INTERNATIONAL ECOLOGICAL CLASSIFICATION STANDARD:

TERRESTRIAL ECOLOGICAL CLASSIFICATIONS

Alliances and Groups of the Northwestern Great Plains and High Plains Ecoregions

Appendix Accompanying Report and Field Keys for the Northwestern Great Plains and High Plains Ecoregions: NatureServe_2017_NVC Field Keys and Report_Nov_2017_NWGP.pdf

1 December 2017

by

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This subset of the International Ecological Classification Standard covers vegetation alliances and groups of the Northwestern Great Plains and High Plains Ecoregions. 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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Citations:

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

United States
Central NatureServe Office, Arlington, VA; Eastern Regional Office, Boston, MA; Midwestern Regional Office, Minneapolis, MN; Southeastern Regional Office, Durham, NC; Western Regional Office, Boulder, CO; Alabama Natural Heritage Program, Montgomery AL; Alaska Natural Heritage Program, Anchorage, AK; Arizona Heritage Data Management Center, Phoenix AZ; Arkansas Natural Heritage Commission Little Rock, AR; Blue Ridge Parkway, Asheville, NC; California Natural Heritage Program, Sacramento, CA; Colorado Natural Heritage Program, Fort Collins, CO; Connecticut Natural Diversity Database, Hartford, CT; Delaware Natural Heritage Program, Smyrna, DE; District of Columbia Natural Heritage Program/National Capital Region Conservation Data Center, Washington DC; Florida Natural Areas Inventory, Tallahassee, FL; Georgia Natural Heritage Program, Social Circle, GA; Great Smoky Mountains National Park, Gatlinburg, TN; Gulf Islands National Seashore, Gulf Breeze, FL; Hawaii Natural Heritage Program, Honolulu, Hawaii; Idaho Conservation Data Center, Boise, ID; Illinois Natural Heritage Division/Illinois Natural Heritage Database Program, Springfield, IL; Indiana Natural Heritage Data Center, Indianapolis, IN; Iowa Natural Areas Inventory, Des Moines, IA; Kansas Natural Heritage Inventory, Lawrence, KS; Kentucky Natural Heritage Program, Frankfort, KY; Louisiana Natural Heritage Program, Baton Rouge, LA; Maine Natural Areas Program, Augusta, ME; Mammoth Cave National Park, Mammoth Cave, KY; Maryland Wildlife & Heritage Division, Annapolis, MD; Massachusetts Natural Heritage & Endangered Species Program, Westborough, MA; Michigan Natural Features Inventory, Lansing, MI; Minnesota Natural Heritage & Nongame Research and Minnesota County Biological Survey, St. Paul, MN; Mississippi Natural Heritage Program, Jackson, MI; Missouri Natural Heritage Database, Jefferson City, MO; Montana Natural Heritage Program, Helena, MT; National Forest in North Carolina, Asheville, NC; National Forests in Florida, Tallahassee, FL; National Park Service, Southeastern Regional Office, Atlanta, GA; Navajo Natural Heritage Program, Window Rock, AZ; Nebraska Natural Heritage Program, Lincoln, NE; Nevada Natural Heritage Program, Carson City, NV; New Hampshire Natural Heritage Inventory, Concord, NH; New Jersey Natural Heritage Program, Trenton, NJ; New Mexico Natural Heritage Program, Albuquerque , NM; New York Natural Heritage Program, Latham, NY; North Carolina Natural Heritage Program, Raleigh, NC; North Dakota Natural Heritage Inventory, Bismarck, ND; Ohio Natural Heritage Database, Columbus, OH; Oklahoma Natural Heritage Inventory, Norman, OK; Oregon Natural Heritage Program, Portland, OR; Pennsylvania Natural Diversity Inventory, PA; Rhode Island Natural Heritage Program, Providence, RI; South Carolina Heritage Trust, Columbia, SC; South Dakota Natural Heritage Data Base, Pierre, SD; Tennessee Division of Natural Heritage, Nashville, TN; Tennessee Valley Authority Heritage Program, Norris, TN; Texas Conservation Data Center, San Antonio, TX; Utah Natural Heritage Program, Salt Lake City, UT; Vermont Nongame & Natural Heritage Program, Waterbury, VT; Virginia Division of Natural Heritage, Richmond, VA; Washington Natural Heritage Program, Olympia, WA; West Virginia Natural Heritage Program, Elkins, WV; Wisconsin Natural Heritage Program, Madison, WI; Wyoming Natural Diversity Database, Laramie, WY

Canada
Alberta Natural Heritage Information Centre, Edmonton, AB, Canada; Atlantic Canada Conservation Data Centre, Sackville, New Brunswick, Canada; British Columbia Conservation Data Centre, Victoria, BC, Canada; Manitoba Conservation Data Centre. Winnipeg, MB, Canada; Ontario Natural Heritage Information Centre, Peterborough, ON, Canada; Quebec Conservation Data Centre, Quebec, QC, Canada; Saskatchewan Conservation Data Centre, Regina, SK, Canada; Yukon Conservation Data Centre, Yukon, Canada

Latin American and Caribbean
Centro de Datos para la Conservacion de Bolivia, La Paz , Bolivia; Centro de Datos para la Conservacion de Colombia, Cali,Valle, Columbia; Centro de Datos para la Conservacion de Ecuador, Quito, Ecuador; Centro de Datos para la Conservacion de Guatemala, Ciudad de Guatemala , Guatemala; Centro de Datos para la Conservacion de Panama, Querry Heights , Panama; Centro de Datos para la Conservacion de Paraguay, San Lorenzo , Paraguay; Centro de Datos para la Conservacion de Peru, Lima, Peru; Centro de Datos para la Conservacion de Sonora, Hermosillo, Sonora , Mexico; Netherlands Antilles Natural Heritage Program, Curacao , Netherlands Antilles; Puerto Rico-Departmento De Recursos Naturales Y Ambientales, Puerto Rico; Virgin Islands Conservation Data Center, St. Thomas, Virgin Islands.

NatureServe also has partnered with many International and United States Federal and State organizations, which have also contributed significantly to the development of the International Classification. Partners include the following The Nature Conservancy; Provincial Forest Ecosystem Classification Groups in Canada; Canadian Forest Service; Parks Canada; United States Forest Service; National GAP Analysis Program; United States National Park Service; United States Fish and Wildlife Service; United States Geological Survey; United States Department of Defense; Ecological Society of America; Environmental Protection Agency; Natural Resource Conservation Services; United States Department of Energy; and the Tennessee Valley Authority. Many individual state organizations and people from academic institutions have also contributed to the development of this classification.

TABLE OF CONTENTS

1. FOREST & WOODLAND

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

1.B. Temperate & Boreal Forest & Woodland

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

1.B.2. Cool Temperate Forest & Woodland

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

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

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

M022. Southern Rocky Mountain Lower Montane Forest

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

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

G229. Southern Rocky Mountain Ponderosa Pine Open Woodland

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

OVERVIEW

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

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

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

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

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

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

VEGETATION

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

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

ENVIRONMENT & DYNAMICS

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

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

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

DISTRIBUTION

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

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

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

LOWER LEVEL UNITS

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

AUTHORSHIP

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

REFERENCES

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

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

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

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

OVERVIEW

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

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

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

Classification Comments:

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

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

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

VEGETATION

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

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

ENVIRONMENT & DYNAMICS

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

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

DISTRIBUTION

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

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

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

LOWER LEVEL UNITS

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

AUTHORSHIP

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

REFERENCES

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

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

G228. Southern Rocky Mountain Ponderosa Pine Forest & Woodland

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

OVERVIEW

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

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

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

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

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

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

VEGETATION

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

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

ENVIRONMENT & DYNAMICS

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

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

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

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

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

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

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

DISTRIBUTION

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

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

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

LOWER LEVEL UNITS

Alliances:

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

AUTHORSHIP

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

REFERENCES

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

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

A3398. Pinus ponderosa Southern Rocky Mountain Forest & Woodland Alliance

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

OVERVIEW

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

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

Classification Comments:

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

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

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

VEGETATION

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

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

ENVIRONMENT & DYNAMICS

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

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

DISTRIBUTION

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

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

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

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

LOWER LEVEL UNITS

Associations:

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

AUTHORSHIP

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

Version Date: 2014/03/14

REFERENCES

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

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

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

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

OVERVIEW

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

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

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

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

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

VEGETATION

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

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

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

ENVIRONMENT & DYNAMICS

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

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

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

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

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

DISTRIBUTION

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

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

CONFIDENCE LEVEL

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

SYNONYMY

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

LOWER LEVEL UNITS

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

AUTHORSHIP

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

REFERENCES

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

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

A3454. Pseudotsuga menziesii Southern Rocky Mountain Forest & Woodland Alliance

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

OVERVIEW

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

Type Concept: These forests and woodlands are primarily distributed in the southern Rocky Mountains, and as far east as Texas. They include evergreen forests dominated by *Pseudotsuga menziesii*. Canopy associates vary widely depending on geographic location and may include *Abies lasiocarpa, Juniperus scopulorum, Pinus contorta, Pinus flexilis, Pinus ponderosa, Pinus strobiformis*, and *Populus tremuloides*. Understories are most often shrub-dominated, but in some associations a layer of graminoids takes

prominence. Common dominant shrubs may include *Arctostaphylos patula, Arctostaphylos uva-ursi, Artemisia tridentata, Cercocarpus montanus, Holodiscus dumosus, Juniperus communis, Paxistima myrsinites, Physocarpus monogynus, Quercus gambelii*, and *Quercus x pauciloba*. Herbaceous dominants may include *Festuca arizonica, Jamesia americana, Muhlenbergia montana, Muhlenbergia straminea (= Muhlenbergia virescens)*, and *Poa fendleriana*. Elevations range from less than 1000 m in the northern Rocky Mountains to nearly 2900 m in the Southern Rockies and plateaus of the southwestern U.S. Lower elevation stands typically occupy protected northern exposures or mesic ravines and canyons, often on steep slopes. At higher elevations, these forests occur primarily on southerly aspects or ridgetops.

Classification Comments:

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

Similar NVC Types:

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

VEGETATION

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

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

ENVIRONMENT & DYNAMICS

Environmental Description: These *Pseudotsuga menziesii* forests and woodlands occur under a comparatively dry and continental climate regime. Elevations range from less than 1000 m in the northern Rocky Mountains to nearly 2900 m in the Southern Rockies and plateaus of the southwestern U.S. Lower elevation stands typically occupy protected northern exposures or mesic ravines and canyons, often on steep slopes. At higher elevations, these forests occur primarily on southerly aspects or ridgetops. Annual precipitation ranges from 50-100 cm with moderate snowfall and a greater proportion falling during the growing season. Monsoonal summer rains contribute a significant proportion of the annual precipitation in Arizona, New Mexico, and Colorado. Soils are highly variable across the range of this alliance and are derived from diverse parent materials. *Pseudotsuga menziesii* forests are reported by most studies (Pfister et al. 1977, Steele et al. 1981, Mauk and Henderson 1984, Lillybridge et al. 1995) to show no particular affinities to geologic substrates. Rock types are typically sedimentary rocks in the Central and Southern Rockies and the Colorado Plateau. The soils are typically slightly acidic (pH 5.0-6.0), well-drained, and well-aerated. They can be derived from moderately deep colluvium or shallow-jointed bedrock, and are usually gravelly or rocky.

Dynamics: Successional relationships in this alliance are complex. *Pseudotsuga menziesii* seedlings compete poorly in deep shade. At drier locales, seedlings may be favored by moderate shading, such as by a canopy of *Pinus ponderosa*, which helps to minimize drought stress. In some locations, much of these forests has been logged or burned during European settlement, and present-day stands are second-growth forests dating from fire, logging, or other stand-replacing disturbances (Mauk and Henderson 1984, Chappell et al. 1997). *Pseudotsuga menziesii* forests were probably subject to a moderate-severity fire regime in presettlement times, with fire-return intervals of 30-100 years. Many of the important tree species in these forests are fire-adapted (*Populus*

tremuloides, Pinus ponderosa, Pinus contorta) (Pfister et al. 1977), and fire-induced reproduction of *Pinus ponderosa* can result in its continued codominance in *Pseudotsuga menziesii* forests (Steele et al. 1981). Seeds of the shrub *Ceanothus velutinus* can remain dormant in forest stands for 200 years (Steele et al. 1981) and germinate abundantly after fire, competitively suppressing conifer seedlings. Some stands may have higher tree-stem density than historically, due largely to fire suppression. Fire suppression has also led to the succession of *Pinus ponderosa* woodlands or *Quercus* spp. woodlands to *Pseudotsuga menziesii* forests.

DISTRIBUTION

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

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

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

LOWER LEVEL UNITS

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

AUTHORSHIP

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

REFERENCES

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

M501. Central Rocky Mountain Dry Lower Montane-Foothill Forest

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

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

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

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

OVERVIEW

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

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

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

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

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

VEGETATION

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

Floristics: This group includes extensive *Pseudotsuga menziesii* forests, occasionally with *Pinus flexilis* on calcareous substrates, *Pinus contorta* at higher elevations and *Juniperus osteosperma* or *Juniperus scopulorum*. True firs, such as *Abies concolor, Abies grandis*,

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

ENVIRONMENT & DYNAMICS

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

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

DISTRIBUTION

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

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

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

LOWER LEVEL UNITS

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

AUTHORSHIP

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

REFERENCES

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

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

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

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

OVERVIEW

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

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

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

Internal Comments:
Other Comments:

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

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

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

VEGETATION

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

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

ENVIRONMENT & DYNAMICS

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

Dynamics: Successional relationships in this alliance are complex. *Pseudotsuga menziesii* is less shade-tolerant than many northern or montane trees such as *Abies concolor, Picea engelmannii, Thuja plicata*, or *Tsuga heterophylla*, and seedlings compete poorly in deep shade. At drier locales, seedlings may be favored by moderate shading, such as by a canopy of *Pinus ponderosa*, which helps to minimize drought stress. In some locations, much of these forests have been logged or burned during European settlement, and

present-day stands are second-growth forests dating from fire, logging, or other stand-replacing disturbances (Mauk and Henderson 1984). *Pseudotsuga menziesii* forests were probably subject to a moderate-severity fire regime in presettlement times, with fire-return intervals of 30-100 years.

DISTRIBUTION

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

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

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

LOWER LEVEL UNITS

Associations:

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

AUTHORSHIP

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

REFERENCES

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

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

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

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

OVERVIEW

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

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

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

Internal Comments:
Other Comments:

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

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

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

VEGETATION

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

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

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance is restricted to mesic to wet sites in the middle Rocky Mountains of central and southern Idaho, the Greater Yellowstone region, and the Wind River, Gros Ventre and Bighorn ranges of Wyoming. It extends north into Montana on the east side of the Continental Divide, to the McDonald Pass area, and also into the Rocky Mountain Front region and central "sky island" ranges of Montana. This alliance occurs in the Central Rockies where the southern monsoon influence is less and maritime climate regime is not important. Climate is drier and more continental than at higher elevations or in the Pacific Northwest. Annual precipitation ranges from 50-100 cm with moderate snowfall and a greater proportion falling during the growing season. Monsoonal summer rains can contribute a significant proportion of the annual precipitation in the southern portion of the range. Elevations range from less than 1000 m in the central Rocky Mountains to over 2400 m in the Wyoming Rockies. Stands typically occupy cooler northern exposures in relatively moist sites such as lower slopes, benches and valley bottoms. Lower elevation stands occupy mesic ravines and canyons on northerly aspects. Soils are highly variable and derived from diverse parent materials, including extrusive volcanics in the Yellowstone region, and sedimentary rocks elsewhere in the Rockies. The soils can be derived from moderately deep colluvium or shallow-jointed bedrock, and are usually gravelly or rocky.

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

DISTRIBUTION

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

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

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

LOWER LEVEL UNITS

Associations:

- CEGL000905 *Pseudotsuga menziesii / Piptatheropsis micrantha* Woodland
- CEGL000445 *Pseudotsuga menziesii / Osmorhiza berteroi* Forest
- CEGL000543 *Populus tremuloides - Pseudotsuga menziesii / Amelanchier alnifolia* Forest

- CEGL000447 *Pseudotsuga menziesii / Physocarpus malvaceus* Forest
- CEGL000418 *Pseudotsuga menziesii / Acer glabrum* Forest
- CEGL000420 *Pseudotsuga menziesii / Amelanchier alnifolia* Forest
- CEGL000441 *Pseudotsuga menziesii / Linnaea borealis* Forest

AUTHORSHIP

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

REFERENCES

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

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

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

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

OVERVIEW

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

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

Classification Comments: How to treat *Pinus flexilis* in the Rocky Mountains is still somewhat uncertain. For now, we have kept three groups which have limber pine as a component. The group described here is composed predominantly of limber pine or juniper that is elevationally below the zone of continuous lower montane forests found in the main Rocky Mountain cordillera. The associations placed in this group are restricted to foothill settings on rock outcrops, or to escarpments in the Great Plains. Associations extending from the foothill zone into the subalpine, such as *Pinus flexilis / Arctostaphylos uva-ursi* Woodland (CEGL000802), are included in Rocky Mountain Subalpine-Montane Limber Pine - Bristlecone Pine Woodland Group (G221). Additionally, there are *Juniperus osteosperma*-dominated stands included in this group from the Pryor, Big Horn, and Laramie mountain ranges because these stands are significantly disjunct from the main distribution of *Juniperus osteosperma* in the Colorado

Plateau and Great Basin regions and have floristic similarities to the Great Plains. Finally, this foothill woodland group is relatively fine scale and closely related to Black Hills-Northwestern Great Plains Ponderosa Pine Forest & Woodland Group (G216). These two groups could be combined into a single group and this original concept could be treated as an alliance of this larger Great Plains woodland group.

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

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

VEGETATION

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

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

ENVIRONMENT & DYNAMICS

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

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

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

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

DISTRIBUTION

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

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

CONFIDENCE LEVEL

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

SYNONYMY

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

LOWER LEVEL UNITS

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

AUTHORSHIP

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

REFERENCES

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

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

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

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

OVERVIEW

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

Type Concept: This woodland alliance occurs in foothill and lower montane zones in the Rocky Mountains from southern Alberta and northern Montana south to central Colorado and on escarpments across Wyoming extending out into the western Great Plains. The vegetation is characterized by an open-tree canopy or patchy woodland that is dominated by either *Juniperus scopulorum* or,

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

Classification Comments: *Juniperus scopulorum* is a wide-ranging species in the Rocky Mountains and may dominate stands in other groups. *Juniperus osteosperma*-dominated stands from the Pryor, Big Horn, and Laramie mountain ranges are included in this alliance because these stands are significantly disjunct from the main distribution of *Juniperus osteosperma* in the Colorado Plateau and Great Basin regions and may have floristic similarities to the Great Plains. At their upper elevational limit, *Juniperus scopulorum* communities may merge with woodlands and forests dominated by *Pinus* species. The dominance of *Juniperus scopulorum* and low cover of other tree species in the tree layer are diagnostic features that can usually be used to separate communities within this alliance from other wooded communities with grassy understories. At the lower elevation edges of this alliance it may be difficult to distinguish where open stands of this alliance transition to grassland with scattered trees (<10% cover).

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

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

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

VEGETATION

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

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

ENVIRONMENT & DYNAMICS

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

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

DISTRIBUTION

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

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

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

LOWER LEVEL UNITS

Associations:

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

- CEGL000748 *Juniperus scopulorum / Pseudoroegneria spicata* Woodland

AUTHORSHIP

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

REFERENCES

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

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

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

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

OVERVIEW

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

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

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

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

Similar NVC Types:

- A3427 *Juniperus osteosperma - Juniperus scopulorum* / Grass Understory Central Rocky Mountain Woodland Alliance: occurs in the same group and the overstory is very similar, but understory is dominated by grasses instead if shrubs.

- A3497 *Juniperus osteosperma* / Herbaceous Understory Open Woodland Alliance: is also dominated by *Juniperus osteosperma* with a grass understory, but occurs in a different group.

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

VEGETATION

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

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

ENVIRONMENT & DYNAMICS

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

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

Dynamics: Woodlands in this alliance are considered to be edaphic or topographic climax communities (Hansen et al. 1984, Tiedemann et al. 1987). *Juniperus scopulorum* is a long-lived species. Hansen and Hoffman (1988) found most trees in stands they sampled to be over 120 years, with some individuals older than 360 years. Fire can be used to control *Juniperus scopulorum* stands on rangeland because the species will not resprout after being burned (Wright et al. 1979, Fischer and Bradley 1987). Young

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

DISTRIBUTION

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

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

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

LOWER LEVEL UNITS

Associations:

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

- CEGL000745 *Juniperus scopulorum / Cercocarpus montanus* Woodland
- CEGL000742 *Juniperus scopulorum / Artemisia nova* Woodland

AUTHORSHIP

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

REFERENCES

References: Badaracco 1971, Baker 1984a, Baker and Kennedy 1985, Bighorn Coal Mine n.d., Bourgeron and Engelking 1994, Brown 1971, Burns and Honkala 1990a, Caicco and Wellner 1983c, Cooper et al. 1995, DeVelice 1992, DeVelice and Lesica 1993, DeVelice et al. 1995, Despain 1973a, Faber-Langendoen et al. 2017b, Fischer and Bradley 1987, Hansen 1985, Hansen and Hoffman 1988, Hansen et al. 1984, Hess 1981, Hess and Alexander 1986, Jennings 1978, Jennings 1979, Johnson and Pfister 1982, Johnston 1987, Jones 1989b, Kline 1973, Knight et al. 1987, Komarkova et al. 1988a, Lesica and DeVelice 1992, Marriott and Jones 1989, Moran 1981a, Ramaley 1909, Rust 1999, Steele et al. 1983, Strong 1980, Terwilliger et al. 1979a, Tiedemann et al. 1987, Warren n.d., Wasser and Hess 1982, Wells 1965, Wells 1970a, Wells 1970b, Wight 1965, Wight and Fisser 1968, Wright et al. 1979

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

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

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

OVERVIEW

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

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

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

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

Similar NVC Types:

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

- A3424 *Pinus flexilis* / Shrub Understory Central Rocky Mountain Woodland Alliance: occurs in the same group and the overstory is very similar, but understory is dominated by shrubs instead of grasses.

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

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has an open tree canopy that is typically to 3-10 m tall. The canopy is dominated by evergreen needle-leaved trees. A sparse to moderately dense herbaceous layer dominated by perennial graminoids is present. Perennial forbs have sparse cover. Annual forbs and grasses may be seasonally present. If shrubs are present, then cover is low <10% and perennial grass cover exceeds shrub cover.

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

ENVIRONMENT & DYNAMICS

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

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

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

DISTRIBUTION

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

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

Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** *Pinus flexilis / Agropyron spicatum* Habitat Type (Alexander 1985)
- **>** *Pinus flexilis / Agropyron spicatum* Habitat Type (Girard et al. 1989)
- **>** *Pinus flexilis / Agropyron spicatum* Habitat Type (Pfister et al. 1977)
- **>** *Pinus flexilis / Leucopoa kingii* Community (Jones 1992b)
- **>** *Pinus flexilis* Habitat Type (USFS 1992)
- **?** *Pinus flexilis* Habitat Type (Steele et al. 1983)
- **<** *Pinus flexilis* Series (Johnston 1987)
- **<** *Pinus flexilis* Series (Girard et al. 1989)

LOWER LEVEL UNITS

Associations:

- CEGL000813 *Pinus flexilis / Pseudoroegneria spicata* Woodland

AUTHORSHIP

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

REFERENCES

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

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

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

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

OVERVIEW

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

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

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

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

Similar NVC Types:
- A0540 *Pinus flexilis* Rocky Mountain Woodland Alliance: is also dominated by *Pinus flexilis* with some associations with a shrub understory, but occurs in a different group at higher elevation.
- A3425 *Pinus flexilis* / Grass Understory Central Rocky Mountain Woodland Alliance: occurs in the same group and the overstory is very similar, but understory is dominated by grasses instead of shrubs.

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

VEGETATION

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

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

ENVIRONMENT & DYNAMICS

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

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

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

aristata or *Pinus albicaulis* occur. There, *Pinus flexilis* is largely restricted to lower elevation, rocky sites. Peet (1978a) also reported that *Pinus flexilis* occurs in the less xeric *Pinus contorta* and *Pinus ponderosa* habitats.

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

DISTRIBUTION

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

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

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

LOWER LEVEL UNITS

Associations:

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

AUTHORSHIP

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

REFERENCES

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

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

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

Scientific Name: *Pinus ponderosa* Northwestern Great Plains Forest & Woodland Group
Common Name (Translated Scientific Name): Ponderosa Pine Northwestern Great Plains Forest & Woodland Group
Colloquial Name: Black Hills Ponderosa Pine Dry-Mesic 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.

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 M331I) 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:

- 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

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.

VEGETATION

Physiognomy and Structure: 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.

Floristics: 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*.

ENVIRONMENT & DYNAMICS

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.

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.

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.

Spatial Scale & Pattern [optional]: Large patch
Nations: US
States/Provinces: CO, KS?, MT, ND, NE, SD, WY
TNC Ecoregions [optional]: 25:C, 26:C, 27:C, 33:C, 34:?
USFS Ecoregions (2007): 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:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate. USNVC Confidence from peer reviewer, not AE. Hollis Marriott: Not Valid. The group is too broad, lumping montane ponderosa pine vegetation in the Black Hills, a matrix type, with stands in the Great Plains, a large-patch type in a matrix of grassland vegetation. The latter pine type does occur at lowest elevations in the Black Hills, especially on the east side, but over most of the uplift ponderosa pine vegetation is a montane matrix type. Montane ponderosa pine in the Black Hills should be added to the Southern Rocky Mountain Ponderosa Pine Forest & Woodland Group (G228). Composition and habitat are well within the range of variation for that group. Also Black Hills ponderosa pine stands have floristic affinities with the Rocky Mountains rather than the Great Plains (McIntosh 1931, Marriott 1985). [See peer reviewer form for more comments.]

SYNONYMY

LOWER LEVEL UNITS

Alliances:
- A3464 *Pinus ponderosa* Dry-Mesic Black Hills Forest & Woodland Alliance
- A3465 *Pinus ponderosa* Mesic Black Hills Forest Alliance
- A3466 *Pinus ponderosa* Northwest Great Plains Open Woodland Alliance

AUTHORSHIP

Primary Concept Source: P.L. Hansen and G.R. Hoffman (1988)
Author of Description: M.S. Reid, K.A. Schulz and H. Marriott
Acknowledgments: H. Marriott
Version Date: 11/09/2015
Classif Resp Region: West
Internal Author: MSR 3-10, mod. KAS/HM 5-13, 11-15

REFERENCES

References: Bock and Bock 1984, Cogan et al. 1999, Eyre 1980, Faber-Langendoen et al. 2017a, Girard 1985, Girard et al. 1987, Girard et al. 1989, Hansen and Hoffman 1988, Hoffman and Alexander 1987, Kindscher pers. comm., Marriott 1985, Marriott and Faber-Langendoen 2000, Marriott et al. 1999, McIntosh 1931, Salas and Pucherelli 1998a, Salas and Pucherelli 1998b, Salas and Pucherelli 1998c, Thilenius 1972

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G216. Black Hills-Northwestern Great Plains Ponderosa Pine Forest & Woodland

A3464. Pinus ponderosa Dry-Mesic Black Hills Forest & Woodland Alliance

Type Concept Sentence: This Black Hills forest and woodland alliance has a tree canopy dominated by *Pinus ponderosa* but may include a sparse to relatively dense subcanopy of *Juniperus scopulorum* and *Populus tremuloides* with an understory composed of relatively dry shrub species such as *Arctostaphylos uva-ursi, Juniperus communis, Juniperus horizontalis*, and *Mahonia repens* without mesic to wet indicator species. Stands occur at foothill and montane elevations on all aspects on gentle to steep dry to mesic slopes.

OVERVIEW

Scientific Name: *Pinus ponderosa* Dry-Mesic Black Hills Forest & Woodland Alliance
Common Name (Translated Scientific Name): Ponderosa Pine Dry-Mesic Black Hills Forest & Woodland Alliance
Colloquial Name: Black Hills Ponderosa Pine Dry-Mesic Forest & Woodland

Type Concept: This forest and woodland alliance occurs on dry to mesic sites at montane and foothill elevations in the Black Hills. Stands are primarily dominated by *Pinus ponderosa* but may include a sparse to relatively dense subcanopy of *Juniperus scopulorum*. The understory is variable. Shrubs may form a sparse to moderately layer or be absent. Characteristic species can include *Arctostaphylos uva-ursi, Artemisia tridentata ssp. wyomingensis, Juniperus communis, Juniperus horizontalis, Mahonia repens, Rhus trilobata, Spiraea betulifolia*, and *Symphoricarpos albus*. The herbaceous understory can range from a sparse to moderately dense layer. Common species include *Carex siccata (= Carex foenea), Danthonia spicata, Galium boreale, Nassella viridula, Oryzopsis asperifolia*, and *Schizachne purpurascens*. This alliance has been found on flat to moderately sloping topography (2-24%) below 1280 m (4200 feet) elevation on sandy loam, silt loam to clay loam soils often derived from weathered sandstone, limestone, and scoria. Stands occur on all aspects. At montane elevations, it often occurs on warmer, drier south-facing slopes, but at lower elevation, it is generally found on cooler northerly aspects.

Classification Comments: These Great Plains ponderosa pine woodlands do show some floristic similarities to those found within the forested mountains of the Rockies, but have herbaceous floristics related to dry to mesic sites in the Great Plains "mixedgrass" prairie. Some broadly defined component associations that range into the southern or central Rocky Mountains need further review.

Internal Comments:
Other Comments:

Similar NVC Types: There are other similar ponderosa pine alliances other NVC groups such as Central Rocky Mountain Ponderosa Pine Open Woodland Group (G213), Southern Rocky Mountain Ponderosa Pine Forest & Woodland Group (G228), and Southern Rocky Mountain Ponderosa Pine Open Woodland Group (G229).
- A3466 *Pinus ponderosa* Northwest Great Plains Open Woodland Alliance: occurs at lower elevations on ecotones with mixedgrass prairie and dominated by prairie species in the understory.

- A3465 *Pinus ponderosa* Mesic Black Hills Forest Alliance: is restricted to more mesic sites and has mesic to wet indicator species.

Diagnostic Characteristics: This alliance is characterized by the dominance of *Pinus ponderosa* in the tree canopy with an understory characterized by species common on dry to mesic sites such as the short shrubs *Arctostaphylos uva-ursi, Juniperus communis, Juniperus horizontalis*, and *Mahonia repens*, and herbaceous species such as *Oryzopsis asperifolia*.

VEGETATION

Physiognomy and Structure: The vegetation structure of stands in this alliance vary from open woodlands to closed-canopy forests composed of needle-leaved evergreen trees typically less than 25 m in height and less than 15 m on dry rock outcrops. Associated trees are primarily needle-leaved evergreen species, but cold-deciduous and broad-leaved evergreen trees may be present in the subcanopy. The understory is dry, often shrubby, with either tall or short layers, and sclerophyllous or cold-deciduous species dominant. Where there is no shrub layer, grassy understories are common, but perennial forbs are important in some stands.

Floristics: This alliance is primarily dominated by *Pinus ponderosa* but may include a sparse to relatively dense subcanopy of *Juniperus scopulorum* or *Populus tremuloides* on disturbed sites. Important or common shrub species with ponderosa pine can include *Arctostaphylos uva-ursi, Artemisia tridentata ssp. wyomingensis, Juniperus communis, Juniperus horizontalis, Mahonia repens, Rhus trilobata, Spiraea betulifolia*, and *Symphoricarpos albus* (Pfister et al. 1977, Hoffman and Alexander 1987). The herbaceous understory can range from a sparse to moderately dense layer Common species include *Carex siccata (= Carex foenea), Eurybia conspicua (= Aster conspicuus), Monarda fistulosa, Nassella viridula, Oryzopsis asperifolia, Schizachne purpurascens, Thalictrum occidentale*, and *Viola canadensis* (Marriott and Faber-Langendoen 2000). 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*. The invasive grass *Poa pratensis* is present in some stands of this type.

ENVIRONMENT & DYNAMICS

Environmental Description: This forest and woodland alliance occurs in the Black Hills and along escarpments, buttes, canyons, rock outcrops or ravines in the surrounding northwestern Great Plains. Stands are found on dry to mesic sites on flat to moderately sloping topography (2-24%) and occur on all aspects. At montane elevations, it often occurs on warmer, drier south-facing slopes, but on at lower elevation, it is generally restricted to cooler northerly aspects (Hoffman and Alexander 1987). Soils are often shallow and rocky, sandy loams, silt loams or clay loams often derived from weathered sandstone, limestone, and scoria (Pfister et al. 1977).

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). Stands in this alliance behave more like the mesic group somewhat higher elevation, north-slope, swale associations.

DISTRIBUTION

Geographic Range: The forest and woodland alliance occurs on dry to mesic site at foothill and montane elevations in the Black Hills along escarpments, buttes, canyons, rock outcrops or ravines and can grade into the surrounding northwestern Great Plains.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** *Pinus ponderosa / Juniperus communis* Habitat Type (Hoffman and Alexander 1976)
- **>** *Pinus ponderosa / Juniperus horizontalis* Plant Association (DeVelice et al. 1995)
- **>** *Pinus ponderosa / Mahonia repens* Forest (Marriott and Faber-Langendoen 2000)
- **>** *Pinus ponderosa / Oryzopsis asperifolia* Woodland (Marriott and Faber-Langendoen 2000)
- **<** Interior Ponderosa Pine - Black Hills (Mehl 1992)

LOWER LEVEL UNITS

Associations:

- CEGL002123 *Pinus ponderosa / Oryzopsis asperifolia* Woodland
- CEGL000859 *Pinus ponderosa / Juniperus communis* Woodland

- CEGL000878 *Pinus ponderosa* Scree Woodland
- CEGL000187 *Pinus ponderosa / Mahonia repens* Forest
- CEGL000860 *Pinus ponderosa / Juniperus horizontalis* Woodland

AUTHORSHIP

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

REFERENCES

References: Alexander 1985, Alexander 1986, Brown 1971, Cooper and Pfister 1985, Currie 1975, DeVelice et al. 1995, Eyre 1980, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Fischer and Clayton 1983, Hansen and Hoffman 1988, Hoffman and Alexander 1976, Hoffman and Alexander 1987, Johnston 1987, MacCracken et al. 1983a, MacCracken et al. 1983b, Marriott and Faber-Langendoen 2000, Mehl 1992, Pfister et al. 1977, Progulske and Shideler 1974, Roberts 1980, Thilenius 1971, Thilenius 1972

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G216. Black Hills-Northwestern Great Plains Ponderosa Pine Forest & Woodland

A3465. Pinus ponderosa Mesic Black Hills Forest Alliance

Type Concept Sentence: This mesic to wet Black Hills forest and woodland alliance has a tree canopy dominated by *Pinus ponderosa* but may include a sparse to relatively dense subcanopy of *Juniperus scopulorum* and presence to codominance of deciduous trees with an understory composed of relatively mesic shrub species and mesic to wet herbaceous indicator species. Stands occur at foothill and montane elevations on cooler northerly aspects and gentle to moderate benches and lower slopes and especially in mesic draws and swales and ravine and canyon bottoms.

OVERVIEW

Scientific Name: *Pinus ponderosa* Mesic Black Hills Forest Alliance
Common Name (Translated Scientific Name): Ponderosa Pine Mesic Black Hills Forest Alliance
Colloquial Name: Black Hills Ponderosa Pine Mesic Forest

Type Concept: This forest and woodland alliance occurs on mesic-wet sites at montane and foothill elevations in the Black Hills and isolated mountains such as Bear's Paw Mountains in the northwestern Great Plains. Stands are primarily dominated by *Pinus ponderosa* but may include a sparse to relatively dense subcanopy of *Juniperus scopulorum*. Deciduous trees such as *Acer negundo, Betula papyrifera, Crataegus succulenta, Fraxinus pennsylvanica, Quercus macrocarpa, Populus tremuloides*, and *Ulmus americana* are an important component in some areas, especially mesic draws and swales, and are sometimes codominant with the pines. The shrub layer is moderately dense to dense with characteristic species that include *Amelanchier alnifolia, Physocarpus monogynus, Prunus virginiana, Symphoricarpos occidentalis*, and *Toxicodendron rydbergii*. The herbaceous layer ranges from moderately dense to dense with moderate species diversity. Species such as *Antennaria rosea, Apocynum androsaemifolium, Carex inops ssp. heliophila, Cerastium arvense, Elymus caninus, Galium boreale, Maianthemum stellatum, Pulsatilla patens*, and *Schizachne purpurascens* are typical components of the herbaceous layer. Mosses and lichens are usually present. These mesic forests and woodlands are found on gentle to moderate (2-40%), cool north-facing slopes and frequently occur close to streams. A few stands are on rolling uplands. The soils are variable but are often sandy loams or loams derived from limestone and sandstone.

Classification Comments: Broadly defined component associations that range into southern or central Rocky Mountains need further review.

Internal Comments:
Other Comments:

Similar NVC Types: There are other similar ponderosa pine alliances other NVC groups such as Central Rocky Mountain Ponderosa Pine Open Woodland Group (G213), Southern Rocky Mountain Ponderosa Pine Forest & Woodland Group (G228), and Southern Rocky Mountain Ponderosa Pine Open Woodland Group (G229).

- A3464 *Pinus ponderosa* Dry-Mesic Black Hills Forest & Woodland Alliance: occurs more widely on dry to mesic sites at foothill and montane elevations and lacks mesic to wet indicator species.
- A3466 *Pinus ponderosa* Northwest Great Plains Open Woodland Alliance: occurs at lower elevations on ecotone with mixedgrass prairie and dominated by prairie species in the understory.
- A3209 *Betula papyrifera - Populus tremuloides - Quercus macrocarpa* Forest Alliance

Diagnostic Characteristics: This alliance is characterized by the dominance of *Pinus ponderosa* in the tree canopy with an understory characterized by species common on mesic-wet sites such as the short shrubs *Amelanchier alnifolia, Physocarpus monogynus, Prunus virginiana, Symphoricarpos occidentalis*, and herbaceous species such as *Apocynum androsaemifolium, Cerastium arvense, Elymus caninus, Galium boreale*, and *Maianthemum stellatum*.

VEGETATION

Physiognomy and Structure: The vegetation structure of stands in this alliance vary from open woodlands to closed-canopy forests composed of needle-leaved evergreen trees typically less than 30 m in height. Associated trees are primarily needle-leaved evergreen species, but cold-deciduous and broad-leaved evergreen trees may be present in the subcanopy. The understory is dry, often shrubby, with either tall or short layers, and sclerophyllous or cold-deciduous species dominant. Where there is no shrub layer, grassy understories are common, but perennial forbs are important in some stands.

Floristics: This mesic forest and woodland alliance is primarily dominated by *Pinus ponderosa* but may include a sparse to relatively dense subcanopy of *Juniperus scopulorum* (Hansen and Hoffman 1988). Deciduous trees such as *Acer negundo, Betula papyrifera, Crataegus succulenta, Fraxinus pennsylvanica, Populus tremuloides, Quercus macrocarpa*, and *Ulmus americana* are an important component in some areas, especially mesic draws and swales, and are sometimes codominant with the pines (Hansen and Hoffman 1988). The shrub layer is moderately dense to dense with characteristic species that include *Amelanchier alnifolia, Physocarpus monogynus, Prunus virginiana, Ribes missouriense, Rosa woodsii, Spiraea betulifolia, Symphoricarpos occidentalis*, and *Toxicodendron rydbergii*. The herbaceous understory can range from moderately dense to dense. The diversity of species is moderate. Species such as *Antennaria rosea, Apocynum androsaemifolium, Carex inops ssp. heliophila, Cerastium arvense, Elymus caninus, Galium boreale, Maianthemum stellatum, Pulsatilla patens*, and *Schizachne purpurascens* are typical components of the herbaceous layer. Mosses and lichens are typically found in this community.

ENVIRONMENT & DYNAMICS

Environmental Description: This forest and woodland alliance occurs on mesic-wet sites at montane and foothill elevations in the Black Hills and isolated mountains such as Bear's Paw Mountains in the northwestern Great Plains. Climate is temperate continental with mean annual precipitation of 35-40 cm (Soil Conservation Service 1981b). Elevation in Bear's Paw Mountains is 1040-1600 m (Roberts 1980). Stands are found on gentle to moderate (2-40%), cool north-facing slopes and frequently occur close to streams (Hansen and Hoffman 1988). A few stands are on rolling uplands. The soils are variable but are often sandy loams or loams derived from limestone and sandstone. Soil reaction is near-neutral, and average duff depth is 6.4 cm (Roberts 1980).

Dynamics: Presettlement stands in the warm, moist *Pinus ponderosa* habitat types were often open and park-like. Surface fires kept stands in open condition by thinning out seedling and sapling trees. However, many modern stands have become overstocked as a result of fire suppression. These overstocked stands are more prone to stand-replacing crown fires (Fischer and Clayton 1983). Apparently *Populus tremuloides* may occasionally be a seral species (Roberts 1980). *Populus tremuloides* is often a component of stands in this alliance. *Populus tremuloides* abundance often increases in response to disturbance and clones will vigorously resprout (Knight 1994). The stems are relatively short-lived (100-150 years), and the stand will succeed to longer-lived conifer forest if undisturbed. With adequate disturbance a clone may live many centuries. Although *Populus tremuloides* produces abundant seeds, seedling survival is rare because of the long moist conditions required to establish are rare in the habitats that it occurs in. Superficial soil drying will kill seedlings (Knight 1994). In the Dakotas and Wyoming, these stands may remain successionally stable for many dozens of years (Girard et al. 1989).

DISTRIBUTION

Geographic Range: This forest and woodland alliance occurs on mesic-wet sites at montane and foothill elevations in the Black Hills and isolated mountains such as Bear's Paw Mountains in the northwestern Great Plains.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Pinus ponderosa / Amelanchier alnifolia* Habitat Type (Roberts 1980)
- **?** *Pinus ponderosa / Physocarpus monogynus* Habitat Type (Hoffman and Alexander 1976)
- **?** *Pinus ponderosa / Prunus virginiana* Habitat Type (Hoffman and Alexander 1987)

- **?** *Pinus ponderosa / Symphoricarpos occidentalis* Habitat Type (Roberts 1980)
- **?** *Populus tremuloides / Padus virginiana* Plant Association (Johnston 1987)

LOWER LEVEL UNITS

Associations:
- CEGL000192 *Pinus ponderosa / Prunus virginiana* Forest
- CEGL000596 *Populus tremuloides / Prunus virginiana* Forest
- CEGL000840 *Pinus ponderosa / Amelanchier alnifolia* Woodland
- CEGL000204 *Pinus ponderosa / Symphoricarpos occidentalis* Forest
- CEGL000190 *Pinus ponderosa / Physocarpus monogynus* Forest

AUTHORSHIP

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

REFERENCES

References: Alexander 1985, Alexander 1986, Brown 1971, Cooper and Heidel 1997, Cooper and Pfister 1981, Cooper and Pfister 1985, Currie 1975, Eyre 1980, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Fischer and Clayton 1983, Girard et al. 1989, Hansen and Hoffman 1988, Hansen et al. 1995, Hoffman and Alexander 1976, Hoffman and Alexander 1987, Johnston 1987, Knight 1994, Lynn et al. n.d., MacCracken et al. 1983a, MacCracken et al. 1983b, Merkle 1962, Pfister et al. 1977, Potter and Green 1964, Potter and Moir 1961, Progulske and Shideler 1974, Roberts 1980, Severson and Thilenius 1976, Soil Conservation Service 1981b, Thilenius 1972, Tiedemann and Klock 1977, WNDD unpubl. data

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1. Forest & Woodland
1.B.2.Nb. Rocky Mountain Forest & Woodland
G216. Black Hills-Northwestern Great Plains Ponderosa Pine Forest & Woodland

A3466. Pinus ponderosa Northwest Great Plains Open Woodland Alliance

Type Concept Sentence: This very open to moderately dense (10-30% cover) *Pinus ponderosa* alliance sometimes has *Quercus macrocarpa* present to codominant in the tree canopy with the understory characterized by a sparse to dense herbaceous layer dominated by mixedgrass prairie species *Andropogon gerardii, Pascopyrum smithii*, and *Schizachyrium scoparium* occurring in foothills of the Black Hills and along escarpments, buttes, canyons, rock outcrops or ravines as an open woodland and grades into the mixedgrass prairie as a pine savanna in surrounding Great Plains.

OVERVIEW

Scientific Name: *Pinus ponderosa* Northwest Great Plains Open Woodland Alliance
Common Name (Translated Scientific Name): Ponderosa Pine Northwest Great Plains Open Woodland Alliance
Colloquial Name: Northwest Great Plains Ponderosa Pine Open Woodland

Type Concept: This alliance occurs in foothills of the Black Hills and along escarpments, buttes, canyons, rock outcrops or ravines as an open woodland and savanna in the surrounding mixedgrass prairie. The very open to moderate (10-30% cover) tree canopy is dominated by *Pinus ponderosa*, but may include a sparse to relatively dense subcanopy of *Juniperus scopulorum* and *Quercus macrocarpa* or other deciduous trees such as *Acer negundo, Betula papyrifera, Fraxinus pennsylvanica*, or *Ulmus americana* that are sometimes codominant with the pines, especially in mesic draws and swales. The understory is characterized by a sparse to dense herbaceous layer with species typifying the surrounding prairie group, with mixedgrass prairie species common, such as *Andropogon gerardii, Bouteloua curtipendula, Pascopyrum smithii*, and *Schizachyrium scoparium*. Soils typically range from well-drained loamy sands to sandy loams formed in colluvium, weathered sandstone, limestone, scoria or eolian sand.

Classification Comments: Currently *Pinus ponderosa* Limestone Cliff Sparse Vegetation (CEGL002055) is placed in this alliance because cliffs are defined as having at least 3-m vertical height which is common on ridgetops, slopes and in drainage bottoms and rock outcrops in the breaks in the Great Plains and foothills. Cliffs are also common in the more mountainous montane zone in the Black Hills, so placement in *Pinus ponderosa* Dry-Mesic Black Hills Forest & Woodland Alliance (A3464) could also be justified, especially since the understory in many stands is often characterized by sparse shrubs, including *Prunus virginiana, Rhus trilobata*, and *Toxicodendron pubescens*.

This alliance may also belong with M151, perhaps in its own group as a *Pinus ponderosa* Great Plains woodland type.

Internal Comments: KAS-12-13: Pinus ponderosa Limestone Cliff Sparse Vegetation (CEGL002055) may fit better in Pinus ponderosa Dry-Mesic Black Hills Forest &Woodland Alliance (A.3464) than this alliance.

Other Comments:

Similar NVC Types: There are other similar ponderosa pine alliances other NVC groups such as Central Rocky Mountain Ponderosa Pine Open Woodland Group (G213), Southern Rocky Mountain Ponderosa Pine Forest & Woodland Group (G228), and Southern Rocky Mountain Ponderosa Pine Open Woodland Group (G229).

- A3465 *Pinus ponderosa* Mesic Black Hills Forest Alliance: is restricted to more mesic sites at foothill and montane elevations and has mesic to wet indicator species.
- A3464 *Pinus ponderosa* Dry-Mesic Black Hills Forest & Woodland Alliance: occurs more widely on dry to mesic sites at foothill and montane elevations and lacks mesic to wet indicator species.

Diagnostic Characteristics: This alliance is characterized by the dominance of *Pinus ponderosa* in an open to sparse (savanna) tree canopy with an understory characterized by a sparse to dense herbaceous layer composed of species typifying the surrounding prairie group, such as *Andropogon gerardii, Bouteloua curtipendula, Carex inops ssp. heliophila, Carex filifolia, Elymus canadensis, Hesperostipa comata, Hesperostipa spartea, Koeleria macrantha, Muhlenbergia racemosa, Nassella viridula, Oryzopsis asperifolia, Pascopyrum smithii, Piptatheropsis micrantha, Schizachyrium scoparium*, and *Sporobolus heterolepis*.

VEGETATION

Physiognomy and Structure: This alliance is characterized by the dominance of needle-leaved evergreen trees in an open to sparse (savanna) tree canopy . Broadleaf trees may be present in the tree canopy or subcanopy. The understory is characterized by a sparse to dense herbaceous layer dominated by perennial graminoids species. Mosses and lichens can be conspicuous in some stands; thick litter and duff layers occur, as do rock outcrops on steep slopes.

Floristics: The very open to moderate (10-50% cover) tree canopy is dominated by *Pinus ponderosa*, but may include a sparse to relatively dense subcanopy of *Juniperus scopulorum* with just a few scattered *Pinus ponderosa* trees. Deciduous trees such as *Acer negundo, Betula papyrifera, Fraxinus pennsylvanica, Quercus macrocarpa*, and *Ulmus americana* are important component in some areas, especially mesic draws and swales, and are sometimes codominant with the pines. The understory is characterized by a sparse to dense herbaceous layer with species typifying the surrounding prairie group, with mixedgrass species common, such as *Andropogon gerardii, Bouteloua curtipendula, Carex inops ssp. heliophila, Carex filifolia, Elymus canadensis, Hesperostipa comata, Hesperostipa spartea, Koeleria macrantha, Muhlenbergia racemosa, Nassella viridula, Oryzopsis asperifolia, Pascopyrum smithii, Piptatheropsis micrantha (= Piptatherum micranthum), Schizachyrium scoparium*, and *Sporobolus heterolepis*. Scattered shrubs may be present individually or in patches, but typically do not form a distinct shrub layer. Common shrub species can include *Amorpha canescens, Artemisia frigida, Mahonia repens, Prunus virginiana, Rhus trilobata, Spiraea betulifolia, Symphoricarpos albus*, and *Toxicodendron pubescens*.

ENVIRONMENT & DYNAMICS

Environmental Description: This ponderosa pine alliance occurs in foothills of the Black Hills and along escarpments, buttes, canyons, rock outcrops or ravines in the woodland to grassland transition zone into the surrounding mixedgrass prairie in the northwestern Great Plains grassland. It is found on warm exposures in the northern portion of its range in southeastern Montana (Pfister et al. 1977), but is found on cool slopes and canyons in the drier portions of the Black Hills (Thilenius 1972) and in the Powder River Basin of Wyoming (Jones 1992b). Elevations are about 1220 m (4000 feet) in Montana, but 1460-1675 m (4800-5500 feet) in South Dakota. Thilenius (1972) reports that stands are in a 45- to 50-cm annual precipitation zone in the Black Hills. Stands in the Black Hills occur on "relatively deep" soils with near-neutral reaction (Thilenius 1972). Montana stands more likely occur on soils derived from sandstone. Stands 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. Soils typically range from well-drained loamy sands to sandy loams formed in colluvium, weathered sandstone, limestone, scoria or eolian sand.

Dynamics: Fire undoubtedly plays an important role in the dynamics of these dry forest communities. Ground layer species composition has much in common with grasslands (Thilenius 1972). Forests vary widely in canopy closure. Understory vegetation may change if canopy closure is allowed to proceed without fire (Hansen and Hoffman 1988).

DISTRIBUTION

Geographic Range: This woodland and savanna alliance occurs in the foothills of the Black Hills on rolling plains and escarpments in the northwestern Great Plains.

Nations: US

States/Provinces: MT, NE, SD, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** *Pinus ponderosa - Quercus macrocarpa / Prunus virginiana / Symphoricarpos albus / Mahonia repens* (Thilenius 1972)
- **>** *Pinus ponderosa - Quercus macrocarpa / Prunus virginiana / Symphoricarpos albus / Schizachne purpurascens - Carex foenea* (Thilenius 1972)
- **>** *Pinus ponderosa / Andropogon scoparius* habitat unit (Thilenius 1972)
- **>** *Pinus ponderosa / Andropogon* spp. Habitat Type (Pfister et al. 1977)
- **>** *Pinus ponderosa / Pascopyrum smithii* Woodland (Marriott and Faber-Langendoen 2000)
- **>** *Pinus ponderosa / Quercus macrocarpa* Habitat Type (Hoffman and Alexander 1987)
- **>** *Pinus ponderosa / Schizachyrium scoparium* Community (Jones 1992b)

LOWER LEVEL UNITS

Associations:

- CEGL002055 *Pinus ponderosa* Limestone Cliff Sparse Vegetation
- CEGL000188 *Pinus ponderosa / Pascopyrum smithii* Open Woodland
- CEGL000201 *Pinus ponderosa / Schizachyrium scoparium* Open Woodland
- CEGL000873 *Pinus ponderosa / Quercus macrocarpa* Open Woodland
- CEGL000841 *Pinus ponderosa / (Andropogon gerardii, Schizachyrium scoparium)* Open Woodland

AUTHORSHIP

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

REFERENCES

References: Alexander 1985, Alexander 1986, Brown 1971, Cooper and Pfister 1985, Currie 1975, Eyre 1980, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Fischer and Clayton 1983, Girard et al. 1987, Hansen and Hoffman 1988, Hoffman and Alexander 1976, Hoffman and Alexander 1987, Jones 1992b, MacCracken et al. 1983a, MacCracken et al. 1983b, Marriott and Faber-Langendoen 2000, Pfister et al. 1977, Potter and Green 1964, Progulske and Shideler 1974, Roberts 1980, Thilenius 1971, Thilenius 1972

M020. Rocky Mountain Subalpine-High Montane Conifer Forest

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

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

G222. Rocky Mountain Subalpine-Montane Aspen Forest & Woodland

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

OVERVIEW

Scientific Name: *Populus tremuloides* Rocky Mountain Forest & Woodland Group
Common Name (Translated Scientific Name): Quaking Aspen Rocky Mountain Forest & Woodland Group
Colloquial Name: Rocky Mountain Paper Birch 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*.

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

Similar NVC Types:

- G328 Northwestern Great Plains Aspen Woodland

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

VEGETATION

Physiognomy and Structure: Occurrences typically have a somewhat closed canopy of trees 5-20 m tall that is dominated by the cold-deciduous, broad-leaved tree *Populus tremuloides*. Conifers my contribute up to 15% of the canopy cover. The open-spaced stems of *Populus tremuloides* often give way to a lush understory consisting of complex multiple shrub and herbaceous layers, or just an herbaceous layer.

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

ENVIRONMENT & DYNAMICS

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

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

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

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

DISTRIBUTION

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

Spatial Scale & Pattern [optional]: Large patch
Nations: CA, MX, US
States/Provinces: AB, AZ, BC, CA, CO, ID, MT, NM, NV, OR, SD, TX, UT, WA, WY
TNC Ecoregions [optional]: 1:P, 3:C, 4:P, 5:P, 7:C, 8:C, 9:C, 11:C, 12:P, 18:C, 19:C, 20:C, 21:P, 25:C, 26:C, 81:P
USFS Ecoregions (2007): 313A:CC, 313B:CC, 313D:CC, 315H:PP, 321A:CC, 322A:CC, 331A:CC, 331F:CC, 331G:CC, 331I:C?, 331J:CC, 331K:CP, 331N:CP, 332F:??, 341A:CC, 341B:CC, 341C:CC, 341D:CC, 341E:CC, 341F:CC, 341G:CC, 342A:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:CC, 342I:CP, 342J:CC, M242B:CP, M242C:CC, M242D:CC, M261D:CC, M261E:CC, M261G:CC, M313A:CC, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CP, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CP, M333D:CC, M334A:CC, M341A:CC, M341B:CC, M341C:CC, M341D:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

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

SYNONYMY

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

LOWER LEVEL UNITS

Alliances:

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

AUTHORSHIP

Primary Concept Source: F.H. Eyre (1980)

Author of Description: M.E. Hall
Acknowledgments:
Version Date: 06/05/2013
Classif Resp Region: West
Internal Author: MEH 2-10, 6-13, mod. GK 12-15

REFERENCES

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

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

A3367. Betula papyrifera Rocky Mountain Forest & Woodland Alliance

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

OVERVIEW

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

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

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

Internal Comments:
Other Comments:

Similar NVC Types:

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

VEGETATION

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

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

ENVIRONMENT & DYNAMICS

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

Dynamics:

DISTRIBUTION

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

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

Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

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

AUTHORSHIP

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

REFERENCES

References: Faber-Langendoen et al. 2017b

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

A2036. Populus tremuloides Rocky Mountain Forest & Woodland Alliance

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

OVERVIEW

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

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

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

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

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

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

VEGETATION

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

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

ENVIRONMENT & DYNAMICS

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

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

DISTRIBUTION

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

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL002816 *Populus tremuloides / Amelanchier alnifolia - Symphoricarpos oreophilus* / Mixed Graminoid Forest
- CEGL000614 *Populus tremuloides / Symphoricarpos oreophilus / Festuca thurberi* Forest
- CEGL000575 *Populus tremuloides / Calamagrostis rubescens* Forest
- CEGL000611 *Populus tremuloides / Symphoricarpos oreophilus / Bromus carinatus* Forest
- CEGL000583 *Populus tremuloides / Corylus cornuta* Forest
- CEGL000619 *Populus tremuloides / Thalictrum fendleri* Forest
- CEGL000620 *Populus tremuloides / Vaccinium myrtillus* Forest

- CEGL000586 *Populus tremuloides / Heracleum sphondylium* Forest
- CEGL000568 *Populus tremuloides / Amelanchier alnifolia - Symphoricarpos oreophilus* / Tall Forbs Forest
- CEGL000585 *Populus tremuloides / Festuca thurberi* Forest
- CEGL000593 *Populus tremuloides / Lupinus argenteus* Forest
- CEGL000603 *Populus tremuloides / Rudbeckia occidentalis* Forest
- CEGL000613 *Populus tremuloides / Symphoricarpos oreophilus / Carex rossii* Forest
- CEGL000567 *Populus tremuloides / Amelanchier alnifolia - Symphoricarpos oreophilus / Calamagrostis rubescens* Forest
- CEGL003146 *Populus tremuloides / Artemisia tridentata / Monardella odoratissima - Kelloggia galioides* Forest
- CEGL000607 *Populus tremuloides / Spiraea betulifolia* Forest
- CEGL000597 *Populus tremuloides / Pteridium aquilinum* Forest
- CEGL000592 *Populus tremuloides / Lonicera involucrata* Forest
- CEGL000602 *Populus tremuloides / Rubus parviflorus* Forest
- CEGL000588 *Populus tremuloides / Juniperus communis / Carex geyeri* Forest
- CEGL000579 *Populus tremuloides / Carex geyeri* Forest
- CEGL000580 *Populus tremuloides / Carex rossii* Forest
- CEGL000578 *Populus tremuloides / Carex siccata* Forest
- CEGL000606 *Populus tremuloides / Shepherdia canadensis* Forest
- CEGL000572 *Populus tremuloides / Artemisia tridentata* Forest
- CEGL000610 *Populus tremuloides / Symphoricarpos oreophilus* Forest
- CEGL000564 *Populus tremuloides / Amelanchier alnifolia* Forest
- CEGL000565 *Populus tremuloides / Amelanchier alnifolia / Pteridium aquilinum* Forest
- CEGL000589 *Populus tremuloides / Juniperus communis / Lupinus argenteus* Forest
- CEGL005932 *Populus tremuloides / Physocarpus monogynus* Forest
- CEGL000581 *Populus tremuloides / Ceanothus velutinus* Forest
- CEGL000617 *Populus tremuloides / Symphoricarpos oreophilus / Wyethia amplexicaulis* Forest
- CEGL005624 *Populus tremuloides / Prunus virginiana* Central Rocky Mountain Forest
- CEGL000587 *Populus tremuloides / Juniperus communis* Forest
- CEGL000563 *Populus tremuloides / Acer glabrum* Forest
- CEGL000598 *Populus tremuloides / Quercus gambelii / Symphoricarpos oreophilus* Forest
- CEGL000608 *Populus tremuloides / Hesperostipa comata* Forest
- CEGL000566 *Populus tremuloides / Amelanchier alnifolia - Symphoricarpos oreophilus / Bromus carinatus* Forest
- CEGL000615 *Populus tremuloides / Symphoricarpos oreophilus* / Tall Forbs Forest
- CEGL000618 *Populus tremuloides* / Tall Forbs Forest
- CEGL000595 *Populus tremuloides / Heracleum maximum* Forest
- CEGL000605 *Populus tremuloides / Sambucus racemosa* Forest
- CEGL000571 *Populus tremuloides / Amelanchier alnifolia / Thalictrum fendleri* Forest
- CEGL000945 *Populus tremuloides / Physocarpus malvaceus - Amelanchier alnifolia* Scree Woodland
- CEGL000594 *Populus tremuloides / Mahonia repens* Forest
- CEGL000604 *Populus tremuloides / Salix scouleriana* Forest
- CEGL000946 *Populus tremuloides / Symphoricarpos albus / Elymus glaucus* Woodland
- CEGL000569 *Populus tremuloides / Amelanchier alnifolia - Symphoricarpos oreophilus / Thalictrum fendleri* Forest
- CEGL000570 *Populus tremuloides / Amelanchier alnifolia* / Tall Forbs Forest
- CEGL000612 *Populus tremuloides / Symphoricarpos oreophilus / Calamagrostis rubescens* Forest
- CEGL000616 *Populus tremuloides / Symphoricarpos oreophilus / Thalictrum fendleri* Forest
- CEGL000591 *Populus tremuloides / Ligusticum filicinum* Forest
- CEGL000622 *Populus tremuloides / Wyethia amplexicaulis* Forest
- CEGL000573 *Populus tremuloides / Bromus carinatus* Forest
- CEGL000609 *Populus tremuloides / Symphoricarpos albus* Forest
- CEGL005848 *Populus tremuloides / Symphoricarpos occidentalis* Forest
- CEGL005849 *Populus tremuloides / Urtica dioica* Forest
- CEGL003748 *Populus tremuloides* / Invasive Perennial Grasses Forest
- CEPS009589 *Populus tremuloides / Ribes* spp. Woodland [Park Special]
- CEGL003145 *Populus tremuloides / Monardella odoratissima* Forest

AUTHORSHIP

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

REFERENCES

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

1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub

These pinyon pine- and juniper-dominated woodlands, scrub, and savannas generally occur just above semi-desert shrublands and grasslands or shortgrass prairies and below montane forest vegetation throughout the semi-arid Intermountain West and western Great Plains of North America.

M027. Southern Rocky Mountain-Colorado Plateau Two-needle Pinyon - Juniper Woodland

This southern Rocky Mountain and Colorado Plateau pinyon and juniper savanna and woodland macrogroup is characterized by an open to closed evergreen, conifer tree canopy composed of diagnostic species *Juniperus monosperma* and/or *Pinus edulis* with an understory dominated by shrubs or grasses that lacks Madrean understory species. It occurs in dry mountains and foothills in southern Colorado south into northern and central New Mexico, and extends west across the Colorado Plateau and east to the plains on breaks in the southwestern Great Plains.

1. Forest & Woodland
1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub
1.B.2.Nc.2.b. M027 Southern Rocky Mountain-Colorado Plateau Two-needle Pinyon - Juniper Woodland

G252. Southern Rocky Mountain Juniper Open Woodland

Type Concept Sentence: This savanna and woodland group occurs along the east and south foothill slopes of the southern Rocky Mountains and into the southeastern Great Plains and includes both open woodland and savanna stands that are dominated by *Juniperus monosperma* in the tree layer with *Pinus edulis* typically absent and a grassy understory dominated by *Bouteloua gracilis, Bouteloua curtipendula, Bouteloua hirsuta, Bouteloua eriopoda, Hesperostipa neomexicana*, and *Pleuraphis jamesii*.

OVERVIEW

Scientific Name: *Juniperus monosperma* Open Woodland Group
Common Name (Translated Scientific Name): One-seed Juniper Open Woodland Group
Colloquial Name: One-seed Juniper / Herb 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.

Classification Comments: This group corresponds to the *Juniperus monosperma*-dominated portion of the *pinyon-juniper savanna* type described by Romme et al. (2009) with low to moderate cover of trees, well-developed graminoid understory, generally a minor shrub component, growing on deeper soils most abundantly in areas with a large proportion of growing season precipitation. Denser woodland areas are the result of infilling of juniper trees and small-patch inclusions of the denser juniper occurring on shallow rocky soils that resemble the *persistent pinyon-juniper woodland* type from Romme et al. (2009).

The similar Southern Rocky Mountain Pinyon - Juniper Woodland Group (G253) usually occurs at higher elevations and has *Pinus edulis* present and either dominant or codominant. This group transitions into Madrean Pinyon - Juniper Woodland Group (G200) and Madrean Juniper Open Woodland Group (G487) to the south. These groups are distinguished by the presence of other

Madrean tree species, such as *Juniperus coahuilensis, Juniperus deppeana, Juniperus pinchotii, Pinus cembroides, Pinus discolor*, or evergreen oaks such as *Quercus grisea* or *Quercus mohriana* along with Madrean grasses and forbs.

Similar NVC Types:
- G487 Madrean Juniper Open Woodland
- G200 Madrean Pinyon - Juniper Woodland
- G253 Southern Rocky Mountain Pinyon - Juniper Woodland

Diagnostic Characteristics: *Juniperus monosperma* dominates the sparse to moderately dense tree layer in this woodland and savanna group. Dominant and diagnostic understory species are similar to those found in shortgrass prairie with *Bouteloua gracilis, Bouteloua curtipendula, Bouteloua hirsuta, Bouteloua eriopoda, Hesperostipa neomexicana*, and *Pleuraphis jamesii* common. Shrubs are typically scattered and sparse, but may include *Quercus x pauciloba, Yucca glauca*, and *Gutierrezia sarothrae*. Woodland stands may have a more developed shrub layer characterized by *Atriplex confertifolia, Artemisia tridentata, Cercocarpus montanus, Ericameria nauseosa, Fallugia paradoxa, Forestiera pubescens, Krascheninnikovia lanata, Ribes cereum*, or *Quercus turbinella*.

VEGETATION

Physiognomy and Structure: This group encompasses savanna that has widely spaced, short (2-10 m tall), mature (>150 years old) juniper trees and occasionally a *Pinus edulis* tree. The open to dense herbaceous layer typically dominates the vegetation and is composed of perennial grasses. These savannas have inclusions of denser juniper stands, especially near rock outcrops, that are somewhat fire-protected, and have greatly expanded into adjacent plains during the last century. Older established stands have widely species large, mature, rounded-crown trees, whereas more recent invasive juniper savanna stands are characterized by younger, shorter (<3 m tall, pointed-crown juniper trees.

Floristics: This group is best described as a savanna that has widely spaced, mature (>150 years old) juniper trees with lush perennial grasses in between trees, but may have inclusions (patches) of denser juniper woodlands. *Juniperus monosperma* is the dominant tree (2-10 m tall) with an occasional *Pinus edulis* tree. *Juniperus scopulorum* may dominate or codominate at higher elevations. Grass species are similar to those found in Shortgrass Prairie in the western Great Plains. *Bouteloua gracilis, Bouteloua curtipendula*, and *Pleuraphis jamesii* are most common, with *Hesperostipa comata, Koeleria macrantha, Lycurus phleoides* and *Muhlenbergia torreyi* often present. *Bouteloua eriopoda* is a more common grass in the southern extent, and *Andropogon hallii* and *Muhlenbergia pungens* are characteristic of deep sandy sites. Shrubs are poorly represented or absent; the ruderal subshrub *Gutierrezia sarothrae* and succulents such as *Cylindropuntia imbricata, Opuntia phaeacantha, Opuntia polyacantha, Rhus trilobata, Yucca baccata*, and *Yucca glauca* are the most frequent. Forbs such as *Astragalus* spp., *Cryptantha cinerea var. jamesii (= Cryptantha jamesii), Eriogonum jamesii, Erigeron divergens, Hymenopappus filifolius, Ipomopsis multiflora, Mentzelia* spp., and *Penstemon* spp. are also common.

ENVIRONMENT & DYNAMICS

Environmental Description: This woodland and savanna group occupies the lower and warmest elevations, growing from 1370 to 2300 m in a semi-arid climate, primarily along the east and south slopes of the southern Rocky Mountains extending south and east into the western Great Plains. Stands occur on all aspects of lower hillslopes, alluvial terraces and plains. This woodland phase is often found on steeper, colluvial slopes of escarpments, dipslopes of moderate slope, and occasionally on lower toeslopes and valley bottoms. Soils range from deep loams to shallow, gravelly to rocky sites. Slope sites tend to be rocky and gravelly, while terraces and plains sites less so, sometimes occurring on deeper loamy soils.

Dynamics: *Juniperus monosperma* is a long-lived, slow-growing, drought-tolerant small tree (3-12 m in height) that also occurs as a tall shrub (Johnson 2002). It is more drought-tolerant than *Pinus edulis* and often occurs without pinyon on more xeric, lower elevation sites (Johnson 2002). It is also non-sprouting and may be killed by fire (Wright et al. 1979). Juniper stands at cooler, higher elevation sites typically occur on xeric microsites that are too arid for pinyon or on post-disturbance sites such as where extended drought or ips beetle (*Ips confusus*) epidemics have eliminated pinyon from mixed pinyon-juniper stands. In this situation junipers and shrubs may act as nurse plants providing shade for pinyon germination and re-establishment, converting a juniper woodland to pinyon-juniper woodland.

Within a given region, the density of trees, both historically and currently, is strongly related to topo-edaphic gradients. Less steep sites, especially those with finer-textured soils, are where savannas, grasslands, and shrub-steppes have occurred in the past. Juniper stands on these gentler slopes may have been larger but more savanna-like, with very open upper canopy and high grass production. Expansion of juniper into previously non-wooded areas occurred prior to European settlement on some sites, although this expansion may have been more extensive in the 20th century versus the previous. However, loss of juniper from marginal sites also occurred historically and recently in some areas (Romme et al. 2009). Especially in areas in which trees were historically rare or absent, there have been type conversions such that the historical condition is unidentifiable/replaced today. An important result of expansion into formerly non-wooded areas in many regions is that formerly heterogeneous mosaics of small patches of woodland,

shrubland, and grassland are becoming more homogeneous as trees become established in the shrubland and grassland patches (Romme et al. 2009).

DISTRIBUTION

Geographic Range: This savanna and woodland group occurs along the east and south foothill slopes of the southern Rocky Mountains and into the plains in southeastern Colorado and northern and central New Mexico, south to the east side of the Sacramento Mountains and the Tularosa Basin, and extending east into the panhandles of Oklahoma and Texas.

Spatial Scale & Pattern [optional]: Large patch
Nations: US
States/Provinces: CO, NM, OK, TX
TNC Ecoregions [optional]: 20:C, 21:C, 27:C
USFS Ecoregions (2007): 315A:CC, 315B:CC, 315H:CC, 321A:PP, 331B:CC, 331C:C?, 331I:CC, 331J:CC, M313B:CC, M331F:CC, M331G:CC
Omernik Ecoregions:
Federal Lands [optional]: DOD (White Sands Missile Range); NPS (Bandelier, Salinas Pueblo Missions)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- = One-seed Juniper Series (Dick-Peddie 1993)
- = One-seed Juniper-Rocky Mountain Juniper Series (Dick-Peddie 1993)

LOWER LEVEL UNITS

Alliances:
- A3575 *Juniperus monosperma* / Herbaceous Understory Open Woodland Alliance
- A3574 *Juniperus monosperma* / Shrub Understory Woodland Alliance

AUTHORSHIP

Primary Concept Source: W.A. Dick-Peddie (1993)
Author of Description: K.A. Schulz and E. Muldavin
Acknowledgments: E. Muldavin
Version Date: 11/09/2015
Classif Resp Region: West
Internal Author: KAS 1-10, 6-13, 11-15

REFERENCES

References: Barnes 1987, Dick-Peddie 1993, Dwyer and Pieper 1967, Eager 1999, Eyre 1980, Faber-Langendoen et al. 2017a, Francis 1986, Gehlbach 1967, Johnson 2002, Larson and Moir 1986, Larson and Moir 1987, Muldavin et al. 2011b, Muldavin et al. 2011d, Muldavin et al. 2012a, Muldavin et al. 2012b, Neely et al. 2001, Rogers 1950, Romme et al. 2009, Shaw et al. 1989, Shiflet 1994, Stuever and Hayden 1997a, West 1999b, West and Young 2000, Wright and Bailey 1982a, Wright et al. 1979

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1. Forest & Woodland
1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub
G252. Southern Rocky Mountain Juniper Open Woodland

A3575. Juniperus monosperma / Herbaceous Understory Open Woodland Alliance

Type Concept Sentence: This juniper woodland and savanna alliance is characterized by an open to moderately dense, short (<15 m) tree canopy and is strongly dominated by *Juniperus monosperma* or *Juniperus scopulorum* at higher elevations with an understory dominated by an open to dense layer of perennial grasses and lacking significant cover of shrubs. It occurs on warm, dry mountains and foothills in southern Colorado east of the Continental Divide and in mountains and plateaus of northern and central New Mexico, extending east on breaks in the southeastern Great Plains.

OVERVIEW

Scientific Name: *Juniperus monosperma* / Herbaceous Understory Open Woodland Alliance
Common Name (Translated Scientific Name): One-seed Juniper / Herbaceous Understory Open Woodland Alliance
Colloquial Name: One-seed Juniper / Herb Open Woodland

Type Concept: This woodland and savanna alliance is characterized by diagnostic tree species *Juniperus monosperma* that forms a very open to moderately dense tree layer. At higher elevations and relatively mesic sites, such as along drainages, *Juniperus scopulorum* may be present and sometimes dominant. In southern transitional areas with Madrean Pinyon - Juniper Woodland

Group (G200) in central New Mexico, *Juniperus deppeana* may be present but not dominant. Other conifers, including *Pinus edulis*, are absent or accidental with very low cover. Scattered shrubs and dwarf-shrubs may be present but do not form a layer. The understory is characterized by an moderate to dense herbaceous layer composed of grasses often with diverse, but low cover of forbs. Characteristic species may include *Achnatherum hymenoides, Achnatherum nelsonii, Achnatherum scribneri, Andropogon hallii, Achnatherum hymenoides, Bouteloua eriopoda, Bouteloua gracilis, Bouteloua hirsuta, Hesperostipa comata, Hesperostipa neomexicana, Pleuraphis jamesii*, and *Schizachyrium scoparium*. This alliance occurs on warm, dry mountains and foothills in southern Colorado east of the Continental Divide and in mountains and plateaus of northern and central New Mexico, extending east on breaks in the southeastern Great Plains. Stands occur on nearly level surfaces to steep, rocky slopes in canyons, on hillsides, and on mesatops, but also occur on stream terraces and on deep sands. Elevations range from 1200-2100 m. Aspect does not seem important except in elevational extremes for a given latitude. Sites are typically dry with shallow, rocky, calcareous, alkaline soils. Soil textures range from sandy loam to clay soils typically derived from limestone, sandstone or shale.

Classification Comments: In northwestern New Mexico, the distributional ranges of *Juniperus monosperma* and *Juniperus osteosperma* overlap. This alliance does not occur within the range of *Juniperus osteosperma* in this transition zone from the southern Rocky Mountain juniper woodland and savanna alliances to the Colorado Plateau juniper woodland and savanna alliances.

Internal Comments: mjr 3-16: Juniperus monosperma does not occur in WY (removed).
Other Comments:

Similar NVC Types: This alliance has similarities to other pinyon-juniper woodland and juniper woodland alliances in several other groups, such as G200, G246, G247, G248, G250, G253, and G487

- A3134 *Juniperus coahuilensis - Juniperus deppeana - Juniperus monosperma* / Grass Understory Open Woodland Alliance: is similar in that it is a juniper savanna, but Madrean and warm desert floristic species overlap very little with southern Rocky Mountain and western Great Plains floristics.
- A3577 *Pinus edulis - Juniperus monosperma* / Herbaceous Understory Open Woodland Alliance: is similar except overstory is characterized by *Pinus edulis* with 5% or more cover.
- A3500 *Juniperus occidentalis* / Herbaceous Understory Open Woodland Alliance: is similar except overstory is dominated by *Juniperus occidentalis*.
- A3574 *Juniperus monosperma* / Shrub Understory Woodland Alliance: is similar but understory has a shrub layer (>10% cover) or, if less, shrub cover exceeds herbaceous cover.
- A3497 *Juniperus osteosperma* / Herbaceous Understory Open Woodland Alliance: is similar except overstory is dominated by *Juniperus osteosperma*.

Diagnostic Characteristics: This woodland alliance is found in foothills in southern Colorado east of the Continental Divide and in mountains and plateaus of northern and central New Mexico, extending east on breaks in the southeastern Great Plains. These woodlands are characterized by diagnostic tree species *Juniperus monosperma* that forms an open to dense tree layer. At higher elevations and relatively mesic sites, *Juniperus scopulorum* may be present and sometimes dominant. In southern transitional areas with Madrean Pinyon-Juniper Woodland Group (G200) in central New Mexico, *Juniperus deppeana* may be present but not dominant. Other conifers, including *Pinus edulis*, are absent or accidental with very low cover. The understory is characterized by a moderate to dense herbaceous layer composed of grasses often with a diverse but low cover of forbs.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a sparse to moderately dense (5-45% cover) tree canopy that is typically 2-10 m tall. Stands are solely dominated by scale-leaved evergreen trees. Broad-leaved and needle-leaved evergreen trees may be present but have low cover (<5%). A sparse to moderate layer that is dominated by perennial graminoids is usually present. Perennial forbs may be scattered. Annual forbs and grasses may be seasonally present. Scattered shrubs may be present with low cover (<10%) and less cover than the herbaceous layer. Cacti and stem succulents are often present.

Floristics: This woodland and savanna alliance is characterized by diagnostic tree species *Juniperus monosperma* that forms a very open to moderately dense tree layer. At higher elevations and relatively mesic sites, such as along drainages, *Juniperus scopulorum* may be present and sometimes dominant. In southern transitional areas with Madrean Pinyon - Juniper Woodland Group (G200) in central New Mexico, *Juniperus deppeana* may be present but not dominant. Other conifers, including *Pinus edulis*, are absent or accidental with very low cover. Scattered shrubs and dwarf-shrubs may be present but do not form a layer. The understory is characterized by an moderate to dense herbaceous layer composed of grasses often with diverse but low cover of forbs. Characteristic graminoids may include *Achnatherum hymenoides, Achnatherum nelsonii, Achnatherum scribneri, Achnatherum hymenoides, Aristida* spp., *Bouteloua eriopoda, Bouteloua gracilis, Bouteloua hirsuta, Hesperostipa comata, Hesperostipa neomexicana, Muhlenbergia* spp., *Piptatheropsis micrantha (= Piptatherum micranthum), Pleuraphis jamesii, Schizachyrium scoparium, Sporobolus* spp., and *Andropogon hallii* in rare, deep sands habitats. Many forb species can occur, but few have much

cover. Commonly present forbs include species of *Artemisia, Dalea, Eriogonum, Heterotheca, Hymenoxys, Mirabilis, Penstemon, Phlox, Physalis, Pediomelum (= Psoralea)*, and *Zinnia*. Annual grasses and forbs are seasonally present.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands included in this woodland alliance occur from eastern Arizona to western Texas and the Panhandle of Oklahoma and in the foothills in the southern Rocky Mountains. Stands also occur in the mountains, mesas, plateaus, piedmonts, canyons, escarpments, and other geographic breaks in the southern Great Plains. Elevations range from 1200-2100 m. Climate is semi-arid with drought not uncommon. Summers are generally hot, and winters have cold periods and occasional snows with extended periods of freezing temperatures. The mean annual precipitation ranges from 30-48 cm. Stands occur on nearly level surfaces to steep, rocky slopes in canyons, on hillsides, and on mesatops, but also occur on stream terraces and on deep sands. Aspect does not seem important except in elevational extremes for a given latitude. Low-elevation stands are restricted to the more mesic north slopes, whereas high-elevation stands occur on south aspects. Sites are typically dry with shallow, rocky, calcareous, alkaline soils. Soil textures range from sandy loam to clay soils typically derived from limestone, sandstone or shale. Other parent materials include basalt, granite, dolomite, siltstone and mixed alluvium.

Dynamics: *Juniperus monosperma* is extremely drought-tolerant. It is also non-sprouting and may be killed by fire (Wright et al. 1979). The effect of fire on a stand is largely dependent on the tree height and density, fine fuel load on the ground, weather conditions, and season (Dwyer and Pieper 1967, Wright et al. 1979). Trees are more vulnerable in open stands where fires frequently occur in the spring, when the relative humidity is low, wind speeds are over 10-20 mph, and there is adequate fine fuels to carry fire (Wright et al. 1979, Fischer and Bradley 1987). Under other conditions, burns tend to be spotty with low tree mortality. Large trees are generally not killed unless fine fuels, such as tumbleweeds, have accumulated beneath the tree to provide ladder fuels for the fire to reach the crown. Closed-canopy stands rarely burn because they typically do not have enough understory or wind to carry a fire. Altered fire regimes, cutting trees for fencing, and improper grazing by livestock have significant impacts on the quality of sites. Grazing by livestock can modify the fire regime by removing the fine fuels that carry fire. *Juniperus monosperma* invasion into grasslands has occurred in places. Control efforts by chaining and prescribed burning have mixed results. More study is needed to understand and manage these woodlands ecologically.

DISTRIBUTION

Geographic Range: This woodland alliance occurs in foothills in southern Colorado east of the Continental Divide and in mountains and plateaus of northern and central New Mexico, extending east on breaks in the southeastern Great Plains.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **<** *Juniperus monosperma* woodland alliance (Hoagland 1998a)
- **<** Oneseed Juniper Series (Dick-Peddie 1993) [includes all the *Juniperus monosperma* stands]

LOWER LEVEL UNITS

Associations:

- CEGL000708 *Juniperus monosperma / Bouteloua curtipendula* Open Woodland
- CEGL000704 *Juniperus monosperma / Andropogon hallii* Open Woodland
- CEGL000710 *Juniperus monosperma / Bouteloua gracilis* Open Woodland
- CEGL000722 *Juniperus monosperma / Hesperostipa neomexicana* Open Woodland
- CEGL000709 *Juniperus monosperma / Bouteloua eriopoda* Open Woodland
- CEGL000711 *Juniperus monosperma / Bouteloua hirsuta* Open Woodland

AUTHORSHIP

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

REFERENCES

References: Adams 1979, Baker 1984a, Barnes 1987, Baxter 1977, Diamond 1993, Dick-Peddie 1987, Dick-Peddie 1993, Dick-Peddie et al. 1984, Donart et al. 1978a, Dwyer and Pieper 1967, Faber-Langendoen et al. 2017b, Fischer and Bradley 1987, Fitzhugh et al. 1987, Francis 1986, Hoagland 1998a, Johnsen 1962, Johnston 1984, Johnston 1987, Ladyman and Muldavin 1996, Larson and Moir 1986, Larson and Moir 1987, Lindsey 1951, Moir and Carleton 1987, Muldavin and Mehlhop 1992, Muldavin et al. 1998c, Nelson and Redders 1982, New Mexico Environmental Institute 1971, Pettit et al. 1980, Pieper 1968, Pieper et al. 1971, Rippel et al. 1998, Rogers 1953, Soil Conservation Service 1978, Terwilliger et al. 1979a, USFS 1981a, USFS 1983c, USFS 1985b, USFS 1985c, USFS 1985e, USFS 1985f, USFS 1985g, Wells 1970b, Woodin and Lindsey 1954, Wright 1972, Wright and Bailey 1982a, Wright et al. 1973, Wright et al. 1979

1. Forest & Woodland
1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub
G252. Southern Rocky Mountain Juniper Open Woodland

A3574. Juniperus monosperma / Shrub Understory Woodland Alliance

Type Concept Sentence: This juniper woodland alliance is characterized by an open to moderately dense, short (<15 m) tree canopy and is strongly dominated by *Juniperus monosperma* or *Juniperus scopulorum* at higher elevations with an understory dominated by open to dense layer of shrubs. It occurs on warm, dry mountains and foothills in southern Colorado east of the Continental Divide and in mountains and plateaus of northern and central New Mexico, extending east on breaks in the southeastern Great Plains.

OVERVIEW

Scientific Name: *Juniperus monosperma* / Shrub Understory Woodland Alliance
Common Name (Translated Scientific Name): One-seed Juniper / Shrub Understory Woodland Alliance
Colloquial Name: One-seed Juniper / Shrub Woodland

Type Concept: This woodland alliance is characterized by diagnostic tree species *Juniperus monosperma* that forms an open to dense tree layer. At higher elevations and relatively mesic sites, such as along drainages, *Juniperus scopulorum* may be present and sometimes dominant. In southern transitional areas with Madrean Pinyon - Juniper Woodland Group (G200) in central New Mexico, *Juniperus deppeana* may be present but not dominant. Other conifers, including *Pinus edulis*, are absent or accidental with very low cover. The understory is characterized by shrubs that typically form an open to moderately dense layer. Characteristic shrubs are many and include *Artemisia bigelovii, Artemisia frigida, Artemisia tridentata, Atriplex canescens, Atriplex confertifolia, Cercocarpus montanus, Chrysothamnus viscidiflorus, Ericameria nauseosa, Fallugia paradoxa, Forestiera pubescens, Gutierrezia sarothrae, Holodiscus dumosus, Krascheninnikovia lanata, Quercus gambelii, Quercus x pauciloba, Quercus turbinella, Ribes cereum, Rhus trilobata*, and *Symphoricarpos oreophilus*. Similar scattered shrubs frequently characterize sparse and rocky understory woodland stands and so those types are included in this alliance. The herbaceous layer is sparse to moderate and composed of grasses often with diverse but low cover of forbs. Common species may include *Achnatherum hymenoides, Achnatherum nelsonii, Achnatherum scribneri, Andropogon hallii, Achnatherum hymenoides, Bouteloua eriopoda, Bouteloua gracilis, Bouteloua hirsuta, Hesperostipa comata, Hesperostipa neomexicana, Pleuraphis jamesii*, and *Schizachyrium scoparium*. This alliance also includes sparse understory stands often with scattered shrubs and grasses. These woodlands occur on warm, dry mountains and foothills in southern Colorado east of the Continental Divide and in mountains and plateaus of northern and central New Mexico, extending east on breaks in the southeastern Great Plains. Stands occur on nearly level surfaces to steep, rocky slopes in canyons, on hillsides, and on mesatops, but also occur on stream terraces and on deep sands. Elevations range from 1200-2100 m. Aspect does not seem important except in elevational extremes for a given latitude. Sites are typically dry with shallow, rocky, calcareous, alkaline soils. Soil textures range from sandy loam to clay soils typically derived from limestone, sandstone or shale.

Classification Comments: In northwestern New Mexico, the distributional ranges of *Juniperus monosperma* and *Juniperus osteosperma* overlap. This alliance does not occur within the range of *Juniperus osteosperma* in this transition zone from the southern Rocky Mountain juniper woodland and savanna alliances to the Colorado Plateau juniper woodland and savanna alliances. Stands with sparse or rocky understories are included in this alliance because scattered similar shrub species are frequently present and characterize the stand at lower cover.

Internal Comments:
Other Comments:

Similar NVC Types: This alliance has similarities to other pinyon-juniper woodland and juniper woodland alliances in several other groups, such as G200, G246, G247, G248, G250, G253, and G487

- A3133 *Juniperus coahuilensis - Juniperus deppeana - Juniperus monosperma* / Shrub Understory Open Woodland Alliance: is similar in that it is a juniper woodland, but Madrean and warm desert floristic species overlap very little with southern Rocky Mountain and western Great Plains floristics.

- A2108 *Pinus monophylla - Juniperus osteosperma* / Shrub Understory Woodland Alliance: is similar except overstory is characterized by *Pinus monophylla* with 5% or more cover.
- A3577 *Pinus edulis - Juniperus monosperma* / Herbaceous Understory Open Woodland Alliance
- A3576 *Pinus edulis - Juniperus monosperma* / Shrub Understory Woodland Alliance
- A3575 *Juniperus monosperma* / Herbaceous Understory Open Woodland Alliance: is similar but understory lacks a shrub layer and is dominated by an herbaceous layer (>10% cover) or, if less, grass cover exceeds shrub cover.
- A3571 *Pinus edulis - Juniperus osteosperma* / Shrub Understory Foothill & Lower Montane Dry-Mesic Woodland Alliance: is similar except overstory is characterized by *Pinus* edulis with 5% or more cover.

Diagnostic Characteristics: This woodland alliance is found in foothills in southern Colorado east of the Continental Divide and in mountains and plateaus of northern and central New Mexico, extending east on breaks in the southeastern Great Plains. These woodlands are characterized by diagnostic tree species *Juniperus monosperma* that forms an open to dense tree layer. At higher elevations and relatively mesic sites, *Juniperus scopulorum* may be present and sometime dominant. In southern transitional areas with Madrean Pinyon - Juniper Woodland Group (G200) in central New Mexico, *Juniperus deppeana* may be present but not dominant. Other conifers, including *Pinus edulis*,are absent or accidental with very low cover. The understory is characterized by shrubs. The herbaceous layer is sparse to moderate and composed of grasses often with diverse but low cover of forbs. This alliance also includes sparse understory stands often with scattered shrubs and grasses. The lack of understory can be caused by harsh substrates (rockland, shale badland) or a dense tree canopy that shades out the understory.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a sparse to moderately dense tree canopy that is typically 2-10 m tall. Stands are solely dominated by scale-leaved evergreen trees. Broad-leaved and needle-leaved evergreen trees may be present but have low cover (<5%). An open to moderately dense (10-60% cover) shrub layer (0.5-3 m tall) is present often as a diverse mix of broad-leaved and microphyllous deciduous or evergreen shrubs. Cacti and stem succulents are often present. A sparse to moderate herbaceous layer that is dominated by perennial graminoids is usually present. Perennial forbs may be scattered. Annual forbs and grasses may be seasonally present. This alliance also includes sparse understory stands often with scattered shrubs and grasses.

Floristics: These woodlands are characterized by diagnostic tree species *Juniperus monosperma* that forms an open to dense tree layer. At higher elevations and relatively mesic sites, such as along drainages, *Juniperus scopulorum* may be present and sometimes dominant. In southern transitional areas with Madrean Pinyon - Juniper Woodland Group (G200) in central New Mexico, *Juniperus deppeana* may be present but not dominant. Other conifers, including *Pinus edulis*, are absent or accidental with very low cover. The understory is characterized by shrubs that typically form an open to moderately dense layer. Characteristic shrubs are many and include *Artemisia bigelovii, Artemisia frigida, Artemisia tridentata, Atriplex canescens, Atriplex confertifolia, Cercocarpus montanus, Chrysothamnus viscidiflorus, Ericameria nauseosa, Fallugia paradoxa, Forestiera pubescens, Gutierrezia sarothrae, Holodiscus dumosus, Krascheninnikovia lanata, Quercus gambelii, Quercus x pauciloba, Quercus turbinella, Ribes cereum, Rhus trilobata, Symphoricarpos oreophilus*, and *Yucca glauca*. Similar scattered shrubs frequently characterize sparse and rocky understory woodland stands and so those types are included in this alliance. The herbaceous layer is sparse to moderate and composed of grasses often with diverse but low cover of forbs. Common species may include *Achnatherum hymenoides, Achnatherum nelsonii, Achnatherum scribneri, Achnatherum hymenoides, Aristida* spp., *Bouteloua eriopoda, Bouteloua gracilis, Bouteloua hirsuta, Hesperostipa comata, Hesperostipa neomexicana, Muhlenbergia* spp., *Piptatheropsis micrantha (= Oryzopsis micrantha), Pleuraphis jamesii, Schizachyrium scoparium*, and *Sporobolus* spp. Many forb species can occur, but few have much cover. Commonly present forbs include species of *Artemisia, Dalea, Eriogonum, Heterotheca, Hymenoxys, Mirabilis, Penstemon, Phlox, Physalis, Pediomelum (= Psoralea)*, and *Zinnia*. Annual grasses and forbs are seasonally present. *Andropogon hallii* occurs with *Artemisia filifolia* as the understory in rare, deep-sand habitats. This alliance also includes sparse understory stands often with scattered shrubs and grasses. The lack of understory can be caused by harsh substrates (rockland, shale badland) or a dense tree canopy resulting from the lack of fire that shades out the understory.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands included in this woodland alliance occur from eastern Arizona to western Texas and the Panhandle of Oklahoma and in the foothills in the southern Rocky Mountains. Stands also occur in the mountains, mesas, plateaus, piedmonts, canyons, escarpments, and other geographic breaks in the southern Great Plains. Elevations range from 1200-2100 m. Climate is semi-arid with drought not uncommon. Summers are generally hot, and winters have cold periods and occasional snows with extended periods of freezing temperatures. The mean annual precipitation ranges from 30-48 cm. Stands occur on nearly level surfaces to steep, rocky slopes in canyons, on hillsides, and on mesatops, but also occur on stream terraces and on deep sands. Aspect does not seem important except in elevational extremes for a given latitude. Low-elevation stands are restricted to the more mesic north slopes, whereas high-elevation stands occur on south aspects. Sites are typically dry with shallow, rocky, calcareous, alkaline soils. Soil textures range from sandy loam to clay soils typically derived from limestone, sandstone or shale. Other parent materials include basalt, granite, dolomite, siltstone and mixed alluvium.

Dynamics: *Juniperus monosperma* is extremely drought-tolerant. It is also non-sprouting and may be killed by fire (Wright et al. 1979). The effect of fire on a stand is largely dependent on the tree height and density, fine fuel load on the ground, weather conditions, and season (Dwyer and Pieper 1967, Wright et al. 1979). Trees are more vulnerable in open stands where fires frequently occur in the spring, when the relative humidity is low, wind speeds are over 10-20 mph, and there are adequate fine fuels to carry fire (Wright et al. 1979, Fischer and Bradley 1987). Under other conditions, burns tend to be spotty with low tree mortality. Large trees are generally not killed unless fine fuels, such as tumbleweeds, have accumulated beneath the tree to provide ladder fuels for the fire to reach the crown. Closed-canopy stands rarely burn because they typically do not have enough understory or wind to carry a fire. Altered fire regimes, cutting trees for fencing, and improper grazing by livestock have significant impacts on the quality of sites. Grazing by livestock can modify the fire regime by removing the fine fuels that carry fire. *Juniperus monosperma* invasion into grasslands has occurred in places. Control efforts by chaining and prescribed burning have mixed results. More study is needed to understand and manage these woodlands ecologically.

DISTRIBUTION

Geographic Range: This woodland alliance occurs on warm, dry mountains and foothills in southern Colorado east of the Continental Divide and in mountains and plateaus of northern and central New Mexico, extending east on breaks in the southeastern Great Plains.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **<** *Juniperus monosperma* woodland alliance (Hoagland 1998a)
- **<** Oneseed Juniper Series (Dick-Peddie 1993) [includes all the *Juniperus monosperma* stands]
- **><** Pinyon - Juniper: 239 (Eyre 1980)

LOWER LEVEL UNITS

Associations:

- CEGL002121 *Juniperus monosperma - Rhus trilobata / Schizachyrium scoparium* Woodland
- CEGL000712 *Juniperus monosperma / Krascheninnikovia lanata* Woodland
- CEGL000715 *Juniperus monosperma / Ericameria nauseosa - Fallugia paradoxa* Woodland
- CEGL000795 *Pinus edulis* / Sparse Understory Forest
- CEGL000716 *Juniperus monosperma / Fallugia paradoxa* Woodland
- CEGL000705 *Juniperus monosperma / Artemisia bigelovii* Woodland
- CEGL000707 *Juniperus monosperma / Atriplex confertifolia / Achnatherum hymenoides* Woodland
- CEGL000721 *Juniperus monosperma / Quercus x pauciloba* Woodland
- CEGL000706 *Juniperus monosperma / Artemisia tridentata* Woodland
- CEGL000713 *Juniperus monosperma / Cercocarpus montanus* Woodland
- CEGL005368 *Juniperus monosperma* / Sparse Understory Woodland
- CEGL005369 *Juniperus monosperma* / Rockland Woodland
- CEGL005371 *Juniperus monosperma / Forestiera pubescens* Woodland
- CEGL000714 *Juniperus monosperma / Cercocarpus montanus - Ribes cereum* Woodland
- CEGL000720 *Juniperus monosperma / Quercus turbinella* Woodland

AUTHORSHIP

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

REFERENCES

References: Adams 1979, Baker 1984a, Barnes 1987, Baxter 1977, Diamond 1993, Dick-Peddie 1987, Dick-Peddie 1993, Dick-Peddie et al. 1984, Donart et al. 1978a, Donart et al. 1978b, Dwyer and Pieper 1967, Eyre 1980, Faber-Langendoen et al. 2017b, Fischer and Bradley 1987, Fitzhugh et al. 1987, Francis 1986, Gehlbach 1967, Hendricks 1934, Hoagland 1998a, Johnsen 1962, Johnston 1984,

Johnston 1987, Ladyman and Muldavin 1996, Larson and Moir 1986, Larson and Moir 1987, Lindsey 1951, Little 1987, Moir 1983, Moir and Carleton 1987, Muldavin and Mehlhop 1992, Muldavin et al. 1996, Muldavin et al. 1998c, Nelson and Redders 1982, New Mexico Environmental Institute 1971, Pettit et al. 1980, Pieper 1968, Pieper 1987, Pieper et al. 1971, Powell 1988b, Rippel et al. 1998, Rogers 1953, Soil Conservation Service 1978, Stuever and Hayden 1997a, Terwilliger et al. 1979a, USFS 1981a, USFS 1983c, USFS 1985b, USFS 1985c, USFS 1985e, USFS 1985f, USFS 1985g, Van Devender et al. 1984, Wells 1970b, Woodin and Lindsey 1954, Wright 1972, Wright and Bailey 1982a, Wright et al. 1973, Wright et al. 1979

1. Forest & Woodland
1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub
1.B.2.Nc.2.c. M027 Southern Rocky Mountain-Colorado Plateau Two-needle Pinyon - Juniper Woodland

G253. Southern Rocky Mountain Pinyon - Juniper Woodland

Type Concept Sentence: This pinyon - juniper woodland group occurs in the southern Rocky Mountains on dry mountains and foothills in southern Colorado east of the Continental Divide and is characterized by *Pinus edulis* that dominates or codominates the tree canopy with *Juniperus monosperma*.

