [optional]:

HIERARCHY***Lower Level NVC Types:**

| Elcode | Scientific or Colloquial Name |
|--------|--|
| A3788 | <i>Aspidotis densa</i> - <i>Poa curtifolia</i> Serpentine Rock Vegetation Alliance |
| A3789 | <i>Rhodiola integrifolia</i> - <i>Penstemon newberryi</i> Rock Alliance |
| A3787 | <i>Achnatherum lemmonii</i> - <i>Racomitrium ericoides</i> Sparse Rock Vegetation Alliance |

DISCUSSION

Discussion [optional]:

CONCEPT HISTORY***Recent Concept Lineage [if applicable]:**

| Date | Predecessor | Note |
|------|-------------|------|
| | | |

RELATED CONCEPTS

Supporting Concepts [optional]:

| Relationship to NVC | Supporting Concept Name | Short Citation | Note |
|---------------------|-------------------------|----------------|------|
| | | | |

AUTHORSHIP***Primary Concept Source [if applicable]:** R. Crawford and T. Keeler-Wolf, in Faber-Langendoen et al. (2011)

| Relationship to NVC | Name Used in Source | Short Citation | Note |
|---------------------|---------------------|----------------|------|
| | | | |

***Author of Description:** M.E. Hall**Acknowledgments [optional]:** D. Meidinger, J. Sawyer

Version Date: 09 Sep 2013

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6. Open Rock Vegetation

6.B.1.Nb. Western North American Temperate & Boreal Cliff, Scree & Rock Vegetation