OVERVIEW

Scientific Name: *Pinus edulis - Juniperus monosperma - Juniperus scopulorum* Woodland Group
Common Name (Translated Scientific Name): Two-needle Pinyon - One-seed Juniper - Rocky Mountain Juniper Woodland Group
Colloquial Name: Southern Rockies Pinyon - Juniper Open Woodland

Type Concept: This southern Rocky Mountain woodland group occurs on dry mountains and foothills in southern Colorado east of the Continental Divide, in mountains and plateaus of northern and central New Mexico, and extends east on breaks in the southeastern Great Plains. The vegetation is characterized by *Pinus edulis* that dominates or codominates the tree canopy with *Juniperus monosperma*. *Juniperus monosperma* may dominate stands provided *Pinus edulis* is present with significant cover. *Juniperus scopulorum* may codominate or replace *Juniperus monosperma* at higher elevations. Stands with mixed *Juniperus osteosperma* are representative of the Colorado Plateau and are not included in this group. In southern transitional areas with Madrean Pinyon - Juniper Woodland Group (G200) in central New Mexico, *Juniperus deppeana* may be present but not codominant. Understory layers are variable and may be dominated by shrubs, graminoids, or be absent. Associated species are generally more typical of the southern Rocky Mountains than the Colorado Plateau. Common species include *Artemisia bigelovii, Cercocarpus montanus, Fallugia paradoxa, Quercus gambelii, Quercus x pauciloba*, and grasses such as *Achnatherum nelsonii, Achnatherum scribneri, Bouteloua gracilis, Festuca arizonica*, or *Pleuraphis jamesii*. Stands in this group are found on mountain slopes, mesas, plateaus, and ridges. Severe climatic events occurring during the growing season, such as frosts and drought, are thought to limit the distribution of pinyon-juniper woodlands to relatively narrow altitudinal belts on mountainsides. Elevationally, stands typically occur above the *Juniperus monosperma* only-dominated woodlands and savannas. Stands range from near 1500 to 2900 m with high-elevation stands restricted to relatively warm, dry ridges and south and west aspects. Soils vary in texture, ranging from stony, cobbly, gravelly sandy loams to clay loam or clay.

Classification Comments: This group corresponds to the *Pinus edulis*-dominated or -codominated portion of the *persistent pinyon-juniper woodland* type from Romme et al. (2009) that occurs in the southern Rocky Mountains east of the Continental Divide on rocky uplands with shallow, coarse-textured, and often skeletal soils that support relatively sparse herbaceous cover and rarely burn. The similar Southern Rocky Mountain Juniper Open Woodland Group (G252) occurs at lower elevations and typically has a strong perennial grass-dominated understory and *Pinus edulis* is absent or accidental. This group transitions into Madrean Pinyon - Juniper Woodland Group (G200) and is distinguished by Madrean tree species *Juniperus coahuilensis, Juniperus deppeana, Juniperus pinchotii, Pinus cembroides, Pinus discolor*, or evergreen oaks such as *Quercus grisea* or *Quercus mohriana*.

Another similar group, Colorado Plateau Pinyon - Juniper Woodland Group (G250), that is defined by the intersection of the ranges of *Juniperus osteosperma* and *Pinus edulis* on the Colorado Plateau, transitions into the Southern Rocky Mountain type in the northwestern corner of New Mexico and southwestern Colorado. Stands in northern Arizona with both *Juniperus monosperma* and *Juniperus osteosperma* are included in the Colorado Plateau group.

Similar NVC Types:
- G200 Madrean Pinyon - Juniper Woodland
- G252 Southern Rocky Mountain Juniper Open Woodland
- G250 Colorado Plateau Pinyon - Juniper Woodland

Diagnostic Characteristics: *Pinus edulis* dominates or codominates the tree canopy with *Juniperus monosperma* in this group. *Juniperus monosperma* may dominate stand as long as *Pinus edulis* is present with significant cover. It is restricted to where the ranges of *Pinus edulis* and *Juniperus monosperma* overlap.

VEGETATION

Physiognomy and Structure: These woodlands are characterized by diagnostic tree species *Pinus edulis* and *Juniperus monosperma* that form an open to dense tree layer 3-10 m tall. Shrub and herbaceous layers are variable and may be sparse to dense or absent.

Floristics: This southern Rocky Mountain woodland group is characterized by a relatively short (3-10 m tall), open to moderately dense tree canopy dominated by *Pinus edulis* and/or *Juniperus monosperma*. *Juniperus scopulorum* may codominate or replace *Juniperus monosperma* at higher elevations. *Juniperus monosperma* may dominate stands as long as *Pinus edulis* is present with significant cover. Stands with *Juniperus osteosperma* are representative of the Colorado Plateau and are not included in this group. In southern transitional areas with Madrean Pinyon - Juniper Woodland Group (G200) in central New Mexico, *Juniperus deppeana* may be present but not dominant. Understory layers are variable and may be dominated by shrubs, graminoids, or be absent. Associated species are generally more typical of the southern Rocky Mountains or Great Plains than the Colorado Plateau. Common species include *Artemisia bigelovii, Atriplex canescens, Cercocarpus montanus, Ericameria nauseosa, Fallugia paradoxa, Quercus gambelii, Quercus x pauciloba, Quercus turbinella, Ribes cereum*, and grasses such as *Achnatherum nelsonii, Achnatherum scribneri, Andropogon hallii, Bouteloua gracilis, Festuca arizonica, Hesperostipa comata, Hesperostipa neomexicana*, or *Pleuraphis jamesii*. Many different foothill and lower montane forbs may be present, but generally with low cover.

ENVIRONMENT & DYNAMICS

Environmental Description: This southern Rocky Mountain woodland group occurs on dry mountains and foothills in southern Colorado east of the Continental Divide, in mountains and plateaus of northern New Mexico, and extends east into the southeastern Great Plains on limestone and shale breaks, escarpments and hills. Stands are found on warm, dry sites on mountain slopes, mesas, plateaus, and ridges. Elevations range from near 1500 to 2900 m with high-elevation stands restricted to relatively warm, dry ridges and south and west aspects. Lower-elevation stands are often restricted to cooler north- and east-facing slopes. Severe climatic events occurring during the growing season, such as frosts and drought, are thought to limit the distribution of pinyon-juniper woodlands to relatively narrow altitudinal belts on a given mountainside. Soils vary in texture ranging from stony, cobbly, gravelly or sandy loams to clay loam or clay.

Dynamics: Both *Pinus edulis* and *Juniperus monosperma* are relatively short (generally <15 m tall), shade-intolerant, drought-tolerant, slow-growing, long-lived trees (Meeuwig and Bassett 1983, Little 1987, Anderson 2002, Johnson 2002, Romme et al. 2003). Both tree species are also non-sprouting and may be killed by fire (Wright et al. 1979).

Pinyon-juniper woodlands are influenced by drought, fires, grazing, and insect-pathogen outbreaks (West 1999b). Stands vary considerably in appearance and composition, both elevationally and geographically. Juniper tends to be more abundant at the warmer/drier lower elevations, pinyon tends to be more abundant at the higher elevations, and the two species share dominance within a broad middle-elevation zone (Woodin and Lindsey 1954).

The effect of a fire on a stand is largely dependent on the tree height and density, fine fuel load on the ground, weather conditions, and season (Dwyer and Pieper 1967, Wright et al. 1979). Some large trees may survive unless the fire gets into the crown due to heavy fuel loads in the understory or extreme fire conditions.

There are many insects, pathogens, and plant parasites that attack pinyon and juniper trees (Meeuwig and Bassett 1983, Gottfried et al. 1995, Rogers 1995, Weber et al. 1999). For pinyon and juniper, there are at least seven insects, plus blackstain root-rot (*Leptographium wageneri*) and mistletoes *Phoradendron juniperinum* and *Arceuthobium divaricatum*. Both mistletoes reduce vigor and cause occasional dieback but rarely cause mortality (Meeuwig and Bassett 1983). The insects are normally present in these woodland stands, and during drought-induced water stress periods, outbreaks may cause local to regional mortality (Wilson and Tkacz 1992, Gottfried et al. 1995, Rogers 1995). Most insect-related pinyon mortality in the West is caused by pinyon ips beetle (*Ips confusus*) (Rogers 1993). Pinyons cannot repel pinyon ips beetles when weakened by drought and many are killed.

DISTRIBUTION

Geographic Range: This southern Rocky Mountain woodland group occurs on dry mountains and foothills in southern Colorado east of the Continental Divide, in mountains and plateaus of northern and central New Mexico, and extends east to breaks in the southeastern Great Plains. It extends south to the Sacramento Mountains, especially the eastern side. The western side has Madrean elements (*Quercus grisea*) and may be classified as Madrean woodland.

Spatial Scale & Pattern [optional]: Matrix
Nations: US
States/Provinces: CO, NM, OK
TNC Ecoregions [optional]: 20:C, 21:C, 22:P, 27:C, 28:C
USFS Ecoregions (2007): 313B:CC, 315A:CC, 315B:CC, 315H:CC, 321A:CC, 322B:CC, 331B:CC, 331H:CP, 331I:CC, 331J:CC, M313B:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC
Omernik Ecoregions:

Federal Lands [optional]: DOD (Pinon Canyon, White Sands Missile Range); NPS (Bandelier, Great Sand Dunes, Salinas Pueblo Missions); USFS (Lincoln)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **>** *Juniperus monosperma/Oryzopsis micrantha* Plant Community (Shaw et al. 1989) [*Pinus edulis* present to codominant.]
- **>** Colorado Pinyon-One-seed Juniper Series (Dick-Peddie 1993)
- **>** Colorado Pinyon-Rocky Mountain Juniper Series (Dick-Peddie 1993)
- **<** Juniper - Pinyon Pine Woodland (504) (Shiflet 1994)
- **<** Pinyon - Juniper: 239 (Eyre 1980)

LOWER LEVEL UNITS

Alliances:

- A3577 *Pinus edulis - Juniperus monosperma* / Herbaceous Understory Open Woodland Alliance
- A3576 *Pinus edulis - Juniperus monosperma* / Shrub Understory Woodland Alliance

AUTHORSHIP

Primary Concept Source: W.A. Dick-Peddie (1993)
Author of Description: K.A. Schulz
Acknowledgments: E. Muldavin
Version Date: 11/09/2015
Classif Resp Region: West
Internal Author: KAS 1-10, 6-13, 11-15

REFERENCES

References: Anderson 2002, Dick-Peddie 1993, Dwyer and Pieper 1967, Eager 1999, Eyre 1980, Faber-Langendoen et al. 2017a, Gottfried et al. 1995, Johnson 2002, Little 1987, Meeuwig and Bassett 1983, Muldavin et al. 2011b, Muldavin et al. 2011d, Muldavin et al. 2012a, Muldavin et al. 2012e, Neely et al. 2001, Rogers 1993, Rogers 1995, Romme et al. 2003, Romme et al. 2009, Salas et al. 2010b, Shaw et al. 1989, Shiflet 1994, Stuever and Hayden 1997a, Weber et al. 1999, West 1999a, West 1999b, Wilson and Tkacz 1992, Woodin and Lindsey 1954, Wright et al. 1979

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1. Forest & Woodland
1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub
G253. Southern Rocky Mountain Pinyon - Juniper Woodland

A3577. Pinus edulis - Juniperus monosperma / Herbaceous Understory Open Woodland Alliance

Type Concept Sentence: This pinyon-juniper woodland and savanna alliance is characterized diagnostic tree species *Pinus edulis* (>5% cover) that forms a very open to moderately dense tree layer often with *Juniperus monosperma* present to codominant (or *Juniperus scopulorum* at higher elevations) with an understory dominated by an open to dense layer of perennial grasses and lacking significant cover of shrubs (<10%). It occurs on warm, dry mountains and foothills in southern Colorado east of the Continental Divide and in mountains and plateaus of northern and central New Mexico, extending east on breaks in the southeastern Great Plains.

OVERVIEW

Scientific Name: *Pinus edulis - Juniperus monosperma* / Herbaceous Understory Open Woodland Alliance
Common Name (Translated Scientific Name): Two-needle Pinyon - One-seed Juniper / Herbaceous Understory Open Woodland Alliance
Colloquial Name: Southern Rockies Pinyon - Juniper Open Woodland

Type Concept: This woodland and savanna alliance is characterized by diagnostic tree species *Pinus edulis* that forms a very open to moderately dense tree layer often with *Juniperus monosperma*. *Juniperus monosperma* may also dominate stands as long as there is significant presence of *Pinus edulis* (not accidental) to characterize the stand as a pinyon-juniper stand and not the more xeric, typically lower elevation *Juniperus osteosperma* woodland and savanna. At higher elevations and relatively mesic sites, such as along drainages, *Juniperus scopulorum* may be present and sometimes dominant. In southern transitional areas with Madrean Pinyon - Juniper Woodland Group (G200) in central New Mexico, *Juniperus deppeana* may be present but not dominant. Other conifers are absent or accidental with very low cover. Scattered shrubs may be present but do not form a layer and do not exceed cover of herbaceous layer. The understory is characterized by an open to dense herbaceous layer composed of grasses often with diverse but low cover of forbs. Characteristic species may include *Achnatherum nelsonii, Achnatherum scribneri, Andropogon hallii, Bouteloua curtipendula, Bouteloua gracilis, Festuca arizonica, Hesperostipa comata, Hesperostipa neomexicana, Leymus ambiguus, Muhlenbergia montana*, and *Pleuraphis jamesii*. This alliance occurs on warm, dry mountains and foothills in southern Colorado east

of the Continental Divide and in mountains and plateaus of northern and central New Mexico, extending east on breaks in the southeastern Great Plains. Stands typically occur on nearly level to steep (to 80%), rocky slopes on hillsides and ridgetops on all aspects except in elevational extremes for a given latitude where low-elevation stands are restricted to the more mesic north slopes; canyons and high-elevation stands occur on south aspects. Sites are typically dry with shallow, rocky, calcareous and alkaline soils. Other sites include eroded "badlands," lava flows, scree slopes, and deep sands.

Classification Comments: Several of the associations in this alliance need further review to clarify whether to add *Juniperus monosperma* to the name and if there is a Colorado Plateau analog codominated by *Juniperus osteosperma*. *Pinus edulis / Bouteloua curtipendula* Open Woodland (CEGL000777) and *Pinus edulis - (Juniperus monosperma) / Festuca arizonica* Open Woodland (CEGL000783) are broadly defined as being codominated by *Juniperus monosperma* or *Juniperus osteosperma*. They may need to be split into new associations to include stands inside the distributional range of *Juniperus osteosperma* and placed in Colorado Plateau Pinyon - Juniper Woodland Group (G250). Colorado stands have 5-25% tree cover. Stands with <5% cover may better be placed in similar grass associations (e.g., CEGL001703). On New Mexico sites, this type typically has 10-30% tree cover with some communities having over 30% tree cover.

Internal Comments:
Other Comments:

Similar NVC Types: This alliance has similarities to other pinyon-juniper woodland and juniper woodland alliances in several other groups, such as G200, G246, G247, G248, G250, G252, and G487

- A3574 *Juniperus monosperma* / Shrub Understory Woodland Alliance: is similar except overstory lacks *Pinus edulis* or has low cover (<5%).
- A3575 *Juniperus monosperma* / Herbaceous Understory Open Woodland Alliance
- A3576 *Pinus edulis - Juniperus monosperma* / Shrub Understory Woodland Alliance: is similar but understory has a shrub layer (>10% cover) or, if less, shrub cover exceeds herbaceous cover.

Diagnostic Characteristics: This alliance is characterized by an open to moderate tree canopy, typically with between 5 and 30% cover. The diagnostic and often dominant species is *Pinus edulis*. *Juniperus monosperma* or *Juniperus scopulorum* is often present to codominant and may dominate stands as long as there is significant presence of *Pinus edulis* (not accidental) to characterize the stand as a pinyon-juniper stand. The understory is characterized by an open to dense herbaceous layer. Characteristic species may include *Achnatherum nelsonii, Achnatherum scribneri, Andropogon hallii, Bouteloua curtipendula, Bouteloua gracilis, Festuca arizonica, Hesperostipa comata, Hesperostipa neomexicana, Leymus ambiguus, Muhlenbergia montana*, and *Pleuraphis jamesii*.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a moderately sparse to moderately dense tree canopy (5-50% cover) that is typically 3-10 m tall. Stands are either solely dominated by evergreen needle-leaved trees or may be codominated by broad-leaved or scale-leaved evergreen trees. An open to moderate ground layer dominated by perennial graminoids is present. Perennial forbs and cacti are often scattered throughout the stands. Annual forbs and grasses may be seasonally present. Scattered broad-leaved and microphyllous deciduous or evergreen shrubs may be present but do not form a layer (<10% cover).

Floristics: This woodland and savanna alliance is characterized by diagnostic tree species *Pinus edulis* that forms a very open to moderately dense, short (<20 m tall) tree layer often with *Juniperus monosperma*. *Juniperus monosperma* may also dominate stands as long as there is significant (>5% cover) presence of *Pinus edulis* (not accidental) to characterize the stand as a pinyon-juniper stand and not the more xeric, typically lower elevation *Juniperus osteosperma* woodland and savanna. At higher elevations and relatively mesic sites, such as along drainages, *Juniperus scopulorum* may be present and sometimes dominant. In southern transitional areas with Madrean Pinyon - Juniper Woodland Group (G200) in central New Mexico, *Juniperus deppeana* may be present but not dominant. Other conifers are absent or accidental with very low cover. Scattered shrubs such as *Artemisia bigelovii, Artemisia tridentata, Cercocarpus montanus, Gutierrezia sarothrae, Krascheninnikovia lanata, Opuntia* spp., and *Rhus trilobata* may be present (<10% total cover) but do not form a layer and do not exceed cover of herbaceous layer. The understory is characterized by an open to dense herbaceous layer composed of perennial grasses often with diverse but low cover of forbs. Characteristic species may include *Achnatherum hymenoides, Achnatherum nelsonii, Achnatherum scribneri, Aristida* spp., *Andropogon hallii, Bouteloua curtipendula, Bouteloua gracilis, Festuca arizonica, Koeleria macrantha, Hesperostipa comata, Hesperostipa neomexicana, Leymus ambiguus, Muhlenbergia montana, Piptatheropsis micrantha (= Oryzopsis micrantha), Pleuraphis jamesii*, and *Sporobolus* spp. Many forb species occur, but few have much cover. Commonly present forbs include species of *Artemisia, Eriogonum, Heterotheca, Mirabilis, Penstemon, Phlox, Senecio*, and *Zinnia*. Annual grasses and forbs are seasonally present. Adjacent vegetation at higher elevations is typically woodland or forest dominated by *Pinus ponderosa*. Adjacent vegetation at lower elevations is often *Juniperus* spp.-dominated woodland and savanna, *Artemisia* spp.-dominated shrubland, or grassland.

ENVIRONMENT & DYNAMICS

Environmental Description: This woodland and savanna alliance occurs on warm, dry mountains and foothills in southern Colorado east of the Continental Divide and in mountains and plateaus of northern and central New Mexico, extending east on breaks in the southeastern Great Plains. Climate is semi-arid and droughts are not uncommon. Summers are generally hot, and winters range from mild with cold periods and occasional snows in southern New Mexico and Arizona to the more typical extended periods of freezing temperatures. The seasonality of precipitation varies from east to west with summer rain more common in the southern and eastern portion of the alliance's range and winter precipitation more common in the western portion of the range. Mean annual precipitation ranges from 30-46 cm. Stands occur on escarpments and canyons, mesas, and piedmonts to the lower montane zone. Elevation ranges from 1406-2510 m. Sites are nearly level to moderately steep, rocky slopes on hillsides and ridgetops. Aspect does not seem important except in elevational extremes for a given latitude where low-elevation stands are restricted to the more mesic north slopes; canyons and high-elevation stands occur on south aspects. Sites are typically dry with shallow, rocky, calcareous and alkaline soils. Other sites include eroded "badlands," lava flows, scree slopes, and deep sands. Soil textures range from sandy loam to clay and are typically derived from limestone, sandstone or shale. Other parent materials include andesite, basalt, granite, quartzite, monzonite, rhyolite and mixed alluvium.

Dynamics: *Pinus edulis* is extremely drought-tolerant and slow-growing (Little 1987, Powell 1988b, Muldavin et al. 1998c). It is also non-sprouting and may be killed by fire (Wright et al. 1979). The effect of fire on a stand is largely dependent on the tree height and density, fine-fuel load on the ground, weather conditions, and season (Dwyer and Pieper 1967, Wright et al. 1979). Trees are more vulnerable in open stands where fires frequently occur in the spring, when the relative humidity is low, wind speeds are over 10-20 mph, and there are adequate fine fuels to carry fire (Wright et al. 1979). Under other conditions, burns tend to be spotty with low tree mortality. Large trees are generally not killed unless fine fuels, such as tumbleweeds, have accumulated beneath the tree to provide ladder fuels for the fire to reach the crown (Jameson 1962). Closed-canopy stands rarely burn because they typically do not have enough understory or wind to carry a fire (Wright et al. 1979).

Although *Pinus edulis* is drought-tolerant, prolonged droughts will weaken trees and promote mortality by secondary agents. Periodic die-offs of pinyon pine caused by insects, such as the pinyon Ips beetle (*Ips confusus*), or fungal agents, such as blackstain root-rot (*Leptographium wageneri*), tend to be correlated with droughts (Anhold 2005). These mortality events may be localized or widespread but can result in 50 to 90% mortality of *Pinus edulis* (Harrington and Cobb 1988).

Climatic and other factors have resulted in denser and expanded pinyon-juniper stands. Denser stands are more susceptible to attack by insects and disease (Anhold 2005). In addition, altered fire regimes, cutting trees for fencing or firewood, and improper grazing by livestock have significant impacts on the quality of sites. Grazing by livestock can modify the fire regime by removing the fine fuels that carry fire. Fire, livestock grazing, and trampling by recreationalists and vehicles disturb cryptogamic soil crusts that help maintain soil structure, reduce soil erosion, provide habitat for plants and preserve biological diversity (Ladyman and Muldavin 1996). More study is needed to understand and manage these woodlands ecologically.

DISTRIBUTION

Geographic Range: This woodland and savanna alliance occurs on warm, dry mountains and foothills in southern Colorado east of the Continental Divide and in mountains and plateaus of northern and central New Mexico (USFS 2007), extending east on breaks in the southeastern Great Plains.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **<** Colorado Pinyon-Alligator Juniper Series (Dick-Peddie 1993)
- **<** Colorado Pinyon-Mixed Juniper Series (Dick-Peddie 1993)
- **<** Colorado Pinyon-One Seeded Juniper Series (Dick-Peddie 1993)
- **<** Colorado Pinyon-Rocky Mountain Juniper Series (Dick-Peddie 1993)

LOWER LEVEL UNITS

Associations:

- CEGL005660 *Pinus edulis - Juniperus monosperma / Hesperostipa comata* Open Woodland
- CEGL000783 *Pinus edulis - (Juniperus monosperma) / Festuca arizonica* Open Woodland
- CEGL000774 *Pinus edulis / Andropogon hallii* Open Woodland

- CEGL002908 *Pinus edulis / Leymus ambiguus* Open Woodland
- CEGL000798 *Pinus edulis / Achnatherum scribneri* Open Woodland
- CEGL000777 *Pinus edulis / Bouteloua curtipendula* Open Woodland
- CEGL002151 *Pinus edulis - (Juniperus monosperma, Juniperus deppeana) / Bouteloua gracilis* Open Woodland
- CEGL000796 *Pinus edulis / Achnatherum nelsonii ssp. dorei* Open Woodland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2017/02/15

REFERENCES

References: Anhold 2005, Baker 1984a, Brown 1982a, Burns and Honkala 1990a, Dick-Peddie 1993, Donart et al. 1978a, Dwyer and Pieper 1967, Everett 1986, Faber-Langendoen et al. 2017b, Francis 1986, Harrington and Cobb 1988, Jameson 1962, Johnston 1984, Johnston 1987, Kennedy 1983a, Ladyman and Muldavin 1996, Larson and Moir 1986, Larson and Moir 1987, Little 1987, Moir and Carleton 1987, Muldavin 1994, Muldavin and Mehlhop 1992, Muldavin et al. 1998c, Pieper 1968, Powell 1988b, Rippel et al. 1998, Rogers 1953, Soil Conservation Service 1978, Steinhoff 1978, USFS 1981b, USFS 1982, USFS 1983a, USFS 1985b, USFS 1985c, USFS 1985d, USFS 1985e, USFS 1985g, USFS 2007, Wells 1970a, Wright et al. 1973, Wright et al. 1979

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1. Forest & Woodland
1.B.2.Nc. Western North American Pinyon - Juniper Woodland & Scrub
G253. Southern Rocky Mountain Pinyon - Juniper Woodland

A3576. Pinus edulis - Juniperus monosperma / Shrub Understory Woodland Alliance

Type Concept Sentence: This pinyon-juniper woodland and savanna alliance is characterized diagnostic tree species *Pinus edulis* (>5% cover) that forms a very open to moderately dense tree layer often with *Juniperus monosperma* present to codominant (or *Juniperus scopulorum* at higher elevations) with an understory dominated by an open to dense shrub or dwarf-shrub layer. It occurs on warm, dry mountains and foothills in southern Colorado east of the Continental Divide and in mountains and plateaus of northern and central New Mexico, extending east on breaks in the southeastern Great Plains.

OVERVIEW

Scientific Name: *Pinus edulis - Juniperus monosperma* / Shrub Understory Woodland Alliance
Common Name (Translated Scientific Name): Two-needle Pinyon - One-seed Juniper / Shrub Understory Woodland Alliance
Colloquial Name: Two-needle Pinyon - One-seed Juniper / Shrub Woodland

Type Concept: These woodlands are characterized by diagnostic tree species *Pinus edulis* that forms an open to dense tree layer often with *Juniperus monosperma*. *Juniperus monosperma* may also dominate stands as long as there is significant presence of *Pinus edulis* (not accidental) to characterize the stand as a pinyon-juniper stand and not the more xeric, typically lower elevation *Juniperus osteosperma* woodland. At higher elevations and relatively mesic sites, such as along drainages, *Juniperus scopulorum* may be present and sometimes dominant. In southern transitional areas with Madrean Pinyon - Juniper Woodland Group (G200) in central New Mexico, *Juniperus deppeana* may be present but not dominant. Other conifers are absent or accidental with very low cover. The understory is characterized by shrubs that typically form an open to moderately dense layer. Characteristic shrubs are many and include *Artemisia bigelovii, Artemisia tridentata, Atriplex canescens, Cercocarpus montanus, Chrysothamnus viscidiflorus, Ericameria nauseosa, Gutierrezia sarothrae, Holodiscus dumosus, Quercus gambelii, Quercus x pauciloba, Ribes cereum, Rhus trilobata*, and *Symphoricarpos oreophilus*. Similar scattered shrubs frequently characterize sparse and rocky understory woodland stands and so those types are included in this alliance. The herbaceous layer is sparse to moderate and composed of grasses and often with diverse but low cover of forbs. Common species may include *Achnatherum hymenoides, Achnatherum nelsonii, Achnatherum scribneri, Andropogon hallii, Bouteloua gracilis, Festuca arizonica, Hesperostipa comata, Hesperostipa neomexicana, Muhlenbergia montana*, and *Pleuraphis jamesii*. This woodland alliance occurs on warm, dry mountains and foothills in southern Colorado east of the Continental Divide and in mountains and plateaus of northern and central New Mexico, extending east on breaks in the southeastern Great Plains. Stands typically occur on nearly level to steep (to 80%), rocky slopes on hillsides and ridgetops on all aspects except in elevational extremes for a given latitude where low-elevation stands are restricted to the more mesic north slopes; canyons and high-elevation stands occur on south aspects. Sites are typically dry with shallow, rocky, calcareous and alkaline soils. Other sites include eroded "badlands," lava flows, and scree slopes.

Classification Comments: In northwestern New Mexico, the distributional ranges of *Juniperus monosperma* and *Juniperus osteosperma* overlap. This alliance does not occur within the range of *Juniperus osteosperma* with this transition zone from the southern Rocky Mountain pinyon-juniper woodland alliances to the Colorado Plateau pinyon-juniper woodland alliances. Stands with sparse or rocky understory are included in this alliance because scattered similar shrub species are frequently present and

characterize the stand at lower cover. The following associations in this alliance need further review and classification action: *Pinus edulis - Juniperus scopulorum / Holodiscus dumosus* Woodland (CEGL002802) is currently known from Black Canyon of the Gunnison, Curecanti National Recreation Area and Great Sand Dunes in Colorado and El Malpais National Monument in New Mexico. More survey and classification work are needed to fully characterize this type. It may need to be split with a new association to include stands inside the distributional range of *Juniperus osteosperma* and placed in Colorado Plateau Pinyon - Juniper Woodland Group (G250).

Internal Comments:
Other Comments:

Similar NVC Types: This alliance has similarities to other pinyon-juniper woodland and juniper woodland alliances in several other groups, such as G200, G246, G247, G248, G250, G253, and G487.

- A3574 *Juniperus monosperma* / Shrub Understory Woodland Alliance: is similar except overstory lacks *Pinus edulis* or has low cover (<5%).
- A3577 *Pinus edulis - Juniperus monosperma* / Herbaceous Understory Open Woodland Alliance: is similar but understory lacks a shrub layer and is dominated by an herbaceous layer (>10% cover) or, if less, grass cover exceeds shrub cover.

Diagnostic Characteristics: This woodland alliance occurs in foothills in southern Colorado east of the Continental Divide and in mountains and plateaus of northern and central New Mexico, extending east on breaks in the southeastern Great Plains. The diagnostic tree species *Pinus edulis* forms an open to dense tree layer often with *Juniperus monosperma*. *Juniperus monosperma* or *Juniperus scopulorum* may also dominate stands as long as there is significant presence of *Pinus edulis* (not accidental) to characterize the stand as a pinyon-juniper stand. The understory is characterized by shrubs. Characteristic shrubs are many. The herbaceous layer is sparse to moderate and composed of grasses and often diverse forbs. This alliance also includes sparse understory stands often with scattered shrubs and grasses.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a moderately sparse to moderately dense tree canopy that is typically 3-10 m tall. Stands are either solely dominated by evergreen needle-leaved trees or may be codominated by broad-leaved or scale-leaved evergreen trees. An open to moderately dense shrub layer (0.5-3 m tall) is present and ranges from a single species to a diverse mix of broad-leaved and microphyllous deciduous or evergreen shrubs that are usually less than 3 m tall. A sparse to moderate ground layer dominated by perennial graminoids is usually present. Perennial forbs and cacti are often scattered throughout the stands. Annual forbs and grasses may be seasonally present. This alliance also includes sparse understory stands often with scattered shrubs and grasses.

Floristics: These woodlands are characterized by diagnostic tree species *Pinus edulis* that forms an open to dense tree layer often with *Juniperus monosperma*. *Juniperus monosperma* may also dominate stands as long as there is significant presence of *Pinus edulis* (not accidental) to characterize the stand as a pinyon-juniper stand and not the more xeric, typically lower elevation *Juniperus osteosperma* woodland. At higher elevations and relatively mesic sites, such as along drainages, *Juniperus scopulorum* may be present and sometimes dominant. In southern transitional areas with Madrean Pinyon - Juniper Woodland Group (G200) in central New Mexico, *Juniperus deppeana* may be present but not dominant. Other conifers are absent or accidental with very low cover. The understory is characterized by shrubs that typically form an open to moderately dense layer. Characteristic shrubs are many and include *Artemisia bigelovii, Artemisia tridentata, Atriplex canescens, Cercocarpus montanus, Chrysothamnus viscidiflorus, Ericameria nauseosa, Fallugia paradoxa, Gutierrezia sarothrae, Holodiscus dumosus, Quercus gambelii, Quercus x pauciloba, Ribes cereum, Rhus trilobata*, and *Symphoricarpos oreophilus*. Similar scattered shrubs frequently characterize sparse and rocky understory woodland stands and so those types are included in this alliance. The herbaceous layer is sparse to moderate and composed of grasses and often with diverse but low cover of forbs. Common species may include *Achnatherum hymenoides, Achnatherum nelsonii, Achnatherum scribneri, Andropogon hallii, Achnatherum hymenoides, Bouteloua gracilis, Festuca arizonica, Hesperostipa comata, Hesperostipa neomexicana, Koeleria macrantha, Muhlenbergia montana, Piptatheropsis micrantha (= Piptatherum micranthum), Pleuraphis jamesii* and *Sporobolus* spp. Many forb species occur, but few have much cover. Commonly present forbs include species of *Artemisia, Eriogonum, Heterotheca, Mirabilis, Penstemon, Phlox, Senecio*, and *Zinnia*. Annual grasses and forbs are seasonally present. Adjacent vegetation at higher elevations is typically woodland or forest dominated by *Pinus ponderosa*. Adjacent vegetation at lower elevations is often *Juniperus* spp.-dominated woodland and savanna, *Artemisia* spp.-dominated shrubland, or grassland.

ENVIRONMENT & DYNAMICS

Environmental Description: This woodland alliance occurs on warm, dry mountains and foothills in southern Colorado east of the Continental Divide and in mountains and plateaus of northern and central New Mexico, extending east on breaks in the southeastern Great Plains. Elevations range from 1406-2510 m. Climate is semi-arid and droughts are not uncommon. Summers are generally hot, and winters range from mild with cold periods and occasional snows in southern New Mexico and Arizona to the more typical extended periods of freezing temperatures. The seasonality of precipitation varies from east to west with summer rain more

common in the southern and eastern portion of the alliance's range and winter precipitation more common in the western portion of the range. Mean annual precipitation ranges from 30-46 cm. Stands typically occur on nearly level to steep (to 80%), rocky slopes on hillsides and ridgetops. Aspect does not seem important except in elevational extremes for a given latitude where low-elevation stands are restricted to the more mesic north slopes, and canyons and high-elevation stands occur on south aspects. Sites are typically dry with shallow, rocky, calcareous and alkaline soils. Other sites include eroded "badlands," lava flows, scree slopes, and deep sands. Soil textures range from sandy loam to clay and are typically derived from limestone, sandstone or shale. Other parent materials include andesite, basalt, granite, quartzite, monzonite, rhyolite and mixed alluvium. This alliance also includes sparse understory stands often with scattered shrubs and grasses. The lack of understory can be caused by harsh substrate (rockland, shale badland) or dense tree canopy resulting from lack of fire that shades out understory.

Dynamics: *Pinus edulis* is extremely drought-tolerant and slow-growing (Little 1987, Powell 1988b, Muldavin et al. 1998c). It is also non-sprouting and may be killed by fire (Wright et al. 1979). The effect of fire on a stand is largely dependent on the tree height and density, fine-fuel load on the ground, weather conditions, and season (Dwyer and Pieper 1967, Wright et al. 1979). Trees are more vulnerable in open stands where fires frequently occur in the spring, when the relative humidity is low, wind speeds are over 10-20 mph, and there are adequate fine fuels to carry fire (Wright et al. 1979). Under other conditions, burns tend to be spotty with low tree mortality. Large trees are generally not killed unless fine fuels, such as tumbleweeds, have accumulated beneath the tree to provide ladder fuels for the fire to reach the crown (Jameson 1962). Closed-canopy stands rarely burn because they typically do not have enough understory or wind to carry a fire (Wright et al. 1979).

Although *Pinus edulis* is drought-tolerant, prolonged droughts will weaken trees and promote mortality by secondary agents. Periodic die-offs of pinyon pine caused by insects, such as the pinyon Ips beetle (*Ips confusus*), or fungal agents, such as blackstain root-rot (*Leptographium wageneri*), tend to be correlated with droughts (Anhold 2005). These mortality events may be localized or widespread but can result in 50 to 90% mortality of *Pinus edulis* (Harrington and Cobb 1988).

Climatic and other factors have resulted in denser and expanded pinyon-juniper stands throughout the Colorado Plateau and Great Basin. Denser stands are more susceptible to attack by insects and disease (Anhold 2005). In addition, altered fire regimes, cutting trees for fencing or firewood, and improper grazing by livestock have significant impacts on the quality of sites. Grazing by livestock can modify the fire regime by removing the fine fuels that carry fire. Fire, livestock grazing, and trampling by recreationalists and vehicles disturb cryptogamic soil crusts that help maintain soil structure, reduce soil erosion, provide habitat for plants and preserve biological diversity (Ladyman and Muldavin 1996). More study is needed to understand and manage these woodlands ecologically.

DISTRIBUTION

Geographic Range: This woodland alliance occurs on warm, dry mountains and foothills in southern Colorado east of the Continental Divide and in mountains and plateaus of northern and central New Mexico, extending east on breaks in the southeastern Great Plains.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** Colorado Pinyon-Alligator Juniper Series (Dick-Peddie 1993)
- **?** Colorado Pinyon-Mixed Juniper Series (Dick-Peddie 1993)
- **?** Colorado Pinyon-One Seeded Juniper Series (Dick-Peddie 1993)
- **?** Colorado Pinyon-Rocky Mountain Juniper Series (Dick-Peddie 1993)

LOWER LEVEL UNITS

Associations:

- CEGL000793 *Pinus edulis - Juniperus monosperma / Quercus x pauciloba* Woodland
- CEGL000794 *Pinus edulis* / Rockland Woodland
- CEGL002802 *Pinus edulis - Juniperus scopulorum / Holodiscus dumosus* Woodland
- CEGL005649 *Pinus edulis - Juniperus (monosperma, deppeana) / Cercocarpus montanus* - Mixed Shrubs Woodland
- CEGL002907 *Pinus edulis - Juniperus scopulorum* Woodland
- CEGL005650 *Pinus edulis - Juniperus monosperma / Artemisia tridentata (ssp. wyomingensis, ssp. vaseyana)* Woodland
- CEGL002188 *Pinus edulis - Juniperus* spp. / *Fallugia paradoxa* Woodland

AUTHORSHIP

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

REFERENCES

References: Anhold 2005, Baker 1984a, Brown 1982a, Burns and Honkala 1990a, Dick-Peddie 1993, Donart et al. 1978a, Dwyer and Pieper 1967, Everett 1986, Faber-Langendoen et al. 2017b, Francis 1986, Harrington and Cobb 1988, Jameson 1962, Johnston 1984, Johnston 1987, Kennedy 1983a, Ladyman and Muldavin 1996, Larson and Moir 1986, Larson and Moir 1987, Little 1987, Moir and Carleton 1987, Muldavin et al. 1998c, Pieper 1968, Powell 1988b, Rippel et al. 1998, Rogers 1953, Soil Conservation Service 1978, Steinhoff 1978, USFS 1981b, USFS 1982, USFS 1983a, USFS 1985b, USFS 1985c, USFS 1985d, USFS 1985e, USFS 1985g, Wells 1970a, Wright et al. 1973, Wright et al. 1979

1.B.2.Ne. North American Great Plains Forest & Woodland

This division contains aspen, oak and mixed hardwood woodlands dominated by *Quercus macrocarpa, Populus tremuloides*, or *Betula papyrifera*, often with an understory dominated by prairie shrubs, grasses and forbs that are more tolerant of shade. It is found throughout the northern Great Plains, from central Kansas to the Canadian aspen parkland region.

M151. Great Plains Forest & Woodland

This macrogroup contains aspen, oak, and mixed hardwood woodlands dominated by *Quercus macrocarpa, Populus tremuloides*, or *Betula papyrifera*, often with an understory dominated by prairie shrubs, grasses and forbs that are more tolerant of shade. It is found throughout northern Great Plains, from central Kansas to the Canadian aspen parkland region.

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1. Forest & Woodland
1.B.2.Ne. North American Great Plains Forest & Woodland
1.B.2.Ne.1.a. M151 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

Scientific Name: *Quercus macrocarpa - Corylus* spp. / *Carex* spp. Forest & Woodland Group
Common Name (Translated Scientific Name): Bur Oak - Hazelnut species / Sedge species Forest & Woodland Group
Colloquial Name: Great Plains Bur Oak 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.

Classification Comments:

Similar NVC Types:
- 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

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.

VEGETATION

Physiognomy and Structure: 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.

Floristics: 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*.

ENVIRONMENT & DYNAMICS

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.

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.

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.

Spatial Scale & Pattern [optional]: Large patch
Nations: CA, US
States/Provinces: IA, KS, MB, MN, MO, MT, ND, NE, SD, SK, WY
TNC Ecoregions [optional]: 25:P, 26:C, 27:C, 33:C, 34:C, 35:C, 36:C, 46:?
USFS Ecoregions (2007): 251B:CC, 251H:C?, 331C:CC, 331E:CC, 331F:CC, 331M:CP, 332B:CC, 332C:CC, 332D:CC, 332E:CC, M334A:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** Aspen: 16 (Eyre 1980) [Rare but possible where it might be adjacent to Aspen Parklands.]
- **>** Aspen: 217 (Eyre 1980)
- **>** Bur Oak: 216 (Eyre 1980)
- **<** Bur Oak: 236 (Eyre 1980)
- **>** Bur Oak: 42 (Eyre 1980)

LOWER LEVEL UNITS

Alliances:
- A1505 *Quercus macrocarpa* / Mixedgrass Woodland Alliance
- A0245 *Quercus macrocarpa* Forest Alliance
- A0620 *Quercus macrocarpa / Corylus* spp. / Mixedgrass Woodland Alliance

AUTHORSHIP

Primary Concept Source: S. Menard and K. Kindscher, in Faber-Langendoen et al. (2011)
Author of Description: S. Menard and J. Drake
Acknowledgments:
Version Date: 05/07/2015
Classif Resp Region: Midwest
Internal Author: SEM 10-10, mod. JD 4-13, 5-15

REFERENCES

References: Barbour and Billings 1988, Comer et al. 2003, Eyre 1980, Faber-Langendoen et al. 2017a, Girard et al. 1989, Tolstead 1947

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1. Forest & Woodland
1.B.2.Ne. North American Great Plains Forest & Woodland
G329. Great Plains Bur Oak Forest & Woodland

A0620. Quercus macrocarpa / Corylus spp. / Mixedgrass Woodland Alliance

Type Concept Sentence: This alliance is widespread in the northern and central Great Plains on mesic or dry-mesic sites with an open to moderately closed tree canopy dominated by *Quercus macrocarpa*.

OVERVIEW

Scientific Name: *Quercus macrocarpa / Corylus* spp. / Mixedgrass Woodland Alliance
Common Name (Translated Scientific Name): Bur Oak / Hazelnut species / Mixedgrass Woodland Alliance
Colloquial Name: Great Plains Bur Oak Woodland

Type Concept: The canopy of this alliance is open to moderately closed and usually dominated by *Quercus macrocarpa*. Common associates in the canopy are *Quercus muehlenbergii* in the southeast portion, *Fraxinus pennsylvanica, Tilia americana*, and *Populus tremuloides* in the northern half, and *Carya* spp. and *Ulmus* spp. in the eastern part of the alliance's range. *Pinus ponderosa* can occur in some stands at the extreme western limit of this alliance's range. A shrub layer 1-2 m tall is often present, especially in the northern half of the range of this alliance. Dominant shrubs include *Amelanchier alnifolia, Corylus americana, Corylus cornuta, Prunus virginiana*, and *Symphoricarpos occidentalis*. The herbaceous layer is dominated by graminoids. These can range from tall grasses, such as *Andropogon gerardii, Panicum virgatum*, and *Sorghastrum nutans*, to mid grasses, such as *Schizachyrium scoparium* and *Hesperostipa spartea (= Stipa spartea)*, to short graminoids, such as *Carex inops ssp. heliophila*. This alliance is found in a landscape dominated by prairie communities. The woodland is typically found on rolling hills, lower mountain slopes (in the Black Hills), or along ravines. These topographic positions provided some protection from the fires that regularly occurred on the surrounding prairies in pre-European times. However, some fire was necessary to prevent the woodland physiognomy from closing and becoming a forest. This was especially important in the more mesic eastern portions of this alliance's range. In Nebraska, the soils are fertile, moderately well-drained to well-drained, and deep. This alliance is widespread in the northern and central Great Plains. All of its associations are found in the midwestern United States west of the Mississippi River.

Classification Comments: There are currently three alliances in the Great Plains dominated by *Quercus macrocarpa*. This alliance has a woodland canopy and many stands have an understory reflecting mixedgrass prairies. There are two physiognomic types in this alliance: those with a shrubby understory and those with a mixedgrass understory. These are currently grouped into one alliance based largely on the canopy dominance of *Quercus macrocarpa* but might be distinct enough to separate into two alliances if dominant species reflect these physiognomic differences. See also *Quercus macrocarpa* / Mixedgrass Woodland Alliance (A1505) which is a drier mixedgrass prairie alliance. It may be that *Quercus macrocarpa / Carex inops ssp. heliophila* Woodland (CEGL000554) should be moved to that alliance. In the northern Great Plains, this alliance can be similar to stands in Northeastern Great Plains Aspen Woodland Group (G146) or Northwestern Great Plains Aspen Woodland Group (G328).

Internal Comments:
Other Comments:

Similar NVC Types:

- A3249 *Populus tremuloides - Populus balsamifera / Corylus americana* Forest Alliance
- A0245 *Quercus macrocarpa* Forest Alliance: tends to have a denser tree canopy and less cover by grasses in the understory.
- A3248 *Betula papyrifera / Corylus cornuta* Woodland Alliance: can occur in similar settings to A0620 but is not dominated by *Quercus macrocarpa*.
- A3250 *Populus tremuloides / Corylus* spp. Woodland Alliance: has more *Populus tremuloides*
- A1505 *Quercus macrocarpa* / Mixedgrass Woodland Alliance: tends to have a more open canopy, though there is overlap.

Diagnostic Characteristics: *Quercus macrocarpa*- or *Quercus muehlenbergii*-dominated woodlands in the Great Plains with shrubs or prairie grasses predominant in the understory.

VEGETATION

Physiognomy and Structure: This alliance has an open to moderately closed tree canopy. The shrub layer can be nearly absent to dense. Graminoids 1-2 m tall dominate the moderate to dense herbaceous layer.

Floristics: The canopy is open to moderately closed and usually dominated by *Quercus macrocarpa*. Common associates in the canopy are *Quercus muehlenbergii* in the southeastern portion, *Fraxinus pennsylvanica, Tilia americana*, and *Populus tremuloides* in the northern half, and *Carya* spp. and *Ulmus* spp. in the eastern part of the alliance's range. *Pinus ponderosa* can occur in some stands at the extreme western limit of this alliance's range. A shrub layer 1-2 m tall is often present, especially in the northern half of the range of this alliance. Dominant shrubs include *Amelanchier alnifolia, Corylus americana, Corylus cornuta, Prunus virginiana*, and *Symphoricarpos occidentalis*. The herbaceous layer is dominated by graminoids. These can range from tall grasses, such as *Andropogon gerardii, Panicum virgatum*, and *Sorghastrum nutans*, to mid grasses, such as *Schizachyrium scoparium* and *Hesperostipa spartea (= Stipa spartea)*, to short graminoids, such as *Carex inops ssp. heliophila*.

ENVIRONMENT & DYNAMICS

Environmental Description: This woodland alliance is found in a landscape dominated by prairie communities. The woodland is typically found on rolling hills, lower mountain slopes (in the Black Hills), or along ravines. These topographic positions provided some protection from the fires that regularly occurred on the surrounding prairies in pre-European times. However, some fire was necessary to prevent the woodland physiognomy from closing and becoming a forest (Abrams 1985, MNNHP 1993). This was especially important in the more mesic eastern portions of this alliance's range. In Nebraska, the soils are fertile, moderately well-drained to well-drained, and deep (Rolfsmeier and Steinauer 2010).

Dynamics: The topographic positions where this alliance occurs provide some protection from the fires that regularly occurred on the surrounding prairies in pre-European times. However, some fire was necessary to prevent the woodland physiognomy from closing and becoming a forest (Abrams 1985, MNNHP 1993). This was especially important in the more mesic eastern portions of this alliance's range. In the Black Hills fire suppression may be favoring *Fraxinus pennsylvanica* over the more fire-tolerant *Quercus macrocarpa* (Girard et al. 1989).

In similar prairie woodlands, cattle and bison use them for forage, shelter and shade. Damage to trees and undergrowth from rubbing and trampling occurs. Grazing can also cause changes in floristic composition. *Poa pratensis, Rosa woodsii, Symphoricarpos occidentalis* and *Taraxacum officinale* occur more abundantly on grazed *Fraxinus* woodland sites (Girard et al. 1987).

DISTRIBUTION

Geographic Range: This alliance occurs across the central Great Plains from the Black Hills east to the eastern Dakotas, western Iowa, and western Missouri and north into southern Canada. It may extend into northern Oklahoma.

Nations: CA, US
States/Provinces: IA, KS, MB?, MO, ND, NE, OK?, SD, SK, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** Bur Oak: 42 (Eyre 1980)
- **<** Mesic Bur Oak Forest and Woodland (Rolfsmeier and Steinauer 2010) [includes A0620 and A0245.]

LOWER LEVEL UNITS

Associations:
- CEGL002138 *Quercus macrocarpa / Prunus virginiana - Symphoricarpos occidentalis* Woodland
- CEGL000556 *Quercus macrocarpa / Corylus americana - Amelanchier alnifolia* Woodland
- CEGL000554 *Quercus macrocarpa / Carex inops ssp. heliophila* Woodland
- CEGL002145 *Quercus muehlenbergii - Quercus macrocarpa / Andropogon gerardii* Ravine Woodland
- CEGL002137 *Quercus macrocarpa / Corylus cornuta* Woodland
- CEGL002052 *Quercus macrocarpa / Andropogon gerardii - Panicum virgatum* Woodland
- CEGL002053 *Quercus macrocarpa / Andropogon gerardii - Hesperostipa spartea* Woodland

AUTHORSHIP

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

REFERENCES

References: Abrams 1985, Eyre 1980, Faber-Langendoen et al. 2017b, Girard et al. 1987, Girard et al. 1989, Hoagland pers. comm., Hoffman and Alexander 1987, Johnston 1987, MNNHP 1993, Olson and Gerhart 1982, Rolfsmeier and Steinauer 2010, WNDD unpubl. data

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1. Forest & Woodland
1.B.2.Ne. North American Great Plains Forest & Woodland
G329. Great Plains Bur Oak Forest & Woodland

A1505. Quercus macrocarpa / Mixedgrass Woodland Alliance

Type Concept Sentence: This alliance, found in the northern Great Plains, is a mixedgrass savanna and woodland. Scattered and clumped trees are always present, and the tree stratum varies from 10 to 60% cover. *Quercus macrocarpa* is the most common tree while mid grasses and tall grasses dominate the ground layer.

OVERVIEW

Scientific Name: *Quercus macrocarpa* / Mixedgrass Woodland Alliance
Common Name (Translated Scientific Name): Bur Oak / Mixedgrass Woodland Alliance
Colloquial Name: Bur Oak / Mixedgrass Woodland

Type Concept: This alliance, found in the northern Great Plains, is a mixedgrass savanna and woodland. Scattered and clumped trees are always present, and the tree stratum varies from 10 to 60% cover. *Quercus macrocarpa* is the most common tree. Mid grasses and tall grasses dominate the ground layer, including *Andropogon gerardii, Carex pensylvanica, Schizachyrium scoparium*, and *Sorghastrum nutans*. Shrubs are present but may be scattered. *Corylus* spp. and *Symphoricarpos occidentalis* are typical shrubs. Stands of this alliance occur on sandy lacustrine and glacial outwash deposits reworked by wind, on shale, and on glacial till. Soils are relatively infertile and excessively well-drained.

Classification Comments: This alliance is rare, and more study needs to be done to characterize it.

Internal Comments:
Other Comments:

Similar NVC Types:
- A0620 *Quercus macrocarpa / Corylus* spp. / Mixedgrass Woodland Alliance: tends to have a more dense tree canopy and more tallgrass species in the understory, but there is overlap in both of these characteristics.

Diagnostic Characteristics: The tree stratum varies from 10 to 60% cover, with *Quercus macrocarpa* the most common dominant. Mid grasses and tall grasses dominate the ground layer, including *Andropogon gerardii, Carex pensylvanica, Schizachyrium scoparium*, and *Sorghastrum nutans*. Stands occur on sandy lacustrine and glacial outwash deposits reworked by wind, on shale, and on glacial till.

VEGETATION

Physiognomy and Structure: This alliance has an open to moderately closed tree canopy (10-60%). Shrubs are typically scattered. Midgrass and tallgrass species form a moderate to dense herbaceous layer 1-2 m tall.

Floristics: This alliance, found in the northern Great Plains, is a mixedgrass savanna. Mid grasses and tall grasses dominate the vegetation. Scattered and clumped trees and shrubs are always present. *Andropogon gerardii, Carex pensylvanica, Schizachyrium scoparium*, and *Sorghastrum nutans* are abundant herbaceous species. *Quercus macrocarpa* is the most common tree and may be the only tree species in some stands. *Corylus* spp. and *Symphoricarpos occidentalis* are typical shrubs.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands of this alliance occur on sandy lacustrine and glacial outwash deposits reworked by wind, on shale, and on glacial till. Soils are relatively infertile and excessively well-drained.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is found in South Dakota and North Dakota and in Canada in southern Manitoba.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL002163 *Quercus macrocarpa* / Mixedgrass Loam Wooded Grassland
- CEGL002162 *Quercus macrocarpa* / Mixedgrass Sand Wooded Grassland
- CEGL002164 *Quercus macrocarpa* / Mixedgrass Shale Wooded Grassland

AUTHORSHIP

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

REFERENCES

References: Faber-Langendoen et al. 2017b

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1. Forest & Woodland
1.B.2.Ne. North American Great Plains Forest & Woodland
G329. Great Plains Bur Oak Forest & Woodland

A0245. Quercus macrocarpa Forest Alliance

Type Concept Sentence: This alliance is usually dominated by *Quercus macrocarpa*, although in some elements *Populus tremuloides* is a codominant, and is restricted to the northern Great Plains and the Black Hills on sites with a moderately closed to closed tree canopy, but is often relatively open for a forest alliance.

OVERVIEW

Scientific Name: *Quercus macrocarpa* Forest Alliance
Common Name (Translated Scientific Name): Bur Oak Forest Alliance
Colloquial Name: Great Plains Bur Oak Forest

Type Concept: This alliance is restricted to the northern Great Plains and the Black Hills. The canopy can be moderately closed to closed but is often relatively open for a forest alliance. The overstory of this alliance is usually dominated by *Quercus macrocarpa*, although in some elements *Populus tremuloides* is a codominant. Associated trees include *Betula papyrifera, Fraxinus pennsylvanica*, and *Ulmus americana* throughout its range, and *Pinus ponderosa* in the Black Hills. There is a subcanopy of *Ostrya virginiana, Juniperus virginiana*, and small overstory species. In the eastern portion of its range, *Juglans nigra* and *Celtis* spp. are often found in the canopy and subcanopy. A shrub layer may be present, typically dominated by species 0.5-2 m tall, such as *Amelanchier alnifolia, Corylus americana, Corylus cornuta, Prunus virginiana, Ribes* spp., and *Symphoricarpos occidentalis*. Smaller shrubs such as *Mahonia repens* and *Rosa* spp. are also commonly found in this alliance. The herbaceous layer typically contains *Aralia nudicaulis, Carex* spp., *Caulophyllum thalictroides, Elymus virginicus, Maianthemum stellatum*, and *Viola* spp. This alliance is found on rolling hills, mountain slopes (in the Black Hills), and along watercourses. These topographic positions provided some protection from the fires that regularly occurred in the surrounding grasslands. In the drier parts of its range, this alliance is predominantly found on north-facing slopes or along watercourses where the microclimate is more mesic. The soils of this alliance tend to be deep, loamy, and moderately well-drained to well-drained.

Classification Comments: There are currently three alliances in the Great Plains dominated by *Quercus macrocarpa*. *Quercus macrocarpa* Forest Alliance (A0245) has a more closed canopy and rarely has much cover from grassland species. Near the U.S.-Canadian border, this alliance can be similar to alliances in Northwestern Great Plains Aspen Woodland Group (G328) or Northeastern Great Plains Aspen Woodland Group (G146).

Internal Comments:
Other Comments:

Similar NVC Types:
- A0620 *Quercus macrocarpa / Corylus* spp. / Mixedgrass Woodland Alliance: tends to have a more open canopy and a denser graminoid ground layer.
- A3248 *Betula papyrifera / Corylus cornuta* Woodland Alliance: can occur in similar settings to A0620 but is not dominated by *Quercus macrocarpa*.
- A3250 *Populus tremuloides / Corylus* spp. Woodland Alliance: tends to have more *Populus tremuloides* but can be very similar in mixed stands.

Diagnostic Characteristics: This alliance is composed of moderately closed to closed *Quercus macrocarpa* forests in the northern Great Plains. The understory does not have significant cover from species typically found in the open prairies.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a moderately dense upper canopy dominated by cold-deciduous broad-leaved trees (5-25 m tall). There is often a subcanopy (2-10 m tall) of smaller cold-deciduous broad-leaved or evergreen scale-leaved trees. A sparse to moderately dense woody layer of short shrubs (<2 m) and dwarf-shrubs (<0.5 m) is typically present. The herbaceous layer is generally sparse because of dense woody cover, and is composed of a mixture of perennial graminoids and forbs.

Floristics: The canopy of this alliance can be moderately closed to closed but is often relatively open for a forest alliance (Hoffman and Alexander 1987, MNNHP 1993). The overstory of this alliance is usually dominated by *Quercus macrocarpa*, although in some elements *Tilia americana* is a codominant. Associated trees include *Betula papyrifera, Fraxinus pennsylvanica*, and *Ulmus americana* throughout its range, and *Pinus ponderosa* in the Black Hills. There is a subcanopy of *Ostrya virginiana, Juniperus virginiana*, and small overstory species. In the eastern portion of its range, *Juglans nigra, Populus tremuloides*, and *Celtis* spp. are often found in the canopy and subcanopy. A shrub layer may be present. It is usually made up of species 0.5-2 m tall, such as *Amelanchier alnifolia, Corylus americana, Corylus cornuta, Prunus virginiana, Ribes* spp., and *Symphoricarpos occidentalis*. Dwarf-shrubs such as *Mahonia repens* and *Rosa* spp. are also commonly found in this alliance. The herbaceous layer typically contains *Aralia nudicaulis, Carex* spp., *Caulophyllum thalictroides, Elymus virginicus, Maianthemum stellatum*, and *Viola* spp.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs in the Black Hills and northern Great Plains. Elevations range from approximately 500-1400 m. Climate is temperate, continental with much of the annual precipitation occurring during the spring. These *Quercus macrocarpa* forests are found on rolling hills, swales, breaks, mountain slopes (in the Black Hills) and along watercourses. In the drier parts of its range, stands are predominantly found on north-facing hillslopes, in draws, along streams, in river canyons and on adjacent bluffs (northern aspect) or near springs where the microclimate is more mesic (Tolstead 1942, Hoffman and Alexander 1987, Steinauer 1989). Sites are gentle to moderately sloping. The substrates tend to be moderately deep to deep sandy loams or loams derived from eolian sand, loess, alluvium, siltstone and glacial till. Soils may be saturated and poorly drained near seeps, but are otherwise moderately well-drained to well-drained. Soil pH may vary from 5.8-7.4. Stands usually are found in mesic areas where topography offers protection from frequent prairie fires. Adjacent vegetation is typically midgrass or tallgrass prairie.

Dynamics: The topographic positions that this alliance occurs on provide some protection from the fires that frequently occurred historically in the surrounding grasslands (Abrams 1985, Grimm 1985). The effects of fire suppression over the last century on the structure and function of these communities is not known. With more frequent surface fires it is possible that some of these forest stands might resemble woodlands or savannas. These prairie forests were important fuelwood and building resources for settlers (Girard et al. 1987).

DISTRIBUTION

Geographic Range: This alliance occurs in the northern Great Plains from the tallgrass sections of western Iowa and western Minnesota to the Black Hills and from southern Canada to Nebraska.

Nations: CA, US
States/Provinces: IA, MB, MN, ND, NE, SD, SK, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** Bur Oak: 42 (Eyre 1980)
- **<** Mesic Bur Oak Forest and Woodland (Rolfsmeier and Steinauer 2010) [includes A0245 and A0620.]

LOWER LEVEL UNITS

Associations:

- CEGL002065 *Quercus macrocarpa - Populus tremuloides / Aralia nudicaulis* Forest
- CEGL002072 *Quercus macrocarpa / Cornus drummondii / Aralia nudicaulis* Forest
- CEGL000555 *Quercus macrocarpa / Ostrya virginiana* Forest

AUTHORSHIP

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

REFERENCES

References: Abrams 1985, Alexander 1986, Eyre 1980, Faber-Langendoen et al. 2017b, Girard et al. 1987, Girard et al. 1989, Grimm 1985, Hoffman and Alexander 1987, Johnston 1987, Lynn et al. n.d., MNNHP 1993, Potter and Moir 1961, Rolfsmeier and Steinauer 2010, Steinauer 1981, Steinauer 1989, Terwilliger et al. 1979a, Tolstead 1942, WNDD unpubl. data

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1. Forest & Woodland
1.B.2.Ne. North American Great Plains Forest & Woodland
1.B.2.Ne.1.b. M151 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

Scientific Name: *Fraxinus pennsylvanica - Ulmus americana / Prunus* spp. Forest & Woodland Group
Common Name (Translated Scientific Name): Green Ash - American Elm / Cherry species Forest & Woodland Group
Colloquial Name: Northern Great Plains Birch - Aspen Forest

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 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. 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.

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:

- 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

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.

VEGETATION

Physiognomy and Structure: 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.

Floristics: 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.

ENVIRONMENT & DYNAMICS

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.

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*.

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).

Spatial Scale & Pattern [optional]:
Nations: CA, US
States/Provinces: AB?, CO, MB, MT, ND, NE, SD, SK, WY
TNC Ecoregions [optional]: 26:C, 27:C, 33:C, 34:C, 35:P, 36:P, 66:C, 67:C
USFS Ecoregions (2007): 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:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** Bur Oak: 216 (Eyre 1980)
- **><** Bur Oak: 236 (Eyre 1980)
- **>** Bur Oak: 42 (Eyre 1980)
- **>** Cottonwood: 63 (Eyre 1980)
- **>** Paper Birch: 18 (Eyre 1980)

- >< Rocky Mountain Juniper: 220 (Eyre 1980)

LOWER LEVEL UNITS

Alliances:
- A3211 *Fraxinus pennsylvanica - Ulmus americana* Great Plains Forest Alliance
- A3210 *Juniperus scopulorum - Juniperus virginiana* Woodland Alliance
- A3209 *Betula papyrifera - Populus tremuloides - Quercus macrocarpa* Forest Alliance

AUTHORSHIP

Primary Concept Source: S. Menard and K. Kindscher, in Faber-Langendoen et al. (2011)
Author of Description: J. Drake
Acknowledgments: C. Lea
Version Date: 05/07/2015
Classif Resp Region: Midwest
Internal Author: JD 11-10, 4-13, 5-15

REFERENCES

References: Eyre 1980, Faber-Langendoen et al. 2017a

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1. Forest & Woodland
1.B.2.Ne. North American Great Plains Forest & Woodland
G145. Great Plains Mesic Forest & Woodland

A3209. Betula papyrifera - Populus tremuloides - Quercus macrocarpa Forest Alliance

Type Concept Sentence: This alliance consists of forests along ravines, draws, and intermittent streams and on mesic, protected slopes in the northern half of the central and eastern Great Plains. The canopy is moderately closed to closed and usually dominated by some combination of *Betula papyrifera* and *Populus tremuloides*.

OVERVIEW

Scientific Name: *Betula papyrifera - Populus tremuloides - Quercus macrocarpa* Forest Alliance
Common Name (Translated Scientific Name): Paper Birch - Quaking Aspen - Bur Oak Forest Alliance
Colloquial Name: Northern Great Plains Birch - Aspen Forest

Type Concept: This alliance consists of forests along ravines, draws, and intermittent streams and on mesic, protected slopes in the northern half of the central and eastern Great Plains. Sites are sheltered from fire and receive moisture from runoff and snow accumulation but are not flooded. The canopy is moderately closed to closed and usually dominated by some combination of *Betula papyrifera* and *Populus tremuloides*. Other trees can be present to common, including *Quercus macrocarpa, Fraxinus pennsylvanica*, and *Ulmus americana*. The shrub and herbaceous strata can range from sparse to dense. Herbaceous composition is typically distinct from the nearby prairies.

Classification Comments: This alliance includes stands across the northern Great Plains and into the lower elevations of the Black Hills. There is overlap with some associations in the Black Hills in Rocky Mountain Subalpine-Montane Aspen Forest & Woodland Group (G222) and Black Hills-Northwestern Great Plains Ponderosa Pine Forest & Woodland Group (G216). Differentiating this alliance from *Populus tremuloides*-dominated stands in those groups may be difficult. This alliance is also similar to *Betula papyrifera / Corylus cornuta* Woodland Alliance (A3248) in Northwestern Great Plains Aspen Woodland Group (G328), which is generally found further north than this alliance, but their distributions are near or overlap in western North Dakota and differential species are not well-established.

Internal Comments:
Other Comments:

Similar NVC Types:
- A2036 *Populus tremuloides* Rocky Mountain Forest & Woodland Alliance: can be very similar in the Black Hills where both occur; A3209 tends to be at lower elevations but there is likely overlap and good differential species are not known.
- A3465 *Pinus ponderosa* Mesic Black Hills Forest Alliance: deciduous-dominated stands can be very similar but usually have *Pinus ponderosa* as a codominant canopy or subcanopy component.
- A3248 *Betula papyrifera / Corylus cornuta* Woodland Alliance: can be very similar to *Betula papyrifera*-dominated stands in parts of North Dakota where the distribution of the two alliances are similar.

Diagnostic Characteristics: Forests in ravines and draws or on protected slopes in a largely prairie landscape. The canopy is dominated by a combination of *Betula papyrifera* and *Populus tremuloides* sometimes with significant *Quercus macrocarpa*. The herbaceous stratum is not dominated by species typical of the prairie.

VEGETATION

Physiognomy and Structure: This alliance is dominated by deciduous trees with a moderate to closed canopy. Trees are typically moderately tall (8-15 m). Shrubs may be nearly absent to abundant, tending to vary in inverse density with the tree canopy. Most shrubs are deciduous and 1-3 m tall. The herbaceous layer is typically dominated by forbs, except in northeastern Nebraska and southeastern South Dakota where some stands have a graminoid-dominated understory.

Floristics: The tree canopy of this alliance is dominated by *Populus tremuloides* and *Betula papyrifera* with *Quercus macrocarpa* and *Tilia americana* present to abundant in some stands, particularly in northeast Nebraska and the Black Hills. *Fraxinus pennsylvanica* is present to abundant in some stands. *Pinus ponderosa* is in some stands in the Black Hills and nearby areas but is not abundant. The shrub layer commonly contains *Amelanchier alnifolia, Corylus* spp., *Prunus virginiana, Ribes* spp., *Spiraea betulifolia*, and *Symphoricarpos occidentalis*. Across most of its range, the herbaceous stratum is dominated by forbs and is distinct from nearby prairies, but in eastern South Dakota and Nebraska graminoids are the dominant understory species. Common forbs include *Actaea rubra, Aralia nudicaulis, Galium boreale, Maianthemum canadense*, and *Maianthemum stellatum*. Common graminoids in the southeastern stands are *Carex eburnea, Carex sprengelii, Elymus virginicus, Elymus villosus, Festuca subverticillata*, and *Piptatheropsis micrantha (= Piptatherum micranthum)*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance is found in ravines, valleys, and on slopes protected from fires spreading from nearby prairies. These sites also tend to receive additional moisture in the form of seeps, runoff from higher slopes, or the melting of snow drifts that have accumulated in the sheltered areas.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is found in the north-central and northeastern Great Plains from Nebraska north to near the Canadian border and west to eastern Wyoming and possibly eastern Montana.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Betula papyrifera / Corylus cornuta* Community Type (Girard et al. 1989)

LOWER LEVEL UNITS

Associations:
- CEGL002129 *Betula papyrifera / Juniperus horizontalis* Shale Woodland
- CEGL002079 *Betula papyrifera / Corylus cornuta* Forest
- CEGL002013 *Betula papyrifera - (Tilia americana, Quercus macrocarpa)* Canyon Forest
- CEGL002130 *Populus tremuloides / Prunus virginiana* Woodland

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Eyre 1980, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Girard et al. 1989, Johnson-Groh 1985, Jones 1992b, MNNHP 1993

1. Forest & Woodland
1.B.2.Ne. North American Great Plains Forest & Woodland
G145. Great Plains Mesic Forest & Woodland

A3211. Fraxinus pennsylvanica - Ulmus americana Great Plains Forest Alliance

Type Concept Sentence: This alliance is found in mesic ravines or draws in the northern and central Great Plains with an open to closed short tree canopy typically dominated by *Fraxinus pennsylvanica* and *Ulmus americana*.

OVERVIEW

Scientific Name: *Fraxinus pennsylvanica - Ulmus americana* Great Plains Forest Alliance
Common Name (Translated Scientific Name): Green Ash - American Elm Great Plains Forest Alliance
Colloquial Name: Great Plains Ash - Elm Ravine Forest

Type Concept: This alliance is found in the northern and central Great Plains. Tree canopy is variable, ranging from open to closed. Trees are often short (5-10 m tall) and dominant trees are *Fraxinus pennsylvanica* and *Ulmus americana*. *Acer negundo* can also be common in some stands and *Populus deltoides* may be scattered. The shrub layer can be sparse to dense. *Prunus virginiana* and *Symphoricarpos occidentalis* are common shrubs. Sites are usually found in mesic ravines and draws that concentrate the available precipitation by receiving runoff from higher uplands and trapping drifting snow. Some stands may be inundated for brief periods in the spring or after heavy rains but flooding does not persist. Rarely, stands of this alliance can be found upper terraces of rivers or streams or on north- or east-facing hillsides. Fires from adjacent upland prairies do not usually move through these sites due to the more mesic conditions and the lower landscape position.

Classification Comments: There are many associations that share dominant canopy species with this alliance and distinguishing those from this alliance where the ranges overlap could be difficult. Other associations dominated by *Fraxinus pennsylvanica, Ulmus americana*, and *Acer negundo* in the Great Plains may have some similarity to this alliance but they are found on true floodplains and experience more frequent flooding.

Internal Comments:
Other Comments:

Similar NVC Types:
- A3210 *Juniperus scopulorum - Juniperus virginiana* Woodland Alliance
- A4131 *Fraxinus pennsylvanica - Ulmus americana - Populus deltoides* Floodplain Forest Alliance: can have similar canopy dominants but is found on floodplains of rivers and large streams.
- A3708 *Acer rubrum - Fraxinus pennsylvanica* Floodplain Forest Alliance: occurs further east, nearly always on floodplains and terraces, and tends to have more *Acer rubrum, Acer saccharinum*, and *Celtis occidentalis*.

Diagnostic Characteristics: *Fraxinus pennsylvanica*- and *Ulmus americana*-dominated stands in ravines but not on active floodplains.

VEGETATION

Physiognomy and Structure: Stands of this alliance have a short tree canopy (5-10 m) composed of cold-deciduous trees (USACE 1979, Girard et al. 1989). The canopy is moderately closed to closed. There is usually a deciduous shrub layer but height and cover are variable. Short evergreen trees are present or dominate in the shrub or subcanopy layers in some stands. The herbaceous layer cover is variable, typically in inverse proportion to the cover of trees and shrubs above it.

Floristics: Across the range of this alliance, the most abundant tree species are *Fraxinus pennsylvanica* and *Ulmus americana*. *Acer negundo* is present to codominant in many stands. *Celtis* spp., *Populus deltoides*, and *Quercus macrocarpa* are often present and become more common in the eastern portion of this alliance's range. *Populus tremuloides* and *Tilia americana* occur only in the east. Common shrubs include *Juniperus scopulorum, Rosa* spp., *Prunus americana, Prunus virginiana, Ribes* spp., *Symphoricarpos occidentalis*, and *Vitis* spp. Herbaceous species of this alliance include *Carex* spp., *Elymus* spp., *Maianthemum stellatum, Poa pratensis, Piptatheropsis micrantha (= Oryzopsis micrantha)*, and *Taraxacum* spp.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance is found in upland ravines, upper terraces of rivers and streams, and, rarely, on north- or east-facing slopes (Rolfsmeier and Steinauer 2010). Sites are usually found in mesic ravines and draws that concentrate the available precipitation by receiving runoff from higher uplands and trapping drifting snow. Some stands may be inundated for brief periods in the spring or after heavy rains but flooding does not persist.

Dynamics: Stands of this alliance are typically in ravines and can be flooded or saturated for brief periods after heavy rains or spring snowmelt. Flooding does not shape this alliance to the extent that it does communities on true floodplains, though. Fires spreading from adjacent grasslands can burn the edges of stands but does not usually spread through the entire stand.

DISTRIBUTION

Geographic Range: This alliance is found in the northern Great Plains from the southern Canadian Prairie Provinces of Manitoba and Saskatchewan south through eastern Montana, eastern Wyoming to Nebraska. In the east it extends into central North and South Dakota.

Nations: CA, US
States/Provinces: MB, MT, ND, NE, SD, SK, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **>** Green Ash - Eastern Red Cedar Scarp Woodland (Rolfsmeier and Steinauer 2010) [Green Ash - Elm - Hackberry Canyon Bottom Woodland and Green Ash - Eastern Red Cedar Scarp Woodland equal A3211 in Nebraska.]
- **>** Green Ash - Elm - Hackberry Canyon Bottom Woodland (Rolfsmeier and Steinauer 2010) [Green Ash - Elm - Hackberry Canyon Bottom Woodland and Green Ash - Eastern Red Cedar Scarp Woodland equal A3211 in Nebraska.]

LOWER LEVEL UNITS

Associations:
- CEGL002082 *Fraxinus pennsylvanica - Ulmus americana / Symphoricarpos occidentalis* Forest
- CEGL000643 *Fraxinus pennsylvanica - Ulmus americana / Prunus virginiana* Woodland

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Girard et al. 1989, Hansen and Hoffman 1988, Hansen et al. 1984, Hansen et al. 1995, Jones 1990, Rolfsmeier and Steinauer 2010, USACE 1979

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1. Forest & Woodland
1.B.2.Ne. North American Great Plains Forest & Woodland
G145. Great Plains Mesic Forest & Woodland

A3210. Juniperus scopulorum - Juniperus virginiana Woodland Alliance

Type Concept Sentence: This woodland alliance is found in the western Great Plains of the United States where *Juniperus scopulorum* and *Juniperus virginiana* dominate the short, open tree canopy on steep north-facing slopes or ravines.

OVERVIEW

Scientific Name: *Juniperus scopulorum - Juniperus virginiana* Woodland Alliance
Common Name (Translated Scientific Name): Rocky Mountain Juniper - Eastern Red-cedar Woodland Alliance
Colloquial Name: Great Plains Juniper Ravine Woodland

Type Concept: This alliance is found in the western Great Plains of the United States. The vegetation is an evergreen woodland with moderately open to dense cover of *Juniperus scopulorum, Juniperus virginiana*, or introgressant hybrids of the two. Woody species other than *Juniperus scopulorum* or *Juniperus virginiana* occur sporadically, but none achieves prominence. Most of the trees are small (10-20 cm dbh) and few exceed 6 m in height. Where the density of the tree canopy is high, the short-shrub and herbaceous strata are not well-developed. In more open places *Piptatheropsis micrantha (= Oryzopsis micrantha)* is often abundant. Other common herbaceous species include *Campanula rotundifolia, Galium boreale*, and *Maianthemum stellatum*. Mosses and lichens can cover much of the ground. Stands occur on steep (30-70%) north-facing slopes or in ravines. The soils are shallow and poorly developed; loamy sands and sandy loams predominate.

Classification Comments: This description includes stands with both *Juniperus scopulorum* and *Juniperus virginiana* over a herbaceous layer, typically with *Piptatheropsis micrantha*. *Pinus ponderosa*, if present, is less than 25% tree canopy cover.

Internal Comments:
Other Comments:

Similar NVC Types:
- A3211 *Fraxinus pennsylvanica - Ulmus americana* Great Plains Forest Alliance: Most stands of this alliance are quite distinct from A3210 but intermediate stands with a mix of *Juniperus* spp. and deciduous trees can be difficult to classify.

Diagnostic Characteristics: Hillsides or ravines dominated by *Juniperus scopulorum* (possibly *Juniperus virginiana* in the eastern portion of the alliance range).

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a moderate to dense tree canopy that is typically 2-6 m tall. Stands are dominated by evergreen scale-leaved trees. Scattered evergreen needle-leaved or deciduous broad-leaved trees may be present, but they never codominate. Lower vegetation layers are usually in inverse proportion to the tree canopy cover; sites with dense tree canopies have sparse lower strata. A sparse to moderately dense shrub layer may be present as a mixture of broadleaf and microphyllous, deciduous shrubs that are usually less than 2 m tall. A sparse to moderately dense herbaceous layer dominated by perennial graminoids is usually present. Perennial forbs may be scattered. Annual forbs and grasses may be seasonally present.

Floristics: This alliance is an evergreen woodland with moderately open to dense cover of *Juniperus scopulorum, Juniperus virginiana*, or introgressant hybrids of the two. Woody species other than *Juniperus scopulorum* or *Juniperus virginiana* occur sporadically, but none achieves prominence. *Fraxinus pennsylvanica* and *Pinus ponderosa* are the most common associates. Where the density of the tree canopy is high, the short-shrub and herbaceous strata are not well-developed. In more open places *Piptatheropsis micrantha (= Oryzopsis micrantha)* is often abundant. Other common herbaceous species include *Campanula rotundifolia, Chenopodium fremontii, Chenopodium simplex, Galium boreale*, and *Maianthemum stellatum*. Drier and more open-canopied examples of this alliance often have *Bouteloua curtipendula, Pseudoroegneria spicata*, and *Schizachyrium scoparium* in the herbaceous layer and *Rhus trilobata* and *Ribes aureum var. villosum (= Ribes odoratum)* in the shrub stratum (Brown 1971, Rolfsmeier and Steinauer 2010). Mosses and lichens can cover much of the ground.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance is found on steep (30-70%) north-facing slopes or in ravines. The soils are shallow and poorly developed; loamy sands and sandy loams predominate except in badlands landscapes where finer-textured soils are abundant. Climate is semi-arid, continental with most of the 40-60 cm of annual precipitation occurring during the growing season.

Dynamics: Altered fire regimes, cutting trees for fencing, and improper grazing by livestock have significant impacts on the quality of sites. Grazing by livestock can modify the fire regime by removing the fine fuels that carry fire.

DISTRIBUTION

Geographic Range: This alliance is found in the western Great Plains of the United States. It is found in the Black Hills and the Badlands of North and South Dakota and Montana, and from the High Plains of eastern Wyoming and northeastern Colorado eastward to central Nebraska.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **=** *Juniperus - Agropyron* Community (Brown 1971)
- **?** *Juniperus scopulorum* Series (Johnston 1987)
- **?** *Juniperus scopulorum* Series (Hess 1981)
- **><** Rocky Mountain Juniper: 220 (Eyre 1980)

LOWER LEVEL UNITS

Associations:

- CEGL000747 *Juniperus scopulorum / Piptatheropsis micrantha* Woodland

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Brown 1971, DeVelice et al. 1995, Eyre 1980, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Francis 1983, Goodding 1923, Hansen 1985, Hansen and Hoffman 1988, Hansen et al. 1984, Hess 1981, Hess and Alexander 1986, Johnston 1987, Moran 1981a, Rolfsmeier and Steinauer 2010, Wasser and Hess 1982, Wells 1965

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1. Forest & Woodland
1.B.2.Ne. North American Great Plains Forest & Woodland
1.B.2.Ne.1.d. M151 Great Plains Forest & Woodland

G328. Northwestern Great Plains Aspen Woodland

Type Concept Sentence: This group occurs in the transition zone from the grasslands of the Great Plains to the boreal forests where *Populus tremuloides* dominates small woodland patches, which vary from open, grassy to shaded shrub and forb understories.

OVERVIEW

Scientific Name: *Populus tremuloides / Symphoricarpos occidentalis / Festuca hallii* Woodland Group
Common Name (Translated Scientific Name): Quaking Aspen / Western Snowberry / Plains Rough Fescue Woodland Group
Colloquial Name: Aspen Parklands Birch Woodland

Type Concept: This aspen woodland group ranges from the North Dakota/Manitoba border west to central Alberta. It occurs in the northern Great Plains, in the boreal forest-prairie grassland transition region. The climate in this region is mostly subhumid low boreal with short, warm summers and cold, long winters. The physiognomy of the area is distinct woodland patches, in moist protected areas on slopes or depressions. Trees are generally short in stature, reaching mature heights of 15-20 m at the northern edge of the range, but averaging 5-10 m on well-drained sites at the southern limit of tree growth in the prairie grasslands. *Populus tremuloides* dominates this group. Common associates are *Populus balsamifera*, with an understory of tall shrubs and diverse herbs. In some areas, *Picea glauca* also occurs, usually as dense stands on north-facing coulee slopes. *Populus tremuloides* tends to grow in pure stands as distinct copses in the southern part of the range, the size of the clumps becoming more extensive moving north. Some of the common shrubs include *Amelanchier alnifolia, Corylus cornuta, Symphoricarpos albus, Symphoricarpos occidentalis, Prunus virginiana, Prunus pensylvanica, Ribes oxyacanthoides, Rosa acicularis, Rosa woodsii*, and *Salix bebbiana*. Common understory herbs include *Aralia nudicaulis, Actaea rubra, Cornus canadensis, Maianthemum canadense*, and *Maianthemum stellatum (= Smilacina stellata)*. On poorly drained sites, *Populus tremuloides* may be associated with *Populus balsamifera*, with *Cornus sericea* and *Viburnum opulus* important components of the shrub layer. *Betula papyrifera* becomes more common on the north or on north-facing slopes. These woodland patches are commonly ringed by *Symphoricarpos occidentalis* on the drier side, moving into the adjacent prairie community, or by wetlands, with a ring of *Salix* spp., usually *Salix discolor*, then *Salix petiolaris* at the water's edge. *Quercus macrocarpa* is found sporadically along the Qu'Appelle River valley and its tributaries in Saskatchewan, becoming more common into Manitoba. Common grasses and forbs include *Apocynum androsaemifolium, Aralia nudicaulis, Carex siccata, Carex sprengelii, Elymus trachycaulus, Lathyrus* spp., *Maianthemum stellatum, Maianthemum canadense, Oryzopsis asperifolia, Prosartes trachycarpa, Sanicula marilandica, Schizachne purpurascens, Thalictrum* spp., and *Vicia americana*. Fire and drought constitute the most important dynamics in this group. Much of this region has undulating to hummocky glacial till topography with depressional wetlands (potholes or kettles). Soils under the grasslands are generally Black Chernozems; Dark Grey Chernozems have developed under the woodlands and Gleysols are associated with the wetland patches.

Classification Comments: By and large this aspen woodland occurs south of the boreal forest, so typical boreal conifers (upland species of *Picea glauca, Pinus banksiana, Pinus contorta*) and wetland conifers (*Larix laricina, Picea mariana*) are essentially absent. Eastward, the degree to which either *Quercus macrocarpa* or *Betula papyrifera* are important components of this type needs review. The Peace River parklands in northern Alberta are probably best placed in a Boreal shrubland and grassland (i.e., North American Boreal Shrubland & Grassland Macrogroup (M055) and perhaps Western Boreal Dry Shrubland & Grassland Group (G359)). The group level distinction between this type and Northeastern Great Plains Aspen Woodland Group (G146) needs review, as Bird (1961) notes that *Quercus macrocarpa* is patchy in Manitoba, though most common in the Red River Valley, tall grass region, and prairie grasses are largely absent from the woodlands *per se*.

Similar NVC Types:
- G222 Rocky Mountain Subalpine-Montane Aspen Forest & Woodland
- G145 Great Plains Mesic Forest & Woodland
- G146 Northeastern Great Plains Aspen Woodland: is found to the east of this group and contains an understory dominated by tallgrass species.

Diagnostic Characteristics: This group comprises moist to dry *Populus tremuloides* woodlands that occur as individual stands surrounded by plains rough fescue grasslands, often associated with wetlands and brush prairies. Southward the aspen woodlands are more patchy within a grassland matrix; whereas northward, they may form extensive stands, but in either case the woodlands do not have characteristic mix of boreal conifers, such as *Larix laricina, Picea glauca, Picea mariana, Pinus banksiana*, or *Pinus contorta*. Clarification of the geographic range of this group and Northern Great Plains Tallgrass Aspen Parkland Group (G146) is needed.

VEGETATION

Physiognomy and Structure: Trees are generally short in stature, reaching mature heights of 15-20 m at the northern edge of the range, but averaging 5-10 m on well-drained sites at the southern limit of tree growth in the prairie grasslands. Most stands throughout the Canadian range are dominated by *Populus tremuloides*, which forms small discrete groves, sometimes consisting of only a single clone of genetically identical trees. *Populus tremuloides* canopies are relatively diffuse, transmitting ample light for development of dense understory vegetation, including both shrub and herb layers. Herb layers are dominated by forbs, but also include a variety of shade-tolerant grasses and sedges. Canopies of *Quercus macrocarpa* and *Fraxinus pennsylvanica* cast more shade than *Populus tremuloides* canopies, and the understory vegetation is correspondingly less dense. Stand structure also varies with site conditions; stands on sandy soils tend to be shorter and more open than those on fine-textured soils. *Populus tremuloides* stands in the southern (grassland) parts of the Canadian range are almost always in landscape depressions, where moisture conditions support tree growth, and are often surrounded by a ring of low shrubs (typically *Symphoricarpos occidentalis*).

Floristics: *Populus tremuloides* is the overwhelmingly dominant tree species throughout the Canadian range of M151. At the eastern end of this range, *Quercus macrocarpa* becomes important, especially on drier sites. *Populus balsamifera* occurs on moist sites in some *Populus tremuloides* stands. *Fraxinus pennsylvanica* appears in *Populus tremuloides* stands at the eastern edge of the range, and forms stands on north-facing valley slopes far out into the mixedgrass prairie. Along the northern edge of the range, *Picea glauca, Pinus banksiana*, and *Betula papyrifera* occur occasionally. In the western part of the range, *Picea glauca* also forms dense stands on steep north-facing walls of "coulees" (i.e., narrow ravines). Important tall-shrub species include *Amelanchier alnifolia, Prunus virginiana, Prunus pensylvanica, Corylus* spp., and on moist sites, *Cornus sericea (= Cornus stolonifera), Salix* spp., *Viburnum opulus*, and *Betula occidentalis*. Low-shrub species include *Symphoricarpos occidentalis, Symphoricarpos albus, Rosa woodsii, Rosa acicularis, Rubus idaeus*, and *Ribes* spp. The dwarf-shrubs *Arctostaphylos uva-ursi* and *Juniperus horizontalis* are abundant in *Populus tremuloides* stands on sandy sites. The herb layer of these forest and woodland patches is almost completely different in species composition from the herbaceous communities of the adjacent prairie grasslands, which contain species that require full sunlight. Common grass and forb species include *Apocynum androsaemifolium, Aralia nudicaulis, Carex siccata, Carex sprengelii, Elymus trachycaulus, Lathyrus* spp., *Maianthemum stellatum, Maianthemum canadense, Oryzopsis asperifolia, Prosartes trachycarpa, Sanicula marilandica, Schizachne purpurascens, Thalictrum* spp., and *Vicia americana*.

ENVIRONMENT & DYNAMICS

Environmental Description: Climate in the range of this group is mostly subhumid low boreal with short, warm summers and long, cold winters. Undulating to hummocky glacial till predominates this region. The northern boundary of aspen parkland is well-defined by the line north or east of which the presence of conifers produces mixed forest (Zoltai 1975). Although *Picea glauca* stands do occasionally occur in mesic location within the region, they tend to be uncommon and restricted to valley bottoms or north-facing slopes. Hogg (1994) found that the northern boundary of the Aspen Parkland correlates with moisture limitations that may limit conifer regeneration or that may have resulted in a fire regime too frequent to allow conifer regeneration. *Populus tremuloides*, however, can persist under a frequent fire regime due to its ability to regenerate by sprouting from the roots.

Dynamics: Fire and drought likely played a strong role in preventing the woodlands from expanding into the grasslands. Invasion of aspen into the moister grassland areas has been documented with a reduction in fire frequency. Drought years, however, see the retreat of the woodlands. Much of the area where this group once occurred has been converted to agricultural lands. Currently, forest/woodland groves are often subject to livestock grazing, to which they are less resilient than grasslands. Heavy grazing eliminates the taller shrubs and herbs, and removes the most palatable species. Grazing also causes soil disturbance that fosters invasion by exotic plant species. Heavily grazed *Populus tremuloides* stands are often reduced to a layer of unpalatable low shrubs, such as *Symphoricarpos occidentalis*, and a layer of exotic grass species such as *Bromus inermis* or *Poa pratensis*. Along with

overgrazing, conversion to agriculture has significantly decreased the extent and range of natural stands of Great Plains forests and woodlands.

DISTRIBUTION

Geographic Range: This group ranges from the boreal-grassland transition region. It arcs north from North Dakota through southwest Manitoba, angling northwest through Saskatchewan into Alberta.

Spatial Scale & Pattern [optional]: Matrix
Nations: CA, US
States/Provinces: AB, MB, ND, SK
TNC Ecoregions [optional]: 66:C, 67:C, 140:C
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Alliances:
- A3248 *Betula papyrifera / Corylus cornuta* Woodland Alliance

AUTHORSHIP

Primary Concept Source: S. Menard, in Faber-Langendoen et al. (2011)
Author of Description: S. Menard, D. Faber-Langendoen, L. Allen, J. Thorpe, K. Baldwin
Acknowledgments:
Version Date: 01/15/2016
Classif Resp Region: Midwest
Internal Author: SEM 10-10, mod. DFL/L. Allen 10-13, 11-13, 1-16, mod. JD 5-15

REFERENCES

References: Barbour and Billings 1988, Bird 1961, Eyre 1980, Faber-Langendoen et al. 2017a, Greenall 1995, Hogg 1994, Natural Regions Committee 2006, Ricketts et al. 1999, Stone et al. 2007, Zoltai 1975

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1. Forest & Woodland
1.B.2.Ne. North American Great Plains Forest & Woodland
G328. Northwestern Great Plains Aspen Woodland

A3248. Betula papyrifera / Corylus cornuta Woodland Alliance

Type Concept Sentence: This alliance consists of *Betula papyrifera*-dominated woodlands in the northwestern Great Plains.

OVERVIEW

Scientific Name: *Betula papyrifera / Corylus cornuta* Woodland Alliance
Common Name (Translated Scientific Name): Paper Birch / Beaked Hazelnut Woodland Alliance
Colloquial Name: Aspen Parklands Birch Woodland

Type Concept: This alliance consists of woodlands in the northwestern Great Plains dominated by *Betula papyrifera*. Other associates include *Populus tremuloides, Quercus macrocarpa*, and, less frequently, *Fraxinus pennsylvanica*. A shrub stratum is nearly always present and often vigorous and dominated by species such as *Corylus* spp., *Prunus virginiana, Amelanchier alnifolia*, and *Symphoricarpos* spp. The herbaceous stratum is dominated by woodland and forest species with few prairie species. Stands can be found on a variety of landscape positions from flat areas to steep slopes, though in the southern part of its range it is limited to steep north-facing slopes.

Classification Comments: This alliance, and the group it is in, Northwestern Great Plains Aspen Woodland Group (G328), have only one association currently, and it is likely a southern expression of the group. Input from Canadian reviewers is needed to flesh out the alliance and group.

Internal Comments:
Other Comments:

Similar NVC Types:
- A0245 *Quercus macrocarpa* Forest Alliance
- A3209 *Betula papyrifera - Populus tremuloides - Quercus macrocarpa* Forest Alliance: is found to the south in the northern Great Plains; differential species for these two alliances are not well-established.
- A0620 *Quercus macrocarpa / Corylus* spp. / Mixedgrass Woodland Alliance

Diagnostic Characteristics: Woodlands in the northwestern Great Plains dominated by *Betula papyrifera*, usually with a prominent shrubby understory of some combination of *Corylus* spp., *Prunus virginiana, Amelanchier alnifolia*, and *Symphoricarpos* spp.

VEGETATION

Physiognomy and Structure: Deciduous woodlands with an open to moderately closed (25-60%), short to medium-tall (8-15 m) tree canopy. A shrub layer 1-2 m tall is nearly always present and often moderate to dense. The herbaceous layer is dominated by forbs with few graminoids prominent.

Floristics: This alliance consists of woodlands dominated by *Betula papyrifera*. Other associates include *Populus tremuloides, Quercus macrocarpa*, and, less frequently, *Fraxinus pennsylvanica*. A shrub stratum is nearly always present and often vigorous and dominated by species such as *Corylus* spp., *Prunus virginiana, Amelanchier alnifolia*, and *Symphoricarpos* spp. The herbaceous stratum is dominated by woodland and forest species with few prairie species. Common herbaceous species are *Aralia nudicaulis, Clematis occidentalis, Cornus canadensis, Galium boreale, Linnaea borealis, Maianthemum canadense*, and *Pyrola elliptica*.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands can be found on a variety of landscape positions from flat areas to steep slopes, though in the southern part of its range it is limited to steep north-facing slopes.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is found in the northwestern Great Plains and western Aspen Parklands from central North Dakota north to southern Manitoba, southern Saskatchewan, and likely southern Alberta.

Nations: CA, US
States/Provinces: AB?, MB, ND, SK
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY
- **?** *Betula papyrifera / Clematis occidentalis* Habitat Type (Girard et al. 1989) [southwestern North Dakota]
- **?** *Betula papyrifera / Corylus cornuta* Community Type (Girard et al. 1989)
- **?** Paper Birch: 18 (Eyre 1980)

LOWER LEVEL UNITS

Associations:
- CEGL002128 *Betula papyrifera / Corylus cornuta* Woodland

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Eyre 1980, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Girard et al. 1989

1.B.3. Temperate Flooded & Swamp Forest

Temperate Flooded & Swamp Forest is a tree-dominated wetland influenced by minerotrophic groundwater, either on mineral or organic (peat) soil, found in mid-latitudes of the globe.

1.B.3.Na. Eastern North American-Great Plains Flooded & Swamp Forest

This division includes swamp and floodplain forests and woodlands found in poorly-drained basins or along lakeshores and deciduous wet forests along small- to large-sized rivers (on a wide range of soil types), ranging across much of cool-temperate eastern North America.

M028. Great Plains Flooded & Swamp Forest

These deciduous forests and woodlands, dominated by *Populus deltoides, Fraxinus pennsylvanica*, and other hardwoods, are found along floodplains of permanent rivers in the prairie-dominated landscapes of the western and central Great Plains from southern Canada to northern Texas.

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1. Forest & Woodland
1.B.3.Na. Eastern North American-Great Plains Flooded & Swamp Forest
1.B.3.Na.4.a. M028 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

Scientific Name: *Populus deltoides - Fraxinus pennsylvanica / Pascopyrum smithii* Floodplain Forest Group
Common Name (Translated Scientific Name): Eastern Cottonwood - Green Ash / Western Wheatgrass Floodplain Forest Group
Colloquial Name: Great Plains Ash - Elm 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.

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:
- G145 Great Plains Mesic Forest & Woodland
- G337 Great Plains Riparian Wet Meadow & Shrubland

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.

VEGETATION

Physiognomy and Structure: 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.

Floristics: *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*.

ENVIRONMENT & DYNAMICS

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.

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.

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.

Spatial Scale & Pattern [optional]: Linear
Nations: CA, US
States/Provinces: AB, CO, KS, MB, MT, ND, NE, NM, OK, SD, SK, TX, WY
TNC Ecoregions [optional]: 10:C, 25:P, 26:C, 27:C, 28:C, 32:C, 33:C, 34:C, 37:C, 66:P, 67:P
USFS Ecoregions (2007): 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:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **<** Cottonwood - Willow: 235 (Eyre 1980)
- **>** Cottonwood: 63 (Eyre 1980)
- **>** Sugarberry - American Elm - Green Ash: 93 (Eyre 1980)

LOWER LEVEL UNITS

Alliances:

- A3423 *Populus deltoides* Floodplain Forest Alliance
- A0636 *Populus deltoides* Floodplain Woodland Alliance
- A4131 *Fraxinus pennsylvanica - Ulmus americana - Populus deltoides* Floodplain Forest Alliance

AUTHORSHIP

Primary Concept Source: S. Menard, K. Kindscher, P. Comer, G. Kittel, in Faber-Langendoen et al. (2011)
Author of Description: J. Drake
Acknowledgments:
Version Date: 05/19/2015
Classif Resp Region: Midwest
Internal Author: JD 11-10, 5-15

REFERENCES

References: Eyre 1980, Faber-Langendoen et al. 2017a

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1. Forest & Woodland
1.B.3.Na. Eastern North American-Great Plains Flooded & Swamp Forest
G147. Great Plains Cottonwood - Green Ash Floodplain Forest

A4131. Fraxinus pennsylvanica - Ulmus americana - Populus deltoides Floodplain Forest Alliance

Type Concept Sentence: This alliance includes forests dominated or codominated by *Fraxinus pennsylvanica* occurring on infrequently flooded floodplains and terraces in the northern Great Plains.

OVERVIEW

Scientific Name: *Fraxinus pennsylvanica - Ulmus americana - Populus deltoides* Floodplain Forest Alliance
Common Name (Translated Scientific Name): Green Ash - American Elm - Eastern Cottonwood Floodplain Forest Alliance
Colloquial Name: Great Plains Ash - Elm Floodplain Forest

Type Concept: These floodplain woodlands and forests are found in the northern Great Plains. They have a medium-tall to tall (8-20 m) tree canopy which ranges from open to closed (25-60+%). A tree subcanopy may be present. A deciduous shrub layer is common and can be dense, especially under more open tree canopies. Most shrubs range from 1-3 m tall. The herbaceous stratum is typically moderate to dense, though shading by dense tree or shrub canopies can limit the growth of this stratum. *Fraxinus pennsylvanica* is usually the dominant tree and is nearly always present in stands. *Acer negundo, Tilia americana*, and *Ulmus americana* are commonly present and can be dominant or codominant. Remnant *Populus deltoides* from earlier successional forest stages may be present, usually significantly taller than the main canopy layer. When a tree subcanopy is present it is composed of canopy species, tall shrubs of *Amelanchier alnifolia, Cornus* spp., *Juniperus scopulorum*, and *Prunus virginiana*. Shorter shrubs, particularly *Symphoricarpos occidentalis*, are present to abundant. Graminoids include *Elymus canadensis, Elymus virginicus, Leersia* spp., *Muhlenbergia racemosa*, and *Poa pratensis*. Many forbs can be present but common ones are *Rudbeckia laciniata, Galium* spp., and *Viola* spp. This alliance occurs on floodplains or terraces and sometimes along lakes or ponds on sites that are flooded periodically but are not subject to frequent scouring or deposition from flood events. Soils are alluvium and deep and usually silty.

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:
- A3211 *Fraxinus pennsylvanica - Ulmus americana* Great Plains Forest Alliance: is found in mesic draws and ravines in the northern Great Plains and can be very similar; the understory has more upland species and sites are rarely, if ever, flooded.
- A3423 *Populus deltoides* Floodplain Forest Alliance: is typically dominated by *Populus deltoides* but intermediate stands can have both *Populus deltoides* and *Fraxinus pennsylvanica*; it is flooded more frequently with scouring/dep

Diagnostic Characteristics: Floodplain forests in the northern Great Plains dominated by *Acer negundo, Fraxinus pennsylvanica, Ulmus americana*, and sometimes *Tilia americana*.

VEGETATION

Physiognomy and Structure: These floodplain woodlands and forests have a medium-tall to tall (8-20 m) deciduous tree canopy. The canopy ranges from open to closed (25-60+%). A tree subcanopy may be present, though due to the often broken canopy and moderate tree height, it can be difficult to distinguish from the tree canopy. A deciduous shrub layer is common and can be dense, especially under more open tree canopies. Most shrubs range from 1-3 m tall. The herbaceous stratum is typically moderate to dense, though shading by dense tree or shrub canopies can limit the growth of this stratum. Graminoids tend to be more abundant than forbs in the western portion of this alliance's range but more equal to or less than forb cover in the east.

Floristics: The tree canopy is dominated by few species in this alliance. *Fraxinus pennsylvanica* is usually dominant and is nearly always present in stands. *Acer negundo, Tilia americana*, and *Ulmus americana* are commonly present and can be dominant or codominant. Remnant *Populus deltoides* from earlier successional forest stages may be present, usually significantly taller than the main canopy layer. When a tree subcanopy is present it is composed of canopy species, tall shrubs of *Amelanchier alnifolia, Cornus* spp., *Juniperus scopulorum*, and *Prunus virginiana*. Shorter shrubs, particularly *Symphoricarpos occidentalis*, are present to abundant. Graminoids include *Elymus canadensis, Elymus virginicus, Leersia* spp., *Muhlenbergia racemosa*, and *Poa pratensis*. Many forbs can be present but common ones are *Rudbeckia laciniata, Galium* spp., and *Viola* spp.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs on floodplains or terraces and sometimes along lakes or ponds on sites that are flooded periodically but are not subject to frequent scouring or deposition from flood events. Soils are alluvium and deep and usually silty.

Dynamics: Flooding is important in maintaining this alliance but intense, frequent floods favor other floodplain alliances. Fires occur in nearby upland prairies but this alliance is not tolerant of burning.

DISTRIBUTION

Geographic Range: This alliance occurs in the northern Great Plains from the Red River valley to southern Saskatchewan, the western Dakotas, and eastern Wyoming. It probably extends into Montana.

Nations: CA, US
States/Provinces: MB, MN?, MT?, ND, SD, SK, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- = *Fraxinus pennsylvanica / Symphoricarpos occidentalis* Habitat Type (Hansen et al. 1984)
- = *Fraxinus pennsylvanica / Symphoricarpos occidentalis* Habitat Type (Girard et al. 1989)

LOWER LEVEL UNITS

Associations:

- CEGL002088 *Fraxinus pennsylvanica - (Ulmus americana) / Symphoricarpos occidentalis* Floodplain Forest
- CEGL005400 *Fraxinus pennsylvanica - Ulmus americana - (Acer negundo, Tilia americana)* Great Plains Floodplain Forest
- CEGL000628 *Acer negundo / Prunus virginiana* Floodplain Forest

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2014)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Faber-Langendoen et al. 2017b, Girard et al. 1989, Hansen et al. 1984

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1. Forest & Woodland
1.B.3.Na. Eastern North American-Great Plains Flooded & Swamp Forest
G147. Great Plains Cottonwood - Green Ash Floodplain Forest

A3423. Populus deltoides Floodplain Forest Alliance

Type Concept Sentence: This alliance, found throughout the Great Plains, contains riverfront floodplain forests with a canopy nearly always dominated by *Populus deltoides* and occurring on alluvial soils.

OVERVIEW

Scientific Name: *Populus deltoides* Floodplain Forest Alliance
Common Name (Translated Scientific Name): Eastern Cottonwood Floodplain Forest Alliance
Colloquial Name: Eastern Cottonwood Floodplain Forest

Type Concept: This alliance, found throughout the Great Plains, contains riverfront floodplain forests. The tree canopy height varies with time since last major disturbance and can reach as much as 30 m, though it is usually shorter. The canopy is nearly always dominated by *Populus deltoides*, often with few other abundant associates. *Fraxinus pennsylvanica* can be codominant, particularly in the northern part of this alliance's range. *Platanus occidentalis* and *Celtis laevigata* can be codominant to dominant in the southern part of this alliance's range. Other common associates are *Acer negundo* and *Ulmus americana*. Tree diversity is limited due to the dynamics of flooding and deposition/scouring of sediments. The shrub layer is sparse to dense, with species such as *Cornus drummondii, Cornus sericea, Prunus virginiana, Salix exigua*, and *Symphoricarpos occidentalis*. Herbaceous growth can be thick and lush but is often patchy and sparse due to frequent inundation. Herbaceous species found throughout the range of this alliance are not well known, but in parts of the range, species can include *Pascopyrum smithii* and *Panicum virgatum* (throughout the range), *Carex* spp., *Juncus* spp., *Leymus cinereus*, and *Elymus canadensis* (common in the northern Great Plains), and *Amphicarpaea bracteata, Carex blanda, Geum canadense, Parietaria pensylvanica*, and others in the central Great Plains. Due to the frequent disturbance, weedy species are almost ubiquitous in the understory, especially *Poa pratensis, Bromus inermis, Melilotus officinalis, Ambrosia* spp., and *Urtica* spp. Stands are found primarily along riverfronts, where they develop on bare, moist soil on newly made sandbars, front-land ridges, and well-drained flats. Soils are formed in alluvium, are deep, medium-textured, and with adequate or excessive moisture available for vegetation during the growing season.

Classification Comments: More open-canopied stands of this alliance can be very similar to *Populus deltoides* Floodplain Woodland Alliance (A0636). Distinguishing them is likely to be difficult.

Internal Comments:
Other Comments:

Similar NVC Types:
- A0636 *Populus deltoides* Floodplain Woodland Alliance: has a more open tree canopy and tends to have more prairie grasses in the understory but the two alliances can be very similar.
- A4131 *Fraxinus pennsylvanica - Ulmus americana - Populus deltoides* Floodplain Forest Alliance
- A3710 *Acer saccharinum - Populus deltoides* Floodplain Forest Alliance

Diagnostic Characteristics: Floodplain forests in the Great Plains, usually dominated by *Populus deltoides*, though sometimes *Ulmus* spp. and *Celtis laevigata* can be dominant in Oklahoma.

VEGETATION

Physiognomy and Structure: The tree layer is dominated by tall (20-35 m in height) single-stemmed deciduous species. The canopy is overlapping, generally forming 60-100% cover. The shrub layer is also dense with up to 60% cover, and often multi-tiered, with both tall and short shrubs. The herbaceous layer is dominated by forbs with up to 20% cover. In parts of this alliance's range, graminoid cover is primarily from introduced grass species.

Floristics: The tree canopy of this alliance is tall (to 30 m) and nearly always dominated by *Populus deltoides*, although *Acer negundo, Celtis laevigata, Fraxinus pennsylvanica, Platanus occidentalis, Salix nigra*, and *Ulmus americana* are also commonly encountered in various parts of this alliance's range. Tree diversity is limited due to the dynamics of flooding and deposition/scouring of sediments. The shrub layer is sparse to dense, with species such as *Cornus drummondii, Cornus sericea, Prunus virginiana, Salix exigua*, and *Symphoricarpos occidentalis*. Herbaceous growth can be thick and lush but is often patchy and sparse due to frequent inundation. Herbaceous species found throughout the range of this alliance are not well known, but in parts of the range, species can include *Pascopyrum smithii* and *Panicum virgatum* (throughout the range), *Carex* spp., *Juncus* spp., *Leymus cinereus*, and *Elymus canadensis* (common in the northern Great Plains), and *Amphicarpaea bracteata, Carex blanda, Geum canadense, Parietaria pensylvanica* and others in the central Great Plains. Due to the frequent disturbance, weedy species are almost ubiquitous in the understory, especially *Poa pratensis, Bromus inermis, Melilotus officinalis, Ambrosia* spp., and *Urtica* spp.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands of this alliance are found primarily along riverfronts, where they develop on bare, moist soil on newly formed sandbars, front-land ridges, low streambanks, overflow areas, and well-drained flats along major streams and rivers. Stands can also be found on abandoned fields and well-drained ridges in the first bottoms. These sites tend to be further from the main channel. Elevations range from 300 m in the central Great Plains to 1300 m in the western Great Plains. Soils are formed in alluvium, are deep, medium-textured, and with adequate or excessive moisture available for vegetation during the growing season. Typically, the soil profile is highly stratified, but with distinct soil development (B) layers. Textures are predominately loose, friable sands interspersed with narrow bands of clay loams and sandy clays.

Dynamics: Cottonwood forests grow within an alluvial environment that is continually changing due to the ebb and flow of the river. Riparian vegetation is constantly being "re-set" by flooding disturbance. Cottonwood communities are early-, mid- or late-seral, depending on the age class of the trees and the associated species of the stand. Mature cottonwood stands do not regenerate in place, but regenerate by "moving" up and down a river reach. Over time, a healthy riparian area supports all stages of cottonwood communities. The process of cottonwood regeneration is well-documented. Periodic flooding events can leave sandbars of bare, mineral substrate. Cottonwood seedlings germinate and become established on newly-deposited, moist sandbars. In the absence of large floods in subsequent years, seedlings begin to trap sediment. In time, the sediment accumulates and the sandbar rises. The young forest community is then above the annual flood zone of the river channel. In this newly elevated position, with an absence of excessive browsing, fire, or agricultural conversion, this cottonwood community can grow into a mature riparian forest. At the same time, the river channel continually erodes streambanks and creates fresh, new surfaces for cottonwood establishment. This results in a dynamic patchwork of different age classes, plant associations and habitats. As cottonwoods mature, other tree species may become established. If the land surface is subject to reworking by the river, the successional processes will start over with erosion and subsequent flooding deposition. If the land surface is not subject to alluvial processes, for example on a high terrace, the cottonwoods will be replaced by upland shrub or tree species from adjacent areas.

DISTRIBUTION

Geographic Range: This alliance is found in the Great Plains from southeastern Alberta and southern Saskatchewan, through the Dakotas and Montana south to the Texas Panhandle and Oklahoma.

Nations: CA, US
States/Provinces: AB, KS, MT, ND, NE, OK, SD, SK, TX, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** *Populus deltoides* Dominance Type (Hansen et al. 1988b)
- **?** *Populus deltoides* forest alliance (Hoagland 1998a)
- **><** *Populus-Salix* wetland forest (No. 24) (Vankat 1990)
- **><** Cottonwood: 63 (Eyre 1980)

LOWER LEVEL UNITS

Associations:

- CEGL000658 *Populus deltoides - Fraxinus pennsylvanica* Floodplain Forest
- CEGL002095 *Populus deltoides - Platanus occidentalis* Floodplain Forest
- CEGL002092 *Platanus occidentalis - (Populus deltoides) - Acer negundo* Floodplain Forest
- CEGL000657 *Populus deltoides / Cornus sericea* Floodplain Forest
- CEGL002096 *Populus deltoides - Ulmus americana - Celtis laevigata* Floodplain Forest

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Eyre 1980, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Hoagland 1998a, Van Auken and Bush 1988, Vankat 1990

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1. Forest & Woodland
1.B.3.Na. Eastern North American-Great Plains Flooded & Swamp Forest
G147. Great Plains Cottonwood - Green Ash Floodplain Forest

A0636. Populus deltoides Floodplain Woodland Alliance

Type Concept Sentence: This alliance occurs near rivers and large streams throughout the Great Plains of the U.S. and Canada and extends west into Wyoming and New Mexico. It is dominated by *Populus deltoides* throughout its range. Secondary canopy species include *Acer negundo* throughout, *Salix nigra* (in the eastern part of its range), *Fraxinus pennsylvanica* and *Ulmus americana* (central and eastern), and *Salix amygdaloides* (central and western). The understory composition and structure are variable.

OVERVIEW

Scientific Name: *Populus deltoides* Floodplain Woodland Alliance
Common Name (Translated Scientific Name): Eastern Cottonwood Floodplain Woodland Alliance
Colloquial Name: Eastern Cottonwood Floodplain Woodland

Type Concept: This alliance occurs near rivers and large streams throughout the Great Plains and extends west into Wyoming and New Mexico. It is dominated by *Populus deltoides* throughout its range. Secondary canopy species include *Acer negundo* throughout, *Salix nigra* (in the eastern part of its range), *Fraxinus pennsylvanica* and *Ulmus americana* (central and eastern), and *Salix amygdaloides* (central and western). *Fraxinus pennsylvanica* and *Ulmus americana* often increase in abundance and dominance as stands of this alliance age. *Populus deltoides* does not reproduce well in established stands. The understory composition and structure are variable. A shrub layer may be present, with species such as *Salix* spp., *Symphoricarpos occidentalis*, and *Prunus virginiana* predominating. Sites experience seasonal floods, which, after receding, leave areas available for colonization. This process often favors the establishment of aggressive native and exotic plants. Among the species that are common in this alliance are *Carex* spp., *Juncus* spp., *Spartina pectinata* (in the east), *Pascopyrum smithii* (in the west), *Elymus* spp., *Cenchrus longispinus, Melilotus officinalis*, and *Equisetum* spp. Typical exotics found in this alliance are *Poa pratensis* and *Bromus* spp. Stands of this alliance are found on level to gently sloping topography near rivers, streams, lakes, and ponds. The areas may have been very recently deposited by water action, or they may have been deposited earlier and occupied by other communities. The water table fluctuates with the level of the adjacent waterbody. This can lead to periods of flooding and soil saturation in the spring and after heavy rains and also

to periods of drought when the water level falls in the summer and fall. The soils are silts, loams, and sands, and are derived from alluvial material.

Classification Comments: This alliance is similar to *Populus deltoides* Floodplain Forest Alliance (A3423). The canopy tends to be more open in this alliance and the understory may have more mid- and tallgrass species but strong differential or characteristic species are not known at this time.

Should this alliance be split into a northern and southern alliance? Given the dominance of *Populus deltoides* throughout the range, there are no consistent canopy species to make the split. There may be a suite of overstory and understory species that could serve to differentiate the two new alliances (*Platanus occidentalis, Celtis laevigata, Sapindus saponaria* for the south and yet-to-be-determined species for the north) but the difference does not seem strong.

Internal Comments: MSR 6-17: AB added. JFD 2-28-13: One association in this alliance, CEGL002017, appears to have had its initial concept changed markedly since its origin. It was originally developed for the lower Missouri River (IA, KS, NE, MO, and maybe SD) but has since been attributed to WY and CO. The association is also noted as possibly not being recognized as a natural community by NE and MO anymore, rather it may be formed by riparian prairies being invaded by *Populus deltoides* and *Salix nigra*. The distribution and concept of this association should be examined.
Other Comments:

Similar NVC Types:
- A3423 *Populus deltoides* Floodplain Forest Alliance: has a more closed canopy and tends to have fewer prairie grasses in the understory, though the alliances can be very similar.

Diagnostic Characteristics: Woodland floodplains in the Great Plains, nearly always dominated by *Populus deltoides*. The understory often has mid- and tallgrass components from the surrounding prairie, though recently scoured sites can be barren or dominated by early-successional species.

VEGETATION

Physiognomy and Structure: The tree layer is dominated by tall (20-35 m) single-stemmed, deciduous species. The canopy is open, generally forming 25-60% cover. The herbaceous layer is dominated by both graminoids and forbs with up to 20% cover. In parts of this alliance's range, graminoid cover is primarily from introduced grass species.

Floristics: This alliance is dominated by *Populus deltoides* (either *ssp. wislizeni* or *ssp. monilifera* and perhaps *ssp. deltoides* in eastern extent) throughout its range. Secondary canopy species include *Acer negundo* throughout, *Salix nigra* (in the eastern part of its range), *Fraxinus pennsylvanica* and *Ulmus americana* (central and eastern), and *Salix amygdaloides* (central and western). *Fraxinus pennsylvanica* and *Ulmus americana* often increase in abundance and dominance as stands of this alliance age (Johnson et al. 1976). *Populus deltoides* does not reproduce well in established stands. The understory composition and structure are variable. A shrub layer may be present, with species such as *Salix* spp., *Symphoricarpos occidentalis*, and *Prunus virginiana* predominating. Sites experience seasonal floods which, after receding, leave areas available for colonization. This process often favors the establishment of aggressive native and exotic plants. Among the species that are common in this alliance are *Carex* spp., *Juncus* spp., *Spartina pectinata* (in the east), *Pascopyrum smithii* (in the west), *Elymus* spp., *Cenchrus longispinus, Melilotus officinalis*, and *Equisetum* spp. Typical exotics found in this alliance are *Poa pratensis* and *Bromus* spp.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands of this alliance are found on level to gently sloping topography near rivers, streams, lakes, and ponds throughout the Great Plains, extending west into Wyoming and New Mexico to the western slope of Colorado and extending into mountain valleys and on to Colorado Plateau. The areas may have been very recently deposited by water action or they may have been deposited earlier and occupied by other communities (Wilson 1970). The water table fluctuates with the level of the adjacent waterbody. This can lead to periods of flooding and soil saturation in the spring and after heavy rains and also to periods of drought when the water level falls in the summer and fall. The soils are silts, loams, and sands, and are derived from alluvial material (Wilson 1970, Hansen et al. 1984, Thilenius et al. 1995).

Dynamics: Cottonwood forests grow within an alluvial environment that is continually changing due to the ebb and flow of the river. Riparian vegetation is constantly being "re-set" by flooding disturbance. Cottonwood communities are early-, mid- or late-seral, depending on the age class of the trees and the associated species of the stand. Mature cottonwood stands do not regenerate in place, but regenerate by "moving" up and down a river reach. Over time, a healthy riparian area supports all stages of cottonwood communities. The process of cottonwood regeneration is well-documented. Periodic flooding events can leave sandbars of bare, mineral substrate. Cottonwood seedlings germinate and become established on newly-deposited, moist sandbars. In the absence of large floods in subsequent years, seedlings begin to trap sediment. In time, the sediment accumulates and the sandbar rises. The young forest community is then above the annual flood zone of the river channel. In this newly elevated position, with an absence of

excessive browsing, fire, or agricultural conversion, this cottonwood community can grow into a mature riparian forest. At the same time, the river channel continually erodes streambanks and creates fresh, new surfaces for cottonwood establishment. This results in a dynamic patchwork of different age classes, plant associations and habitats. As cottonwoods mature, other tree species may become established. If the land surface is subject to reworking by the river, the successional processes will start over with erosion and subsequent flooding deposition. If the land surface is not subject to alluvial processes, for example on a high terrace, the cottonwoods will be replaced by upland shrub or tree species from adjacent areas.

DISTRIBUTION

Geographic Range: This alliance is found in the Great Plains from southern Alberta and Saskatchewan and southwestern Manitoba, through the Dakotas and Montana south to the Texas Panhandle, Oklahoma, and northeastern New Mexico. This alliance probably extends east along the Missouri River and major tributaries into western Iowa and western Missouri.

Nations: CA, US
States/Provinces: AB, CO, IA, KS, MB, MO?, MT, ND, NE, NM, OK, SD, SK?, TX, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Populus deltoides* woodland alliance (Hoagland 1998a)
- **><** Cottonwood: 63 (Eyre 1980)
- **><** Eastern Broadleaf Forests: 98: Northern Floodplain Forest (*Populus-Salix-Ulmus*) (Küchler 1964)

LOWER LEVEL UNITS

Associations:

- CEGL000659 *Populus deltoides - (Salix amygdaloides) / Salix (exigua, interior)* Floodplain Woodland
- CEGL005025 *Populus deltoides - Celtis laevigata / Sapindus saponaria* Floodplain Woodland
- CEGL001454 *Populus deltoides / Panicum virgatum - Schizachyrium scoparium* Floodplain Woodland
- CEGL000660 *Populus deltoides / Symphoricarpos occidentalis* Floodplain Woodland
- CEGL005024 *Populus deltoides / Pascopyrum smithii - Panicum virgatum* Floodplain Woodland
- CEGL002017 *Populus deltoides - (Salix nigra) / Spartina pectinata - Carex* spp. Floodplain Woodland
- CEGL002152 *Populus deltoides / Juniperus scopulorum* Floodplain Woodland
- CEGL004919 *Populus deltoides - Salix nigra* Floodplain Woodland
- CEGL002649 *Populus deltoides / Carex pellita* Floodplain Woodland

AUTHORSHIP

Primary Concept Source: D. Culver and K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2017/06/30

REFERENCES

References: Bunin 1985, Christy 1973, Crouch 1961b, Crouch 1978, Crouch 1979a, Crouch 1979b, Diamond 1993, Eyre 1980, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Fitzgerald 1978, Hansen et al. 1984, Hansen et al. 1995, Hoagland 1998a, Jackson 1972, Jackson and Lindauer 1978, Johnson et al. 1976, Keammerer 1974a, Keammerer 1974b, Kittel and Lederer 1993, Kittel et al. 1996, Kittel et al. 1997a, Kittel et al. 1999a, Küchler 1964, Lindauer 1970, Lindauer 1978, Lindauer and Christy 1972, Lindauer and Fitzgerald 1974, Lindauer and Ward 1968, Lindauer et al. 1973, Masek 1979, McEachern 1979, Thilenius and Smith 1985, Thilenius et al. 1995, Wilson 1970

1.B.3.Nd. Western North American Interior Flooded Forest

This lowland riparian forest and woodland type is dominated by broad-leaved deciduous trees (cottonwoods, sycamores, and hackberries) and palms that occur along perennial and intermittent rivers, springs and oases of the California Central Valley, Southwest U.S. deserts, and the Tamaulipan region of south Texas and adjacent Mexico.

M298. Interior West Ruderal Flooded & Swamp Forest & Woodland

This macrogroup consists of low-elevation riparian and lacustrine areas throughout the southwestern U.S. and into Mexico that are dominated by non-native invasive woody species such as *Tamarix* spp., *Elaeagnus angustifolia*, or *Phoenix dactylifera*.

1. Forest & Woodland
1.B.3.Nd. Western North American Interior Flooded Forest
1.B.3.Nd.90.a. M298 Interior West Ruderal Flooded & Swamp Forest & Woodland

G510. Interior West Ruderal Riparian Forest & Scrub

Type Concept Sentence: Stands of *Tamarix* spp., *Elaeagnus angustifolia*, or other introduced facultative wet-tolerant species in low-elevation riparian areas throughout the western U.S. and into Mexico.

OVERVIEW

Scientific Name: *Tamarix* spp. - *Elaeagnus angustifolia* Ruderal Riparian Forest & Scrub Group
Common Name (Translated Scientific Name): Tamarisk species - Russian-olive Ruderal Riparian Forest & Scrub Group
Colloquial Name: Ruderal Box-elder Riparian Forest

Type Concept: This group consists of low-elevation riparian areas, seeps and springs throughout the southwestern U.S. and into Mexico that are dominated by non-native invasive woody species. Present to abundant species include *Elaeagnus angustifolia, Myoporum laetum, Phoenix canariensis, Prunus mahaleb, Robinia pseudoacacia, Schinus molle, Schinus terebinthifolius, Tamarix* spp., *Ulmus pumila*, or *Washingtonia robusta*. Salt-cedar habitats tend to support fewer species and individuals than native habitats. If present, native species contribute less than 10% relative cover. Elevation ranges from sea level to above 2135 m (7000 feet). Sites are typically streambanks and benches, floodplains and canyons with permanent, intermittent or temporary waterflow.

Classification Comments: The name is "scrub" rather than forest or woodland to capture lower heights and more open canopy densities and the fact that some dominant species are multi-stemmed and may not meet "forest" or "woodland" criteria. Planted stands of *Washingtonia robusta, Washingtonia filifera*, and *Phoenix canariensis* are not part of this group but would be considered "cultural" vegetation. *Washingtonia robusta* is native to Mexico, so only naturalized stands within the U.S. belong to this group.

Similar NVC Types:
- G797 Western Interior Riparian Forest & Woodland

Diagnostic Characteristics: Tall, deciduous trees dominated by naturalized, invasive species not considered native to North America or, if native to North America, naturalized beyond their native ranges.

VEGETATION

Physiognomy and Structure: Open- to closed-canopy riparian woodlands that can have a scrubby appearance (multi-stemmed, 1-20 m tall) dominated by non-native woody species, generally following linear paths of adjacent streams, rivers and floodplains.

Floristics: Present to abundant species include *Elaeagnus angustifolia, Myoporum laetum, Phoenix canariensis, Prunus mahaleb, Robinia pseudoacacia, Schinus molle, Schinus terebinthifolius, Tamarix* spp., *Ulmus pumila*, or *Washingtonia robusta*. Some of these are not necessarily restricted to riparian/wetland settings. Salt-cedar habitats tend to support fewer species and individuals than native habitats (Smith and Douglas 1989, Barbour et al. 2007, Sogge et al. 2008, Sawyer et al. 2009). Non-native understory species may include *Acroptilon repens, Aegilops* sp., *Agrostis gigantea, Agrostis stolonifera, Alopecurus geniculatus, Alopecurus pratensis, Arundo donax, Conyza canadensis, Cirsium arvense, Echinochloa crus-galli, Eichhornia crassipes, Hordeum murinum, Phalaris arundinacea, Phleum pratense, Phragmites australis, Poa palustris, Poa pratensis, Rumex crispus*, and *Sonchus arvensis*.

ENVIRONMENT & DYNAMICS

Environmental Description: Elevation ranges from sea level to above 2135 m (7000 feet). *Climate:* Warm Temperate. *Soil/substrate/hydrology:* Sites are typically alluvial streambanks and floodplains, with slightly alkaline soils and water heavy in agricultural runoff (Smith and Douglas 1989, Barbour et al. 2007, Sogge et al. 2008, Sawyer et al. 2009).

Dynamics:

DISTRIBUTION

Geographic Range: This group is found throughout the western interior of the U.S. and into Mexico.

Spatial Scale & Pattern [optional]: Large patch, Linear
Nations: MX, US

States/Provinces: AZ, CA, ID, NM, NV, OK, TX
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Alliances:
- A4160 *Rubus armeniacus - Sesbania punicea - Ficus carica* Ruderal Riparian Scrub Alliance
- A4155 *Acer negundo - Populus* spp. - *Picea* spp. Ruderal Riparian Forest Alliance
- A4161 *Phoenix dactylifera - Washingtonia filifera* Ruderal Riparian Woodland Alliance
- A4218 *Prosopis* spp. Lowland Ruderal Understory Wet Scrub Alliance
- A3566 *Elaeagnus angustifolia* Ruderal Riparian Scrub Alliance
- A0842 *Tamarix* spp. Ruderal Riparian Scrub Alliance
- A4192 *Salix alba - Salix fragilis* Ruderal Riparian Forest Alliance

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2011)
Author of Description: G. Kittel
Acknowledgments:

REFERENCES

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1. Forest & Woodland
1.B.3.Nd. Western North American Interior Flooded Forest
G510. Interior West Ruderal Riparian Forest & Scrub

A4155. Acer negundo - Populus spp. - Picea spp. Ruderal Riparian Forest Alliance [Low - Poorly Documented]

Type Concept Sentence:

OVERVIEW

Scientific Name: *Acer negundo - Populus* spp. - *Picea* spp. Ruderal Riparian Forest Alliance
Common Name (Translated Scientific Name): Box-elder - Cottonwood species - Spruce species Ruderal Riparian Forest Alliance
Colloquial Name: Ruderal Box-elder Riparian Forest

Type Concept:

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics:

VEGETATION

Physiognomy and Structure:

Floristics:

ENVIRONMENT & DYNAMICS

Environmental Description:

Dynamics:

DISTRIBUTION

Geographic Range:

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL005485 *Populus fremontii / Tamarix* sp. Ruderal Riparian Woodland
- CEGL002693 *Acer negundo* / Disturbed Understory Riparian Woodland
- CEGL003749 *Populus angustifolia* / Invasive Perennial Grasses Ruderal Riparian Woodland
- CEGL005958 *Picea pungens / Poa pratensis* Ruderal Riparian Woodland
- CEGL003810 *Populus deltoides ssp. wislizeni* / Disturbed Understory Ruderal Flooded Woodland
- CEGL005961 *Populus angustifolia - Acer negundo / Poa pratensis* Ruderal Riparian Woodland

AUTHORSHIP

Primary Concept Source: G. Kittel
Author of Description:
Acknowledgments:

REFERENCES

1. Forest & Woodland
1.B.3.Nd. Western North American Interior Flooded Forest
G510. Interior West Ruderal Riparian Forest & Scrub

A3566. Elaeagnus angustifolia Ruderal Riparian Scrub Alliance [Low - Poorly Documented]

Type Concept Sentence: This alliance is dominated by the introduced tree species *Elaeagnus angustifolia* with a variety of native and introduced species in the shrub and herbaceous layers. It is a widespread woodland alliance found throughout much of the southwestern United States. It is a naturalized species whose seeds are spread by birds. Stands tend to be small and linear and occur in a variety of native habitats, particularly more mesic ones, such as near streams and rivers, upland basins and drainages.

OVERVIEW

Scientific Name: *Elaeagnus angustifolia* Ruderal Riparian Scrub Alliance
Common Name (Translated Scientific Name): Russian-olive Ruderal Riparian Scrub Alliance
Colloquial Name: Ruderal Russian-olive Riparian Scrub

Type Concept: This wooded alliance is dominated by the introduced tree species *Elaeagnus angustifolia* with a variety of native and introduced species in the shrub and herbaceous layers. Additional associated species have not been documented. The alliance is widespread and found throughout much of the southwestern United States. It is a naturalized species that has been widely planted in hedgerows for windbreaks. It has since spread (by birds distributing their seeds) to a variety of native habitats, particularly more mesic ones, such as near streams and rivers. Stands tend to be small and linear.

Classification Comments: Often a co-inhabitant with tamarisk but forms woodlands and stands in slightly less wet and less frequently flooded areas than tamarisk.

Internal Comments: GK 9-16: ID added for Minidoka.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Woodlands dominated by *Elaeagnus angustifolia*.

VEGETATION

Physiognomy and Structure:

Floristics: The vegetation in this ruderal alliance is characterized by the dominance of the introduced tree species *Elaeagnus angustifolia* with a variety of native and introduced species in the shrub and herbaceous layers. Native species present include (with less than 10% cover) *Amorpha fruticosa, Atriplex patula, Distichlis spicata, Hordeum jubatum, Pascopyrum smithii, Populus fremontii, Salix exigua*, and *Sporobolus airoides*. Introduced species that may also be present include *Bassia scoparia (= Kochia scoparia), Descurainia sophia, Lepidium latifolium, Tamarix ramosissima*, and many others.

ENVIRONMENT & DYNAMICS

Environmental Description: *Elaeagnus angustifolia* has since spread to a variety of native habitats, particularly more mesic ones, such as near streams and rivers. Habitats include shorelines of lakes, streambanks and floodplains of rivers, subirrigated upland basins and drainages.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is found throughout disturbed mesic areas of the southwestern U.S.

Nations: US
States/Provinces: AZ, CO, ID, ND, SD, UT
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL005269 *Elaeagnus angustifolia* Ruderal Riparian Woodland

AUTHORSHIP

Primary Concept Source: D. Faber-Langendoen and K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Faber-Langendoen et al. 2017b

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1. Forest & Woodland
1.B.3.Nd. Western North American Interior Flooded Forest
G510. Interior West Ruderal Riparian Forest & Scrub

A4192. Salix alba - Salix fragilis Ruderal Riparian Forest Alliance [Low - Poorly Documented]

Type Concept Sentence: Naturalized stands of *Salix fragilis* and/or *Salix alba* occurring along riverbanks and lakeside margins and found throughout the western U.S. and probably in the western Great Plains.

OVERVIEW

Scientific Name: *Salix alba - Salix fragilis* Ruderal Riparian Forest Alliance
Common Name (Translated Scientific Name): White Willow - Crack Willow Ruderal Riparian Forest Alliance
Colloquial Name: Ruderal White Willow - Crack Willow Riparian Forest

Type Concept: *Salix fragilis* and *Salix alba* are large tree willows that were introduced to the United States as ornamental and/or shade trees. These have naturalized along streams and rivers throughout the western U.S. and probably in the western Great Plains. They can reproduce vegetatively and will spread slowly, and usually not far from their source planting. They appear both as individual trees and in large stands. Ecologically they compete with the native tree willows, such as *Salix amygdaloides, Salix nigra*, and *Salix gooddingii*, as well as native cottonwoods. Native shrubs such as *Salix exigua*, and *Toxicodendron rydbergii* may be present. Understory species include native sedges, grasses and forbs such as *Beckmannia syzigachne, Carex aquatilis, Carex utriculata, Carex nebrascensis, Carex hystericina, Calamagrostis* spp., *Galium* spp., *Maianthemum stellatum, Mentha arvensis*, and *Urtica dioica*, and others. Non-native herbaceous species can also be abundant, such as *Arctium minus, Cynoglossum officinale, Bromus tectorum,*

Bromus inermis, Poa pratensis, Phleum pratense, Cirsium arvense, Melilotus officinalis, Dactylis glomerata, Conium maculatum, and others. Stands are found in disturbed places, generally near settlements, that are wet naturally or irrigated, such as riparian areas, golf courses, city parks, floodplains, streambanks, ditches and lake margins below 2286 m (7500 feet) in elevation.

Classification Comments: Hybrids between *Salix fragilis* and *Salix alba* exist, and can be difficult to identify. Also, they are known to hybridize with native willows, such as *Salix nigra* and *Salix amygdaloides*.

Internal Comments: GK 9-16: AZ, CA, CO, MT, NM, NV, OR, UT, WA, WY added.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics:

VEGETATION

Physiognomy and Structure:

Floristics: *Salix fragilis* and *Salix alba* are large tree willows that were introduced to the United States as ornamental and/or shade trees. These have naturalized along streams and rivers throughout the western U.S. and probably in the western Great Plains. They can reproduce vegetatively and will spread slowly, and usually not far from their source planting. They appear both as individual trees and in large stands. Ecologically it competes with the native tree willows, such as *Salix amygdaloides, Salix nigra*, and *Salix gooddingii*, as well as native cottonwoods. Native shrubs such as *Salix exigua*, and *Toxicodendron rydbergii* may be present. Understory species include native sedges, grasses and forbs such as *Beckmannia syzigachne, Carex aquatilis, Carex utriculata, Carex nebrascensis, Carex hystericina, Calamagrostis* spp., *Galium* spp., *Maianthemum stellatum, Mentha arvensis*, and *Urtica dioica*, and others. Non-native herbaceous species can also be abundant, such as *Arctium minus, Cynoglossum officinale, Bromus tectorum, Bromus inermis, Poa pratensis, Phleum pratense, Cirsium arvense, Melilotus officinalis, Dactylis glomerata, Conium maculatum*, and others.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands are found in disturbed places, generally near settlements, that are wet naturally or irrigated, such as riparian areas, golf courses, city parks, floodplains, streambanks, ditches and lake margins below 2286 m (7500 feet) in elevation.

Dynamics: *Salix fragilis* is called crack willow because it is highly susceptible to wind, ice and snow damage. It has escaped cultivation and can form pure stands. Willows can spread easily from detached twigs floating downstream.

DISTRIBUTION

Geographic Range: This alliance is known from throughout the western U.S. and probably also occurs in the western Great Plains.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL005622 *Salix (fragilis, alba)* Ruderal Riparian Woodland

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2015)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2016/09/28

REFERENCES

References: Czarapata 2005, Faber-Langendoen et al. 2017b, Hickman 1993

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1. Forest & Woodland
1.B.3.Nd. Western North American Interior Flooded Forest
G510. Interior West Ruderal Riparian Forest & Scrub

A0842. Tamarix spp. Ruderal Riparian Scrub Alliance [Low - Poorly Documented]

Type Concept Sentence: This alliance is composed of shrublands dominated by introduced species of *Tamarix*, including *Tamarix chinensis, Tamarix gallica, Tamarix parviflora*, and *Tamarix ramosissima*. It forms moderately dense to dense thickets on banks of larger streams, rivers and playas across the southwestern U.S. and northern Mexico.

OVERVIEW

Scientific Name: *Tamarix* spp. Ruderal Riparian Scrub Alliance
Common Name (Translated Scientific Name): Tamarisk species Ruderal Riparian Scrub Alliance
Colloquial Name: Ruderal Tamarisk Riparian Scrub

Type Concept: This alliance is composed of shrublands dominated by introduced species of *Tamarix*, including *Tamarix chinensis, Tamarix gallica, Tamarix parviflora*, and *Tamarix ramosissima*. It forms moderately dense to dense thickets on banks of larger streams, rivers and playas across the southwestern U.S. and northern Mexico. Introduced from the Mediterranean, *Tamarix* spp. have become naturalized in various sites, including salt flats, springs, and especially along streams and regulated rivers, often replacing *Salix* or *Prosopis* spp. shrublands or other native vegetation. A remnant herbaceous layer may be present, depending on the age and density of the shrub layer. These species have become a critical nuisance along most large rivers in the semi-arid western U.S.

Classification Comments: Stands also occur in Oklahoma, and this alliance includes them as well.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Riparian woodlands and washes dominated by *Tamarix* spp.

VEGETATION

Physiognomy and Structure:

Floristics: This alliance consists of shrublands with moderate to dense cover of a tall-shrub layer that is solely or strongly dominated by *Tamarix*, including (commonly) *Tamarix chinensis, Tamarix gallica, Tamarix parviflora*, and *Tamarix ramosissima*. Other introduced species of *Tamarix* have been documented in the U.S., but whether these form full stands is yet to be documented. Additional *Tamarix* species include *Tamarix africana, Tamarix aphylla, Tamarix aralensis, Tamarix canariensis*, and *Tamarix tetragyna* (Kartesz 1999). Other native shrubs may be present and include species of *Salix* (especially *Salix exigua*) and *Prosopis, Rhus trilobata*, and *Sarcobatus vermiculatus*, but with low cover (if shrub species are codominant, then stand may be classified as a native shrubland type). Scattered native *Acer negundo, Elaeagnus angustifolia, Populus* spp., or *Salix amygdaloides* trees may also be present. Depending on stand age and density of the shrub layer, an herbaceous layer may be present. Associated native species include *Distichlis spicata, Sporobolus airoides*, and introduced forage species such as *Agrostis gigantea, Agrostis stolonifera*, and *Poa pratensis*. Other introduced herbaceous species such as *Conyza canadensis, Lepidium latifolium*, and *Polypogon monspeliensis* may also be present.

ENVIRONMENT & DYNAMICS

Environmental Description: These widespread shrublands are common along larger streams, rivers, and around playas. Elevation ranges from 75 m below sea level to 1860 m. Sites include riverbanks, floodplains, basins, sandbars, side channels, springs, salt flats, and other saline habitats. Substrates are commonly thin sandy loam soil over alluvial deposits of sand, gravel or cobbles. Stands grow especially well along regulated rivers and rivers with agricultural runoff that increase the salts in the water.

Dynamics: *Tamarix* spp. are extremely drought- and salt-tolerant, produce prolific wind-dispersed seeds over much of the growing season, can resprout after burning or cutting, and, if kept moist, buried or broken branches will develop adventitious roots and grow. Stands seem to favor disturbed and flow-regulated rivers, but establish well in pristine areas, too. Once established, stands are extremely difficult to eradicate, requiring cutting and herbicide application on stumps to prevent resprouting (Smith and Douglas 1989).

In California, tamarisk species are among the most invasive, widely distributed, and troublesome non-natives to infest wetlands. Multiple, interacting factors facilitate tamarisk invasion, including intentional planting for erosion control and windbreaks; land conversion to agriculture; reduced flood frequencies after damming rivers; changing and stabilizing waterflows, times, and rates downstream from reservoirs; and increased salinity levels in the rivers from evaporation in the reservoirs (Everitt 1980). Tamarisk vigorously sprouts and increases flowering and seed production after fire. Mixed riparian stands often change to tamarisk-dominated stands after fires (Zouhar 2003b, Brooks and Minnich 2006). Active programs to remove tamarisk are ongoing in the state (Lovich 2000). Discouraging tamarisk establishment by biological and mechanical control is the most effective method of control. Once established in large stands, control and eradication efforts are difficult and costly; many managers recommend integrated management approaches (Lovich 2000, Zouhar 2003b, Carpenter 2005).

DISTRIBUTION

Geographic Range: This alliance is found throughout the southwestern U.S. and northern Mexico.

Nations: MX, US
States/Provinces: AZ, CA, CO, MT, MXCH, MXCO, MXSO, NM, NV, OK, TX, UT, WY
TNC Ecoregions [optional]: 11:C, 13:C, 15:C, 16:C, 17:C, 23:C
USFS Ecoregions (2007): 261B:CC, 262A:CC, 322Ab:CCC, 322Al:CCC, 322At:CCC, 322Av:CCC, 322Ay:CCC, 322Az:CCC, 322B:CC, 322C:CC, 341Fc:CCC, M261A:CC, M261B:CC, M261C:CC, M261F:CC, M262A:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Joshua Tree, Lake Mead, Mojave)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

- **=** *Tamarix* spp. (Tamarisk thickets) Semi-natural Stands (Sawyer et al. 2009) [63.810.00]
- **?** *Tamarix chinensis* Community Type (Hansen et al. 1995)
- **?** *Tamarix chinensis* shrubland alliance (Hoagland 1998a)
- **?** *Tamarix pentandra* Community Type (Szaro 1989)
- **?** *Tamarix ramosissima* (Salt cedar) Association (Nachlinger and Reese 1996)
- **=** *Tamarix* spp. Semi-Natural Shrubland Stands (Evens et al. 2012)
- **=** *Tamarix* spp. Semi-Natural Stands (Tamarisk thickets) (Buck-Diaz et al. 2012)
- **=** *Tamarix* spp. Semi-natural Shrubland Alliance (Evens et al. 2014)
- **=** *Tamarix* spp. Shrubland Semi-Natural Alliance (CNPS 2017) [63.810.00]
- **?** Salt cedar series (Paysen et al. 1980)
- **=** Saltcedar Alliance (Muldavin et al. 2000a)
- **?** Saltcedar Series (Dick-Peddie 1993)
- **=** Tamarisk Scrub (#63810) (Holland 1986b)
- **=** Tamarisk series (Sawyer and Keeler-Wolf 1995)

LOWER LEVEL UNITS

Associations:
- CEPP005697 *Tamarix chinensis* Ruderal Lakeshore Scrub
- CEGL003114 *Tamarix* spp. Ruderal Riparian Shrubland

AUTHORSHIP

Primary Concept Source: M.S. Reid and K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Brooks and Minnich 2006, Brown 1982a, Buck-Diaz et al. 2012, CNPS 2017, Campbell and Dick-Peddie 1964, Carpenter 2005, DiTomaso and Healy 2007, Dick-Peddie 1993, Evens and San 2006, Evens et al. 2012, Evens et al. 2014, Faber-Langendoen et al. 2017b, Hansen et al. 1995, Hefley 1937, Hoagland 1998a, Holland 1986b, Johnson 1987b, Keeler-Wolf et al. 1998a, Keeler-Wolf et al. 2005, Klein and Evens 2006, Little 1996, Lovich 2000, Muldavin et al. 2000a, Nachlinger and Reese 1996, Neill 1985, Paysen et al. 1980, Powell 1988b, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Smith and Douglas 1989, Sproul et al. 2011, Szaro 1989, Thomas et al. 2004, USBOR 1976, Von Loh et al. 2002, Zouhar 1993b

2. SHRUB & HERB VEGETATION

Grasslands, shrublands, open tree savannas, marshes, bogs and fens dominated by broadly mesomorphic (including scleromorphic) shrub and herb growth forms (including *broad-leaved, needle-leaved*, and *sclerophyllous shrubs*, and *forb* and *graminoid herbs*) with an irregular horizontal canopy structure, mesomorphic trees typically <10% cover (but tropical tree savannas typically <40%), tropical to boreal and subalpine climates, and wet to dry substrate conditions.

2.B. Temperate & Boreal Grassland & Shrubland

Temperate & Boreal Grassland & Shrubland is dominated by mesomorphic grasses and shrubs, with or without scattered trees (and trees typically <10% cover), ranging from temperate coastal to inland lowland and montane grasslands and shrublands, with a strongly seasonal climate and at least some frost to extended cold seasons.

2.B.2. Temperate Grassland & Shrubland

Temperate Grassland, Meadow & Shrubland is dominated by perennial grasses, forbs and shrubs typical of moderately dry to moist habitats, and is found in the mid-latitude regions of all continents (23° to 55°N and S), varying from large open grassland landscapes to droughty hillside meadows in forested landscapes.

2.B.2.Na. Western North American Grassland & Shrubland

This division contains cool-temperate lowland to subalpine shrubland, grassland, and meadow communities that are dominated by cold-deciduous shrubs or cool-season bunchgrasses or mesic forbs in the mountainous regions of western North America, from Alaska's Aleutian Islands south to the central coast of California, and down through the Intermountain West ranges and Rocky Mountains to Arizona and New Mexico.

M049. Southern Rocky Mountain Montane Shrubland

This shrubland macrogroup is found in the foothills, canyon slopes and montane zone of mountains of the southern Rocky Mountains and Colorado Plateau and extends out onto outcrops and canyon slopes in the western and southern Great Plains. The vegetation is characterized by an open to dense shrub layer typically dominated by *Cercocarpus montanus, Purshia tridentata*, and/or *Quercus gambelii*, and several other characteristic shrubs.

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
2.B.2.Na.1.b. M049 Southern Rocky Mountain Montane Shrubland

G276. Southern Rocky Mountain Mountain-mahogany - Mixed Foothill Shrubland

Type Concept Sentence: This foothills shrubland group occurs in the Rocky Mountains and Colorado Plateau from lower montane zone to canyons and breaks in the western Great Plains and is characterized by an open to closed shrub layer of nearly pure *Cercocarpus montanus* or a mixed shrub layer with *Amelanchier utahensis, Quercus x pauciloba, Purshia tridentata, Rhus trilobata, Ribes cereum*, or *Symphoricarpos oreophilus*.

OVERVIEW

Scientific Name: *Cercocarpus montanus - Quercus x pauciloba - Rhus trilobata* Foothill Shrubland Group
Common Name (Translated Scientific Name): Alderleaf Mountain-mahogany - Wavyleaf Oak - Skunkbush Sumac Foothill Shrubland Group
Colloquial Name: Utah Serviceberry - Mountain-mahogany Shrubland

Type Concept: This Rocky Mountain foothill shrubland group ranges from southern New Mexico north into Wyoming, and west into the Intermountain West region. *Cercocarpus montanus* dominates pure stands in parts of Wyoming and Colorado. The vegetation is typically dominated by a variety of shrubs, including *Amelanchier utahensis, Cercocarpus montanus, Quercus x pauciloba, Purshia tridentata, Rhus trilobata, Ribes cereum, Symphoricarpos oreophilus*, or *Yucca glauca*. Grasses and sedges are dominant in the understory and may include *Achnatherum scribneri, Bouteloua curtipendula, Carex geyeri, Elymus lanceolatus, Hesperostipa comata, Hesperostipa neomexicana, Leymus ambiguus, Muhlenbergia montana*, and *Pseudoroegneria spicata*. Scattered trees or inclusions of grassland patches or steppe may be present. Stands are found in the foothills, canyon slopes and lower mountains of the Rocky Mountains and on outcrops and canyon slopes in the western Great Plains. These shrublands occur between 1500 and 2900 m elevation and are usually associated with exposed sites, rocky substrates, and dry conditions, which limit tree growth. It is common where *Quercus gambelii* is absent, such as the northern Colorado Front Range and in drier foothills and prairie hills. This group is

generally drier than Southern Rocky Mountain Gambel Oak - Mixed Montane Shrubland Group (G277), but may include mesic montane shrublands where *Quercus gambelii* does not occur. Fires play an important role in this group as the dominant shrubs usually have a severe die-back, although some plants will stump sprout. *Cercocarpus montanus* requires a disturbance such as fire to reproduce, either by seed sprout or root-crown sprouting. Fire suppression may have allowed an invasion of trees into some of these shrublands, but in many cases, sites are too xeric for tree growth.

Classification Comments: While *Cercocarpus montanus* is the common dominant shrub in this group, it is not the only dominant, and in many occurrences is not found at all. In addition, in some occurrences, shrub cover is low, which allows for some stands to be graminoid-dominated. In Wyoming, stands where *Cercocarpus montanus* is a component of mixed shrublands are placed in Central Rocky Mountain Montane-Foothill Deciduous Shrubland Group (G272).

Similar NVC Types:
- G277 Southern Rocky Mountain Gambel Oak - Mixed Montane Shrubland
- G272 Central Rocky Mountain Montane-Foothill Deciduous Shrubland

Diagnostic Characteristics: Open to dense broadleaf shrublands or shrub-grasslands where *Cercocarpus montanus* occurs as the most often dominant shrub, but may be a codominant or be absent in some stands. Other characteristic shrubs include *Amelanchier utahensis, Artemisia tridentata, Cercocarpus intricatus, Fallugia paradoxa, Fendlera rupicola, Glossopetalon spinescens, Purshia tridentata, Quercus x pauciloba, Ribes cereum*, and *Rhus trilobata*. The herbaceous layer is characterized by an open to dense layer of grasses and sedges. Typical species include *Achnatherum scribneri, Bouteloua curtipendula, Carex geyeri, Elymus lanceolatus, Hesperostipa comata, Hesperostipa neomexicana, Leymus ambiguus, Muhlenbergia montana*, and *Pseudoroegneria spicata*.

VEGETATION

Physiognomy and Structure: Open to dense, broadleaf deciduous shrublands or shrub-grasslands with canopies 1-2 m tall. Occurrences are typically multi-layered shrub-dominated stands where grasses occur in canopy openings. In occurrences where shrub cover is open, grasses may attain higher cover than overstory shrubs.

Floristics: This group consists of two major cover types: those most commonly dominated by *Cercocarpus montanus* or by *Purshia tridentata*. Within these communities, either nominal may be dominant, codominant or absent. Other shrubs include *Amelanchier utahensis, Artemisia tridentata, Cercocarpus intricatus, Fallugia paradoxa, Fendlera rupicola, Glossopetalon spinescens, Quercus x pauciloba, Rhus trilobata, Ribes cereum, Symphoricarpos oreophilus*, or *Yucca glauca*. Grasses are prominent and include *Andropogon gerardii, Achnatherum scribneri, Bouteloua curtipendula, Elymus lanceolatus ssp. lanceolatus, Hesperostipa comata, Hesperostipa neomexicana, Muhlenbergia montana*, and *Pseudoroegneria spicata*.

ENVIRONMENT & DYNAMICS

Environmental Description: This group is found on gentle to extremely steep slopes (5-60%) on slopes, ridges, canyons, mesas, and less often sand dunes. Sites are often subject to drought stress. Elevations range from 1500 to 2700 m. Geologic substrates can include sandstone, shale, basalt, and limestone. Soils are generally poorly developed, rapidly drained and include sand, sandy loam, coarse gravels, loams, and clay loams.

Dynamics:

DISTRIBUTION

Geographic Range: This group is found in the foothills, canyon slopes and lower mountains of the southern Rocky Mountains and on outcrops and canyon slopes in the western and southern Great Plains. It ranges from southern New Mexico, extending north into Wyoming, and west into the Intermountain West region.

Spatial Scale & Pattern [optional]: Large patch
Nations: US
States/Provinces: CO, MT, NE?, NM, NV?, SD, TX, UT, WY
TNC Ecoregions [optional]: 9:P, 10:C, 11:P, 18:C, 19:C, 20:C, 21:C, 25:C, 26:C, 27:C
USFS Ecoregions (2007): 313A:CC, 313B:CC, 315A:CC, 315B:CC, 315H:CP, 321A:CC, 331B:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 331J:CC, 341B:CC, 341C:CC, 342E:CC, 342F:CC, 342G:CC, M313B:CC, M331A:CP, M331B:CP, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332G:??, M334A:??, M341B:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **=** Mountain Mahogany - Mixed Shrub Series (Dick-Peddie 1993)

LOWER LEVEL UNITS

Alliances:

- A3733 *Cercocarpus montanus - Quercus x pauciloba* Shrubland Alliance
- A3731 *Purshia tridentata - Ribes cereum* Shrubland Alliance
- A3730 *Fallugia paradoxa - Rhus trilobata* Shrubland Alliance
- A3732 *Amelanchier utahensis - Cercocarpus montanus - Cercocarpus intricatus* Shrubland Alliance

AUTHORSHIP

Primary Concept Source: K. Hess and C.H. Wasser (1982)
Author of Description: M.E. Hall and K.A. Schulz
Acknowledgments:
Version Date: 11/09/2015
Classif Resp Region: West
Internal Author: MEH 3-10, 9-13, mod, KAS 11-15

REFERENCES

References: Dick-Peddie 1993, Faber-Langendoen et al. 2017a, Hess 1981, Hess and Wasser 1982, Johnston 1987, Marriott and Faber-Langendoen 2000, Muldavin 1994, Muldavin et al. 2000b, Shiflet 1994, Thilenius et al. 1995

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G276. Southern Rocky Mountain Mountain-mahogany - Mixed Foothill Shrubland

A3732. Amelanchier utahensis - Cercocarpus montanus - Cercocarpus intricatus Shrubland Alliance

Type Concept Sentence: This alliance is characterized by shrublands dominated by *Amelanchier utahensis, Cercocarpus montanus* or *Cercocarpus intricatus* in the southern Rocky Mountains, Wyoming Basins, Colorado Plateau and extending west to the Great Basin.

OVERVIEW

Scientific Name: *Amelanchier utahensis - Cercocarpus montanus - Cercocarpus intricatus* Shrubland Alliance
Common Name (Translated Scientific Name): Utah Serviceberry - Alderleaf Mountain-mahogany - Littleleaf Mountain-mahogany Shrubland Alliance
Colloquial Name: Utah Serviceberry - Mountain-mahogany Shrubland

Type Concept: This alliance is known from the southern Rocky Mountains, Wyoming Basins, Colorado Plateau and extending west to the Great Basin. Stands are characterized by mixed tall-shrub canopies dominated by *Amelanchier utahensis, Cercocarpus montanus*, or *Cercocarpus intricatus*. Species that may codominate in some stands include *Artemisia tridentata, Fendlera rupicola, Glossopetalon spinescens*, and *Rhus trilobata*. Total canopy cover ranges from sparse to moderately dense. Occasional trees, such as *Juniperus* spp., *Quercus* spp., *Pinus edulis, Pinus ponderosa*, or *Pseudotsuga menziesii*, may be scattered in some stands. The herbaceous layer is variable and may have sparse to moderate cover. The most typical dominants are graminoids and may include *Carex geyeri, Elymus lanceolatus ssp. lanceolatus, Hesperostipa comata*, and *Pseudoroegneria spicata*. Elevations range from 1800-2700 m. Sites are variable but are generally xeric and rocky with moderate to very steep slopes or on ridges. Stands are found on various aspects, but typically the higher elevation and northern sites are on warmer, southern exposures, and lower elevation and southern stands are restricted to more mesic north slopes.

Classification Comments: Inclusion of *Cercocarpus intricatus* Montane Shrubland (CEGL002587) is tentative as it occupies the same geographic range and montane environments of other associations in this alliance and has similar floristics. *Cercocarpus intricatus - Glossopetalon spinescens* Shrubland (CEGL005426) is included in that it is montane with some floristic overlap, but is a geographic outlier, therefore placement here is low in confidence. Other *Cercocarpus intricatus* associations are more associated with slickrock environments and range more western and southern.

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

Similar NVC Types: This alliance is distinguished from the alliance listed above in have species with more northern distributions.

- A3733 *Cercocarpus montanus - Quercus x pauciloba* Shrubland Alliance: has species with more southern distributions.

Diagnostic Characteristics: Mixed montane shrublands dominated *Amelanchier utahensis, Cercocarpus montanus*, or occasionally *Cercocarpus intricatus*. Shrub cover may be sparse to moderate. These shrublands may be either codominated by other shrub species or have sparse to dense understories of graminoids. Tree may be present, but are scattered and have low cover.

VEGETATION

Physiognomy and Structure: This alliance is characterized by a moderate to dense canopy of cold-deciduous shrubs up to 4 m in height. There is often another stratum (sometimes two) of low cold-deciduous shrubs from 0.5-2 m tall. The ground layer is usually a species-rich assemblage of cespitose graminoids and erect forbs.

Floristics: These shrublands are typically sparse to dense and tall with multiple vegetation layers. The upper shrub layer is typically dominated by *Amelanchier utahensis, Cercocarpus montanus*, or *Cercocarpus intricatus*. Species that may codominate in some stands include *Artemisia tridentata, Fendlera rupicola, Glossopetalon spinescens*, and *Rhus trilobata*. Other shrub associates may include *Chrysothamnus viscidiflorus, Ephedra viridis, Eriogonum corymbosum, Holodiscus dumosus, Mahonia repens, Purshia tridentata, Ribes cereum, Rosa woodsii, Symphoricarpos oreophilus*, and *Tetradymia canescens*. Occasional trees, such as *Juniperus* spp., *Quercus* spp., *Pinus edulis, Pinus ponderosa* or *Pseudotsuga menziesii*, may be scattered in some stands. The herbaceous layer is variable and may have sparse to moderate cover and is most often dominated by graminoids. Dominant graminoids may include *Carex geyeri, Elymus lanceolatus ssp. lanceolatus, Hesperostipa comata*, and *Pseudoroegneria spicata*. Other associated graminoids may include *Achnatherum hymenoides, Koeleria macrantha, Leymus salinus, Poa fendleriana*, and *Poa fendleriana*. Forbs do not contribute significant cover, but may be diverse in some stands. Associates may include *Artemisia ludoviciana, Balsamorhiza sagittata, Collinsia parviflora, Hedeoma hispida, Lathyrus pauciflorus*, and *Symphyotrichum oblongifolium (= Aster oblongifolius)*.

ENVIRONMENT & DYNAMICS

Environmental Description: Plant associations in this alliance occur at middle elevations (1850-2700 m) of mountains. Climate is semi-arid. Summers are hot and winters are typically cold, with freezing temperatures and snow common, however, stands on the southwestern U.S. may have mild winter temperatures. Precipitation ranges from 30-50 cm annually with a large proportion falling as winter snow. Sites are variable but are generally xeric and rocky with moderate to very steep slopes or on ridges. Stands are found on various aspects, but typically the higher elevation and northern sites are on warmer, southern exposures, and lower elevation and southern stands are restricted to more mesic north slopes. Environments include sheltered rocky canyons, mesa slopes, slickrock, moderate to very steep slopes and ridges. Soils are variable, from shallow and skeletal near rock outcroppings, to moderately deep with abundant organic matter. Soil textures range from sandy loam to clay. Soils range from slightly acidic to slightly alkaline depending on parent material, which includes alluvium, colluvium and residuum from igneous, metamorphic or sedimentary rocks such as granite, gneiss, limestone, quartz monzonite, rhyolite, sandstone, schist and shale.

Dynamics: Yake and Brotherson (1979) noted that regeneration of *Amelanchier utahensis* was most favorable on moderately deep, fine-textured soils of northerly-aspected sites. They noted that seedling herbivory by native ungulates was greater at such sites. Annual grasses were noted to have a negative effect on seedling densities. *Amelanchier utahensis* hybridizes with *Amelanchier alnifolia*, and distinctions between the two species may become blurred in areas where their ranges overlap. *Cercocarpus montanus* is a dominant understory species in several woodland and forests dominated by *Juniperus deppeana, Juniperus monosperma, Juniperus osteosperma, Juniperus scopulorum, Pinus edulis, Pinus ponderosa, Pseudotsuga menziesii, Quercus gambelii, Quercus grisea*, and *Quercus x pauciloba*. *Cercocarpus montanus* stands often occur in the more xeric habitat below these woodland and forest stands. In xeric habitats studied by Greenwood and Brotherson (1978), *Cercocarpus montanus* sites had significantly more rock than the *Pinus edulis* and *Juniperus osteosperma* sites. Brotherson et al. (1984) suggested that stands are moisture-limited because stands on southern aspects were always higher in elevation than stands on northern aspects. They also found that the *Cercocarpus montanus* stands were more likely to occur on northern slopes than on southern in central Utah. However, *Cercocarpus montanus* did not typically occur with mesic shrubs such as *Symphoricarpos oreophilus* and *Amelanchier alnifolia*. There is often a broad *Cercocarpus montanus* shrub/herbaceous ecotone between these shrublands and grasslands. Ecological factors that control shrub densities such as fire and drought need more investigation. Unlike other species of *Cercocarpus, Cercocarpus montanus* is a fire-resistant species because it can resprout from the base after a fire has killed the top (Cronquist et al. 1997). In the southern portion of its range, *Cercocarpus montanus* functions as an evergreen shrub by retaining leaves during mild winters and losing them during cold winters (Dick-Peddie 1993). *Cercocarpus montanus* is preferred winter range browse for deer (Roughton 1966, 1972, Hoffman and Alexander 1987). Stands can also produce significant forage that can be utilized by grazing livestock provided the slopes are not too steep (Hoffman and Alexander 1987). More information is needed on the effects of livestock grazing and wildlife browsing on the structure and function of these shrublands.

DISTRIBUTION

Geographic Range: This alliance is known from the southern Rocky Mountains, Arizona-New Mexico mountains, north to the Wyoming Basins, east to escarpments of the Great Plains and west to the Colorado Plateau and parts of the Great Basin.

Nations: US
States/Provinces: AZ, CA, CO, NE, NM, NV, SD, TX, UT, WY

TNC Ecoregions [optional]: 11:C, 17:C
USFS Ecoregions (2007): 322Aj:CCC, 341Fb:CCC, 341Fc:CCC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Great Basin, Mojave)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **>** *Cercocarpus intricatus* (Small leaf mountain mahogany scrub) Provisional Alliance (Sawyer et al. 2009) [76.300.00]
- **>** *Cercocarpus intricatus* Shrubland Alliance (Evens et al. 2014)

LOWER LEVEL UNITS

Associations:

- CEGL003494 *Chamaebatiaria millefolium - Yucca baccata - (Mahonia repens)* Shrubland
- CEGL001069 *Amelanchier utahensis / Pseudoroegneria spicata* Shrubland
- CEGL001067 *Amelanchier utahensis* Shrubland
- CEGL001090 *Cercocarpus montanus / Pseudoroegneria spicata* Shrubland
- CEGL002912 *Cercocarpus montanus - Rhus trilobata / Andropogon gerardii* Shrubland
- CEGL001087 *Cercocarpus montanus / Elymus lanceolatus ssp. lanceolatus* Shrubland
- CEGL001070 *Amelanchier (utahensis, alnifolia) - Cercocarpus montanus* Shrubland
- CEGL001092 *Cercocarpus montanus / Hesperostipa comata* Shrubland
- CEGL002798 *Cercocarpus montanus* Shale Shrubland
- CEGL002587 *Cercocarpus intricatus* Montane Shrubland
- CEGL003817 *Amelanchier utahensis - Fendlera rupicola* Shrubland
- CEGL003820 *Cercocarpus montanus - Fendlera rupicola* Shrubland
- CEGL005805 *Cercocarpus montanus - Artemisia tridentata* Shrubland
- CEGL005393 *Cercocarpus intricatus - (Quercus turbinella)* Mixed Shrubland
- CEGL005426 *Cercocarpus intricatus - Glossopetalon spinescens* Shrubland
- CEGL001068 *Amelanchier utahensis* - Mixed Shrub / *Carex geyeri* Shrubland

AUTHORSHIP

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

REFERENCES

References: Brotherson and Barnes 1984, Cronquist et al. 1997, Dick-Peddie 1993, Evens et al. 2014, Faber-Langendoen et al. 2017b, Greenwood and Brotherson 1978, Hoffman and Alexander 1987, Roughton 1966, Roughton 1972, Sawyer et al. 2009, Thomas et al. 2004, Yake and Brotherson 1979

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G276. Southern Rocky Mountain Mountain-mahogany - Mixed Foothill Shrubland

A3733. Cercocarpus montanus - Quercus x pauciloba Shrubland Alliance

Type Concept Sentence: This alliance is characterized by shrublands dominated or codominated by *Cercocarpus montanus* and *Quercus x pauciloba* occurring in the southern Rocky Mountains south to the northern Chihuahuan Desert and east to the Southern Shortgrass Prairie with outlying occurrences in adjacent ecoregions.

OVERVIEW

Scientific Name: *Cercocarpus montanus - Quercus x pauciloba* Shrubland Alliance
Common Name (Translated Scientific Name): Alderleaf Mountain-mahogany - Wavyleaf Oak Shrubland Alliance
Colloquial Name: Alderleaf Mountain-mahogany - Wavyleaf Oak Shrubland

Type Concept: The vegetation of this alliance is characterized by shrublands most commonly dominated by *Cercocarpus montanus*, but in the southern portion of its range is codominated by *Quercus x pauciloba*. Structure varies from dense to having little to no canopy overlap with lush herbaceous layers. Shrub associates may include *Ceanothus greggii, Dasylirion leiophyllum, Quercus grisea* (shrub form), and *Quercus turbinella*. The understory is most commonly graminoid-dominated by *Bouteloua curtipendula, Hesperostipa neomexicana, Muhlenbergia montana*, or *Petrophytum caespitosum*. Additional species may include *Achnatherum scribneri, Bouteloua gracilis, Carex geyeri, Elymus albicans (= Elymus lanceolatus ssp. albicans), Festuca arizonica*, and the perennial

forbs *Helianthus pumilus, Heterotheca villosa, Potentilla fissa*, and *Scutellaria brittonii*. Introduced annual grass *Bromus tectorum* is often present. This alliance primarily occurs in the southern Rocky Mountains, northern Chihuahuan Desert and east to the Southern Shortgrass Prairie, but has outlying occurrences in adjacent ecoregions. It occurs on montane slopes at 915 to 2440 m (3000-8000 feet) elevation. Stands are found on various aspects, but typically the higher elevation and northern sites are on warmer, southern exposures, and lower elevation and southern stands are restricted to more mesic north slopes.

Classification Comments: This alliance includes *Cercocarpus montanus* associations previously included in one larger Rocky Mountain alliance, but has been created separately to reflect the more southern floristic elements of this new alliance. Stands in this alliance appear to be separated from stands in *Cercocarpus montanus* Madrean Montane Chaparral Alliance (A3791) by the density of the shrub layer alone. Stands in this shrub-herbaceous alliance have only been described from southwestern New Mexico but may occur throughout the range of *Cercocarpus montanus*. A *Cercocarpus montanus / Stipa neomexicana* shrubland has been described from the Colorado Front Range foothills by the Colorado Natural Heritage Program but has not yet been included in the National Vegetation Classification (S. Kettler pers. comm.).

Internal Comments:
Other Comments:

Similar NVC Types:
- A3732 *Amelanchier utahensis - Cercocarpus montanus - Cercocarpus intricatus* Shrubland Alliance
- A3791 *Cercocarpus montanus* Madrean Montane Chaparral Alliance

Diagnostic Characteristics: Broad-leaved shrublands dominated or codominated by the hybrid scrub oak *Quercus x pauciloba* and *Cercocarpus montanus* with grasses predominant in the understory. Understory associated species tend to reflect southern distributions.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a moderately sparse to moderately dense cover of broad-leaved deciduous shrubs 2 m tall. The sparse to moderately dense herbaceous layer is usually less than 1 m tall and dominated by graminoids. Some stands have herbaceous layers dominated by perennial forbs, but generally forb cover is sparse. Annuals are seasonally present.

Floristics: The sparse to moderately dense shrub layer is 1-2 m tall and is dominated by the cold-deciduous, broad-leaved shrub *Cercocarpus montanus* or the hybrid oak *Quercus x pauciloba*. Occasional trees, such as *Juniperus* spp., *Pinus edulis, Pinus ponderosa, Pseudotsuga menziesii*, or *Quercus* spp., may be scattered in some stands. Shrub cover is generally denser on northern aspects and increases with elevation. Lower elevation stands grade into shrub savannas with decreasing elevation. The herbaceous layer is sparse to moderately dense depending on the density of the shrub layer and soil moisture. It is dominated by perennial graminoids or forbs with annuals present seasonally. Associated species vary with location. In the western Great Plains, *Artemisia frigida* and *Rhus trilobata* are common woody species. The herbaceous layer is sparse to moderately dense and is dominated by the warm-season, perennial midgrass *Bouteloua curtipendula*. *Achnatherum hymenoides (= Oryzopsis hymenoides), Aristida purpurea, Elymus elymoides, Hesperostipa comata (= Stipa comata)*, and *Piptatheropsis micrantha (= Oryzopsis micrantha)* may also be present. Common forbs are *Artemisia ludoviciana, Hedeoma hispida*, and *Symphyotrichum oblongifolium (= Aster oblongifolius)*. Stands in the Rocky Mountain foothills are similar, but with the graminoid layer usually dominated by the cool-season, perennial mid grasses *Bouteloua gracilis, Hesperostipa comata*, or *Hesperostipa neomexicana (= Stipa neomexicana)*. In addition to *Artemisia frigida* and *Rhus trilobata*, associated shrubs and dwarf-shrubs may include *Purshia tridentata, Quercus gambelii*, and *Ribes cereum*. Other associated species, such as *Allium textile, Artemisia ludoviciana, Astragalus parryi, Bouteloua gracilis, Eriogonum umbellatum, Helianthus pumilus*, and *Poa* spp., are common in the herbaceous layer. In the Chihuahuan Desert montane scrublands, the dominant species may be a different subspecies, *Cercocarpus montanus var. paucidentatus*. Associated shrubs and dwarf-shrubs include Madrean elements such as *Agave parryi, Ceanothus greggii, Dasylirion leiophyllum, Dasylirion wheeleri, Ericameria laricifolia, Garrya flavescens, Garrya wrightii, Petrophytum caespitosum, Quercus grisea* (shrub form), *Quercus turbinella, Yucca baccata*, and shrubby species of *Opuntia*, sometimes forming a mixed cold-deciduous/evergreen stand. Occasional trees such as *Quercus arizonica, Quercus gambelii*, and other *Quercus* spp. and conifers such as *Juniperus deppeana* may be present. The herbaceous layer is sparse on the very rocky sites to moderately dense, and usually is dominated by perennial grasses, including *Aristida ternipes, Bothriochloa barbinodis, Bouteloua curtipendula, Bouteloua gracilis, Eragrostis intermedia, Koeleria macrantha, Lycurus phleoides, Muhlenbergia emersleyi, Muhlenbergia montana*, and *Muhlenbergia pauciflora*. Forbs may be diverse and include *Artemisia ludoviciana, Eriogonum jamesii, Hedeoma plicata, Heliomeris longifolia, Heliomeris multiflora, Mirabilis multiflora*, and *Viguiera dentata*.

ENVIRONMENT & DYNAMICS

Environmental Description: Shrublands included in this alliance are found on prairie breaks and on slopes of foothills, mountains and canyons. Elevations range from 915 to 2440 m (3000-8000 feet). Climate is semi-arid. Summers are hot and winters are typically cold, with freezing temperatures and snow common. Mean annual precipitation ranges from 24-55 cm with precipitation occurring bimodally during the winter and late summer with a droughty period in late spring/early summer. The late-summer rain often occurs as high-intensity thunderstorms. Sites are variable but are generally xeric and rocky with moderate to very steep slopes or on ridges. Stands are found on various aspects, but typically the higher elevation and northern sites are on warmer, southern exposures, and lower elevation and southern stands are restricted to more mesic north slopes. Substrates are typically thin, well-drained, poorly developed, lithic soils with abundant rock outcrops. Soil textures range from sandy loam to clay. Soils range from slightly acidic to slightly alkaline depending on parent material, which includes alluvium, colluvium and residuum from igneous, metamorphic or sedimentary rocks such as granite, gneiss, limestone, quartz monzonite, rhyolite, sandstone, schist and shale.

Dynamics: *Cercocarpus montanus* is a dominant understory species in several woodland and forests dominated by *Juniperus deppeana, Juniperus monosperma, Juniperus osteosperma, Juniperus scopulorum, Pinus edulis, Pinus ponderosa, Pseudotsuga menziesii, Quercus gambelii, Quercus grisea*, and *Quercus x pauciloba*. *Cercocarpus montanus* stands often occur in the more xeric habitat below these woodland and forest stands. In xeric habitats studied by Greenwood and Brotherson (1978), *Cercocarpus montanus* sites had significantly more rock than the *Pinus edulis* and *Juniperus osteosperma* sites. Brotherson et al. (1984) suggested that stands are moisture-limited because stands on southern aspects were always higher in elevation than stands on northern aspects. However, *Cercocarpus montanus* did not typically occur with mesic shrubs such as *Symphoricarpos oreophilus* and *Amelanchier alnifolia*. There is often a broad *Cercocarpus montanus* shrub/herbaceous ecotone between these shrublands and grasslands. Ecological factors that control shrub densities such as fire and drought need more investigation. Unlike other species of *Cercocarpus, Cercocarpus montanus* is a fire-resistant species because it can resprout from the base after a fire has killed the top (Cronquist et al. 1997). In the southern portion of its range, *Cercocarpus montanus* functions as an evergreen shrub by retaining leaves during mild winters and losing them during cold winters (Dick-Peddie 1993). *Cercocarpus montanus* is preferred winter range browse for deer (Roughton 1966, 1972, Hoffman and Alexander 1987). Stands can also produce significant forage that can be utilized by grazing livestock provided the slopes are not too steep (Hoffman and Alexander 1987). More information is needed on the effects of livestock grazing and wildlife browsing on the structure and function of these shrublands.

DISTRIBUTION

Geographic Range: This alliance is known from the southern Rocky Mountains south to the northern Chihuahuan Desert and east to the Southern Shortgrass Prairie of Colorado, New Mexico and Texas.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Cercocarpus montanus - Rhus aromatica / Bouteloua curtipendula* Plant Association (Johnston 1987) [*Rhus aromatica* is a synonym for *R. tridentata*]
- **?** *Cercocarpus montanus / Bouteloua curtipendula* Habitat Type (Hoffman and Alexander 1987)
- **?** *Cercocarpus montanus* (Mountain Mahogany) Series (Muldavin et al. 1998b)
- **?** Mountain Mahogany-Mixed Shrub Series (Dick-Peddie 1993) [included within the Montane Scrubland Vegetation Type]
- **?** Mountain mahogany Series (133.34) (Brown 1982a) [included within Interior Chaparral]

LOWER LEVEL UNITS

Associations:

- CEGL004589 *Cercocarpus montanus var. paucidentatus / Petrophyton caespitosum* Shrubland
- CEGL002913 *Cercocarpus montanus / Achnatherum scribneri* Shrubland
- CEGL002914 *Cercocarpus montanus / Muhlenbergia montana* Shrubland
- CEGL005378 *Quercus x pauciloba / Bouteloua curtipendula* Shrubland
- CEGL001118 *Quercus x pauciloba / Cercocarpus montanus* Shrubland
- CEGL001091 *Cercocarpus montanus / Rhus trilobata var. trilobata* Shrubland
- CEGL002911 *Cercocarpus montanus / Hesperostipa neomexicana* Shrubland
- CEGL001086 *Cercocarpus montanus / Bouteloua curtipendula* Shrubland

AUTHORSHIP

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

REFERENCES

References: Brotherson et al. 1984, Brown 1982a, Cronquist et al. 1997, Diamond 1993, Dick-Peddie 1993, Faber-Langendoen et al. 2017b, Greenwood and Brotherson 1978, Hoffman and Alexander 1987, Johnston 1987, Kettler pers. comm., Muldavin et al. 1998b, Roughton 1966, Roughton 1972

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G276. Southern Rocky Mountain Mountain-mahogany - Mixed Foothill Shrubland

A3731. Purshia tridentata - Ribes cereum Shrubland Alliance

Type Concept Sentence: This alliance is characterized by shrublands of the eastern Front Range of Colorado within canyons dominated by *Purshia tridentata* or *Ribes cereum*.

OVERVIEW

Scientific Name: *Purshia tridentata - Ribes cereum* Shrubland Alliance
Common Name (Translated Scientific Name): Antelope Bitterbrush - Wax Currant Shrubland Alliance
Colloquial Name: Antelope Bitterbrush - Wax Currant Shrubland

Type Concept: This shrubland alliance is found on gentle to very steep slopes in the foothills and mountains in the Colorado Front Range. Shrublands included in this alliance are characterized by a *Purshia tridentata*- or *Ribes cereum*-dominated shrub canopy. *Artemisia frigida* is the most constant shrub associate. *Arctostaphylos uva-ursi, Artemisia tridentata ssp. vaseyana, Ceanothus fendleri, Chrysothamnus viscidiflorus, Ericameria nauseosa (= Chrysothamnus nauseosus), Jamesia americana, Juniperus communis, Prunus virginiana, Rhus trilobata*, and *Rubus deliciosus* are sometimes present. Scattered trees such as *Juniperus scopulorum, Pinus ponderosa*, and *Pseudotsuga menziesii* may be present at low covers. Graminoids are the most common herbaceous dominants, the most constant being *Hesperostipa comata, Leymus ambiguus*, and *Muhlenbergia montana*. Other common herbaceous associates include *Achillea millefolium, Achnatherum scribneri (= Stipa scribneri), Antennaria* sp., *Artemisia ludoviciana, Astragalus* sp., *Bouteloua gracilis, Chenopodium leptophyllum, Cryptantha virgata, Elymus albicans, Erigeron* spp., *Geranium caespitosum, Harbouria trachypleura, Helianthus pumilus, Heterotheca villosa, Penstemon virens, Phacelia heterophylla, Potentilla fissa, Scutellaria brittonii*, and *Symphyotrichum falcatum*. Sites where found are exposed, steep (30-90% slope) mountain slopes with southerly aspects on the eastern slopes of the Front Range, from 1700 to 2800 m in elevation. These sites are typically too xeric to support extensions of the surrounding coniferous forests. Parent materials are colluvial and residual metamorphic rocks.

Classification Comments: This alliance is very narrowly defined and may be better included in a *Cercocarpus montanus* alliance as the range is overlapping. The inclusion of *Ribes cereum* is tentative here since it occupies steeper, talus slope environments than those of the other associations, but has some floristic and geographic overlap.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: broad-leaved semi-evergreen shrublands of steep canyons and mountain slopes dominated by *Purshia tridentata* or *Ribes cereum*. Shrub cover may range from sparse to open.

VEGETATION

Physiognomy and Structure: These are typically moderately dense to open (15-40% cover) microphyllous evergreen (or late cold-deciduous) shrublands with the dominant shrubs varying from 0.5-3 m in height. Maximum shrub height generally decreases with latitude and altitude, reaching a minimum in subalpine stands. A second tier of microphyllous evergreen or cold-deciduous shrubs may be present. Cespitose graminoids are typical herbaceous associates and may strongly dominate the ground layer. Some regional variants may have a substantial forb component as well. Lichens and mosses may cover the ground surface in good-condition stands.

Floristics: Shrublands included in this alliance are characterized by a *Purshia tridentata*- or *Ribes cereum*-dominated shrub canopy. Canopies are 1-2 m tall and total cover ranges from 15-40%. Other shrubs are poorly represented, but *Artemisia frigida* is the most constant shrub associate. *Arctostaphylos uva-ursi, Artemisia tridentata ssp. vaseyana, Ceanothus fendleri, Chrysothamnus*

viscidiflorus, Ericameria nauseosa (= Chrysothamnus nauseosus), Jamesia americana, Juniperus communis, Prunus virginiana, Rhus trilobata, and *Rubus deliciosus* are sometimes present. Scattered trees such as *Juniperus scopulorum, Pinus ponderosa*, and *Pseudotsuga menziesii* may be present at low covers. The herbaceous layer is dominated by perennial graminoids 0.5-m tall, the most constant species being *Hesperostipa comata, Leymus ambiguus*, and *Muhlenbergia montana*. Other common herbaceous associates include *Achillea millefolium, Achnatherum scribneri (= Stipa scribneri), Antennaria* sp., *Artemisia ludoviciana, Astragalus* sp., *Bouteloua gracilis, Chenopodium leptophyllum, Cryptantha virgata, Elymus albicans, Erigeron* spp., *Geranium caespitosum, Harbouria trachypleura, Helianthus pumilus, Heterotheca villosa, Penstemon virens, Phacelia heterophylla, Potentilla fissa, Scutellaria brittonii, Symphyotrichum falcatum*.

ENVIRONMENT & DYNAMICS

Environmental Description: Most of the region where this alliance occurs is arid to semi-arid with annual precipitation ranging from 15 to 75 cm. The entire range is under a continental temperature regime of cold winters, cool to warm summers and large diurnal variation. These shrublands are found on exposed, steep (30-90% slope) mountain slopes with southerly aspects on the eastern slopes of the Front Range (Hess 1981). Elevations range from 1700 to 2800 m. These sites are typically too xeric to support extensions of the surrounding coniferous forests. Parent materials are colluvial and residual metamorphic rocks which have developed into soils classified as Entisols. These soils are poorly developed and rocky, with loamy and sandy textures, and shallow A horizons over rocky C horizons. The soil surface is also moderately rocky.

Dynamics: Sawyer and Keeler-Wolf (1995) report that stands of *Purshia tridentata* can reach 125 years of age on deep, well-drained sites, but more commonly become decadent at 30 years, and die at 40-50 years of age. Stands appear to result from either a disturbance event (such as fire), or from rare years when many seedlings survive. This results in even-aged stands (Sawyer and Keeler-Wolf 1995). *Purshia tridentata* displays considerable plasticity in growth across its range. The broad range in height and form of different populations appears to be related to ecotypic variation (Mozingo 1987). Although mycorrhizae are considered important in establishment and growth of individual plants, *Purshia tridentata* is one of the first species to colonize barren volcanic substrates following eruption. The species is valuable as winter browse for native ungulates and livestock and is used extensively. Moderate livestock utilization (<60% of the year's current growth) has been reported to stimulate twig growth the following spring (Mueggler and Stewart 1980).

DISTRIBUTION

Geographic Range: This alliance is currently known from the eastern Front Range of Colorado.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Elymus ambiguus* Series (Hess 1981) [*Elymus ambiguus/Ribes cereum* is the sole habitat type in this series.]
- **><** *Ribes* spp. Series (Johnston 1987)

LOWER LEVEL UNITS

Associations:
- CEGL001057 *Purshia tridentata / Muhlenbergia montana* Shrubland
- CEGL001055 *Purshia tridentata / Artemisia frigida / Hesperostipa comata* Shrubland
- CEGL001124 *Ribes cereum / Leymus ambiguus* Shrubland

AUTHORSHIP

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

REFERENCES

References: Faber-Langendoen et al. 2017b, Hess 1981, Johnston 1987, Mozingo 1987, Sawyer and Keeler-Wolf 1995

M493. Western North American Ruderal Grassland & Shrubland

This upland macrogroup contains ruderal grasslands, meadows and shrublands found on human-disturbed sites, and dominated by non-native and generalist native species that occur in temperate areas throughout the western U.S. (Rockies westward) and southwestern Canada.

2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
2.B.2.Na.90.a. M493 Western North American Ruderal Grassland & Shrubland

G624. Western North American Interior Ruderal Grassland & Shrubland

Type Concept Sentence: This group includes grasslands dominated by the non-native grass *Elymus repens* and is known from disturbed valley bottoms, alluvial flats, fans and lower valley wall sites in western Colorado and northwestern Montana.

OVERVIEW

Scientific Name: Western North American Interior Ruderal Grassland & Shrubland Group
Common Name (Translated Scientific Name): Western North American Interior Ruderal Grassland & Shrubland Group
Colloquial Name: Western Ruderal Perennial Grassland

Type Concept: This montane, mesic to subhygric herbaceous group has low overall species diversity due to the dominance of *Elymus repens*, an exotic rhizomatous grass. *Elymus repens* is a highly invasive species in mesic areas and tends to exclude other species once established. Overall herbaceous cover ranges from 25-85% with *Elymus repens* clearly dominating with 5-80% cover. This group occurs in western Colorado, northwestern Montana, and southern Idaho. Sites include disturbed valley bottoms, alluvial flats, fans and lower valley wall sites between 1450 and 2300 m in elevation.

Classification Comments:

Similar NVC Types:
- G678 Californian Ruderal Forest
- G819 North American Warm Desert Ruderal Scrub
- G677 North American Warm Desert Ruderal Grassland
- G600 Great Basin-Intermountain Ruderal Dry Shrubland & Grassland

Diagnostic Characteristics:

VEGETATION

Physiognomy and Structure:

Floristics:

ENVIRONMENT & DYNAMICS

Environmental Description:

Dynamics:

DISTRIBUTION

Geographic Range:

Spatial Scale & Pattern [optional]:
Nations: CA, US
States/Provinces: CA, CO, KS, MT, ND, NE, NV, SD, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Alliances:
- A4191 *Rumex crispus* - (other FAC & Dryland Forb Species) Ruderal Meadow Alliance
- A2658 *Elymus repens* Ruderal Grassland Alliance
- A3254 *Agropyron cristatum - Bromus inermis - Poa pratensis* Ruderal Grassland Alliance

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2011)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 11/23/2016
Classif Resp Region: West
Internal Author: KAS 9-11; GK 11-16

REFERENCES

References: Faber-Langendoen et al. 2017a

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G624. Western North American Interior Ruderal Grassland & Shrubland

A3254. Agropyron cristatum - Bromus inermis - Poa pratensis Ruderal Grassland Alliance [Low - Poorly Documented]

Type Concept Sentence: This alliance occurs in disturbed dry to mesic grasslands and meadows found in lowland, montane and subalpine elevations (sea level to 3600 m) throughout the western U.S. and Canada. Vegetation can be a monoculture of a single non-native graminoid species, or a mix of several non-native forbs and graminoids. Graminoids include *Agropyron cristatum* and *Bromus inermis* (which has been purposefully seeded to prevent soil erosion), as well as many introduced forage species, especially in more mesic montane uplands such as *Alopecurus pratensis, Dactylis glomerata, Phleum pratense, Poa pratensis*, and *Psathyrostachys juncea*. Highly invasive and wind- and animal-distributed non-native forb species include *Sisymbrium altissimum, Descurainia sophia*, and *Lappula occidentalis*.

OVERVIEW

Scientific Name: *Agropyron cristatum - Bromus inermis - Poa pratensis* Ruderal Grassland Alliance
Common Name (Translated Scientific Name): Crested Wheatgrass - Smooth Brome - Kentucky Bluegrass Ruderal Grassland Alliance
Colloquial Name: Western Ruderal Perennial Grassland

Type Concept: This alliance occurs in disturbed dry to mesic grasslands and meadows found in lowland, montane and subalpine elevations (sea level to 3600 m) throughout the western U.S. and Canada. Vegetation can be a monoculture of a single non-native graminoid species, or a mix of several non-native forbs and graminoids. Graminoids include *Agropyron cristatum* and *Bromus inermis* (which has been purposefully seeded to prevent soil erosion), as well as many introduced forage species, especially in more mesic montane uplands, such as *Alopecurus pratensis, Dactylis glomerata, Phleum pratense, Poa pratensis*, and *Psathyrostachys juncea (= Elymus junceus)*. Highly invasive and wind- and animal-distributed non-native forb species include *Sisymbrium altissimum, Descurainia sophia*, and *Lappula occidentalis*.

Classification Comments: Successful introductions of non-native forage species have created stands of late-seral grasslands that are difficult to restore to native species.

Internal Comments:
Other Comments:

Similar NVC Types:
- A4148 *Agropyron cristatum* Western Ruderal Perennial Grassland Alliance

Diagnostic Characteristics: Dominant diagnostic species for this alliance are invasive, perennial grass species such as *Agropyron cristatum, Alopecurus pratensis, Dactylis glomerata, Phleum pratense, Poa pratensis, Psathyrostachys juncea*, and many others.

VEGETATION

Physiognomy and Structure:

Floristics:

ENVIRONMENT & DYNAMICS

Environmental Description:

Dynamics:

DISTRIBUTION

Geographic Range: This alliance occurs in lowland, montane and subalpine elevations (sea level to 3600 m) throughout the western U.S. and Canada.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL005266 *Agropyron cristatum - (Pascopyrum smithii, Hesperostipa comata)* Ruderal Grassland
- CEGL005264 *Bromus inermis - (Pascopyrum smithii)* Ruderal Grassland
- CEGL005471 *Agropyron cristatum - Bromus tectorum* Ruderal Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2013/09/27

REFERENCES

References: Faber-Langendoen et al. 2017b

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G624. Western North American Interior Ruderal Grassland & Shrubland

A2658. Elymus repens Ruderal Grassland Alliance

Type Concept Sentence: This alliance is dominated by the non-native grass *Elymus repens* and is known from disturbed valley bottoms, alluvial flats, fans and lower valley wall sites in western Colorado and northwestern Montana.

OVERVIEW

Scientific Name: *Elymus repens* Ruderal Grassland Alliance
Common Name (Translated Scientific Name): Quackgrass Ruderal Grassland Alliance
Colloquial Name: Ruderal Quackgrass Grassland

Type Concept: This montane, mesic to subhygric herbaceous alliance has low overall species diversity due to the dominance of *Elymus repens (= Elytrigia repens var. repens)*, an exotic rhizomatous grass. *Elymus repens* is a highly invasive species in mesic areas and tends to exclude other species once established. Overall herbaceous cover ranges from 25-85% with *Elymus repens* clearly dominating this association with 5-80% cover. This alliance is known western Colorado, northwestern Montana and southern Idaho. Sites include disturbed valley bottoms, alluvial flats, fans and lower valley wall sites between 1450 and 2300 m in elevation.

Classification Comments:

Internal Comments: GK 11-16: ID added for Minidoka.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Temperate semi-natural sod grasslands of disturbed areas characterized by a near monoculture of *Elymus repens*.

VEGETATION

Physiognomy and Structure: This alliance is characterized by a moderate to dense layer of medium-tall (0.5-1 m) perennial graminoids.

Floristics: This montane, mesic to subhygric herbaceous association has low overall species diversity due to the dominance of *Elymus repens (= Elytrigia repens var. repens)*, an exotic rhizomatous grass. *Elymus repens* is a highly invasive species in mesic areas and tends to exclude other species once established. Overall herbaceous cover ranges from 25-85% with *Elymus repens* clearly dominating this association with 5-80% cover. Other species sometimes present with low cover include *Achillea millefolium, Cerastium arvense, Carex* spp., *Equisetum laevigatum, Iva axillaris, Poa palustris, Penstemon confertus, Symphyotrichum laeve (= Aster laevis)*, and *Taraxacum officinale*.

ENVIRONMENT & DYNAMICS

Environmental Description: It occurs on flat to gently sloping lower slopes, toeslopes and valley bottoms at elevations between 1450 and 1555 m (4750-5100 feet) in Montana and between 1710 and 2285 m (5610-7500 feet) in Colorado. Soils are derived from glacial or fluvial deposits but are variable in soil texture, ranging from moderately well-drained sandy loams to clay loams to poorly drained gravel and rock. Litter dominates the ground surface.

Dynamics: Although characterized as an early-seral dominant (Gross and Werner 1982), *Elymus repens* is a highly invasive species in mesic areas and tends to exclude other species once established. It is tolerant of mildly saline conditions. It hybridizes readily with other wheatgrasses (e.g., *Pascopyrum smithii, Pseudoroegneria spicata*) and has fair to good forage value for domestic livestock. Many of the occurrences in the western U.S. can be traced to plantings of *Elymus repens* or hybrids for pasture or hay (Beetle 1955).

DISTRIBUTION

Geographic Range: This alliance is currently known from western Colorado, northwestern Montana, and southern Idaho.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL005868 *Elymus repens* Ruderal Grassland

AUTHORSHIP

Primary Concept Source: J. Coles, in Faber-Langendoen et al. (2013)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2016/11/23

REFERENCES

References: Beetle 1955, Faber-Langendoen et al. 2017b, Gross and Werner 1982

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2. Shrub & Herb Vegetation
2.B.2.Na. Western North American Grassland & Shrubland
G624. Western North American Interior Ruderal Grassland & Shrubland

A4191. Rumex crispus - (other FAC & Dryland Forb Species) Ruderal Meadow Alliance [Low - Poorly Documented]

Type Concept Sentence:

OVERVIEW

Scientific Name: *Rumex crispus* - (other FAC & Dryland Forb Species) Ruderal Meadow Alliance
Common Name (Translated Scientific Name): Curly Dock - (and other FAC & Dryland Forb Species) Ruderal Meadow Alliance
Colloquial Name: Ruderal FAC & Dryland Forb Meadow

Type Concept:

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics:

VEGETATION

Physiognomy and Structure:

Floristics:

ENVIRONMENT & DYNAMICS

Environmental Description:

Dynamics:

DISTRIBUTION

Geographic Range:

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL005621 *Rumex crispus* Ruderal Grassland

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2015)
Author of Description:
Acknowledgments:

REFERENCES

2.B.2.Nb. Central North American Grassland & Shrubland

This division is found in the central plains of North America, and is dominated by grassland vegetation commonly referred to as shortgrass, mixedgrass and tallgrass prairie, interspersed with evergreen and deciduous shrublands. The vegetation occurs on either glaciated or non-glaciated substrates, rolling to rugged topography, and fine-textured to coarse-textured soils, and natural disturbances include grazing and fire.

M051. Great Plains Mixedgrass & Fescue Prairie

The macrogroup is dominated by mixed grasses and scattered to moderately dense shrubs. It is found from northern Texas to southern Alberta across to southwest in the region between the tallgrass prairies to the east and the shortgrass prairies to the west.

It occurs on both glaciated and non-glaciated substrates on a wide variety of landforms, and natural disturbances include grazing and fire.

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
2.B.2.Nb.2.a. M051 Great Plains Mixedgrass & Fescue Prairie

G133. Central Great Plains Mixedgrass Prairie

Type Concept Sentence: This group occurs in the central Great Plains where grasslands are dominated by *Bouteloua curtipendula, Pascopyrum smithii*, and *Schizachyrium scoparium*, often with tallgrass or shortgrass species present to codominant.

OVERVIEW

Scientific Name: *Schizachyrium scoparium - Bouteloua curtipendula - Pascopyrum smithii* Mixedgrass Prairie Group
Common Name (Translated Scientific Name): Little Bluestem - Sideoats Grama - Western Wheatgrass Mixedgrass Prairie Group
Colloquial Name: Seep Muhly Grassland

Type Concept: This mixedgrass prairie group ranges from South Dakota into the Rolling Plains and the western Edwards Plateau of Texas. The loessal regions in west-central Kansas and central Nebraska, the Red Hills region of south-central Kansas and northern Oklahoma are all located within this group. Because of its proximity to other ecoregions, this group contains elements from both shortgrass and tallgrass prairies, which combine to form the mixedgrass prairie group throughout its range. The distribution, species richness and productivity of plant species within the mixedgrass group is controlled primarily by environmental conditions, in particular soil moisture and topography. Grazing and fire are important dynamic processes in this group. The relative dominance of the various grass and forb species within different associations in the group also can strongly depend on the degree of natural or human disturbance. This group can contain grass species such as *Andropogon gerardii, Hesperostipa comata*, and *Sporobolus heterolepis*, although the majority of the associations within the region are dominated by *Pascopyrum smithii* or *Schizachyrium scoparium*, often with substantial *Bouteloua gracilis* or *Bouteloua curtipendula*. *Muhlenbergia reverchonii* can be a dominant in the southern part of the group's range. Numerous forb and sedge species (*Carex* spp.) can also occur within the mixedgrass group in the western Great Plains. *Bouteloua dactyloides (= Buchloe dactyloides)* and *Yucca glauca* can be common in drier or overgrazed areas. Some common forb species include *Ambrosia psilostachya, Echinacea angustifolia*, and *Lygodesmia juncea*. Oak species such as *Quercus macrocarpa* can occur also in areas protected from fire due to topographic position, which may resemble an oak savanna, and fire suppression may result in a closed canopy and expansion of bur oak beyond sheltered areas. Likewise, within the mixedgrass prairie, small seeps may occur, especially during the wettest years. Although these are not considered a separate group, the suppression of fire within the region has enabled the invasion of both exotics and some shrub species such as *Juniperus virginiana* and also allowed for the establishment of *Pinus ponderosa* in the northwestern parts of the range.

Classification Comments: This group was originally split into a dry group and a mesic group. It was combined into one group as the difference between mesic and dry appeared more appropriately separated at the alliance level.

Similar NVC Types: This group contains elements from both Great Plains Shortgrass Prairie Group (G144) and Central Tallgrass Prairie Group (G333). It is similar in structure and contains some similar species to both Northern Great Plains Mesic Mixedgrass Prairie Group (G141) and Northern Great Plains Dry Mixedgrass Prairie Group (G331).

- G144 Great Plains Shortgrass Prairie
- G141 Northern Great Plains Mesic Mixedgrass Prairie
- G068 Great Plains Sand Grassland
- G333 Central Tallgrass Prairie

Diagnostic Characteristics: This group contains elements from both shortgrass prairies to the west and tallgrass prairies to the north and east, which combine to form the mixedgrass prairie group throughout its range. Dominance by some combination of *Schizachyrium scoparium, Bouteloua curtipendula*, and *Bouteloua gracilis* in the central Great Plains is characteristic.

VEGETATION

Physiognomy and Structure: The vegetation is characterized by a dense to sparse mixture of tall, mid, and short grasses interspersed with forbs. Woody vegetation is uncommon in most examples but can become common in the prolonged absence of fire, especially in the wetter, eastern part of this group's range.

Floristics: This group typically contains mixedgrass species such as *Pascopyrum smithii, Bouteloua curtipendula, Schizachyrium scoparium, Hesperostipa comata, Sporobolus heterolepis*, and *Bouteloua gracilis*. Some tallgrass species may be common, such as *Andropogon gerardii, Sorghastrum nutans*, and *Panicum virgatum*. *Bouteloua dactyloides (= Buchloe dactyloides)* can become

common on overgrazed sites. Common forb species include *Ambrosia psilostachya, Echinacea angustifolia*, and *Lygodesmia juncea*. Scattered patches of trees, often *Juniperus virginiana* and *Quercus macrocarpa* but also *Pinus ponderosa* in the northwest, and shrubs, typically *Artemisia filifolia* (on sandier soils), *Gutierrezia sarothrae, Prosopis glandulosa* (in the south), *Prunus virginiana*, and *Yucca glauca*, occur in some stands and these can increase in the prolonged absence of fire.

ENVIRONMENT & DYNAMICS

Environmental Description: Topographic and soil characteristics also vary across the range of this group. It is often characterized by rolling to extremely hilly landscapes with soils developed from loess, shale, limestone, or sandstone parent material. Mollisol soils are most prevalent and range from silt loams and silty clay loams with sandy loams possible on the western edge of the range. The Red Hills region of Kansas and Oklahoma, which contains examples of this group, contains somewhat unique soil characteristics and has developed from a diversity of sources including red shale, red clay, sandy shale, siltstone, or sandstone. These soils have developed a characteristic reddish color from the primary material. They can consist of silt, loam, or clay and can have textures ranging from fine sandy loam to a more clayey surface.

Dynamics: Fire and grazing are the primary processes occurring within the group. The diversity in this mixedgrass group likely reflects both the short- and long-term responses of the vegetation to these often concurrent disturbance regimes. Fire suppression and overgrazing can lead to the invasion of woody species such as *Juniperus virginiana* and *Pinus ponderosa*. Likewise, fire suppression may lead to a more closed canopy of *Quercus macrocarpa*.

DISTRIBUTION

Geographic Range: This group is found throughout the central and southern areas of the Western Great Plains ranging from southern South Dakota and possibly southern North Dakota into Texas with a few occurrences in the tallgrass-dominated landscapes of western Iowa, eastern Nebraska, and northwestern Missouri.

Spatial Scale & Pattern [optional]: Matrix
Nations: CA, US
States/Provinces: CO, IA, KS, ND, NE, NM, OK, SD, TX
TNC Ecoregions [optional]: 27:P, 28:P, 29:C, 32:C, 33:C, 36:C, 37:P
USFS Ecoregions (2007): 223A:??, 251A:CP, 251B:CC, 251E:CP, 251F:CC, 251H:CC, 255A:??, 315F:CC, 331B:CC, 331C:CC, 331E:CC, 331F:CC, 331H:CC, 331I:CC, 331M:CP, 332B:CC, 332C:CC, 332D:CC, 332E:CC, 332F:CC
Omernik Ecoregions: 9.4.2.27:C, 9.4.2.27d:C, 9.4.2.27g:C, 9.4.2.27h:C, 9.4.2.27i:C, 9.4.2.27k:C, 9.4.2.27l:C, 9.4.2.27n:C, 9.4.2.27o:C, 9.4.2.27r:C, 9.4.3.26:C, 9.4.3.26a:C, 9.4.3.26c:C
Federal Lands [optional]: DOD (Fort Hood)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** Blue Grama - Western Wheatgrass (704) (Shiflet 1994)
- **<** Bluestem - Grama (709) (Shiflet 1994)
- **>** Bluestem - Grama Prairie (604) (Shiflet 1994)
- **>** Eastern Redcedar: 46 (Eyre 1980) [Only on really degraded sites.]

LOWER LEVEL UNITS

Alliances:

- A4042 *Schizachyrium scoparium - Bouteloua curtipendula* Central Great Plains Grassland Alliance
- A4038 *Rhus trilobata* Great Plains Shrubland Alliance
- A4039 *Pascopyrum smithii - Bouteloua gracilis* Great Plains Grassland Alliance
- A4040 *Muhlenbergia reverchonii* Grassland Alliance

AUTHORSHIP

Primary Concept Source: S. Menard and K. Kindscher, in Faber-Langendoen et al. (2011)
Author of Description: S. Menard, K. Kindscher, D. Faber-Langendoen and J. Drake
Acknowledgments: B. Hoagland
Version Date: 05/07/2015
Classif Resp Region: Midwest
Internal Author: SEM 12-10, mod. DFL/BH 10-13, mod. JD 5-15

REFERENCES

References: Barbour and Billings 1988, Comer et al. 2003, Eyre 1980, Faber-Langendoen et al. 2017a, Ricketts et al. 1999, Shiflet 1994, Tolstead 1941, Tolstead 1942, Weaver and Albertson 1956, Weaver and Bruner 1948

2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G133. Central Great Plains Mixedgrass Prairie

A4040. Muhlenbergia reverchonii Grassland Alliance

Type Concept Sentence: This alliance consists of grasslands of limestone slopes and associated seeps of the Edwards Plateau and central Oklahoma where *Muhlenbergia reverchonii* is dominant or codominant.

OVERVIEW

Scientific Name: *Muhlenbergia reverchonii* Grassland Alliance
Common Name (Translated Scientific Name): Seep Muhly Grassland Alliance
Colloquial Name: Seep Muhly Grassland

Type Concept: This alliance consists of grasslands of limestone slopes and associated seeps of the Edwards Plateau and the Arbuckle Mountains of Oklahoma. This type is characterized by *Muhlenbergia reverchonii*, vernally moist to wet from seepage flow; examples often co-occur with clumps of *Juniperus virginiana* and *Juniperus ashei*. Other typical species include *Stenaria nigricans (= Hedyotis nigricans)* and *Dodecatheon meadia*. In Texas, this alliance occurs in a matrix of *Juniperus ashei* and *Quercus fusiformis* woodlands. Dominant species include *Muhlenbergia reverchonii* and *Bouteloua hirsuta var. pectinata (= Bouteloua pectinata)*. Other species present include *Andropogon glomeratus, Eupatorium serotinum, Heliotropium tenellum, Schizachyrium scoparium*, and *Dodecatheon meadia*.

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: This alliance is characterized by sites wet in the spring or from seepage and dominated by *Muhlenbergia reverchonii*.

VEGETATION

Physiognomy and Structure: This alliance is dominated by mid grasses. Sites are often with clumps of short trees and may be partially shaded by them.

Floristics: This type is characterized by *Muhlenbergia reverchonii*, vernally moist to wet from seepage flow; examples often co-occur with clumps of *Juniperus virginiana* and *Juniperus ashei*. Other typical species include *Stenaria nigricans (= Hedyotis nigricans)* and *Dodecatheon meadia*. In Texas, this alliance occurs in a matrix of *Juniperus ashei* and *Quercus fusiformis* woodlands. Dominant species include *Muhlenbergia reverchonii* and *Bouteloua hirsuta var. pectinata (= Bouteloua pectinata)*. Other species present include *Schizachyrium scoparium* and *Dodecatheon meadia*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance consists of grasslands of limestone slopes and associated seeps of the Edwards Plateau and central Oklahoma, and small-patch occurrences (mostly less than 1 acre in size) in the Fort Worth Prairie and Western Crosstimbers regions of Texas and to a lesser extent the Whiterock Cuesta of the Blackland Prairie region of Texas.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance occurs in the Edwards Plateau of Texas and the Arbuckle Mountains of Oklahoma.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Muhlenbergia reverchonii* herbaceous alliance (Hoagland 1998a)

LOWER LEVEL UNITS

Associations:

- CEGL004785 *Muhlenbergia reverchonii - Croton monanthogynus* Grassland
- CEGL004520 *Muhlenbergia reverchonii - Bouteloua hirsuta var. pectinata - Carex microdonta* Grassland
- CEGL004219 *Muhlenbergia reverchonii - Bouteloua curtipendula - Desmanthus velutinus* Grassland

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments: We have incorporated significant descriptive information previously compiled by B. Hoagland.
Version Date: 2014/12/18

REFERENCES

References: Dale 1959, Faber-Langendoen et al. 2017b, Hoagland 1998a

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G133. Central Great Plains Mixedgrass Prairie

A4039. Pascopyrum smithii - Bouteloua gracilis Great Plains Grassland Alliance

Type Concept Sentence: This alliance is found in the southwestern Great Plains to western New Mexico where *Pascopyrum smithii* and *Bouteloua gracilis* dominate in swales and valleys.

OVERVIEW

Scientific Name: *Pascopyrum smithii - Bouteloua gracilis* Great Plains Grassland Alliance
Common Name (Translated Scientific Name): Western Wheatgrass - Blue Grama Great Plains Grassland Alliance
Colloquial Name: Great Plains Western Wheatgrass - Blue Grama Grassland

Type Concept: This alliance of the southern Great Plains, Chihuahuan Desert and western New Mexico mountains of the United States was once an extensive grassland. Ground cover is characterized by scattered bunchgrasses and patches of the rhizomatous grasses and litter with exposed soil and gravel in the intergrass spaces. Luxuriant cover that can be dominated by either *Bouteloua gracilis* or *Pascopyrum smithii* typifies this grassland. Graminoid diversity is usually low, with scattered grasses such as *Elymus elymoides, Koeleria macrantha*, and *Muhlenbergia repens* often present. In Kansas, *Bouteloua curtipendula* and *Bouteloua dactyloides (= Buchloe dactyloides)* may also be present. The shrub layer is very open and moderate in diversity and generally includes *Atriplex canescens* and *Krascheninnikovia lanata* (which both occur as phases and can become dominant in disturbed areas), as well as *Cylindropuntia imbricata (= Opuntia imbricata)* and *Opuntia phaeacantha*. Forb diversity and cover are generally low. Stands occur within montane swales or along upland valley bottoms. It generally occurs on northerly or northeasterly aspects at elevations between 915 and 2440 m (3000-8000 feet). Slopes are typically gentle with fine-textured and well-developed soils that are predominantly from eroded Paleozoic sandstone and limestone.

Classification Comments: This alliance currently contains only one association (CEGL001578). This alliance should be considered in relation to *Pascopyrum smithii - Nassella viridula* Northwestern Great Plains Grassland Alliance (A4031). This alliance (A4039) has similar dominants, though it occurs further south than A4031.

Internal Comments:
Other Comments:

Similar NVC Types:

- A4031 *Pascopyrum smithii - Nassella viridula* Northwestern Great Plains Grassland Alliance: is found in the northern Great Plains; diagnostic criteria for these two alliances in the northern Great Plains are not well-established.

Diagnostic Characteristics: This alliance is characterized by stands dominated by *Pascopyrum smithii* and *Bouteloua gracilis*.

VEGETATION

Physiognomy and Structure: This is an herbaceous alliance, dominated by short to mid-height graminoids. Mid grasses are the dominant vegetation in most examples of this alliance, although short grasses can be codominant. The vegetation tends to be denser where the mid grasses are predominant and more open where shorter graminoids are abundant. The mid grasses grow to

0.5-1.0 m on favorable sites, while the short grasses are less than 0.5 m tall. Both forb and shrub species are minor in this alliance. If shrubs are present, they are typically less than 1 m in height.

Floristics: Luxuriant cover that can be dominated by either *Bouteloua gracilis* or *Pascopyrum smithii* typifies this grassland. *Juniperus monosperma* or *Pinus edulis* communities usually surround this swale association the mountains of New Mexico. In New Mexico, *Atriplex canescens* is the most frequently occurring and abundant shrub, with *Ericameria nauseosa, Opuntia phaeacantha*, and *Gutierrezia sarothrae* common associates, but overall cover seldom exceeds 2.5%. Graminoid diversity is usually low, with scattered grasses such as *Elymus elymoides, Koeleria macrantha*, and *Muhlenbergia repens* often present. In Kansas, *Bouteloua curtipendula* and *Bouteloua dactyloides (= Buchloe dactyloides)* may also be present. The shrub layer is very open and moderate in diversity and generally includes *Atriplex canescens* and *Krascheninnikovia lanata* (which both occur as phases and can become dominant in disturbed areas), as well as *Cylindropuntia imbricata (= Opuntia imbricata)* and *Opuntia phaeacantha*. Forb diversity and cover are generally low. In New Mexico, forbs are common but variable; the most abundant are *Artemisia campestris ssp. caudata, Engelmannia peristenia, Glandularia bipinnatifida*, and *Penstemon virgatus*. Trees and shrubs are accidental or absent.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands occur within montane swales or along upland valley bottoms. It generally occurs on northerly or northeasterly aspects at elevations between 915 and 2500 m (3000-8000 feet). Slopes are typically gentle with fine-textured and well-developed soils that are predominantly from eroded Paleozoic sandstone and limestone. In Kansas, stands are common on nearly level uplands or shallow depressions in uplands. Soils are silty clay loam with an impermeable or slowly permeable claypan subsoil layer. Ground cover is characterized by scattered bunchgrasses and patches of the rhizomatous grasses and litter with exposed soil and gravel in the intergrass spaces.

Dynamics: *Pascopyrum smithii* is rhizomatous and is tolerant of moderate grazing. If severely overgrazed, *Pascopyrum smithii* will decline and may be replaced by less desirable warm-season grasses and exotic species such as *Poa pratensis*.

DISTRIBUTION

Geographic Range: This alliance is found in the southern Great Plains, Chihuahuan Desert and western New Mexico mountains in the United States, ranging from Colorado and Kansas south to Texas. It has also been reported from Wyoming.

Nations: CA, US
States/Provinces: CO, KS, NE?, NM, OK, TX, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL001578 *Pascopyrum smithii - Bouteloua gracilis* Grassland

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Branson et al. 1964, Branson et al. 1965, Bujakiewicz 1975, Bunin 1985, Costello 1944b, Culwell and Scow 1982, Dick-Peddie 1993, Donart et al. 1978a, Faber-Langendoen et al. 2017b, Hadley and Branson 1965, Hanson et al. 1931, Johnston 1987, Moir 1969b, Muldavin and Mehlhop 1992, Mutel 1976, Ramaley 1927, Rogers 1953, Shantz 1906, Shantz 1923, Soil Conservation Service 1978, Vestal 1919, Weaver and Albertson 1956, Wooten 1980

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G133. Central Great Plains Mixedgrass Prairie

A4038. Rhus trilobata Great Plains Shrubland Alliance

Type Concept Sentence: This alliance has been identified in the northern panhandle of Texas but is likely more widespread in the southwestern Great Plains. It occurs on steep talus slopes with a moderate short-shrub canopy dominated by *Rhus trilobata* with lesser amounts of *Dalea formosa, Mimosa borealis*, and *Yucca glauca* and a herbaceous layer dominated by *Bouteloua curtipendula* and *Schizachyrium scoparium*.

OVERVIEW

Scientific Name: *Rhus trilobata* Great Plains Shrubland Alliance
Common Name (Translated Scientific Name): Skunkbush Sumac Great Plains Shrubland Alliance
Colloquial Name: Great Plains Skunkbush Sumac Shrubland

Type Concept: This alliance has been identified in the northern panhandle of Texas and Oklahoma, but is likely more widespread in the southwestern Great Plains. There is a moderate short-shrub canopy dominated by *Rhus trilobata* with lesser amounts of *Dalea formosa, Mimosa borealis*, and *Yucca glauca*. North-facing slopes often have denser shrub cover. There are also scattered individuals of *Ptelea trifoliata* and shrubby *Celtis laevigata* scattered throughout. *Bouteloua curtipendula* and *Schizachyrium scoparium* dominate the moderate to dense herbaceous stratum. Many other herbaceous species, including *Andropogon gerardii, Bouteloua hirsuta, Erioneuron pilosum, Elymus canadensis, Eriogonum longifolium*, and *Tetraneuris scaposa*, can occur in this type, but none are abundant. This alliance occurs on steep talus slopes consisting of large and small boulders. Stands occur on north- and south-facing slopes and typically have loamy soils.

Classification Comments: This alliance currently has one association that was described from a location in the Texas Panhandle. *Rhus trilobata* communities in the southwestern Great Plains are more widespread and more diverse than is reflected in this description.

Internal Comments: BH 10-13: OK added.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: This alliance occurs in the southwestern Great Plains on rocky slopes with >25% canopy of short shrubs. *Rhus trilobata* is the most abundant shrub. Short and mid grasses, particularly *Schizachyrium scoparium* and *Bouteloua curtipendula*, dominate the herbaceous stratum.

VEGETATION

Physiognomy and Structure: This alliance has a short-shrub (<1 m) canopy, typically with low to moderate cover (25-60%). Short and mid grasses can have moderate to dense cover. Scattered small trees may be present.

Floristics: The shrub stratum in this alliance is dominated or codominated by *Rhus trilobata*. Associated shrubs include *Dalea formosa, Mimosa borealis*, and *Yucca glauca* and scattered scrubby trees of *Ptelea trifoliata* and *Celtis laevigata*. *Bouteloua curtipendula* and *Schizachyrium scoparium* dominate the moderate to dense (30-50% cover) herbaceous stratum. Many other herbaceous species, including *Andropogon gerardii, Artemisia ludoviciana, Calylophus serrulatus, Chaetopappa ericoides (= Leucelene ericoides), Elymus canadensis, Eriogonum longifolium*, and *Tetraneuris scaposa*, can occur in this alliance, but none is abundant. Forbs are variable depending on site characteristics.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs on steep talus slopes consisting of large and small boulders. Stands occur on north- and south-facing slopes and typically have loamy soils.

Dynamics: *Rhus trilobata* has seeds that are impermeable and exhibit embryonic dormancy. Germination requires scarification either through cold stratification, fire, or animal ingestion. However, the primarily means of reproduction is vegetative through root sprouts which can result in dense thickets.

DISTRIBUTION

Geographic Range: This alliance has been identified only in Oklahoma and northern Texas but is likely more widespread on rocky slopes in the southwestern Great Plains.

Nations: US
States/Provinces: OK, TX
TNC Ecoregions [optional]:
USFS Ecoregions (2007):

Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL005026 *Rhus trilobata / Bouteloua curtipendula - Schizachyrium scoparium* Shrubland

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments: We have incorporated significant descriptive information previously compiled by B. Hoagland.
Version Date: 2014/12/18

REFERENCES

References: Belcher 1985, Faber-Langendoen et al. 2017b

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G133. Central Great Plains Mixedgrass Prairie

A4042. Schizachyrium scoparium - Bouteloua curtipendula Central Great Plains Grassland Alliance

Type Concept Sentence: This alliance is common in the central and southern Great Plains on slopes and rolling uplands where *Schizachyrium scoparium* and *Bouteloua curtipendula* are dominant or codominant, possibly with a variety of other short, mid, and tallgrass species.

OVERVIEW

Scientific Name: *Schizachyrium scoparium - Bouteloua curtipendula* Central Great Plains Grassland Alliance
Common Name (Translated Scientific Name): Little Bluestem - Sideoats Grama Central Great Plains Grassland Alliance
Colloquial Name: Central Great Plains Little Bluestem - Sideoats Grama Grassland

Type Concept: This alliance is found largely in the central and southern Great Plains with some occurrences in the northern Great Plains. It is widespread and common. Across its range, the vegetation is dominated by mid grasses. The vegetation cover can be moderately sparse to dense. Tall grasses and short grasses contribute substantially to the vegetation cover in most communities. The dominants are the nominal species *Schizachyrium scoparium* and *Bouteloua curtipendula*. *Bouteloua gracilis* and *Bouteloua hirsuta* are common associates across this alliance's range. Other graminoids that are present to codominant are *Andropogon gerardii, Andropogon hallii* (on sandier soils), *Bouteloua dactyloides (= Buchloe dactyloides)* (in the south and west of this alliance's range), *Calamovilfa longifolia* (on sandier soils), *Koeleria macrantha, Pascopyrum smithii, Sporobolus cryptandrus, Sporobolus compositus var. compositus* (in the south), and *Sporobolus heterolepis* (in the east). There are a great number of forbs that occur in communities of this alliance, although they do not make up a large part of the herbaceous canopy. *Ambrosia psilostachya, Amorpha canescens, Dalea purpurea, Echinacea angustifolia, Gaura coccinea, Liatris punctata, Lygodesmia juncea, Ratibida columnifera, Sphaeralcea coccinea, Symphyotrichum ericoides*, and *Symphyotrichum oblongifolium* are found in many communities in this alliance. Shrubs are not abundant, but *Artemisia filifolia, Artemisia frigida, Rhus trilobata, Rosa* spp., *Symphoricarpos occidentalis*, and *Yucca glauca* may be scattered among the herbaceous species. Communities within this alliance are most commonly found on slopes but can occur on level ground. Loam and silt soils appear to be the most common; however, in the southwest of this alliance's range, some communities are predominantly on sandy soils.

Classification Comments: Two associations in this alliance appear to represent the same or very similar communities. *Juniperus virginiana var. virginiana / Schizachyrium scoparium - Bouteloua curtipendula* Great Plains Grassland (CEGL004066) and *Juniperus virginiana var. virginiana / Schizachyrium scoparium* Wooded Grassland (CEGL004209) should be considered for merging or more clearly differentiated.

Internal Comments: mjr 6-16: MX? added based on members.
Other Comments:

Similar NVC Types:
- A4034 *Schizachyrium scoparium* Northwestern Great Plains Grassland Alliance: is found further north and west.
- A4058 *Schizachyrium scoparium - Bouteloua curtipendula - Sorghastrum nutans* Central Bedrock Grassland Alliance

- A4028 *Andropogon gerardii - Sorghastrum nutans* Mixedgrass Western Plains Grassland Alliance
- A1919 *Juniperus virginiana / Schizachyrium scoparium - Bouteloua curtipendula* Alkaline Bedrock Scrub Grassland Alliance

Diagnostic Characteristics: This alliance is concentrated in the central and southern Great Plains. Stands are mixedgrass communities dominated by *Schizachyrium scoparium*, often with *Bouteloua curtipendula* and possibly a variety of other grasses.

VEGETATION

Physiognomy and Structure: Across its range, this alliance is dominated by mid grasses. The vegetation cover can be moderately sparse to dense. Tall and short grasses contribute substantially to the vegetation cover in most communities. The proportions of these two lifeforms are typically negatively correlated with each other and vary with the specific community and site. The tall grasses are more prevalent on sandier soils and on moderate or gentle lower slopes. The short grasses tend to be more common on flat uplands or steep slopes with heavier soils (Weaver and Albertson 1956). Shrubs and small trees are usually absent or rare but can become common in the absence of fire, particularly in the eastern portion of this alliance's range.

Floristics: The dominants are the nominal species *Schizachyrium scoparium* and *Bouteloua curtipendula*. *Bouteloua gracilis* and *Bouteloua hirsuta* are common associates across this alliance's range. Other graminoids that are present to codominant are *Andropogon gerardii, Andropogon hallii* (on sandier soils), *Bouteloua dactyloides (= Buchloe dactyloides)* (in the south and west of this alliance's range), *Calamovilfa longifolia* (on sandier soils), *Koeleria macrantha, Pascopyrum smithii, Sporobolus cryptandrus, Sporobolus compositus var. compositus* (in the south), and *Sporobolus heterolepis* (in the east). There are a great number of forbs that occur in communities of this alliance, although they do not make up a large part of the herbaceous canopy. *Ambrosia psilostachya, Amorpha canescens, Dalea purpurea, Echinacea angustifolia, Gaura coccinea, Liatris punctata, Lygodesmia juncea, Ratibida columnifera, Sphaeralcea coccinea, Symphyotrichum ericoides*, and *Symphyotrichum oblongifolium* are found in many communities in this alliance. Shrubs are not abundant, but *Artemisia filifolia, Artemisia frigida, Rhus trilobata, Rosa* spp., *Symphoricarpos occidentalis*, and *Yucca glauca* may be scattered among the herbaceous species. In the eastern portion of this alliance's range, *Juniperus virginiana* can become abundant in the absence of fire or other methods of control.

ENVIRONMENT & DYNAMICS

Environmental Description: Communities within this alliance are most commonly found on slopes but can occur on level ground. Soils and substrates vary considerably for this alliance. Loam and silt soils appear to be the most common; however, in the southwest of this alliance's range, some communities are predominantly on sandy soils (Weaver and Albertson 1956). Some communities are found on loess soils.

Dynamics: Fire is important to prevent the invasion of woody species into stands, especially in the eastern portion of this alliance's range. However, fire is not as important as in more mesic grasslands, because drought conditions slow encroachment by woody species.

DISTRIBUTION

Geographic Range: This alliance is common from the central Great Plains south to northern Texas and has scattered occurrences in the north-central Great Plains.

Nations: MX?, US
States/Provinces: CO, IA, KS, MO, ND, NE, OK, SD, TX
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** *Schizachyrium scoparium / Juniperus virginiana* herbaceous alliance (Hoagland 1998a)
- **><** Bluestem-Grama Prairie (Küchler 1974)
- **><** Cedar Hills Prairie (Küchler 1974)
- **><** Chalkflat Prairie (Küchler 1974)
- **?** Mixed prairie [*Stipa-Bouteloua* association] (Bruner 1931)
- **?** T5B1aI1a. *Schizachyrium scoparium* (Foti et al. 1994)
- **?** T5B1aI1c. *Bouteloua curtipendula* (Foti et al. 1994)
- **?** Various communities (Weaver and Albertson 1956)

LOWER LEVEL UNITS

Associations:

- CEGL002246 *Schizachyrium scoparium - Bouteloua curtipendula - Bouteloua gracilis* Central Plains Grassland
- CEGL002238 *Hilaria belangeri - Bouteloua curtipendula* Grassland
- CEGL005031 *Sporobolus cryptandrus - Schizachyrium scoparium - Bouteloua curtipendula* Grassland
- CEGL002247 *Schizachyrium scoparium - Bouteloua curtipendula* Chalkflat Grassland
- CEGL002036 *Schizachyrium scoparium - Bouteloua curtipendula* Loess Mixedgrass Grassland
- CEGL002035 *Schizachyrium scoparium - Bouteloua curtipendula - Bouteloua hirsuta - (Yucca glauca)* Grassland
- CEGL002248 *Schizachyrium scoparium - Bouteloua curtipendula* Red Hills Grassland
- CEGL004066 *Juniperus virginiana var. virginiana / Schizachyrium scoparium - Bouteloua curtipendula* Great Plains Grassland
- CEGL001594 *Schizachyrium scoparium - Bouteloua curtipendula* Western Great Plains Grassland
- CEGL002252 *Schizachyrium scoparium - Lesquerella gordonii - Castilleja purpurea var. citrina* Grassland
- CEGL004209 *Juniperus virginiana var. virginiana / Schizachyrium scoparium* Wooded Grassland
- CEGL004070 *Schizachyrium scoparium - Bouteloua curtipendula - Nassella leucotricha* Grassland

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments: We have incorporated significant descriptive information previously compiled by B. Hoagland.
Version Date: 2014/12/18

REFERENCES

References: Bruner 1931, Diamond 1993, Faber-Langendoen et al. 2017b, Foti et al. 1994, Hansen and Hoffman 1988, Hoagland 1997, Hoagland 1998a, Johnston 1987, Küchler 1974, Lauver et al. 1999, Nelson 1985, Soil Conservation Service 1978, Weaver and Albertson 1956

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
2.B.2.Nb.2.c. M051 Great Plains Mixedgrass & Fescue Prairie

G141. Northern Great Plains Mesic Mixedgrass Prairie

Type Concept Sentence: This group is widespread in the northern Great Plains and has scattered occurrences in the western Great Plains; sites are dominated by a mixture of short, medium, and tall grasses, including *Andropogon gerardii, Carex inops ssp. heliophila, Carex filifolia, Nassella viridula, Panicum virgatum, Pascopyrum smithii, Schizachyrium scoparium*, and *Sorghastrum nutans*.

OVERVIEW

Scientific Name: *Pascopyrum smithii - Hesperostipa comata - Schizachyrium scoparium* Mixedgrass Prairie Group
Common Name (Translated Scientific Name): Western Wheatgrass - Needle-and-Thread - Little Bluestem Mixedgrass Prairie Group
Colloquial Name: Western Plains Mixedgrass Grassland

Type Concept: This mixedgrass group is widespread from northern Nebraska into southern Canada and westward to the Rocky Mountain Front Range in Montana and Wyoming, on both glaciated and non-glaciated substrates. It also extends south along the Front Range to northeastern New Mexico and western Oklahoma. The vegetation is dominated by moderate to moderately dense medium-tall grasses or sometimes, in the western Great Plains and Sandhills of Nebraska, a mix of tall and medium-tall grasses. Shrubs are usually scattered or absent but can form dense, local patches, particularly in swales or low areas. Dominant species include *Pascopyrum smithii, Schizachyrium scoparium, Carex inops ssp. heliophila*, and *Carex filifolia*. In Montana, this includes *Festuca idahoensis*. Sites with a strong component of *Nassella viridula* indicate a more favorable moisture balance and perhaps a favorable grazing regime as well because this is one of the most palatable of the midgrasses. *Calamovilfa longifolia* is often found with high cover values on sandier soils, and *Koeleria macrantha* cover increases on degraded sites. Common or dominant tallgrasses in the western Great Plains are *Andropogon gerardii, Panicum virgatum*, and *Sorghastrum nutans*. Other common species include *Bouteloua curtipendula, Bouteloua gracilis, Hesperostipa curtiseta, Hesperostipa neomexicana, Muhlenbergia montana, Pseudoroegneria spicata, Sorghastrum nutans*, and *Sporobolus cryptandrus*. Common woody species include *Amelanchier alnifolia, Artemisia cana, Dasiphora fruticosa ssp. floribunda, Juniperus horizontalis, Prunus virginiana, Rhus trilobata*, and *Symphoricarpos occidentalis*. Some examples may range into more of a shrub-steppe. Fire and grazing constitute the primary dynamics affecting this group. Drought can also impact it, in general favoring the shortgrass component at the expense of the midgrasses. With intensive grazing, cool-season exotics such as *Poa pratensis, Bromus inermis*, and *Bromus arvensis (= Bromus japonicus)* can increase in dominance. Shrub species such as *Juniperus virginiana* can also increase in dominance with fire suppression. Conversion to

agriculture likewise has decreased the range of this group. This group occurs on a wide variety of landforms (e.g., mesatops, stream terraces) and in proximity to a diversity of other groups. Soils range from fine-textured loams to sandy or gravelly soils.

Classification Comments: This group originally included all mixedgrass prairies in the northwestern Great Plains, then was split into mesic and dry components (G331 was the dry mixedgrass prairie), was re-formed as a single group, and then re-split into Northern Great Plains Dry Mixedgrass Prairie Group (G331) and this group (G141). The range of the group, as currently defined, extends into northeastern New Mexico in the form of western Great Plains tallgrass prairies. The Colorado and New Mexico stands should possibly be moved to a separate group [see *Andropogon gerardii - Schizachyrium scoparium* Western Great Plains Grassland (CEGL001463)].

Similar NVC Types:
- G273 Central Rocky Mountain Lower Montane, Foothill & Valley Grassland
- G133 Central Great Plains Mixedgrass Prairie
- G331 Northern Great Plains Dry Mixedgrass Prairie
- G332 Northern Great Plains Rough Fescue Prairie
- G068 Great Plains Sand Grassland

Diagnostic Characteristics: This group is dominated by medium-tall graminoids, or tall and medium-tall grasses in the western Great Plains, particularly the midgrasses *Nassella viridula, Pascopyrum smithii*, and *Schizachyrium scoparium* and tallgrasses *Andropogon gerardii, Panicum virgatum*, and *Sorghastrum nutans*, and occurs in the northwestern Great Plains and along the Front Range south to northeastern New Mexico. The group also includes shrub-dominated sites with abundant *Amelanchier alnifolia, Dasiphora fruticosa ssp. floribunda, Juniperus horizontalis, Prunus americana, Prunus virginiana*, and *Symphoricarpos occidentalis*. Sites dominated by *Festuca* spp. are in a separate group with the exception of *Festuca idahoensis* stands in Great Plains of central Montana and Wyoming which are left here.

VEGETATION

Physiognomy and Structure: The vegetation is characterized by a dense to sparse mixture of tall and short grasses interspersed with forbs. Dwarf-shrubs can be dominant in some stands in the northern part of the group's range and medium or tall shrubs (1-3 m tall) can be locally common to dense.

Floristics: Dominant species include *Pascopyrum smithii, Schizachyrium scoparium, Carex inops ssp. heliophila*, and *Carex filifolia*. In Montana, this includes *Festuca idahoensis*. Sites with a strong component of *Nassella viridula* indicate a more favorable moisture balance and perhaps a favorable grazing regime as well because this is one of the most palatable of the midgrasses. *Calamovilfa longifolia* is often found with high cover values on sandier soils, and *Koeleria macrantha* cover increases on degraded sites. Common or dominant tallgrasses in the western Great Plains are *Andropogon gerardii, Panicum virgatum*, and *Sorghastrum nutans*. Other common species include *Bouteloua curtipendula, Bouteloua gracilis, Hesperostipa curtiseta, Hesperostipa neomexicana, Muhlenbergia montana, Pseudoroegneria spicata, Sorghastrum nutans*, and *Sporobolus cryptandrus*. *Hesperostipa comata* may be present but sites where it is abundant are usually too dry for this group. Common woody species include *Amelanchier alnifolia, Artemisia cana, Dasiphora fruticosa ssp. floribunda, Juniperus horizontalis, Prunus virginiana, Rhus trilobata*, and *Symphoricarpos occidentalis*.

ENVIRONMENT & DYNAMICS

Environmental Description: This group occurs on a wide variety of landforms and in proximity to a diversity of other groups. Climate and growing season length for the region in which it occurs are intermediate to the shortgrass regions to the west and southwest and the tallgrass regions to the east. Soils range from loams, clay loams, silty clays, and clays to more coarse-textured sandy or gravelly soils. Some examples may include an impermeable or slowly permeable claypan subsoil layer.

Dynamics: Fire and grazing constitute the primary dynamics affecting this group. Drought can also impact it, in general favoring the shortgrass component at the expense of the midgrasses. With intensive grazing, cool-season exotics such as *Poa pratensis, Bromus inermis*, and *Bromus arvensis* can increase in dominance. Shrub species such as *Juniperus virginiana* can also increase in dominance with fire suppression. Conversion to agriculture likewise has decreased the range of this group.

DISTRIBUTION

Geographic Range: This group occurs throughout the Western Great Plains from northern Nebraska into southern Canada, and west to central Montana. It also occurs in a narrow to broad transitional band between the Rocky Mountains and the Shortgrass Steppe ranging from the Rocky Mountain foothills and piedmont and adjacent plains, extending farther east on the Palmer Divide, north alongside the Chalk Bluffs near the Colorado-Wyoming border, and south on and below mesas and escarpments in southeastern Colorado, northeastern New Mexico, and the panhandles of Oklahoma and Texas.

Spatial Scale & Pattern [optional]: Large patch
Nations: CA, US
States/Provinces: AB, CO, KS, MB, MT, ND, NE, NM, OK, SD, SK, TX?, WY
TNC Ecoregions [optional]: 10:C, 20:C, 21:C, 24:C, 25:P, 26:P, 27:C, 28:P, 33:C, 34:C, 66:P, 67:C
USFS Ecoregions (2007): 315A:CC, 315B:CC, 315H:CC, 331B:CC, 331C:CC, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 331J:CC, 331K:CC, 331L:CC, 331M:CC, 331N:CC, 332B:CC, 332C:CC, 332D:CC, 342A:CP, 342F:CC, 342G:CC, M313A:CP, M313B:CC, M331A:CP, M331B:CC, M331F:CC, M331G:CC, M331I:CC, M331J:C?, M334A:CC, M341A:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** Bluestem Prairie (601) (Shiflet 1994)
- **>** Bluestem Prairie (710) (Shiflet 1994)
- **><** Fescue Grassland (613) (Shiflet 1994)
- **>** Wheatgrass (610) (Shiflet 1994)
- **><** Wheatgrass - Bluestem - Needlegrass (606) (Shiflet 1994)
- **>** Wheatgrass - Grama (609) (Shiflet 1994)
- **>** Wheatgrass - Grama - Needlegrass (608) (Shiflet 1994)
- **>** Wheatgrass - Needlegrass (607) (Shiflet 1994)
- **><** Wheatgrass - Saltgrass - Grama (615) (Shiflet 1994)

LOWER LEVEL UNITS

Alliances:
- A0954 *Crataegus douglasii - Crataegus succulenta* Shrubland Alliance
- A4035 *Juniperus horizontalis - Dasiphora fruticosa ssp. floribunda / Schizachyrium scoparium* Shrubland Alliance
- A4036 *Prunus virginiana - Symphoricarpos occidentalis - Amelanchier alnifolia* Great Plains Shrubland Alliance
- A4034 *Schizachyrium scoparium* Northwestern Great Plains Grassland Alliance
- A4031 *Pascopyrum smithii - Nassella viridula* Northwestern Great Plains Grassland Alliance
- A1537 *Rhus trilobata / Schizachyrium scoparium - Carex filifolia* Shrub Grassland Alliance
- A4028 *Andropogon gerardii - Sorghastrum nutans* Mixedgrass Western Plains Grassland Alliance

AUTHORSHIP

Primary Concept Source: S. Menard, in Faber-Langendoen et al. (2011)
Author of Description: S. Menard and J. Drake
Acknowledgments:
Version Date: 05/07/2015
Classif Resp Region: Midwest
Internal Author: SEM 12-10, mod. JD 9-13, 5-15

REFERENCES

References: Bailey et al. 1994, Barbour and Billings 1988, Comer et al. 2003, Faber-Langendoen et al. 2017a, Hess and Wasser 1982, Lauenroth and Milchunas 1992, Lauver et al. 1999, MTNHP 2002b, Mast et al. 1997, Mast et al. 1998, Neely et al. 2001, Opler and Krizek 1984, Ricketts et al. 1999, Shiflet 1994, Weaver 1954, Weaver and Albertson 1956

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G141. Northern Great Plains Mesic Mixedgrass Prairie

A4028. Andropogon gerardii - Sorghastrum nutans Mixedgrass Western Plains Grassland Alliance

Type Concept Sentence: This alliance is found in the northern and western Great Plains on sites where moisture availability is greater than the surrounding landscape. The vegetation is characterized by a mix of tall and mid grasses within a mixedgrass landscape, commonly with *Andropogon gerardii, Bouteloua curtipendula, Sorghastrum nutans*, and *Schizachyrium scoparium*.

OVERVIEW

Scientific Name: *Andropogon gerardii - Sorghastrum nutans* Mixedgrass Western Plains Grassland Alliance
Common Name (Translated Scientific Name): Big Bluestem - Indiangrass Mixedgrass Western Plains Grassland Alliance
Colloquial Name: Western Plains Mixedgrass Grassland

Type Concept: This alliance is found in the western Great Plains from central North Dakota west to eastern Montana and south to northeastern New Mexico. The vegetation is characterized by a mix of tall and mid grasses within a mixedgrass landscape. *Andropogon gerardii, Bouteloua curtipendula, Sorghastrum nutans*, and *Schizachyrium scoparium* are common through most of the range. *Pascopyrum smithii, Panicum virgatum*, and *Sporobolus heterolepis* are often present to abundant. Through the broad range of this alliance, other grasses can be locally common, including *Hesperostipa spartea* and *Festuca idahoensis* in the north and *Muhlenbergia montana* and *Sporobolus cryptandrus* in the south. Shrubs can be scattered but are not abundant across large areas. It occurs west of the predominant tallgrass prairie on sites where moisture availability is greater than the surrounding landscape, such as riparian areas, swales, or on lower slopes. The greater moisture availability can be a result of coarse-textured surface soils and finer subsoils that allow rapid infiltration of precipitation or low areas in the landscape. In the central Dakotas and Nebraska where precipitation is more abundant, it can occur in a wider variety of settings.

Classification Comments: This alliance has a broad range from near the U.S.-Canadian border south along the Front Range to northeastern New Mexico. Splitting this alliance into a northern Great Plains and central Great Plains alliance should be investigated. This split could possibly involve *Andropogon gerardii - Schizachyrium scoparium* Northern Plains Grassland (CEGL002205), *Andropogon gerardii - Sporobolus heterolepis - Schizachyrium scoparium - Pascopyrum smithii* Grassland (CEGL002376), and the northern part of *Andropogon gerardii - Schizachyrium scoparium* Western Great Plains Grassland (CEGL001463) and *Andropogon gerardii - Sorghastrum nutans* Western Great Plains Grassland (CEGL001464), *Andropogon gerardii - Sporobolus heterolepis* Western Foothills Grassland (CEGL001465), vs. the southern part of CEGL001463. This would split the associations roughly along the Wyoming-Colorado border or a little south and would parallel the split between the northern and central mixedgrass prairie Northern Great Plains Mesic Mixedgrass Prairie Group (G141) and Central Great Plains Mixedgrass Prairie Group (G133). *Festuca idahoensis* and *Hesperostipa spartea* seem to be more common in the north, while *Muhlenbergia montana* and maybe *Sporobolus cryptandrus* are more common in the south.

Internal Comments:
Other Comments:

Similar NVC Types:
- A4042 *Schizachyrium scoparium - Bouteloua curtipendula* Central Great Plains Grassland Alliance: lacks dominance by tall grasses, though intermediate stands can be hard to classify.
- A4057 *Andropogon gerardii - Sorghastrum nutans - Coreopsis palmata* Central Grassland Alliance: can have similar dominants but occurs further east, has fewer mid grasses, and tends to have more forbs.
- A4056 *Andropogon gerardii - Panicum virgatum* Wet Prairie Alliance

Diagnostic Characteristics: This alliance is characterized by the dominance of tall and mid grasses in mixedgrass prairie landscape of the northern or western Great Plains. *Andropogon gerardii* and *Sorghastrum nutans* are the most common tallgrass dominants.

VEGETATION

Physiognomy and Structure: This is a mesic, tallgrass prairie alliance, dominated by a moderately dense to very dense layer of graminoids up to 2 m tall. Forbs are typically abundant in these vegetation types. Woody species are uncommon.

Floristics: The vegetation is characterized by a mix of tall and mid grasses within a mixedgrass landscape. *Andropogon gerardii, Bouteloua curtipendula, Sorghastrum nutans*, and *Schizachyrium scoparium* are common through most of the range. *Pascopyrum smithii, Panicum virgatum*, and *Sporobolus heterolepis* are often present to abundant. Through the broad range of this alliance, other grasses can be locally common, including *Hesperostipa spartea* and *Festuca idahoensis* in the north and *Muhlenbergia montana* and *Sporobolus cryptandrus* in the south. Trees and tall shrubs are infrequent in high-quality stands. Among those that may be found are scattered *Symphoricarpos occidentalis* (in the northern Great Plains), *Rhus* spp., and *Pinus ponderosa* (along the Front Range). In the far western extent, vegetation in this alliance is either relict true prairie found along the eastern foothills and floodplains of the Front Range of the Rocky Mountains or a western version of the northern tallgrass prairie along the Missouri basin. *Andropogon gerardii* is the major diagnostic species, as well as *Sorghastrum nutans, Panicum virgatum, Schizachyrium scoparium, Sporobolus heterolepis*, the other common tallgrass prairie species. *Bouteloua curtipendula* and *Pascopyrum smithii* are also common grasses.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs west of the predominant tallgrass prairie on sites where moisture availability is greater than the surrounding landscape (Hanson and Whitman 1938). Along the Front Range, "relict" true prairie is found along the foothills in parks and on slopes below *Pinus ponderosa* woodlands (Livingston 1952, Bichel 1959). Soils are coarse-textured, and runoff and seeps enhance soil moisture. The alliance is also found in floodplains adjacent to streams where the water table is within reach of plant roots. On the plains the alliance can be found in areas with gravelly soil where water infiltrates below the surface, but is held by an impermeable subsurface layer. Floodplain and toeslope soils are deep and fine-textured, whereas the foothills soils are

coarse-textured, often with cobble-sized rocks. In the northwestern plains, this alliance is found on lower slopes of hills, creeks and creek terraces. Soils are generally finer-textured (clay loams).

Dynamics: Overgrazing can change a tallgrass prairie site to a mixedgrass and eventually a shortgrass site. Heavy summer grazing is especially hard on the warm-season tallgrass species. Introduced *Poa* spp. and weedy herbs often replace the tall grasses. Fire is important to maintain the grassland from invading woody vegetation and maintain species diversity. Much potential habitat in the Colorado Front Range foothills may have been invaded by *Pinus ponderosa* because of decades of fire suppression.

DISTRIBUTION

Geographic Range: This alliance is found in the western Great Plains from central North Dakota west to eastern Montana and south to northeastern New Mexico.

Nations: CA, US
States/Provinces: CO, KS, MB, MT, ND, NE, NM, OK, SD, SK, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** *Andropogon gerardii* herbaceous alliance (Hoagland 1998a)
- **?** Big Bluestem (Hanson and Whitman 1938)

LOWER LEVEL UNITS

Associations:
- CEGL002205 *Andropogon gerardii - Schizachyrium scoparium* Northern Plains Grassland
- CEGL002376 *Andropogon gerardii - Sporobolus heterolepis - Schizachyrium scoparium - Pascopyrum smithii* Grassland
- CEGL002023 *Andropogon gerardii - Panicum virgatum* Sandhills Grassland
- CEGL001465 *Andropogon gerardii - Sporobolus heterolepis* Western Foothills Grassland
- CEGL001464 *Andropogon gerardii - Sorghastrum nutans* Western Great Plains Grassland
- CEGL001463 *Andropogon gerardii - Schizachyrium scoparium* Western Great Plains Grassland

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Bichel 1959, Branson et al. 1961, Branson et al. 1965, Culwell and Scow 1981, Culwell and Scow 1982, Faber-Langendoen et al. 2017b, Hadley and Branson 1965, Hansen et al. 1984, Hanson and Dahl 1956, Hanson and Whitman 1938, Hoagland 1998a, James 1930, Johnston 1987, Kettler pers. comm., Kittel et al. 1996, Küchler 1964, Livingston 1947, Livingston 1952, Marr 1964b, Moir 1969b, Moir 1972, Mutel 1976, Ramaley and Kelso 1931, Robbins 1917, Soil Conservation Service 1978, Tatina 1987, Taylor and Holst 1976, Tolstead 1942, Vestal 1914, Wasser and Hess 1982

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G141. Northern Great Plains Mesic Mixedgrass Prairie

A0954. Crataegus douglasii - Crataegus succulenta Shrubland Alliance

Type Concept Sentence: Stands of this temporarily flooded alliance occur in mesic draws and along streams in the northern Great Plains and adjacent foothills with a typically dense, tall (to 2.5 m) shrub layer that is dominated by *Crataegus douglasii* or *Crataegus succulenta*, either alone or together.

OVERVIEW

Scientific Name: *Crataegus douglasii - Crataegus succulenta* Shrubland Alliance
Common Name (Translated Scientific Name): Black Hawthorn - Fleshy Hawthorn Shrubland Alliance
Colloquial Name: Black Hawthorn - Fleshy Hawthorn Shrubland

Type Concept: Stands of this temporarily flooded alliance have a typically dense, tall (to 2.5 m), deciduous shrub layer that is dominated by *Crataegus douglasii* or *Crataegus succulenta (= Crataegus columbiana var. occidentalis)*, either alone or together. This tall-shrub layer often includes a substantial amount of *Prunus virginiana* and may include substantial amounts of *Amelanchier alnifolia* and *Prunus americana*. *Viburnum lentago* may also be present. This tall-shrub layer often is so thick as to be all but impenetrable, but it may contain openings. A short-shrub layer (0.5-1 m tall) dominated by *Amorpha canescens, Rosa woodsii, Symphoricarpos occidentalis*, or *Symphoricarpos albus* is present in stands with patchy tall-shrub layers, with the lower shrubs growing beneath the openings in the taller shrub canopy. The herbaceous layer, present in stands with patchy shrub layers, usually consists of exotic species (*Bromus inermis, Poa pratensis, Phleum pratense, Cirsium arvense*), although several native species (*Carex sprengelii, Elymus glaucus, Elymus virginicus, Elymus trachycaulus ssp. trachycaulus, Galium boreale, Galium aparine, Galium triflorum*) often are present and may have constituted the original understories. Herbaceous species are sparse beneath dense shrub overstories. In northeastern Wyoming, the surrounding matrix vegetation typically is grassland. In Montana, vegetation on adjacent wetter sites may be *Populus* or *Salix* stands, or *Fraxinus pennsylvanica* or *Acer negundo* woodlands. Stands occur in mesic draws and along streams in the northern Great Plains and adjacent foothills of Montana and Wyoming. Elevations range up to1370 m. Stands grow in mesic draws, ravines, and on alluvial terraces on higher surfaces in streamside riparian areas. Sites are flat to gently sloping and temporarily flooded by spring runoff or after storms. Soils are moderately deep with soil textures ranging from sandy loam to clay loam derived from alluvium. Water tables are shallow (usually less than 1 m deep) except during dry periods.

Classification Comments: Similar stands occur on north-facing slopes in the Judith and Snowy mountains in Montana that are not flooded and would not be included in this alliance (Hansen et al. 1995). Group concept appears to include primarily mesic streamside terrace types that are not wetlands, as well as wetland types. It may be that this and other alliances in this group need to move to an upland alliance.

Internal Comments:
Other Comments:

Similar NVC Types:
- A4036 *Prunus virginiana - Symphoricarpos occidentalis - Amelanchier alnifolia* Great Plains Shrubland Alliance: lacks dominance by *Crataegus* spp. and can be found in both riparian and upland settings but can otherwise be similar.
- A0918 *Elaeagnus commutata* Wet Shrubland Alliance: occurs in the same setting and may share several species but is dominated by *Elaeagnus commutata*.
- A3590 *Shepherdia argentea* Wet Shrubland Alliance: occurs in the same setting and may share several species but is dominated by *Shepherdia argentea*.

Diagnostic Characteristics: Tall-shrub stands in ravines and along streams dominated by *Crataegus douglasii* or *Crataegus succulenta*. Other tall shrubs, including *Prunus americana, Prunus virginiana*, and *Amelanchier alnifolia*, may be common. Stands may flood for short periods.

VEGETATION

Physiognomy and Structure: This vegetation is dominated by a dense (near 100% cover) tall-shrub layer (to 2.5 m tall) of broad-leaved deciduous shrubs. If there are openings present in the tall canopy a broad-leaved, a deciduous short-shrub layer (0.5-1 m tall) may also be present. Herbaceous layers are generally relatively sparse because of the dense woody canopy, but may be important in stands with a patchy shrub canopy. This layer is often dominated by perennial graminoid species with perennial forbs present to abundant.

Floristics: Stands have a typically dense, tall (to 2.5 m), deciduous shrub layer that is dominated or codominated by *Crataegus douglasii* or *Crataegus succulenta (= Crataegus columbiana var. occidentalis*), either alone or together. This tall-shrub layer often includes a substantial amount of *Prunus virginiana* and may include substantial amounts of *Amelanchier alnifolia* and *Prunus americana*. *Viburnum lentago* may also be present. This tall-shrub layer often is so thick as to be all but impenetrable, but it may contain openings. A short-shrub layer (0.5-1 m tall) dominated by *Symphoricarpos occidentalis* or *Symphoricarpos albus* is present in stands with patchy tall-shrub layers, with the lower shrubs growing beneath the openings in the taller shrub canopy. The herbaceous layer, present in stands with patchy shrub layers, usually consists of exotic species (*Bromus inermis, Poa pratensis, Phleum pratense, Cirsium arvense*), although several native species (*Carex sprengelii, Elymus glaucus, Elymus virginicus, Elymus trachycaulus ssp. trachycaulus, Galium boreale, Galium aparine, Galium triflorum*) often are present and may have constituted the original understories. Herbaceous species are sparse beneath dense shrub overstories.

ENVIRONMENT & DYNAMICS

Environmental Description: Shrublands included in this temporarily flooded alliance are found in the plains and adjacent foothills of Montana and Wyoming and the northwestern and central Great Plains. Elevations range up to1370 m. Stands grow in mesic draws, ravines and on alluvial terraces on higher surfaces in streamside riparian areas (Hansen et al. 1995, Thilenius et al. 1995). Sites are

flat to gently sloping and temporarily flooded by spring runoff or after storms. Soils are moderately deep with soil textures ranging from sandy loam to clay loam derived from alluvium. Water tables are shallow (usually less than 1 m deep) except during dry periods. In northeastern Wyoming, the surrounding matrix vegetation typically is grassland (WNDD unpubl. data). In Montana, vegetation on adjacent wetter sites may be *Populus* or *Salix* stands, or *Fraxinus pennsylvanica* or *Acer negundo* woodlands (Hansen et al. 1995).

Dynamics: Hansen et al. (1995) state that stands of this type are grazing disclimaxes and that the undisturbed vegetation is *Fraxinus pennsylvanica* woodland or *Acer negundo* woodland. This may be untrue for many of the stands in northeastern Wyoming, which grow in draws and ravines that appear to be too dry to support *Fraxinus pennsylvanica* or *Acer negundo* woodlands (WNDD unpubl. data). *Crataegus succulenta* and *Crataegus douglasii* have fair palatability for cattle and sheep, and heavy grazing and browsing in stands of this type will cause the amount of *Rosa* spp., *Symphoricarpos* spp., and *Poa pratensis* to increase. Excessive disturbance will expose bare soil (Hansen et al. 1995).

DISTRIBUTION

Geographic Range: Stands in this alliance occur in mesic draws and along streams in the northern and central Great Plains and adjacent foothills of Montana and Wyoming.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** *Crataegus erythropoda-Prunus virginiana* Vegetation Type (Thilenius et al. 1995)
- **><** *Crataegus succulenta* Community Type (Hansen et al. 1995)

LOWER LEVEL UNITS

Associations:
- CEGL001097 *Crataegus succulenta* Shrubland
- CEGL001093 *Crataegus douglasii - (Crataegus chrysocarpa)* Shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Dusek 1980, Faber-Langendoen et al. 2017b, Hansen et al. 1995, Thilenius et al. 1995, WNDD unpubl. data

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G141. Northern Great Plains Mesic Mixedgrass Prairie

A4035. Juniperus horizontalis - Dasiphora fruticosa ssp. floribunda / Schizachyrium scoparium Shrubland Alliance

Type Concept Sentence: This alliance is found on hillslopes in the northwestern Great Plains where *Juniperus horizontalis* and *Dasiphora fruticosa ssp. floribunda* dominate a sparse to moderate short-shrub layer mixed with moderate to dense cover of midgrasses.

OVERVIEW

Scientific Name: *Juniperus horizontalis - Dasiphora fruticosa ssp. floribunda / Schizachyrium scoparium* Shrubland Alliance
Common Name (Translated Scientific Name): Creeping Juniper - Shrubby-cinquefoil / Little Bluestem Shrubland Alliance
Colloquial Name: Creeping Juniper - Shrubby-cinquefoil / Little Bluestem Shrubland

Type Concept: This alliance is found on moderate to steep slopes in the northwestern Great Plains. The vegetation is characterized by moderate to dense graminoids and >10% cover by dwarf-shrubs. The most abundant dwarf-shrubs are *Juniperus horizontalis* and

Dasiphora fruticosa ssp. floribunda. Other shrubs such as *Rosa* spp., *Symphoricarpos occidentalis, Rhus trilobata*, and *Prunus virginiana* can be present but never dominant. *Schizachyrium scoparium* is nearly always present and often the dominant graminoid. Other common species include *Calamovilfa longifolia, Carex filifolia, Carex inops ssp. heliophila, Carex duriuscula, Koeleria macrantha*, and *Muhlenbergia cuspidata*. Slopes are usually north-facing. Soils are often shallow. Scoria or gravel is frequently in the upper soil layers.

Classification Comments: The shrub herbaceous association *Dasiphora fruticosa ssp. floribunda / Schizachyrium scoparium* Shrub Grassland (CEGL002198) is included in this alliance. This association appears intermediate both floristically and physiognomically between this alliance and a grass-dominated one. It was placed here based on the consistent presence of shrubs, even if at low cover, and because the environment (moderate to steep north-facing slopes) fits well with the other associations in the alliance.

Internal Comments:
Other Comments:

Similar NVC Types:

- A4034 *Schizachyrium scoparium* Northwestern Great Plains Grassland Alliance: has fewer shrubs and is not as closely linked to north-facing slopes, but the two alliances occur in the same area and the herbaceous stratum can be very similar.

Diagnostic Characteristics: Stands are on moderate to steep slopes with abundant mid and short grasses and typically >25% cover by dwarf-shrubs, particularly *Juniperus horizontalis* and *Dasiphora fruticosa ssp. floribunda*. Stands with 10-25% cover by dwarf-shrubs but which still have abundant *Schizachyrium scoparium* and other graminoids typical of this alliance are also placed here.

VEGETATION

Physiognomy and Structure: This alliance is dominated by short shrubs and graminoids. Shrubs are nearly always <1 m tall and many are <0.5 m. Shrub cover is typically >25% but some stands may have 10-25% shrub cover. Dominant graminoids are also generally <1 m tall and can have open to moderate cover. Total vegetation cover is typically high (Hansen et al. 1984, Hansen and Hoffman 1988). Trees and taller shrubs are rare or absent.

Floristics: This alliance is found in the northern Great Plains. The most abundant species is the creeping shrub *Juniperus horizontalis*. This species can cover 80% of the ground (Hansen et al. 1984, Hansen and Hoffman 1988). *Dasiphora fruticosa ssp. floribunda* dominates the shrub stratum of some stands, though usually the total shrub cover in those is low (10-30%). *Schizachyrium scoparium* and *Carex inops ssp. heliophila* are typically the most abundant graminoids. In most stands the four species provide the majority of the vegetation cover. Other shrubs that may be present are *Symphoricarpos occidentalis, Rosa arkansana, Rhus aromatica*, and *Artemisia frigida*. Associated graminoids include *Bouteloua gracilis, Calamovilfa longifolia, Carex duriuscula (= Carex eleocharis), Carex filifolia, Elymus lanceolatus, Festuca idahoensis, Festuca altaica, Koeleria macrantha, Muhlenbergia cuspidata*, and *Hesperostipa comata (= Stipa comata)*. Forbs are present but do not usually contribute greatly to the canopy. Common forbs are *Campanula rotundifolia, Dalea purpurea, Echinacea angustifolia, Galium boreale, Linum perenne, Packera plattensis (= Senecio plattensis), Pulsatilla patens ssp. multifida (= Anemone patens)*, and *Thermopsis rhombifolia*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance is found in the northern Great Plains on moderate to steep, rarely gentle, slopes. These are usually north-facing in the United States but south-facing in southern Canada. The climate is interior continental with warm to hot summers and cold winters. Elevations where stands of the alliance are found range from roughly 700 to 1075 m. Parent materials are siltstone, claystone, sandstone, and glacial till (USFS 1992). The soils are clay loams, silty loams, and sandy loams (Johnston 1987). There is an impermeable layer of scoria, gravel, or sandstone beneath shallow upper soils in some locations.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is found in the northwestern Great Plains from western South Dakota and eastern Wyoming to Montana and southwestern Manitoba.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL001394 *Juniperus horizontalis / Schizachyrium scoparium* Dwarf-shrubland
- CEGL001393 *Juniperus horizontalis / Carex inops ssp. heliophila* Dwarf-shrubland
- CEGL002198 *Dasiphora fruticosa ssp. floribunda / Schizachyrium scoparium* Shrub Grassland

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: DeVelice et al. 1991, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Hansen and Hoffman 1988, Hansen et al. 1984, Hirsch 1985, Johnston 1987, USFS 1992

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G141. Northern Great Plains Mesic Mixedgrass Prairie

A4031. Pascopyrum smithii - Nassella viridula Northwestern Great Plains Grassland Alliance

Type Concept Sentence: This alliance is found in the northern Great Plains on fine-textured soils in mesic settings where the midgrasses *Pascopyrum smithii* and *Nassella viridula* are dominant or codominant.

OVERVIEW

Scientific Name: *Pascopyrum smithii - Nassella viridula* Northwestern Great Plains Grassland Alliance
Common Name (Translated Scientific Name): Western Wheatgrass - Green Needlegrass Northwestern Great Plains Grassland Alliance
Colloquial Name: Northwestern Great Plains Mesic Western Wheatgrass Grassland

Type Concept: This alliance is found in the northern Great Plains from the southern Prairie Provinces of Canada to Colorado and western Nebraska. Midgrasses are dominant, especially *Pascopyrum smithii*. Other common species are *Elymus lanceolatus, Nassella viridula, Koeleria macrantha*, and *Hesperostipa comata*. The short graminoids *Bouteloua gracilis, Carex filifolia, Carex inops ssp. heliophila, Carex duriuscula*, and the exotics *Bromus racemosus (= Bromus commutatus)* and *Bromus tectorum* can contribute substantial cover. Shrubs and scattered trees can often be found in the mesic settings occupied by this alliance. It usually occurs on fine-textured soils in mesic settings. Some stands can be on deep sandy soils. It is often in swales or valleys but can also be on rolling uplands.

Classification Comments: This alliance shares some abundant species with the poorly described *Hesperostipa curtiseta - Elymus lanceolatus* Grassland Alliance (A4029) which probably occurs in similar habitats and is on the margin of the range of this alliance (A4031). These alliances should be considered for merging in some fashion. *Pascopyrum smithii* is a common constituent in many communities in the Great Plains. Its presence in so many communities can make it difficult to distinguish communities within this alliance from other dry-mesic midgrass communities in other alliances. The dominance of *Pascopyrum smithii* is typically a good diagnostic feature. Stands that have other species as codominants or even dominants may be difficult to classify.

Internal Comments:
Other Comments:

Similar NVC Types:
- A4029 *Hesperostipa curtiseta - Elymus lanceolatus* Grassland Alliance: Little information is available about this alliance but it shares some dominant species and habitat features; A4031 has >25% *Pascopyrum smithii* or dominance by *Nassella viridula*.
- A4033 *Hesperostipa comata* Northwestern Great Plains Grassland Alliance
- A4039 *Pascopyrum smithii - Bouteloua gracilis* Great Plains Grassland Alliance
- A3586 *Artemisia cana ssp. cana* Wet Shrubland Alliance
- A0918 *Elaeagnus commutata* Wet Shrubland Alliance

Diagnostic Characteristics: This northern Great Plains alliance is dominated by mid grasses, especially *Pascopyrum smithii* but also *Elymus lanceolatus* and *Nassella viridula*. These species should contribute more cover than *Hesperostipa comata*.

VEGETATION

Physiognomy and Structure: This is an herbaceous alliance, dominated by short to mid-height graminoids. Mid grasses are the dominant vegetation in most examples of this alliance, although short grasses and sedges can be codominant. The vegetation tends to be denser where the mid grasses are predominant and more open where shorter graminoids are abundant. The mid grasses grow to 0.5-1.0 m on favorable sites, while the short grasses and sedges are less than 0.5 m tall. Both forb and shrub species are minor in this alliance. If shrubs are present, they are typically less than 1 m in height.

Floristics: The most abundant midgrass across all sites is *Pascopyrum smithii*. Some sites are dominated by *Nassella viridula*. Common associates include *Elymus trachycaulus, Hesperostipa comata (= Stipa comata), Hesperostipa spartea (= Stipa spartea), Koeleria macrantha, Poa* spp., and *Schizachyrium scoparium*. In the drier communities of this alliance *Bouteloua gracilis* is the most common shortgrass. Other short graminoids typically found in the drier communities include *Aristida purpurea, Bouteloua curtipendula, Carex duriuscula (= Carex eleocharis), Carex filifolia*, and *Carex inops ssp. heliophila*. Forbs and shrubs are generally minor components of communities within this alliance. If shrubs are present, they are rarely taller than 1 m. Some forbs that are usually scattered about are *Amorpha canescens, Astragalus* spp., *Gaura coccinea, Sphaeralcea coccinea*, and *Tragopogon dubius*. Shrubs include *Artemisia cana, Artemisia frigida, Opuntia* spp., and *Symphoricarpos occidentalis*.

ENVIRONMENT & DYNAMICS

Environmental Description: Grasslands included in this alliance occur across the Great Plains, on several different soil types (Hanson and Whitman 1938, Johnston 1987, USFS 1992). The soil is most often clay or clay loam; however, it can be loam or sandy loam. In the eastern and central part of this alliance's range, these communities can be found on flat or rolling uplands, hillslopes, or along streams or depressions. In the western part of the range, communities are found where local conditions are wetter than the average. This includes such areas as localized depressions, the base of slopes or along rivers or streams (Weaver and Albertson 1956, Jones 1992b).

Dynamics: *Pascopyrum smithii* is rhizomatous and is tolerant of moderate grazing. If severely overgrazed, *Pascopyrum smithii* will decline and may be replaced by less desirable warm-season grasses and exotic species such as *Poa pratensis*.

DISTRIBUTION

Geographic Range: This alliance is found in the northern Great Plains from the southern Prairie Provinces of Canada to Colorado and western Nebraska.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** *Elytrigia smithii* Series (Johnston 1987)

LOWER LEVEL UNITS

Associations:
- CEGL002034 *Pascopyrum smithii - Hesperostipa comata* Central Mixedgrass Grassland
- CEGL002543 *Nassella viridula - Hesperostipa comata* Grassland
- CEGL001579 *Pascopyrum smithii - Bouteloua gracilis - Carex filifolia* Grassland
- CEGL001583 *Pascopyrum smithii - Nassella viridula* Grassland
- CEGL001713 *Nassella viridula* Grassland

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Baker and Kennedy 1985, Branson et al. 1961, Branson et al. 1964, Branson et al. 1965, Bujakiewicz 1975, Bunin 1985, Costello 1944b, Culwell and Scow 1982, DeVelice et al. 1991, Faber-Langendoen et al. 2017b, Hadley and Branson 1965, Hansen 1985, Hansen and Hoffman 1988, Hansen et al. 1984, Hanson and Dahl 1956, Hanson and Whitman 1938, Hanson et al. 1931, Hyder et al. 1966, Johnston 1987, Jones 1992b, Kahler 1973, Moir 1969b, Mutel 1976, Ramaley 1927, Ramaley 1942, Shantz 1911, Shantz 1923, Soil Conservation Service 1978, Thompson and Hansen 2002, USFS 1992, Vanderhorst et al. 1998, Vestal 1913, Vestal 1914, Vestal 1919, Weaver and Albertson 1956, Wooten 1980

2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G141. Northern Great Plains Mesic Mixedgrass Prairie

A4036. Prunus virginiana - Symphoricarpos occidentalis - Amelanchier alnifolia Great Plains Shrubland Alliance

Type Concept Sentence: This alliance is composed of shrublands in the northern Great Plains and adjacent areas dominated by the deciduous shrubs *Amelanchier alnifolia, Prunus* spp., and *Symphoricarpos occidentalis* with >25% cover.

OVERVIEW

Scientific Name: *Prunus virginiana - Symphoricarpos occidentalis - Amelanchier alnifolia* Great Plains Shrubland Alliance
Common Name (Translated Scientific Name): Chokecherry - Western Snowberry - Saskatoon Serviceberry Great Plains Shrubland Alliance
Colloquial Name: Great Plains Chokecherry - Western Snowberry - Saskatoon Serviceberry Shrubland

Type Concept: This alliance is centered in the northern Great Plains with some occurrences in the western tallgrass prairie region. Shrubs generally 1-3 m tall form a canopy 25-100% cover. Stands tend to be small and distinct in a grass-dominated landscape of the Great Plains or Rocky Mountain foothills. Stands can be strongly dominated by one or two species or a more even mix. The most typical shrub species are *Prunus virginiana, Prunus americana, Amelanchier alnifolia*, and *Symphoricarpos occidentalis*. The herbaceous understory varies in inverse proportion to the amount of shrub canopy. In the Great Plains, a variety of tall, mid, and short grasses can occur with the shrubs, though mid grasses tend to be most common. *Pascopyrum smithii, Elymus lanceolatus*, and the exotics *Bromus inermis, Elymus repens*, and *Poa pratensis* are typical. These shrubland usually occur in swales, ravines, and floodplains.

Classification Comments: *Crataegus douglasii - Crataegus succulenta* Shrubland Alliance (A0954) appears to be quite similar, though there is not much descriptive information, and it should be considered for merging or at least moving the two alliances into the same group.

Internal Comments:
Other Comments:

Similar NVC Types:
- A3963 *Amelanchier alnifolia* Central Rocky Mountain Montane-Foothill Shrubland Alliance
- A0954 *Crataegus douglasii - Crataegus succulenta* Shrubland Alliance: appears very similar, with some differences in dominants but an overall similarity in floristic and environmental characteristics. *Crataegus douglasii* and *Crataegus succulenta*
- A4208 *Corylus americana - Malus ioensis - Ceanothus americanus* Central Shrubland Alliance: occurs further east, may have more *Cornus drummondii* and *Rhus glabra*, though some stands do not have much of those, and has tallgrass species in the shrub canopy.
- A3590 *Shepherdia argentea* Wet Shrubland Alliance

Diagnostic Characteristics: This alliance is characterized by >25% cover by shrubs 1 m or taller within the predominantly prairie landscape of the northern Great Plains. Dominant shrubs are *Prunus virginiana, Prunus americana, Amelanchier alnifolia*, and *Symphoricarpos occidentalis*.

VEGETATION

Physiognomy and Structure: This alliance is characterized by a moderate to dense canopy of cold-deciduous shrubs, generally 1-3 m tall. Where tall shrubs (2-3 m) are abundant, there may be another lower stratum of shrubs 0.5-1 m tall. The herbaceous stratum cover varies in inverse proportion to the shrub strata. Stands with an open or moderately open shrub canopy tend to have an herbaceous stratum dominated by graminoids common in the surrounding prairie landscape. Stands with a dense shrub canopy or that have been subject to heavy grazing often have a higher proportion of forbs.

Floristics: The shrub canopy is often strongly dominated by one or two shrub species but may be a mix of several. Dominant shrubs include *Amelanchier alnifolia, Prunus virginiana*, and *Symphoricarpos occidentalis*. Other shrubs that may be found include *Rhus aromatica* and *Rosa woodsii*. Typical herbaceous species include *Bouteloua gracilis, Pascopyrum smithii, Hesperostipa comata (= Stipa comata)*, and other species characteristic of mixedgrass prairie. Other herbaceous species include *Achillea millefolium, Artemisia ludoviciana, Bromus inermis, Bromus tectorum, Cirsium arvense, Galium boreale, Glycyrrhiza lepidota*, and *Poa pratensis*. Woody vines sometimes occur, most commonly *Parthenocissus vitacea*. *Symphoricarpos occidentalis* shrublands often have a significant component of exotic species, especially where grazing has been intense (Hansen and Hoffman 1988, Jones and Walford 1995). *Bromus inermis, Cirsium arvense*, and *Poa pratensis* are the most abundant of these exotics. Overgrazing of prairies can lead to the expansion of degraded forms of this alliance. Where there is enough moisture to support them, generally in riparian areas, scattered small trees such as *Fraxinus pennsylvanica* and *Ulmus americana* may be present.

ENVIRONMENT & DYNAMICS

Environmental Description: The vegetation in this alliance occurs in riparian habitats and in upland swales and ravines in the northern Great Plains and in foothill canyons of the Rocky Mountains. Stands are located on terraces above the floodplain of large rivers, on small and intermittent creeks, and on hillsides below springs or seeps. Stands are found between 600 and 2000 m elevation. Soils are classified as Entisols (Fluvents), Mollisols (Borolls), Regosols or Chernozems. The soils are fertile and well-drained to imperfectly drained silts and loams (Johnston 1987, Jones and Walford 1995). The upper soil horizon is usually deep, although a thin layer of sand may be present if the site has been recently flooded (Jones and Walford 1995). Soil textures range from well-drained loamy sands to poorly drained silty clays. The upper soil horizon is relatively thick. The vegetation is tolerant of brief flooding.

Dynamics: In Montana, *Prunus virginiana* communities may be grazing-induced successional stages of the *Fraxinus pennsylvanica / Prunus virginiana* community type (Hansen et al. 1995). Both *Prunus virginiana* and *Symphoricarpos occidentalis* are tolerant of fire and will usually sprout after fires and grow into even denser stands. Dense stands of *Prunus virginiana* may preclude use by livestock, while open stands may provide adequate grazing opportunities. However, if grazed for the entire season, the strongly rhizomatous *Rosa woodsii* and non-native grasses may become established (Hansen et al. 1988b, Manning and Padgett 1995).

Symphoricarpos occidentalis shrublands often have a significant component of exotic species, especially where grazing has been intense (Hansen and Hoffman 1988b, Jones and Walford 1995). *Bromus inermis, Cirsium arvense*, and *Poa pratensis* are the most abundant of these exotics. Overgrazing of prairies can lead to the expansion of degraded forms of this alliance. Hansen et al. (1988b) consider the presence of *Symphoricarpos occidentalis* to indicate a grazing-induced community type. In Colorado and Wyoming, the presence of *Symphoricarpos occidentalis* seems to indicate a lack of grazing. There is a dramatic fenceline contrast between grazed and ungrazed areas along small creeks in the Pawnee National Grassland. On the grazed side of the fence, *Symphoricarpos occidentalis* is widely spaced and nearly hidden by the tall *Thinopyrum intermedium*. While on the ungrazed side of the fence, *Symphoricarpos occidentalis* and *Prunus virginiana* grow in thick, impenetrable stands (Kittel et al. 1996).

DISTRIBUTION

Geographic Range: This alliance is common as small patches in the northern Great Plains west to the Rocky Mountain foothills.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Prunus virginiana* Community Type (Hansen et al. 1995)
- **?** *Symphoricarpos occidentalis/Elytrigia smithii* Shrubland (Johnston 1987)
- **?** *Symphoricarpos occidentalis* Community (Hansen and Hoffman 1988)
- **?** *Symphoricarpos occidentalis* Community (Hansen et al. 1984)
- **?** Common Chokecherry Dominance Type (Jones and Walford 1995)
- **?** Western Snowberry Dominance Type (Jones and Walford 1995)

LOWER LEVEL UNITS

Associations:

- CEGL005453 *Prunus virginiana* Great Plains Shrubland
- CEGL002183 *Amelanchier alnifolia* Shrubland
- CEGL001131 *Symphoricarpos occidentalis* Shrubland

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Christy 1973, Clark et al. 1980, Faber-Langendoen et al. 2017b, Hansen and Hoffman 1988, Hansen et al. 1984, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Harvey 1980, Johnston 1987, Jones and Walford 1995, Kittel et al. 1996, Manning and Padgett 1995, Meyer 1985, Thompson and Hansen 2002

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G141. Northern Great Plains Mesic Mixedgrass Prairie

A1537. Rhus trilobata / Schizachyrium scoparium - Carex filifolia Shrub Grassland Alliance

Type Concept Sentence: This alliance is found in the northwestern Great Plains on moderate to steep slopes where short shrubs, especially *Rhus trilobata*, are scattered in a mixedgrass prairie generally dominated by *Schizachyrium scoparium* and *Carex filifolia*.

OVERVIEW

Scientific Name: *Rhus trilobata / Schizachyrium scoparium - Carex filifolia* Shrub Grassland Alliance
Common Name (Translated Scientific Name): Skunkbush Sumac / Little Bluestem - Threadleaf Sedge Shrub Grassland Alliance
Colloquial Name: Skunkbush Sumac / Little Bluestem - Threadleaf Sedge Shrub Grassland

Type Concept: This alliance is found in the northwestern Great Plains. Total vegetation cover is usually moderate and dominated by herbaceous species. Short shrubs (0.5-1 m tall) form an open canopy (usually 10-25% but sometimes more). Dominant herbaceous species usually include *Schizachyrium scoparium* and *Carex filifolia*. Other common species found in the shade of shrubs are *Carex inops ssp. heliophila, Elymus lanceolatus, Hesperostipa comata, Koeleria macrantha*, and *Muhlenbergia cuspidata*. *Rhus trilobata* is the most common shrub by far with lesser amounts of *Artemisia frigida, Gutierrezia sarothrae, Rosa arkansana*, and *Symphoricarpos occidentalis*. The alliance is found on moderate to steep slopes. Soils are shallow and rocky and may be sandy loam, loamy sand, or loam.

Classification Comments: It is often difficult to determine the borders of stands within this alliance because one of the primary distinguishing features of this alliance, the presence of a 10-25% canopy of *Rhus trilobata*, is not continuous over the entire stand. When grassland communities adjoin stands of this alliance, they usually contain many of the same species. The presence and approximate limits of stands within this alliance is judged from physiognomic and sometimes floristic differences between adjacent stands. In the dry environments in which stands of this alliance are found, certain species not commonly found in the open grow in the shade of shrubs (Hansen and Hoffman 1988).

In his *Rhus aromatica ssp. trilobata* Series, Johnson (1987) described two other plant associations with *Sporobolus cryptandrus*- and *Muhlenbergia montana*-dominated herbaceous layers that need to be reviewed for possible inclusion into this alliance. Grasslands with clumps of *Rhus trilobata* are common in the foothills of the Colorado Front Range and also need association-level classification.

Internal Comments:
Other Comments:

Similar NVC Types:
- A4034 *Schizachyrium scoparium* Northwestern Great Plains Grassland Alliance: has less shrub cover but can be very similar, otherwise.

Diagnostic Characteristics: This alliance is characterized by a mid- and shortgrass community on moderate to steep slopes with 10-25% cover (or sometimes greater) by short shrubs, particularly *Rhus trilobata*. Dominant graminoids are *Schizachyrium scoparium* and *Carex filifolia*.

VEGETATION

Physiognomy and Structure: Vegetation in this alliance has a moderately dense graminoid layer that is dominated by perennial bunchgrasses. There is a sparse but conspicuous, patchily distributed layer of cold-deciduous shrubs that averages 10-25% in cover and is less than 1 m tall. Sparse to moderate cover of perennial forbs is also present. Annual forbs and grasses are seasonally present.

Floristics: The cold-deciduous shrub *Rhus trilobata* is diagnostic of these stands and often occurs in dense patches 0.5-1 m tall. High cover of bare ground and rock cover also contribute to the patchy nature of this vegetation. In addition to *Rhus trilobata* there are small amounts of *Artemisia tridentata, Chrysothamnus* spp., *Prunus virginiana, Ribes* spp., and *Symphoricarpos occidentalis*. Shorter shrubs, such as *Artemisia frigida, Gutierrezia sarothrae, Rosa* spp., and *Yucca glauca* may be present. The herbaceous layer is dominated by graminoids, such as *Bouteloua gracilis, Calamovilfa longifolia, Carex inops ssp. heliophila, Carex filifolia, Festuca idahoensis, Hesperostipa comata (= Stipa comata), Muhlenbergia cuspidata, Pseudoroegneria spicata, Pascopyrum smithii*, and *Schizachyrium scoparium*. Forbs that may occur in communities within this alliance include *Artemisia dracunculus, Dalea purpurea, Echinacea angustifolia, Heterotheca villosa var. villosa, Gaura coccinea, Liatris punctata, Phlox hoodii, Sphaeralcea coccinea*, and *Symphyotrichum ericoides (= Aster ericoides)*. Annual forbs and grasses are seasonally present, but do not contribute much to total vegetation cover unless the site is disturbed. Cover of nonvascular plants such as *Selaginella densa* may be common on grazed stands (DeVelice et al. 1995).

ENVIRONMENT & DYNAMICS

Environmental Description: Stands included in this shrub-herbaceous alliance are found on breaks and hillsides in the northwestern Great Plains steppe of Montana, Wyoming and the Dakotas. Elevations range from 1000-1400 m. Climate is temperate, relatively xeric and continental with mean annual precipitation of 33-50 cm. Most of the precipitation (75%) occurs during the growing season from April to September. Stands occur in patches or strips along the shoulder slopes of river breaks (but may extend to the footslopes), and on gently rolling to steep, rocky hillsides (Mueggler and Stewart 1980, Hansen and Hoffman 1988, MTNHP 1988). These communities may occur on any aspect, but are most common on warm-dry south- and west-facing slopes. Soils are typically shallow and rocky, neutral to slightly alkaline (pH 7-7.9) often with high cover (>50%) of rock/gravel and bare ground. Soil texture is typically coarse and may be sand, sandy loam, loamy sand, or loam (Hansen and Hoffman 1988, Thilenius et al. 1995). Substrates include calcareous sandstones, shales, porcelanite and occasionally extrusive volcanic rock (Brown 1971, DeVelice et al. 1995). Adjacent stands include woodlands dominated by *Pinus ponderosa* or *Juniperus* spp., *Artemisia tridentata* shrublands, and other dry grasslands dominated by species common in this vegetation.

Dynamics: *Rhus trilobata* sprouts vigorously from rhizomes or from the root crown when above-ground vegetation is burned (Mueggler and Stewart 1980). Vegetative reproduction is the primary mode of re-establishment after fire; however, *Rhus trilobata* may also reproduce through seed. Fire has variable effects on *Pseudoroegneria spicata* bunchgrasses. Plants usually survive burning; growth is often stimulated, except when fire occurs in the driest month when the crowns will burn because of low moisture in the vegetation and the meristems are damaged (Johnson and Simon 1987).

Livestock grazing does not impact stands on the steeper slopes, but where stands are more accessible, heavy summer use will reduce the abundance of the more palatable species such as *Pseudoroegneria spicata, Festuca idahoensis*, and *Hesperostipa comata*. Less palatable species such as *Artemisia frigida, Heterotheca villosa*, and *Achillea millefolium* will increase. *Rhus trilobata* may also be favored by continued overgrazing (Mueggler and Stewart 1980). The exotic species *Bromus tectorum* often occurs in these stands and contributes significant cover on sites disturbed by livestock or small mammals (Mueggler and Stewart 1980).

DISTRIBUTION

Geographic Range: This alliance is found in the northwestern Great Plains from the western Dakotas into Montana and Wyoming.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Rhus aromatica ssp. trilobata* Series (Johnston 1987) [includes two habitats types not described in this alliance: a subalpine type in Colorado and a sandy plains type in Oklahoma]
- **=** *Rhus aromatica/Carex filifolia* (Hansen and Hoffman 1988)
- **><** *Rhus trilobata* Series (Mueggler and Stewart 1980)

LOWER LEVEL UNITS

Associations:
- CEGL001504 *Rhus trilobata / Carex filifolia* Shrub Grassland
- CEGL001506 *Rhus trilobata / Schizachyrium scoparium* Shrub Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Brown 1971, Culwell and Scow 1982, DeVelice et al. 1995, Faber-Langendoen et al. 2017b, Hansen and Hoffman 1986, Hansen and Hoffman 1988, Hansen et al. 1984, Johnson and Simon 1987, Johnston 1987, MTNHP 1988, Mueggler and Stewart 1980, Thilenius et al. 1995, Tweit and Houston 1980

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G141. Northern Great Plains Mesic Mixedgrass Prairie

A4034. Schizachyrium scoparium Northwestern Great Plains Grassland Alliance

Type Concept Sentence: This alliance is found in the northwestern Great Plains on coarse- or medium-textured soils where *Schizachyrium scoparium* is the dominant grass but other mid and short grasses and sedges can be abundant, particularly *Bouteloua curtipendula, Bouteloua gracilis, Carex inops ssp. heliophila*, and *Carex filifolia*.

OVERVIEW

Scientific Name: *Schizachyrium scoparium* Northwestern Great Plains Grassland Alliance
Common Name (Translated Scientific Name): Little Bluestem Northwestern Great Plains Grassland Alliance
Colloquial Name: Northwestern Great Plains Little Bluestem Grassland

Type Concept: This alliance is found in the northwestern Great Plains. *Schizachyrium scoparium* is the dominant grass but other mid and short grasses and sedges can be abundant, particularly *Bouteloua curtipendula, Bouteloua gracilis, Carex inops ssp. heliophila*, and *Carex filifolia*. In a few stands in eastern Montana and possibly western North Dakota, *Muhlenbergia cuspidata* can be a codominant. Several other mid or tall grasses can be present, including *Andropogon gerardii, Calamovilfa longifolia, Hesperostipa comata, Koeleria macrantha, Nassella viridula*, and *Pascopyrum smithii*. Forbs do not contribute greatly to the canopy and shrubs and trees are absent or sparse. The alliance is found on coarse- or medium-textured soils and nearly always on moderate or steep slopes.

Classification Comments: This alliance is similar to *Schizachyrium scoparium - Bouteloua curtipendula* Central Great Plains Grassland Alliance (A4042). Both tend to be dominated by *Schizachyrium scoparium* but the ranges are generally distinct (with some overlap in South Dakota and Wyoming) and short sedges (*Carex filifolia, Carex inops ssp. heliophila*) seem to be less common in the central Great Plains and south. Whether these are truly good differential species should be reviewed.

Internal Comments:
Other Comments:

Similar NVC Types:
- A1537 *Rhus trilobata / Schizachyrium scoparium - Carex filifolia* Shrub Grassland Alliance: has a sparse canopy (10-30%) of short shrubs, usually dominated by *Rhus trilobata*.
- A4035 *Juniperus horizontalis - Dasiphora fruticosa ssp. floribunda / Schizachyrium scoparium* Shrubland Alliance
- A4042 *Schizachyrium scoparium - Bouteloua curtipendula* Central Great Plains Grassland Alliance: is found further south and lacks some northern species such as *Carex inops ssp. heliophila* and *Carex filifolia*.

Diagnostic Characteristics: This alliance is found in the northwestern Great Plains. Stands are dominated by *Schizachyrium scoparium*, though other mid and short grasses and sedges may be common.

VEGETATION

Physiognomy and Structure: This alliance is dominated by mid grasses. The vegetation cover can be moderately sparse to dense. Short graminoids contribute substantially to the vegetation cover in most communities. The short grasses tend to be more common on flat uplands or steep slopes with heavier soils (Weaver and Albertson 1956). Trees and shrubs are rare to absent.

Floristics: *Schizachyrium scoparium* is the dominant grass but other mid and short grasses and sedges can be abundant, particularly *Bouteloua curtipendula, Bouteloua gracilis, Carex inops ssp. heliophila*, and *Carex filifolia*. In a few stands in eastern Montana and possibly western North Dakota, *Muhlenbergia cuspidata* can be a codominant. Several other mid or tall grasses can be present, including *Andropogon gerardii, Calamovilfa longifolia, Hesperostipa comata, Koeleria macrantha, Nassella viridula*, and *Pascopyrum*

smithii. Forb species richness is high, but cover is low (15-20%). *Artemisia ludoviciana* and *Phlox hoodii* are the most common forbs. Other forbs may include *Astragalus gracilis, Cerastium arvense, Echinacea pallida, Gaura coccinea, Helianthus pauciflorus (= Helianthus rigidus), Heterotheca villosa, Pediomelum argophyllum (= Psoralea argophylla)*, and many others. Scattered short shrubs and dwarf-shrubs (<5% cover) may be present such as *Artemisia cana, Artemisia frigida, Calylophus serrulatus (= Oenothera serrulata), Rhus trilobata, Rosa arkansana*, and *Symphoricarpos occidentalis*. Annual forbs and grasses may be seasonally present, especially in disturbed areas.

ENVIRONMENT & DYNAMICS

Environmental Description: The alliance is found on coarse- or medium-textured soils and nearly always on moderate or steep slopes (Hanson and Whitman 1938, Hansen et al. 1984, Johnston 1987).

Dynamics: These grasslands are dominated by deep-rooted perennial mid grasses that are able to utilize moisture that penetrates deep into these well-drained, coarse-textured soils (Morris and Lovegrove 1975). Fire is important to prevent the invasion of these vegetation types by woody species. However, fire is not as important as in more mesic grasslands, because drought conditions slow encroachment by woody species.

DISTRIBUTION

Geographic Range: This alliance is found in the northwestern Great Plains from southern Saskatchewan and Manitoba to central South Dakota and eastern Wyoming.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** *Andropogon scoparius/Carex filifolia* (Hansen and Hoffman 1988)
- **?** *Andropogon scoparius* community (Prodgers 1978) [This community description was cited in Culwell and Scow (1982).]
- **><** *Muhlenbergia cuspidata/Andropogon scoparius* Habitat Type (Jorgensen 1979)
- **?** Sidehill (grassland) community (Ansc/Cahe/Bocu/Calo) (Culwell and Scow 1982)
- **?** Various communities (Weaver and Albertson 1956)

LOWER LEVEL UNITS

Associations:

- CEGL001683 *Schizachyrium scoparium - Muhlenbergia cuspidata* Grassland
- CEGL001682 *Schizachyrium scoparium - Carex inops ssp. heliophila* Grassland
- CEGL001681 *Schizachyrium scoparium - Bouteloua (curtipendula, gracilis) - Carex filifolia* Grassland

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Culwell and Scow 1982, Faber-Langendoen et al. 2017b, Hansen and Hoffman 1988, Hansen et al. 1984, Hanson and Dahl 1956, Hanson and Whitman 1938, Johnston 1987, Jorgensen 1979, Klipple and Costello 1960, Morris and Lovegrove 1975, Prodgers 1978, Soil Conservation Service 1978, Thilenius et al. 1995, Vestal 1913, Vestal 1914, Weaver and Albertson 1956

M053. Western Great Plains Shortgrass Prairie

This macrogroup is composed of the matrix short grasslands in the western Great Plains, from southeastern Wyoming to the Texas panhandle, and is characterized the dominance of short grasses *Bouteloua gracilis* and *Bouteloua dactyloides*.

G144. Great Plains Shortgrass Prairie

Type Concept Sentence: This semi-arid shortgrass grassland group occurs in the western half of the Western Great Plains and is usually composed of *Bouteloua gracilis* as the dominant or codominant species with associated graminoids *Aristida purpurea, Bouteloua curtipendula, Bouteloua hirsuta, Bouteloua dactyloides, Hesperostipa comata, Hesperostipa neomexicana, Pascopyrum smithii, Pleuraphis jamesii, Sporobolus cryptandrus*, and scattered shrubs, dwarf-shrubs and cacti.

OVERVIEW

Scientific Name: *Bouteloua gracilis - Bouteloua dactyloides - Pleuraphis jamesii* Shortgrass Prairie Group
Common Name (Translated Scientific Name): Blue Grama - Buffalograss - James' Galleta Shortgrass Prairie Group
Colloquial Name: Fringed Sagebrush - Featherplume - Broom Snakeweed Dwarf-shrubland

Type Concept: This group occurs in the western half of the Western Great Plains Division in the rainshadow of the Rocky Mountains and forms the matrix grassland with *Bouteloua gracilis* as the typical dominant species. Associated graminoids may include *Aristida purpurea, Bouteloua curtipendula, Bouteloua hirsuta, Bouteloua dactyloides (= Buchloe dactyloides), Hesperostipa comata, Hesperostipa neomexicana, Koeleria macrantha (= Koeleria cristata), Pascopyrum smithii (= Agropyron smithii), Pleuraphis jamesii*, and *Sporobolus cryptandrus*. Although mid-height grass species may be present, especially on more mesic land positions and sandy soils, they are secondary in importance to the sod-forming short grasses. Scattered shrub and dwarf-shrub species such as *Artemisia filifolia, Artemisia frigida, Artemisia tridentata, Atriplex canescens, Eriogonum effusum, Gutierrezia sarothrae*, and *Lycium pallidum* may also be present. Also, because this group spans a wide range, there can be some differences in the relative dominance of some species from north to south and from east to west. This group occurs primarily on flat to rolling uplands with loamy, ustic soils ranging from sandy to clayey ranging from the Nebraska Panhandle south into Texas, Oklahoma and New Mexico, although grazing-impacted examples may reach as far north as southern Canada where it grades into Northern Great Plains Dry Mixedgrass Prairie Group (G331). In eastern Colorado and western Kansas and Nebraska, it grades into Central Great Plains Mixedgrass Prairie Group (G133).

Large-scale processes such as climate, fire and grazing influence this group. High variation in amount and timing of annual precipitation impacts the relative cover of cool- and warm-season herbaceous species. In contrast to other prairie groups, fire is less important, especially in the western range of this group. This is because the dry to xeric climate conditions produce less vegetation/fuel load, so relative fire frequency is lower within the group. However, historically, fires that did occur were often very expansive, especially after a series of years with above average precipitation when litter/fine fuels could build up. Currently, fire suppression and more extensive grazing in the region have likely decreased the fire frequency even more, and it is unlikely that these processes could occur at a natural scale. A large part of the range for this group (especially in the east and near rivers) has been converted to agriculture. Areas of the central and western range have been impacted by the unsuccessful attempts to develop dryland cultivation during the Dust Bowl of the 1930s. The short grasses that dominate this group are extremely drought- and grazing-tolerant. These species evolved with drought and large herbivores and, because of their stature, are relatively resistant to overgrazing. This group, in combination with the associated wetland groups, represents one of the richest areas for mammals and birds. Endemic bird species to the shortgrass group may constitute one of the fastest declining bird populations.

Classification Comments: The dominant grass in this group, *Bouteloua gracilis*, is tolerant of heavy grazing and drought, which favor it over other taller and less xeric grass species (Weaver and Albertson 1956). Some ecologists consider stands in this group to be disclimax grassland of mixedgrass prairie resulting from overgrazing by livestock (Weaver and Albertson 1956). Because this group classifies existing vegetation, it includes both early-seral "disclimax" and late-seral "climax" stands extending from the northwestern mixedgrass region in Montana and Canada, south into the Texas Panhandle. The Shortgrass Prairie grassland type in Sims et al. (1978) is closest conceptually to this group. Many others, such as Singh et al. (1983), Lauenroth and Milchunas (1992), Dick-Peddie (1993), Sims and Risser (2000), and Lauenroth and Burke (2008), recognize only the central and southern portions of this group as shortgrass steppe or prairie as they are looking at climate or other environmental or geographic factors.

Similar NVC Types:
- G487 Madrean Juniper Open Woodland
- G130 Hardwood - Loblolly Pine Nonriverine Wet Flatwoods
- G133 Central Great Plains Mixedgrass Prairie
- G068 Great Plains Sand Grassland
- G331 Northern Great Plains Dry Mixedgrass Prairie
- G192 Comanchian Mesquite - Mixed Scrub
- G069 Great Plains Sand Shrubland
- G489 Chihuahuan Semi-Desert Lowland Grassland

Diagnostic Characteristics: This group is characterized by a short, often discontinuous graminoid layer dominated or codominated by *Bouteloua gracilis*. Many other graminoids may be associated, including some medium-tall grasses; however, medium-tall and tall

grasses will not dominate. *Gutierrezia sarothrae* is often present to codominant, especially in disturbed areas. Other woody plants may be present but characteristically do not form a layer, e.g., less than 10% cover. To the south, this group transitions to desert grassland groups that are characterized by desert species.

VEGETATION

Physiognomy and Structure: This group is characterized by a short, often discontinuous herbaceous layer dominated by short perennial grasses.

Floristics: This group spans a wide range and thus there can be some differences in the relative dominance of some species from north to south and from east to west. This group is primarily dominated by *Bouteloua gracilis* throughout its range with various associated graminoid species depending on precipitation, soils and management. Associated graminoids may include *Achnatherum hymenoides, Aristida purpurea, Bouteloua curtipendula, Bouteloua hirsuta, Bouteloua dactyloides (= Buchloe dactyloides), Carex filifolia, Hesperostipa comata, Koeleria macrantha (= Koeleria cristata), Muhlenbergia torreyi, Pascopyrum smithii (= Agropyron smithii), Pleuraphis jamesii, Sporobolus airoides*, and *Sporobolus cryptandrus*. Although mid-height grass species may be present, especially on more mesic land positions and soils, they are secondary in importance to the sod-forming short grasses. Sandy soils have higher cover of *Hesperostipa comata, Sporobolus cryptandrus*, and *Yucca* spp. Scattered shrub and dwarf-shrub species such as *Artemisia filifolia, Artemisia frigida, Artemisia tridentata, Atriplex canescens, Eriogonum effusum, Gutierrezia sarothrae, Lycium pallidum*, and *Rhus trilobata* may also be present. High annual variation in amount and timing of precipitation impacts relative cover of herbaceous species. Cover of cool-season grasses is dependent on winter and early spring precipitation whereas warm-season grasses respond to mid-summer thunderstorms). Floristic information was compiled from Weaver and Albertson (1956), Sims et al. (1978), Brown et al. (1980, 1998), Barbour and Billings (1988), Milchunas et al. (1989), Lauenroth and Milchunas (1992), Dick-Peddie (1993), Ricketts et al. (1999), Sims and Risser (2000), and Lauenroth and Burke (2008).

ENVIRONMENT & DYNAMICS

Environmental Description: This group is located on primarily flat to rolling uplands. Soils typically are loamy and ustic and range from sandy to clayey. Climate is continental with mean annual precipitation generally about 300 mm ranging to 500 mm to the south in Texas. Most of the annual precipitation occurs during the growing season as thunderstorms (Sims et al. 1978). Precipitation events are mostly <10 cm with occasional larger events (Sala and Lauenroth 1982).

Dynamics: Climate, fire and grazing constitute the primary processes impacting this group. Drought-tolerant shortgrass species have root systems that extend up near the soil surface where they can utilize low precipitation events (Sala and Lauenroth 1982). Fire is less important in this group compared to other Western Great Plains prairie systems, especially in the western portion of its range (Milchunas et al. 1989). Previous comments in the literature citing *Opuntia* spp. increasing with overgrazing may not be borne out by more recent research (R. Rondeau pers. comm.). The Long expedition found extensive prickly-pear stands near the South Platt River above the forks in 1823 (Hart 2008). Milchunas et al. (2008) found that *Opuntia* spp. do not increase with grazing.

Upland *Prosopis glandulosa* shrublands have expanded in the shortgrass prairie in the last hundred years and most consider *Prosopis glandulosa* Prairie Ruderal Scrub Alliance (A3952) to be ruderal or novel vegetation. *Prosopis glandulosa* was reported in the Texas Panhandle in 1849 and along the Canadian River in New Mexico in 1715 prior to extensive cattle grazing (Hart 2008). However, conversion to agriculture and pastureland with subsequent irrigation has degraded and extirpated this group in some areas of its range.

Although *Prosopis glandulosa* has expanded in the shortgrass prairie in the last hundred years and some consider *Prosopis glandulosa* Prairie Ruderal Scrub Alliance (A3952) to be ruderal or novel vegetation, *Prosopis glandulosa* was reported in the Texas Panhandle in 1849 and along the Canadian River in New Mexico in 1715 prior to extensive cattle grazing (Hart 2008). However, conversion to agriculture and pastureland with subsequent irrigation has degraded and extirpated this group in some areas of its range.

DISTRIBUTION

Geographic Range: This group is found primarily in the western half of the Western Great Plains Division east of the Rocky Mountains and ranges from the Nebraska Panhandle south into the panhandles of Oklahoma and Texas and New Mexico, although some examples may reach as far north as southern Canada.

Spatial Scale & Pattern [optional]: Matrix
Nations: CA, US
States/Provinces: CO, KS, NE, NM, OK, TX, WY
TNC Ecoregions [optional]: 26:P, 27:C, 28:C, 33:P
USFS Ecoregions (2007): 315A:CC, 315B:CC, 315F:CC, 321A:CC, 331B:CC, 331C:CC, 331F:CC, 331H:CC, 331I:CC, 332C:CC, 332E:CC, 332F:CC, M313B:CC, M331F:CC, M331I:CC
Omernik Ecoregions: 9.4.2.27:C, 9.4.2.27d:C, 9.4.2.27g:C, 9.4.2.27h:C, 9.4.2.27i:C, 9.4.2.27k:C, 9.4.2.27l:C, 9.4.2.27n:C, 9.4.2.27o:C, 9.4.2.27r:C, 9.4.3.26:C, 9.4.3.26a:C, 9.4.3.26c:C, 9.4.6.30:C, 9.4.6.30a:C, 9.4.6.30d:C

Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **<** *Bouteloua-Buchloë* (Küchler 1964) [This potential natural vegetation type is broader than the NVC group existing vegetation.]
- **=** Grama "Shortgrass" Series - 142.12 (Brown et al. 1980)
- **=** Grama "Shortgrass" Series - 142.12 (Brown et al. 1998)
- **=** Grama - Buffalo Grass Section (3113) (Bailey 1980)
- **><** Mixed "Shortgrass" Series - 142.13 (Brown et al. 1998)
- **><** Mixed "Shortgrass" Series - 142.14 (Brown et al. 1980)
- **><** Plains and Mesas Grasslands (Dick-Peddie 1993)
- **=** Shortgrass Prairie (Sims et al. 1978)
- **=** Shortgrass Steppe (Singh et al. 1983)
- **><** Shrub-Grass Disclimax Series - 142.15 (Brown et al. 1980)

LOWER LEVEL UNITS

Alliances:

- A4000 *Bouteloua gracilis - Bouteloua dactyloides* Shortgrass Prairie Alliance
- A4002 *Bouteloua gracilis - Bouteloua hirsuta - Hesperostipa neomexicana* Shortgrass Prairie Alliance
- A3999 *Artemisia frigida - Dalea formosa - Gutierrezia sarothrae* Dwarf-shrubland Alliance
- A4001 *Bouteloua gracilis - Bouteloua hirsuta - Bouteloua curtipendula* Shortgrass Prairie Alliance

AUTHORSHIP

Primary Concept Source: P.L. Sims, J.S. Singh, and W.K. Lauenroth (1978)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 11/10/2015
Classif Resp Region: West
Internal Author: KAS 11-10, 8-15, 11-15, mod. B. Hoagland 9-13

REFERENCES

References: Bailey 1980, Barbour and Billings 1988, Brown et al. 1980, Brown et al. 1998, Dick-Peddie 1993, Faber-Langendoen et al. 2017a, Hart 2008, Küchler 1964, Lauenroth and Burke 2008, Lauenroth and Milchunas 1992, Milchunas et al. 1989, Milchunas et al. 2008, Ricketts et al. 1999, Rondeau pers. comm., Sala and Lauenroth 1982, Shiflet 1994, Sims and Risser 2000, Sims et al. 1978, Singh et al. 1983, Weaver and Albertson 1956

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G144. Great Plains Shortgrass Prairie

A3999. Artemisia frigida - Dalea formosa - Gutierrezia sarothrae Dwarf-shrubland Alliance

Type Concept Sentence: This dwarf-shrubland alliance is composed of a variety of shrubs, such as *Artemisia frigida, Dalea formosa, Gutierrezia sarothrae, Mimosa borealis*, and/or *Yucca glauca*, and occurs in the shortgrass steppe of the western Great Plains in a variety of environments but is common in shallow soils near escarpments.

OVERVIEW

Scientific Name: *Artemisia frigida - Dalea formosa - Gutierrezia sarothrae* Dwarf-shrubland Alliance
Common Name (Translated Scientific Name): Fringed Sagebrush - Featherplume - Broom Snakeweed Dwarf-shrubland Alliance
Colloquial Name: Fringed Sagebrush - Featherplume - Broom Snakeweed Dwarf-shrubland

Type Concept: This alliance occurs in the shortgrass steppe of the western Great Plains from eastern Colorado and New Mexico to the panhandle of Texas. Vegetation is dominated by dwarf-shrubs with variable cover of herbaceous plants. The dominant and diagnostic shrubs are *Artemisia bigelovii, Artemisia frigida, Dalea formosa, Gutierrezia sarothrae, Mimosa borealis*, and/or *Yucca glauca*. The herbaceous layer ranges from sparse to dense and is dominated by graminoids, especially *Bouteloua gracilis* with *Aristida purpurea, Bouteloua curtipendula, Elymus elymoides, Nassella viridula, Poa fendleriana, Schedonnardus paniculatus*, and *Sporobolus cryptandrus*. Forbs cover is often sparse and sometimes diverse. Species such as *Eriogonum jamesii* and *Sphaeralcea coccinea* are frequently present. This alliance occurs in a variety of environments and conditions, such as narrow bands along the tops of escarpments and narrow ridges where bedrock is at or very near the surface and soils are shallow, as well as in kipukas of old lavaflows, and areas with repeated disturbance such as sites associated with prairie dog towns and heavily grazed pastures in the vicinity of livestock watering ponds. Substrates are often derived from alluvium lava, limestone or sandstone.

Classification Comments: This alliance includes dwarf-shrublands on both rocky shallow soils near escarpments and deep loamy soils with prairie dog disturbance. Further classification work may result in separating scarp communities from prairie communities. Dwarf-shrublands dominated by *Artemisia bigelovii* or *Krascheninnikovia lanata* occur in the shortgrass steppe. Stands dominated by *Artemisia bigelovii* occur on breaks in the southern shortgrass steppe in southeastern Colorado and eastern New Mexico. These broadly defined associations also occur on the Colorado Plateau, and stands have been grouped with other *Artemisia bigelovii* communities in Intermountain Low & Black Sagebrush Steppe & Shrubland Group (G308) in Great Basin-Intermountain Dwarf Sagebrush Steppe & Shrubland Macrogroup (M170). Stands dominated by *Krascheninnikovia lanata* occur in the shortgrass steppe in eastern Colorado, eastern New Mexico and western Kansas. These broadly defined associations also occur in the intermountain western U.S., and stands have been grouped with other *Krascheninnikovia lanata* communities in Intermountain Semi-Desert Steppe & Shrubland Group (G310) in Great Basin-Intermountain Dry Shrubland & Grassland Macrogroup (M171). Further research is needed to determine if these associations should be split based on regional floristics.

Internal Comments: DFL 11-14: This is a very problematic alliance and needs further review; shortgrass with dwarf shrub okay as concept but needs further flushout. KAS 12-13: Stands of *Artemisia frigida / Bouteloua gracilis* Dwarf-shrubland (CEGL002782) are reported from montane parks and have been included.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: This alliance is dominated by diagnostic dwarf-shrubs *Artemisia frigida, Dalea formosa, Gutierrezia sarothrae, Mimosa borealis*, and/or *Yucca glauca*. The sparse to dense herbaceous layer is often dominated by *Bouteloua gracilis* with *Aristida purpurea, Bouteloua curtipendula, Elymus elymoides, Nassella viridula, Poa fendleriana, Schedonnardus paniculatus*, and *Sporobolus cryptandrus* present to codominant. Forbs cover is often sparse and diverse. Species such as *Eriogonum jamesii* and *Sphaeralcea coccinea* are frequently present.

VEGETATION

Physiognomy and Structure: This alliance is characterized by an open to moderately dense dwarf-shrub layer with an often discontinuous herbaceous layer dominated by short perennial grasses.

Floristics: This alliance is characterized by a variety of dwarf-shrubs with variable cover of herbaceous plants. The dominant and diagnostic shrubs are *Artemisia frigida, Dalea formosa, Gutierrezia sarothrae, Mimosa borealis, Opuntia polyacantha*, and/or *Yucca glauca*. Other shrubs present in lesser amounts include *Chrysothamnus viscidiflorus, Ericameria parryi, Krascheninnikovia lanata, Lycium pallidum, Rhus trilobata*, and *Rosa* spp. The herbaceous layer ranges from sparse to dense and is dominated by graminoids, especially *Bouteloua gracilis*. Associated grasses include *Aristida purpurea, Bouteloua curtipendula, Elymus elymoides, Hesperostipa comata, Nassella viridula, Pascopyrum smithii, Pleuraphis jamesii, Poa fendleriana, Schedonnardus paniculatus*, and *Sporobolus cryptandrus*. Forbs cover is often sparse (<5% cover) and may be diverse. Species such as *Chamaesyce* spp., *Eriogonum jamesii*, and *Sphaeralcea coccinea* are frequently present. However, in deeper soils on prairie dog towns, *Argentina anserina* and *Achillea millefolium* may be common. Non-native species such as *Bromus tectorum, Erodium cicutarium, Melilotus officinalis, Sisymbrium altissimum*, or *Salsola kali* may be present to codominant in herbaceous layers of some disturbed stands. Ground cover is mostly of bare soil and small gravel with some litter under shrubs and within bunchgrasses.

ENVIRONMENT & DYNAMICS

Environmental Description: This dwarf-shrub alliance is found in the shortgrass steppe of the western Great Plains. Climate is semi-arid, continental with more than half to the precipitation falling during the summer. Most stands occur at elevations below 1830 m (6000 feet), but outlier stands my occur in semi-arid foothills and mountain parks up to 2640 m (8660 feet). Stands occur in a variety of environments and conditions, such as narrow bands along the tops of escarpments and narrow ridges where bedrock is at or very near the surface and soils are shallow, as in kipukas of old lavaflows. Deeper soils may be present on sites associated with repeated disturbance such as prairie dog towns and heavily grazed pastures in the vicinity of livestock watering ponds. These soils are often finer-textured loams and clays that will support burrowing activity, but also occur on sandy substrates. Substrates are often derived from lava, scoria, basalt, limestone, sandstone or alluvium.

Dynamics: This dwarf-shrubland becomes established on disturbed sites such as prairie dogs towns, steep colluvial slopes and near edges of escarpments, and on sandy wind-blown sites. Other common sites include heavily grazed pastures, especially in the vicinity of livestock watering ponds. Historically, disturbance from large herds of bison may have created habitat. Stands of this alliance on prairie dogs towns were likely as extensive as the prairie dog towns themselves but have been reduced to a fraction of their former extent. *Artemisia frigida* is an increaser under livestock grazing regimes and is evidently unpalatable or less palatable to prairie dogs, as well. The age of the colony determines to what extent *Artemisia frigida* dominates the site, and the following description covers

sites that have been used by prairie dogs for several years. Prairie dog colonies that are densely occupied typically have vegetative cover values less than 40%.

Gutierrezia sarothrae occurs in many natural grassland and steppe communities in the western U.S. and is known to increase when these communities are disturbed mechanically or by overgrazing (USFS 1937, Stubbendieck et al. 1992). The role of disturbance in this association needs further study to understand its successional nature.

DISTRIBUTION

Geographic Range: This alliance occurs in the shortgrass steppe in the western Great Plains from eastern Colorado and New Mexico to the panhandles of Texas and likely Oklahoma.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** *Dalea formosa - Mimosa borealis* Dwarf-shrubland (Bell 2005)
- **=** Shrub-Blue Grama Series (Dick-Peddie 1993)

LOWER LEVEL UNITS

Associations:
- CEGL005011 *Gutierrezia sarothrae - Yucca glauca* Dwarf-shrubland
- CEGL002782 *Artemisia frigida / Bouteloua gracilis* Dwarf-shrubland

AUTHORSHIP

Primary Concept Source: W.A. Dick-Peddie (1993)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Bell 2005, Dick-Peddie 1993, Faber-Langendoen et al. 2017b, Stubbendieck et al. 1992, USFS 1937

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G144. Great Plains Shortgrass Prairie

A4000. Bouteloua gracilis - Bouteloua dactyloides Shortgrass Prairie Alliance

Type Concept Sentence: This shortgrass alliance is characterized by a moderate to dense sod of short grasses *Bouteloua gracilis* and *Bouteloua dactyloides* on semi-arid prairies and is common across the western portions of the Great Plains.

OVERVIEW

Scientific Name: *Bouteloua gracilis - Bouteloua dactyloides* Shortgrass Prairie Alliance
Common Name (Translated Scientific Name): Blue Grama - Buffalograss Shortgrass Prairie Alliance
Colloquial Name: Blue Grama - Buffalograss Shortgrass Prairie

Type Concept: This shortgrass prairie alliance is common across the western portions of the central and southern Great Plains with outlier stands in the northern Great Plains. This vegetation is characterized by a moderate to dense sod of short grasses *Bouteloua gracilis* and *Bouteloua dactyloides (= Buchloe dactyloides)* with scattered midgrasses and forbs . Other short graminoids include *Bouteloua hirsuta, Carex duriuscula, Carex inops ssp. heliophila, Carex filifolia*, and *Muhlenbergia torreyi*. Midgrasses such as *Aristida purpurea, Bothriochloa saccharoides, Bouteloua curtipendula, Elymus elymoides, Hesperostipa comata (= Stipa comata), Pascopyrum smithii, Pleuraphis jamesii, Schizachyrium scoparium*, and *Sporobolus cryptandrus* are usually sparse and stunted by the semi-arid conditions and do not exceed 0.7 m in height. Forb cover is generally low but may be diverse and includes species of *Astragalus, Eriogonum, Machaeranthera, Opuntia, Psoralidium, Ratibida, Sphaeralcea*, and *Zinnia*. Scattered shrubs are rare and may include *Artemisia frigida, Atriplex canescens, Ericameria nauseosa (= Chrysothamnus nauseosus), Gutierrezia sarothrae*, and *Yucca glauca*. Climate is semi-arid continental, with over half the annual precipitation typically occurring during the summer. Stands often occur in lowland sites that have well-developed soils ranging from loams to clay and silty clay.

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:
- A4001 *Bouteloua gracilis - Bouteloua hirsuta - Bouteloua curtipendula* Shortgrass Prairie Alliance: is similar but *Bouteloua dactyloides* is absent or has low cover.

Diagnostic Characteristics: This alliance is characterized by an open to dense short herbaceous layer codominated by diagnostic species *Bouteloua gracilis* and *Bouteloua dactyloides*. Other short graminoid associates with lower cover may include *Bouteloua hirsuta, Carex duriuscula, Carex inops ssp. heliophila, Carex filifolia*, and *Muhlenbergia torreyi*. Midgrass associates may be present with low cover. Characteristic midgrasses include *Aristida purpurea, Bothriochloa saccharoides, Bouteloua curtipendula, Elymus elymoides, Hesperostipa comata, Pascopyrum smithii, Pleuraphis jamesii, Schizachyrium scoparium*, and *Sporobolus cryptandrus*. Forb associates are typical of shortgrass steppe and include *Astragalus* spp., *Eriogonum jamesii, Gaura coccinea, Machaeranthera pinnatifida var. pinnatifida, Opuntia polyacantha, Plantago patagonica, Psoralidium tenuiflorum, Ratibida columnifera, Sphaeralcea coccinea*, and *Zinnia grandiflora*.

VEGETATION

Physiognomy and Structure: Stands in this alliance have a graminoid layer dominated by short grasses that typically form a sod. Midgrasses may be present to codominate in some communities. Rarely, sparse scattered shrubs may be present. Some ungrazed stands may have a short bunchgrass form.

Floristics: This vegetation of this shortgrass prairie alliance is characterized by a moderate to dense sod of short grasses with scattered midgrasses and forbs. The dominant and diagnostic species are *Bouteloua gracilis* and *Bouteloua dactyloides (= Buchloe dactyloides)*. Other short graminoids include *Bouteloua hirsuta, Carex duriuscula, Carex inops ssp. heliophila*, and *Carex filifolia*. Midgrasses, if present, are usually stunted by the arid conditions and often do not exceed 0.7 m in height. They include *Aristida purpurea, Bothriochloa saccharoides, Bouteloua curtipendula, Elymus elymoides, Hesperostipa comata (= Stipa comata), Muhlenbergia torreyi, Pascopyrum smithii, Pleuraphis jamesii, Schizachyrium scoparium*, and *Sporobolus cryptandrus*. Characteristic forbs such as *Astragalus* spp., *Eriogonum jamesii, Gaura coccinea, Machaeranthera pinnatifida var. pinnatifida, Opuntia polyacantha, Plantago patagonica, Psoralidium tenuiflorum, Ratibida columnifera, Sphaeralcea coccinea*, and *Zinnia grandiflora* are common. Scattered shrubs are rare and may include *Artemisia frigida, Atriplex canescens, Ericameria nauseosa (= Chrysothamnus nauseosus), Gutierrezia sarothrae, Yucca glauca*, and *Cylindropuntia imbricata (= Opuntia imbricata)* (in the southern extent).

ENVIRONMENT & DYNAMICS

Environmental Description: This shortgrass prairie alliance is common across the western portions of the central and southern Great Plains with outlier stands in the northern Great Plains. Climate is semi-arid continental, with over half the annual precipitation typically occurring during the summer. Stands typically occur in lowland sites that have well-developed soils that range from loams to clay and silty clay (Weaver and Albertson 1956, Johnston 1987, Steinauer 1989).

Dynamics: Large-scale processes such as climate, fire and grazing constitute the primary processes impacting this alliance. The short grasses that dominate this alliance are extremely drought- and grazing-tolerant (Lauenroth and Milchunas 1992, Lauenroth et al. 1994, Milchunas and Lauenroth 2008). *Bouteloua gracilis* is one of the most widely distributed grasses in the western U.S. and is present in many different grassland, shrubland and woodland communities. It evolved with grazing by large herbivores and generally forms a short sod. However, in some stands, ungrazed plants develop the upright physiognomy of a bunchgrass. If *Bouteloua gracilis* is eliminated from an area by extended drought (3-4 years) or disturbance such as plowing, regeneration is slow because of very slow tillering rates (Samuel 1985), low and variable seed production (Coffin and Lauenroth 1992), minimal seed storage in the soil (Coffin and Lauenroth 1989c) and limited seedling germination and establishment due to particular temperature and extended soil moisture requirements for successful seedling establishment (Hyder et al. 1971, Briske and Wilson 1978, 1980). *Bouteloua dactyloides* is often abundant in swales and depressions. It is less drought-tolerant than *Bouteloua gracilis*, but following disturbance re-establishes more quickly via seeds and above-ground tillering (Peters et al. 2008).

DISTRIBUTION

Geographic Range: This shortgrass prairie alliance is common across much of the central and southern Great Plains of the United States with outlier stands in the northern Great Plains.

Nations: CA, US
States/Provinces: CO, KS, ND, NE, NM, OK, SD, TX, WY
TNC Ecoregions [optional]:

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- = *Bouteloua gracilis-Buchloe dactyloides* (Bourgeron and Engelking 1994)
- = *Buchloe - Bouteloua* Community (Heitschmidt et al. 1970)
- = *Bulbilis-Bouteloua* Association (Bruner 1931) [Oklahoma]
- = Blue Grama-Buffalograss Series (Diamond 1993)
- = Buffalograss Type (Hanson and Whitman 1938)
- = Central and Eastern Grasslands: 65: Grama-Buffalo Grass (*Bouteloua-Buchloe*) (Küchler 1964)
- = Grama-Buffalograss Series (Dick-Peddie 1993)
- = Northern Grama-Buffalograss Prairie (Küchler 1974) [Kansas]
- = Southern Grama-Buffalograss Prairie (Küchler 1974) [Kansas]

LOWER LEVEL UNITS

Associations:

- CEGL002271 *Bouteloua gracilis - Bouteloua dactyloides - Pleuraphis jamesii* Grassland
- CEGL001756 *Bouteloua gracilis - Bouteloua dactyloides* Grassland
- CEGL002270 *Bouteloua gracilis - Bouteloua dactyloides* Xeric Soil Grassland

AUTHORSHIP

Primary Concept Source: H.C. Hanson and W. Whitman (1938)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Beavis et al. 1982, Bonham and Lerwick 1976, Bourgeron and Engelking 1994, Briske and Wilson 1978, Briske and Wilson 1980, Bruner 1931, Coffin and Lauenroth 1989, Coffin and Lauenroth 1992, Costello 1944b, Diamond 1993, Dick-Peddie 1993, Donart et al. 1978b, Faber-Langendoen et al. 2017b, Hanson 1950, Hanson and Whitman 1938, Heerwagen 1958, Heitschmidt et al. 1970, Hoagland 1998a, Hyder et al. 1971, Johnston 1987, Küchler 1964, Küchler 1974, Lauenroth and Burke 2008, Lauenroth and Milchunas 1992, Lauenroth et al. 1994a, Milchunas and Lauenroth 2008, Milchunas et al. 1989, Moir and Trlica 1976, Peters et al. 2008, Ramaley 1914, Robbins 1917, Rogers 1953, Samuel 1985, Shantz 1911, Shantz 1923, Steinauer 1989, Weaver and Albertson 1956, Zimmerman 1967

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G144. Great Plains Shortgrass Prairie

A4001. Bouteloua gracilis - Bouteloua hirsuta - Bouteloua curtipendula Shortgrass Prairie Alliance

Type Concept Sentence: This shortgrass prairie alliance is characterized by a moderate to dense layer of short grasses dominated by *Bouteloua gracilis, Bouteloua hirsuta*, and midgrass *Bouteloua curtipendula* with *Bouteloua dactyloides* absent or has low cover. It is common across the western portions of the central and southern Great Plains.

OVERVIEW

Scientific Name: *Bouteloua gracilis - Bouteloua hirsuta - Bouteloua curtipendula* Shortgrass Prairie Alliance
Common Name (Translated Scientific Name): Blue Grama - Hairy Grama - Sideoats Grama Shortgrass Prairie Alliance
Colloquial Name: Great Plains Grama Shortgrass Prairie

Type Concept: This shortgrass prairie alliance is common across the western portions of the central and southern Great Plains. This vegetation is characterized by a moderate to dense sod of dominated by short grasses, *Bouteloua gracilis, Bouteloua hirsuta* and midgrass, *Bouteloua curtipendula*. However, not all three species are always present. *Bouteloua dactyloides (= Buchloe dactyloides)* is absent or has low cover (<5%). Other grasses that may be present to codominant in *Aristida purpurea, Bouteloua eriopoda*, and *Muhlenbergia torreyi*. *Elymus elymoides, Hesperostipa comata (= Stipa comata), Pascopyrum smithii, Pleuraphis jamesii, Schedonnardus paniculatus, Schizachyrium scoparium*, and *Sporobolus cryptandrus* may also be present. Forbs have low cover but may be diverse including species of *Astragalus, Eriogonum, Gaura, Machaeranthera, Opuntia, Plantago, Psoralidium, Ratibida, Sphaeralcea* and *Zinnia*. Scattered shrubs are rare and may include *Artemisia frigida, Atriplex canescens, Ericameria nauseosa (=*

Chrysothamnus nauseosus), Gutierrezia sarothrae, and *Cylindropuntia imbricata (= Opuntia imbricata)* in the southern extent). Soils are well developed with texture ranging from sandy loam to clay loam.

Classification Comments: Stands containing a mix of *Bouteloua gracilis, Carex filifolia*, and moderate amounts of *Pascopyrum smithii* or *Hesperostipa comata* may present classification problems. *Bouteloua gracilis* increases with heavy grazing pressure as other species decline in many western plant communities, often resulting in difficulties in classification.

Internal Comments:
Other Comments:

Similar NVC Types:
- A4000 *Bouteloua gracilis - Bouteloua dactyloides* Shortgrass Prairie Alliance: is similar but codominated by *Bouteloua dactyloides*.

Diagnostic Characteristics: This alliance is characterized by an open to dense short herbaceous layer dominated by diagnostic species *Bouteloua gracilis, Bouteloua curtipendula*, and *Bouteloua hirsuta*. However, not all three species are always present. *Bouteloua dactyloides* is absent or has low cover (<5%). Other diagnostic grasses that may be present to codominant are *Aristida purpurea, Bouteloua eriopoda*, and *Muhlenbergia torreyi*. Additional associates include *Elymus elymoides, Hesperostipa comata, Pascopyrum smithii, Pleuraphis jamesii, Schedonnardus paniculatus, Schizachyrium scoparium*, and *Sporobolus cryptandrus*. Forb associates include *Astragalus* spp., *Eriogonum jamesii, Gaura coccinea, Machaeranthera pinnatifida var. pinnatifida, Opuntia polyacantha, Plantago patagonica, Psoralidium tenuiflorum, Ratibida columnifera, Sphaeralcea coccinea*, and *Zinnia grandiflora*.

VEGETATION

Physiognomy and Structure: Stands in this alliance have a graminoid layer dominated by short grasses that typically form a sod. Midgrasses may codominate in some communities. Rarely, sparse scattered shrubs may be present. Some ungrazed stands may have a short bunchgrass form.

Floristics: This vegetation of this alliance is characterized by a moderate to dense sod of short grasses, midgrasses and forbs. The dominant and diagnostic species are *Bouteloua gracilis, Bouteloua curtipendula*, and *Bouteloua hirsuta*. However, not all three species are always present. *Bouteloua dactyloides (= Buchloe dactyloides)* is absent or has low cover (<5%). Other grasses that may be present to codominant are *Aristida purpurea, Bouteloua eriopoda*, and *Muhlenbergia torreyi*. *Elymus elymoides, Hesperostipa comata (= Stipa comata), Pascopyrum smithii, Pleuraphis jamesii, Schedonnardus paniculatus, Schizachyrium scoparium*, and *Sporobolus cryptandrus* may also be present. Forbs such as *Astragalus* spp., *Eriogonum jamesii, Gaura coccinea, Machaeranthera pinnatifida var. pinnatifida, Opuntia polyacantha, Plantago patagonica, Psoralidium tenuiflorum, Ratibida columnifera, Sphaeralcea coccinea*, and *Zinnia grandiflora* are common throughout this community. Scattered shrubs are rare and may include *Artemisia frigida, Atriplex canescens, Ericameria nauseosa (= Chrysothamnus nauseosus), Gutierrezia sarothrae*, and *Cylindropuntia imbricata (= Opuntia imbricata)* (in the southern extent).

ENVIRONMENT & DYNAMICS

Environmental Description: This shortgrass prairie alliance is widespread across the western portions of the central and southern Great Plains. Climate is semi-arid continental, with over half the annual precipitation typically occurring during the summer. Soils are well-developed and range from sandy loam to clay loam.

Dynamics: *Bouteloua gracilis* is an extremely drought- and grazing-tolerant shortgrass species. It is one of the most widely distributed grasses in the western U.S. and is present in many different grassland, shrubland and woodland communities. It evolved with grazing by large herbivores and generally forms a short sod. However, in some stands, ungrazed plants develop the upright physiognomy of a bunchgrass.

DISTRIBUTION

Geographic Range: This shortgrass prairie alliance is common across the western portions of the central and southern Great Plains.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **<** *Bouteloua gracilis-Bouteloua curtipendula* (Bourgeron and Engelking 1994)
- **<** *Bouteloua gracilis-Bouteloua hirsuta* (Bourgeron and Engelking 1994)
- **>** *Bouteloua gracilis* herbaceous alliance (Hoagland 1998a)
- **<** *Bouteloua hirsuta-Bouteloua curtipendula* (Bourgeron and Engelking 1994)
- **?** *Bouteloua hirsuta* Series (Wood et al. 1998) [This also includes some of the shrub herbaceous alliances.]
- **<** *Bouteloua hirsuta* herbaceous alliance (Hoagland 1998a) [This only includes southern Great Plains associations.]
- **>** Central and Eastern Grasslands: 53: Grama-Galleta Steppe (*Bouteloua-Hilaria*) (Küchler 1964)
- **<** Grama-Galleta Series (Dick-Peddie 1993)
- **<** Grama-Threeawn Series (Dick-Peddie 1993)
- **<** Lower Slope (Beavis et al. 1982)
- **<** Plains-Mesa Grassland (Dick-Peddie 1993)

LOWER LEVEL UNITS

Associations:

- CEGL001755 *Bouteloua gracilis - Bouteloua hirsuta* Grassland
- CEGL005389 *Bouteloua gracilis - Muhlenbergia torreyi - Aristida purpurea* Grassland
- CEGL001761 *Bouteloua gracilis - Sporobolus cryptandrus* Grassland
- CEGL001754 *Bouteloua gracilis - Bouteloua curtipendula* Grassland
- CEGL002250 *Bouteloua curtipendula - Bouteloua (eriopoda, gracilis)* Grassland
- CEGL001764 *Bouteloua hirsuta - Bouteloua curtipendula* Grassland
- CEGL002673 *Bouteloua hirsuta* Grassland [Placeholder]

AUTHORSHIP

Primary Concept Source: W.A. Dick-Peddie (1993)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Beavis et al. 1982, Bonham and Lerwick 1976, Bourgeron and Engelking 1994, Bruner 1931, Clements and Goldsmith 1924, Costello 1944b, Diamond 1993, Dick-Peddie 1993, Donart et al. 1978b, Faber-Langendoen et al. 2017b, Heitschmidt et al. 1970, Hoagland 1998a, Klipple 1964, Küchler 1964, Küchler 1974, Milchunas et al. 1989, Moir and Trlica 1976, Moulton et al. 1981, Muldavin and Mehlhop 1992, Muldavin et al. 1998c, Muldavin et al. 2000b, Mutel 1976, Rogers 1953, Shantz 1923, Stearns-Roger, Inc. 1978, Steinauer 1989, Vestal 1914, Weaver and Albertson 1956, Wood et al. 1998, Zimmerman 1967

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G144. Great Plains Shortgrass Prairie

A4002. Bouteloua gracilis - Bouteloua hirsuta - Hesperostipa neomexicana Shortgrass Prairie Alliance

Type Concept Sentence: This mixedgrass alliance is characterized by a moderately dense grass layer of midgrass *Hesperostipa neomexicana* with a shortgrass layer composed of codominant *Bouteloua gracilis* and/or *Bouteloua hirsuta*. It is found from the northern Chihuahuan Desert north into the southwestern Great Plains on gentle to moderately steep slopes in foothills and escarpments.

OVERVIEW

Scientific Name: *Bouteloua gracilis - Bouteloua hirsuta - Hesperostipa neomexicana* Shortgrass Prairie Alliance
Common Name (Translated Scientific Name): Blue Grama - Hairy Grama - New Mexico Feathergrass Shortgrass Prairie Alliance
Colloquial Name: Blue Grama - Hairy Grama - New Mexico Feathergrass Shortgrass Prairie

Type Concept: Vegetation of this grassland alliance is characterized by a moderately dense midgrass layer of bunchgrass *Hesperostipa neomexicana* over a shortgrass layer composed of *Bouteloua gracilis* and/or *Bouteloua hirsuta*. Other grass species include *Aristida purpurea* and *Bouteloua curtipendula*, but stands are not codominated by desert grasses such as *Bouteloua eriopoda, Eragrostis intermedia, Muhlenbergia emersleyi*, or *Muhlenbergia setifolia*. The forb layer is variable and commonly includes *Lesquerella fendleri* and *Melampodium leucanthum*. Scattered shrubs, subshrubs or succulents may be present, but do not form a layer. This alliance occurs from the northern San Andres Mountains, Chupadera Mesa and the Oscura Mountains in the northern Chihuahuan Desert and extends north into the foothills of central New Mexico and Colorado and east on escarpments in the southwestern Great Plains. Stands occur on generally cool aspects on gentle to moderately steep slopes. The ground surfaces are generally gravelly, with scattered rocks and little exposed soil.

Classification Comments: This alliance includes grasslands that also occur in the Chihuahuan Desert. Currently they are placed in a Great Plains group. If a stand has lots of desert grasses present, such as *Bouteloua eriopoda, Bouteloua radicosa, Digitaria californica, Eragrostis intermedia, Muhlenbergia emersleyi, Muhlenbergia setifolia*, or is codominated by them, it may be better classified as a desert grassland.

~*Hesperostipa neomexicana* Grassland (CEGL001708) and *Hesperostipa neomexicana* Mixed Prairie Grassland (CEGL001711) from the archived *Hesperostipa neomexicana* Southwestern Great Plains Alliance (A4041) are now included here. The current description needs revision to reflect this merge.

Internal Comments: KAS-12-13: The diagnostic species *Hesperostipa neomexicana* occurs the foothills and mountains of the northern Chihuahuan Desert to foothills and escarpments in the southwestern Great Plains and Rocky Mountain Front Range into southern Wyoming. The associations in this alliance are very similar to *Hesperostipa neomexicana* Herbaceous Vegetation (CEGL001708) and *Hesperostipa neomexicana* Mixed Prairie Herbaceous Vegetation (CEGL001711) in Hesperostipa neomexicana Southwestern Great Plains Herbaceous Alliance (A4041), which is in Northern Great Plains Mixedgrass Mesic Prairie (G141). Also associations in this alliance are documented from White Sands Missile Range in the northern Chihuahuan Desert (Muldavin and Mehlhop 1992, Muldavin et al. 200b), so they may be more desert grassland than Great Plains. By definition, stands codominated by this species are mixedgrass so Great Plains Shortgrass Prairie Group (G144) may not be the best fit. Need more data on *Hesperostipa neomexicana* stands in southwestern Great Plains to clarify classification. If we determined to maintain this alliance, we show consider moving *Hesperostipa neomexicana* Mixed Prairie Herbaceous Vegetation (CEGL001711) from New Mexico into this alliance.

Other Comments:

Similar NVC Types: Stands in Chihuahuan Desert Foothill-Piedmont & Lower Montane Grassland Group (G490) may be similar in transition zone between the northern Chihuahuan Desert and southwestern Great Plains and need further review.

- A3206 *Muhlenbergia emersleyi - Muhlenbergia setifolia - Hesperostipa neomexicana* Madrean Lower Montane Grassland Alliance: may also codominated by *Hesperostipa neomexicana*.

Diagnostic Characteristics: This alliance is characterized by dominant and diagnostic species *Hesperostipa neomexicana* with a shortgrass layer composed of *Bouteloua gracilis* and/or *Bouteloua hirsuta* and sparsely scattered shrubs. Desert grasses may be present but do not codominate, especially *Bouteloua eriopoda, Eragrostis intermedia, Muhlenbergia emersleyi*, and *Muhlenbergia setifolia*.

VEGETATION

Physiognomy and Structure: Stands in this mixedgrass alliance are composed of a moderately dense to dense, medium-tall, bunchgrass layer with an open to moderately dense shortgrass layer composed of perennial grasses. Low cover of forbs is often present. Sparse scattered shrubs may be present but do not form a layer.

Floristics: This grassland alliance is characterized by a moderately dense to dense perennial grass layer composed of midgrass *Hesperostipa neomexicana* over an open to moderately dense shortgrass layer composed of *Bouteloua gracilis* and/or *Bouteloua hirsuta*. Other grasses may be present to codominant such as *Aristida purpurea* and *Bouteloua curtipendula*, but stands are not codominated by desert grasses such as *Bouteloua eriopoda, Eragrostis intermedia, Muhlenbergia emersleyi*, or *Muhlenbergia setifolia*. Scattered shrubs and dwarf-shrubs present may include *Artemisia bigelovii, Chrysothamnus pulchellus, Dalea formosa, Gutierrezia sarothrae*, and *Rhus trilobata*. Forb cover is generally sparse (<10%), but may be diverse. Common forbs include *Astragalus* spp., *Gaura coccinea, Lesquerella fendleri, Machaeranthera pinnatifida ssp. pinnatifida, Melampodium leucanthum, Plantago patagonica, Psoralidium tenuiflorum, Ratibida columnifera*, and *Sphaeralcea coccinea*. Succulents such as *Opuntia polyacantha* and *Opuntia phaeacantha* are common. Occasional *Juniperus monosperma* (live or standing dead) are common. Southern stands may have scattered *Agave palmeri, Dasylirion wheeleri, Nolina microcarpa*, or *Prosopis glandulosa* present.

ENVIRONMENT & DYNAMICS

Environmental Description: This grassland alliance occurs in the northern San Andres Mountains, Chupadera Mesa and the Oscura Mountains in the northern Chihuahuan Desert and extends north into foothills of central New Mexico and the Colorado Front Range extending out on escarpments and mesas in the southwestern Great Plains. Stands occur on generally cool aspects on gentle to moderately steep slopes at elevations ranging from 1525-2130 m (5000-7000 feet). Soils range from coarse loams to silty clays, but can be shallow and rocky and contain caliche layers derived from limestone and/or sandstones. The ground surfaces are generally gravelly, with scattered rocks and little exposed soil.

Dynamics:

DISTRIBUTION

Geographic Range: This grassland alliance occurs in the northern San Andres Mountains, Chupadera Mesa and the Oscura Mountains in the northern Chihuahuan Desert and extends north into foothills of central New Mexico and the Colorado Front Range extending east out on escarpments and mesas in the southwestern Great Plains.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **>** *Bouteloua gracilis - Stipa neomexicana* PA (Muldavin and Mehlhop 1992)
- **>** *Stipa neomexicana / Bouteloua hirsuta* PA (Muldavin and Mehlhop 1992)
- **=** Grama-Feathergrass Series (Dick-Peddie 1993) [This series includes semi-desert grasslands in both the Chihuahuan Desert and Great Plains.]
- **>** New Mexico Needlegrass-Blue Grama PA (Muldavin et al. 2000b)
- **>** New Mexico Needlegrass-Hairy Grama PA (Muldavin et al. 2000b)
- **=** Ridge (Beavis et al. 1982) [Ridge topographic was codominated by *Hesperostipa neomexicana* and *Bouteloua gracilis*.]

LOWER LEVEL UNITS

Associations:

- CEGL001763 *Bouteloua gracilis - Hesperostipa neomexicana* Grassland
- CEGL001766 *Bouteloua hirsuta - Hesperostipa neomexicana* Grassland
- CEGL001708 *Hesperostipa neomexicana* Grassland
- CEGL001711 *Hesperostipa neomexicana* Mixed Prairie Grassland

AUTHORSHIP

Primary Concept Source: W.A. Dick-Peddie (1993)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Beavis et al. 1982, Bonham and Lerwick 1976, Bourgeron et al. 1993b, Bruner 1931, Bujakiewicz 1975, Costello 1944b, Diamond 1993, Dick-Peddie 1993, Donart et al. 1978b, Faber-Langendoen et al. 2017b, Muldavin and Mehlhop 1992, Muldavin et al. 1994a, Muldavin et al. 1998a, Muldavin et al. 2000b, Mutel 1976, Ramaley 1914, Rogers 1953, Wood et al. 1998

M052. Great Plains Sand Grassland & Shrubland

This Great Plains macrogroup is found from Texas to southern Canada on somewhat excessively to excessively well-drained, deep sandy to loamy sand soils and contains grasses and scattered to moderately dense shrubs well-adapted to these soil conditions. Wind erosion, grazing and fire can significantly impact this macrogroup.

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
2.B.2.Nb.4.a. M052 Great Plains Sand Grassland & Shrubland

G069. Great Plains Sand Shrubland

Type Concept Sentence: This group is found on sandy soils across most of the Great Plains where a sparse to dense shrub cover, mostly *Artemisia filifolia* but also *Amorpha canescens, Prosopis glandulosa, Prunus pumila var. besseyi, Rhus trilobata*, and *Yucca glauca*, occurs over medium-tall grasses.

OVERVIEW

Scientific Name: *Artemisia filifolia / Calamovilfa longifolia - Yucca glauca* Sand Shrubland Group
Common Name (Translated Scientific Name): Sand Sagebrush / Prairie Sandreed - Soapweed Yucca Sand Shrubland Group
Colloquial Name: Great Plains Sand Sagebrush Sand Prairie Scrub

Type Concept: This group is found mostly in south-central areas of the Western Great Plains Division ranging from southwestern Wyoming and southwestern Nebraska up into the Nebraska Sandhill region, south through eastern Colorado, and New Mexico to central Texas, although some examples may reach as far north as the Badlands of South Dakota. Typically, this group is characterized by a sparse to moderately dense woody layer dominated by *Artemisia filifolia*, but other characteristic species may be present, including *Amorpha canescens, Prosopis glandulosa* (southern stands), *Prunus angustifolia, Prunus pumila var. besseyi* (northern stands), *Rhus trilobata*, and *Yucca glauca*. In the southern range of this group, *Quercus havardii* may also be present to dominant and represents one succession pathway that develops over time following disturbance. Associated herbaceous species can vary with geography, amount and season of precipitation, disturbance, and soil texture. The herbaceous layer typically has a moderate to dense canopy but can be sparse. Several mid- to tallgrass species characteristic of sand substrates are usually present to dominant, such as *Andropogon hallii, Calamovilfa gigantea, Calamovilfa longifolia, Schizachyrium scoparium, Sporobolus cryptandrus, Sporobolus giganteus*, or *Hesperostipa comata*. Overgrazing can lead to decreasing dominance of some of the grass species, such as *Andropogon hallii, Calamovilfa gigantea*, and *Schizachyrium scoparium*, and may result in a shift from the Great Plains Sand Grassland Group (G068) to this group. In the western extent of this group in the shortgrass prairie, more xeric mid- and shortgrass species such as *Hesperostipa comata, Sporobolus cryptandrus*, and *Bouteloua gracilis* often dominate the herbaceous layer. The climate is semi-arid to arid for much of the region in which this group occurs. It occurs on somewhat excessively to excessively well-drained, deep sandy soils that are often associated with dune systems and ancient floodplains.

Classification Comments: Overgrazing can lead to decreasing dominance of some of the grass species such as *Andropogon hallii, Calamovilfa gigantea*, and *Schizachyrium scoparium* and may result in a shift to this group from Great Plains Sand Grassland Group (G068).

Similar NVC Types:
- G068 Great Plains Sand Grassland: contains several of the same graminoid species and may occur in a mosaic with this group, especially if overgrazing has occurred.
- G144 Great Plains Shortgrass Prairie
- G331 Northern Great Plains Dry Mixedgrass Prairie
- G491 Chihuahuan Sandy Plains Semi-Desert Grassland

Diagnostic Characteristics: This group is distinguished by a sparse to moderately dense shrub layer dominated by *Artemisia filifolia*. It occurs in semi-arid to arid areas of the Great Plains on somewhat excessively to excessively well-drained and deep sandy soils.

VEGETATION

Physiognomy and Structure: This group is characterized by a sparse to moderately dense shrub layer interspersed with scattered to dense graminoids.

Floristics: This group is distinguished by a sparse to moderately dense shrub layer dominated by *Artemisia filifolia*. Graminoid species, such as *Andropogon hallii, Calamovilfa longifolia, Calamovilfa gigantea, Hesperostipa comata, Schizachyrium scoparium, Sporobolus cryptandrus*, and *Bouteloua* spp., can also be found within this group. Other shrub species, such as *Yucca glauca, Rhus trilobata*, and *Prunus angustifolia*, may be present. The shrubs *Quercus havardii* and *Prosopis glandulosa* may also be present in the southern extent of this group, as can the grasses *Panicum havardii* and *Sporobolus giganteus*. In the extension of this group into the shortgrass prairie, more xeric mid- and shortgrass species such as *Hesperostipa comata, Sporobolus cryptandrus* and *Bouteloua gracilis* can dominate the herbaceous layer.

ENVIRONMENT & DYNAMICS

Environmental Description: This group is found primarily in semi-arid to arid areas of the Great Plains. It occurs on somewhat excessively to excessively well-drained and deep sandy soils. This group is often found associated with dune systems and/or ancient floodplains but may occur in soils derived from sandstone residuum and/or occur on sandstone outcrop ridges and down associated slopes.

Dynamics: Fire and grazing constitute the most important processes impacting this group. Burning shrublands reduces cover of *Artemisia filifolia* for several years, resulting in grassland patches that form a mosaic pattern with shrublands. Composition of grasslands depends on precipitation and management. Drought stress can also influence this group in some areas.

DISTRIBUTION

Geographic Range: This group is found primarily within the south-central areas of the Great Plains ranging from the Nebraska Sandhills south into central Texas. However, examples can be found north in the Badlands in South Dakota and parts of North Dakota and the southern Canadian Prairie Provinces and west into Wyoming and Montana.

Spatial Scale & Pattern [optional]: Large patch

Nations: CA, US
States/Provinces: AB, CO, KS, MB, MT, ND, NE, NM, OK, SD, SK, TX, WY
TNC Ecoregions [optional]: 26:C, 27:C, 28:C, 33:C, 34:P
USFS Ecoregions (2007): 315A:CC, 315B:CC, 315F:CC, 321A:CC, 331B:CC, 331C:CC, 331D:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 332C:CC, 332E:CC, 332F:CC, M313B:PP
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **><** Blue Grama - Sideoats Grama - Black Grama (707) (Shiflet 1994)
- **<** Bluestem - Dropseed (708) (Shiflet 1994)
- **>** Mesquite (southern type): 68 (Eyre 1980)
- **>** Mesquite (western type): 242 (Eyre 1980)
- **>** Mohrs (Shin) Oak: 67 (Eyre 1980)
- **>** Sand Bluestem - Little Bluestem Dunes (720) (Shiflet 1994)
- **=** Sand Sagebrush - Mixed Prairie (722) (Shiflet 1994)
- **>** Sand Shinnery Oak (730) (Shiflet 1994)
- **<** Sandsage Prairie (605) (Shiflet 1994)

LOWER LEVEL UNITS

Alliances:

- A0816 *Artemisia filifolia* Great Plains Sand Prairie Scrub Alliance
- A1540 *Yucca glauca* Prairie Scrub Alliance
- A4112 *Quercus havardii* Prairie Scrub Alliance
- A0627 *Sapindus saponaria* Prairie Scrub Alliance

AUTHORSHIP

Primary Concept Source: S. Menard and K. Kindscher, in Faber-Langendoen et al. (2011)
Author of Description: S. Menard and J. Drake
Acknowledgments:
Version Date: 05/07/2015
Classif Resp Region: Midwest
Internal Author: SEM 10-10, mod. JD 5-15

REFERENCES

References: Comer et al. 2003, Eyre 1980, Faber-Langendoen et al. 2017a, Ramaley 1939b, Shiflet 1994, Sims et al. 1976, Tolstead 1942

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G069. Great Plains Sand Shrubland

A0816. Artemisia filifolia Great Plains Sand Prairie Scrub Alliance

Type Concept Sentence: This alliance includes *Artemisia filifolia*-dominated shrublands occurring mostly in the western Great Plains from as far north as the Black Hills, south to the Trans-Pecos of western Texas and northern Chihuahuan Desert, extending northwest into the Colorado Plateau. These shrublands typically occur on flat, hummocky, or rolling terrain, as well as on partially stabilized dunes and sandsheets. Vegetation cover is sparse to moderately dense, with a shrub stratum approximately 1 m tall, dominated by *Artemisia filifolia*, interspersed with areas of bare substrate and scattered tall or midgrasses.

OVERVIEW

Scientific Name: *Artemisia filifolia* Great Plains Sand Prairie Scrub Alliance
Common Name (Translated Scientific Name): Sand Sagebrush Great Plains Sand Prairie Scrub Alliance
Colloquial Name: Great Plains Sand Sagebrush Sand Prairie Scrub

Type Concept: This alliance includes *Artemisia filifolia*-dominated shrublands occurring mostly in the western Great Plains from as far north as the Black Hills, south to the Trans-Pecos of western Texas and northern Chihuahuan Desert, extending northwest into the Colorado Plateau. Vegetation cover is sparse to moderately dense, with a shrub stratum approximately 1 m tall, dominated by *Artemisia filifolia*, interspersed with areas of bare substrate and scattered tall or midgrasses. Species composition varies with geography, precipitation, disturbance, and soil texture. Associated species may include *Andropogon hallii, Artemisia frigida,*

Bouteloua curtipendula, Bouteloua gracilis, Carex duriuscula (= Carex eleocharis), Calamovilfa gigantea, Calamovilfa longifolia, Calylophus serrulatus, Carex inops ssp. heliophila, Helianthus petiolaris, Hesperostipa comata (= Stipa comata), Heterotheca villosa var. villosa, Ipomoea leptophylla, Lathyrus polymorphus, Lygodesmia juncea, Opuntia spp., *Penstemon buckleyi, Prosopis glandulosa, Prunus angustifolia, Psoralidium lanceolatum, Schizachyrium scoparium, Sporobolus giganteus, Sporobolus cryptandrus*, and *Yucca glauca*. Communities associated with gypsum dunes have many gypsophiles or gypsum endemics. Colorado Plateau shrub associates include *Ericameria nauseosa, Ephedra torreyana, Ephedra viridis, Gutierrezia sarothrae, Atriplex canescens*, and the graminoids *Muhlenbergia pungens, Sporobolus cryptandrus, Bouteloua eriopoda*, and *Achnatherum hymenoides*. Some examples found in Texas and Oklahoma may be dominated by *Quercus havardii*. Degraded examples of this alliance may be dominated by *Prunus angustifolia*. Some examples in Oklahoma and Texas may be codominated by *Quercus havardii*. These shrublands typically occur on flat, hummocky, or rolling terrain, as well as on partially stabilized dunes and sandsheets. Soils supporting these communities have low water retention and nutrient availability, and are typically sand or loamy sand, primarily of eolian origin, but include sand deposits derived from sandstone residuum and cinder deposits. Less xeric sites tend to be more grass-dominated. In western Kansas and eastern Colorado, this alliance is found downwind of major waterways where alluvial sand is blown. In Texas these shrublands occur over sandy soils in the Rolling and High Plains and on gypsum dunes in the Trans-Pecos. On the Colorado Plateau, stands occur on a variety of sites including pockets of sand below sandstone cliffs, dunes and sheets of sand or cinder, floodplain terraces and alluvial fans. Timing and amount of growing-season precipitation can greatly affect species abundance from year to year. Drought or overgrazing stands of this alliance will reduce vegetation cover and can allow the wind to cause blowouts or active dunes.

Classification Comments: This alliance contains all the *Artemisia filifolia*-dominated associations and ranges across the entire Great Plains. More information may suggest a north-south separation. Name of the alliance needs to include better diagnostic species, as this alliance has a name very similar to A3181 (G312). For now, a geographic modifier is used to distinguish it.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Shrublands dominated by *Artemisia filifolia* within the Great Plains. Degraded examples may be dominated by *Prunus angustifolia* and some examples in Oklahoma and Texas may be codominated by *Quercus havardii*.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a sparse to moderately dense cover of microphyllous evergreen shrubs less than 1.5 m tall. The sparse to moderately dense graminoid layer is dominated by tall, medium-tall or short bunch grasses. Forb cover is generally sparse. Scattered broad-leaved deciduous tall shrubs may be present.

Floristics: This alliance includes *Artemisia filifolia*-dominated shrublands that occur on sandy sites in the central and southern Great Plains (extending as far north as the Black Hills), the Chihuahuan Desert, and the Colorado Plateau. The vegetation is characterized by a sparse to moderately dense woody layer approximately 1 m tall that is dominated by the microphyllous evergreen shrub *Artemisia filifolia*. These shrubs usually do not grow as clumps but as individuals with the interstices most often dominated by a sparse to moderately dense layer of tall, mid or short grasses (Bruner 1931, Ramaley 1939a, 1939b, Steinauer 1989, Dick-Peddie 1993). Associated shrub and dwarf-shrub composition varies with geography, precipitation, disturbance, and soils. In the Great Plains, some stands have *Prunus angustifolia* or *Quercus havardii* as a codominants in the shrub layer. This species often grows taller than *Artemisia filifolia* and may form thickets (McGregor and Barkley 1986). In northern stands, *Artemisia frigida* is more common, and Chihuahuan Desert stands may include *Dalea lanata, Psorothamnus scoparius, Tiquilia hispidissima*, or *Yucca elata*. On the Colorado Plateau, *Ericameria nauseosa, Ephedra torreyana, Ephedra viridis, Gutierrezia sarothrae*, or *Atriplex canescens* may codominate. *Coleogyne ramosissima* is typically absent. Species of *Opuntia* and *Yucca* are common in many stands throughout its range.

The sparse to moderately dense herbaceous layer is typically dominated by graminoids. The most abundant and widespread species are *Achnatherum hymenoides (= Oryzopsis hymenoides), Andropogon hallii, Bouteloua gracilis, Bouteloua curtipendula, Calamovilfa longifolia, Schizachyrium scoparium*, or *Sporobolus cryptandrus*. *Carex inops ssp. heliophila, Carex duriuscula (= Carex eleocharis)*, and *Hesperostipa comata (= Stipa comata)* are more common in northern stands, and *Bouteloua breviseta, Bouteloua eriopoda, Bouteloua trifida, Sporobolus flexuosus, Sporobolus giganteus*, and *Sporobolus nealleyi* are restricted to southern stands. *Muhlenbergia pungens, Sporobolus cryptandrus, Bouteloua eriopoda*, and *Achnatherum hymenoides* are important graminoids on the Colorado Plateau. Forbs are typically not abundant in these communities. Associated species include *Calylophus serrulatus, Heterotheca villosa var. villosa, Helianthus petiolaris, Ipomoea leptophylla, Lathyrus polymorphus, Lepidium montanum, Lygodesmia juncea, Mentzelia* spp., *Penstemon buckleyi*, and *Psoralidium lanceolatum*. Communities associated with gypsum dunes have many gypsophiles or gypsum endemics.

ENVIRONMENT & DYNAMICS

Environmental Description: Shrublands included in this alliance occur on sandy sites in the central and southern Great Plains into the Chihuahuan Desert and on the Colorado Plateau. Elevations range from 1122 to 1769 m (3680-5803 feet). The climate is semi-arid to arid, and mean annual precipitation ranges from 20-65 cm. Sites include flat to moderately sloping hummocky or rolling terrain to partially stabilized dunes. Stands can occur on any aspect. The soils are sand or loamy sand, primarily of eolian origin, but include sand deposits derived from sandstone residuum and cinder deposits. All substrates are well-drained to excessively well-drained. Water retention and nutrient availability of the soils are low because water infiltrates rapidly and percolates deeply into the coarse-textured substrate and is therefore only available to deep-rooted plants. In southwestern Kansas and southeastern Colorado, this alliance is found downwind of major waterways where alluvial sand is blown (Johnston 1987). In Texas these shrublands occur on sandy soils in the Rolling and High Plains and on gypsum dunes in the Trans-Pecos (Dick-Peddie 1993). On the Colorado Plateau, stands occur on a variety of sites including pockets of sand below sandstone cliffs, partially stabilized dunes and sheets of cinder or sand, floodplain terraces and alluvial fans. Adjacent vegetation varies by geographic location but is generally grasslands dominated by shortgrass and midgrass prairie species such as *Bouteloua gracilis, Pleuraphis jamesii, Calamagrostis canadensis*, and *Hesperostipa comata*. In desert areas it is surrounded by Chihuahuan Desert scrub dominated by *Larrea tridentata*.

Dynamics: These shrublands occur as any one of several stages in a successional sequence. Drought or overgrazing stands of this alliance will reduce vegetation cover and can allow the wind to cause blowouts or active dunes (Ramaley 1939b). Ramaley (1939b) describes the succession in Colorado from loose sand to a sandhills - mixed community dominated by *Muhlenbergia pungens*. It then may proceed to an *Artemisia filifolia* (sand sage) community or skip this stage and succeed to the sand prairie, late seral community dominated by *Hesperostipa comata, Calamovilfa longifolia*, and *Andropogon hallii*. This can happen relatively quickly with adequate precipitation and rest from grazing. Ramaley (1939b) also reported that unless protected from overgrazing and fires, the sand sage community will not succeed into the sand prairie community. However, in regions with marginal precipitation, such as occurs over much of eastern Colorado, the sand sage community may be the last successional stage (Ramaley 1939b).

A 10-year grazing study on sand sage pastures in Colorado by Sims et al. (1976) and Dahl and Norris (1965) found that *Bouteloua gracilis* abundance increased with increased cattle grazing, whereas *Calamovilfa longifolia* and *Hesperostipa comata* decreased. With heavy grazing, *Artemisia filifolia* density increased because of seedling recruitment. This may be due to decreased competition with grasses. In the lightly grazed treatments, *Hesperostipa comata* abundance more than doubled and the *Artemisia filifolia* density decreased slightly. Weaver and Albertson (1956) reported *Artemisia filifolia* and *Sporobolus cryptandrus* both increasing with grazing in sandhills of Oklahoma.

In Colorado, fire frequency and extent are thought to be low in these stands because sand sage areas are usually surrounded by other communities that are too moist or too sparse to carry a fire well (Ramaley 1939b). In the Great Plains, Wright and Bailey (1980) reported that after fire *Artemisia filifolia* will resprout and will also reproduce vigorously as seedlings. The shrubs *Prunus angustifolia* and *Rhus* spp. also vigorously resprouted after fire (Jackson 1965). Generally, however, fire reduces the vegetation cover that protects these shrublands from blowouts.

Timing and amount of growing-season precipitation can greatly affect species abundance from year to year. Normal to wet springs with a dry summer often result in biomass being dominated by cool-season species such as *Hesperostipa comata*. A year with a dry spring and normal to wet summer results in biomass being dominated by warm-season species such as *Andropogon hallii* and *Calamovilfa longifolia*. Similarly, timing of grazing can have the same result. Forb abundance and diversity can be very high during summers with significantly higher than average precipitation. *Panicum virgatum, Sorghastrum nutans*, and *Prunus pumila var. besseyi* are present in low abundance in good condition stands in Colorado but are often eliminated by heavy grazing (Soil Conservation Service 1978).

DISTRIBUTION

Geographic Range: This alliance occurs on sandy sites in the Great Plains and Chihuahuan Desert from the Black Hills in southwestern South Dakota south to Trans-Pecos Texas, southern New Mexico, and Arizona.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Artemisia filifolia* Series #303 (Johnston 1987)
- **?** *Artemisia filifolia* Shrubland Alliance (Hoagland 2000)
- **?** *Artemisia filifolia* shrubland alliance (Hoagland 1998a)

- **=** SRM Cover Type #605 - Sandsage Prairie (Shiflet 1994)
- **?** Sand Sage Community (Ramaley 1939b) [Colorado]
- **?** Sand Sagebrush (Dick-Peddie 1993) [New Mexico]
- **?** Sandsage Prairie (Küchler 1974)

LOWER LEVEL UNITS

Associations:

- CEGL005000 *Artemisia filifolia - Rhus trilobata* Shrubland
- CEGL002176 *Artemisia filifolia / Bouteloua (curtipendula, gracilis)* Shrubland
- CEGL002178 *Artemisia filifolia / Schizachyrium scoparium - Andropogon hallii* Shrubland
- CEGL002177 *Artemisia filifolia / Calamovilfa longifolia* Shrubland
- CEGL001459 *Artemisia filifolia / Andropogon hallii* Shrubland
- CEGL002179 *Artemisia filifolia / Sporobolus cryptandrus* Shrubland
- CEGL002180 *Prunus angustifolia / Schizachyrium scoparium* Ruderal Shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: S. Menard
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Aldous and Shantz 1924, Bruner 1931, Costello and Turner 1944, Dahl and Norris 1965, Daley 1972, Diamond 1993, Dick-Peddie 1993, Evans 1964, Faber-Langendoen et al. 2017b, Garrison et al. 1977, Great Plains Flora Association 1986, Green 1969, Hoagland 1998a, Hoagland 2000, Jackson 1965, Johnston 1987, Küchler 1974, Maxwell and Brown 1968, McGregor and Barkley 1986, McMahan et al. 1984, Muldavin and Mehlhop 1992, Ramaley 1916b, Ramaley 1939a, Ramaley 1939b, Rogers 1950, Rogers 1953, Savage 1937, Shiflet 1994, Sims et al. 1976, Soil Conservation Service 1978, Steinauer 1989, Weaver and Albertson 1956, Wright and Bailey 1980

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G069. Great Plains Sand Shrubland

A4112. Quercus havardii Prairie Scrub Alliance [Low - Poorly Documented]

Type Concept Sentence:

OVERVIEW

Scientific Name: *Quercus havardii* Prairie Scrub Alliance
Common Name (Translated Scientific Name): Havard Oak Prairie Scrub Alliance
Colloquial Name: Havard Oak Prairie Scrub

Type Concept:

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics:

VEGETATION

Physiognomy and Structure:

Floristics:

ENVIRONMENT & DYNAMICS

Environmental Description:

Dynamics:

DISTRIBUTION

Geographic Range:

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL002171 *Quercus havardii / Sporobolus cryptandrus - Schizachyrium scoparium* Shrubland
- CEGL004558 *Quercus havardii - (Penstemon ambiguus, Croton dioicus) / Sporobolus giganteus* Scrub

AUTHORSHIP

Primary Concept Source: D. Faber-Langendoen
Author of Description:
Acknowledgments:

REFERENCES

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G069. Great Plains Sand Shrubland

A0627. Sapindus saponaria Prairie Scrub Alliance

Type Concept Sentence: This alliance includes patchy woodlands in western Oklahoma often consisting of scattered clonal mottes of *Sapindus saponaria*.

OVERVIEW

Scientific Name: *Sapindus saponaria* Prairie Scrub Alliance
Common Name (Translated Scientific Name): Wingleaf Soapberry Prairie Scrub Alliance
Colloquial Name: Soapberry Prairie Scrub

Type Concept: This alliance includes patchy woodlands often consisting of scattered clonal mottes of *Sapindus saponaria*. A community in this alliance has been defined for Oklahoma, occurring in the western two-thirds of the state, with scattered occurrences in the east and possibly ranging into Texas. Characteristic associates include *Andropogon gerardii, Celtis laevigata var. reticulata, Quercus macrocarpa, Rhus aromatica, Schizachyrium scoparium, Smilax bona-nox*, and *Ulmus americana*. *Zanthoxylum hirsutum* may be a codominant species in parts of the range. These woodlands occur on sand dunes and talus slopes on Black Mesa, Oklahoma.

Classification Comments: More information is needed to fully document the range and floristics of this alliance. Related semi-natural or cultural vegetation may be found along fencerows, margins of other forest and woodland associations, or as mottes on floodplain pastures (B. Hoagland pers. comm.).

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Patchy woodlands often consisting of scattered clonal mottes of *Sapindus saponaria*.

VEGETATION

Physiognomy and Structure: This alliance consists of patchy woodlands of scattered clonal mottes of *Sapindus saponaria*.

Floristics: Stands are dominated by scattered clonal mottes of *Sapindus saponaria var. drummondii*. Characteristic associates include *Andropogon gerardii, Celtis laevigata var. reticulata, Quercus macrocarpa, Rhus aromatica, Schizachyrium scoparium, Smilax bonanox*, and *Ulmus americana*. *Zanthoxylum hirsutum* may be a codominant species in parts of the range.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance is known from sand dunes and talus slopes on Black Mesa, Oklahoma.

Dynamics: More information is needed to better describe the dynamics for this vegetation. Fire, climate, native grazing and edaphic factors all likely played a role historically in maintaining this vegetation. Loss of these natural processes may have resulted in a shift toward a more closed canopy, increase in successional woody species, and decrease in native grass cover.

DISTRIBUTION

Geographic Range: This woodland occurs throughout Oklahoma, but is most common in central and western Oklahoma. It may also occur in Texas and northern Mexico.

Nations: MX?, US
States/Provinces: OK, TX?
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Sapindus saponaria* woodland alliance (Hoagland 1998a)
- **?** Soapberry Series (Dick-Peddie 1993)

LOWER LEVEL UNITS

Associations:
- CEGL004535 *Sapindus saponaria var. drummondii* Woodland

AUTHORSHIP

Primary Concept Source: B. Hoagland and A.S. Weakley, in Faber-Langendoen et al. (2013)
Author of Description: B. Hoagland, A.S. Weakley, J. Teague
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Dick-Peddie 1993, Faber-Langendoen et al. 2017b, Hoagland 1998a, Hoagland pers. comm.

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G069. Great Plains Sand Shrubland

A1540. Yucca glauca Prairie Scrub Alliance

Type Concept Sentence: This alliance includes stands of herbaceous vegetation with a sparse shrub layer growing on sandstone outcrops and sandy soils in the northwestern Great Plains. Elevations range from 1100-1850 m. Stands of this alliance contain an open to moderately dense (at least 10% cover), low-shrub layer above a species-rich herbaceous layer. Dominance of the shrub layer by *Yucca glauca* is characteristic (cover ranging from 5-15%). *Artemisia tridentata ssp. wyomingensis* and *Artemisia cana ssp. cana* may be present but are sparse and contribute little cover.

OVERVIEW

Scientific Name: *Yucca glauca* Prairie Scrub Alliance
Common Name (Translated Scientific Name): Soapweed Yucca Prairie Scrub Alliance
Colloquial Name: Great Plains Soapweed Yucca Prairie Scrub

Type Concept: This alliance includes stands of herbaceous vegetation with a sparse shrub layer growing on caliche, sandstone outcrops and sandy soils in the northwestern Great Plains. Elevations range from 1100-1850 m. In the western Great Plains, precipitation occurs mostly in the spring. Summers are hot and dry, except for locally occurring, high-intensity convective storms. Stands typically occur along ridgetops and upper slopes, on sandstone or scoria outcrops and probably on stabilized sand dunes as well. Soils in some cases are residual and relatively deep, with genetic horizons. Texture varies from nearly pure sand on the surface

to medium-textured and medium-coarse-textured at depth. Stands of this alliance contain an open to moderately dense (at least 10% cover), low-shrub layer above a species-rich herbaceous layer. Dominance of the shrub layer by *Yucca glauca* is characteristic (cover ranging from 5-15%). *Artemisia tridentata ssp. wyomingensis* and *Artemisia cana ssp. cana* may be present but are sparse and contribute little cover. In the herbaceous layer, *Hesperostipa comata (= Stipa comata)* and *Calamovilfa longifolia* are the most abundant and constant species, and *Bouteloua gracilis, Schizachyrium scoparium*, and *Carex filifolia* often are present but contribute much less cover than do *Hesperostipa* or *Calamovilfa*. *Pseudoroegneria spicata* is dominant in some stands. Forbs are common but contribute little cover; *Artemisia frigida* has the highest constancy, but no forbs are characteristic of the alliance. Litter covers can be high, up to 50% of the ground surface, and bare soil covers the rest of the ground surface.

Classification Comments: This alliance was not changed from the original. At least one association within this alliance is poorly described and needs more data to completely articulate the type. As association data are further developed, this alliance may need to be revised. There are several *Yucca*-dominated areas within the southern Great Plains. These areas are mostly degraded, overgrazed and/or fire suppressed prairies, mostly from *Andropogon hallii* Sand Prairie Alliance (A1193).

Internal Comments:
Other Comments:

Similar NVC Types: This alliance can co-occur with other alliances in the northern Great Plains and many species overlap.
- A1201 *Calamovilfa longifolia* Sand Prairie Alliance
- A3586 *Artemisia cana ssp. cana* Wet Shrubland Alliance

Diagnostic Characteristics: This alliance contains grasslands with a shrub layer of *Yucca glauca* that occur on sandy soils and sandstone outcrops in the northwestern Great Plains.

VEGETATION

Physiognomy and Structure: This alliance is dominated by perennial bunch grasses, with scattered perennial forbs. Succulent shrubs form a sparse layer, ranging in cover from 5-25%.

Floristics: Stands of this alliance contain an open to moderately-dense (at least 10% cover), low-shrub layer above a species-rich herbaceous layer. Dominance of the shrub layer by *Yucca glauca* is characteristic (cover ranging from 5-15%). *Artemisia tridentata ssp. wyomingensis* and *Artemisia cana ssp. cana* may be present but are sparse and contribute little cover. In the herbaceous layer, *Hesperostipa comata (= Stipa comata)* and *Calamovilfa longifolia* are the most abundant and constant species and *Bouteloua gracilis, Schizachyrium scoparium*, and *Carex filifolia* often are present but contribute much less cover than do *Hesperostipa* or *Calamovilfa*. *Pseudoroegneria spicata* is dominant in some stands. Forbs are common but contribute little cover; *Artemisia frigida* has the highest constancy, but no forbs are characteristic of the alliance. Litter covers can be high, up to 50% of the ground surface, and bare soil covers the rest of the ground surface.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance includes stands of herbaceous vegetation with a sparse shrub layer growing on sandstone outcrops and sandy soils in the northwestern Great Plains. Elevations range from 1100-1850 m. The climate is temperate, mostly continental and semi-arid to arid. Mean annual precipitation ranges from 25-35 cm. In the western Great Plains, precipitation occurs mostly in the spring. Summers are hot and dry, except for locally occurring, high-intensity convective storms. Stands typically occur along ridge tops and upper slopes, on sandstone or scoria outcrops and probably on stabilized sand dunes as well (Prodgers 1978, Thilenius et al. 1995). Soils in some cases are residual and relatively deep, with genetic horizons. Texture varies from nearly pure sand on the surface to medium-textured and medium-coarse-textured at depth (Thilenius et al. 1995), such as loamy sand, sandy loam, fine sandy loam, or loam textural classes (Prodgers 1978).

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is found in the northwestern Great Plains in South Dakota, Montana and Wyoming.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Associations:

- CEGL001499 *Yucca glauca / Pseudoroegneria spicata* Shrub Grassland
- CEGL002675 *Yucca glauca / Calamovilfa longifolia* Shrub Grassland

AUTHORSHIP

Primary Concept Source: M.S. Reid and G.P. Jones, in Faber-Langendoen et al. (2013)
Author of Description: M.S. Reid, G.P. Jones, and S. Menard
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Barnes et al. 1984, Faber-Langendoen et al. 2017b, Johnston 1987, Prodgers 1978, Ross and Hunter 1976, Thilenius et al. 1995

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
2.B.2.Nb.4.b. M052 Great Plains Sand Grassland & Shrubland

G068. Great Plains Sand Grassland

Type Concept Sentence: This sand prairie is most common in the north-central Great Plains but occurs in other parts of the western plains, as well. Medium and tall grasses dominate the sandy soils of this group, typically *Andropogon hallii, Calamovilfa longifolia, Hesperostipa comata*, and *Panicum virgatum*.

OVERVIEW

Scientific Name: *Andropogon hallii - Calamovilfa longifolia - Hesperostipa comata* Sand Grassland Group
Common Name (Translated Scientific Name): Sand Bluestem - Prairie Sandreed - Needle-and-Thread Sand Grassland Group
Colloquial Name: Great Plains Sand Bluestem Grassland

Type Concept: The sand prairies constitute a very unique group within the Western Great Plains. These sand prairies are often considered part of the tallgrass or mixedgrass regions in the Western Great Plains but can contain elements from Great Plains Shortgrass Prairie Group (G144), Central Great Plains Mixedgrass Prairie Group (G133), and Northern Great Plains Mesic Mixedgrass Prairie Group (G141). The largest expanse of sand prairies (approximately 5 million ha) can be found in the Sandhills of north-central Nebraska and southwestern South Dakota. These areas are relatively intact. The unifying and controlling feature for this group is that coarse-textured soils predominate and the dominant grasses are well-adapted to this condition. Graminoid species dominate the sand prairies, although relative dominance can change due to impacts of wind disturbance. *Andropogon hallii* and *Calamovilfa longifolia* are the most common species, but other grass and forb species such as *Hesperostipa comata, Carex inops ssp. heliophila*, and *Panicum virgatum* may be present. Apparently only *Calamovilfa longifolia* functions as a dominant throughout the range of the group. In the western extent, *Hesperostipa comata* becomes more dominant, and *Andropogon hallii* is less abundant but still present. Communities of *Artemisia cana ssp. cana* are included here in central and eastern Montana. Patches of *Quercus havardii* can also occur within this group in the southern Great Plains. Soils in the sand prairies can be relatively undeveloped and are highly permeable. Soil texture and drainage along with a species' rooting morphology, photosynthetic physiology, and mechanisms to avoid transpiration loss are highly important in determining the composition of the sand prairies. In the northwestern portion of its range, stand size corresponds to the area of exposed caprock sandstone; small patches predominate, but large patches are also found embedded in the encompassing Northern Great Plains Mesic Mixedgrass Prairie Group (G141). Another important feature is their susceptibility to wind erosion. Blowouts and sand draws are some of the unique wind-driven disturbances in the sand prairies. In most of eastern Montana, substrates supporting this group have weathered in place from sandstone caprock; thus, the solum is relatively thin, and the wind-sculpted features present further east do not develop. In Colorado, examples of this group include active sand dunes in the shortgrass prairie and San Luis Valley with the largest occurrence occurring in Great Sand Dunes National Park and Preserve and surrounding dune field. Fire and grazing constitute the other major dynamic processes that can influence this group.

Classification Comments: Overgrazing can decrease the dominance of some of the grass species, such as *Andropogon hallii, Calamovilfa gigantea*, and *Schizachyrium scoparium*, facilitating an increased abundance of shrubs such as *Artemisia filifolia* and a change in classification to Great Plains Sand Shrubland Group (G069).

Similar NVC Types: This group can contain elements of Great Plains Shortgrass Prairie Group (G144), Central Great Plains Mixedgrass Prairie Group (G133), and Northern Great Plains Mesic Mixedgrass Prairie Group (G141). This group may occur in a mosaic with the Great Plains Sand Shrubland Group (G069).

- G144 Great Plains Shortgrass Prairie
- G133 Central Great Plains Mixedgrass Prairie
- G331 Northern Great Plains Dry Mixedgrass Prairie
- G069 Great Plains Sand Shrubland
- G141 Northern Great Plains Mesic Mixedgrass Prairie
- G491 Chihuahuan Sandy Plains Semi-Desert Grassland

Diagnostic Characteristics: This group is distinguished by sparse to moderately dense graminoids. It occurs in semi-arid to arid areas of the Great Plains on somewhat excessively to excessively well-drained and deep sandy soils. The most characteristic example of this group occurs in the Nebraska Sandhills region.

VEGETATION

Physiognomy and Structure: The vegetation is characterized by a dense to sparse layer of tall grasses interspersed with forbs.

Floristics: This group is distinguished by the dominance of graminoids such as *Andropogon hallii* and *Calamovilfa longifolia*. Other graminoids such as *Hesperostipa comata, Carex inops ssp. heliophila*, and *Panicum virgatum* may be present. Characteristic forbs differ by region, but species of *Psoralidium* and *Pediomelum* are a common feature. *Penstemon haydenii* (Federally listed endangered) is endemic to the sand prairie group and of special conservation concern because of its probable decline due to grazing and fire suppression. Very diffuse patches of *Rhus trilobata* are found on shallow sandy soils, often associated with breaklands; other shrubs occasionally occurring include *Artemisia cana ssp. cana, Betula occidentalis, Juniperus horizontalis*, and *Yucca glauca*. Many of the warm-season graminoids extend at least to the Rocky Mountain Front Range as dominant components on appropriate sites or as a response to disturbance. All the characteristic species mentioned for Nebraska and South Dakota are also found in Montana stands (and possibly Wyoming and perhaps the rest of the states cited). Some of the communities cited as part of the concept in Nebraska and South Dakota are only marginally present in Montana, but others are found throughout Montana's Great Plains region. In the southern range of this group, patches of *Quercus havardii* can also occur.

ENVIRONMENT & DYNAMICS

Environmental Description: The distribution, species richness and productivity of plant species within this group are controlled primarily by environmental conditions, in particular the temporal and spatial distribution of soil moisture and topography. Soil texture and drainage along with a species' rooting morphology, photosynthetic physiology, and mechanisms to avoid transpiration loss are highly important in determining the composition and distribution of communities/associations. This group is found primarily on sandy and sandy loam soils that can be relatively undeveloped and highly permeable. Another important aspect of soils in the sand prairies is their susceptibility to wind erosion. Blowouts and sand draws are some of the unique wind-driven disturbances which can profoundly impact vegetation composition and succession. This group is usually found in areas with a rolling topography and can occur on ridges, midslopes and/or lowland areas within a region. It often occurs on moving sand dunes, especially within the Sandhills region of Nebraska and South Dakota. In Montana, occurrences are intimately associated with Northern Great Plains Mixedgrass Prairie Group (G141), usually occupying higher positions in local landscapes due to the fact that sandy members of some formations (that are predominantly marine shales) constitute the highest (and most weathering-resistant) points in the landscape.

Dynamics: The distribution, species richness and productivity of plant species within this group are controlled primarily by environmental conditions, in particular the temporal and spatial distribution of soil moisture and topography. Another important aspect of this group is its susceptibility to wind erosion. Blowouts and sand draws are some of the unique wind-driven disturbances in the sand prairies, particularly the Nebraska Sandhills, which can profoundly impact vegetation composition and succession within this group. Fire and grazing constitute the other major disturbances that can influence this group. Overgrazing, fire and trampling that leads to the removal of vegetation within those areas susceptible to blowouts can either instigate a blowout or perpetuate one already occurring. Overgrazing can also lead to significant erosion.

DISTRIBUTION

Geographic Range: This group is found throughout the Western Great Plains Division ranging from North Dakota south to Texas. The largest and most intact example of this group is found within the Sandhills region of Nebraska and South Dakota. However, it is also common (though occurring in predominantly small patches) farther west into central and eastern Montana. Its western extent in Wyoming is still to be determined, but it does occur in the Wyoming Highlands (mapzone 29) on weathered-in-place sandy soils, where *Calamovilfa longifolia* is found, along with *Artemisia cana*.

Spatial Scale & Pattern [optional]: Large patch
Nations: CA, US

States/Provinces: CO, KS, MT, ND, NE, NM?, OK, SD, TX, WY
TNC Ecoregions [optional]: 26:C, 27:C, 28:C, 33:C, 34:C
USFS Ecoregions (2007): 251F:CC, 251H:CC, 255A:PP, 315A:CC, 315B:CC, 315F:CC, 321A:??, 331B:CC, 331C:CC, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 331H:CC, 331K:CC, 331L:CC, 331M:CP, 331N:C?, 332C:CC, 332D:CC, 332E:CC, 332F:CC
Omernik Ecoregions: 8.4.7.37:C, 8.4.7.37e:C, 9.2.4.40:C, 9.2.4.40b:C, 9.2.4.40d:C, 9.4.2.27:C, 9.4.2.27d:C, 9.4.2.27g:C, 9.4.2.27h:C, 9.4.2.27i:C, 9.4.2.27k:C, 9.4.2.27l:C, 9.4.2.27n:C, 9.4.2.27o:C, 9.4.2.27r:C, 9.4.5.29:C, 9.4.5.29b:C, 9.4.5.29d:C, 9.4.5.29g:C
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **><** Blue Grama - Sideoats Grama - Black Grama (707) (Shiflet 1994)
- **<** Bluestem - Dropseed (708) (Shiflet 1994)
- **>** Bluestem - Prairie Sandreed (602) (Shiflet 1994)
- **>** Grama - Bluestem (714) (Shiflet 1994) [Soil texture ranges from sand to clay loam? Inclusions?]
- **>** Mohrs (Shin) Oak: 67 (Eyre 1980)
- **>** Prairie Sandreed - Needlegrass (603) (Shiflet 1994) [This SRM type is found in the more northerly and northwest portions of this group (as far west as central Montana).]
- **>** Sand Bluestem - Little Bluestem Dunes (720) (Shiflet 1994)
- **>** Sand Bluestem - Little Bluestem Plains (721) (Shiflet 1994)
- **><** Wheatgrass - Grama - Needlegrass (608) (Shiflet 1994) [Sandy portions of this SRM type are included in this group.]

LOWER LEVEL UNITS

Alliances:

- A1201 *Calamovilfa longifolia* Sand Prairie Alliance
- A1193 *Andropogon hallii* Sand Prairie Alliance

AUTHORSHIP

Primary Concept Source: S. Menard and K. Kindscher, in Faber-Langendoen et al. (2011)
Author of Description: S. Menard and K. Kindscher
Acknowledgments:
Version Date: 12/17/2010
Classif Resp Region: Midwest
Internal Author: SEM 12-10, mod. JD 5-15

REFERENCES

References: Barbour and Billings 1988, Comer et al. 2003, Eyre 1980, Faber-Langendoen et al. 2017a, Shiflet 1994, Tolstead 1942

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G068. Great Plains Sand Grassland

A1193. Andropogon hallii Sand Prairie Alliance

Type Concept Sentence: This alliance includes herbaceous vegetation with *Andropogon hallii*, occurring in the Great Plains from the United States-Canada border south to Texas. It is dominated by tall and midgrass species, with shortgrass species becoming important in the western portion of its range. *Andropogon hallii* is usually dominant or codominant.

OVERVIEW

Scientific Name: *Andropogon hallii* Sand Prairie Alliance
Common Name (Translated Scientific Name): Sand Bluestem Sand Prairie Alliance
Colloquial Name: Great Plains Sand Bluestem Grassland

Type Concept: This alliance includes herbaceous vegetation with *Andropogon hallii*, occurring in the Great Plains from the United States-Canada border south to Texas. It is dominated by tall and midgrass species, with shortgrass species becoming important in the western portion of its range. *Andropogon hallii* is usually dominant or codominant. *Calamovilfa longifolia* is present to codominant in most stands south of the South Dakota-Nebraska border. *Bouteloua gracilis, Bouteloua hirsuta, Eragrostis trichodes, Hesperostipa comata (= Stipa comata), Koeleria macrantha, Pascopyrum smithii, Schizachyrium scoparium*, and *Sporobolus cryptandrus* are typical grasses in stands of this alliance. Upland sedges are also very common, especially *Carex filifolia, Carex inops ssp. heliophila*, and *Carex duriuscula (= Carex eleocharis)*. Although graminoids are overwhelmingly dominant, several species of forbs can be found in many stands of this alliance. Some of the more common forbs are *Ambrosia psilostachya, Ipomoea leptophylla, Liatris punctata, Psoralidium* spp., and *Tradescantia occidentalis*. There may be widely scattered low shrubs, including *Rosa woodsii,*

Prunus pumila var. besseyi, and *Yucca glauca*. In west Texas common associates on deep sands include *Panicum havardii, Sporobolus giganteus*, and *Calamovilfa gigantea*. Stands of this alliance occur on sand deposits, usually on gentle to steep slopes but sometimes on flat ground. The soils are sand, loamy sand, or sandy loam. They can be poorly to moderately well-developed. There is little runoff or evaporation because moisture quickly sinks into the coarse soil. Soil near the surface is consequently dry throughout much of the year, but moisture is present further down, favoring deep-rooting species such as *Andropogon hallii* and *Calamovilfa longifolia*. Wind sometimes scours sand and vegetation from small areas, creating blowouts. These bare spots are initially colonized by species that are uncommon in this alliance, such as *Muhlenbergia pungens* and *Redfieldia flexuosa*. Eventually, these blowouts succeed to one of the communities in this alliance. These grasslands occur on semi-stabilized quartz sand dunes in eastern Trans-Pecos Texas, where they form landscape mosaics with *Quercus havardii* shrublands, wetland dune swales, and sparsely vegetated dunes. In the southern plains, this alliance is a small-patch occurrence nested within the more common *Artemisia filifolia* shrublands. The rare plant *Penstemon haydenii*, an endemic to dune blowouts in the sandhills of Nebraska, may be endangered by the decline in habitat because of fire suppression and low to moderate stocking rates.

Classification Comments: There is some overlap with *Calamovilfa longifolia* Sand Prairie Alliance (A1201) in those stands that contain both *Andropogon hallii* and *Calamovilfa longifolia*. Stands dominated by *Calamovilfa longifolia* and with *Andropogon hallii* present to moderately abundant present difficult classification questions. Sparsely vegetated, early-successional dune associations are also included in this alliance. They may need their own alliance but currently not enough data exist to justify a separate alliance.

Internal Comments:
Other Comments:

Similar NVC Types:
- A1201 *Calamovilfa longifolia* Sand Prairie Alliance: overlaps in those stands that contain both *Andropogon hallii* and *Calamovilfa longifolia*.

Diagnostic Characteristics: Stands are dominated by *Andropogon hallii* and are typically dry to dry-mesic.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a moderate to dense herbaceous layer (0.5-1.5 m tall) that is dominated by tall grasses and mid grasses, with short grasses common in the western portion of its range. There is usually a sparse forb layer. Widely scattered low shrubs may also be present.

Floristics: This alliance is found on sandy sites in the Great Plains from the U.S.-Canadian border south to Texas. It is dominated by tall- and midgrass species, with shortgrass species becoming important in the western portion of its range. The dominant species range from 0.5-1.5 m in height. *Andropogon hallii* is usually dominant or codominant. *Calamovilfa longifolia* is present to codominant in most stands north of the South Dakota-Nebraska border. *Bouteloua gracilis, Bouteloua hirsuta, Eragrostis trichodes, Hesperostipa comata (= Stipa comata), Koeleria macrantha, Pascopyrum smithii, Schizachyrium scoparium*, and *Sporobolus cryptandrus* are typical grasses in stands of this alliance. Upland sedges are also very common, especially *Carex filifolia, Carex inops ssp. heliophila*, and *Carex duriuscula (= Carex eleocharis)*. Although graminoids are overwhelmingly dominant, several species of forbs can be found in many stands of this alliance. Some of the more common forbs are *Ambrosia psilostachya, Ipomoea leptophylla, Liatris punctata, Psoralidium* spp., and *Tradescantia occidentalis*. There are widely scattered low shrubs, including *Rosa* spp., *Prunus pumila var. besseyi*, and *Yucca glauca*. In west Texas, common associates on deep sands include *Panicum havardii, Sporobolus giganteus*, and *Calamovilfa longifolia*.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands of this alliance occur on sand deposits in the Great Plains. The climate is semi-arid and continental, with annual precipitation ranging from 46-61 cm. Elevations are generally between 1000 and 1600 m. Sites where this alliance is found are usually on gentle to steep slopes but sometimes on flat ground (Tolstead 1942, Steinauer 1989). The soils are sand, loamy sand, or sandy loam, and they can be poorly to moderately well-developed (Johnston 1987, Steinauer 1989). There is little runoff or evaporation because moisture quickly sinks into the coarse soil. Soil near the surface is consequently dry throughout much of the year, but moisture is present deeper in the soil profile. This favors deep-rooting species such as *Andropogon hallii* and *Calamovilfa longifolia* (Barnes and Harrison 1982). In the northern and western extent, adjacent grasslands dominated by *Pascopyrum smithii* or *Bouteloua* spp. occur on fine-textured soils. In western Texas, these grasslands form mosaics with *Quercus havardii* shrublands.

Dynamics: Wind is a dominant factor that shapes the landscape where this alliance occurs. Wind sometimes scours sand and vegetation from small areas and creates blowouts. These bare spots are initially colonized by species that are relatively uncommon in this alliance, such as *Redfieldia flexuosa, Muhlenbergia pungens, Yucca glauca*, and *Achnatherum hymenoides*. Eventually, these blowouts succeed to other communities (Savage 1937, Ramaley 1939a, Tolstead 1942, Harrison 1980). Tolstead (1942) cites

Nebraska pioneer accounts that dunes were less vegetated than at present, and blowouts and stands were more common before cattle ranching. Fire frequency and extent are also thought to have declined since settlement because of fuel removal by livestock grazing and fire control (Burzlaff 1965, Wolfe 1973). Consequently, active dunes and large blowouts are less common now, as are the pioneer plant species *Redfieldia flexuosa, Andropogon hallii* and *Yucca glauca* (Harrison 1980).

These grasslands provide excellent summer forage and need careful management to prevent grazing out desirable species. Tolstead (1942) found that *Andropogon hallii* and *Eragrostis trichodes* are less common on pastures that receive year-round grazing. Generally, overgrazing this alliance decreases the cover of species of *Andropogon, Calamovilfa, Eragrostis*, and *Hesperostipa*, and increases the cover of *Bouteloua gracilis, Bouteloua hirsuta, Muhlenbergia pungens, Achnatherum hymenoides*, and *Sporobolus cryptandrus* (Savage 1937, Ramaley 1939a, Tolstead 1942, Harrison 1980). Overgrazing also kills out desirable shrubs, especially *Amorpha canescens* and *Prunus pumila var. besseyi* (Ryan et al. 1994). This grassland responds rapidly to management. Deferment of grazing in the late spring and summer favors warm-season grasses such as *Andropogon hallii, Bouteloua hirsuta, Bouteloua gracilis, Calamovilfa longifolia, Eragrostis trichodes, Koeleria macrantha*, and *Schizachyrium scoparium*.

Drought also causes declines in cover of all species, especially tall grasses, and can make the grassland more vulnerable to blowouts. Savage (1937) found large declines in tallgrass cover on sandy sites during drought in 1935. He ranked the cause of damage by decreasing effect: heat, drought, and, to a much lesser extent, grazing and then soil blowing. Ramaley (1939a) reports that in Colorado there is marginally enough precipitation to maintain this alliance. Drought causes retrogression to mixed sandhill, sand sage, or blow-out communities, which increases *Muhlenbergia pungens, Artemisia filifolia*, and *Achnatherum hymenoides*. Grazing during droughts increases the intensity of the damage (Ramaley 1939a).

DISTRIBUTION

Geographic Range: Grasslands in this alliance occur on sandy sites in the Great Plains in Texas, Oklahoma, Kansas, Colorado, Nebraska and Montana, and extends into Arizona, as well as southern Saskatchewan and southern Manitoba. It may also occur in South Dakota, North Dakota.

Nations: CA, US
States/Provinces: CO, KS, MB, MT, ND, NE, OK, SD, SK, TX
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Andropogon hallii* Series (Johnston 1987) [Colorado]
- **?** *Andropogon hallii* herbaceous alliance (Hoagland 1998a) [Oklahoma]
- **?** Bunchgrass Community (Weaver and Albertson 1956) [Nebraska]
- **?** Postclimax Grasses on Dunes (Tolstead 1941) [South Dakota]
- **?** Sand Prairie Community (Ramaley 1939a) [Colorado]
- **?** Sand-hills Mixed Type (Weaver and Albertson 1956) [Colorado]
- **?** Tall Grasses of the Dunes (Tolstead 1942) [Nebraska]
- **?** USDA-NRCS Deep Sand Range Sites #15,16,19 (Soil Conservation Service n.d.)

LOWER LEVEL UNITS

Associations:

- CEGL001467 *Andropogon hallii - Calamovilfa longifolia* Grassland
- CEGL001466 *Andropogon hallii - Carex inops ssp. heliophila* Grassland
- CEGL004016 *Andropogon hallii - Calamovilfa gigantea* Grassland
- CEGL002578 Forb Dune Sparse Vegetation
- CEGL002577 Shortgrass Dune Sparse Vegetation
- CEGL004591 *Andropogon hallii - Panicum havardii - Sporobolus giganteus* Grassland

AUTHORSHIP

Primary Concept Source: R.J. Pool (1913)
Author of Description: S. Menard
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Barnes and Harrison 1982, Bruner 1931, Burgess 1965, Burzlaff 1962, Comer et al. 1999, Culwell and Scow 1982, Drake and Faber-Langendoen 1997, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Harrison 1980, Hirsch 1985, Hoagland 1998a, Johnston 1987, Keeler et al. 1980, Küchler 1974, Looman 1980, Pool 1913, Ramaley 1939a, Ross et al. 1973, Ryan et al. 1994, Savage 1937, Savage and Runyon 1937, Soil Conservation Service 1978, Soil Conservation Service n.d., Steinauer 1989, TPWD 1996, Tolstead 1941, Tolstead 1942, Weaver and Albertson 1956, Wolfe 1973

2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
G068. Great Plains Sand Grassland

A1201. Calamovilfa longifolia Sand Prairie Alliance

Type Concept Sentence: This alliance, found in the northwestern Great Plains, occurs on sandy dry-mesic sites. Stands are almost exclusively found on sand deposits; a few are on coarse loams. There are two prominent vegetation layers in stands of this alliance and a moderate amount of bare ground. The tallest layer, about 0.6-1.5 m tall, is dominated by midgrasses, particularly *Calamovilfa longifolia*.

OVERVIEW

Scientific Name: *Calamovilfa longifolia* Sand Prairie Alliance
Common Name (Translated Scientific Name): Prairie Sandreed Sand Prairie Alliance
Colloquial Name: Great Plains Prairie Sandreed Prairie

Type Concept: This alliance, found in the northwestern Great Plains, occurs on sandy dry-mesic sites. There are two prominent vegetation layers in stands of this alliance and a moderate amount of bare ground. The tallest layer, about 0.6-1.5 m tall, is dominated by mid grasses, particularly *Calamovilfa longifolia*. Other species present include *Andropogon hallii, Hesperostipa comata (= Stipa comata), Schizachyrium scoparium, Koeleria macrantha*, and *Sporobolus cryptandrus*. The shorter layer includes several short graminoid species, forbs, and some small shrubs. Graminoids make up the majority of this layer, especially upland Carices. Among the most frequent are *Carex duriuscula (= Carex eleocharis, = Carex stenophylla), Carex inops ssp. heliophila*, and *Carex filifolia*. *Bouteloua gracilis* is prominent in some stands, especially in the western portion of this alliance's range. Forbs and shrubs do not usually contribute greatly to the vegetation cover, although forb species diversity can be moderately high. The forbs that are present typically include *Chenopodium leptophyllum, Lathyrus* spp., *Lygodesmia juncea, Phlox hoodii*, and *Liatris punctata*. *Psoralidium lanceolatum* and *Rumex venosus* are most common on the least stabilized locations. Shrubs are uncommon, but when they are present, short shrubs such as *Yucca glauca, Rosa* spp., and *Artemisia frigida* are the most likely to be found. *Artemisia cana* and *Elaeagnus commutata* may be associated with more northern stands. Stands of this alliance are almost exclusively found on sand deposits; a few are on coarse loams. Stands are usually on gentle slopes but can be on flat ground or steep slopes. The soil is sand, loamy sand, or sandy loam, and there is little horizon development. Water penetrates the coarse soil quickly. This results in the upper soil having little available moisture for most of the growing season. Water and wind erosion can be frequent disturbances in this alliance.

Classification Comments: There is some overlap with *Andropogon hallii* Sand Prairie Alliance (A1193) in those stands that contain both *Andropogon hallii* and *Calamovilfa longifolia*.

Internal Comments:
Other Comments:

Similar NVC Types: Communities in this alliance can be very similar to those in *Andropogon hallii* Sand Prairie Alliance (A1193). The latter generally has a more southern distribution but does extend into Montana and the Dakotas. Where these two alliances have overlapping ranges, stands in A1193 may tend to occur on sites with more moisture stress. Diagnostic species or environmental characteristics need to be developed to properly classify borderline stands.

- A1540 *Yucca glauca* Prairie Scrub Alliance
- A1193 *Andropogon hallii* Sand Prairie Alliance: overlaps in those stands that contain both *Andropogon hallii* and *Calamovilfa longifolia*.

Diagnostic Characteristics: These stands are on sandy soils throughout the Great Plains and are dominated by *Calamovilfa longifolia*.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a moderate to dense herbaceous layer (0.5-1.5 m tall) that is dominated by tall grasses and mid grasses, with short grasses common in the western portion of its range. There is usually a sparse forb layer. Widely scattered low shrubs may also be present.

Floristics: Stands have a medium to tall herbaceous layer dominated by widely spaced bunchgrasses 0.6-1.5 m tall. This layer is dominated by *Calamovilfa longifolia*. Other species present include *Achnatherum hymenoides (= Oryzopsis hymenoides), Andropogon hallii, Hesperostipa comata (= Stipa comata), Koeleria macrantha, Pascopyrum smithii* (clayey sites), *Schizachyrium scoparium*, and *Sporobolus cryptandrus*. Many of these stands also have a second herbaceous layer dominated by short graminoid species, forbs, and some small shrubs. Graminoids make up the majority of this layer, especially upland *Carex* spp. Among the most frequent are *Carex duriuscula (= Carex eleocharis*, *= Carex stenophylla), Carex inops ssp. heliophila*, and *Carex filifolia*. *Bouteloua gracilis* is prominent in some stands, especially in the western portion of this alliance's range. Forbs and shrubs do not usually contribute greatly to the vegetation cover, although forb species diversity can be moderately high (Hanson and Whitman 1938, USFS 1992). The forbs that are present typically include *Artemisia* spp., *Chenopodium leptophyllum, Lathyrus* spp., *Liatris punctata, Lygodesmia juncea*, and *Phlox hoodii*. *Psoralidium lanceolatum* and *Rumex venosus* are most common on the least stabilized locations. Shrubs are uncommon, but when they are present, short shrubs such as *Artemisia filifolia, Artemisia frigida, Rhus trilobata, Rosa* spp., and *Yucca glauca* are the most likely to occur.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands of this alliance occur on sandy sites in the central and northern Great Plains. The climate is temperate, continental with annual precipitation ranging from 46-61 cm. Elevations are generally between 1000 and 1600 m. Stands are found on stabilized sand dunes, interdune valleys, colluvial sand on toeslopes and badland benches (DeVelice et al. 1995). Sites where this alliance is found are usually on gentle to steep slopes on any aspect, but sometimes occur on flat ground (Tolstead 1942, Steinauer 1989). The soils are sand, loamy sand, or sandy loam, and they can be poorly to moderately well-developed (Looman 1980, Johnston 1987, Steinauer 1989). Parent materials include eolian sand and coarse-textured colluvium from sandstone, shales and other sedimentary rocks. There is little runoff or evaporation because moisture quickly sinks into the coarse soil. Soil near the surface is consequently dry throughout much of the year, but moisture is present deeper in the soil profile. This favors deep-rooting species such as *Andropogon hallii* and *Calamovilfa longifolia* (Barnes and Harrison 1982). Water and wind erosion can be frequent disturbances in this alliance. In the north and western extent, adjacent grasslands dominated by *Pascopyrum smithii* or *Bouteloua* spp. occur on fine-textured soils.

Dynamics: Wind is a dominant factor that shapes the landscape where this alliance occurs. Wind sometimes scours sand and vegetation from small areas and creates blowouts. These bare spots are initially colonized by species that are relatively uncommon in this alliance, such as *Redfieldia flexuosa, Muhlenbergia pungens, Yucca glauca*, and *Achnatherum hymenoides*. Eventually, these blowouts succeed to other communities (Savage 1937, Ramaley 1939b, Tolstead 1942, Harrison 1980). Tolstead (1942) cites Nebraska pioneer accounts that dunes were less vegetated than at present, and blowouts and stands were more common before cattle ranching. Fire frequency and extent are also thought to have declined since settlement because of fuel removal by livestock grazing and fire control (Burzlaff 1962, Wolfe 1973). Consequently, active dunes and large blowouts are less common now, as are the pioneer plant species *Redfieldia flexuosa, Andropogon hallii*, and *Yucca glauca* (Harrison 1980).

These grasslands provide excellent summer forage and need careful management to prevent grazing out desirable species. Generally, overgrazing this alliance decreases the cover of species of *Andropogon, Calamovilfa, Eragrostis*, and *Hesperostipa*, and increases the cover of *Bouteloua gracilis, Bouteloua hirsuta, Muhlenbergia pungens, Achnatherum hymenoides*, and *Sporobolus cryptandrus* (Savage 1937, Tolstead 1942, Harrison 1980). Overgrazing also kills out desirable shrubs, especially *Amorpha canescens* and *Prunus pumila var. besseyi* (Ryan et al. 1994). This grassland responds rapidly to management. Deferment of grazing in the late spring and summer favors warm-season grasses such as *Andropogon hallii, Bouteloua hirsuta, Bouteloua gracilis, Calamovilfa longifolia, Eragrostis trichodes, Koeleria macrantha*, and *Schizachyrium scoparium*.

Drought also causes declines in cover of all species, especially tall grasses, and can make the grassland more vulnerable to blowouts. Savage (1937) found large declines in tallgrass cover on sandy sites during drought in 1935. He ranked the cause of damage by decreasing effect: heat, drought, and, to a much lesser extent, grazing and then soil blowing. Ramaley (1939a, b) reports that in Colorado there is marginally enough precipitation to maintain this alliance. Drought causes retrogression to mixed sandhill, sand sage, or blowout communities, which increases *Muhlenbergia pungens, Artemisia filifolia*, and *Achnatherum hymenoides*. Grazing during droughts increases the intensity of the damage (Ramaley 1939a, b). Many of these stands, especially those disturbed by wind and grazing, are vulnerable to invasion by exotic annual species of *Bromus* such as *Bromus arvensis, Bromus squarrosus*, or *Bromus tectorum* (Comer et al. 1999).

DISTRIBUTION

Geographic Range: Grasslands in this alliance occur on sandy sites in the central and northern Great Plains from Wyoming and Nebraska north to Alberta, Saskatchewan and Manitoba, Canada. Stands may potentially occur into Colorado or Kansas.

Nations: CA, US
States/Provinces: AB, CO?, MT, ND, NE, SD, SK, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:

Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Calamovilfa longifolia* Series (Johnston 1987) [Colorado]
- **?** Bunchgrass Community (Weaver and Albertson 1956) [Nebraska]
- **?** Postclimax Grasses on Dunes (Tolstead 1941) [South Dakota]
- **?** Sand Prairie Community (Ramaley 1939a) [Colorado]
- **?** Sand-hills Mixed Type (Weaver and Albertson 1956) [Colorado]
- **?** Tall Grasses of the Dunes (Tolstead 1942) [Nebraska]
- **?** USDA-NRCS Deep Sand Range Sites #15,16,19 (Soil Conservation Service 1978)

LOWER LEVEL UNITS

Associations:

- CEGL001473 *Calamovilfa longifolia - Hesperostipa comata* Grassland
- CEGL002219 *Calamovilfa longifolia - Achnatherum hymenoides* Grassland
- CEGL001471 *Calamovilfa longifolia - Carex inops ssp. heliophila* Grassland
- CEGL001457 *Rhus trilobata / Calamovilfa longifolia* Shrub Grassland
- CEGL002184 *Betula occidentalis - Juniperus horizontalis / Calamovilfa longifolia* Shrubland

AUTHORSHIP

Primary Concept Source: W.L. Tolstead (1942); J.E. Weaver and F.W. Albertson (1956)
Author of Description: S. Menard, K.A. Schulz, L. Allen
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Adams et al. 1997, BLM 1979b, Barnes and Harrison 1982, Burgess 1965, Burzlaff 1962, CDM Consultants n.d., Comer et al. 1999, DeVelice et al. 1995, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Hansen 1985, Hansen and Hoffman 1988, Hanson and Whitman 1938, Harrison 1980, Heerwagen 1958, Hirsch 1985, Johnston 1987, Looman 1980, MTNHP unpubl. data, Mine Reclamation Consultants 1977, Ramaley 1937, Ramaley 1939a, Ramaley 1939b, Ross et al. 1973, Ruangpanit 1977, Ryan et al. 1994, Savage 1937, Soil Conservation Service 1978, Steinauer 1989, Taylor and Holst 1976, Tolstead 1941, Tolstead 1942, USFS 1992, Weaver and Albertson 1956, Wolfe 1973

M498. Great Plains Ruderal Grassland & Shrubland

Type Concept Sentence: This macrogroup is found on dry to mesic sites in the central and western Great Plains dominated by exotic herbaceous species or deciduous shrubs.

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2. Shrub & Herb Vegetation
2.B.2.Nb. Central North American Grassland & Shrubland
M498. Great Plains Ruderal Grassland & Shrubland

G679. Northern & Central Great Plains Ruderal Grassland & Shrubland

Type Concept Sentence: This group is found in the Great Plains from Nebraska and Colorado north where exotic grasses and forbs constitute >75% of the herbaceous cover and trees and shrubs each have less than 25% cover.

OVERVIEW

Scientific Name: *Poa pratensis - Phleum pratense - Cirsium arvense* Northern & Central Plains Ruderal Grassland & Shrubland Group
Common Name (Translated Scientific Name): Kentucky Bluegrass - Timothy - Canada Thistle Northern & Central Plains Ruderal Grassland & Shrubland Group

Type Concept: This group occurs in the northern two-thirds of the Great Plains. Sites are strongly dominated by exotic grasses and forbs, mostly perennial species but sometimes annuals. Examples range from having a mix of species to sites strongly dominated by one or two species. Abundant species vary across the group, depending on land-use history, including what may have been planted on the site, nearby seed sources, whether a site is mesic or dry, and other factors. Common abundant or dominant species include the grasses *Agropyron cristatum, Agrostis gigantea, Agrostis stolonifera, Bromus inermis, Lolium perenne, Phleum pratense, Poa annua, Poa pratensis*, and *Thinopyrum intermedium* and the forbs *Ambrosia* spp., *Cirsium arvense, Cirsium vulgare, Euphorbia esula*, and *Melilotus officinalis*.

Classification Comments: This group occurs when the floristics of a site are so changed that the natural vegetation type is no longer recognizable. This requires a very high cover by exotic and native weedy species. The cut-off is currently in the range of 75-90% cover.

Internal Comments: JD 5-15: KS?, MB, NE added.
Other Comments:

Similar NVC Types:
- G680 Great Plains Comanchian Ruderal Grassland & Shrubland

Diagnostic Characteristics: This group is found in the northern half of the Great Plains and is strongly dominated (>75%) by exotic and weedy native herbaceous species.

VEGETATION

Physiognomy and Structure: Grasses and forbs dominate this group with shrubs and trees sometimes present but with less than 25% cover. The herbaceous stratum is generally 0.5-1 m tall with some stands dominated by species approximately 2 m tall. Perennial species are typically most abundant but sites in the western part of the group's range or those that were recently disturbed may have significant amounts of annuals.

Floristics: Examples range from having a mix of species to sites strongly dominated by one or two species. Abundant species vary across the group, depending on land-use history, including what may have been planted on the site, nearby seed sources, whether a site is mesic or dry, and other factors. Common abundant or dominant species include the grasses *Agropyron cristatum, Agrostis gigantea, Agrostis stolonifera, Bromus inermis, Lolium perenne, Phleum pratense, Poa annua, Poa pratensis*, and *Thinopyrum intermedium* and the forbs *Ambrosia* spp., *Cirsium arvense, Cirsium vulgare, Euphorbia esula*, and *Melilotus officinalis*. Other common species include the annual grasses *Bromus arvensis, Bromus catharticus, Bromus hordeaceus, Bromus racemosus, Bromus secalinus, Bromus tectorum, Digitaria* spp., *Setaria faberi, Setaria italica, Setaria pumila, Setaria verticillata*, and *Setaria viridis* and the forbs *Bassia scoparia, Carduus* spp., *Centaurea* spp., *Chenopodium album, Datura stramonium, Lotus corniculatus, Rumex acetosella, Rumex crispus, Salsola* spp., *Sonchus* spp., *Trifolium arvense, Trifolium aureum, Trifolium campestre, Trifolium dubium, Trifolium hybridum, Trifolium repens*, and *Trifolium pratense*.

ENVIRONMENT & DYNAMICS

Environmental Description: This group can be found on a variety of environmental settings. It can occur on wet-mesic to dry-mesic sites ranging from swales and floodplains to drier ridges and slopes.

Dynamics: Examples of this group are, by definition, a result of a change in ecological processes or a direct introduction of exotic species. This is usually the result of some combination of a reduction in fire frequency, increased grazing pressure, intentional planting of exotic species or the unintentional spread of exotic species from nearby sources. Many of the exotic species are persistent once they are established on a site so reversion to a native vegetation type is not certain even if the disturbance that allowed the formation of this group is removed.

DISTRIBUTION

Geographic Range: This group is found across the northern two-thirds of the Great Plains from Colorado and Nebraska north with possible outlier occurrences in Utah. It is likely in Kansas, as well.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Alliances:

AUTHORSHIP

Primary Concept Source:

Author of Description: J. Drake
Acknowledgments:
Version Date: 2015/05/07

REFERENCES

References: Faber-Langendoen et al. 2017a

2.C. Shrub & Herb Wetland

Shrub & Herb Wetland includes open bogs, fens, fresh and saltwater marshes, wet meadows and wet shrublands. The vegetation occurs from tropical to polar regions.

2.C.4. Temperate to Polar Freshwater Marsh, Wet Meadow & Shrubland

Temperate to Polar Freshwater Marsh, Wet Meadow & Shrubland includes wet riparian and swamp shrublands, wet meadows, wet prairies, and shallow and deep emergent marshes. The vegetation comprises seasonal green emergent, hydrophytic shrubs and herbs with at least 10% cover, on mucky, inundated or saturated soils across the mid-latitudes of the Northern and Southern hemispheres from 23° to 70°.

2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

This division contains marshes, wet meadows and shrublands, singly and in mosaics, along riparian corridors, around vernal pools, depressions, seeps and springs on mineral soils or shallow organic layers over mineral substrates in temperate (and possibly southern boreal) latitudes of western North America.

M301. Western North American Ruderal Marsh, Wet Meadow & Shrubland

This macrogroup includes disturbed natural wetland habitats of temperate western North America that are now strongly dominated by non-native and sometimes weedy or generalist native species.

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
2.C.4.Nb.90.a. M301 Western North American Ruderal Marsh, Wet Meadow & Shrubland

G524. Western North American Ruderal Marsh, Wet Meadow & Shrubland

Type Concept Sentence: This group contains wet meadows dominated by non-native species such as *Agrostis gigantea, Agrostis stolonifera, Alopecurus pratensis, Conyza canadensis, Cirsium arvense, Sonchus* spp., *Lactuca serriola, Phalaris arundinacea, Phragmites australis ssp. australis, Poa palustris*, and/or *Poa pratensis* that occur in the same physical settings as native wet meadows found throughout the western U.S. and Canada.

OVERVIEW

Scientific Name: *Poa pratensis - Conyza canadensis - Cirsium arvense* Ruderal Marsh, Wet Meadow & Shrubland Group
Common Name (Translated Scientific Name): Kentucky Bluegrass - Canadian Horseweed - Canada Thistle Ruderal Marsh, Wet Meadow & Shrubland Group
Colloquial Name: Western Ruderal Forb Wet Meadow

Type Concept: This group contains disturbed wet meadows found in lowland, montane and subalpine elevations, occasionally reaching into the lower edges of the alpine elevations (sea level to 3600 m) throughout the western U.S. and Canada. Vegetation is dominated by non-native species such as *Agrostis gigantea, Agrostis stolonifera, Alopecurus pratensis, Bromus inermis, Conyza canadensis, Cirsium arvense, Sonchus* spp., *Lactuca serriola, Phalaris arundinacea, Phragmites australis ssp. australis, Poa bulbosa, Poa palustris*, and *Poa pratensis*. Native species may be present but are so low in abundance that the original native plant association is impossible to determine. These can be wet meadows, wet emergent marshes, coastal backwater dunes, sloughs, open wet depressions, basins and flats with low-velocity surface and subsurface flows. They can be large meadows in montane or subalpine valleys, or occur as narrow strips bordering ponds, lakes, and streams, and along toeslope seeps. They are typically found on flat areas or gentle slopes, but may also occur on subirrigated sites with slopes up to 10%. Sites are usually seasonally wet, often drying by late summer, and many occur in a tension zone between perennial wetlands and uplands, where water tables fluctuate in response to long-term climatic cycles. They may have surface water for part of the year, but depths rarely exceed a few centimeters.

Soils are mostly mineral and show typical hydric soil characteristics such as low chroma and redoximorphic features; some areas may have high organic content as inclusions or pockets. Due to disturbance, soils may be compacted.

Classification Comments: This group may be difficult to tease apart from its native counterpart. The test is that the non-native species far outweigh native species in abundance and richness, such that a well-trained observer cannot tell what the native counterpart may have been or to do so is only speculation. This group does not include actively managed irrigated hay meadows that have been historically seeded. Those belong under 7 Agricultural & Developed Vegetation Class (CCL01).

Similar NVC Types:
- G517 Vancouverian Freshwater Wet Meadow & Marsh: is dominated by native species.
- G521 Vancouverian-Rocky Mountain Montane Wet Meadow & Marsh: is dominated by native species.
- G531 Arid West Interior Freshwater Marsh
- G819 North American Warm Desert Ruderal Scrub
- G677 North American Warm Desert Ruderal Grassland
- G600 Great Basin-Intermountain Ruderal Dry Shrubland & Grassland

Diagnostic Characteristics: Wet graminoid and forb meadow or marsh dominated by non-native species.

VEGETATION

Physiognomy and Structure: Herbaceous wet meadow dominated by perennial herbs introduced to North America.

Floristics: Vegetation of this group is dominated by non-native species such as *Agrostis gigantea, Agrostis stolonifera, Alopecurus pratensis, Bromus inermis, Conyza canadensis, Lactuca serriola, Cirsium arvense, Iris pseudacorus, Phalaris arundinacea, Phragmites australis, Poa bulbosa, Poa palustris, Poa pratensis, Poa trivialis*, and *Scirpus cyperinus*. Native species may be present but are so low in abundance that the original native plant association is impossible to determine. Floristic information was compiled from Whitson et al. (1996), Rondeau (2001), Faber-Langendoen et al. (2008), and Sawyer et al. (2009).

ENVIRONMENT & DYNAMICS

Environmental Description: *Soil/substrate/hydrology:* These wet meadows occur in open wet depressions, basins and flats with low-velocity surface and subsurface flows. They can be large meadows in montane or subalpine valleys, or occur as narrow strips bordering ponds, lakes, and streams, and along toeslope seeps. They are typically found on flat areas or gentle slopes, but may also occur on subirrigated sites with slopes up to 10%. Sites are usually seasonally wet, often drying by late summer, and many occur in a tension zone between perennial wetlands and uplands, where water tables fluctuate in response to long-term climatic cycles. Some sites occur under an agricultural management regime of seasonal sheet irrigation for grazing or haying purposes, and may bear no resemblance to historical types of the area. They may have surface water for part of the year, but depths rarely exceed a few centimeters. Soils are mostly mineral and show typical hydric soil characteristics such as low chroma and redoximorphic features; some areas may have high organic content as inclusions or pockets. Due to disturbance, soils may be compacted.

This group occurs in the same environmental settings as Vancouverian-Rocky Mountain Montane Wet Meadow & Marsh Group (G521), Vancouverian Freshwater Wet Meadow & Marsh Group (G517), and Arid West Interior Freshwater Marsh Group (G531).

Dynamics: This group is a product of disturbance such as continuous heavy grazing by domestic livestock, soil disturbance/compactions, significant change in hydrologic regime, invasion after natural disturbance such as fire, floods or landslides, and are a combination of infestation by non-native invasive plants, and by diminished or lack of competition by native plants.

DISTRIBUTION

Geographic Range: This group is found throughout the entire western U.S. and Canada.

Spatial Scale & Pattern [optional]: Small patch
Nations: CA, US
States/Provinces: AB, AK, BC, CA, CO, ID, MT, NM, NV, OR, SD, TX, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Alliances:
- A2020 *Sorghum halepense* Ruderal Desert Grassland Alliance
- A3848 *Poa pratensis - Agrostis gigantea - Agrostis stolonifera* Ruderal Marsh Alliance
- A4217 *Salix* spp. - *Artemisia cana* Ruderal Understory Wet Shrubland Alliance
- A3847 *Phragmites australis ssp. australis - Arundo donax - Typha angustifolia* Ruderal Marsh Alliance
- A3849 *Conyza canadensis - Cirsium arvense - Lactuca serriola* Ruderal Wet Meadow Alliance
- A3846 *Phalaris arundinacea* Western Ruderal Marsh Alliance

AUTHORSHIP

Primary Concept Source: D. Faber-Langendoen, in Faber-Langendoen et al. (2011)
Author of Description: G. Kittel
Acknowledgments: Associate Editor: F.J. Triepke. Peer review by J. Rocchio.
Version Date: 09/29/2016
Classif Resp Region: West
Internal Author: GK 12-10, 3-11, 6-12, 9-13, 12-15, 9-16, 10-16, 8-17

REFERENCES

References: Buck-Diaz et al. 2012, Faber-Langendoen et al. 2008a, Faber-Langendoen et al. 2017a, Rondeau 2001, Sawyer et al. 2009, Whitson et al. 2000

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G524. Western North American Ruderal Marsh, Wet Meadow & Shrubland

A3849. Conyza canadensis - Cirsium arvense - Lactuca serriola Ruderal Wet Meadow Alliance

Type Concept Sentence: This alliance covers those non-native forb-dominated waste and other disturbed places of the western U.S. dominated by such species as *Conyza canadensis, Cirsium arvense*, or *Lactuca serriola* (other species may be present to dominant).

OVERVIEW

Scientific Name: *Conyza canadensis - Cirsium arvense - Lactuca serriola* Ruderal Wet Meadow Alliance
Common Name (Translated Scientific Name): Canadian Horseweed - Canada Thistle - Prickly Lettuce Ruderal Wet Meadow Alliance
Colloquial Name: Western Ruderal Forb Wet Meadow

Type Concept: This alliance covers herbaceous areas dominated by non-native forb species such as *Conyza canadensis, Cirsium arvense*, or *Lactuca serriola*. Many other facultative wet forbs may be present or dominant, such as *Chenopodium album, Dipsacus fullonum, Lepidium perfoliatum, Rumex crispus, Sisymbrium altissimum, Sonchus arvensis*, and many others. These disturbed places are generally seasonally or intermittently flooded, usually drying completely between wet episodes. They are generally not alkaline but may be mildly so. It is found throughout the western U.S.

Classification Comments: This alliance covers western U.S. mesic to seasonally wet to moist areas, not dry upland areas.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Disturbed areas dominated by one or a mix of non-native wetland or facultative forb species such as *Chenopodium album, Cirsium arvense, Conyza canadensis, Dipsacus fullonum, Lactuca serriola, Lepidium perfoliatum, Rumex crispus, Sisymbrium altissimum*, or *Sonchus arvensis*.

VEGETATION

Physiognomy and Structure: Broad-leaved annual or perennial herbaceous stands <2 m in height.

Floristics: These stands are dominated by non-native forb species such as *Conyza canadensis, Cirsium arvense*, or *Lactuca serriola*. Many other facultative wet forbs may be present or dominant, such as *Chenopodium album, Cirsium arvense, Conyza canadensis, Dipsacus fullonum, Lactuca serriola, Lepidium perfoliatum, Rumex crispus, Sisymbrium altissimum, Sonchus arvensis*, and many others. Other commonly associated forbs present and contributing low to moderate cover include *Melilotus officinalis, Rorippa*

palustris ssp. hispida, Salsola tragus, and *Verbascum thapsus*. Some graminoids such as *Hordeum jubatum* may also be present, but these tend to be not as abundant as the total forb cover.

ENVIRONMENT & DYNAMICS

Environmental Description: These alliance occur in mesic areas that are somehow disturbed, and are common throughout western North America. Stands occur in reservoir drawdown zones, disturbed areas near streams or old fields, and heavily damaged soils near open water.

Dynamics: This alliance is generally a product of serious soil disturbance in areas that are periodically wet, such as abandoned fields within flood zones or high water areas or drawn down reservoirs, or rings around stock ponds.

DISTRIBUTION

Geographic Range: This alliance is found throughout the western U.S.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL002800 *Conyza canadensis* Ruderal Wet Meadow

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/01/07

REFERENCES

References: Faber-Langendoen et al. 2017b

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G524. Western North American Ruderal Marsh, Wet Meadow & Shrubland

A3846. Phalaris arundinacea Western Ruderal Marsh Alliance

Type Concept Sentence: Stands are dominated by *Phalaris arundinacea*, which tends to occur in monocultures and is known to occur in mesic to wet disturbed areas and along rivers that no longer flood throughout the western U.S.

OVERVIEW

Scientific Name: *Phalaris arundinacea* Western Ruderal Marsh Alliance
Common Name (Translated Scientific Name): Reed Canarygrass Western Ruderal Marsh Alliance
Colloquial Name: Western Ruderal Reed Canarygrass Marsh

Type Concept: This herbaceous alliance covers stands dominated by *Phalaris arundinacea*, which tends to occur in monocultures. Stands are found along riparian areas, pond and lake margins, wet meadows, and intermittent drainages, and is known from throughout the western U.S.

Classification Comments: This alliance covers non-native strains of the nominal species. Extensive planting as a forage crop has led to the spread of this semi-natural type (Hansen et al. 1995, Hall and Hansen 1997). *Phalaris arundinacea* is native and widespread in Alberta, although some introduced genotypes may be present. Further work is required to resolve the natural versus introduced nature of this type in western North America. Midwest and eastern North American stands are covered by groups and alliances for those geographic areas.

Internal Comments: mjr 2-15: CA added based on Buck-Diaz et al. (2012).

Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Stands dominated by *Phalaris arundinacea*, which tends to occur in monocultures.

VEGETATION

Physiognomy and Structure: Tall herbaceous perennial graminoid that can reach heights >2 m tall.

Floristics: Stands are dominated by non-native strains of *Phalaris arundinacea*, which tends to occur in monocultures or associated with *Calamagrostis canadensis* in northern areas.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs in wet areas, primarily riparian, occurring along rivers and streams, as well as shallow lakeshores (MacKenzie and Moran 2004, Willoughby et al. 2004). Elevations range from near sea level to 2307 m. The poorly drained alluvial soils are commonly fine-textured (occasionally coarse-textured) and may be flooded for brief to extended periods.

Dynamics:

DISTRIBUTION

Geographic Range: This herbaceous alliance occurs throughout the western U.S. It also occurs in Canada, in the southern two-thirds of British Columbia, in areas with warm and relatively dry summers and in Alberta. Its distribution as a natural type is complicated because this native species is widely cultivated as a forage crop and has escaped and established in wetlands and riparian areas, displacing the local flora.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** *Phalaris arundinacea* Provisional Semi-Natural Stands (Reed canary grass grassland) (Buck-Diaz et al. 2012)

LOWER LEVEL UNITS

Associations:
- CEGL001474 *Phalaris arundinacea* Western Marsh

AUTHORSHIP

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

REFERENCES

References: Boggs et al. 1990, Buck-Diaz et al. 2012, Crawford 2001, Faber-Langendoen et al. 2017b, Hall and Hansen 1997, Hansen et al. 1991, Hansen et al. 1995, MacKenzie and Moran 2004, Muldavin et al. 2000a, Willoughby et al. 2004

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G524. Western North American Ruderal Marsh, Wet Meadow & Shrubland

A3847. Phragmites australis ssp. australis - Arundo donax - Typha angustifolia Ruderal Marsh Alliance [Low - Poorly Documented]

Type Concept Sentence: This common reed marsh alliance is dominated by introduced *Phragmites australis ssp. australis, Arundo donax, Typha angustifolia* or other invasive wetland graminoid species, and is found across the west-temperate regions of the United States and Canada.

OVERVIEW

Scientific Name: *Phragmites australis ssp. australis - Arundo donax - Typha angustifolia* Ruderal Marsh Alliance
Common Name (Translated Scientific Name): European Common Reed - Giant Reed - Narrowleaf Cattail Ruderal Marsh Alliance
Colloquial Name: Western Ruderal Common Reed Marsh

Type Concept: This common reed-dominated marsh alliance is found across the west-temperate regions of the United States and Canada. *Phragmites australis ssp. australis, Arundo donax*, or *Typha angustifolia* will often invade into existing natural or semi-natural communities present on the site, and once established, this alliance is usually strongly dominated with few or no other vascular plants present. Stands occur in semipermanently flooded marshes, ditches, impoundments, etc. that have often been disturbed by human activity.

Classification Comments: This alliance is limited to the western U.S. and is intended to cover the non-native stands of introduced *Phragmites australis ssp. australis, Arundo donax*, or *Typha angustifolia*. Compare with similar monotypic stands in Great Plains and eastern U.S. alliances.

Internal Comments: DFL 8-17: AB added. mjr 8-15: MX added based on members.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Stands strongly dominated by non-native *Phragmites australis ssp. australis, Arundo donax*, or *Typha angustifolia*.

VEGETATION

Physiognomy and Structure: Tall perennial graminoid herbaceous that is <3 m in height.

Floristics: Stands are monocultures of introduced *Phragmites australis ssp. australis, Arundo donax*, or *Typha angustifolia*. Some stands may have minor cover of associates such as *Agrostis stolonifera, Carex* spp., *Conyza canadensis, Glycyrrhiza lepidota, Iva axillaris, Mentha arvensis, Schoenoplectus acutus (= Scirpus acutus)*, and *Typha* spp. Other species present may include *Ambrosia psilostachya, Anemopsis californica, Baccharis douglasii, Distichlis spicata, Juncus arcticus, Juncus cooperi, Lepidium latifolium, Schoenoplectus americanus, Schoenoplectus californicus*, and *Xanthium strumarium*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance is found in non-tidal marshes with semipermanently or, rarely, seasonally flooded hydrology, either in depressions or along rivers with seasonal fluctuation in water level throughout the western United States and adjacent Canada. This includes semipermanently flooded marshes, ditches, impoundments, etc.

Dynamics: Stands are generally a product of human-induced disturbance, either through direct habitat manipulation or through passive introduction of reproductive material to naturally disturbed substrates (Marks et al. 1994).

DISTRIBUTION

Geographic Range: West-temperate regions of the United States and Canada.

Nations: CA, MX, US
States/Provinces: AB, AZ, CA, CO, ID, MT, NM, NV, TX, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Lake Mead, Mojave); USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

- **>** *Arundo donax* (Giant reed breaks) Semi-natural Stands (Sawyer et al. 2009) [42.080.00]
- **>** *Arundo donax* Herbaceous Alliance (Keeler-Wolf and Evens 2006)
- **>** *Arundo donax* Semi-Natural Stands (Giant reed breaks) (Buck-Diaz et al. 2012)
- **>** *Phragmites australis* (Common reed marshes) Alliance (Sawyer et al. 2009) [41.061.00]
- **=** *Phragmites australis* Herbaceous Alliance (Evens et al. 2014)

LOWER LEVEL UNITS

Associations:
- CEGL001475 *Phragmites australis ssp. australis* Western Ruderal Wet Meadow
- CEGL004101 *Arundo donax* Riverbank Ruderal Wet Meadow

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2017/08/14

REFERENCES

References: Buck-Diaz et al. 2012, Evens et al. 2014, Faber-Langendoen et al. 2017b, Hickson and Keeler-Wolf 2007, Keeler-Wolf and Evens 2006, Keeler-Wolf and Vaghti 2000, Marks et al. 1994, Niering and Warren 1977, Overholt et al. 2015, Sawyer et al. 2009, Sproul et al. 2011, Swearingen and Saltonstall 2010, Swearingen and Saltonstall 2012, VegCAMP and AIS 2013

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G524. Western North American Ruderal Marsh, Wet Meadow & Shrubland

A3848. Poa pratensis - Agrostis gigantea - Agrostis stolonifera Ruderal Marsh Alliance

Type Concept Sentence: This alliance includes grasslands dominated by introduced grasses such as *Agrostis gigantea, Agrostis stolonifera, Alopecurus pratensis*, or *Poa pratensis*, and is a very common and widespread in the western U.S. where it has invaded natural meadows, wetlands and riparian areas.

OVERVIEW

Scientific Name: *Poa pratensis - Agrostis gigantea - Agrostis stolonifera* Ruderal Marsh Alliance
Common Name (Translated Scientific Name): Kentucky Bluegrass - Redtop - Creeping Bentgrass Ruderal Marsh Alliance
Colloquial Name: Ruderal Kentucky Bluegrass - Redtop - Creeping Bentgrass Marsh

Type Concept: This alliance includes mesic grasslands and wetlands dominated by introduced grasses such as Agrostis gigantea, Agrostis stolonifera, Alopecurus pratensis, or *Poa pratensis*. This semi-natural grassland is widespread in the western U.S. where it has invaded natural meadows, wetlands and riparian areas. *Agrostis stolonifera* and *Poa pratensis* have been widely planted for forage and have invaded native communities from hay fields, especially more mesic areas such as riparian floodplains and seasonally flooded wetlands in the semi-arid western U.S.

Classification Comments: This alliance covers areas invaded by these non-native grasses and does not include irrigated hay meadows or other actively managed areas.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Grasslands dominated by *Agrostis gigantea, Agrostis stolonifera, Alopecurus pratensis*, or *Poa pratensis*.

VEGETATION

Physiognomy and Structure: Low-statured perennial herbaceous graminoid, generally <1 m in height.

Floristics: This widespread, semi-natural alliance is characterized by a moderate to dense herbaceous canopy that is strongly dominated by *Agrostis gigantea, Agrostis stolonifera, Alopecurus pratensis*, or *Poa pratensis*. Associate species are often those early-seral and weedy species that tolerate historic heavy livestock grazing or other disturbance well, such as *Achillea millefolium, Cirsium arvense, Elymus repens, Equisetum* spp., *Fragaria virginiana, Hordeum* spp., *Juncus balticus, Linaria vulgaris, Potentilla gracilis, Taraxacum officinale*, and introduced forage species such as *Agrostis stolonifera, Bromus inermis*, and *Phleum pratense*. Remnant native species present may include *Ambrosia psilostachya, Amorpha canescens, Andropogon gerardii, Artemisia ludoviciana, Carex* spp., *Deschampsia cespitosa, Pascopyrum smithii*, and *Psoralidium tenuiflorum*.

ENVIRONMENT & DYNAMICS

Environmental Description: Sites are generally flat to moderately sloping and occur on all aspects. Stands typically occur on pastures found in the plains, montane meadows, stream benches and terraces. In the semi-arid region it is restricted to relatively mesic sites. Stands with *Alopecurus pratensis* are the wettest of this alliance that tolerates very high water table throughout the growing season.

Stands can also tolerate mildly alkaline and saline soils, and some drought (Kovalchik 1987, Padgett et al. 1989, Hansen et al. 1995, Manning and Padgett 1995, Hall and Hansen 1997).

Dynamics: *Poa pratensis* is tolerant of heavy grazing and increases at the expense of less tolerant native species (Volland 1978, Hansen et al. 1995). It is also adapted to burning and quickly resprouts after fire, except when burned during growing periods (Volland and Dell 1981).

DISTRIBUTION

Geographic Range: This alliance is found throughout western U.S.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **>** *Agrostis (gigantea, stolonifera) - Festuca arundinacea* (Bent grass - tall fescue meadows) Semi-natural Stands (Sawyer et al. 2009) [45.106.00]
- **>** *Agrostis (gigantea, stolonifera)-Festuca arundinacea* Herbaceous Semi-Natural Alliance (CNPS 2017) [45.106.00]
- **>** *Poa pratensis* (Kentucky blue grass turf) Semi-natural Stands (Sawyer et al. 2009) [42.060.00]
- **>** *Poa pratensis* Herbaceous Semi-Natural Alliance (CNPS 2017) [42.060.00]

LOWER LEVEL UNITS

Associations:

- CEGL001558 *Agrostis (gigantea, stolonifera)* Ruderal Marsh
- CEGL005615 *Echinochloa crus-galli* Ruderal Wet Meadow
- CEGL005209 *Alopecurus pratensis* Western Ruderal Wet Meadow
- CEGL003081 *Poa pratensis* Ruderal Marsh

AUTHORSHIP

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

REFERENCES

References: CNPS 2017, Carsey et al. 2003a, Faber-Langendoen et al. 2017b, Franklin and Dyrness 1973, Hall and Hansen 1997, Hansen et al. 1991, Hansen et al. 1995, Kauffman et al. 1983, Kauffman et al. 1985, Kittel et al. 1999b, Kovalchik 1987, Manning and Padgett 1995, Padgett et al. 1989, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Tuhy and Jensen 1982, Volland 1978, Volland and Dell 1981, Youngblood et al. 1985a

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2. Shrub & Herb Vegetation
2.C.4.Nb. Western North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G524. Western North American Ruderal Marsh, Wet Meadow & Shrubland

A4217. Salix spp. - Artemisia cana Ruderal Understory Wet Shrubland Alliance [Low - Poorly Documented]

Type Concept Sentence: Stands of native willows and/or native *Artemisia cana* sagebrush with non-native grasses and forbs dominant in the understory, found in western U.S. streams and floodplains.

OVERVIEW

Scientific Name: *Salix* spp. - *Artemisia cana* Ruderal Understory Wet Shrubland Alliance
Common Name (Translated Scientific Name): Willow species - Silver Sagebrush Ruderal Understory Wet Shrubland Alliance
Colloquial Name: Ruderal Willow - Silver Sagebrush Wet Shrubland

Type Concept: These riparian shrublands are dominated by native willows such as *Salix exigua, Salix monticola, Salix geyeriana, Salix drummondiana, Salix commutata*, and others, as well as shrublands dominated by *Artemisia cana* (*ssp. viscidula* and *ssp. bolanderi*) where the understory herbaceous layer has been completely replaced by non-native invasive species such as *Bromus tectorum, Poa*

pratensis, Dactylis glomerata, Bromus inermis, Elymus repens, Medicago sativa, Trifolium repens, Melilotus officinalis, and *Phragmites australis*. This alliance occurs in relatively moist environments, including riparian areas and alkaline or saline playa lakes of the western U.S.

Classification Comments:

Internal Comments: GK 9-16: CO confirmed and AZ, CA, NV, WA added.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Stands lack an abundance of native herbaceous species such as *Danthonia intermedia, Deschampsia cespitosa, Eleocharis palustris, Elymus elymoides, Festuca idahoensis, Festuca ovina, Festuca thurberi, Leymus cinereus, Muhlenbergia richardsonis, Poa cusickii*, and *Poa secunda*.

VEGETATION

Physiognomy and Structure:

Floristics: These riparian shrublands are dominated by native willows such as *Salix exigua, Salix monticola, Salix geyeriana, Salix drummondiana, Salix commutata*, and others, as well as shrublands dominated by *Artemisia cana* (*ssp. viscidula* and *ssp. bolanderi*) where the understory herbaceous layer has been completely replaced by non-native invasive species such as *Bromus tectorum, Poa pratensis, Dactylis glomerata, Bromus inermis, Elymus repens, Medicago sativa, Trifolium repens, Melilotus officinalis*, and *Phragmites australis*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs in relatively moist environments, including riparian areas and alkaline or saline playa lakes.

Dynamics: Stands have been disturbed by chronic grazing (by native ungulates or livestock), recreational use, or other heavy use that disturbs the soil surface and makes it possible for invasive species to become dominant.

DISTRIBUTION

Geographic Range: This alliance is found throughout the western U.S. in riparian areas, especially near populated areas.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL001199 *Salix exigua / Agrostis stolonifera* Ruderal Wet Shrubland
- CEGL005623 *Salix exigua / Phalaris arundinacea* Ruderal Wet Shrubland
- CEGL002988 *Artemisia cana (ssp. bolanderi, ssp. viscidula) / Poa pratensis* Ruderal Wet Shrubland

AUTHORSHIP

Primary Concept Source: M. Reid, in Faber-Langendoen et al. (2015)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2016/09/28

REFERENCES

References: Faber-Langendoen et al. 2017b, Manning and Padgett 1995, Padgett et al. 1989

2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

This division consists of vegetation in eastern cool-temperate and boreal North America, including the Great Plains. Stands are dominated by shrubs and/or non-hydromorphic herbaceous plants that are facultatively to obligately adapted to freshwater wetland conditions and that grow in mineral or mucky organic soils with regular (intermittent to permanent) saturated and flooded conditions.

M071. Great Plains Marsh, Wet Meadow, Shrubland & Playa

This wetland macrogroup is found throughout the Great Plains in riparian and non-riparian settings, dominated by a wide variety of herb or shrub obligate or facultative wetland species.

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2. Shrub & Herb Vegetation
2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
2.C.4.Nd.5.a. M071 Great Plains Marsh, Wet Meadow, Shrubland & Playa

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

Scientific Name: *Typha* spp. - *Schoenoplectus americanus* - *Scolochloa festucacea* Great Plains Freshwater Marsh Group
Common Name (Translated Scientific Name): Cattail species - Chairmaker's Bulrush - Common Rivergrass Great Plains Freshwater Marsh Group
Colloquial Name: Texas Wild Rice 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.

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:
- G556 Eastern Ruderal Wet Meadow & Marsh
- G336 Great Plains Wet Prairie, Wet Meadow & Seepage Fen: is drier, with little *Typha* 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

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.

VEGETATION

Physiognomy and Structure: 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.

Floristics: 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 pensylvanicum, 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.

ENVIRONMENT & DYNAMICS

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.

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.

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.

Spatial Scale & Pattern [optional]:
Nations: CA, US
States/Provinces: AB, CO, IA, KS, MB, MN, MT, ND, NE, OK, SD, SK, TX, WY
TNC Ecoregions [optional]: 25:C, 26:C, 27:?, 33:C, 34:C, 35:C, 36:C, 66:C, 67:C
USFS Ecoregions (2007): 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:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **<** Prairie Potholes (Richardson 2000)

LOWER LEVEL UNITS

Alliances:
- A3488 *Sagittaria latifolia - Sagittaria cuneata - Leersia oryzoides* Great Plains Marsh Alliance
- A3486 *Schoenoplectus acutus - Bolboschoenus maritimus - Schoenoplectus tabernaemontani* Marsh Alliance
- A3487 *Typha angustifolia - Typha latifolia - Schoenoplectus* spp. Marsh Alliance
- A3485 *Schoenoplectus americanus* Marsh Alliance
- A3484 *Carex atherodes - Carex aquatilis - Scolochloa festucacea* Marsh Alliance
- A3490 *Polygonum pensylvanicum - Polygonum lapathifolium* Marsh Alliance
- A3489 *Eleocharis palustris* Great Plains Marsh Alliance
- A3665 *Zizania texana* Marsh Alliance

AUTHORSHIP

Primary Concept Source: C.J. Richardson, in Barbour and Billings (2000)

Author of Description: J. Drake
Acknowledgments:
Version Date: 05/08/2015
Classif Resp Region: Midwest
Internal Author: JD 12-10, 5-13, 5-15

REFERENCES

References: Faber-Langendoen et al. 2017a, Hoagland 2000, Kantrud et al. 1989a, Lauver et al. 1999, Richardson 2000, Steinauer and Rolfsmeier 2000, Stewart and Kantrud 1971

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2. Shrub & Herb Vegetation
2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G325. Great Plains Freshwater Marsh

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

Scientific Name: *Spartina pectinata - Calamagrostis stricta - Carex* spp. Great Plains Wet Prairie, Wet Meadow & Seepage Fen Group
Common Name (Translated Scientific Name): Prairie Cordgrass - Slimstem Reedgrass - Sedge species Great Plains Wet Prairie, Wet Meadow & Seepage Fen Group
Colloquial Name: Great Plains Marl 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.

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:
- G325 Great Plains Freshwater Marsh: is similar but wetter and has more species tolerant of long-term flooding such as *Typha* 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

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.

VEGETATION

Physiognomy and Structure: 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.

Floristics: 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*.

ENVIRONMENT & DYNAMICS

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.

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.

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.

Spatial Scale & Pattern [optional]:
Nations: CA, US
States/Provinces: CO, IA, KS, MB, MN, MO, MT, ND, NE, OK, SD, SK, WY
TNC Ecoregions [optional]: 25:C, 26:C, 27:?, 33:C, 34:C, 35:C, 36:C, 66:C, 67:C
USFS Ecoregions (2007): 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:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **<** Prairie Potholes (Richardson 2000)

LOWER LEVEL UNITS

Alliances:
- A3495 *Carex* spp. - *Triglochin maritima - Eleocharis quinqueflora* Alkaline Fen Alliance
- A3493 *Spartina pectinata* Great Plains Wet Meadow Alliance
- A3492 *Panicum virgatum - Pascopyrum smithii* Wet Meadow Alliance

AUTHORSHIP

Primary Concept Source: C.J. Richardson, in Barbour and Billings (2000)
Author of Description: J. Drake
Acknowledgments:
Version Date: 05/08/2015
Classif Resp Region: Midwest
Internal Author: JD 12-10, 7-13, 5-15

REFERENCES

References: Faber-Langendoen et al. 2017a, Lauver et al. 1999, Richardson 2000, Steinauer and Rolfsmeier 2000, Stewart and Kantrud 1971

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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

A3495. Carex spp. - Triglochin maritima - Eleocharis quinqueflora Alkaline Fen Alliance [Low - Poorly Documented]

Type Concept Sentence: This herbaceous fen alliance, found in the northwestern Great Plains, occurs where mineral-rich groundwater emerges at the ground's surface and *Carex* spp. and short, fine-textured species such as *Eleocharis quinqueflora, Lobelia kalmii, Parnassia palustris*, and *Rhynchospora capillacea* are abundant.

OVERVIEW

Scientific Name: *Carex* spp. - *Triglochin maritima - Eleocharis quinqueflora* Alkaline Fen Alliance

Common Name (Translated Scientific Name): Sedge species - Seaside Arrow-grass - Few-flower Spikerush Alkaline Fen Alliance
Colloquial Name: Great Plains Marl Fen

Type Concept: Vegetation of this herbaceous fen alliance is short to medium-tall. Common species include *Eleocharis quinqueflora (= Eleocharis pauciflora), Lobelia kalmii, Parnassia palustris*, and *Rhynchospora capillacea*. There are also areas of taller vegetation, such as *Carex aquatilis, Carex prairea*, and *Schoenoplectus pungens (= Scirpus pungens)*. This alliance is found in localized areas where mineral-rich groundwater emerges at the ground's surface. These areas remain saturated throughout the growing season, permitting the development of organic peat. These communities may have small pools which have precipitates of calcium carbonate and other minerals. This alliance is found in the northwestern Great Plains.

Classification Comments: *Carex* spp. - *Typha latifolia - Schoenoplectus pungens* Seep Alliance (A3494) is a similar alliance that is distinguished by having more tall graminoids and no marl. This distinction may not be worthy of separation at the alliance level. In South Dakota neither the *Carex* spp. nor *Triglochin maritima* may be characteristic. Type concept is restricted to regions west of the tallgrass prairie ecoregion (Bailey's Province 251), in which *Carex prairea - Schoenoplectus pungens - Rhynchospora capillacea* Fen (CEGL002267) is used.

Internal Comments:
Other Comments:

Similar NVC Types:
- A4129 *Carex interior - Carex pellita* Central Plains Graminoid Fen Alliance
- A3494 *Carex* spp. - *Typha latifolia - Schoenoplectus pungens* Seep Alliance: can share some abundant species but is found generally east of A3495, on neutral to acidic groundwater, and lacks any marl.

Diagnostic Characteristics: This alliance is characterized by areas where mineral-rich groundwater emerges that are dominated by fen indicators such as *Eleocharis quinqueflora, Lobelia kalmii, Parnassia palustris*, and *Rhynchospora capillacea*.

VEGETATION

Physiognomy and Structure: Open to dense graminoids less than 1 m tall comprise the majority of the vegetation.

Floristics: Common species include *Eleocharis quinqueflora (= Eleocharis pauciflora), Lobelia kalmii, Parnassia palustris*, and *Rhynchospora capillacea*. There are also areas of taller vegetation, such as *Carex aquatilis, Carex prairea*, and *Schoenoplectus pungens (= Scirpus pungens)*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance is found in localized areas where mineral-rich groundwater emerges at the ground's surface. These areas remain saturated throughout the growing season, permitting the development of organic peat. These communities may have small pools which have precipitates of calcium carbonate and other minerals.

Dynamics:

DISTRIBUTION

Geographic Range: This community type is found in seepage areas in the mixedgrass prairie regions of the northwestern Great Plains, particularly in the western Dakotas.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

LOWER LEVEL UNITS

Associations:

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)

Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Faber-Langendoen et al. 2017b

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

A3492. Panicum virgatum - Pascopyrum smithii Wet Meadow Alliance

Type Concept Sentence: This central Great Plains alliance is found in basins and drainages with moderate to heavy grass cover dominated by *Panicum virgatum*, sometimes with *Pascopyrum smithii* as a codominant or local dominant.

OVERVIEW

Scientific Name: *Panicum virgatum - Pascopyrum smithii* Wet Meadow Alliance
Common Name (Translated Scientific Name): Switchgrass - Western Wheatgrass Wet Meadow Alliance
Colloquial Name: Great Plains Switchgrass Wet Meadow

Type Concept: Medium-tall grasses dominate the moderate to dense vegetation cover. *Panicum virgatum* is usually dominant, though some stands may have *Pascopyrum smithii* as a codominant or local dominant. Other grasses can be common, including *Sporobolus airoides, Sporobolus compositus*, and *Distichlis spicata* (on more saline sites). *Schizachyrium scoparium* and *Calamovilfa longifolia* become more common on the upland edge of this alliance. This alliance is found in drainages and basins in the central and southern Great Plains. Stands occur on sites flooded for brief periods during the growing season, whether in basins that collect sufficient runoff or along drainages that flood after snowmelt or heavy rains. Soils can be fine- to coarse-textured.

Classification Comments: This alliance and its component associations are defined largely by the abundance of *Panicum virgatum*, often in combination with *Pascopyrum smithii* in a basin or riparian setting. Rangewide review is lacking.

Internal Comments: JD 4-14: ND added & TX removed.
Other Comments:

Similar NVC Types:
- A3597 *Pascopyrum smithii* Wet Meadow Alliance
- A1354 *Pascopyrum smithii - Distichlis spicata - Hordeum jubatum* Wet Meadow Alliance: is on more saline sites and lacks significant *Panicum virgatum*.

Diagnostic Characteristics: Stands in the western Great Plains dominated by *Panicum virgatum*, often with *Pascopyrum smithii* as an associate or even codominant.

VEGETATION

Physiognomy and Structure: Stands are dominated by graminoids, the tallest of which rarely reach 1 m. Most of the vegetation is 0.6 m tall or shorter. Shrubs and trees are rare or absent.

Floristics: *Panicum virgatum* is usually dominant, though some stands may have *Pascopyrum smithii* as a codominant or local dominant. Other grasses can be common, including *Sporobolus airoides, Sporobolus compositus*, and *Distichlis spicata* (on more saline sites). *Schizachyrium scoparium* and *Calamovilfa longifolia* become more common on the upland edge of this alliance. *Pascopyrum smithii* is rhizomatous and is tolerant of moderate grazing. If severely overgrazed, *Pascopyrum smithii* will decline and may be replaced by less desirable warm-season grasses and exotic species such as *Poa pratensis*.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands occur on sites flooded for brief periods during the growing season, whether in basins that collect sufficient runoff or along drainages that flood after snowmelt or heavy rains. Soils can be fine- to coarse-textured.

Dynamics: Brief flooding in the spring and after heavy rains is common in stands of this alliance. The water table is usually not far below the surface.

DISTRIBUTION

Geographic Range: This alliance has been identified in western South Dakota. It likely occurs elsewhere in the central western Great Plains.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL001484 *Panicum virgatum - (Pascopyrum smithii)* Wet Meadow
- CEGL002239 *Pascopyrum smithii - (Elymus trachycaulus)* Clay Pan Wet Meadow

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/04/28

REFERENCES

References: Diamond 1993, Faber-Langendoen et al. 2017b, Johnston 1987

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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

A3493. Spartina pectinata Great Plains Wet Meadow Alliance

Type Concept Sentence: This wet prairie alliance is found throughout the Great Plains on intermittently flooded sites with dense, tall graminoids, usually with *Spartina pectinata* common or abundant along with species such as *Calamagrostis canadensis, Carex aquatilis, Carex atherodes, Carex pellita*, and *Carex sartwellii*.

OVERVIEW

Scientific Name: *Spartina pectinata* Great Plains Wet Meadow Alliance
Common Name (Translated Scientific Name): Prairie Cordgrass Great Plains Wet Meadow Alliance
Colloquial Name: Great Plains Prairie Cordgrass Wet Meadow

Type Concept: The vegetation of this alliance is characterized by dense stands of graminoids 1-2 m tall with scattered to very infrequent woody plants. The most abundant species are *Calamagrostis canadensis, Carex aquatilis, Carex atherodes, Carex pellita (= Carex lanuginosa), Carex sartwellii*, and *Spartina pectinata*. In some stands, *Spartina pectinata* can form virtual monocultures. Shrubs and small trees are infrequent, though become somewhat more common in the eastern portion of this alliance's range. Among these *Cornus* spp., *Fraxinus pennsylvanica*, and *Salix* spp. are typical. This alliance is found throughout the Great Plains from Oklahoma to the U.S.-Canadian border. Stands of this wide-ranging alliance are found on level to gently sloping sites with sand, loam, or clay soils. They occur near lakes or rivers or in depressions. All sites are typically flooded for part of the winter and spring and can remain saturated for much of the growing season. Some sites are moderately saline.

Classification Comments: This wet prairie is similar to *Calamagrostis stricta - Carex sartwellii - Carex praegracilis* Saline Wet Meadow Alliance (A1350) but has a higher dominance by grasses, though sedges are usually a component of both alliances.

Internal Comments: SEM 1-16: AB, ID, MB, MN, OK added based on assignment of CEGL002220.
Other Comments:

Similar NVC Types:
- A3654 *Spartina pectinata* Wet Prairie Alliance: is found further east in the tallgrass prairie region.

Diagnostic Characteristics: Wet prairie sites in the Great Plains dominated by *Spartina pectinata*, sometimes as a monoculture and sometimes with other grasses such as *Calamagrostis canadensis, Eleocharis* spp., or *Pascopyrum smithii*. *Carex* spp. are usually present and can be codominant, including *Carex aquatilis, Carex atherodes, Carex pellita*, and *Carex sartwellii*.

VEGETATION

Physiognomy and Structure: This alliance is characterized by the dominance of perennial graminoids, generally 1-2 m in height and with high cover. Forbs are present in most stands, but generally with low abundance. Woody plants are scattered to very infrequent.

Floristics: The most abundant species are *Calamagrostis canadensis, Carex aquatilis, Carex atherodes, Carex pellita (= Carex lanuginosa), Carex nebrascensis, Carex sartwellii*, and *Spartina pectinata*, which can form virtual monocultures, as a result of growth from vigorous rhizomes (Hansen et al. 1995, Johnson and Knapp 1995). Other common graminoids include *Muhlenbergia richardsonis, Panicum virgatum, Pascopyrum smithii*, and *Poa palustris*. Shrubs and small trees are infrequent, though become somewhat more common in the eastern portion of this alliance's range. Among these *Cornus* spp., *Fraxinus pennsylvanica*, and *Salix* spp. are typical.

ENVIRONMENT & DYNAMICS

Environmental Description: Locations supporting this alliance are moist, poorly drained, sometimes alkaline areas along ephemeral, intermittent or perennial streams, and overflow areas of large river floodplains. Weaver (1965) reported that, historically, large stands of *Spartina pectinata* occurred on mudflats of the Missouri River. This alliance can also be found in swales, meadows, and on the margins of marshes, ponds or lakes. Sites are generally level to gently sloping. Jones and Walford (1995) found stands along highly meandering, narrow (<12.5 m wide) floodplains, and often the channel was deeply entrenched. The water table is typically high, within 1 m of the surface; sites are typically flooded for part of the winter and spring. Soils are fine-textured, ranging from clay to silt-loam (Weaver 1960, Rolfsmeier and Steinauer 2010), and may be slightly to moderately alkaline (Ungar 1974c, Hansen et al. 1995, Jones and Walford 1995). Soil water movement is rapid enough to preclude the accumulation of salts in the surface horizon. Sites remain saturated for much of the growing season (Kuchler 1974).

Dynamics: *Spartina pectinata* is an early colonizer of suitable habitat and is tolerant of sediment deposition (Weaver 1965, Hansen et al. 1995). On the South Platte River floodplain, it appears to be an early colonizer of the fresh sediments laid down by the 1995 flood. Stands of *Spartina pectinata* have high production rates; however, the rough-edged leaves make for poor forage quality, and it is not readily eaten by livestock or wildlife. Its tall height and thick growth provide shade and cover for wildlife and certain bird species (Hansen et al. 1988).

DISTRIBUTION

Geographic Range: This alliance is found throughout the Great Plains from the U.S.-Canadian border south to Oklahoma.

Nations: CA, US
States/Provinces: AB, CO, ID, KS, MB, MN, MT, ND, NE, OK, SD, SK?, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** *Spartina pectinata* Dominance Type (Jones and Walford 1995)
- **><** *Spartina pectinata* Habitat Type (Hansen et al. 1995)
- **?** *Spartina pectinata* Series (Johnston 1987)
- **=** *Spartina pectinata* herbaceous alliance (Hoagland 1998a)

LOWER LEVEL UNITS

Associations:
- CEGL005625 *Spartina pectinata* Great Plains Wet Meadow
- CEGL001478 *Spartina pectinata - Schoenoplectus pungens* Wet Meadow
- CEGL001477 *Spartina pectinata - Carex* spp. Wet Meadow
- CEGL002028 *Calamagrostis canadensis - Juncus* spp. - *Carex* spp. Sandhills Wet Meadow
- CEGL002223 *Spartina pectinata - Eleocharis* spp. - *Carex* spp. Wet Meadow
- CEGL002220 *Carex atherodes* Wet Meadow
- CEGL002254 *Carex pellita - Calamagrostis stricta* Wet Meadow

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:

Version Date: 2014/01/08

REFERENCES

References: Culwell and Scow 1982, Faber-Langendoen et al. 2017b, Hansen and Hoffman 1988, Hansen et al. 1989, Hansen et al. 1991, Hansen et al. 1995, Hoagland 1998a, Johnson and Knapp 1995, Johnston 1987, Jones and Walford 1995, Kittel et al. 1996, Kittel et al. 1999a, Küchler 1974, Rolfsmeier and Steinauer 2010, Ungar 1974c, Weaver 1960, Weaver 1965

2. Shrub & Herb Vegetation
2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
2.C.4.Nd.5.c. M071 Great Plains Marsh, Wet Meadow, Shrubland & Playa

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

Scientific Name: *Cornus* spp. - *Prunus virginiana / Pascopyrum smithii* Great Plains Riparian Wet Meadow & Shrubland Group
Common Name (Translated Scientific Name): Dogwood species - Chokecherry / Western Wheatgrass Great Plains Riparian Wet Meadow & Shrubland Group
Colloquial Name: Oklahoma Alder Wet 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).

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:
- G147 Great Plains Cottonwood - Green Ash Floodplain Forest
- G526 Rocky Mountain-Great Basin Lowland-Foothill Riparian Shrubland
- G568 Great Plains Riverscour Vegetation
- G336 Great Plains Wet Prairie, Wet Meadow & Seepage Fen

Diagnostic Characteristics: Shrubby or herbaceous riparian areas found above active channels in the Great Plains. Often these occur on terraces or islands.

VEGETATION

Physiognomy and Structure: 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.

Floristics: 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).

ENVIRONMENT & DYNAMICS

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.

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.

DISTRIBUTION

Geographic Range: This group is found in much of the Great Plains from the U.S.-Canadian border region to Oklahoma.

Spatial Scale & Pattern [optional]:
Nations: CA, US
States/Provinces: AB, CO, KS, MB, MT, ND, NE, OK, SD, SK, WY
TNC Ecoregions [optional]: 26:C, 27:C, 33:C, 34:C, 36:C, 37:?, 66:C, 67:C
USFS Ecoregions (2007): 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:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate. Concept is strong but this needs work on the geographic range, particularly on the eastern boundary.

SYNONYMY

LOWER LEVEL UNITS

Alliances:
- A3590 *Shepherdia argentea* Wet Shrubland Alliance
- A3587 *Schoenoplectus* spp. - *Poa palustris* Marsh Alliance
- A3588 *Cornus drummondii - Amorpha fruticosa* Wet Shrubland Alliance
- A3589 *Salix interior* Wet Shrubland Alliance
- A0942 *Alnus maritima ssp. oklahomensis* Wet Shrubland Alliance
- A3586 *Artemisia cana ssp. cana* Wet Shrubland Alliance
- A0918 *Elaeagnus commutata* Wet Shrubland Alliance

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2011)
Author of Description: J. Drake
Acknowledgments:
Version Date: 05/08/2015
Classif Resp Region: Midwest
Internal Author: JD 12-10, 5-13, 5-15

REFERENCES

References: Faber-Langendoen et al. 2017a

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2. Shrub & Herb Vegetation
2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G337. Great Plains Riparian Wet Meadow & Shrubland

A0942. Alnus maritima ssp. oklahomensis Wet Shrubland Alliance [Low - Poorly Documented]

Type Concept Sentence: Shrublands in this alliance are dominated by *Alnus maritima ssp. oklahomensis*, occurring on cobble bars and riparian zones in southern Oklahoma.

OVERVIEW

Scientific Name: *Alnus maritima ssp. oklahomensis* Wet Shrubland Alliance
Common Name (Translated Scientific Name): Oklahoma Alder Wet Shrubland Alliance
Colloquial Name: Oklahoma Alder Wet Shrubland

Type Concept: Shrublands in this alliance are dominated by *Alnus maritima*. This alliance currently contains only one association that occurs on cobble bars and riparian zones in southern Oklahoma, where the stands are dominated by *Alnus maritima ssp. oklahomensis*. An associated species is *Amorpha fruticosa*. Other subspecies of *Alnus maritima* are also known from Georgia, and from southern Delaware and the eastern shore of Maryland.

Classification Comments: The three disjunct populations of *Alnus maritima* (in Oklahoma, Georgia, and the Delmarva Peninsula) are remnants of a once widespread population. It is suspected that during the Holocene glaciation, conditions suitable for *Alnus maritima*, i.e., sunny, wet, disturbed sites on nutrient-poor gravel or sand, were much more widespread in what is now the eastern United States, but with the retreat of the last glacier, sites available for primary succession diminished and the species began to decline and populations fragmented (Schrader and Graves 2004, Schrader et al. 2006).

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: This riparian shrubland is dominated by *Alnus maritima ssp. oklahomensis*.

VEGETATION

Physiognomy and Structure: Stands in this alliance are dominated by tall shrubs.

Floristics: Shrublands in this alliance are dominated by *Alnus maritima ssp. oklahomensis*. An associated species is *Amorpha fruticosa*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance currently contains only one association that occurs on cobble bars and riparian zones in southern Oklahoma, where the stands are dominated by *Alnus maritima ssp. oklahomensis*. *Alnus maritima ssp. oklahomensis* grows in slightly to moderately alkaline soils, low in nitrate and potassium, very low in phosphorus, and high in calcium and magnesium, found along fast-flowing streams in southern Oklahoma, where the summers are very hot and dry (Schrader and Graves 2002).

Dynamics: *Alnus maritima ssp. oklahomensis* can withstand flooding and sprouts vigorously after scour damage, but seedlings do not persist under a shaded canopy (Schrader et al. 2006). The species is best suited to sites undergoing primary succession after severe disturbance (Schrader et al. 2006).

DISTRIBUTION

Geographic Range: This alliance is found in a very limited area of southern Oklahoma.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

- **?** *Alnus maritima* shrubland alliance (Hoagland 1998a)

LOWER LEVEL UNITS

Associations:
- CEGL004455 *Alnus maritima ssp. oklahomensis - Amorpha fruticosa* Wet Shrubland

AUTHORSHIP

Primary Concept Source: B. Hoagland, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Faber-Langendoen et al. 2017b, Hoagland 1998a, Schrader and Graves 2002, Schrader and Graves 2004, Schrader et al. 2006

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2. Shrub & Herb Vegetation
2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G337. Great Plains Riparian Wet Meadow & Shrubland

A3586. Artemisia cana ssp. cana Wet Shrubland Alliance

Type Concept Sentence: This alliance, found in the northern Great Plains along streams and intermittent watercourses, has a sparse to dense short-shrub layer dominated by *Artemisia cana ssp. cana* with *Artemisia tridentata, Ericameria* spp., and *Sarcobatus vermiculatus* possibly present to codominant and mixedgrass species in the herbaceous layer.

OVERVIEW

Scientific Name: *Artemisia cana ssp. cana* Wet Shrubland Alliance
Common Name (Translated Scientific Name): Plains Silver Sagebrush Wet Shrubland Alliance
Colloquial Name: Plains Silver Sagebrush Wet Shrubland

Type Concept: This alliance is found in the northern Great Plains along streams and intermittent watercourses and sometimes in upland settings. There is a sparse to dense short-shrub layer 0.5-1 m tall dominated by *Artemisia cana ssp. cana*. *Artemisia tridentata, Ericameria* spp., and *Sarcobatus vermiculatus* may be present to codominant. Medium-tall grasses dominate the sparse to moderate herbaceous layer including *Calamovilfa longifolia, Hesperostipa comata, Cryptantha* spp., *Eriogonum* spp., *Bouteloua gracilis, Pascopyrum smithii, Andropogon hallii, Pascopyrum smithii, Nassella viridula*, and *Poa pratensis*. Stands are found on sites that receive run-off from higher landscape positions, i.e., ravines, stream valleys, and other intermittent or perennial watercourses and some are flooded periodically. Soils are often fine-textured but some stands occur on sandy sites.

Classification Comments: Many of the herbaceous species common in this alliance are common upland mixedgrass species. Though this alliance generally occurs near permanent or intermittent streams, it is often on the driest margins of what could be considered riparian habitat. The alliance seems to fit this group better than others but it should be recognized that it is on the margins. Two associations in this alliance, *Artemisia cana ssp. cana / Hesperostipa comata* Shrub Wet Meadow (CEGL001553) and *Artemisia cana ssp. cana / Calamovilfa longifolia* Shrub Wet Meadow (CEGL001555), do not occur only in riparian settings. The dominant and some associated species fit this alliance so they are left here for now but should be considered for removal to another group. They are possibly more related to upland dry-mesic prairies. There are currently two closely related associations that should probably be merged. The difference between *Artemisia cana / Pascopyrum smithii* Wet Shrubland (CEGL001072) and *Artemisia cana ssp. cana / Pascopyrum smithii* Shrub Wet Meadow (CEGL001556) appears to be only in the amount of shrub cover, though CEGL001556 allows for varying amounts of shrub. These may be slight physiognomic variations of a single association.

Internal Comments:
Other Comments:

Similar NVC Types:
- A4031 *Pascopyrum smithii - Nassella viridula* Northwestern Great Plains Grassland Alliance: is usually found on uplands away from floodplains or alluvial terraces and lacks significant cover by *Artemisia cana*.
- A1540 *Yucca glauca* Prairie Scrub Alliance
- A3200 *Artemisia cana ssp. bolanderi - Artemisia cana ssp. viscidula* Steppe & Shrubland Alliance

Diagnostic Characteristics: This alliance has a sparse to dense shrub cover of *Artemisia cana ssp. cana*. Associated species vary but often include *Calamovilfa longifolia, Cryptantha* spp., *Eriogonum* spp., *Hesperostipa comata*, and *Pascopyrum smithii*.

VEGETATION

Physiognomy and Structure: These are microphyllous evergreen shrublands, often with a well-developed grass layer. The grasses may exceed the shrubs in height and total cover. Shrubs are typically 0.5-1.5 m tall. Prostrate and, occasionally, upright forbs are present.

Floristics: Stands in this alliance have an open to moderately closed short-shrub stratum in which *Artemisia cana* is dominant or codominant. *Artemisia tridentata* is a common associate. Along intermittent streambeds, other common shrubs include *Atriplex canescens, Ericameria nauseosa*, and *Sarcobatus vermiculatus*. Medium-tall and short grasses comprise most of the herbaceous layer and often have more cover than the shrubs. Common grasses include *Bouteloua gracilis, Elymus elymoides, Koeleria macrantha, Nassella viridula*, and *Pascopyrum smithii*. On sandier sites *Achnatherum hymenoides, Calamovilfa longifolia*, and *Hesperostipa comata* may be found. Forbs are common but do not contribute substantial cover compared to grasses unless sites are

heavily grazed. Typical forbs are *Achillea millefolium, Artemisia ludoviciana, Gaura coccinea, Lactuca tatarica var. pulchella, Linum perenne, Sphaeralcea coccinea*, and *Trifolium* spp. Common exotic associates that might be abundant in some stands include *Bromus arvensis (= Bromus japonicus), Bromus tectorum, Melilotus officinalis, Poa pratensis*, and *Taraxacum officinale*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance is found at elevations from 500-1500 m in the Great Plains. Precipitation is generally 25-50 cm annually. It occurs most frequently on alluvial terraces and fans, intermittent creek bottoms, and sometimes in mesic swales. Soils are deep and usually fine-textured, though some stands are found on sandy soils. Sites may flood in the spring or after heavy rains but do not stay saturated for extended periods. While surface water does not remain for long, sites receive more moisture than the surrounding uplands from runoff.

Dynamics: Vegetation types in this alliance occur on alluvial terrain. They 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 increases in the cover of shrubs and non-native grass species, such as *Poa pratensis*. *Artemisia cana* resprouts vigorously following spring fire, and this method may serve to increase shrub coverage of stands. Conversely, fire in the fall may decrease shrub abundance (Hansen et al. 1995). Sarr (1995) noted that *Artemisia cana* was associated with higher floodplain terraces of alluvial meadows where the late-summer water table averaged 0.8-1.5 m below the surface. Gully erosion of meadows led to an invasion of this type to formerly wet meadows. Comparisons of grazed and protected floodplain sites showed a tendency for *Artemisia cana* to occur more commonly in grazed than ungrazed habitats of the similar groundwater hydrology.

DISTRIBUTION

Geographic Range: This alliance occurs in the northwestern Great Plains from southern Saskatchewan and southern Alberta to Wyoming and western South Dakota.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **<** SRM Cover Type #408 - Other Sagebrush Types (Shiflet 1994)

LOWER LEVEL UNITS

Associations:

- CEGL002175 *Artemisia cana ssp. cana - Sarcobatus vermiculatus - (Ericameria nauseosa)* Wet Shrubland
- CEGL001553 *Artemisia cana ssp. cana / Hesperostipa comata* Shrub Wet Meadow
- CEGL001555 *Artemisia cana ssp. cana / Calamovilfa longifolia* Shrub Wet Meadow
- CEGL001556 *Artemisia cana ssp. cana / Pascopyrum smithii* Shrub Wet Meadow
- CEGL001072 *Artemisia cana / Pascopyrum smithii* Wet Shrubland

AUTHORSHIP

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

REFERENCES

References: Bramble-Brodahl 1978, Faber-Langendoen et al. 2017b, Hansen and Hoffman 1988, Hansen et al. 1984, Hansen et al. 1991, Hansen et al. 1995, Hanson and Whitman 1938, Johnston 1987, Jones and Walford 1995, Padgett et al. 1989, Sarr 1995, Shiflet 1994, Thilenius and Brown 1990, Thilenius et al. 1995, USFS 1992

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2. Shrub & Herb Vegetation
2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G337. Great Plains Riparian Wet Meadow & Shrubland

A3588. Cornus drummondii - Amorpha fruticosa Wet Shrubland Alliance

Type Concept Sentence: This dogwood shrubland is found along rivers and streams in the central Great Plains above the stream channel where periodic flooding in late winter or spring inundates the sites favoring dominance by *Amorpha fruticosa* and *Cornus drummondii* with scattered patches of *Cornus sericea, Salix exigua*, and *Populus deltoides* saplings.

OVERVIEW

Scientific Name: *Cornus drummondii - Amorpha fruticosa* Wet Shrubland Alliance
Common Name (Translated Scientific Name): Roughleaf Dogwood - False Indigobush Wet Shrubland Alliance
Colloquial Name: Dogwood - Tall Indigobush Wet Shrubland

Type Concept: This dogwood shrubland community is found along rivers and streams in the central Great Plains of the United States. Vegetation consists of patches of moderate to locally dense cold-deciduous shrubs 2-3 m tall. *Amorpha fruticosa* and *Cornus drummondii* dominate the stands, with scattered patches of *Cornus sericea, Salix exigua*, and *Populus deltoides* saplings. The herbaceous understory varies in response to flooding. Sedges, such as *Carex cristatella, Carex emoryi*, and *Carex pellita*, are found with mesophytic grasses, such as *Panicum virgatum* and *Andropogon gerardii*. *Poa pratensis* can be common, as well. In more xeric habitats, weedy annual forbs, such as *Ambrosia artemisiifolia*, may be abundant, whereas wetter sites are dominated by forbs typical of marshes, e.g., *Impatiens capensis, Mentha arvensis*. This alliance is found along high banks, raised islands, and terraces above the stream channel, which experience periodic flooding in late winter or spring. Soils are moderately well-drained and formed in alluvium.

Classification Comments: This alliance has only one association currently. There is another riparian shrubland association found in southern Oklahoma, *Alnus maritima ssp. oklahomensis - Amorpha fruticosa* Wet Shrubland (CEGL004455), with *Amorpha fruticosa* as an associated species that could possibly be folded into this alliance. Little is known about CEGL004455 and it appears to be rather unique in having *Alnus maritima ssp. oklahomensis* as a dominant, so for now they are in separate, single-association alliances.

This alliance was described based on two communities from Currier (1982): *Cornus/Amorpha* Community and *Amorpha/Cornus* Community.

Internal Comments:
Other Comments:

Similar NVC Types:
- A3589 *Salix interior* Wet Shrubland Alliance: is often near to but lower than A3588 and is flooded more often; *Salix* spp. shrubs are dominant in this alliance but not in A3588.

Diagnostic Characteristics: Riparian shrublands dominated by *Cornus drummondii, Cornus sericea*, and *Amorpha fruticosa*.

VEGETATION

Physiognomy and Structure: This alliance is characterized by a moderate to dense shrub layer 2-3 m tall. Herbaceous cover increases with time since flooding and tends to vary inversely with the amount of shrub cover. Herbaceous vegetation is 0.5-1 m tall.

Floristics: *Amorpha fruticosa* and *Cornus drummondii* dominate stands of this alliance, with scattered patches of *Cornus sericea, Salix exigua*, and *Populus deltoides* saplings. The herbaceous understory varies in response to flooding and the canopy of shrubs. Sedges, such as *Carex cristatella, Carex emoryi*, and *Carex pellita*, are found with mesophytic grasses, such as *Panicum virgatum* and *Andropogon gerardii*. *Poa pratensis* can be common, as well. In more xeric habitats, weedy annual forbs, such as *Ambrosia artemisiifolia*, may be abundant, whereas wetter sites are dominated by forbs typical of marshes, e.g., *Impatiens capensis, Mentha arvensis*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance is found along high banks, raised islands, and terraces above the stream channel, which experience periodic flooding in late winter or spring. Soils are moderately well-drained and formed in alluvium.

Dynamics: Stands in this alliance often flood in later winter or spring but they are raised enough above the riverbed to avoid being flooded for most of the growing season. This alliance appears to be spreading with the reduction in flooding frequency on major Nebraska rivers (Rolfsmeier and Steinauer 2010).

DISTRIBUTION

Geographic Range: This alliance has been described only in Nebraska and is likely more common in the east with scattered occurrences in the western part of the state (Rolfsmeier and Steinauer 2010).

Nations: US

States/Provinces: NE
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** *Amorpha/Cornus* Community (Currier 1982)
- **>** *Cornus/Amorpha* Community (Currier 1982)

LOWER LEVEL UNITS

Associations:
- CEGL005220 *Cornus drummondii - Amorpha fruticosa - Cornus sericea* Wet Shrubland

AUTHORSHIP

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

REFERENCES

References: Currier 1982, Faber-Langendoen et al. 2017b, Rolfsmeier and Steinauer 2010

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2. Shrub & Herb Vegetation
2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G337. Great Plains Riparian Wet Meadow & Shrubland

A0918. Elaeagnus commutata Wet Shrubland Alliance

Type Concept Sentence: This silverberry shrubland occurs in the northwestern Great Plains on north-facing slopes and river valley slopes where open thickets dominated by *Elaeagnus commutata* occur within the mixedgrass prairie landscape.

OVERVIEW

Scientific Name: *Elaeagnus commutata* Wet Shrubland Alliance
Common Name (Translated Scientific Name): Silverberry Wet Shrubland Alliance
Colloquial Name: Silverberry Wet Shrubland

Type Concept: This silverberry shrubland occurs in the northwestern portion of the Great Plains of the United States and Canada. The vegetation forms open thickets within the mixedgrass prairie landscape. *Elaeagnus commutata* is generally a short to medium height shrub, although it can grow up to 5 m. These thickets are often associated with *Rosa woodsii* and *Symphoricarpos occidentalis*. Other plants associated with this type include *Anemone multifida, Campanula rotundifolia, Elymus trachycaulus, Festuca altaica (= Festuca scabrella), Geum triflorum, Heuchera richardsonii, Pascopyrum smithii, Potentilla arguta*, and *Symphyotrichum laeve (= Aster laevis)*. This shrubland occurs in relatively open stands. Stands occur on a variety of glacial landforms, including kames, eskers, and areas of till and outwash. They are common on north-facing slopes and sites where moisture is more abundant, including along river valley slopes.

Classification Comments: The single association in this alliance has been quantitatively described only in Hill County of northeastern Montana, based on only one sample plot; reconnaissance in Montana indicates that the type exists as small stands in floodplain situations on coarse substrates (mixed gravels and sand), usually in association with *Salix exigua*-dominated communities. The *Elaeagnus commutata*-dominated patches almost invariably are small and stringer-like in shape; perhaps *Elaeagnus commutata* is an inferior competitor to the associated rhizomatous willow (usually *Salix exigua*). The extensive wetlands inventory by the Montana Wetland/Riparian Association makes no mention of *Elaeagnus commutata* types, either as dominance types or community types. From floristic studies in North Dakota and the Canadian Prairie Provinces, this association has been described for uplands, occurring as open thickets, associated with *Symphoricarpos occidentalis*- and *Rosa woodsii*-dominated shrublands, within a matrix of mixedgrass steppe. The occurrences in Montana versus the North Dakota and Canadian Prairie Provinces seem to be at variance in their abiotic parameters and landscape settings.

Internal Comments: DFL 8-17: AB added per AB NHP.
Other Comments:

Similar NVC Types:
- A0954 *Crataegus douglasii - Crataegus succulenta* Shrubland Alliance
- A4031 *Pascopyrum smithii - Nassella viridula* Northwestern Great Plains Grassland Alliance: is usually found on uplands away from floodplains or alluvial terraces and has <25% shrub cover.

Diagnostic Characteristics: This alliance is characterized by *Elaeagnus commutata*-dominated shrublands in the northwestern Great Plains.

VEGETATION

Physiognomy and Structure: This is a shrubland alliance dominated by broad-leaved deciduous shrubs, often relatively short in height (1-3 m), but occasionally reaching 5 m. There is an herbaceous layer dominated by perennial grasses, with forbs present but not dominant.

Floristics: This shrub alliance is found in the northern Great Plains as open thickets in a mixedgrass prairie matrix. It is dominated by mid to tall shrubs, especially *Elaeagnus commutata*. The shrubs are typically less than 5 m in height, but can occasionally be taller. Other shrubs often present include *Rosa woodsii, Amelanchier alnifolia*, and *Symphoricarpos occidentalis*. The grass *Pascopyrum smithii* is dominant in the herbaceous layer, typically accompanied by *Hesperostipa comata (= Stipa comata), Koeleria macrantha*, and *Schizachyrium scoparium*. Other grasses and forbs that may be present include *Anemone multifida, Campanula rotundifolia, Elymus trachycaulus (= Agropyron trachycaulum), Festuca altaica (= Festuca scabrella), Geum triflorum, Heuchera richardsonii, Potentilla arguta*, and *Symphyotrichum laeve (= Aster laevis)*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance of the northern Great Plains occurs at low to moderate elevations in a region of interior continental climate regime. Summers can be hot, while winters are bitterly cold. This alliance is found across a wide range of glacial and fluvial landforms and parent materials, including kames, eskers, glacial drift, outwash and alluvium of considerable textural variety. It also occurs on weathered-in-place materials of northern slopes, protected positions, and river valley slopes. Hulett et al. (1966) found *Elaeagnus commutata* to be most abundant on flat sandy sites in southern Saskatchewan. No other information is available on the distribution patterns of this alliance.

Dynamics: *Elaeagnus commutata* is an increaser species on overgrazed cattle rangelands. Land management practices which modify shrub cover can alter the composition of passerine bird communities in mixedgrass prairie of North Dakota. Many bird species are not attracted to mixedgrass prairie with reduced cover of silverberry. *Elaeagnus commutata* is top-killed by most fires, but patches of shrubs can be maintained by employing partial burns (Esser 1994).

DISTRIBUTION

Geographic Range: This alliance is found in the northwestern Great Plains from North Dakota, eastern Wyoming north to southern Manitoba, Alberta and Saskatchewan.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL001099 *Elaeagnus commutata / Pascopyrum smithii* Wet Shrubland

AUTHORSHIP

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

REFERENCES

References: DeVelice 1992, Esser 1994a, Faber-Langendoen et al. 2017b, Hulett et al. 1966

2. Shrub & Herb Vegetation
2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G337. Great Plains Riparian Wet Meadow & Shrubland

A3589. Salix interior Wet Shrubland Alliance

Type Concept Sentence: This shrubland is found in the Great Plains along streams and rivers where flooding is frequent and *Salix interior* is the dominant shrub, though other shrubs or saplings are common, including *Cornus sericea, Populus deltoides, Salix amygdaloides, Salix eriocephala, Salix lutea*, and *Salix nigra* (in the east).

OVERVIEW

Scientific Name: *Salix interior* Wet Shrubland Alliance
Common Name (Translated Scientific Name): Sandbar Willow Wet Shrubland
Colloquial Name: Great Plains Sandbar Willow Wet Shrubland

Type Concept: This alliance is found in the Great Plains along streams and rivers. Shrubs dominate the alliance. Depending on time since the last major disturbance (usually flooding), the shrubs can be short to tall (0-4 m). *Salix interior* is the dominant shrub, but other shrubs or saplings are common, including *Cornus sericea, Populus deltoides, Salix amygdaloides, Salix eriocephala, Salix lutea*, and *Salix nigra* (in the east). The understory is usually moderate to lush but can be sparse if subject to a recent major flood. The herbaceous layer is typically dominated by mid and tall graminoids such as *Carex* spp., *Pascopyrum smithii, Panicum virgatum, Spartina pectinata*, and *Schoenoplectus* spp. (in wetter areas). Other common herbaceous species include *Ambrosia artemisiifolia, Equisetum hyemale, Polygonum* spp., and *Xanthium strumarium*.

Classification Comments: There is only one association currently in this alliance for the entire Great Plains. It includes recently scoured, low-diversity *Salix interior* shrublands and older shrublands where floristic diversity may be higher. This may be too broad a concept for a single association. The current alliance includes the Great Plains portions of two former associations, CEGL001203 (now restricted to the Rocky Mountains and west) and CEGL001197 (now subsumed in CEGL001203).

Internal Comments:
Other Comments:

Similar NVC Types:
- A3588 *Cornus drummondii - Amorpha fruticosa* Wet Shrubland Alliance: is known only from Nebraska and lacks dominance by *Salix* spp.

Diagnostic Characteristics: This alliance is composed of riparian shrublands in the Great Plains dominated by *Salix interior*.

VEGETATION

Physiognomy and Structure: Short to tall deciduous shrubs dominate stands of this alliance. Cover is variable with recently flooded stands having less cover. Stands that have not experienced scouring floods for several years can have a nearly complete shrub canopy. Common shrubs can reach 3-4 m tall but are often kept shorter by flood damage. The herbaceous layer is also variable with stands recently flooded being the most open and filling in with time since the last major flood.

Floristics: Stands in this alliance are typically dominated by *Salix interior*, but other shrubs or saplings are common, including *Cornus sericea, Populus deltoides, Salix amygdaloides, Salix eriocephala, Salix lutea*, and *Salix nigra* (in the east). The herbaceous layer is typically dominated by mid and tall graminoids such as *Carex* spp., *Pascopyrum smithii, Panicum virgatum, Spartina pectinata*, and *Schoenoplectus* spp. (in wetter areas). Other common herbaceous species include *Ambrosia artemisiifolia, Equisetum hyemale, Polygonum* spp., and *Xanthium strumarium*.

ENVIRONMENT & DYNAMICS

Environmental Description: Soils are poorly developed or absent. The substrate is typically alluvial sand or gravel, though finer sediments can occur in places.

Dynamics: Flooding affects stands of this alliance frequently. Scouring or deposition from flooding is necessary to maintain stands or create new habitat for this early-successional vegetation type. In the prolonged absence of floods, stands succeed to riparian woodlands or forests.

DISTRIBUTION

Geographic Range: This alliance is found in the central and northern Great Plains from Kansas to southern Saskatchewan and west to southern Alberta, central Montana, and eastern Colorado.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **<** Sandbar Willow Shrubland (Rolfsmeier and Steinauer 2010) [Nebraska state type includes A3589 and A3646 in Nebraska.]

LOWER LEVEL UNITS

Associations:
- CEGL005282 *Salix interior / Pascopyrum smithii - Equisetum hyemale* Wet Shrubland

AUTHORSHIP

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

REFERENCES

References: Faber-Langendoen et al. 2017b, Rolfsmeier and Steinauer 2010

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2. Shrub & Herb Vegetation
2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G337. Great Plains Riparian Wet Meadow & Shrubland

A3587. Schoenoplectus spp. - Poa palustris Marsh Alliance

Type Concept Sentence: This herbaceous wetland is found lining perennial streams at lower to mid elevations in the Black Hills of the United States, and perhaps more widely in the northern Great Plains. Species composition is variable, and dominance is patchy within stands; local dominants include *Agrostis stolonifera, Cicuta douglasii, Eleocharis palustris, Glyceria grandis, Leersia oryzoides, Lycopus asper, Poa palustris, Nasturtium officinale*, and *Scirpus pallidus*. *Ranunculus longirostris* can be abundant in adjacent shallow water.

OVERVIEW

Scientific Name: *Schoenoplectus* spp. - *Poa palustris* Marsh Alliance
Common Name (Translated Scientific Name): Bulrush species - Fowl Bluegrass Marsh Alliance
Colloquial Name: Bulrush - Fowl Bluegrass Marsh

Type Concept: This herbaceous wetland is found lining perennial streams at lower to mid elevations in the Black Hills of the United States, and perhaps more widely in the northern Great Plains. Species composition is variable, and dominance is patchy within stands. Local dominants include *Agrostis stolonifera, Cicuta douglasii, Eleocharis palustris, Glyceria grandis, Leersia oryzoides, Lycopus asper, Poa palustris, Nasturtium officinale (= Rorippa nasturtium-aquaticum)*, and *Scirpus pallidus*. *Ranunculus longirostris (= Ranunculus circinatus)* can be abundant in adjacent shallow water. *Catabrosa aquatica, Mimulus guttatus*, and several species of *Veronica* and *Epilobium* commonly grow in adjacent shallow water. This type is undersurveyed and not well-characterized. It typically forms a narrow border, perhaps only a few meters wide, along streams, and this scale may be too fine for recognition as an association.

Classification Comments: If the association (CEGL005263) and this alliance (A3587) are retained, it seems there should be other small-scale herbaceous-dominated streamside associations in the Great Plains. Perhaps they could be added to this association. At one time a closely related type, the former Black Hills Streamside Vegetation, *Glyceria grandis - Poa palustris* - Mixed Herbaceous Black Hills Herbaceous Vegetation (CEGL005262), was recognized as the higher elevation equivalent of this type, but stands appear similar enough based on existing data that they have been combined. This type still needs further characterization. It typically forms a narrow border, perhaps only a few meters wide, along streams, and this scale may be too fine for recognition as associations. Girard (c. 1991) described stands of *Glyceria grandis*, one of the more common streamside dominants, as part of a vegetation complex associated with beaver dams, occurring in shallow water or on saturated soils.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: This association covers streamside herbaceous vegetation in the Black Hills and possibly elsewhere in the Great Plains. Dominants vary but can include *Agrostis stolonifera, Cicuta douglasii, Eleocharis palustris, Glyceria grandis, Leersia oryzoides, Lycopus asper, Poa palustris, Nasturtium officinale*, and *Scirpus pallidus*.

VEGETATION

Physiognomy and Structure: This alliance is characterized by short and medium-tall herbaceous wetland species with few to no shrubs.

Floristics: Species composition is variable, and dominance is patchy within stands. Local dominants include *Agrostis stolonifera, Cicuta douglasii, Eleocharis palustris, Glyceria grandis, Leersia oryzoides, Lycopus asper, Poa palustris, Nasturtium officinale (= Rorippa nasturtium-aquaticum)*, and *Scirpus pallidus*. *Ranunculus longirostris (= Ranunculus circinatus)* can be abundant in adjacent shallow water. *Catabrosa aquatica, Mimulus guttatus*, and several species of *Veronica* and *Epilobium* commonly grow in adjacent shallow water. This type is undersurveyed and not well-characterized.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands of this alliance typically form a narrow border, perhaps only a few meters wide, along streams.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance has been identified only in the Black Hills region of South Dakota but likely occurs elsewhere in the Great Plains.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Associations:

- CEGL005263 *Schoenoplectus* spp. - *Poa palustris* - Mixed Herbaceous Great Plains Streamside Marsh

AUTHORSHIP

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

REFERENCES

References: Faber-Langendoen et al. 2017b, Girard 1991

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2. Shrub & Herb Vegetation
2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G337. Great Plains Riparian Wet Meadow & Shrubland

A3590. Shepherdia argentea Wet Shrubland Alliance

Type Concept Sentence: The vegetation of this mesic shrubland alliance is dominated by a moderate to dense canopy of medium-tall shrubs. The most abundant of these, *Shepherdia argentea*, is typically 1.5-3 m tall. Other common shrub species are *Juniperus horizontalis, Prunus virginiana, Ribes* spp., *Rhus aromatica, Rosa woodsii*, and *Symphoricarpos occidentalis*. Graminoids and forbs may have only half the coverage of the shrub layer. It is found in the northern Great Plains of the United States and Canada. Stands occur on stream terraces, rolling uplands, and badlands, and where moisture is more plentiful than on the surrounding landscape, such as in swales, ravines, near streams, and on northwest- to east-facing slopes.

OVERVIEW

Scientific Name: *Shepherdia argentea* Wet Shrubland Alliance
Common Name (Translated Scientific Name): Buffaloberry Wet Shrubland Alliance
Colloquial Name: Buffaloberry Wet Shrubland

Type Concept: The vegetation of this mesic shrubland alliance is dominated by a moderate to dense canopy of medium-tall shrubs. The most abundant of these, *Shepherdia argentea*, is typically 1.5-3 m tall. Other common shrub species are *Juniperus horizontalis, Prunus virginiana, Ribes* spp., *Rhus aromatica, Rosa woodsii*, and *Symphoricarpos occidentalis*. Graminoids and forbs may have only half the coverage of the shrub layer. Graminoids include *Poa pratensis, Pascopyrum smithii*, and *Bromus* spp. Common forbs are *Achillea millefolium, Artemisia ludoviciana*, and *Parietaria pensylvanica*. This alliance is found in the northern Great Plains of the United States and Canada. Stands occur on stream terraces, rolling uplands, and badlands, and where moisture is more plentiful than on the surrounding landscape, such as in swales, ravines, near streams, and on northwest- to east-facing slopes. This community occurs in a predominantly prairie landscape as either narrow bands along streams or in small thickets.

Classification Comments: This alliance contains just one association, *Shepherdia argentea* Wet Shrubland (CEGL001128). This association used to include *Shepherdia argentea* stands in western Colorado and Utah but those have been split into a separate association in Rocky Mountain-Great Basin Lowland-Foothill Riparian Shrubland Group (G526). This alliance is not restricted to riparian settings so it goes beyond the concept of Great Plains Riparian Wet Meadow & Shrubland Group (G337), but that group appears to be the best fit for the alliance as a whole.

Stands of this alliance are usually easy to differentiate from the surrounding prairie landscape based solely on the shrubland physiognomy. There may be some difficulty classifying stands that contain an abundance of *Symphoricarpos occidentalis* with moderate amounts of *Shepherdia argentea* and other taller shrubs. These may be in either *Shepherdia argentea* Wet Shrubland Alliance (A3590) or *Prunus virginiana - Symphoricarpos occidentalis - Amelanchier alnifolia* Great Plains Shrubland Alliance (A4036).

Internal Comments:
Other Comments:

Similar NVC Types:

- A0954 *Crataegus douglasii - Crataegus succulenta* Shrubland Alliance
- A4036 *Prunus virginiana - Symphoricarpos occidentalis - Amelanchier alnifolia* Great Plains Shrubland Alliance: can occur on similar landscape settings but is not dominated by *Shepherdia argentea*.

Diagnostic Characteristics: Shrublands in the northern Great Plains dominated by *Shepherdia argentea*.

VEGETATION

Physiognomy and Structure: Vegetation in this alliance is characterized by broad-leaved deciduous shrubs, often in two strata. The tall-shrub canopy is dominated by a spreading to ascending shrub with 25-100% cover. The short-shrub layer has less than or equal cover. The herbaceous layer is generally dominated by graminoids.

Floristics: *Shepherdia argentea* dominates the upper shrub canopy and occurs in small, open patches or in narrow bands parallel to a stream channel. *Symphoricarpos occidentalis* is often present in a lower shrub layer; *Juniperus horizontalis, Prunus virginiana, Rhus aromatica, Ribes* spp., and *Rosa woodsii* occur in some stands. Native and exotic herbaceous species occur in the understory and form a sparse to dense ground cover. Grass species, such as *Bromus inermis, Bromus tectorum, Calamagrostis montanensis, Leymus cinereus, Pascopyrum smithii*, and *Poa pratensis*, and forbs, such as *Achillea millefolium, Cirsium arvense, Galium boreale, Maianthemum stellatum, Parietaria pensylvanica*, and *Solidago* spp., are present in different stands (Hansen and Hoffman 1988, USFS 1992). DeVelice et al. (1995) stated that stands in northeastern Montana were typically smaller than 0.1 ha.

ENVIRONMENT & DYNAMICS

Environmental Description: The vegetation in this alliance occurs in riparian habitats in the Rocky Mountains and in moist swales in the glaciated region of the northern Great Plains. It occurs where moisture is more plentiful than on the surrounding landscape, such as in swales, ravines, near streams, and on northwest- to east-facing slopes (Hansen and Hoffman 1988, DeVelice et al. 1995). This trend is more pronounced in Wyoming where Jones and Walford (1995) found this alliance only near streams, and may be less pronounced in Saskatchewan and northern Montana. Stands are located on terraces above the floodplain of large rivers, on small and intermittent creeks, and on hillsides below springs or seeps in the Rockies and in moist depressions in rolling prairie uplands. Stands are found between 500-1600 m elevation on the plains and in the northern Rockies and between 1950-2150 m in Colorado. Soils are classified predominantly as Entisols (Fluvents) or Mollisols (Borolls). Soil textures range from well-drained loamy sands to somewhat poorly drained silty clay loams and are derived from glacial drift, siltstone, or sandstone (USFS 1992, DeVelice et al. 1995). The vegetation is tolerant of brief flooding. Adjacent riparian vegetation includes *Acer negundo, Fraxinus pennsylvanica, Populus angustifolia, Populus deltoides*, and *Salix amygdaloides* woodlands and *Cornus sericea* and *Salix exigua* shrublands.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance occurs in the northern Great Plains, in the Rocky Mountains, and on the Colorado Plateau and high plateaus of Utah. The alliance is found from southern Saskatchewan and Alberta, Canada, south through the Dakotas, Montana, Wyoming, western Colorado, and Utah.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Shepherdia argentea* Community Type (Hansen et al. 1988a)
- **?** *Shepherdia argentea* Habitat Type (USFS 1992)
- **?** *Shepherdia argentea* Plant Association (DeVelice et al. 1995)
- **?** Silver Buffaloberry Dominance Type (Jones and Walford 1995)

LOWER LEVEL UNITS

Associations:

- CEGL001128 *Shepherdia argentea* Wet Shrubland

AUTHORSHIP

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

REFERENCES

References: DeVelice et al. 1995, Faber-Langendoen et al. 2017b, Hansen and Hoffman 1988, Hansen et al. 1984, Hansen et al. 1988a, Hansen et al. 1991, Hansen et al. 1995, Jones and Walford 1995, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1999a, Thompson and Hansen 2002, USFS 1992

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2. Shrub & Herb Vegetation
2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
2.C.4.Nd.5.d. M071 Great Plains Marsh, Wet Meadow, Shrubland & Playa

G568. Great Plains Riverscour Vegetation

Type Concept Sentence: This group encompasses sparsely vegetated sites within the scour zone of stream channels in the Great Plains from the U.S.-Canadian border region south to the U.S.-Mexican border region.

OVERVIEW

Scientific Name: *Salix interior / Sporobolus cryptandrus - Artemisia campestris* Riverscour Group
Common Name (Translated Scientific Name): Sandbar Willow / Sand Dropseed - Field Sagewort Riverscour Group
Colloquial Name: Edwards Plateau Riverscour Wet Meadow

Type Concept: This group encompasses sites within the scour zone of stream channels in the Great Plains from the U.S.-Canadian border region south to the U.S.-Mexican border region. It is more common in the western Great Plains than the eastern Great Plains. Examples of this group are found in watercourses that have been recently scoured by flooding. These can be beds of intermittent streams or in the floodplains of more permanent streams or rivers which have frequent flooding. Stands can have sparse cover of short shrubs or tree seedlings or herbaceous species. Frequent scouring prevents more dense vegetation from developing. *Salix* spp., and particularly *Salix interior*, are the most common shrubs. Seedlings of *Populus deltoides* can be present. The herbaceous component is diverse and can have significant amounts of exotic species. Species such as *Sporobolus cryptandrus, Artemisia campestris, Juncus articulatus, Polygonum* spp., and the exotics *Agrostis stolonifera, Bidens frondosa*, and *Trifolium repens* are common in much of the Great Plains with *Andropogon glomeratus* and *Panicum virgatum* often abundant in south Texas.

Classification Comments: Name and concept need review. Current associations in this group are attributed to only Nebraska and Texas. The group is certainly more widespread but associations are not well-described for most of its range. How far east does this riparian scour group go? This group is similar to Rocky Mountain-Great Basin Lowland-Foothill Riparian Shrubland Group (G526), which occurs at higher elevations, and to Great Plains Riparian Wet Meadow & Shrubland Group (G337), though both of these have more vegetation cover. The concept of this group includes sites dominated by *Populus* spp. seedlings. Without disturbance, these sites will become another vegetation type (probably within Great Plains Cottonwood - Green Ash Floodplain Forest Group (G147)) within a few years. How tall/dense do *Populus* spp. saplings have to be to convert to G147?

Similar NVC Types:
- G526 Rocky Mountain-Great Basin Lowland-Foothill Riparian Shrubland
- G337 Great Plains Riparian Wet Meadow & Shrubland

Diagnostic Characteristics: This group is characterized by sparse deciduous shrub or herbaceous cover in recently scoured riparian settings. In south Texas, vegetation can be denser.

VEGETATION

Physiognomy and Structure: Stands in this group are dominated by deciduous shrubs or herbaceous species. Cover can be sparse to moderate depending on time since most recent flood and severity of flooding. Shrubs are typically 1-2 m tall though they can sometimes be taller. Seedlings of deciduous trees can dominate some sites. Barring stand-replacing disturbance, these sites will succeed to a different vegetation type in several years.

Floristics: *Salix* spp., and particularly *Salix interior*, are usually dominant shrubs. Seedlings of *Populus deltoides* can be present. The herbaceous component is diverse and can have significant amounts of exotic species. Species such as *Sporobolus cryptandrus, Artemisia campestris, Juncus articulatus, Polygonum* spp., and the exotics *Agrostis stolonifera, Bidens frondosa*, and *Trifolium repens* are common (Friedman et al. 1996). In south Texas, *Andropogon glomeratus, Cladium mariscoides*, and *Panicum virgatum* are common.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands can be found in deep-cut ravines or wide, braided channels. Soils are recently deposited or re-worked, coarse-textured alluvium. Water input is usually from overland flow, local precipitation, or groundwater discharge and not from major perennial tributary streams. Flooding is important to create sites for establishment of plants in the group and in controlling succession to other vegetation types. This group is more likely in the Western Great Plains where the water sources are less consistent and scouring flood events followed by a drop in water levels are more frequent.

Dynamics: These are disturbance-driven communities that require flooding, scour, and deposition for germination and maintenance.

DISTRIBUTION

Geographic Range: This group occurs throughout the western and central Great Plains from the U.S.-Canadian border region south to the Texas-Mexico border area.

Spatial Scale & Pattern [optional]:
Nations: CA?, US
States/Provinces: AB?, CO, IA?, KS, MT, ND, NE, OK, SD, SK?, TX, WY
TNC Ecoregions [optional]: 25:P, 26:C, 27:C, 33:C, 34:C, 36:P, 66:C, 67:C
USFS Ecoregions (2007): 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:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Alliances:
- A4115 *Panicum virgatum - Andropogon glomeratus* Riverscour Wet Meadow Alliance
- A3591 *Sporobolus cryptandrus - Artemisia campestris* Wet Meadow Alliance

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2011)

Author of Description: J. Drake
Acknowledgments:
Version Date: 05/08/2015
Classif Resp Region: Midwest
Internal Author: JD 12-10, 5-13, 5-15

REFERENCES

References: Faber-Langendoen et al. 2017a, Friedman et al. 1996

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2. Shrub & Herb Vegetation
2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G568. Great Plains Riverscour Vegetation

A4115. Panicum virgatum - Andropogon glomeratus Riverscour Wet Meadow Alliance

Type Concept Sentence: This herbaceous alliance is found in southern Texas along streams that are periodically scoured by flooding and have an open to dense herbaceous stratum dominated by *Andropogon glomeratus var. pumilus, Cladium mariscus ssp. jamaicense, Fuirena simplex, Panicum virgatum*, and *Rhynchospora colorata*.

OVERVIEW

Scientific Name: *Panicum virgatum - Andropogon glomeratus* Riverscour Wet Meadow Alliance
Common Name (Translated Scientific Name): Switchgrass - Bushy Bluestem Riverscour Wet Meadow Alliance
Colloquial Name: Edwards Plateau Riverscour Wet Meadow

Type Concept: This herbaceous alliance is found along streams in southern Texas. The herbaceous stratum varies in density from very open to dense. Herbs are rooted in cracks and in soil mats, and characteristic species are *Andropogon glomeratus var. pumilus, Cladium mariscus ssp. jamaicense, Fuirena simplex, Panicum virgatum*, and *Rhynchospora colorata (= Dichromena colorata)*. Other species may include *Arundo donax, Bothriochloa ischaemum var. songarica* (exotic), *Eleocharis geniculata (= Eleocharis caribaea), Eleocharis montevidensis, Eupatorium serotinum, Indigofera lindheimeriana, Polanisia dodecandra, Ratibida columnifera, Schizachyrium scoparium, Senna lindheimeriana*, and *Solidago altissima*. Woody shrubs and trees may occur as scattered individuals and may include *Baccharis neglecta, Baccharis salicifolia, Chilopsis linearis, Juglans microcarpa, Platanus occidentalis*, and *Salix nigra*. This community occurs on periodically scoured flat-bedded limestone shores of perennial streams.

Classification Comments: This alliance is based on a single association which is known only from Texas.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Periodically scoured herbaceous-dominated limestone streambeds in the Edwards Plateau and Stockton Plateau.

VEGETATION

Physiognomy and Structure: This alliance has an open to dense herbaceous layer composed of species up to 1.5 m. Shrubs and trees are absent or occur as scattered individuals.

Floristics: The characteristic species of the dominant herbaceous stratum are *Andropogon glomeratus var. pumilus, Cladium mariscus ssp. jamaicense, Fuirena simplex, Panicum virgatum*, and *Rhynchospora colorata (= Dichromena colorata)*. Other species may include Arundo donax, Bothriochloa ischaemum var. songarica (exotic), *Eleocharis geniculata (= Eleocharis caribaea), Eleocharis montevidensis, Eupatorium serotinum, Indigofera lindheimeriana, Polanisia dodecandra, Ratibida columnifera, Schizachyrium scoparium, Senna lindheimeriana*, and *Solidago altissima*. Woody shrubs and trees may occur as scattered individuals, and may include *Baccharis neglecta, Baccharis salicifolia, Chilopsis linearis, Juglans microcarpa, Platanus occidentalis*, and *Salix nigra*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs on periodically scoured flat-bedded limestone shores of perennial streams in southern Texas. Most patches are less than 1 ha.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is known from the Edwards Plateau and Stockton Plateau of Texas. It may extend into northern Mexico.

Nations: MX?, US
States/Provinces: MXCO?, TX
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL004928 *Panicum virgatum - Andropogon glomeratus - Cladium mariscus ssp. jamaicense* Wet Meadow

AUTHORSHIP

Primary Concept Source: A.S. Weakley, in Faber-Langendoen et al. (2014)
Author of Description: J. Drake
Acknowledgments: We have incorporated significant descriptive information previously compiled by A. Weakley.
Version Date: 2014/12/18

REFERENCES

References: Faber-Langendoen et al. 2017b

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2. Shrub & Herb Vegetation
2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
G568. Great Plains Riverscour Vegetation

A3591. Sporobolus cryptandrus - Artemisia campestris Wet Meadow Alliance

Type Concept Sentence: This riverine gravel flats alliance is found in the central Great Plains of the United States where gravel bars and terraces of rivers have a short, sparse herbaceous stratum of annual grasses and forbs.

OVERVIEW

Scientific Name: *Sporobolus cryptandrus - Artemisia campestris* Wet Meadow Alliance
Common Name (Translated Scientific Name): Sand Dropseed - Field Sagewort Wet Meadow Alliance
Colloquial Name: Great Plains Riverine Gravel Flats

Type Concept: This riverine gravel flats alliance is found in the central Great Plains of the United States. Vegetation is sparse and often consists of nearly equal cover of annual grasses, perennial grasses, and annual or biennial forbs under 1 m tall. *Sporobolus cryptandrus* and *Artemisia campestris ssp. caudata* are conspicuous. In some sites, *Populus deltoides* may be scattered to woodland-like in structure. Shrubs are also scattered and uncommon, with *Amorpha fruticosa* the most frequent. Other herbaceous species that can occur include *Ambrosia artemisiifolia, Chamaesyce glyptosperma, Chamaesyce serpyllifolia, Froelichia gracilis, Helianthus petiolaris, Opuntia macrorhiza*, and *Triplasis purpurea*. Stands occur along major rivers where gravel has been deposited on the first terraces of rivers. The substrate consists of a mixture of gravel and some sand, and soils are poorly developed or absent. Sites can occasionally be flooded in spring.

Classification Comments: The description of this alliance is based on the Nebraska state type. Rangewide review of the alliance is needed.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Gravel flats formed by flooding and scouring in Great Plains rivers. Vegetation cover is usually low and dominated by herbaceous species. Abundant species vary but *Sporobolus cryptandrus* and *Artemisia campestris* are among the most common.

VEGETATION

Physiognomy and Structure: This alliance is typified by low to moderate cover of annual and perennial grasses and annual forbs. Most species are <1 m tall. Shrubs are uncommon.

Floristics: *Sporobolus cryptandrus* and *Artemisia campestris ssp. caudata* are conspicuous. In some sites, *Populus deltoides* may be scattered to woodland-like in structure. Shrubs are also scattered and uncommon, with *Amorpha fruticosa* the most frequent. Other herbaceous species that can occur include *Ambrosia artemisiifolia, Chamaesyce glyptosperma, Chamaesyce serpyllifolia, Froelichia gracilis, Helianthus petiolaris, Opuntia macrorhiza*, and *Triplasis purpurea*.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands occur along major rivers where gravel has been deposited on the first terraces of rivers. The substrate consists of a mixture of gravel and some sand, and soils are poorly developed or absent. Sites can occasionally be flooded in spring.

Dynamics: Periodic flooding followed by longer stretches of dry conditions maintain this alliance.

DISTRIBUTION

Geographic Range: This alliance is described from Nebraska but very likely occurs throughout the central Great Plains.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL005223 Great Plains Riverine Gravel Flats Sparse Vegetation

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Faber-Langendoen et al. 2017b

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2. Shrub & Herb Vegetation
2.C.4.Nd. Eastern North American Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
2.C.4.Nd.5.e. M071 Great Plains Marsh, Wet Meadow, Shrubland & Playa

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

Scientific Name: *Pascopyrum smithii - Panicum obtusum - Bouteloua dactyloides* Playa & Rainwater Basin Wetland Group
Common Name (Translated Scientific Name): Western Wheatgrass - Vine-mesquite - Buffalograss Playa & Rainwater Basin Wetland Group
Colloquial Name: Vine-mesquite Wet Meadow

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.

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:

- G336 Great Plains Wet Prairie, Wet Meadow & Seepage Fen

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.

VEGETATION

Physiognomy and Structure: 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.

Floristics: 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*.

ENVIRONMENT & DYNAMICS

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.

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.

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.

Spatial Scale & Pattern [optional]: Small patch
Nations: MX?, US
States/Provinces: CO, KS, NE, NM, OK, TX
TNC Ecoregions [optional]: 24:C, 26:C, 27:C, 28:C, 29:C, 32:P, 33:C
USFS Ecoregions (2007): 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:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Alliances:
- A1348 *Polygonum* spp. - *Echinochloa* spp. - *Distichlis spicata* Wet Meadow Alliance
- A1238 *Panicum obtusum* Wet Meadow Alliance
- A3597 *Pascopyrum smithii* Wet Meadow Alliance

AUTHORSHIP

Primary Concept Source: S. Menard and K. Kindscher, in Faber-Langendoen et al. (2011)
Author of Description: S. Menard, K. Kindscher, J. Drake
Acknowledgments:
Version Date: 05/08/2015
Classif Resp Region: Midwest
Internal Author: SEM 10-10, mod. JD 5-13, 5-15

REFERENCES

References: Faber-Langendoen et al. 2017a, Haukos and Smith 1993

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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

A1238. Panicum obtusum Wet Meadow Alliance

Type Concept Sentence: This alliance is found in the southern Great Plains and northern Chihuahuan Desert on heavy, mesic soils in depressions, along streams, and in playa basins with abundant *Panicum obtusum*.

OVERVIEW

Scientific Name: *Panicum obtusum* Wet Meadow Alliance
Common Name (Translated Scientific Name): Vine-mesquite Wet Meadow Alliance
Colloquial Name: Vine-mesquite Wet Meadow

Type Concept: This alliance is found in the southern Great Plains and northern Chihuahuan Desert on mesic sites. Mid grasses are characteristic and typically dominate though short grasses can be abundant on some sites. Vegetation cover is typically moderate but is often more dense than surrounding drier vegetation. *Panicum obtusum* is consistently abundant or dominant. *Bouteloua dactyloides (= Buchloe dactyloides), Helianthus ciliaris, Panicum hirsutum*, and *Pascopyrum smithii* are common to abundant. *Panicum hallii* can be common, particularly on degraded sites. It occurs on heavy, mesic soils in depressions, along streams, and in playa basins.

Classification Comments: There is limited information for the three associations making up this alliance. Further review of the associations and the alliance is warranted. Due to the limited information for the component associations, it is difficult to determine if this alliance really fits in Great Plains Playa & Rainwater Basin Wetland Group (G136) or if it is better placed in a mesic grassland (riparian?) group.

Some stands described by Bourgeron et al. (1993b) have only 1-3% *Panicum obtusum*. A more appropriate alliance classification may be a *Panicum obtusum - Panicum hallii - Panicum hirsutum* Herbaceous Alliance.

Internal Comments:
Other Comments:

Similar NVC Types:

- A3597 *Pascopyrum smithii* Wet Meadow Alliance: is also found in playas on the southern Great Plains and can share some common species, but it seems to be in sites that receive more flooding than A1238.

Diagnostic Characteristics: This alliance is characterized by abundant *Panicum obtusum* in playa, riparian, or basin settings.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a moderately dense graminoid layer dominated by medium-tall perennial bunch grasses. Short grasses and forbs may codominate. Scattered cacti may be present.

Floristics: Stands in this alliance have a sparse to moderately dense graminoid layer (20-50% cover) of medium-tall perennial bunchgrasses and are usually dominated by *Panicum obtusum, Panicum hallii*, or *Panicum hirsutum*. The shortgrass *Bouteloua dactyloides (= Buchloe dactyloides)* and the perennial forb *Helianthus ciliaris* may codominate some stands. Characteristic graminoids include *Bouteloua gracilis, Bouteloua curtipendula, Cyperus* spp., *Eragrostis intermedia, Scleropogon brevifolius*, and the annual *Aristida adscensionis*. The usually sparse forb layer may reach 20% cover. Common forbs include *Grindelia squarrosa, Hoffmannseggia glauca, Proboscidea* spp., *Solanum* spp., *Sphaerophysa salsula*, and *Zinnia grandiflora*. Scattered *Opuntia phaeacantha* are present in some stands.

ENVIRONMENT & DYNAMICS

Environmental Description: Grasslands included in this alliance occur in swales and playas in the southern Great Plains and the Chihuahuan Desert. Elevations range from 1300-1600 m. Climate is arid to semi-arid with hot summers. Freezing temperatures may occur during winter. Mean annual precipitation decreases from Oklahoma to southwestern New Mexico. It is approximately 22 cm at the Jornada Experimental Range, but is highly variable with drought not uncommon. Annual precipitation is distributed bimodally with about one-third occurring in late winter and two-thirds in July through October, often as high-intensity convective storms. These grasslands commonly occur in swales and playas, and along drainages that dissect the plains, piedmonts, and mesas. Sites are nearly level to gently sloping and receive excess runoff from the surrounding landscape. Soils are deep, silty clays, often gravelly. Soils are derived from gravelly or silty alluvium. Ground cover is relatively low. Bourgeron et al. (1993b) described stands where mean cover of bare soil, rock, litter, and basal vegetation ranged from 60-90%, 0-30%, 0-1% and 10-30%, respectively. Stands are surrounded by a matrix of desert shrublands, *Quercus* savannas, and upland grasslands.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is found in the southern Great Plains and northern Chihuahuan Desert. It may occur as far south as southeastern Arizona and in Mexico in northern Chihuahua and Coahuila.

Nations: MX?, US
States/Provinces: AZ?, CO, MXCH?, MXCO?, NM, OK, TX
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Panicum obtusum* herbaceous alliance (Hoagland 1998a)

LOWER LEVEL UNITS

Associations:
- CEGL001573 *Panicum obtusum - Bouteloua dactyloides* Wet Meadow
- CEGL001574 *Panicum obtusum - Helianthus ciliaris* Wet Meadow
- CEGL001575 *Panicum obtusum - Panicum hallii* Wet Meadow

AUTHORSHIP

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

REFERENCES

References: Bourgeron et al. 1993b, Bourgeron et al. 1995a, Faber-Langendoen et al. 2017b, Hoagland 1998a

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

A3597. Pascopyrum smithii Wet Meadow Alliance

Type Concept Sentence: This herbaceous alliance is found in the southern Great Plains from Nebraska to Oklahoma and northern Texas in depressions or along streams and *Pascopyrum smithii* is dominant.

OVERVIEW

Scientific Name: *Pascopyrum smithii* Wet Meadow Alliance
Common Name (Translated Scientific Name): Western Wheatgrass Wet Meadow Alliance
Colloquial Name: Western Wheatgrass Wet Meadow

Type Concept: This herbaceous alliance is found in the southern Great Plains from Nebraska to Oklahoma and northern Texas. Overall, grasses, and especially mid grasses, dominate stands of this alliance. Forbs can be abundant or even dominant in some stands, and short grasses become more abundant under grazing pressure. *Pascopyrum smithii* is the typical dominant species and can be strongly dominant, sometimes with *Panicum virgatum* as a codominant. Associated species vary with amount of flooding and grazing. *Agrostis hyemalis, Eleocharis macrostachya, Eleocharis palustris, Elymus virginicus*, and *Hordeum jubatum* are often present. *Bouteloua dactyloides (= Buchloe dactyloides)* can be common on grazed sites. Stands occur in depressions or along streams. These sites retain water from snowmelt and rains and may flood for short periods but dry out for most of the growing season, and this type may overlap with moist mixedgrass prairie types.

Classification Comments: The dominant species *Pascopyrum smithii* can be abundant in upland or other intermittently flooded alliances as well as this alliance. Differential species need to be better documented, though the environmental setting (ephemeral wetlands) is a good diagnostic feature. This alliance may not fit the group concept as well as others. Possibly these are southern Great Plains mixedgrass prairie associations.

Internal Comments: DFL 4-14: ND, SD, SK?, WY and Canada? removed.
Other Comments:

Similar NVC Types:
- A3592 *Acer rubrum - Gleditsia aquatica - Fraxinus profunda* Swamp Forest Alliance: is found on floodplains and depressions. It is poorly documented so characteristic species beyond the nominals are not known.
- A3492 *Panicum virgatum - Pascopyrum smithii* Wet Meadow Alliance
- A1238 *Panicum obtusum* Wet Meadow Alliance: is also found in playas in the southern Great Plains and can share some common species but seems to be flooded less often than A3597.
- A1354 *Pascopyrum smithii - Distichlis spicata - Hordeum jubatum* Wet Meadow Alliance: is found in more saline wetlands.

Diagnostic Characteristics: This alliance is characterized by stands dominated by *Pascopyrum smithii* over a claypan. Sites are usually flooded for some time in the spring but dry out for most of the growing season.

VEGETATION

Physiognomy and Structure: This is an herbaceous alliance, with most stands dominated by mid grasses. Stands that have more grazing pressure or are drier than average tend to have higher amounts of short grasses. Stands in the southern part of this alliance's range that have longer than normal flooding can have abundant annual forbs occur on bare patches. The vegetation ranges in height and density with available moisture; sites that have consistent moisture availability have denser and taller vegetation, up to approximately 1 m tall.

Floristics: *Pascopyrum smithii* is the typical dominant species and can be strongly dominant, sometimes with *Panicum virgatum* as a codominant. Associated species vary with amount of flooding and grazing. *Agrostis hyemalis, Eleocharis macrostachya, Eleocharis palustris, Elymus virginicus*, and *Hordeum jubatum* are often present. *Bouteloua dactyloides (= Buchloe dactyloides)* can be common on grazed sites. Early-season ephemeral annuals such as *Alopecurus carolinianus, Elatine rubella, Myosurus minimus*, and *Veronica peregrina* are ubiquitous, and *Limosella aquatica* and *Plagiobothrys scouleri* may be common. Perennial forbs are conspicuous in some places, including *Ambrosia* spp., *Oenothera canescens, Phyla cuneifolia (= Lippia cuneifolia)*, and *Vernonia fasciculata*. Stands of this alliance often occur at the margin of playa and pond marsh communities and grade into upland tallgrass and mixedgrass prairie. The extent and species composition of stands vary with water levels from year to year. Species diversity is low to moderate.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands occur in depressions or along streams. These sites retain water from snowmelt and rains and may flood for short periods but dry out for most of the growing season. Surface soils are fine-textured loam, silt, or clay and are

typically formed from loess or alluvium. A subsurface layer of impermeable soil prevents water from infiltrating quickly. After snowmelt or heavy rains, stands retain much of the water in the upper soils for some time and may flood or become saturated. Stands in this alliance are not flooded for extended portions of the growing season, though they may go through more than one cycle of becoming wet and dry in a single year.

Dynamics: Stands in this alliance are found in low parts of the local landscape and receive runoff from surrounding areas. This creates more mesic conditions on these stands than is typical of surrounding uplands. This alliance does not flood for extended parts of the growing season, though nearby, deeper parts of a depression may contain wetland vegetation.

DISTRIBUTION

Geographic Range: This alliance is found in the Great Plains from Nebraska to northern Texas and Oklahoma.

Nations: US
States/Provinces: KS, NE, OK, TX
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** *Elytrigia smithii* Series (Johnston 1987)
- **?** *Pascopyrum smithii* herbaceous alliance (Hoagland 1998a)

LOWER LEVEL UNITS

Associations:
- CEGL005019 *Panicum virgatum - Pascopyrum smithii* Southern Wet Meadow
- CEGL002038 *Pascopyrum smithii - Bouteloua dactyloides - (Phyla cuneifolia, Oenothera canescens)* Wet Meadow

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: S. Menard and D. Faber-Langendoen
Acknowledgments:
Version Date: 2014/04/28

REFERENCES

References: Faber-Langendoen et al. 2017b, Hoagland 1998a, Johnston 1987, Weaver and Albertson 1956

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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

A1348. Polygonum spp. - Echinochloa spp. - Distichlis spicata Wet Meadow Alliance

Type Concept Sentence: This wetland community is found in the central Great Plains of the United States where it occurs in shallow depressions with annual herbaceous graminoids and forbs, mostly <1 m tall, dominating the exposed mudflats.

OVERVIEW

Scientific Name: *Polygonum* spp. - *Echinochloa* spp. - *Distichlis spicata* Wet Meadow Alliance
Common Name (Translated Scientific Name): Knotweed species - Cockspur Grass species - Saltgrass Wet Meadow Alliance
Colloquial Name: Knotweed - Cockspur Grass - Saltgrass Wet Meadow

Type Concept: This wetland community is found in the central Great Plains of the United States. Annual herbaceous graminoids and forbs, mostly <1 m tall, dominate the exposed mudflats, and species composition and extent of the community fluctuate from site to site and year to year. In Nebraska, graminoids include *Cyperus acuminatus, Eleocharis engelmannii*, and *Echinochloa muricata*, and forbs include *Bacopa rotundifolia, Coreopsis tinctoria, Elatine rubella, Heteranthera limosa, Limosella aquatica, Lindernia dubia, Mollugo verticillata, Polygonum pensylvanicum (= Polygonum bicorne), Polygonum lapathifolium, Rumex stenophyllus*, and *Sagittaria calycina*. In Kansas, graminoids include *Hordeum jubatum*, and forbs include *Ambrosia grayi, Symphyotrichum subulatum (= Aster subulatus)*, and *Chenopodium berlandieri*. The frequent water fluctuations and thick claypan prevent establishment of most perennial hydrophytes, such as *Schoenoplectus* spp. (= *Scirpus* spp.) and *Typha* spp. It occurs in shallow depressions on gently sloping

topography. Soils are deep to moderately deep loams or clay loams underlain by a dense clay sublayer. Sites flood for some part of the growing season but do not stay flooded for long periods.

Classification Comments: This alliance currently has only one association. There is a related association, *Polygonum pensylvanicum - Polygonum lapathifolium* Marsh (CEGL002277), in a different alliance that might merit merging into a single alliance. The hydroperiod and some associated species are different so they are placed in separate alliances for now. Rolfsmeier and Steinauer (2010) note that stands in northwestern Nebraska may or may not belong to this type because they are associated with artificial impoundments. The global name for this type is weak, and better characteristic species are needed to name it. It is unclear whether stands from Nebraska, Kansas, and Oklahoma really fit into the same type.

Internal Comments:
Other Comments:

Similar NVC Types:
- A3490 *Polygonum pensylvanicum - Polygonum lapathifolium* Marsh Alliance
- A3489 *Eleocharis palustris* Great Plains Marsh Alliance

Diagnostic Characteristics: This alliance is found on fine soils over claypans where flooding occurs for part of the growing season but sites dry out enough to prevent most wetland vegetation from growing. Dominant species vary with time of year and amount of flooding but typically include *Distichlis spicata, Echinochloa muricata, Polygonum lapathifolium*, and *Polygonum pensylvanicum*.

VEGETATION

Physiognomy and Structure: This alliance is characterized by annual graminoids and forbs less than 1 m tall. Vegetation cover is variable. Recently exposed sites tend to have little vegetation and the cover expands as the annual plants germinate.

Floristics: Annual herbaceous graminoids and forbs mostly less than 1 m tall dominate the exposed mudflats of this alliance. Species composition and extent of stands vary from year to year. *Coreopsis tinctoria, Echinochloa* spp., *Eleocharis engelmannii, Lindernia dubia, Polygonum* spp., and *Rumex stenophyllus* are typical species of this alliance. In sites which have been modified to hold water longer, i.e., drainage ditches and re-use pits, perennials such as *Eleocharis palustris* and *Marsilea vestita* may dominate. The frequent water fluctuations and thick claypan prevent establishment of most perennial hydrophytes typical of pond marshes.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands of this alliance occur in shallow depressions in nearly level ground. Soils are silty clay loam underlain by a claypan. These areas are temporarily or sometimes seasonally flooded by ponded rainwater and surface runoff. Sites dry out by mid to late summer in all but the wettest years.

Dynamics: The cycle of flooding and drying is important in maintaining stands of this alliance. The widely varying hydrologic conditions prevent perennial species from becoming abundant.

DISTRIBUTION

Geographic Range: This alliance is found in the central Great Plains in Nebraska and Kansas and possibly Oklahoma.

Nations: US
States/Provinces: KS, NE, OK?
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL002039 *Polygonum* spp. - *Echinochloa* spp. - *Distichlis spicata* Playa Lake Wet Meadow

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:

Version Date: 2014/01/08

REFERENCES

References: Faber-Langendoen et al. 2017b, Rolfsmeier and Steinauer 2010

2.C.5. Salt Marsh

Salt Marsh is a wetland that has shallow water and levels that usually fluctuate due primarily to tides along the coast or changes in water depth in depressions. Coastal salt marshes are primarily intertidal; that is, they are found in areas at least occasionally inundated by high tide but not flooded during low tide, including estuaries, lagoons, and the lee side of barrier islands. The vegetation comprises emergent shrubs and herbs with at least 10% cover, especially saline or halophytic species. They occur at all latitudes around the globe, but are concentrated in the temperate mid-latitudes (23-70°N and S).

2.C.5.Na. North American Great Plains Saline Marsh

Brackish marsh and saline wet meadows found along shallow lakes and basins and surrounding areas across the Great Plains of North America.

M077. Great Plains Saline Wet Meadow & Marsh

This macrogroup consists of graminoid-dominated saline shallow depressions and mudflats dominated by *Distichlis spicata, Hordeum jubatum, Pascopyrum smithii*, or *Salicornia rubra*, as well as other flood- and saline-tolerant species. It occurs throughout the Great Plains from southern Canada to the panhandle of Texas and west into the plains of Montana, Wyoming and Colorado.

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2. Shrub & Herb Vegetation
2.C.5.Na. North American Great Plains Saline Marsh
2.C.5.Na.1.a. M077 Great Plains Saline Wet Meadow & Marsh

G324. Great Plains Saline Wet Meadow & Marsh

Type Concept Sentence: This group occurs in much of the Great Plains where herbaceous saline wetlands form. Typical dominant or common species are *Distichlis spicata* or *Hordeum jubatum*, along with *Eleocharis* spp., *Poa arida, Puccinellia nuttalliana, Bolboschoenus maritimus, Schoenoplectus pungens, Sporobolus airoides*, and *Suaeda calceoliformis*.

OVERVIEW

Scientific Name: *Distichlis spicata - Hordeum jubatum - Pascopyrum smithii* Great Plains Saline Wet Meadow & Marsh Group
Common Name (Translated Scientific Name): Saltgrass - Foxtail Barley - Western Wheatgrass Great Plains Saline Wet Meadow & Marsh Group
Colloquial Name: Great Plains Saltgrass Saline Wet Meadow

Type Concept: This group occurs in shallow-sloped basins in the Great Plains that experience seasonal flooding. Stands are dominated by short to medium-tall herbaceous species tolerant of flooding and salinity. The most abundant species at a site typically include *Distichlis spicata* or *Hordeum jubatum*. Other common associates or dominants are *Atriplex patula, Eleocharis* spp., *Poa arida, Puccinellia nuttalliana, Bolboschoenus maritimus (= Schoenoplectus maritimus), Schoenoplectus pungens, Sporobolus airoides, Suaeda calceoliformis*, and *Iva annua*. Where flooding is less frequent and where salinity is not high, *Pascopyrum smithii* is often present to dominant. Strongly saline mudflats usually have a high proportion of *Salicornia rubra*. Soils are saline and create brackish water.

Classification Comments:

Similar NVC Types:
- G336 Great Plains Wet Prairie, Wet Meadow & Seepage Fen: is similar but less saline.
- G538 North American Desert Alkaline-Saline Marsh & Playa

Diagnostic Characteristics: Sites in this group are intermittently to seasonally flooded, dominated by short to medium-tall graminoids, and have saline soils.

VEGETATION

Physiognomy and Structure: Examples of this group are dominated by short to medium-tall herbaceous species, usually graminoids. Tall woody species are rare, but short shrubs are sometimes present but with less than 10% cover. Total vegetation cover can vary from relatively sparse (often where soils are most saline and/or where variation in available moisture is greatest) to dense.

Floristics: This group is dominated by herbaceous, usually graminoid, species. Salinity and moisture levels have a great affect on the species that grow at individual sites or where they grow within individual sites. The most abundant species at a site typically include *Distichlis spicata* or *Hordeum jubatum*. Other common associates or dominants are *Atriplex patula, Eleocharis* spp., *Poa arida, Puccinellia nuttalliana, Bolboschoenus maritimus (= Schoenoplectus maritimus), Schoenoplectus pungens, Sporobolus airoides, Suaeda calceoliformis*, and *Iva annua*. Where flooding is less frequent and where salinity is not high, *Pascopyrum smithii* is often present to dominant. Strongly saline mudflats usually have a high proportion of *Salicornia rubra*.

ENVIRONMENT & DYNAMICS

Environmental Description: This group occurs in shallow-sloped basins that experience seasonal flooding. Sites may dry out by the end of the growing season. Soils are saline and create brackish water. Salt brought to the surface by water that later evaporates may form crusts. This group is found in basins and low parts of floodplains where water collects. The soils and water are moderately to strongly saline (>0.5-1%) (Ungar 1967, 1970). The salts are leached from saline soils in the watershed or, rarely, come from saline groundwater discharge. Salts accumulate as the water in which they were dissolved evaporates. Salt crusts are present on the soil surface of some stands. Soils are fine-grained, typically with a silt or clay component, and poorly drained. The wettest examples are flooded through most or all of the growing season and can support aquatic species. Other aspects can be flooded or saturated for short periods (Dodd and Coupland 1966, Stewart and Kantrud 1971).

Dynamics: Variations in water and salinity levels have a strong impact on this group. Plants that are abundant are tolerant of at least moderate salinity and periodic flooding. Unusually wet periods or high spring snowmelt may flush some salt away, shifting the boundaries temporarily until more salt accumulates. Salinity varies during the growing season, decreasing in the spring or after heavy rains and increasing during dry periods. The increased salinity due to concentration of the salt as the water evaporates - common in the late summer and early fall - creates a seasonally shifting environment. Species composition is strongly linked to salinity and soil moisture so there is usually notable zonation within this group with the species tolerant of the wettest and most saline conditions in the center, grading towards midgrass prairie at the edges (Ungar 1967, 1970). Fire may spread into this system from adjacent upland prairies and can burn areas with higher vegetation cover but the low vegetation cover and wet soils typical of many stands do not carry fire well.

DISTRIBUTION

Geographic Range: This group occurs throughout the Great Plains from southern Canada to the panhandle of Texas. The group extends to the mixedgrass and shortgrass prairies of central Montana, eastern Wyoming, and eastern Colorado. The eastern limit of the main part of this group is in western Minnesota, eastern Nebraska, northwestern Missouri, and eastern Kansas. There are rare saline marshes in the southern and eastern Great Lakes area that are included in this group.

Spatial Scale & Pattern [optional]:
Nations: CA, MX?, US
States/Provinces: CO, IL, KS, MB?, MI, MN, MO, MT, ND, NE, OK, ON, QC, SD, SK, TX, WY
TNC Ecoregions [optional]: 25:P, 26:C, 27:C, 28:?, 32:?, 33:C, 34:C, 35:C, 36:P, 37:?, 66:C, 67:C
USFS Ecoregions (2007): 251A:C?, 251B:CC, 251C:CP, 251F:CP, 331B:CC, 331C:CC, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 331H:CP, 331I:CP, 332A:CC, 332B:CC, 332C:CC, 332D:CC, 332E:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Alliances:
- A1341 *Distichlis spicata - Hordeum jubatum* Wet Meadow Alliance
- A4071 *Salicornia rubra* Wet Meadow Alliance
- A1354 *Pascopyrum smithii - Distichlis spicata - Hordeum jubatum* Wet Meadow Alliance
- A4069 *Schoenoplectus pungens* Great Plains Marsh Alliance

AUTHORSHIP

Primary Concept Source: S. Menard and K. Kindscher, in Faber-Langendoen et al. (2011)

Author of Description: J. Drake
Acknowledgments:
Version Date: 05/08/2015
Classif Resp Region: Midwest
Internal Author: JD 12-10, 9-13, 5-15

REFERENCES

References: Dodd and Coupland 1966, Faber-Langendoen et al. 2017a, Stewart and Kantrud 1971, Ungar 1967, Ungar 1970

2. Shrub & Herb Vegetation
2.C.5.Na. North American Great Plains Saline Marsh
G324. Great Plains Saline Wet Meadow & 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

Scientific Name: Western Great Plains Saline Wet Meadow Group
Common Name (Translated Scientific Name): Western Great Plains Saline Wet Meadow Group
Colloquial Name: Great Plains Greasewood Wet Shrubland

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.

Classification Comments: Recently split from a wider ranging group, this group is limited to the Great Plains.

Similar NVC Types:
- G537 North American Desert Alkaline-Saline Wet Scrub

Diagnostic Characteristics: Moderately saline stands dominated by *Sporobolus airoides, Sarcobatus vermiculatus*, and/or *Puccinellia nuttalliana*.

VEGETATION

Physiognomy and Structure: Perennial grassland <1 m in height, shrubs and dwarf shrubs often present with generally <25% cover.

Floristics: 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., *Symphyotrichum ericoides (= Aster ericoides)*, and *Salicornia rubra* (on more saline inclusions).

ENVIRONMENT & DYNAMICS

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.

Dynamics: Periodic subsurface irrigation is needed to maintain this group.

DISTRIBUTION

Geographic Range: This group is found in the Great Plains, generally western portions, but ranges from north to south throughout.

Spatial Scale & Pattern [optional]:
Nations: CA, US
States/Provinces: MT, ND, SD, SK?, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Alliances:
- A3904 *Sporobolus airoides* Great Plains Marsh Alliance
- A3905 *Sarcobatus vermiculatus* Great Plains Wet Shrubland Alliance

AUTHORSHIP

Primary Concept Source: Faber-Langendoen et al.
Author of Description: G. Kittel
Acknowledgments:
Version Date: 12/03/2015
Classif Resp Region: West
Internal Author: GK 5-15, 12-15, mod. DFL 12-15

REFERENCES

References: Faber-Langendoen et al. 2017a

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2. Shrub & Herb Vegetation
2.C.5.Na. North American Great Plains Saline Marsh
G534. Western Great Plains Saline Wet Meadow

A3905. Sarcobatus vermiculatus Great Plains Wet Shrubland Alliance

Type Concept Sentence: This alliance has high herbaceous cover and widely spaced shrubs, hence the name "scrub herbaceous." The dominant herbaceous species include *Distichlis spicata, Grindelia squarrosa, Hordeum jubatum, Pascopyrum smithii, Plantago* spp., Puccinellia nuttalliana, Salicornia rubra, and/or *Symphyotrichum ericoides*. The very open and widely spaced shrub layer is dominated by *Artemisia frigida, Artemisia tridentata*, and/or *Sarcobatus vermiculatus*. Total vegetation cover can be low to moderate and abundant bare soil can be common. Soils are often alkaline. This alliance occurs in the northern and western Great Plains and Rocky Mountain foothills.

OVERVIEW

Scientific Name: *Sarcobatus vermiculatus* Great Plains Wet Shrubland Alliance
Common Name (Translated Scientific Name): Greasewood Great Plains Wet Shrubland Alliance
Colloquial Name: Great Plains Greasewood Wet Shrubland

Type Concept: This alliance covers widely scattered shrubs with a high graminoid layer, hence the name "scrub herbaceous." The shrub layer is dominated by *Sarcobatus vermiculatus*, with *Atriplex confertifolia, Artemisia tridentata*, and *Chrysothamnus viscidiflorus* in smaller amounts. *Symphoricarpos occidentalis* and *Rhus aromatica* are sometimes found in more mesic microhabitats within this community. Herbaceous cover is sparse beneath the shrubs and moderate to dense in between. The herbaceous layer typically has *Distichlis spicata* and *Puccinellia nuttalliana* that may be dominant, accompanied by *Grindelia squarrosa, Hordeum jubatum, Pascopyrum smithii, Plantago* spp., *Salicornia rubra* (on more saline inclusions), and *Symphyotrichum ericoides (= Aster ericoides)*. This alliance occurs in the northern and western Great Plains and Rocky Mountain foothills. It is found on terraces, floodplains, swales and other low sites where drainage is poor. The soils are moderately to strongly saline, fine-textured, and moderately deep to deep. Although periodic flooding is rare, stands of this alliance receive more water than the surrounding uplands through runoff. Stands in this alliance are found on flat to gently sloping alluvial fans, terraces, lakebeds, and floodplains.

Classification Comments: Shrub cover may be low (10-25% canopy cover), but consistently scattered throughout stand.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Saline areas with scattered *Sarcobatus vermiculatus* shrubs with a dense herbaceous ground cover.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a sparse to moderate layer of microphyllous, deciduous xeromorphic shrubs 0.5-2 m tall. The herbaceous layer is sparse to moderately dense and dominated by tall and medium-tall bunchgrasses or rhizomatous short grasses. Scattered cacti and trees may be present. Perennial forbs are sparse. Annual grasses and forbs may be seasonally present.

Floristics: This alliance is characterized by the presence of an open scattered shrub layer with an herbaceous layer. The shrub layer is dominated by *Atriplex confertifolia, Artemisia frigida, Artemisia tridentata, Chrysothamnus viscidiflorus*, and/or *Sarcobatus vermiculatus* that form a canopy that rarely exceeds 25%. *Symphoricarpos occidentalis* and *Rhus aromatica* are sometimes found in mesic microhabitats. The herbaceous layer has high cover, especially in the open areas, and is dominated by *Bouteloua gracilis, Distichlis spicata, Grindelia squarrosa, Hesperostipa comata (= Stipa comata), Hordeum jubatum, Pascopyrum smithii, Plantago* spp., *Puccinellia nuttalliana, Salicornia rubra* (on more saline inclusions), and/or *Symphyotrichum ericoides (= Aster ericoides)*. Few forbs are found in this community. *Achillea millefolium* and *Opuntia polyacantha* are the only species with high constancy. Overall species diversity in this community is low (Hansen and Hoffman 1988). Non-native species can be abundant, such as *Bromus arvensis (= Bromus japonicus)* and *Bromus tectorum*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance is found on flat to gently sloping alluvial fans, terraces, floodplains, lakebeds, swales and other low sites where drainage is poor (Mueggler and Stewart 1980, Hansen and Hoffman 1988). Although periodic flooding is rare, stands of this alliance receive more water than the surrounding uplands through runoff. Sites are intermittently flooded with a shallow or perched water table often within 1 m depth (Hansen et al. 1995). The soils are moderately to strongly alkaline/saline, fine-textured, and moderately deep to deep (USFS 1992). Substrates are generally shallow, fine-textured soils (clays to silt loams), derived from alluvium, although coarse soils are possible (Hirsch 1985, USFS 1992, Jones and Walford 1995, Thilenius et al. 1995). Elevations range from 655-2400 m.

Dynamics: *Sarcobatus vermiculatus*, like many facultative halophytes, is tolerant of alkaline and saline soil conditions that allow it to occur in sites with less interspecific competition (Ungar et al. 1969, Branson et al. 1976). *Sarcobatus vermiculatus* is often found on sites with high water tables that are intermittently flooded. Hansen et al. (1995) reported that it can tolerate saturated soil conditions for up to 40 days. *Sarcobatus vermiculatus* is not ordinarily browsed, but Daubenmire (1970) found that under heavy stocking rates the shrubs will develop a compact canopy. Hansen et al. (1995) also reported browsing damage with heavy spring and summer grazing, but noted that *Sarcobatus vermiculatus* is moderately poisonous to livestock, especially in the fall, and supplemental feed is recommended to avoid livestock loss. Hanson (1929) states that *Sarcobatus vermiculatus* can form an important part of winter forage for sheep. Fire will topkill *Sarcobatus vermiculatus*, but the shrub will promptly resprout from the root crown (Daubenmire 1970).

DISTRIBUTION

Geographic Range: This alliance occurs in the northern and western Great Plains and Rocky Mountain foothills.

Nations: CA?, US
States/Provinces: MT, ND, NE, SD, SK?, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Puccinellia nuttalliana / Distichlis spicata* Habitat Type (USFS 1992) [western North Dakota.]
- **?** *Sarcobatus vermiculatus / Pascopyrum smithii* Shrub Herbaceous Vegetation (Brown 1971)
- **?** *Sarcobatus vermiculatus / Pseudoroegneria spicata* Shrub Herbaceous Vegetation (Hansen and Hoffman 1988)

- **?** *Sarcobatus vermiculatus / Pseudoroegneria spicata* Shrub Herbaceous Vegetation (USFS 1992)
- **><** *Sarcobatus vermiculatus/Agropyron spicatum* habitat type (Hansen et al. 1988a)
- **><** *Sarcobatus vermiculatus* Series (Johnston 1987)
- **><** Black Greasewood (*Sarcobatus vermiculatus*) Dominance Type (Jones and Walford 1995)

LOWER LEVEL UNITS

Associations:

- CEGL001508 *Sarcobatus vermiculatus / Pascopyrum smithii - (Elymus lanceolatus)* Shrub Wet Meadow
- CEGL002146 *Sarcobatus vermiculatus / Distichlis spicata - (Puccinellia nuttalliana)* Shrub Wet Meadow

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Branson et al. 1976, Brown 1971, Daubenmire 1970, Dodd and Coupland 1966, Faber-Langendoen et al. 2017b, Fisser et al. 1965, Hamner 1964, Hansen and Hoffman 1988, Hansen et al. 1988a, Hansen et al. 1995, Hanson 1929, Hirsch 1985, Johnston 1987, Jones and Walford 1995, MTNHP 1988, Mueggler and Stewart 1980, Olson and Gerhart 1982, Thilenius et al. 1995, USFS 1992, Ungar et al. 1969, Walford 1996

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2. Shrub & Herb Vegetation
2.C.5.Na. North American Great Plains Saline Marsh
G534. Western Great Plains Saline Wet Meadow

A3904. Sporobolus airoides Great Plains Marsh Alliance

Type Concept Sentence: This alliance consists of *Sporobolus airoides*-dominated or -codominated grasslands. The vegetation is characterized by a sparse to moderately dense graminoid layer of medium-tall bunchgrasses with smaller densities of short grasses and forbs. Widely scattered (<10% cover) xeromorphic or halophytic shrubs and dwarf-shrubs may also be present. This grassland alliance occurs in the western and southern Great Plains. Stands occur in a wide variety of lowland sites, such as stream terraces, swales, interdune basins, and alluvial flats.

OVERVIEW

Scientific Name: *Sporobolus airoides* Great Plains Marsh Alliance
Common Name (Translated Scientific Name): Alkali Sacaton Great Plains Marsh Alliance
Colloquial Name: Great Plains Alkali Sacaton Marsh

Type Concept: *Sporobolus airoides* is the dominant or codominant grass. Typical codominant grasses include *Muhlenbergia porteri, Panicum obtusum*, or *Scleropogon brevifolius*. Other common grasses are *Bouteloua dactyloides (= Buchloe dactyloides), Hordeum pusillum, Pascopyrum smithii*, and *Sporobolus cryptandrus*. Forbs and shrubs are typically sparse. Common forb associates are *Chaetopappa ericoides* and species of *Sphaeralcea, Machaeranthera, Ratibida, Helianthus*, and other Asteraceae spp. Scattered shrubs may include *Allenrolfea occidentalis, Atriplex canescens, Chrysothamnus* spp., *Gutierrezia sarothrae*, and *Sarcobatus vermiculatus*. This grassland alliance occurs in the western and southern Great Plains. Stands occur in a wide variety of lowland sites, such as stream terraces, swales, interdune basins, and alluvial flats. The soil often 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. Parent material is typically alluvium derived from limestone, shale, or sandstone.

Classification Comments: This alliance is being spilt and is now limited to the western and southern Great Plains. Occurrences across the southwestern United States from the Chihuahuan Desert into southern and western California, Colorado Plateau and throughout the Great Basin, and those likely to occur in the Mexican states of Coahuila, Chihuahua, Sonora, and Baja California belong to another alliance within North American Desert Alkaline-Saline Marsh & Playa Group (G538).

Internal Comments: GK 10-14: CEGL001685 should be moved from M082 to this group (M077. Great Plains Brackish Marsh & Saline Wet Meadow). What we split off is the western portion (aka Colorado Plateau and intermountain basins, California and Chihuahuan Desert occurrences, but not the southern GP occurrences (eastern CO, KS, OK, TX, eastern NM). Or rather I am suggesting that this association be split (currently lists AZ, CA?, CO, KS, MT, MXCO, NM, TX, UT, WY) hmmm first time I've heard of MT and WY as "southern." So AZ, CA, MXCO, UT belong in M082 and CO, KS, in the GP M077 (at least eastern CO).
Other Comments:

Similar NVC Types:
- A3186 *Sporobolus airoides - Sporobolus wrightii - Panicum obtusum* Lowland Desert Grassland Alliance

Diagnostic Characteristics: Moderately saline stands dominated by *Sporobolus airoides*.

VEGETATION

Physiognomy and Structure: Dense graminoid layer dominated by medium-tall bunchgrasses with smaller densities of short grasses and forbs. Widely scattered xeromorphic or halophytic shrubs may also be present.

Floristics: These are grasslands dominated by *Sporobolus airoides* in pure and mixed stands. Typical codominant grasses include *Muhlenbergia porteri, Panicum obtusum*, or *Scleropogon brevifolius*. Not included in this alliance are stands codominated by *Bouteloua gracilis, Distichlis spicata, Pleuraphis jamesii (= Hilaria jamesii)*, or *Hordeum jubatum*, although these species may be present in small amounts. Other common grasses are *Bouteloua dactyloides (= Buchloe dactyloides), Hordeum pusillum, Pascopyrum smithii*, and *Sporobolus cryptandrus*. Forbs and shrubs are typically sparse. Common forb associates are *Chaetopappa ericoides* and species of *Sphaeralcea, Machaeranthera, Ratibida, Helianthus*, and other Asteraceae spp. Species of *Salicornia* or *Suaeda* may be present in more saline habitats. The dwarf-shrub *Gutierrezia sarothrae* is common in many stands. Scattered shrubs may include *Allenrolfea occidentalis, Atriplex canescens, Atriplex confertifolia, Atriplex obovata, Chrysothamnus* spp., *Ericameria nauseosa*, and *Sarcobatus vermiculatus* typically with less than 10% total cover. Some stands have significant amounts of prickly-pear and cholla cacti (*Opuntia* spp.). Culver et al. (1996) described stands from southeastern Colorado with the following percent canopy cover: *Sporobolus airoides* (5-42%), *Pascopyrum smithii* (1-11%), *Bouteloua gracilis* (0-11%), *Distichlis spicata* (0-9%), *Hordeum pusillum* (0-5%), and *Symphyotrichum falcatum (= Aster falcatus)* (0-7%). In New Mexico, Francis (1986) reported a nearly pure stand of *Sporobolus airoides* with 14% cover and mixed stands with canopy cover of 7-30% for *Sporobolus airoides*, 2-4% for *Pascopyrum smithii*, and less than 2% each for *Bouteloua gracilis, Sporobolus cryptandrus*, and *Pleuraphis jamesii*.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands are reported from a variety of lowland sites, such as stream terraces, swales, toeslopes, interdune basins and alluvial flats. Elevations range from near sea level to 2100 m, but the alliance occurs primarily from 1000-1700 m. The soil often has a high water table because of land position or an impermeable subsurface horizon. Soils are non-saline to moderately saline and usually alkaline. Soil surface textures are sandy to clayey. The soil 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.

Dynamics: *Sporobolus airoides* will decrease in abundance with increased soil salinity. If a moderate salinity level is maintained, this grass forms hummocks that accumulate sand and gradually lose salinity and moisture. This creates a microhabitat for invasion by salt-intolerant species (Ungar 1974a, as cited by Johnston 1987).

DISTRIBUTION

Geographic Range: This alliance is found in the northern, western and southern Great Plains of the U.S. and southern Canada. More associations are likely to occur and need to be researched and added to this alliance.

Nations: CA, US
States/Provinces: CO, KS, MT, ND, NM, OK, SD, SK, TX, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Sporobolus airoides* Series (Johnston 1987)
- **><** Alkali Meadow (#45310) (Holland 1986b)
- **?** Alkali Sacaton Series (Sawyer and Keeler-Wolf 1995)
- **><** Sacaton Series (Dick-Peddie 1993)
- **?** Tussock Grass, Type 37 (Aldous and Shantz 1924)
- **?** Valley Sacaton Grassland (#42120) (Holland 1986b)

LOWER LEVEL UNITS

Associations:
- CEGL002274 *Sporobolus airoides* Northern Plains Marsh

AUTHORSHIP

Primary Concept Source: G. Kittel, in Faber-Langendoen et al. (2013)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Aldous and Shantz 1924, Burgess and Klein n.d., Cooper 1984, Culver et al. 1996, Diamond 1993, Dick-Peddie 1993, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 1997, Faber-Langendoen et al. 2017b, Francis 1986, Henrickson et al. 1985, Holland 1986b, Johnston 1987, Kittel and Lederer 1993, Lesica and DeVelice 1992, Lindauer 1970, Muldavin and Mehlhop 1992, Muldavin et al. 2000b, Neher and Bailey 1976, Sawyer and Keeler-Wolf 1995, Soil Conservation Service 1978, Steward 1982, Ungar 1968, Ungar 1972, Ungar 1974a

3. DESERT & SEMI-DESERT

Cool and warm semi-deserts dominated by xeromorphic growth forms, including *succulent* (e.g., cacti, euphorbias) and *small-leaved shrubs* and *trees*, desert grasses and other xeromorphic growth forms, with an irregular horizontal canopy spacing that is often open to very sparse (1%) cover.

3.B. Cool Semi-Desert Scrub & Grassland

Cool Semi-Desert Scrub & Grassland occurs in dry, cool-temperate climates, at mid-latitudes (35° to 50°N), typically in the interior of continents, and varies from low shrublands to very open grassland and shrub-steppe, including open rocky or sandy semi-desert vegetation.

3.B.1. Cool Semi-Desert Scrub & Grassland

Cool Semi-Desert Scrub & Grassland occurs in dry, cool-temperate climates, at mid-latitudes (35° to 50°N), typically in the interior of continents.

3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland

This division encompasses all upland shrub and grassland vegetation within the Western North American Cool Semi-desert region, from south-central Alberta through the Great Basin and western margins of the Great Plains to New Mexico, westward to dry-interior southern British Columbia and south through eastern Oregon and interior California, into the mountains of northwestern Baja California, Mexico. It includes extensive shrublands dominated by *Artemisia tridentata*, ranging from mid to upper slopes and deep to shallow soils, and extensive *Atriplex* shrublands.

M171. Great Basin-Intermountain Dry Shrubland & Grassland

This diverse semi-arid macrogroup is found throughout the Intermountain West, including mid-elevation sites in eastern and central Mojave Desert, the Great Basin, Colorado Plateau, Columbia Plateau, and lower elevation sites in the central Rocky Mountains extending east across Wyoming Basins into the western Great Plains. It can occur as open shrubland, dwarf-shrub, shrub herbaceous, or grassland communities. Characteristic species include shrubs *Chrysothamnus viscidiflorus, Coleogyne ramosissima, Ephedra* spp., *Ericameria nauseosa, Gutierrezia sarothrae, Krascheninnikovia lanata*, and dry grasses such as *Achnatherum hymenoides, Achnatherum lettermanii, Aristida purpurea, Bouteloua gracilis, Hesperostipa comata, Leymus salinus ssp. salinus, Muhlenbergia pungens, Pleuraphis jamesii, Poa fendleriana, Poa secunda, Pseudoroegneria spicata, Sporobolus cryptandrus*, and *Sporobolus airoides*.

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
3.B.1.Ne.1.d. M171 Great Basin-Intermountain Dry Shrubland & Grassland

G310. Intermountain Semi-Desert Steppe & Shrubland

Type Concept Sentence: This widespread dwarf-shrubland, shrubland and shrub-steppe group occurs throughout the semi-arid western U.S. on a variety of sites and disturbance regimes and is characterized by an open to moderately dense woody layer composed of diverse woody species such as *Chamaebatiaria millefolium, Chrysothamnus albidus, Chrysothamnus viscidiflorus, Ericameria nauseosa, Ephedra viridis, Ephedra torreyana, Glossopetalon spinescens, Gutierrezia sarothrae, Gutierrezia microcephala, Ericameria nana, Ericameria parryi, Ericameria teretifolia, Krascheninnikovia lanata, Mahonia fremontii, Opuntia polyacantha*, and *Tetradymia canescens* with or without an herbaceous layer.

OVERVIEW

Scientific Name: *Chrysothamnus viscidiflorus - Ericameria nauseosa - Krascheninnikovia lanata* Steppe & Shrubland Group
Common Name (Translated Scientific Name): Yellow Rabbitbrush - Rubber Rabbitbrush - Winterfat Steppe & Shrubland Group
Colloquial Name: Yellow Rabbitbrush 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.

Classification Comments: This group encompasses a somewhat broad range of semi-desert shrublands in the Intermountain West. Many of these communities are somewhat disturbance-maintained, early-seral types. Additional data and analysis are needed to clarify the associations that should be placed here. Shrub communities occurring over talus included in this group are part of a continuum and can be highly variable, and some dwarf-shrub communities can technically be defined as herbaceous types.

Similar NVC Types:

Diagnostic Characteristics: This group occurs as open shrub, dwarf-shrub, or shrub herbaceous communities. Shrub canopy ranges from 10-60% shrub cover with herbaceous layer usually sparse but ranging from dense to absent. Dominant/diagnostic shrubs in this group include *Chamaebatiaria millefolium, Chrysothamnus albidus, Chrysothamnus viscidiflorus, Ephedra viridis, Ephedra torreyana, Ericameria nauseosa, Ericameria nana, Ericameria parryi, Ericameria teretifolia, Glossopetalon spinescens, Gutierrezia sarothrae, Gutierrezia microcephala, Krascheninnikovia lanata, Mahonia fremontii, Opuntia fragilis, Opuntia phaeacantha, Opuntia polyacantha, Tetradymia canescens*, and *Tetradymia tetrameres*. Characteristic herbaceous species may include *Achnatherum hymenoides, Aristida purpurea, Bouteloua curtipendula, Bouteloua eriopoda, Bouteloua gracilis, Hesperostipa comata, Pleuraphis jamesii, Poa secunda, Sphaeralcea coccinea*, and *Sporobolus cryptandrus*. Scattered *Juniperus* spp. are common, but rarely attain more than 5% cover.

VEGETATION

Physiognomy and Structure: Open shrub, dwarf-shrub, or shrub herbaceous communities dominated by cold-deciduous, broad-leaved shrub, dwarf-shrub species, or perennial grasses with an open shrub layer.

Floristics: The most important, widespread shrubs in this group include *Chrysothamnus viscidiflorus, Ericameria nauseosa, Gutierrezia sarothrae, Gutierrezia microcephala, Krascheninnikovia lanata, Opuntia polyacantha*, and *Opuntia phaeacantha*. Other dominant/diagnostic shrubs with narrower ranges are *Chrysothamnus albidus, Chamaebatiaria millefolium, Ericameria nana, Ericameria parryi, Ericameria teretifolia, Glossopetalon spinescens, Mahonia fremontii, Opuntia phaeacantha*, and *Opuntia polyacantha*. Other commonly present to codominant species include *Artemisia* spp., *Ephedra torreyana, Ephedra viridis , Coleogyne ramosissima, Fallugia paradoxa, Isocoma drummondii, Eriogonum* spp., *Grayia spinosa, Holodiscus dumosus, Lycium pallidum, Opuntia* fragilis, *Purshia tridentata, Tetradymia canescens*, and *Tetradymia tetrameres*. Semi-desert grasses are common, including *Achnatherum hymenoides, Aristida purpurea, Aristida purpurea, Bouteloua curtipendula, Bouteloua eriopoda, Bouteloua gracilis, Elymus elymoides, Hesperostipa comata, Leymus salinus, Muhlenbergia pungens, Pascopyrum smithii, Pleuraphis jamesii, Poa secunda, Pseudoroegneria spicata, Sporobolus airoides*, and *Sporobolus cryptandrus*. Perennial forbs may include *Achillea millefolium, Astragalus purshii, Calochortus macrocarpus, Chamaesyce* spp., *Erigeron* spp., *Penstemon deustus, Phlox hoodii, Sphaeralcea coccinea*, and *Sphaeralcea munroana*. Annuals may be seasonally present to abundant depending on precipitation and disturbance. Exotic annuals such as *Bromus tectorum* or *Salsola kali* can be abundant.

ENVIRONMENT & DYNAMICS

Environmental Description: This group occurs throughout the Intermountain West from the western Great Basin to the Northern Rocky Mountains and Colorado Plateau at elevations ranging from 300 m up to 2500 m. The climate where this group occurs is generally hot in summers and cold in winters with low annual precipitation, ranging from 18-40 cm and high inter-annual variation. Much of the precipitation falls as snow, and growing-season drought is characteristic. Temperatures are continental with large annual and diurnal variations. Sites are generally alluvial fans and flats with moderate to deep soils. Some sites can be flat, poorly drained and intermittently flooded with a shallow or perched water table often within 1 m depth (West 1983e). Substrates are generally shallow, calcareous, fine-textured soils (clays to silt-loams), derived from alluvium; deep, fine to medium-textured alluvial soils with some source of subirrigation during the summer season, or sandstone talus over shale. Soils may be alkaline and typically moderately saline (West 1983e).

Dynamics:

DISTRIBUTION

Geographic Range: This group occurs throughout the semi-arid western U.S., including areas in the western Great Plains.

Spatial Scale & Pattern [optional]: Large patch
Nations: CA?, US
States/Provinces: AZ, CA, CO, ID, KS, MT, NM, NV, OR, SD, TX, UT, WY
TNC Ecoregions [optional]: 4:C, 6:C, 8:C, 9:C, 10:C, 11:C, 18:C, 19:C, 20:C, 21:C
USFS Ecoregions (2007): 313A:CC, 313B:CC, 313C:CC, 313D:CC, 315A:CC, 315B:CC, 315H:CC, 321A:CC, 322A:CC, 331B:CC, 331H:CC, 331I:CC, 331J:CC, 341A:CC, 341B:CC, 341C:CC, 341D:CC, 341E:CC, 341F:CC, 341G:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:CC, 342I:CP, 342J:CC, M242C:CC, M261E:CC, M261G:CC, M313A:CC, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332E:CP, M332G:CC, M333A:??, M341A:CC, M341B:CC, M341C:CC, M341D:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Arches); USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **=** Southeastern Utah galleta-threeawn shrub steppe (West 1983e)

LOWER LEVEL UNITS

Alliances:
- A2650 *Opuntia* spp. Colorado Plateau Shrubland Alliance
- A2540 *Ericameria teretifolia* Shrubland Alliance
- A3197 *Ericameria parryi* Shrubland Alliance
- A3196 *Ericameria nauseosa* Steppe & Shrubland Alliance
- A3203 *Gutierrezia sarothrae - Gutierrezia microcephala* Dwarf-shrubland Alliance
- A1032 *Glossopetalon spinescens* Shrubland Alliance
- A0834 *Chrysothamnus albidus* Shrubland Alliance
- A3202 *Krascheninnikovia lanata* Steppe & Dwarf-shrubland Alliance
- A3195 *Chrysothamnus viscidiflorus* Steppe & Shrubland Alliance

AUTHORSHIP

Primary Concept Source: N.E. West (1983e)
Author of Description: M.E. Hall, M.S. Reid, K.A. Schulz
Acknowledgments: P. Comer
Version Date: 11/06/2015
Classif Resp Region: West
Internal Author: MEH/MSR 3-10, mod. PC 4-13, mod. KAS 11-15

REFERENCES

References: Branson et al. 1976, Faber-Langendoen et al. 2017a, Hanson 1929, Shiflet 1994, Stout et al. 2013, Tuhy et al. 2002, West 1983e

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G310. Intermountain Semi-Desert Steppe & Shrubland

A3195. Chrysothamnus viscidiflorus Steppe & Shrubland Alliance

Type Concept Sentence: This alliance is characterized by a sparse to dense layer of *Chrysothamnus viscidiflorus* and sparse to dense layer of graminoids and is known from in the southern San Luis Valley of Colorado, the lower slopes of mountains in western Wyoming and northern Utah, and on mesas and high plateaus of the Colorado Plateau.

OVERVIEW

Scientific Name: *Chrysothamnus viscidiflorus* Steppe & Shrubland Alliance
Common Name (Translated Scientific Name): Yellow Rabbitbrush Steppe & Shrubland Alliance
Colloquial Name: Yellow Rabbitbrush Steppe & Shrubland

Type Concept: The vegetation is characterized by an open to moderate shrub layer dominated by *Chrysothamnus viscidiflorus* with 3-35% cover. Other shrub species may be present with low cover, such as *Amelanchier utahensis, Artemisia bigelovii, Artemisia tridentata, Atriplex canescens, Atriplex confertifolia, Eriogonum corymbosum, Ephedra viridis, Ericameria nauseosa, Gutierrezia sarothrae, Mahonia fremontii, Shepherdia rotundifolia, Symphoricarpos oreophilus, Tetradymia canescens*, and *Yucca baccata*. The herbaceous layer is variable and ranges from being moderately dense, diverse and bunchgrass-dominated to sparse and often depauperate. In some stands the herbaceous layer is dominant over shrubs. Dominant and common grasses may include *Achnatherum hymenoides (= Oryzopsis hymenoides), Bouteloua gracilis, Elymus elymoides, Hesperostipa comata, Koeleria macrantha, Leymus salinus ssp. salinus, Pascopyrum smithii, Poa fendleriana, Poa secunda, Pseudoroegneria spicata*, and the introduced annuals *Bromus briziformis* and *Bromus tectorum*. *Leymus cinereus* may be present in mesic gully bottoms in Utah. Scattered forbs are present, such as *Antennaria* spp., *Astragalus bisulcatus, Castilleja* spp., *Cirsium undulatum, Cryptantha humilis, Linanthus pungens (= Leptodactylon pungens)*, and *Linanthus watsonii (= Leptodactylon watsonii)*. Stands of the alliance occur in the southern San Luis Valley of Colorado, the lower slopes of mountains in western Wyoming and northern Utah, and on mesas and high plateaus of the Colorado Plateau. Stands occur on a variety of sites and range from level to moderately sloping, disturbed sites on ridges and in valleys. Elevations range from 1300 to 2440 m (4250-8000 feet). Substrates include eolian sands, alluvium, metamorphic rocks, granite or limestone, and the soil is likewise variable, with textures ranging from silt loam, sandy loam, loamy sand and silty clay loam.

Classification Comments: This alliance has one association that is based on the Van Pelt (1978) description of *Chrysothamnus viscidiflorus / Leymus salinus ssp. salinus* Plant Association on Bridger Jack Mesa. Information on other occurrences is needed to describe the full range of this alliance.

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

Similar NVC Types:

Diagnostic Characteristics: Shrublands of the Colorado Plateau and southern Rocky Mountains where *Chrysothamnus viscidiflorus* is the dominant species ranging from 3-35% cover or some stands with <10% cover and graminoid layer with 5-25% cover.

VEGETATION

Physiognomy and Structure: The vegetation in this alliance has a sparse to dense graminoid layer dominated by medium-tall bunch grasses with a sparse to dense short xeromorphic shrub layer.

Floristics: Vegetation included in this shrub herbaceous alliance is characterized by a sparse to moderate shrub layer dominated by *Chrysothamnus viscidiflorus* with 3-20% cover. Other shrub species may be present with low cover, such as *Amelanchier utahensis, Artemisia tridentata, Artemisia bigelovii, Atriplex canescens, Atriplex confertifolia, Ephedra viridis, Ericameria nauseosa, Eriogonum corymbosum, Gutierrezia sarothrae, Mahonia fremontii, Shepherdia rotundifolia, Symphoricarpos oreophilus, Tetradymia canescens*, and *Yucca baccata*. Occasional *Pinus edulis* and *Juniperus osteosperma* trees or seedlings may be present in the stand. The herbaceous layer is variable and ranges from being moderately dense, diverse and bunchgrass-dominated to sparse and sometimes depauperate. Common dominant graminoid species include *Achnatherum hymenoides (= Oryzopsis hymenoides), Bouteloua gracilis, Elymus elymoides, Hesperostipa comata, Koeleria macrantha, Leymus salinus ssp. salinus, Pascopyrum smithii, Poa fendleriana, Poa secunda, Pseudoroegneria spicata*, and introduced annuals *Bromus briziformis* and *Bromus tectorum*. *Leymus cinereus* may be present in mesic gully bottoms in Utah. Forbs may be diverse but typically contribute very little cover. Associate species may include *Antennaria* spp., *Arenaria* sp., *Astragalus bisulcatus, Castilleja* spp., *Chenopodium leptophyllum, Cirsium undulatum, Crepis acuminata, Cryptantha cinerea var. jamesii, Cryptantha humilis, Erigeron* spp., *Eriogonum* sp., *Heterotheca villosa, Linanthus pungens (= Leptodactylon pungens), Linanthus watsonii (= Leptodactylon watsonii), Lupinus caudatus, Packera tridenticulata, Sedum lanceolatum, Schoenocrambe linifolia, Stenotus armerioides var. armerioides*, and cacti such as *Mammillaria* spp. and *Opuntia* spp.

ENVIRONMENT & DYNAMICS

Environmental Description: This shrubland alliance includes associations found in the Colorado Plateau extending east into the southern Rocky Mountains. Stands occur on a variety of sites and range from level to moderately sloping, disturbed sites on ridges and in valleys. Elevations range from 1300 to 2440 m (4250-8000 feet). Substrates include eolian sands, alluvium, metamorphic rocks, granite or limestone, and the soil is likewise variable, with textures ranging from silt loam to sandy loam to loamy sand. Ground surface is variable and has low to high cover of gravel, bare soil, litter and duff.

Dynamics: Disturbance by fire may be important in the creation and maintenance of these stands. Burned tree snags indicate these stands were created by fire that burned openings in the *Pinus edulis* and *Juniperus osteosperma* woodland (Van Pelt 1978). Van Pelt (1978) reported that young *Pinus edulis* are slowly invading the park and in time will convert it back to woodland unless fire reburns the site. Lightning likely starts these fires. With past fire suppression policies on some federal lands and livestock grazing which removes the necessary fine fuels needed to carry fire through woodlands, these parks may be disappearing. More information is needed to understand their current status and management needs.

DISTRIBUTION

Geographic Range: Stands of the alliance occur in the southern San Luis Valley of Colorado, the lower slopes of mountains in western Wyoming and northern Utah, and on mesas and high plateaus of the Colorado Plateau.

Nations: US
States/Provinces: CA, CO, ID, MT, NV, UT, WY
TNC Ecoregions [optional]: 11:C
USFS Ecoregions (2007): 341Fc:CCC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley); USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** *Chrysothamnus viscidiflorus* Shrubland Alliance (Evens et al. 2014)
- **?** Salina Wildrye/Douglas Rabbitbrush Community (Van Pelt 1978)

LOWER LEVEL UNITS

Associations:
- CEGL005594 *Chrysothamnus viscidiflorus / Pseudoroegneria spicata* Shrubland
- CEGL002781 *Chrysothamnus viscidiflorus - Ericameria parryi* Shrub Grassland
- CEGL001501 *Chrysothamnus viscidiflorus / Leymus salinus ssp. salinus* Shrub Grassland
- CEPP005695 *Chrysothamnus viscidiflorus* / Disturbed Understory Shrubland
- CEGL002530 *Chrysothamnus viscidiflorus* Shrub Grassland
- CEGL002799 *Chrysothamnus viscidiflorus / Hesperostipa comata* Shrubland
- CEGL005592 *Chrysothamnus viscidiflorus / Pascopyrum smithii* Shrubland

AUTHORSHIP

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

REFERENCES

References: Evens et al. 2014, Faber-Langendoen et al. 2017b, Van Pelt 1978

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G310. Intermountain Semi-Desert Steppe & Shrubland

A3196. Ericameria nauseosa Steppe & Shrubland Alliance

Type Concept Sentence: This alliance is characterized by shrub and shrub herbaceous vegetation where *Ericameria nauseosa* is dominant and includes both natural and semi-natural stands from localized areas across the northern Great Plains and throughout the western U.S.

OVERVIEW

Scientific Name: *Ericameria nauseosa* Steppe & Shrubland Alliance

Common Name (Translated Scientific Name): Rubber Rabbitbrush Steppe & Shrubland Alliance
Colloquial Name: Rubber Rabbitbrush Steppe & Shrubland

Type Concept: The vegetation is characterized by a sparse to moderately dense, short-shrub layer (5-60% cover) that is dominated by *Ericameria nauseosa*. Depending on geography, associated shrubs may include scattered *Artemisia filifolia, Artemisia tridentata, Chrysothamnus viscidiflorus, Gutierrezia sarothrae, Opuntia* spp., *Prunus virginiana, Rhus trilobata, Symphoricarpos occidentalis*, and *Yucca* spp. The herbaceous layer can vary from sparse moderately dense, being more prominent in some stands than shrubs, and dominated by graminoids. Common native grasses include *Achnatherum hymenoides (= Oryzopsis hymenoides), Bouteloua* spp., *Elymus trachycaulus ssp. trachycaulus, Leymus flavescens (= Elymus flavescens), Pascopyrum smithii, Pleuraphis jamesii, Pseudoroegneria spicata*, and *Sporobolus cryptandrus*. Native forbs generally have low cover. Disturbed stands typically have high cover of introduced annual *Bromus* species. This alliance includes both natural and semi-natural stands from localized areas across the northern Great Plains and throughout the western U.S. Elevations range from 1100 to 2200 m. Soils are variable but generally well-drained and coarse-textured. Sites are flat to gently sloping, occurring on all aspects. The semi-natural stands included in this alliance are seral shrubland communities resulting from overgrazing by livestock, road building, or other cultural disturbance of typically grass-dominated communities.

Classification Comments: Further study is needed on the effects of livestock grazing on vegetation structure in these stands and on the relationship between *Ericameria nauseosa* shrub herbaceous associations and shrubland associations. *Mahonia fremontii* Shrubland (CEGL003967) has been placed in this alliance tentatively until further studies can be completed on this association.

Internal Comments: GK 9-16: ID added for Minidoka.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Very widespread shrub and shrub herbaceous vegetation where *Ericameria nauseosa* ranges in cover from 15-60% cover and where herbaceous component is sparse or absent. Cover of *Ericameria nauseosa* is 5-25% in cover when graminoids are more abundant.

VEGETATION

Physiognomy and Structure: Vegetation in this alliance has a sparse to dense layer of microphyllous evergreen shrubs (<2 m tall) with a sparse to moderately dense herbaceous layer dominated by perennial medium-tall and short grasses. Perennial forbs are sparse. Annual forbs and grasses may be present seasonally.

Floristics: The vegetation is characterized by a sparse to moderately dense, short-shrub layer (5-60% cover) that is dominated by *Ericameria nauseosa*. Depending on geography, associated shrubs may include scattered *Artemisia filifolia, Artemisia tridentata, Chrysothamnus viscidiflorus, Gutierrezia sarothrae, Opuntia* spp., *Prunus virginiana, Rhus trilobata, Symphoricarpos occidentalis*, and *Yucca* spp. The herbaceous layer can vary from sparse to dense and is dominated by graminoids. In some stands, the herbaceous component may surpass that of shrubs. Common native grasses include *Achnatherum hymenoides (= Oryzopsis hymenoides), Aristida purpurea, Bouteloua* spp., *Elymus trachycaulus ssp. trachycaulus, Leymus flavescens (= Elymus flavescens), Pascopyrum smithii, Pleuraphis jamesii, Pseudoroegneria spicata*, and *Sporobolus cryptandrus*. Native forbs generally have low cover, but may include species such as *Lygodesmia grandiflora, Machaeranthera canescens (= Aster canescens), Phacelia hastata (= Phacelia leucophylla)*, and *Psoralidium lanceolatum (= Psoralea lanceolata)*. Disturbed stands typically have high cover of introduced annual *Bromus* species such as *Bromus tectorum, Bromus arvensis (= Bromus japonicus)*, and *Bromus rubens*. Introduced forbs may include *Bassia scoparia (= Kochia scoparia), Melilotus officinalis*, and *Salsola kali*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance includes both natural and semi-natural stands from localized areas across the northern Great Plains and throughout the western U.S. Stands occur in the a variety of habitats such as gentle or steep slopes, dunes, and washes. Elevations range from 1100 to 2200 m elevation. Substrates may be eolian, alluvial, or colluvial with soils that are generally well-drained and coarse-textured. The semi-natural stands included in this alliance are seral shrubland communities resulting from overgrazing by livestock, road building, or other cultural disturbance of typically grass-dominated communities.

Dynamics: Grazing has significantly impacted much of the vegetation in this region, which has had a long history of settlement and heavy livestock use. With proper livestock management and time, palatable species such as *Achnatherum hymenoides, Artemisia tridentata, Elymus elymoides, Pascopyrum smithii, Schedonnardus paniculatus*, and *Sporobolus cryptandrus* may increase, and *Gutierrezia sarothrae* and *Ericameria nauseosa* may decline in abundance (Francis 1986).

DISTRIBUTION

Geographic Range: This alliance includes shrublands from localized areas across the northern Great Plains and throughout much of the western U.S.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **><** *Chrysothamnus* Subformation (Francis 1986)

LOWER LEVEL UNITS

Associations:
- CEGL002713 *Ericameria nauseosa* Shrubland
- CEGL002918 *Ericameria nauseosa / Sporobolus airoides* Shrubland
- CEGL002996 *Ericameria nauseosa / Pleuraphis jamesii - (Hesperostipa comata)* Shrub Grassland
- CEPP006725 *Lepidospartum latisquamum* Shrubland
- CEGL003495 *Ericameria nauseosa / Bouteloua gracilis* Shrub Grassland
- CEGL003967 *Mahonia fremontii* Shrubland
- CEGL001330 *Ericameria nauseosa / Pseudoroegneria spicata* Shrubland

AUTHORSHIP

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

REFERENCES

References: Faber-Langendoen et al. 2017b, Francis 1986

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G310. Intermountain Semi-Desert Steppe & Shrubland

A3202. Krascheninnikovia lanata Steppe & Dwarf-shrubland Alliance

Type Concept Sentence: This alliance represents vegetation of the interior western U.S. characterized by a sparse to dense layer of *Krascheninnikovia lanata*.

OVERVIEW

Scientific Name: *Krascheninnikovia lanata* Steppe & Dwarf-shrubland Alliance
Common Name (Translated Scientific Name): Winterfat Steppe & Dwarf-shrubland Alliance
Colloquial Name: Winterfat Steppe & Dwarf-shrubland

Type Concept: This alliance includes dwarf-shrublands dwarf-shrub herbaceous vegetation scattered across the interior western U.S. Shrub layers are characterized by a sparse to moderately dense dwarf-shrub layer dominated by *Krascheninnikovia lanata*. Other woody species may include scattered *Artemisia frigida, Artemisia nova, Artemisia tridentata, Chrysothamnus* spp., *Gutierrezia sarothrae, Opuntia polyacantha, Rhus trilobata*, and *Yucca glauca*. In the Mojave Desert, *Ambrosia dumosa, Atriplex polycarpa, Larrea tridentata*, and *Lycium andersonii* may also be present. The herbaceous layer has sparse to very dense cover dominated by graminoids with scattered perennial forbs which in some stands may take prominence over shrubs. Graminoids such as *Achnatherum hymenoides (= Oryzopsis hymenoides), Bouteloua gracilis, Hesperostipa comata (= Stipa comata), Pascopyrum smithii, Pleuraphis jamesii (= Hilaria jamesii), Poa secunda*, and *Pseudoroegneria spicata* are most abundant. Perennial forbs may include *Achillea millefolium, Astragalus purshii, Calochortus macrocarpus, Erigeron* spp., *Phlox hoodii, Sphaeralcea coccinea*, and *Sphaeralcea munroana*. Annuals may be seasonally present to abundant depending on precipitation and disturbance. Exotic annuals, such as *Bromus tectorum*, can be abundant. Elevations range from 100-2700 m. Stands occur on plateaus, plains, mesas, hillslopes, alkaline flats around playas and along drainages. Some habitats are intermittently flooded wetlands. Sites are typically flat to gently sloping, occurring on any aspect, but stands have also been reported from moderately steep slopes. Soils are calcareous, moderately

alkaline and sometimes saline. Soil texture is typically stony, sandy loam, but may be coarser textured. The ground cover is mostly bare soil.

Classification Comments: The vegetation is sparse in many of these stands, and they would be better classified in a sparsely vegetated alliance. Only stands described by Daubenmire (1970) and DeVelice et al. (1991) have the necessary woody cover to be dwarf-shrublands.

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

Similar NVC Types:

Diagnostic Characteristics: Shrublands of the interior western U.S. where *Krascheninnikovia lanata* is the dominant species ranging from 3-35% cover or some stands with <10% cover and graminoid layer with cover 5-25%.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance is dominated by a sparse to moderately dense evergreen, dwarf-shrub layer often with scattered shrubs. Also present is a sparse to moderately dense herbaceous layer dominated by perennial graminoids with scattered perennial forbs. Annual grasses and forbs are seasonally present to abundant.

Floristics: Vegetation included in this alliance has a sparse to moderately dense dwarf-shrub layer dominated by *Krascheninnikovia lanata*. Other woody species may include scattered *Artemisia frigida, Artemisia nova, Artemisia tridentata, Chrysothamnus* spp., *Gutierrezia sarothrae, Opuntia polyacantha, Rhus trilobata*, and *Yucca glauca*. In the Mojave Desert, *Ambrosia dumosa, Atriplex polycarpa, Larrea tridentata*, and *Lycium andersonii* may also be present. The herbaceous layer has sparse to moderately dense cover dominated by graminoids with scattered perennial forbs. In some stands, shrubs may be very widely spaced and graminoids take prominence over shrub cover. Graminoids such as *Achnatherum hymenoides (= Oryzopsis hymenoides), Bouteloua gracilis, Hesperostipa comata (= Stipa comata), Muhlenbergia torreyi, Pascopyrum smithii, Pleuraphis jamesii (= Hilaria jamesii), Poa secunda*, and *Pseudoroegneria spicata* are most abundant. Scattered *Carex filifolia, Koeleria macrantha, Nassella viridula*, and *Sporobolus airoides* are also often present. Perennial forbs may include *Achillea millefolium, Astragalus purshii, Calochortus macrocarpus, Erigeron* spp., *Phlox hoodii, Sphaeralcea coccinea*, and *Sphaeralcea munroana*. Annuals may be seasonally present to abundant depending on precipitation and disturbance. Common native annual are *Chenopodium* spp., *Descurainia pinnata, Lappula occidentalis (= Lappula redowskii)*, and *Plantago patagonica*. Exotic annuals may include *Bromus arvensis (= Bromus japonicus), Bromus tectorum, Halogeton glomeratus, Melilotus officinalis, Salsola kali*, and many others.

ENVIRONMENT & DYNAMICS

Environmental Description: Elevations range from 100-2700 m. Climate is semi-arid with about half the annual precipitation occurring in July to September often as high-intensity, convective storms. Sites include plains, alkaline flats, mesas and plateaus, hillslopes, alkaline flats around playas and along drainages. Sites are typically flat to gentle-sloped, but occasionally occur on moderate slopes up to 45%. Sites include all aspects. Soil textures are typically stony, sandy loams, but range to fine-textured silty clays and are typically shallow to moderate deep.

Dynamics: Stands dominated by *Krascheninnikovia lanata* occur locally. They often have sharp ecotones with other vegetation types and are thought to be an edaphic community type by Daubenmire (1970). However, edaphic factors separating these stands from adjacent stands have yet to be found. Soil characteristics, such as excessive amounts of calcium carbonate or lack of the nutrients N, P, K or S, have been studied and do not appear to control the occurrence of this alliance (Daubenmire 1970, DeVelice et al. 1995). *Krascheninnikovia lanata* is also important range forage. It is highly palatable in the winter and is tolerant of heavy browsing (Daubenmire 1970). Many stands have long histories of grazing impacts and are thought to be in a degraded state (Francis 1986, DeVelice et al. 1995). These stands often have low perennial herbaceous cover and many have high cover of the exotic annual grass *Bromus tectorum* (Daubenmire 1970, Francis 1986). DeVelice et al. (1995) described stands dominated by *Krascheninnikovia lanata* and *Hesperostipa comata*, which they considered to be a seral stage of a *Krascheninnikovia lanata / Pseudoroegneria spicata* community type that is not currently described in the National Vegetation Classification. Francis (1986) predicts that with protection from grazing, *Gutierrezia sarothrae* cover will decrease and *Krascheninnikovia lanata, Sporobolus airoides*, and *Achnatherum hymenoides* will increase in cover.

DISTRIBUTION

Geographic Range: Stands in this minor dwarf-shrubland alliance occur on the Columbia Plateau and Great Basin, and extend east to the northwestern Great Plains and south to the Mojave Desert, northern Chihuahuan Desert and Colorado Plateau. It is reported from eastern Washington and Oregon, Idaho, Montana, Nevada, New Mexico, Colorado and likely occurs in Utah, California, and Saskatchewan, Canada.

Nations: CA?, US
States/Provinces: AZ, CA, CO, ID, KS, MT, NM, NV, OR, SK?, TX, UT, WA, WY
TNC Ecoregions [optional]: 6:C, 11:C, 13:C, 15:C, 17:C
USFS Ecoregions (2007): 262A:CC, 322Al:CCC, 322Av:CCC, 341D:CC, 341Fa:CCC, 341Fb:CCC, 341Fc:CCC, 341Fe:CCC, 341Ff:CCC, 342B:CC, M262A:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Lake Mead, Mojave); USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Eurotia lanata - Poa secunda* habitat type (Daubenmire 1970)
- **?** *Eurotia lanata* Series (Johnston 1987) [includes the *Eurotia lanata/Hilaria jamesii* plant association.]
- **=** *Krascheninnikovia lanata* (Winterfat scrubland) Alliance (Sawyer et al. 2009) [36.500.00]
- **=** *Krascheninnikovia lanata* Shrubland Alliance (Evens et al. 2014)
- **=** *Krascheninnikovia lanata* Shrubland Alliance (CNPS 2017) [36.500.00]
- **><** Mixed Saltdesert Shrub - Playa (Chappell et al. 1997)
- **><** Shadscale Scrub (#36140) (Holland 1986b)
- **?** Winterfat Series (Sawyer and Keeler-Wolf 1995)

LOWER LEVEL UNITS

Associations:

- CEGL001321 *Krascheninnikovia lanata / Bouteloua gracilis* Dwarf-shrub Grassland
- CEGL001327 *Krascheninnikovia lanata / Hesperostipa comata* Dwarf-shrubland
- CEGL001325 *Krascheninnikovia lanata / Phlox* spp. Dwarf-shrubland
- CEGL001326 *Krascheninnikovia lanata / Poa secunda* Dwarf-shrubland
- CEGL001324 *Krascheninnikovia lanata / Pascopyrum smithii - Bouteloua gracilis* Dwarf-shrub Grassland
- CEGL001320 *Krascheninnikovia lanata* Dwarf-shrubland
- CEGL001323 *Krascheninnikovia lanata / Achnatherum hymenoides* Dwarf-shrubland
- CEGL001322 *Krascheninnikovia lanata / Pleuraphis jamesii* Dwarf-shrubland

AUTHORSHIP

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

REFERENCES

References: CNPS 2017, Carey 1995, Chappell et al. 1997, Daubenmire 1970, DeVelice et al. 1991, DeVelice et al. 1995, Evens et al. 2014, Faber-Langendoen et al. 2017b, Francis 1986, Holland 1986b, Johnston 1987, Keeler-Wolf and Thomas 2000, MacMahon 1988, Reid et al. 1999, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Stout et al. 2013, Thomas et al. 2004, Turner 1982c, VegCAMP and AIS 2013, West 1988, Young et al. 1977, Young et al. 2007b

M170. Great Basin-Intermountain Dwarf Sagebrush Steppe & Shrubland

This semi-arid intermountain western U.S. macrogroup is characterized by short sagebrush taxa that form an open to moderately dense dwarf-shrub layer on shallow, rocky, calcareous or alkaline soils. Stands are dominated by one of several diagnostic *Artemisia* taxa depending on location and habitat, including *Artemisia arbuscula ssp. arbuscula, Artemisia arbuscula ssp. longiloba, Artemisia arbuscula ssp. longicaulis, Artemisia arbuscula ssp. thermopola, Artemisia bigelovii, Artemisia frigida, Artemisia nova, Artemisia rigida*, or *Artemisia tripartita ssp. rupicola*.

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
3.B.1.Ne.2.b. M170 Great Basin-Intermountain Dwarf Sagebrush Steppe & Shrubland

G308. Intermountain Low & Black Sagebrush Steppe & Shrubland

Type Concept Sentence: This broadly defined semi-arid sagebrush dwarf-shrubland and steppe occurs throughout much of the intermountain western U.S. and is characterized by an open to moderately dense shrub or dwarf-shrub layer that is typically dominated by one of the following: *Artemisia arbuscula ssp. arbuscula, Artemisia arbuscula ssp. longicaulis, Artemisia arbuscula ssp. longiloba, Artemisia arbuscula ssp. thermopola, Artemisia bigelovii, Artemisia frigida, Artemisia nova*, or *Artemisia tripartita ssp. rupicola* depending on environment and range of species.

OVERVIEW

Scientific Name: *Artemisia arbuscula - Artemisia bigelovii - Artemisia nova* Steppe & Shrubland Group
Common Name (Translated Scientific Name): Little Sagebrush - Bigelow's Sagebrush - Black Sagebrush Steppe & Shrubland Group
Colloquial Name: Bigelow's Sagebrush Steppe & Shrubland

Type Concept: This broadly defined semi-arid dwarf-shrubland and steppe occurs throughout much of the intermountain western U.S. The vegetation in this broadly defined shrubland and steppe group includes an open to moderately dense shrub or dwarf-shrub layer with a sparse to dense herbaceous layer. Several different taxa of sagebrush may dominate depending on location and by habitat. *Artemisia nova* is most widespread, occurring throughout most of the region on mid- to low-elevation, gravelly, calcareous soils. *Artemisia arbuscula ssp. arbuscula* occurs on low- to high-elevation sites often on shallow, fine-textured soils with a dense clay layer that impedes drainage in spring. *Artemisia arbuscula ssp. longiloba* is widespread in the Columbia Basin and Great Basin into southwestern Wyoming and badlands in the western Great Plains. It occurs on shallow, alkaline, calcareous soils derived from shale. *Artemisia bigelovii* occurs throughout much of the Colorado Plateau and extends across northern New Mexico and southeastern Colorado on shallow soils on limestone hills and shale outcrops. Several other more restricted taxa include *Artemisia tripartita ssp. rupicola, Artemisia arbuscula ssp. longicaulis, Artemisia arbuscula ssp. thermopola*, and *Artemisia frigida*. Other shrubs present to codominant may include *Artemisia tridentata ssp. wyomingensis, Artemisia tridentata ssp. vaseyana, Ephedra torreyana, Ephedra viridis, Grayia spinosa*, or *Purshia tridentata*, depending on habitat. The herbaceous layer, if present, ranges from sparse cushion plants such as *Arenaria hookeri, Eriogonum brevicaule*, and *Phlox hoodii* to moderate to dense cover of perennial grasses. Characteristic grasses include *Achnatherum hymenoides, Bouteloua gracilis, Elymus lanceolatus, Festuca idahoensis, Hesperostipa comata, Pascopyrum smithii, Pleuraphis jamesii, Poa fendleriana, Poa secunda*, and *Pseudoroegneria spicata*. Some stands have significant biological crust formation on the soil surface. Sites are generally xeric and may be wind-blown ridges and benches, gravelly alluvial fans, hilltops, canyons, gravelly draws, and dry flats. Substrates are typically shallow, gravelly or finer-textured alkaline, calcareous soils. Most stands occur from 1000 to 3000 m elevation with some extending to 3800 m in subalpine and alpine habitats of the Sierra Nevada. Substrates are variable, but are typically alluvium derived from limestone, shale, basalt, rhyolite or volcanics.

Classification Comments: Alliances in this group are distinguished largely by the predominant species: *Artemisia nova, Artemisia bigelovii*, and the nominal subspecies of *Artemisia arbuscula*, and by the importance of the perennial graminoid layer (>20% cover) in the shrub herbaceous alliances. The *Artemisia arbuscula* subspecies are distinguished by the nominal subspecies taxonomically and by the different environments which they occupy. *Artemisia arbuscula ssp. longicaulis* Shrubland Alliance (A2548) occurs in more alkaline and less stony settings than *Artemisia arbuscula ssp. arbuscula* Steppe & Shrubland Alliance (A3219). *Artemisia arbuscula ssp. thermopola - Artemisia papposa / Festuca idahoensis* Steppe & Shrubland Alliance (A4122) occurs in more calcareous soils and has a restricted distribution. Beetle and Johnson (1982) report that *Artemisia arbuscula ssp. arbuscula* grows in soils with a high volume of gravel (even though soil may be in clay textural class, or contain a clay-rich layer that impedes drainage), and that *Artemisia arbuscula ssp. longiloba* grows in clay soils, often alkaline, that contain no gravels.

Similar NVC Types:

Diagnostic Characteristics: This group has an open to moderately dense shrub or dwarf-shrub layer with a sparse to dense herbaceous layer. Several different taxa of sagebrush are diagnostic depending on location and by habitat: *Artemisia nova, Artemisia arbuscula ssp. arbuscula, Artemisia arbuscula ssp. longiloba, Artemisia arbuscula ssp. longicaulis, Artemisia bigelovii, Artemisia tripartita ssp. rupicola, Artemisia arbuscula ssp. longicaulis, Artemisia arbuscula ssp. thermopola*, and *Artemisia frigida*. In all cases, these sagebrush taxa tend to occur in shallow, rocky, calcareous or alkaline soils, often fine-textured and sometimes with a claypan impeding drainage. Associated herbaceous taxa are semi-desert grasses and forbs.

VEGETATION

Physiognomy and Structure: The vegetation is this broadly defined shrubland and steppe group includes an open to moderately dense shrub or dwarf-shrub layer dominated by microphyllous evergreen shrubs with a sparse to dense herbaceous layer usually dominated by perennial graminoids (often bunch grasses).

Floristics: This broadly defined shrubland and steppe group includes an open to moderately dense shrub or dwarf-shrub layer with a sparse to dense herbaceous layer. Several different taxa of sagebrush may dominate depending on location and by habitat. *Artemisia nova* is most widespread, occurring throughout most of the region on mid- to low-elevation, gravelly, calcareous soils. *Artemisia arbuscula ssp. arbuscula* occurs on low- to high-elevation sites often on shallow, fine-textured soils with a dense clay layer that impedes drainage in spring. *Artemisia arbuscula ssp. longiloba* is widespread in the Columbia Basin and Great Basin into southwestern Wyoming and badlands in the western Great Plains. It occurs on shallow, alkaline, calcareous soils derived from shale. *Artemisia bigelovii* occurs throughout much of the Colorado Plateau and extends across northern New Mexico and southeastern Colorado on shallow soils on limestone hill and shale outcrops. Several other more restricted taxa may dominate, including *Artemisia tripartita ssp. rupicola* (central Wyoming), *Artemisia arbuscula ssp. longicaulis* (Lahontan Basin of northwestern Nevada, southeastern Oregon, and northeastern California), *Artemisia arbuscula ssp. thermopola* (ridgetops and benches in mountains at 1830 to 2690 m in southern Idaho), and *Artemisia frigida* (described from sites in the Rocky Mountains). Other shrubs present to codominant may include *Artemisia tridentata ssp. wyomingensis, Artemisia tridentata ssp. vaseyana, Ephedra torreyana, Ephedra viridis, Grayia spinosa*, or *Purshia tridentata*, depending on habitat. The herbaceous layer is variable. If present, it ranges from sparse cushion plants such as *Arenaria hookeri, Astragalus bisulcatus, Astragalus jejunus, Eriogonum brevicaule, Minuartia nuttallii (= Arenaria nuttallii), Phlox hoodii, Stenotus acaulis*, and *Trifolium gymnocarpon* to moderate to dense cover of perennial grasses. Characteristic grasses may include *Achnatherum hymenoides, Achnatherum thurberianum, Bouteloua gracilis, Elymus elymoides, Elymus lanceolatus, Festuca idahoensis, Hesperostipa comata, Leymus salinus, Pascopyrum smithii, Pleuraphis jamesii, Poa fendleriana, Poa secunda*, and *Pseudoroegneria spicata*. Some stands have significant biological crust formation on soil surface.

ENVIRONMENT & DYNAMICS

Environmental Description: This broadly defined semi-arid dwarf-shrubland and steppe group occurs throughout much of the intermountain western U.S. Sites are generally xeric and may be on wind-blown, shallow, gravelly or finer-textured alkaline soils. Throughout eastern Oregon, northern Nevada, southern Idaho, western Montana, western Wyoming, and western Colorado, stands typically occur on mountain ridges and flanks and broad terraces, ranging from 1000 to 3000 m in elevation with stands extending to 3800 m elevation in subalpine and alpine habitats of the Sierra Nevada. Substrates are shallow, fine-textured soils, poorly drained clays, shallow-soiled areas, almost always very stony, characterized by recent rhyolite or basalt or are alkaline soils derived from shale (Zamora and Tueller 1973, Baker and Kennedy 1985). In central and southern Wyoming, typical sites are very windy, gently rolling hills and long, gently sloping pediments and fans with shallow, often rocky soils where this group forms the matrix vegetation and large patches on the margins of high-elevation basins. In higher elevation areas, it forms a mosaic with Intermountain Mountain Big Sagebrush Steppe & Shrubland Group (G304) and is restricted to wind-blown ridges. In the Colorado Plateau, Tavaputs Plateau and Uinta Basin, stands occur in canyons, gravelly draws, hilltops, and dry flats at elevations generally below 1800 m. Soils are often rocky, shallow, and alkaline. This group also extends across northern New Mexico and Wyoming into the western Great Plains on limestone hills and shale outcrops.

Dynamics: This broadly defined semi-arid dwarf-shrubland and steppe group occurs throughout much of the intermountain western U.S. Sites are generally xeric and may be on wind-blown, shallow, gravelly or finer-textured alkaline soils. Throughout eastern Oregon, northern Nevada, southern Idaho, western Montana, western Wyoming, and western Colorado, stands typically occur on mountain ridges and flanks and broad terraces, ranging from 1000 to 3000 m in elevation with stands extending to 3800 m elevation in subalpine and alpine habitats of the Sierra Nevada. Substrates are shallow, fine-textured soils, poorly drained clays, shallow-soiled areas, almost always very stony, characterized by recent rhyolite or basalt or are alkaline soils derived from shale (Zamora and Tueller 1973, Baker and Kennedy 1985). In central and southern Wyoming, typical sites are very windy, gently rolling hills and long, gently sloping pediments and fans with shallow, often rocky soils where this group forms the matrix vegetation and large patches on the margins of high-elevation basins. In higher elevation areas, it forms a mosaic with Intermountain Mountain Big Sagebrush Steppe & Shrubland Group (G304) and is restricted to wind-blown ridges. In the Colorado Plateau, Tavaputs Plateau and Uinta Basin, stands occur in canyons, gravelly draws, hilltops, and dry flats at elevations generally below 1800 m. Soils are often rocky, shallow, and alkaline. This group also extends across northern New Mexico and Wyoming into the western Great Plains on limestone hills and shale outcrops.

DISTRIBUTION

Geographic Range: This broadly defined semi-arid dwarf-shrubland and steppe group occurs throughout much of the intermountain western U.S.

Spatial Scale & Pattern [optional]: Large patch
Nations: US
States/Provinces: AZ, CA, CO, ID, MT, NM, NV, OR, UT, WY
TNC Ecoregions [optional]: 6:C, 8:C, 9:C, 10:C, 11:C, 12:P, 17:P, 18:C, 19:C, 20:C, 21:P, 26:C, 27:C, 28:C
USFS Ecoregions (2007): 313A:CC, 313B:CC, 313D:CC, 315A:C?, 315B:CC, 315H:CC, 321A:CC, 331A:CC, 331B:CC, 331F:CC, 331G:CC, 331K:CP, 331L:C?, 331N:CP, 341A:CC, 341B:CC, 341C:CC, 341E:CP, 341G:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CP, 342F:CC, 342G:CC, 342H:CC, 342I:CC, 342J:CC, M242C:CC, M242D:CC, M261D:CC, M261G:CC, M313A:CC, M313B:CC, M331A:C?, M331B:CC, M331D:CC,

M331E:CC, M331F:CP, M331G:CC, M331H:CC, M331I:CC, M332A:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:??, M341A:CC, M341B:CC, M341C:CC

Omernik Ecoregions:

Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate. USNVC Confidence from peer reviewer, not AE. This is a very broad group and further review may suggest splitting into two or three groups.

SYNONYMY

- = Great Basin-Colorado Plateau sagebrush semi-desert (West 1983a)

LOWER LEVEL UNITS

Alliances:

- A3221 *Artemisia arbuscula ssp. longiloba* Steppe & Shrubland Alliance
- A3223 *Artemisia bigelovii* Steppe & Shrubland Alliance
- A3222 *Artemisia nova* Steppe & Shrubland Alliance
- A2548 *Artemisia arbuscula ssp. longicaulis* Shrubland Alliance
- A3219 *Artemisia arbuscula ssp. arbuscula* Steppe & Shrubland Alliance
- A2565 *Artemisia frigida* Dwarf-shrubland Alliance
- A4122 *Artemisia arbuscula ssp. thermopola - Artemisia papposa / Festuca idahoensis* Steppe & Shrubland Alliance

AUTHORSHIP

Primary Concept Source: N.E. West (1983a)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 11/06/2015
Classif Resp Region: West
Internal Author: KAS 3-10, 11-15

REFERENCES

References: Baker and Kennedy 1985, Beetle and Johnson 1982, Brown 1982a, Brown et al. 1979, Dick-Peddie 1993, Faber-Langendoen et al. 2017a, Francis 1986, Jones 1992b, Knight 1994, Knight et al. 1987, Shiflet 1994, West 1983a, West 1983c, Zamora and Tueller 1973

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G308. Intermountain Low & Black Sagebrush Steppe & Shrubland

A3223. Artemisia bigelovii Steppe & Shrubland Alliance

Type Concept Sentence: Shrub and shrub-herbaceous vegetation dominated by *Artemisia bigelovii* occurring in the Tularosa Basin of southern New Mexico and the Colorado Plateau in southwestern Utah and northern Arizona and near canyon rims and along escarpments in southeastern Colorado.

OVERVIEW

Scientific Name: *Artemisia bigelovii* Steppe & Shrubland Alliance
Common Name (Translated Scientific Name): Bigelow's Sagebrush Steppe & Shrubland Alliance
Colloquial Name: Bigelow's Sagebrush Steppe & Shrubland

Type Concept: The structure of this vegetation may be shrub-herbaceous or shrub-dominated. The shrub layer is characterized by a sparse to moderately dense dwarf-shrub layer that is dominated or codominated by *Artemisia bigelovii*. Dwarf-shrub associates from the shortgrass steppe include *Frankenia jamesii, Glossopetalon spinescens var. meionandrum, Krascheninnikovia lanata*, and *Yucca glauca*, which may be present to codominant. On the Colorado Plateau, stands may be codominated by *Ephedra* spp., *Eriogonum corymbosum, Parryella filifolia*, or *Purshia stansburiana*. *Gutierrezia sarothrae* and species of *Atriplex* are common in most stands. Scattered *Juniperus* spp. and *Pinus edulis* trees are occasionally present. A sparse to dense graminoid layer is usually present. Dominant grasses include *Aristida purpurea, Achnatherum hymenoides (= Oryzopsis hymenoides), Bouteloua gracilis, Hesperostipa neomexicana (= Stipa neomexicana), Pleuraphis jamesii (= Hilaria jamesii), Sporobolus cryptandrus*, or less commonly *Pascopyrum smithii*. On the Colorado Plateau, forbs are generally sparse. However, cushion plants are common on shortgrass steppe slopes. Other forbs, such as *Astragalus missouriensis, Heterotheca villosa, Melampodium cinereum, Picradeniopsis oppositifolia, Stanleya pinnata*, and *Zinnia grandiflora*, may be present. Exotic annuals, such as *Bromus arvensis (= Bromus japonicus), Bromus tectorum, Descurainia sophia*, and *Salsola kali*, may be present to common depending on disturbance and the amount of seasonal precipitation. This alliance is reported from the Tularosa Basin of southern New Mexico and the Colorado Plateau in southwestern

Utah and northern Arizona and near canyon rims and along escarpments in southeastern Colorado. Sites include gentle to moderately steep shale hillslopes and mesas in Arizona and Utah and escarpment and canyon breaks and shaly plains in the shortgrass steppe west to the foothills near the Colorado Front Range. Soils are typically shallow, well-drained, calcareous loams, clay loams, and clays derived from limestone, sandstone, shale and alluvium. The soil surface has high cover of bare soil and rock.

Classification Comments: The vegetation in some stands included in this alliance may be too sparse to be classified as dwarf-shrubland.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics:

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has sparse to moderately dense cover of microphyllous evergreen dwarf-shrubs less than 0.5 m tall. A sparse to dense graminoid layer dominated by perennial medium-tall bunch grasses and short grasses is also present and may be more prominent than the shrubs. Forb cover is generally sparse. Scattered scale-leaved and needle-leaved evergreen trees may be present.

Floristics: The vegetation is characterized by a sparse to moderately dense dwarf-shrub layer that is dominated or codominated by *Artemisia bigelovii*. Dwarf-shrub associates for the shortgrass steppe include *Frankenia jamesii, Glossopetalon spinescens var. meionandrum, Krascheninnikovia lanata*, and *Yucca glauca*, which may be present to codominant. Scattered shrubs such as *Atriplex canescens, Cercocarpus montanus, Ericameria nauseosa (= Chrysothamnus nauseosus), Lycium pallidum*, and *Rhus trilobata* are occasionally present. On the Colorado Plateau, stands may be codominated by *Atriplex confertifolia, Ephedra* spp., *Eriogonum corymbosum, Opuntia polyacantha var. polyacantha, Cylindropuntia whipplei (= Opuntia whipplei), Parryella filifolia*, or *Purshia stansburiana*. *Gutierrezia sarothrae* and species of *Atriplex* and *Yucca* are common in most stands. Scattered *Juniperus* spp. and *Pinus edulis* trees are occasionally present. A sparse to dense graminoid layer is usually present and may take prominence over shrubs. Dominant grasses include *Achnatherum hymenoides (= Oryzopsis hymenoides), Aristida purpurea, Bouteloua gracilis, Hesperostipa neomexicana (= Stipa neomexicana), Muhlenbergia torreyi, Pascopyrum smithii, Pleuraphis jamesii (= Hilaria jamesii), Poa fendleriana, Sporobolus airoides*, and *Sporobolus cryptandrus*. On the Colorado Plateau, forbs are generally sparse. However, on shortgrass steppe slopes, cushion plants such as *Arenaria hookeri, Eriogonum lachnogynum, Tetraneuris acaulis (= Hymenoxys acaulis)*, and *Paronychia sessiliflora* are common. Other forbs, such as *Astragalus missouriensis, Heterotheca villosa, Melampodium cinereum, Picradeniopsis oppositifolia, Stanleya pinnata*, and *Zinnia grandiflora*, are usually present. Exotic annuals, such as *Bromus arvensis (= Bromus japonicus), Bromus tectorum, Salsola kali*, and *Descurainia sophia*, may be present to common depending on disturbance, and amount and season of precipitation.

ENVIRONMENT & DYNAMICS

Environmental Description: Elevation ranges from 1350-1890 m. Climate is semi-arid with 22-35 cm of mean annual precipitation occurring during the growing season. Sites are nearly flat to moderate and include shale hillslopes and mesas in Arizona and breaks and shale plains in the shortgrass steppe west to the foothills near the Colorado Front Range. Soils are typically shallow, well-drained, calcareous loams, clay loams, and clays derived from limestone, sandstone, shale and alluvium. The soil surface has high cover of bare soil and rock.

Dynamics: Livestock grazing must be managed carefully to prevent the loss of highly palatable grasses such as *Schizachyrium scoparium, Bouteloua curtipendula, Hesperostipa neomexicana*, and *Achnatherum hymenoides*. The effects of fire on this vegetation are unknown. However, the vegetation is usually too sparse to carry a fire under most circumstances.

DISTRIBUTION

Geographic Range: Stands included in this shrubland alliance are found in Arizona, western Colorado and Utah on the Colorado Plateau and in southeastern Colorado.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **><** *Artemisia bigelovii/Bouteloua gracilis* Plant Community (Shaw et al. 1989)
- **><** Limestone Breaks SCS Range Site #58 (Soil Conservation Service n.d.)
- **<** SRM Cover Type #408 - Other Sagebrush Types (Shiflet 1994)
- **><** Sandstone Breaks SCS Range Site #53 (Soil Conservation Service n.d.)
- **><** Shaley Plains SCS Range Site (Soil Conservation Service n.d.)

LOWER LEVEL UNITS

Associations:

- CEGL000276 *Artemisia bigelovii* Shrubland
- CEGL000990 *Artemisia bigelovii / Achnatherum hymenoides* Shrubland
- CEGL001742 *Artemisia bigelovii / Bouteloua gracilis* Dwarf-shrub Grassland

AUTHORSHIP

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

REFERENCES

References: Faber-Langendoen et al. 2017b, Shaw et al. 1989, Shiflet 1994, Soil Conservation Service 1978, Soil Conservation Service n.d.

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G308. Intermountain Low & Black Sagebrush Steppe & Shrubland

A2565. Artemisia frigida Dwarf-shrubland Alliance

Type Concept Sentence: This shrubland alliance is dominated by the dwarf-shrub *Artemisia frigida* and is described from the Colorado Plateau and western slope of the southern Rocky Mountains.

OVERVIEW

Scientific Name: *Artemisia frigida* Dwarf-shrubland Alliance
Common Name (Translated Scientific Name): Prairie Sagewort Dwarf-shrubland Alliance
Colloquial Name: Prairie Sagewort Dwarf-shrubland

Type Concept: This shrubland alliance is dominated by the dwarf-shrub *Artemisia frigida*. Total shrub cover ranges from 5-85%. Other common shrubs and dwarf-shrubs include *Artemisia nova, Chrysothamnus viscidiflorus, Gutierrezia sarothrae, Krascheninnikovia lanata, Tetradymia canescens*, and the cactus *Pediocactus simpsonii*. The understory is dominated by perennial graminoids, including *Achnatherum hymenoides, Bouteloua gracilis*, and *Poa secunda*. Other herbaceous species often include low-growing cushion plants. Other herbaceous associates may include *Festuca brachyphylla, Hymenoxys richardsonii, Paronychia sessiliflora, Penstemon strictus, Poa fendleriana, Stenotus armerioides, Pleiacanthus spinosus (= Lygodesmia spinosa)*, and *Tetraneuris torreyana*. Cryptogamic cover varies from low to moderate and is occasionally as high as 55%, mostly composed of crustose and foliose lichens. This alliance is described from the Colorado Plateau and western slope of the southern Rocky Mountains. Stands occur on mid to upper slopes and tops of mesas, hills and ridges, but also midslopes of mountains, active slopes and on valley terraces. Site are flat to moderately steep (to 53% slope) on all aspects between 2315 and 2965 m elevation.

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Shrublands of the Colorado Plateau and western slope of the southern Rocky Mountains in which *Artemisia frigida* is dominant and has >50% of the total shrub cover, typically found on exposed, wind-blown sites. The other characteristic species are perennial graminoids.

VEGETATION

Physiognomy and Structure: This alliance is characterized by a sparse to moderate cover of a suffrutescent plant that occurs as both a dwarf-shrub and forb. Cespitose graminoids dominate the understory.

Floristics: Vegetation is dominated by the suffrutescent dwarf-shrub *Artemisia frigida*. Total shrub cover ranges from 5-85%. Other common shrubs and dwarf-shrubs include *Artemisia nova, Chrysothamnus viscidiflorus, Gutierrezia sarothrae, Krascheninnikovia lanata, Tetradymia canescens*, and the cactus *Pediocactus simpsonii*. The understory is dominated by perennial graminoids, including *Achnatherum hymenoides, Bouteloua gracilis*, and *Poa secunda*. Other herbaceous species often include low-growing cushion plants. Other herbaceous associates may include *Festuca brachyphylla, Hymenoxys richardsonii, Paronychia sessiliflora, Penstemon strictus, Poa fendleriana, Stenotus armerioides, Pleiacanthus spinosus (= Lygodesmia spinosa)*, and *Tetraneuris torreyana*. Cryptogamic cover varies from low to moderate and is occasionally as high as 55%, mostly composed of crustose and foliose lichens.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands occur on mid to upper slopes and tops of mesas, hills and ridges, but also midslopes of mountains, active slopes and on valley terraces. Site are flat to moderately steep (to 53% slope) on all aspects between 2315 and 2965 m elevation. Various amounts of bedrock, large and small rocks, and bare soil compose the majority of the ground surface, with sparse to low cover of litter. Parent materials are frequently volcanic (basalt) rocks that are present as bedrock, boulders and gravel, Mesozoic shale, and Quaternary landslide deposits. Soils are shallow, rapidly drained and range from coarse sand and sandy loam to sandy clay loam and sandy clay.

Dynamics: Dry, windswept conditions appear to be important for this alliance.

DISTRIBUTION

Geographic Range: This shrubland is described from the Colorado Plateau and western slope of the southern Rocky Mountains.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Associations:

- CEGL002344 *Artemisia frigida - (Bouteloua gracilis, Achnatherum hymenoides, Poa secunda)* - Lichens Rocky Mesa Dwarf-shrubland

AUTHORSHIP

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

REFERENCES

References: Faber-Langendoen et al. 2017b

M169. Great Basin-Intermountain Tall Sagebrush Steppe & Shrubland

This macrogroup includes the big sagebrush shrubland and shrub-steppe that is a matrix and large-patch type throughout much of the intermountain western U.S. and that is dominated by *Artemisia tridentata, Purshia tridentata*, and several local dominants such as *Artemisia cana* and *Artemisia tripartita ssp. tripartita*.

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
3.B.1.Ne.3.a. M169 Great Basin-Intermountain Tall Sagebrush Steppe & Shrubland

G303. Intermountain Dry Tall Sagebrush Steppe & Shrubland

Type Concept Sentence: This widely distributed, matrix-forming shrubland group is concentrated in the drier, more southerly portions of the interior western U.S., but extends into more xeric portions of the Columbia Plateau, Rocky Mountains, across Wyoming, then northeast into the northwestern Great Plains. Vegetation is typically dominated by *Artemisia tridentata ssp. wyomingensis* and *Artemisia tridentata ssp. tridentata*, sometimes codominated by xeric shrubs such as *Atriplex* spp., with a typically sparse to open herbaceous layer dominated by dry-site graminoids.

OVERVIEW

Scientific Name: *Artemisia tridentata ssp. wyomingensis - Artemisia tridentata ssp. tridentata* Steppe & Shrubland Group
Common Name (Translated Scientific Name): Wyoming Big Sagebrush - Basin Big Sagebrush Steppe & Shrubland Group
Colloquial Name: Big Sagebrush - Mixed Shrub Dry Steppe & Shrubland

Type Concept: This widely distributed, matrix-forming shrubland group is concentrated in the drier, more southerly portions of the interior western U.S., especially in the Great Basin and Colorado Plateau, but extends into more xeric portions of the Columbia Plateau, Wyoming steppe, Rocky Mountains, and northeast into the northwestern Great Plains. Stands are dominated by *Artemisia tridentata ssp. wyomingensis* and *Artemisia tridentata ssp. tridentata* and, in some cases, codominated by xeric shrubs such as *Atriplex canescens, Atriplex confertifolia, Ephedra nevadensis, Ephedra viridis, Ericameria nauseosa, Grayia spinosa*, or *Sarcobatus vermiculatus*. Other common shrubs include *Amelanchier utahensis, Artemisia frigida, Atriplex gardneri, Chrysothamnus* spp., *Ericameria* spp., *Peraphyllum ramosissimum, Purshia tridentata*, and *Tetradymia* spp. If present, the herbaceous layer ranges from sparse and patchy to moderately dense and is typically dominated by dry-site graminoids with low cover of forbs. Characteristic graminoids include *Achnatherum hymenoides, Achnatherum lettermanii (= Stipa lettermanii), Achnatherum pinetorum, Achnatherum thurberianum, Bouteloua gracilis, Bromus tectorum, Carex filifolia, Distichlis spicata, Elymus albicans, Elymus elymoides, Hesperostipa comata (= Stipa comata), Leymus ambiguus, Leymus salinus, Pleuraphis jamesii, Poa fendleriana, Poa secunda, Pseudoroegneria spicata, Sporobolus airoides*, and *Sporobolus cryptandrus*. A sparse layer of cold-deciduous needle-leaved or scale-leaved evergreen trees may occasionally be emergent over the shrubs. This group occurs on flat to steeply sloping upland slopes on alluvial fans and terraces, toeslopes, lower and middle slopes, draws, badlands, and foothills. Stands are found at elevations as low as 500 m in the northwestern Great Plains to 2500 m in the Rocky Mountains and Colorado Plateau. Sites with little slope tend to have deep soils, while those with steeper slopes have shallow to moderately deep soils. Climate is mostly semi-arid but ranges from semi-arid in the western Great Basin to subhumid in the northern Great Plains and Rocky Mountains with much of the precipitation falling primarily as snow. The amount and reliability of growing-season moisture increase eastward and with increasing elevation.

Classification Comments: This group tends to occur in drier biophysical settings than the two similar tall sagebrush groups (G302, G304). Hence, it tends to have a less abundant herbaceous component, with the predominant grasses being more adapted to drier conditions. In addition, the co-occurring shrub taxa will include more desert species as well as cacti. This is a slid group in concept, but the specific associations included in it need to be reviewed and will require some adjustment.

Similar NVC Types:
- G302 Intermountain Mesic Tall Sagebrush Steppe & Shrubland
- G304 Intermountain Mountain Big Sagebrush Steppe & Shrubland

Diagnostic Characteristics: Stands are dominated by *Artemisia tridentata ssp. wyomingensis* or *Artemisia tridentata ssp. tridentata* and, in some cases, codominated by dry-site shrubs such as *Atriplex canescens, Ephedra nevadensis, Ephedra viridis, Ericameria nauseosa*, or *Sarcobatus vermiculatus*. If present, the herbaceous component layer ranges from sparse and patchy to moderately dense and is typically dominated by dry-site graminoids with low cover of forbs. Characteristic graminoids include *Achnatherum hymenoides, Achnatherum lettermanii, Achnatherum pinetorum, Achnatherum thurberianum, Bouteloua gracilis, Bromus tectorum, Carex filifolia, Distichlis spicata, Elymus albicans, Elymus elymoides, Hesperostipa comata, Leymus ambiguus, Leymus salinus, Pleuraphis jamesii, Poa fendleriana, Poa secunda, Pseudoroegneria spicata, Sporobolus airoides*, and *Sporobolus cryptandrus*. Associated species tend to include more semi-desert taxa with core distribution in the Great Basin and Colorado Plateau regions. Warm-season grasses are common in the southern and eastern portions of its range.

VEGETATION

Physiognomy and Structure: This deciduous scrub and grassland group is structurally characterized by open to dense sagebrush with associated shrubs interspersed and/or a moderately dense understory of perennial grasses.

Floristics: Stands are dominated by *Artemisia tridentata ssp. wyomingensis* and *Artemisia tridentata ssp. tridentata* and, in some cases, codominated by *Atriplex canescens, Atriplex confertifolia, Ephedra nevadensis, Ephedra viridis, Ericameria nauseosa, Grayia spinosa*, or *Sarcobatus vermiculatus*. Other common shrubs include *Artemisia frigida, Atriplex gardneri, Chrysothamnus* spp., *Ericameria* spp., *Krascheninnikovia lanata, Peraphyllum ramosissimum, Prunus virginiana, Purshia tridentata, Symphoricarpos*

longiflorus, and *Tetradymia* spp. A sparse layer of cold-deciduous needle-leaved or scale-leaved evergreen trees may occasionally be emergent over the shrubs. The herbaceous layer may be sparse to strongly dominated by graminoids, including *Achnatherum hymenoides, Achnatherum lettermanii (= Stipa lettermanii), Achnatherum pinetorum, Achnatherum thurberianum, Bouteloua gracilis, Bromus tectorum, Carex filifolia, Elymus albicans, Elymus elymoides, Elymus lanceolatus, Festuca idahoensis, Hesperostipa comata (= Stipa comata), Leymus ambiguus, Pleuraphis jamesii, Poa fendleriana, Poa secunda, Pseudoroegneria spicata, Sporobolus airoides*, and *Sporobolus cryptandrus*. Trees found across the range include *Cercocarpus ledifolius, Juniperus monosperma, Juniperus occidentalis, Juniperus osteosperma, Juniperus scopulorum, Pinus edulis, Pinus flexilis, Pinus jeffreyi, Pinus monophylla, Pinus ponderosa, Populus tremuloides, Quercus gambelii, Quercus garryana*, and *Yucca brevifolia*.

ENVIRONMENT & DYNAMICS

Environmental Description: This shrubland group is widely distributed in the western U.S., at elevations as low as 500 m in the northwestern Great Plains to 2500 m in the Rocky Mountains and Colorado Plateau. This group occurs on flat to steeply sloping upland slopes on alluvial fans and terraces, toeslopes, lower and middle slopes, draws, badlands, and foothills. *Climate:* Climate ranges from arid in the western Great Basin to subhumid in the northern plains and Rocky Mountains with much of the precipitation falling primarily as snow. The amount and reliability of growing-season moisture increase eastward and with increasing elevation. *Soil/substrate/hydrology:* Sites with little slope tend to have deep soils while those with steeper slopes have shallow to moderately deep soils. Soil texture is loamy sand, loam, sandy loam, or clay loam (Hansen and Hoffman 1988), and there is often a significant amount of coarse fragments in the soil profile.

Dynamics: The natural fire regime of this group likely maintains patchy distribution of shrubs, so the general aspect of the vegetation is that of a grassland. Shrubs may increase following heavy grazing and/or with fire suppression, particularly in moist portions of the northern Columbia Plateau where it forms a landscape mosaic pattern with shallow-soil scabland shrublands. Response to grazing can be variable depending on the type of grazer and the season in which grazing occurs. *Hesperostipa comata* can increase in abundance in response to either grazing or fire. Microphytic crust is very important in this group.

DISTRIBUTION

Geographic Range: This widely distributed, matrix-forming shrubland group is concentrated in the drier, more southerly portions of the interior western U.S., especially in the Great Basin and Colorado Plateau, but extends into more xeric portions of the Columbia Plateau, Wyoming steppe, Rocky Mountains, and northeast into the northwestern Great Plains.

Spatial Scale & Pattern [optional]: Matrix, Large patch
Nations: CA, US
States/Provinces: BC, CA, CO, ID, MT, ND, NV, OR, SD?, UT, WY
TNC Ecoregions [optional]: 4:C, 6:C, 8:C, 9:C, 10:C, 11:C, 12:C, 18:C, 19:C, 20:C, 26:C, 27:C
USFS Ecoregions (2007): 313A:CC, 313B:CC, 322A:CC, 331A:CP, 331D:CC, 331F:CC, 331G:CC, 331H:CC, 331J:C?, 341A:CC, 341B:CC, 341C:CC, 342A:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:CC, 342I:CC, M242C:CC, M261G:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333D:CC, M334A:CC, M341A:CC, M341B:CC, M341C:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Arches, Bighorn Canyon, Black Canyon of the Gunnison?, Bryce Canyon, Canyon de Chelly, Canyonlands, Capitol Reef, Colorado, Curecanti, Death Valley, Dinosaur, Fossil Butte, Glen Canyon, Golden Spike, Grand Canyon, Hovenweep, John Day Fossil Beds, Mesa Verde, Natural Bridges, Theodore Roosevelt, Zion); USFS (Arapaho-Roosevelt, Custer, Medicine Bow, Shoshone, Thunder Basin); USFWS (Ouray)

CONFIDENCE LEVEL

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

SYNONYMY

- **><** Basin Big Sagebrush (401) (Shiflet 1994)
- **=** Great Basin-Colorado Plateau sagebrush semi-desert (West 1983a)
- **><** Wyoming Big Sagebrush (403) (Shiflet 1994)

LOWER LEVEL UNITS

Alliances:
- A3194 *Artemisia tridentata ssp. tridentata - Artemisia tridentata ssp. xericensis* Dry Steppe & Shrubland Alliance
- A3198 *Artemisia tridentata* - Mixed Shrub Dry Steppe & Shrubland Alliance
- A3184 *Artemisia tridentata ssp. wyomingensis* Dry Steppe & Shrubland Alliance

AUTHORSHIP

Primary Concept Source: N.E. West (1983a)
Author of Description: M.E. Hall and K.A. Schulz

Acknowledgments:
Version Date: 11/06/2015
Classif Resp Region: West
Internal Author: MEH/KAS 3-10, mod. GK 8-15, mod. KAS 11-15

REFERENCES

References: Baker and Kennedy 1985, Barbour and Billings 1988, Barbour and Major 1988, Blackburn and Tueller 1970, Brown 1982a, Brown et al. 1979, Chappell et al. 1997, Daubenmire 1970, Ecosystems Working Group 1998, Faber-Langendoen et al. 2017a, Hansen and Hoffman 1988, Hironaka et al. 1983, Holland and Keil 1995, Knight 1994, Mueggler and Stewart 1980, Shiflet 1994, West 1983a, West 1983c

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G303. Intermountain Dry Tall Sagebrush Steppe & Shrubland

A3198. Artemisia tridentata - Mixed Shrub Dry Steppe & Shrubland Alliance

Type Concept Sentence: Stands in this alliance have a mixed shrub canopy codominated by *Artemisia tridentata* with dry-site shrub species such as *Atriplex canescens, Atriplex confertifolia, Ephedra aspera, Ephedra viridis, Ephedra nevadensis, Grayia spinosa, Sarcobatus vermiculatus*, or *Tetradymia canescens* present to codominant. The sparse to moderately dense herbaceous layer is dominated by perennial graminoids with lower cover of sometimes diverse forbs characteristic of semi-arid upland sites.

OVERVIEW

Scientific Name: *Artemisia tridentata* - Mixed Shrub Dry Steppe & Shrubland Alliance
Common Name (Translated Scientific Name): Big Sagebrush - Mixed Shrub Dry Steppe & Shrubland Alliance
Colloquial Name: Big Sagebrush - Mixed Shrub Dry Steppe & Shrubland

Type Concept: Stands in this alliance have a mixed shrub canopy codominated by *Artemisia tridentata* with dry-site shrub species such as *Atriplex canescens, Atriplex confertifolia, Ephedra aspera (= Ephedra fasciculata), Ephedra viridis, Ephedra nevadensis, Grayia spinosa, Sarcobatus vermiculatus*, or *Tetradymia canescens* present to codominant. The sparse to moderately dense herbaceous layer is dominated by perennial graminoids with lower cover of sometimes diverse forbs characteristic of semi-arid upland sites. Characteristic dry-site understory species include *Achnatherum hymenoides, Achnatherum speciosum, Bouteloua gracilis, Bromus tectorum, Elymus elymoides, Elymus lanceolatus, Hesperostipa comata (= Stipa comata), Leymus cinereus, Opuntia polyacantha, Phlox hoodii, Pleuraphis jamesii, Poa fendleriana, Poa secunda, Sphaeralcea coccinea*, and *Sporobolus cryptandrus*. This dry-site shrubland alliance is distributed throughout the central and southern interior western U.S., especially in the Great Basin and Colorado Plateau regions. Stands occur on flat to steeply sloping upland sites, on a wide variety of landform positions such as alluvial fans and plains, plateaus, mesas and foothills. Soil texture is loamy sand, loam, sandy loam, or clay loam, and there is often a significant amount of coarse fragments in the soil profile.

Classification Comments: This is a weak artificial alliance. It would be better to further develop this alliance using more biogeographic or environmental (stabilized dunes) information, but the analysis is not done. Big sagebrush subspecies include *Artemisia tridentata ssp. tridentata, Artemisia tridentata ssp. xericensis*, and *Artemisia tridentata ssp. wyomingensis*.

Internal Comments:
Other Comments:

Similar NVC Types:
- A3194 *Artemisia tridentata ssp. tridentata - Artemisia tridentata ssp. xericensis* Dry Steppe & Shrubland Alliance: is not codominated by non-sagebrush shrubs.

Diagnostic Characteristics: Stands in this dry shrubland alliance have a mixed shrub canopy codominated by *Artemisia tridentata* with dry-site shrub species such as *Atriplex canescens, Atriplex confertifolia, Ephedra aspera, Ephedra viridis, Ephedra nevadensis, Grayia spinosa, Peraphyllum ramosissimum, Purshia tridentata, Sarcobatus vermiculatus*, or *Tetradymia canescens*. Characteristic dry shrubland understory species include *Achnatherum hymenoides, Achnatherum speciosum, Bouteloua gracilis, Elymus elymoides, Elymus lanceolatus, Hesperostipa comata, Leymus cinereus, Phlox hoodii, Pleuraphis jamesii, Poa fendleriana, Poa secunda, Sphaeralcea coccinea*, and *Sporobolus cryptandrus*.

VEGETATION

Physiognomy and Structure: The vegetation in this alliance is characterized by a moderate to dense (25-70%) cover of microphyllous evergreen shrubs, usually 0.5-1 m in height. Cespitose graminoids are usually prominent, often matching the shrubs in height and cover. Forb species may be frequent, but usually contribute little canopy cover. With increasing summer rain in the eastern portion

of the range, there is a corresponding increase in the abundance of sod-forming grasses as compared to bunchgrasses. There may be significant cover on the ground surface by mosses and lichens, or a cryptogamic soil crust.

Floristics: Stands in this alliance have a mixed shrub canopy codominated by *Artemisia tridentata* with dry-site shrub species such as *Atriplex canescens, Atriplex confertifolia, Ephedra aspera (= Ephedra fasciculata), Ephedra viridis, Ephedra nevadensis, Grayia spinosa, Sarcobatus vermiculatus*, or *Tetradymia canescens* present to codominant. The sparse to moderately dense herbaceous layer is dominated by perennial graminoids with lower cover of sometimes diverse forbs characteristic of semi-arid upland sites. Characteristic dry-site understory species include *Achnatherum hymenoides, Achnatherum speciosum, Bouteloua gracilis, Bromus tectorum, Elymus elymoides, Elymus lanceolatus, Hesperostipa comata (= Stipa comata), Leymus cinereus, Opuntia polyacantha, Phlox hoodii, Pleuraphis jamesii, Poa fendleriana, Poa secunda, Sphaeralcea coccinea*, and *Sporobolus cryptandrus*.

ENVIRONMENT & DYNAMICS

Environmental Description: This dry-site shrubland alliance is distributed throughout the central and southern interior western U.S., especially in the Great Basin and Colorado Plateau regions. Climate is semi-arid with the amount and reliability of growing-season moisture increasing eastward and with increasing elevation. Stands occur on flat to steeply sloping upland sites, on a wide variety of landform positions. These include alluvial fans and terraces, toeslopes, lower and middle slopes, draws, badly eroded badland slopes, and foothills. Sites with little slope tend to have deep soils, while those with steeper slopes have shallow to moderately deep soils. Sloping sites tend to have southerly aspects. Soil texture is loamy sand, loam, sandy loam, or clay loam, and there is often a significant amount of coarse fragments in the soil profile.

Dynamics: Complex ecological interactions between fire regimes, grazing history, and climate patterns result in equally complex patterns of species structure and composition in *Artemisia tridentata*. These present corresponding difficulties in the classification of these shrublands, which have been compounded by the influence of human settlement and agricultural patterns. What follows is a summary of some of the influences of altered fire regimes and grazing history on *Artemisia tridentata* shrublands and shrub-herbaceous vegetation.

Artemisia tridentata ssp. wyomingensis shrublands may represent either drier or more disturbed examples of the *Artemisia tridentata ssp. wyomingensis* shrubland and shrub-herbaceous alliances. Shrub densities typically increase with overgrazing of the bunchgrass component or with increasing summer drought (West 1983c). There is considerable debate over whether present shrub-dominated stands are actually degraded "steppe" (e.g., shrub-herbaceous physiognomy), and if the stands will return to steppe with changes in grazing and fire management. *Artemisia tridentata* is inhibited by fire, and excessive grazing may decrease fire frequency due to consumption of herbaceous forage, resulting in increased shrub density. Conversely, invasion by non-native annual grasses (e.g., *Bromus tectorum* or *Bromus arvensis*) may increase fire frequency sufficiently to eliminate the shrubs from the stands (Hironaka et al. 1983). With a change in fire frequency, species composition will be altered as well (West 1983c). With a high fire frequency (every 2-5 years), perennial grasses and shrubs are eliminated and non-native annual grasses dominate. At fire-return intervals of 10-30 years, short-lived resprouting shrubs such as *Chrysothamnus* or *Tetradymia* spp. dominate. At fire intervals of 30-70 years, a mixture of perennial bunchgrasses and shrubs is maintained. Finally, in the complete absence of fire, deep-rooted shrubs such as *Artemisia tridentata* become the theoretical dominants.

DISTRIBUTION

Geographic Range: This broadly distributed alliance is found in the western United States on dry steppes with core distribution in the Great Basin and Colorado Plateau regions.

Nations: US
States/Provinces: AZ, CA, CO, ID, MT, NV, OR, UT, WY
TNC Ecoregions [optional]: 4:C, 5:C, 11:C, 12:C, 13:C, 15:C, 16:C, 17:C
USFS Ecoregions (2007): 262A:CC, 322A:CC, 341D:CC, 341F:CC, 342B:CC, M261A:CC, M261D:CC, M261E:CC, M261G:CC, M262A:CC, M262B:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Great Basin, Mojave)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** *Artemisia tridentata* (Big sagebrush) Alliance (Sawyer et al. 2009) [35.110.00]
- **=** *Artemisia tridentata* Shrubland Alliance (Evens et al. 2014)
- **=** *Artemisia tridentata* Shrubland Alliance (CNPS 2017) [35.110.00]
- **><** Big Sagebrush Scrub (#35210) (Holland 1986b)
- **<** Big Sagebrush Series (Sawyer and Keeler-Wolf 1995)
- **><** Great Basin Mixed Scrub (#35100) (Holland 1986b)

- **><** Sagebrush Steppe (#35300) (Holland 1986b)

LOWER LEVEL UNITS

Associations:
- CEGL001040 *Artemisia tridentata ssp. wyomingensis - Atriplex confertifolia* Shrubland
- CEGL000993 *Artemisia tridentata - Atriplex confertifolia* Shrubland
- CEGL001054 *Purshia tridentata - Artemisia tridentata ssp. tridentata* Shrubland
- CEGL001004 *Artemisia tridentata ssp. tridentata - Grayia spinosa* Shrubland
- CEPP005793 *Artemisia tridentata - Ericameria teretifolia* Shrubland
- CEGL001355 *Artemisia tridentata - Atriplex canescens - Sarcobatus vermiculatus / (Achnatherum hymenoides)* Shrubland
- CEGL005430 *Peraphyllum ramosissimum - Artemisia tridentata* Shrubland
- CEGL001002 *Artemisia tridentata - Ephedra nevadensis* Shrubland
- CEGL001056 *Purshia tridentata - Ericameria nauseosa* Shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Blackburn 1967, Blackburn et al. 1968a, Blackburn et al. 1968b, Blackburn et al. 1969a, Blackburn et al. 1969b, Blackburn et al. 1969c, Blackburn et al. 1969d, Blackburn et al. 1971, Brown 1971, CNPS 2017, Cheng 2004, Evens et al. 2014, Faber-Langendoen et al. 2017b, Ferren and Davis 1991, Francis 1983, Gordon and White 1994, Hanes 1976, Hironaka et al. 1983, Holland 1986b, Johnson 2000b, Keeler-Wolf et al. 2003a, Klein and Evens 2006, Paysen et al. 1980, Peterson 1984a, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Thomas et al. 2004, Tirmenstein 1999c, West 1983c, Wolfram and Martin 1965, Young et al. 1977, Young et al. 2007b

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G303. Intermountain Dry Tall Sagebrush Steppe & Shrubland

A3194. Artemisia tridentata ssp. tridentata - Artemisia tridentata ssp. xericensis Dry Steppe & Shrubland Alliance

Type Concept Sentence: Stands in this semi-arid shrubland alliance have a shrub canopy dominated by *Artemisia tridentata ssp. tridentata* or *Artemisia tridentata ssp. xericensis*. Other shrubs have low cover, except species that increase with disturbance such as *Gutierrezia sarothrae, Chrysothamnus viscidiflorus*, and *Ericameria nauseosa*. The understory, if present, is characterized by dry-site grass species.

OVERVIEW

Scientific Name: *Artemisia tridentata ssp. tridentata - Artemisia tridentata ssp. xericensis* Dry Steppe & Shrubland Alliance
Common Name (Translated Scientific Name): Basin Big Sagebrush - Foothill Big Sagebrush Dry Steppe & Shrubland Alliance
Colloquial Name: Basin Big Sagebrush - Foothill Big Sagebrush Dry Steppe & Shrubland

Type Concept: This semi-arid alliance occurs throughout much of the Intermountain West, especially in the Great Basin and Colorado Plateau. Stands in have a mixed shrub canopy dominated by *Artemisia tridentata ssp. tridentata* or *Artemisia tridentata ssp. xericensis*. Other shrubs have low cover, except species that increase with disturbance such as *Gutierrezia sarothrae, Chrysothamnus viscidiflorus*, and *Ericameria nauseosa*. Characteristic dry shrubland understory species include *Achnatherum hymenoides, Achnatherum lettermanii, Bouteloua gracilis, Distichlis spicata, Pascopyrum smithii, Pleuraphis jamesii, Poa secunda, Sporobolus airoides*, and *Sporobolus cryptandrus*. The non-native, invasive annual grass *Bromus tectorum* may be present and dominant in disturbed stands. Sites supporting this alliance include sloping fans, footslopes, rolling hills, swales, draws, and deep, well-drained alluvial bottomlands. Soils are deep, fine- to medium-textured alluvial soils with some source of subirrigation during the summer season, but moderately deep upland soils with ample moisture storage also support these shrublands. Some stands occur on deep, sandy soils, or soils that are highly calcareous.

Classification Comments: Associations with undetermined subspecies of *Artemisia tridentata* from former *Artemisia tridentata* Shrubland Alliance (A.829) were reviewed and placed into either *Artemisia tridentata ssp. wyomingensis* Dry Steppe & Shrubland Alliance (A3184) or *Artemisia tridentata ssp. tridentata - Artemisia tridentata ssp. xericensis* Dry Steppe & Shrubland Alliance (A3194). More review would increase confidence of placement. *Artemisia tridentata / Ericameria nauseosa* Shrubland (CEGL000998) is currently a broadly defined association that may need to be split into an *Artemisia tridentata ssp. wyomingensis / Ericameria*

nauseosa shrubland association and an *Artemisia tridentata ssp. tridentata / Ericameria nauseosa* shrubland association after more data are available.

Internal Comments:
Other Comments:

Similar NVC Types:
- A3198 *Artemisia tridentata* - Mixed Shrub Dry Steppe & Shrubland Alliance: is codominated by non-sagebrush shrubs.

Diagnostic Characteristics: Stands in this semi-arid shrubland alliance are dominated by *Artemisia tridentata ssp. tridentata* or *Artemisia tridentata ssp. xericensis*. Characteristic herbaceous species include *Achnatherum hymenoides, Achnatherum lettermanii, Bouteloua gracilis, Distichlis spicata, Pascopyrum smithii, Pleuraphis jamesii, Poa secunda, Sporobolus airoides*, and *Sporobolus cryptandrus*.

VEGETATION

Physiognomy and Structure: The shrublands in this alliance are characterized by a open to dense (10-75%) cover of microphyllous evergreen shrubs, usually 1-2 m in height. Cespitose graminoids are scattered in the shrub matrix and can occasionally match the shrubs in height. A sparse, emergent layer of scale-leaved or needle-leaved evergreen trees may also be present, but in many areas no trees are present. Forb species may be frequent, but are usually of low cover. With increasing summer rain in the southeastern edge of the range, there is an increase in the importance of sod-forming grasses in comparison to bunchgrasses. In many areas, undisturbed stands in this alliance will have a cryptogamic soil crust composed of a mix of lichens, tiny mosses, and bacteria.

Floristics: Stands in this semi-arid shrubland alliance have a mixed shrub canopy dominated by *Artemisia tridentata ssp. tridentata* or *Artemisia tridentata ssp. xericensis*. Other shrubs have low cover, except species that increase with disturbance such as *Gutierrezia sarothrae, Chrysothamnus viscidiflorus*, and *Ericameria nauseosa*. Characteristic dry shrubland understory species include *Achnatherum hymenoides, Achnatherum lettermanii, Bouteloua gracilis, Distichlis spicata, Pascopyrum smithii, Pleuraphis jamesii, Poa secunda, Sporobolus airoides*, and *Sporobolus cryptandrus*. The non-native, invasive annual grass *Bromus tectorum* may be present and dominant in disturbed stand. Forbs are generally of low importance and are highly variable across the range, but may be diverse in some stands. Common forbs include species of *Astragalus, Oenothera, Eriogonum*, and *Erigeron*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs throughout the Intermountain West from the western Great Basin to the Columbia Basin and Colorado Plateau at elevations ranging from 240 m in the Columbia Basin up to 2500 m. The climate where this alliance occurs is semi-arid with annual precipitation ranging from 18-40 cm and high inter-annual variation. Much of the precipitation falls as snow, and growing-season drought is characteristic. Temperatures are continental with large annual and diurnal variation. In drier regions, these shrublands are usually associated with perennial or ephemeral stream drainages with water tables less than 3 m from the soil surface. Sites supporting this alliance include sloping fans, footslopes, rolling hills, swales, draws, and deep, well-drained alluvial bottomlands. Soils are deep, fine- to medium-textured alluvial soils with some source of subirrigation during the summer season, but moderately deep upland soils with ample moisture storage also support these shrublands. Some stands occur on deep, sandy soils, or soils that are highly calcareous (Hironaka et al. 1983). Although this alliance may grade into sites with alkaline soils at the edge of internally drained basins, *Artemisia tridentata* is a non-halophyte and requires low salinity for optimum growth. The importance of perennial bunchgrasses, the most typical herbaceous associates, is favored with greater spring and summer rain, which increases northward and eastward. Because of the deep alluvial soils, stands have been converted to agriculture in much of the range of the alliance. Adjacent vegetation is highly variable, but some common adjacent communities include *Juniperus occidentalis-*, *Pinus ponderosa-*, and *Cercocarpus ledifolius*-dominated woodlands, as well as shrublands dominated by *Artemisia tridentata ssp. vaseyana*.

Dynamics: Complex ecological interactions between fire regimes, grazing history, and climate patterns result in equally complex patterns of species structure and composition in *Artemisia tridentata* stands. These present corresponding difficulties in the classification of these shrublands, which have been compounded by the influence of human settlement and agricultural patterns. What follows is a summary of some of the influences of altered fire regimes and grazing history on *Artemisia tridentata* shrublands and shrub-herbaceous vegetation.

Artemisia tridentata is inhibited by fire, and excessive grazing may decrease fire frequency due to consumption of herbaceous forage, resulting in increased shrub density. Conversely, invasion by non-native annual grasses (e.g., *Bromus tectorum*) may increase fire frequency sufficiently to eliminate the shrubs from the stands (Daubenmire 1970). With a change in fire frequency, species composition will be altered as well (West 1983c). With a high fire frequency (every 2-5 years), perennial grasses and shrubs are eliminated and non-native annual grasses dominate. At fire-return intervals of 10-30 years, short-lived resprouting shrubs such as *Chrysothamnus* or *Tetradymia* spp. dominate. At fire intervals of 30-70 years, a mixture of perennial bunchgrasses and shrubs is maintained. Finally, in the complete absence of fire, deep-rooted shrubs such as *Artemisia tridentata* become the dominant shrubs.

This alliance is often found in seasonal or intermittent stream drainages. Currently, it can often be found on the benches of perennial steams which have become restricted to a downcut channel, although these are generally in poor condition with a *Bromus tectorum* understory. It is likely that these habitats are a result of livestock grazing impacts.

DISTRIBUTION

Geographic Range: This broadly distributed alliance is found in the western United States on dry steppes with core distribution in the Great Basin and Colorado Plateau regions.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **>** *Artemisia tridentata / Sporobolus cryptandrus - Oryzopsis hymenoides* Plant Community (Francis 1986)
- **><** Big Sagebrush Scrub (#35210) (Holland 1986b)
- **><** Big Sagebrush Series (Sawyer and Keeler-Wolf 1995)
- **<** SRM Cover Type #401 - Basin Big Sagebrush (Shiflet 1994)
- **><** Western Shrub: 38: Great Basin Sagebrush (*Artemisia*) (Küchler 1964)

LOWER LEVEL UNITS

Associations:

- CEGL001545 *Artemisia tridentata / Sporobolus cryptandrus - Achnatherum hymenoides* Shrub Grassland
- CEGL000999 *Artemisia tridentata / Chrysothamnus viscidiflorus / (Poa secunda)* Shrubland
- CEGL001000 *Artemisia tridentata ssp. tridentata / Distichlis spicata* Shrubland
- CEGL001008 *Artemisia tridentata ssp. tridentata / Poa secunda* Shrubland
- CEGL000996 *Artemisia tridentata / Bouteloua gracilis - Pleuraphis jamesii* Shrubland
- CEGL001006 *Artemisia tridentata / Achnatherum hymenoides* Shrubland
- CEGL000995 *Artemisia tridentata / Bouteloua gracilis* Shrubland
- CEGL000997 *Artemisia tridentata / Bouteloua gracilis - Pascopyrum smithii* Shrubland
- CEGL001011 *Artemisia tridentata / Achnatherum lettermanii* Shrubland
- CEGL000998 *Artemisia tridentata / Ericameria nauseosa* Shrubland
- CEGL001013 *Artemisia tridentata* Upperzone Community Shrubland
- CEGL000991 *Artemisia tridentata* Shrubland
- CEGL002200 *Artemisia tridentata ssp. tridentata / Sporobolus airoides* Shrubland
- CEGL003826 *Artemisia tridentata ssp. tridentata / Sporobolus cryptandrus* Shrubland
- CEGL001015 *Artemisia tridentata ssp. tridentata / Pleuraphis jamesii* Shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Baker 1982b, Baker 1983b, Baker 1984a, Barbour and Major 1988, Barrows et al. 1977, Blackburn 1967, Blackburn et al. 1968a, Blackburn et al. 1968c, Blackburn et al. 1969a, Blackburn et al. 1969b, Blackburn et al. 1969c, Blackburn et al. 1969d, Blackburn et al. 1971, Branson et al. 1976, Britton et al. 1981, Caicco and Wellner 1983f, Caicco and Wellner 1983k, Chappell et al. 1997, Daubenmire 1970, DeVelice and Lesica 1993, Donart et al. 1978b, Eddleman and Jaindl 1994, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Fenemore 1970, Francis 1983, Francis 1986, Francis and Aldon 1983, Franklin and Dyrness 1973, Hansen et al. 1984, Harper and Jaynes 1986, Heinze et al. 1962, Hess 1981, Hironaka 1978, Hironaka et al. 1983, Holecheck and Stephenson 1983, Holland 1986b, Jameson et al. 1962, Jensen et al. 1988a, Johnson and Payne 1968, Johnson and Simon 1987, Jorgensen 1979, Keammerer 1977, Kittel et al. 1994, Kittel et al. 1999a, Kurzius 1981, Küchler 1964, Leary and Peterson 1984, Lesica and DeVelice 1992, Loope 1969, McArthur and Welch 1986, McLean 1970, Mooney 1985, Moretti 1979, Moretti and Brotherson 1982, Mueggler and Stewart 1980, Northcutt 1978, ORNHP unpubl. data, Poulton 1955, Ralston 1969, Reid et al. 1994, Rickard and Beatley 1965, Robertson 1971, Savage 1968, Sawyer and Keeler-Wolf 1995, Sheehy and Winward 1981, Shiflet 1994, Strong 1980,

Tiedemann et al. 1987, Tisdale 1986, Tisdale and Hironaka 1981, Tueller and Blackburn 1974, Tueller et al. 1966, Tweit and Houston 1980, USFS 1992, Warren et al. 1982, West 1983a, West 1983c

3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G303. Intermountain Dry Tall Sagebrush Steppe & Shrubland

A3184. Artemisia tridentata ssp. wyomingensis Dry Steppe & Shrubland Alliance

Type Concept Sentence: This semi-arid shrubland alliance is found in the western United States on dry steppes with core distribution in the Great Basin, Colorado Plateau and Wyoming and is characterized by an open to moderately dense shrub canopy dominated by *Artemisia tridentata ssp. wyomingensis*. Other shrubs have low cover, except species that increase with disturbance such as *Gutierrezia sarothrae, Chrysothamnus viscidiflorus*, and *Ericameria nauseosa*. This understory is a sparse to moderately dense herbaceous layer characterized by dry-site perennial graminoids such as *Achnatherum hymenoides, Bouteloua gracilis, Carex filifolia, Distichlis spicata, Elymus elymoides, Hesperostipa comata, Pleuraphis jamesii*, and *Poa fendleriana*.

OVERVIEW

Scientific Name: *Artemisia tridentata ssp. wyomingensis* Dry Steppe & Shrubland Alliance
Common Name (Translated Scientific Name): Wyoming Big Sagebrush Dry Steppe & Shrubland Alliance
Colloquial Name: Wyoming Big Sagebrush Dry Steppe & Shrubland

Type Concept: This broadly distributed semi-arid shrubland alliance is found in the western United States on dry sites with core distribution in the Great Basin, Colorado Plateau and Wyoming. Stands have open to moderately dense shrub canopy dominated by *Artemisia tridentata ssp. wyomingensis*. *Artemisia tridentata ssp. tridentata* may be present in some stands. Other shrubs have low cover, except species that increase with disturbance such as *Gutierrezia sarothrae, Chrysothamnus viscidiflorus*, and *Ericameria nauseosa*. This understory is a sparse to moderately dense herbaceous layer characterized by dry-site graminoids such as *Achnatherum hymenoides, Achnatherum pinetorum, Achnatherum thurberianum, Bouteloua gracilis, Carex filifolia, Distichlis spicata, Elymus albicans, Elymus elymoides, Elymus lanceolatus, Hesperostipa comata, Leymus ambiguus, Leymus salinus, Pleuraphis jamesii*, and *Poa fendleriana*. The non-native, invasive species *Agropyron cristatum, Bromus tectorum*, and *Psathyrostachys juncea* may be present and dominant in disturbed stands. This alliance occurs on flat to steeply sloping sites with southerly aspects. Sites with little slope tend to have deep soils, while those with steeper slopes have shallow to moderately deep soils. Soil texture is loamy sand, loam, sandy loam, or clay loam.

Classification Comments: Associations with undetermined subspecies of *Artemisia tridentata* from former *Artemisia tridentata* Shrubland Alliance (A.829) were reviewed and placed into either *Artemisia tridentata ssp. wyomingensis* Dry Steppe & Shrubland Alliance (A3184) or *Artemisia tridentata ssp. tridentata - Artemisia tridentata ssp. xericensis* Dry Steppe & Shrubland Alliance (A3194). More review would increase confidence of placement.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Stands in this dry-site alliance are dominated by *Artemisia tridentata ssp. wyomingensis*. Characteristic herbaceous species include *Achnatherum hymenoides, Achnatherum pinetorum, Achnatherum thurberianum, Bouteloua gracilis, Carex filifolia, Distichlis spicata, Elymus albicans, Elymus elymoides, Elymus lanceolatus, Hesperostipa comata, Leymus ambiguus, Leymus salinus, Pleuraphis jamesii*, and *Poa fendleriana*.

VEGETATION

Physiognomy and Structure: The vegetation in this alliance is characterized by a moderate to dense (25-70%) cover of microphyllous evergreen shrubs, usually 0.5-1 m in height. Cespitose graminoids are usually prominent, often matching the shrubs in height and cover. Forb species may be frequent, but usually contribute little canopy cover. With increasing summer rain in the eastern portion of the range, there is a corresponding increase in the abundance of sod-forming grasses as compared to bunchgrasses. There may be significant cover on the ground surface by mosses and lichens, or a cryptogamic soil crust.

Floristics: Stands in this dry-site shrublands alliance have an open to moderately dense shrub canopy dominated by *Artemisia tridentata ssp. wyomingensis*. *Artemisia tridentata ssp. tridentata* may be present in some stands. Other shrubs have low cover, except species that increase with disturbance such as *Gutierrezia sarothrae, Chrysothamnus viscidiflorus*, and *Ericameria nauseosa*. Characteristic dry shrubland understory species include *Achnatherum hymenoides, Achnatherum pinetorum, Achnatherum thurberianum, Bouteloua gracilis, Carex filifolia, Distichlis spicata, Elymus albicans, Elymus elymoides, Elymus lanceolatus, Hesperostipa comata, Leymus ambiguus, Leymus salinus, Pleuraphis jamesii*, and *Poa fendleriana*. The non-native, invasive species

Agropyron cristatum, Bromus tectorum, and *Psathyrostachys juncea* may be present and dominant in disturbed stands. Forbs form a minor and highly variable portion of this vegetation. Recurrent species include *Achillea millefolium, Balsamorhiza sagittata, Camelina microcarpa, Erigeron* spp., *Opuntia* spp., *Phlox* spp., and *Sphaeralcea coccinea*. Mosses and lichens, such as *Selaginella densa* and *Tortula ruralis*, may occur on bare ground, and in Washington and Idaho stands may cover up to 50% of the ground surface. Diagnostic of this dry-site shrubland alliance is the *Artemisia tridentata ssp. wyomingensis*-dominated shrub layer typically lacking a significant perennial graminoid layer (<20% cover).

ENVIRONMENT & DYNAMICS

Environmental Description: This broadly distributed alliance is found in the western United States on dry steppes with core distribution in the Great Basin, Colorado Plateau and Wyoming. Climate ranges from semi-arid in the western Great Basin and Colorado Plateau to subhumid in the northern plains. The amount and reliability of growing-season moisture increase eastward and with increasing elevation. These shrublands occur from less than 1000 m elevation in the Columbia Basin and northern Great Plains to over 2500 m in the Rocky Mountains and Great Basin ranges. The alliance occurs on flat to steeply sloping upland sites, on a wide variety of landform positions. These include alluvial fans and terraces, toeslopes, lower and middle slopes, draws, badly eroded badland slopes, and foothills. Sites with little slope tend to have deep soils, while those with steeper slopes have shallow to moderately deep soils (USFS 1992). Sloping sites tend to have southerly aspects. Soil texture is loamy sand, loam, sandy loam, or clay loam (Hansen and Hoffman 1988), and there is often a significant amount of coarse fragments in the soil profile. Hironaka et al. (1983) reported that most of their *Artemisia tridentata ssp. wyomingensis* habitat types occurred on calcareous soils, often with some form of a cemented duripan or silica-hardpan at about 1 m in depth.

In eastern Idaho and western Wyoming, *Artemisia tridentata ssp. wyomingensis* occupies somewhat dry, low-elevation sites, while *Artemisia tridentata ssp. tridentata* or *Artemisia cana* occupy deep alluvial soils of drainage bottoms at low elevation, and *Artemisia tridentata ssp. vaseyana* occupies cooler, moister upland sites at higher elevation. In addition to *Artemisia tridentata* and *Artemisia cana*, other associated vegetation types include *Atriplex confertifolia, Ericameria* spp., or *Chrysothamnus* spp. shrublands, *Populus tremuloides, Pinus ponderosa, Pinus contorta, Abies grandis*, or *Pseudotsuga menziesii* forests, *Pinus - Juniperus* woodlands, or mesic herbaceous communities.

Dynamics: Complex ecological interactions between fire regimes, grazing history, and climate patterns result in equally complex patterns of species structure and composition in *Artemisia tridentata*. These present corresponding difficulties in the classification of these shrublands, which have been compounded by the influence of human settlement and agricultural patterns. What follows is a summary of some of the influences of altered fire regimes, and grazing history on *Artemisia tridentata* shrublands and shrub-herbaceous vegetation.

Artemisia tridentata ssp. wyomingensis shrublands may represent either drier or more disturbed examples of the *Artemisia tridentata ssp. wyomingensis* shrubland and shrub herbaceous alliances. Shrub densities typically increase with overgrazing of the bunchgrass component or with increasing summer drought (West 1983c). There is considerable debate over whether present shrub-dominated stands are actually degraded "steppe" (e.g., shrub-herbaceous physiognomy), and if the stands will return to steppe with changes in grazing and fire management. *Artemisia tridentata* is inhibited by fire, and excessive grazing may decrease fire frequency due to consumption of herbaceous forage, resulting in increased shrub density. Conversely, invasion by non-native annual grasses (e.g., *Bromus tectorum* or *Bromus arvensis*) may increase fire frequency sufficiently to eliminate the shrubs from the stands (Hironaka et al. 1983). With a change in fire frequency, species composition will be altered as well (West 1983c). With a high fire frequency (every 2-5 years), perennial grasses and shrubs are eliminated and non-native annual grasses dominate. At fire-return intervals of 10-30 years, short-lived resprouting shrubs such as *Chrysothamnus* or *Tetradymia* spp. dominate. At fire intervals of 30-70 years, a mixture of perennial bunchgrasses and shrubs is maintained. Finally, in the complete absence of fire, deep-rooted shrubs such as *Artemisia tridentata* become the theoretical dominants.

DISTRIBUTION

Geographic Range: This broadly distributed alliance is found in the western United States on dry steppes with core distribution in the Great Basin, Colorado Plateau and Wyoming.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **><** Big Sagebrush Scrub (#35210) (Holland 1986b)

- **><** Big Sagebrush Series (Sawyer and Keeler-Wolf 1995)
- **><** SRM Cover Type #314 - Big Sagebrush-Bluebunch Wheatgrass (Shiflet 1994)
- **<** SRM Cover Type #403 - Wyoming Big Sagebrush (Shiflet 1994)
- **<** SRM Cover Type #612 - Sagebrush - Grass (Shiflet 1994)
- **><** Western Shrub and Grasslands Combinations: 55: Sagebrush-Steppe (*Artemisia-Agropyron*) (Küchler 1964)
- **><** Western Shrub: 38: Great Basin Sagebrush (*Artemisia*) (Küchler 1964)

LOWER LEVEL UNITS

Associations:

- CEGL001534 *Artemisia tridentata ssp. wyomingensis* / Mixed Grasses Shrub Grassland
- CEGL002761 *Artemisia tridentata ssp. wyomingensis / Hesperostipa comata* Colorado Plateau Shrubland
- CEGL001041 *Artemisia tridentata ssp. wyomingensis / Bouteloua gracilis* Shrubland
- CEGL001001 *Artemisia tridentata / Elymus elymoides* Shrubland
- CEGL001005 *Artemisia tridentata / Pleuraphis jamesii* Shrubland
- CEGL001042 *Artemisia tridentata ssp. wyomingensis / Carex filifolia* Shrubland
- CEGL002810 *Artemisia tridentata ssp. wyomingensis / Achnatherum pinetorum* Shrubland
- CEGL001045 *Artemisia tridentata ssp. wyomingensis / Leymus ambiguus* Shrubland
- CEGL001046 *Artemisia tridentata ssp. wyomingensis / Achnatherum hymenoides* Shrubland
- CEGL001052 *Artemisia tridentata ssp. wyomingensis / Achnatherum thurberianum* Shrubland
- CEGL002084 *Artemisia tridentata ssp. wyomingensis / Pleuraphis jamesii* Shrubland
- CEGL002768 *Artemisia tridentata ssp. wyomingensis* / Sparse Understory Shrubland
- CEGL002775 *Artemisia tridentata ssp. wyomingensis / Poa fendleriana* Shrubland
- CEGL002813 *Artemisia tridentata ssp. wyomingensis / Leymus salinus* Shrubland
- CEGL001043 *Artemisia tridentata ssp. wyomingensis / Elymus elymoides* Shrubland
- CEGL001044 *Artemisia tridentata ssp. wyomingensis / Elymus albicans* Shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by D. Sarr.
Version Date: 2014/12/18

REFERENCES

References: Baker 1982b, Baker 1983c, Baker and Kennedy 1985, Bear Creek Uranium Mine Application n.d., Bighorn Coal Mine n.d., Blackburn 1967, Blackburn et al. 1968a, Blackburn et al. 1968b, Blackburn et al. 1968c, Blackburn et al. 1969a, Blackburn et al. 1969b, Blackburn et al. 1969c, Blackburn et al. 1969d, Blackburn et al. 1971, Britton et al. 1981, Brotherson and Brotherson 1981, Brown 1971, Caicco and Wellner 1983f, Caicco and Wellner 1983i, Caicco and Wellner 1983j, Caicco and Wellner 1983k, Caicco and Wellner 1983l, Chappell et al. 1997, Comer 1999, Cotter-Ferguson Project n.d., Daubenmire 1970, Day and Wright 1985, DeVelice and Lesica 1993, DeVelice et al. 1991, Doescher et al. 1986, Driese et al. 1997, Earth Resource Technology n.d., Eddleman and Jaindl 1994, Ellis and Hackney 1981, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Fenemore 1970, Ferchau 1973, Fisser 1964, Fisser 1970, Francis 1983, Francis 1986, Franklin and Dyrness 1973, Giese 1975, Gross 1955, Hall 1973, Hansen and Hoffman 1988, Hansen et al. 1984, Harper and Jaynes 1986, Heinze et al. 1962, Hess 1981, Hess and Wasser 1982, Hironaka 1978, Hironaka et al. 1983, Holecheck and Stephenson 1983, Holland 1986b, Jameson et al. 1962, Jensen et al. 1988a, Johnson and Payne 1968, Johnson and Simon 1987, Johnston 1987, Jorgensen 1979, Keammerer 1987, Knight 1994, Knight et al. 1987, Komarkova 1986, Kurzius 1981, Küchler 1964, Leary and Peterson 1984, Lesica and DeVelice 1992, Leucite Hills Mine Application n.d., Lewis 1975a, Loope 1969, Lucky McMine Application n.d., Lundberg 1977, Marr et al. 1979, McArthur and Welch 1986, McLean 1970, Moretti 1979, Moretti and Brotherson 1982, Mueggler and Stewart 1980, Nichols 1964a, Nichols 1964b, Northwest Resources Co. 1981, ORNHP unpubl. data, Poulton 1955, Ralston 1969, Rickard and Beatley 1965, Robertson 1971, Savage 1968, Sawyer and Keeler-Wolf 1995, Seminoe I Mine Application n.d., Sheehy and Winward 1981, Shiflet 1994, Skull Point Mine Application n.d., Skull Point Mine Permit Renewal n.d., Smith n.d.b, Steger 1970, Stoecker-Keammerer Consultants n.d.a, Strong 1980, Sweetwater Uranium Project 1978, Sweetwater Uranium Project n.d., Terwilliger et al. 1979a, Thorne Ecological Institute 1973a, Thorne Ecological Institute 1973b, Tiedemann et al. 1987, Tisdale 1947, Tisdale and Hironaka 1981, Tueller and Blackburn 1974, Tueller et al. 1966, Tweit and Houston 1980, USFS 1992, Van Pelt 1978, Warren et al. 1982, West 1983c, West et al. 1984, Winward 1970

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
3.B.1.Ne.3.b. M169 Great Basin-Intermountain Tall Sagebrush Steppe & Shrubland

G302. Intermountain Mesic Tall Sagebrush Steppe & Shrubland

Type Concept Sentence: This widespread matrix-forming sagebrush steppe and shrubland group occurs throughout the interior western U.S., Wyoming and the northwestern Great Plains and is characterized by an open to sparse shrub layer of *Artemisia tridentata* (*ssp. tridentata, ssp. xericensis*) or *Artemisia tripartita ssp. tripartita* with an often dense herbaceous layer dominated by perennial bunchgrasses such as *Achnatherum occidentale, Festuca campestris, Festuca idahoensis, Leymus cinereus, Poa secunda*, and *Pseudoroegneria spicata*.

OVERVIEW

Scientific Name: *Artemisia tridentata - Artemisia tripartita - Purshia tridentata* Big Sagebrush Steppe & Shrubland Group
Common Name (Translated Scientific Name): Basin Big Sagebrush - Threetip Sagebrush - Antelope Bitterbrush Big Sagebrush Steppe & Shrubland Group
Colloquial Name: Basin Big Sagebrush - Foothill Big Sagebrush Mesic Steppe & Shrubland

Type Concept: This widespread matrix-forming sagebrush steppe group occurs throughout much of the western U.S. in the Great Basin, Columbia Plateau, northwestern Great Plains, eastern Sierra Nevada, Wyoming Basins, Rocky Mountains, and Colorado Plateau between elevations of 1200 and 2400 m. Stands are characterized by open to sparse shrublands dominated by *Artemisia tridentata* (*ssp. tridentata, ssp. xericensis*) or *Artemisia tripartita ssp. tripartita* which tend to occupy more mesic sites with well-developed soil, and *Purshia tridentata* which tends to occupy drier, rockier soils and positions, as well as sandy dune areas. Some *Artemisia tridentata ssp. wyomingensis* associations are included here, where they occur in biophysical settings conducive to an abundant herbaceous layer, and more mesic-indicator species. Herbaceous layers are often dense and dominated by perennial bunchgrasses, especially as *Festuca idahoensis* and *Pseudoroegneria spicata*. Other common graminoids include *Achnatherum hymenoides, Achnatherum occidentale, Carex pensylvanica, Festuca campestris, Hesperostipa comata, Leymus cinereus, Pascopyrum smithii*, and *Poa secunda*. In some cases scattered trees may form an emergent layer of individual trees; species include *Cercocarpus ledifolius, Juniperus occidentalis, Juniperus osteosperma, Juniperus scopulorum*, or *Pinus ponderosa*. Many perennial forb species are important in these shrublands, and microphytic crust is very important in this group. This group may occur on stream terraces, point bars, valley floors, alluvial fans, floodplains, washes, gullies, stabilized dunes, swales, and rocky slopes. Soils vary from deep and well-developed to shallow, rocky and poorly developed sandy loams, loamy sands, sand, silt loams, and clay loams derived from alluvium, loess, shale, and sandstone.

Classification Comments: This group is a solid concept at its core, although the associations considered "mesic tall sagebrush" probably need adjustment. These communities tend to occur in the northern Great Basin and Northern Rockies, or on somewhat more mesic settings than the dry tall sagebrush group. Slightly higher precipitation and less evapotranspiration stress combined with deeper soils allow for the significant bunchgrass and perennial forb component of the shrublands in this group.

Similar NVC Types:
- G303 Intermountain Dry Tall Sagebrush Steppe & Shrubland
- G304 Intermountain Mountain Big Sagebrush Steppe & Shrubland

Diagnostic Characteristics: Stands are characterized by open to sparse shrublands dominated by *Artemisia tridentata (ssp. tridentata, ssp. xericensis)* or *Artemisia tripartita ssp. tripartita* which tend to occupy more mesic sites with well-developed soil, and *Purshia tridentata* which tends to occupy drier, rockier soils and positions, as well as sandy dune areas. Herbaceous layers are often dense and dominated by perennial bunchgrasses and a significant perennial graminoid layer is diagnostic of this group. Common graminoids include *Achnatherum hymenoides, Achnatherum occidentale, Achnatherum thurberianum, Carex pensylvanica, Elymus lanceolatus, Festuca campestris, Festuca idahoensis, Hesperostipa comata, Koeleria macrantha, Leymus cinereus, Pascopyrum smithii, Poa secunda*, and *Pseudoroegneria spicata*.

VEGETATION

Physiognomy and Structure: These are microphyllous evergreen or deciduous scrublands, with a significant component of perennial grasses. The group is structurally characterized by open to dense sagebrush or bitterbrush with associated shrubs interspersed and/or a dense understory of perennial bunch grasses.

Floristics: This shrub and shrub herbaceous group is characterized by communities dominated by *Artemisia tridentata ssp. tridentata, Artemisia tridentata ssp. xericensis, Artemisia tridentata ssp. wyomingensis, Artemisia tripartita ssp. tripartita*, and *Purshia tridentata*. Other associated shrubs and dwarf-shrubs may include *Arctostaphylos uva-ursi, Artemisia frigida, Chrysothamnus viscidiflorus, Ericameria* spp., *Peraphyllum ramosissimum, Philadelphus lewisii, Prunus virginiana, Ribes cereum, Symphoricarpos longiflorus*, and *Symphoricarpos rotundifolius*. Herbaceous layers are often dense and dominated by perennial bunchgrasses. Common graminoids include *Achnatherum hymenoides, Achnatherum nelsonii, Achnatherum occidentale, Achnatherum thurberianum, Carex pensylvanica, Elymus lanceolatus, Festuca campestris, Festuca idahoensis, Hesperostipa comata, Koeleria*

macrantha, Leymus cinereus, Muhlenbergia montana, Pascopyrum smithii, Poa secunda, and *Pseudoroegneria spicata*. Forbs are often diverse and have moderate to low cover. Species may include *Balsamorhiza sagittata, Eriogonum umbellatum*, or *Penstemon deustus*. In some cases scattered trees may form an emergent layer of individual trees; species include *Cercocarpus ledifolius, Juniperus occidentalis, Juniperus osteosperma, Juniperus scopulorum*, or *Pinus ponderosa*.

ENVIRONMENT & DYNAMICS

Environmental Description: This widespread matrix-forming group occurs throughout much of the western U.S. between elevations of 600 m in the northern extents to 2500 m in southern range limits. This group may occur on stream terraces, point bars, valley floors, alluvial fans, floodplains, washes, gullies, stabilized dunes, mesic uplands, swales, and rocky slopes. Slopes are variable from gentle to very steep. *Climate:* The climate where this group occurs is semi-arid with annual precipitation ranging from 18-40 cm and high inter-annual variation. Much of the precipitation falls as snow, and growing-season drought is characteristic. Temperatures are continental with large annual and diurnal variations. *Soil/substrate/hydrology:* Soils vary from deep and well-developed to rocky and poorly developed sandy loams, loamy sands, sand, silt loams, and clay loams derived from alluvium, loess, shale, and sandstone. In drier regions, these shrublands are usually associated with perennial or ephemeral stream drainages with water tables less than 3 m from the soil surface.

Dynamics: The natural fire regime of this group likely maintains a patchy distribution of shrubs so that the general aspect of the vegetation is a grassland. Shrubs may increase following heavy grazing and/or with fire suppression, particularly in moist portions in the northern Columbia Plateau where it forms a landscape mosaic pattern with shallow-soil scabland shrublands. Response to grazing can be variable depending on the type of grazer and the season in which grazing occurs. *Hesperostipa comata* can increase in abundance in response to either grazing or fire. In central and eastern Montana (and possibly elsewhere), complexes of prairie dog towns are common in this group. Microphytic crust is very important in this group.

DISTRIBUTION

Geographic Range: This widespread matrix-forming sagebrush steppe group occurs throughout much of the western U.S. in the Columbia Plateau, Great Basin, eastern Sierra Nevada, Colorado Plateau, Wyoming Basins, Rocky Mountains, and northwestern Great Plains.

Spatial Scale & Pattern [optional]: Matrix, Large patch
Nations: CA, US
States/Provinces: BC, CA, CO, ID, MT, ND, NV, OR, SD?, UT, WA, WY
TNC Ecoregions [optional]: 4:P, 6:C, 8:C, 9:C, 10:C, 11:C, 18:C, 19:C, 20:C, 26:C, 68:C
USFS Ecoregions (2007): 313A:CC, 331D:CC, 331G:CC, 341A:CC, 341B:CC, 342A:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:C?, 342I:CC, M242C:CC, M261G:CC, M331A:CC, M331D:CC, M331E:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:C?, M332D:CC, M332E:CC, M332F:CC, M332G:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Arches, Curecanti, Dinosaur, Fossil Butte, Golden Spike, Grand Teton?, John Day Fossil Beds, Mesa Verde, Natural Bridges, Zion); USFS (Arapaho-Roosevelt, Bridger-Teton, Shoshone); USFWS (Minidoka)

CONFIDENCE LEVEL

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

SYNONYMY

- **=** Western Intermountain sagebrush steppe (West 1983c)

LOWER LEVEL UNITS

Alliances:
- A3179 *Purshia tridentata - Artemisia tridentata* Mesic Steppe & Shrubland Alliance
- A3183 *Artemisia tridentata ssp. tridentata - Artemisia tridentata ssp. xericensis* Mesic Steppe & Shrubland Alliance
- A1528 *Artemisia tripartita ssp. tripartita - Artemisia tridentata* Mesic Steppe & Shrubland Alliance
- A3182 *Artemisia tridentata ssp. wyomingensis* Mesic Steppe & Shrubland Alliance

AUTHORSHIP

Primary Concept Source: N.E. West (1983c)
Author of Description: M.E. Hall and K.A. Schulz
Acknowledgments:
Version Date: 11/06/2015
Classif Resp Region: West
Internal Author: MEH/KAS 3-10, mod. KAS 11-15

REFERENCES

References: Barbour and Billings 1988, Barbour and Major 1977, Barbour and Major 1988, Brown 1982a, Brown et al. 1979, Daubenmire 1970, Faber-Langendoen et al. 2017a, Hironaka et al. 1983, Holland and Keil 1995, Knight 1994, Mueggler and Stewart 1980, Shiflet 1994, West 1983a, West 1983c

3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G302. Intermountain Mesic Tall Sagebrush Steppe & Shrubland

A3183. Artemisia tridentata ssp. tridentata - Artemisia tridentata ssp. xericensis Mesic Steppe & Shrubland Alliance

Type Concept Sentence: This mesic shrubland and steppe alliance occurs throughout the Intermountain West on sloping fans, footslopes, rolling hills, and especially deep, well-drained alluvial bottomlands with vegetation characterized by an open to moderately dense (10-70% cover) shrub layer of *Artemisia tridentata ssp. tridentata* or *Artemisia tridentata ssp. xericensis* and a sparse to dense herbaceous layer dominated by perennial bunchgrasses, especially *Elymus lanceolatus, Festuca idahoensis, Hesperostipa comata, Leymus cinereus, Pascopyrum smithii*, and *Pseudoroegneria spicata*.

OVERVIEW

Scientific Name: *Artemisia tridentata ssp. tridentata - Artemisia tridentata ssp. xericensis* Mesic Steppe & Shrubland Alliance
Common Name (Translated Scientific Name): Basin Big Sagebrush - Foothill Big Sagebrush Mesic Steppe & Shrubland Alliance
Colloquial Name: Basin Big Sagebrush - Foothill Big Sagebrush Mesic Steppe & Shrubland

Type Concept: This mesic shrubland and steppe alliance occur throughout the Intermountain West from the western Great Basin to the northern Rocky Mountains, the Columbian Basin and Colorado Plateau. The vegetation included in this alliance is characterized by a somewhat sparse to moderately dense (10-70% cover) shrub layer of *Artemisia tridentata ssp. tridentata* or *Artemisia tridentata ssp. xericensis*. Shrub associates include *Ericameria nauseosa (= Chrysothamnus nauseosus)* or *Chrysothamnus viscidiflorus* which increase with disturbance. Other shrubs occasionally present include *Atriplex* spp., *Gutierrezia sarothrae*, and *Symphoricarpos longiflorus*. Occasionally individual trees are present in some stands. The sparse to dense herbaceous layer is dominated by bunchgrasses that occupy patches in the shrub matrix. The most widespread species is *Pseudoroegneria spicata*, which occurs from the Columbia Basin to the Northern Rockies. Other locally dominant or important species include *Elymus elymoides, Elymus lanceolatus, Festuca idahoensis, Hesperostipa comata (= Stipa comata), Koeleria macrantha, Leymus cinereus, Muhlenbergia richardsonis, Pascopyrum smithii, Pleuraphis jamesii (= Hilaria jamesii)*, and *Poa secunda*. Forbs are generally of low importance and are highly variable across the range. Mosses and lichens are important ground cover in some stands. This mesic shrubland and steppe alliance occurs on sloping fans, footslopes, rolling hills, and especially deep, well-drained alluvial bottomlands.

Classification Comments: This mesic shrubland and steppe alliance occurs as large patch/matrix stands in relatively mesic northern latitudes. However, in semi-arid landscapes in more southern latitudes, it frequently occurs in smaller patch stands restricted to relatively mesic sites, such as swales and basins, that receive additional moisture from surrounding slopes, and at higher elevations.

The subspecies of *Artemisia tridentata* occurring in some associations included in this alliance are not determined, inconsistent or may be mixed. As the subspecies in stands in this alliance are determined, some associations can be moved or split and placed into these other alliances. Further study is needed to re-apportion communities within this alliance or justify the current classification. Mueggler and Stewart (1980) describe two *Artemisia tridentata* habitat types, one with *Festuca campestris* diagnostic and the other with *Festuca idahoensis*. The first one includes both *ssp. vaseyana* and *ssp. wyomingensis* depending on elevation. They cite an *Artemisia tridentata ssp. tridentata / Festuca idahoensis* Habitat Type from eastern Washington (Daubenmire 1970). Dick-Peddie (1993) described several vegetation types that may be classified in this alliance from four shrub-grass series in New Mexico. More complete descriptions of both alliances are needed to distinguish them.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: This mesic shrubland and steppe alliance is characterized by a somewhat sparse to moderately dense (10-70% cover) shrub layer of *Artemisia tridentata ssp. tridentata* or *Artemisia tridentata ssp. xericensis*. The open to moderately dense herbaceous layer is dominated by bunchgrasses. Characteristic species are *Elymus lanceolatus, Festuca idahoensis, Hesperostipa comata, Leymus cinereus, Pascopyrum smithii, Poa secunda*, and *Pseudoroegneria spicata*.

VEGETATION

Physiognomy and Structure: The vegetation is characterized by a sparse cover of microphyllous evergreen shrubs, usually 1-2 m in height. Shrub cover can be variable, but on average is less than 25% for steppe sites and 10-70% cover for shrubland sites. Perennial cespitose graminoids form a matrix surrounding the shrubs in steppe, occasionally matching them in height, or form a sparse to moderately dense graminoid layer in shrublands. Forb species may be frequent, but are usually of low canopy cover. The ground surface is covered with mosses and lichens in good condition stands, except for fluvial sites.

Floristics: The vegetation included in this alliance is characterized by a somewhat sparse to moderately dense (10-70% cover) shrub layer of *Artemisia tridentata ssp. tridentata* or *Artemisia tridentata ssp. xericensis*. Shrub associates include *Ericameria nauseosa (= Chrysothamnus nauseosus)* or *Chrysothamnus viscidiflorus* which increase with disturbance. Other shrubs occasionally present include *Atriplex* spp., *Gutierrezia sarothrae*, and *Symphoricarpos longiflorus*. Occasionally individual trees are present in some stands. The open to dense herbaceous layer is dominated by bunchgrasses that occupy patches in the shrub matrix. The most widespread species is *Pseudoroegneria spicata*, which occurs from the Columbia Basin to the Northern Rockies. Other locally dominant or important species include *Achnatherum hymenoides (= Oryzopsis hymenoides), Elymus elymoides, Elymus lanceolatus, Festuca idahoensis, Hesperostipa comata (= Stipa comata), Koeleria macrantha, Leymus cinereus, Muhlenbergia richardsonis, Pascopyrum smithii, Pleuraphis jamesii (= Hilaria jamesii)*, and *Poa secunda*. Forbs are generally of low importance and are highly variable across the range. Mosses and lichens are important ground cover in some stands. Diagnostic of this alliance is the *Artemisia tridentata ssp. tridentata*- or *Artemisia tridentata ssp. xericensis*-dominated shrub layer. The graminoid layer typically has >20% cover perennial graminoids or has over 40% total cover of shrubs.

ENVIRONMENT & DYNAMICS

Environmental Description: This mesic shrubland and steppe alliance occurs throughout the Intermountain West from the western Great Basin to the Colorado Plateau, northern Rocky Mountains and northwestern Great Plains. Elevation is mostly 1200-2500 m, but extends down to 240 m in the Columbia Basin. Mean annual precipitation ranges from 20-50 cm. Precipitation primarily occurs in the winter as snow or rain in the western portion of its range; however, spring and summer precipitation becomes important in the eastern portion of its range. This moisture is stored in the soil profile and utilized during the typically dry summers. Sites supporting this alliance include sloping fans, footslopes, rolling hills, and deep, well-drained alluvial bottomlands and swales. Soils are deep, fine- to medium-textured alluvial soils with some source of subirrigation during the summer season, but moderately deep upland soils with ample moisture storage also support these shrublands. Some stands occur on deep, sandy soils, or soils that are highly calcareous.

Dynamics: Complex ecological interactions between fire regimes, grazing history, and climate patterns result in equally complex patterns of species structure and composition in *Artemisia tridentata*. These present corresponding difficulties in the classification of these shrublands, which have been compounded by the influence of human settlement and agricultural patterns. What follows is a summary of some of the influences of altered fire regimes and grazing history on *Artemisia tridentata* shrublands and shrub-herbaceous vegetation that can result in the conversion of stands of this alliance into stands of exotic annual grassland. Exotic plants have invaded many stands, especially where disturbed (Daubenmire 1970). Common exotics may include annual grasses such as *Bromus tectorum, Bromus arvensis*, and *Bromus briziformis* which may be abundant during wet years; and annual forbs such as *Epilobium brachycarpum, Erodium cicutarium, Lactuca serriola, Tragopogon dubius*, and the perennial forb *Hypericum perforatum*. The winter precipitation recharges soil moisture, and the typically dry summers favor shrubs and deep-rooted grasses (West 1983c, 1988). The exotic annual grass *Bromus tectorum* competes favorably with these cool-season, perennial bunchgrasses in these stands by geminating in the fall, establishing a root system during the winter, then utilizing and depleting soil moisture early in the spring while the bunchgrasses are still mostly dormant (West 1983c).

Artemisia tridentata (ssp. tridentata, ssp. xericensis) shrub-herbaceous communities may represent either moister or less disturbed examples of the *Artemisia tridentata (ssp. tridentata, ssp. xericensis)* shrubland complex. Shrub densities typically increase with overgrazing of the bunchgrass component or with increasing summer drought (West 1983c). *Artemisia tridentata* is inhibited by fire, and excessive grazing may decrease fire frequency due to consumption of herbaceous forage, resulting in increased shrub density. Conversely, invasion by non-native annual grasses (e.g., *Bromus tectorum*) may increase fire frequency sufficiently to eliminate the shrubs from the stands (Daubenmire 1970). With a change in fire frequency, species composition will be altered as well (West 1983c). With a high fire frequency (every 2-5 years), perennial grasses and shrubs are eliminated and non-native annual grasses dominate. At fire-return intervals of 10-30 years, short-lived resprouting shrubs, such as *Chrysothamnus* or *Tetradymia* spp. dominate. At fire intervals of 30-70 years, a mixture of perennial bunchgrasses and shrubs is maintained. Finally, in the complete absence of fire, deep-rooted shrubs such as *Artemisia tridentata* become the dominant shrubs.

DISTRIBUTION

Geographic Range: This shrubland and steppe alliance occurs throughout the Intermountain West from the western Great Basin to the Colorado Plateau, northern Rocky Mountains and northwestern Great Plains.

Nations: CA, US

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **?** *Artemisia tridentata ssp. tridentata / Festuca idahoensis* habitat type (Daubenmire 1970)
- **><** *Artemisia tridentata ssp. tridentata* and *ssp. wyomingensis* Shrub Steppe (Chappell et al. 1997)
- **>** *Artemisia tridentata-Agropyron spicatum* habitat type (Daubenmire 1970)
- **>** *Artemisia tridentata/Agropyron spicatum* Habitat Type (Hironaka et al. 1983)
- **<** *Artemisia tridentata* Series (Mueggler and Stewart 1980)
- **><** Big Sagebrush Scrub (#35210) (Holland 1986b)
- **<** Big Sagebrush Series (Sawyer and Keeler-Wolf 1995)
- **<** Great Basin Sagebrush (*Artemisia*), #32 (Küchler 1964)
- **>** SRM Cover Type #314 - Big Sagebrush-Bluebunch Wheatgrass (Shiflet 1994)
- **<** Sagebrush Steppe (*Artemisia-Agropyron*) (Küchler 1964)

LOWER LEVEL UNITS

Associations:

- CEGL001530 *Artemisia tridentata / Festuca idahoensis* Shrub Grassland
- CEGL001017 *Artemisia tridentata ssp. tridentata / Pascopyrum smithii - (Elymus lanceolatus)* Shrubland
- CEGL001019 *Artemisia tridentata (ssp. tridentata, ssp. xericensis) / Pseudoroegneria spicata - Poa secunda* Shrub Grassland
- CEGL001016 *Artemisia tridentata ssp. tridentata / Leymus cinereus* Shrubland
- CEGL001012 *Artemisia tridentata / Symphoricarpos longiflorus* Shrubland
- CEGL001014 *Artemisia tridentata ssp. tridentata / Festuca idahoensis* Shrubland
- CEGL002966 *Artemisia tridentata ssp. tridentata / Hesperostipa comata* Shrubland
- CEGL001458 *Artemisia tridentata / Leymus cinereus* Shrub Grassland
- CEGL001018 *Artemisia tridentata (ssp. tridentata, ssp. xericensis) / Pseudoroegneria spicata* Shrub Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Blackburn et al. 1968a, Blackburn et al. 1968c, Blackhawk Coal Company 1981, Brotherson and Brotherson 1979, Caicco and Wellner 1983k, Chappell et al. 1997, Dastrup 1963, Daubenmire 1970, Daubenmire 1992, Dick-Peddie 1993, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Graham 1937, Hall 1973, Hansen 1985, Hansen et al. 1984, Hironaka 1978, Hironaka et al. 1983, Hirsch 1985, Holland 1986b, Jensen et al. 1988a, Küchler 1964, Mariah Associates 1981, McArthur and Welch 1986, McLean 1970, Mooney 1985, Mueggler and Stewart 1980, ORNHP unpubl. data, Poulton 1955, Ralston 1969, Sawyer and Keeler-Wolf 1995, Shiflet 1994, Thilenius et al. 1995, Tisdale 1947, Tweit and Houston 1980, USFS 1992, Van Pelt 1978, West 1983c, West 1988

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G302. Intermountain Mesic Tall Sagebrush Steppe & Shrubland

A3182. Artemisia tridentata ssp. wyomingensis Mesic Steppe & Shrubland Alliance

Type Concept Sentence: This mesic shrubland and steppe alliance is found in the western United States and southwestern Canada and is characterized by an open to dense (10-70% cover) shrub layer that is dominated (or codominated with at least 40% relative cover in mixed stands) by *Artemisia tridentata ssp. wyomingensis*. Common associates include *Atriplex confertifolia, Artemisia frigida, Krascheninnikovia lanata, Purshia tridentata*, and *Symphoricarpos longiflorus*.

OVERVIEW

Scientific Name: *Artemisia tridentata ssp. wyomingensis* Mesic Steppe & Shrubland Alliance
Common Name (Translated Scientific Name): Wyoming Big Sagebrush Mesic Steppe & Shrubland Alliance
Colloquial Name: Wyoming Big Sagebrush Mesic Steppe & Shrubland

Type Concept: This mesic shrubland and steppe alliance is found in the western United States and southwestern Canada and is characterized by an open to dense (10-70% cover) shrub layer that is dominated (or codominated with at least 40% relative cover in mixed stands) by *Artemisia tridentata ssp. wyomingensis*. Common associates include *Atriplex confertifolia, Artemisia frigida, Krascheninnikovia lanata, Purshia tridentata*, and *Symphoricarpos longiflorus*. The herbaceous stratum can be diverse and have open to dense cover, but perennial graminoids typically total >20% cover. Characteristic dominant species are *Balsamorhiza sagittata, Hesperostipa comata, Pascopyrum smithii, Poa secunda*, and *Pseudoroegneria spicata*. Stands occur on flat to steeply sloping upland sites. Sites with little slope tend to have deep soils, while those with steeper slopes have shallow to moderately deep soils. Soil texture is loam, sandy loam, or clay loam with coarse fragments common in the soil profile.

Classification Comments: This mesic shrubland and steppe alliance occurs as large patch/matrix stands in relatively mesic northern latitudes. However, in semi-arid landscapes in more southern latitudes, it frequently occurs in smaller patch stands restricted to relatively mesic sites, such as swales and basins, that receive additional moisture from surrounding slopes and at higher elevations.

Associations with undetermined subspecies of *Artemisia tridentata* from old alliances *Artemisia tridentata* Shrubland Alliance (A.829) and *Artemisia tridentata* Shrub Herbaceous Alliance (A.1521) were reviewed and placed into either *Artemisia tridentata ssp. wyomingensis* Mesic Steppe & Shrubland Alliance (A3182) or *Artemisia tridentata ssp. tridentata - Artemisia tridentata ssp. xericensis* Mesic Steppe & Shrubland Alliance (A3183). More review would increase confidence of placement. *Artemisia tridentata ssp. wyomingensis - Peraphyllum ramosissimum / Festuca idahoensis* Shrubland (CEGL001048) was placed in this alliance (A3182) instead of *Artemisia tridentata* - Mixed Shrub Dry Shrubland Alliance (A3198) because it is a relatively mesic shrubland, and the current concept of the association only requires *Peraphyllum ramosissimum* be present to codominant (1-20% cover), so it is not a reliable *Artemisia tridentata* - mixed shrub stand. Currently, this alliance includes stands in North Dakota In the northwestern Great Plains.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: This mesic steppe and shrubland alliance has an open to moderately dense conspicuous shrub layer dominated by diagnostic shrub *Artemisia tridentata ssp. wyomingensis*. Associated shrubs include *Atriplex confertifolia, Artemisia frigida, Purshia tridentata*, and *Krascheninnikovia lanata*. The herbaceous layer ranges from open to moderate cover, but perennial graminoids typically total >20% cover. Characteristic dominant species are *Balsamorhiza sagittata, Hesperostipa comata, Pascopyrum smithii, Poa secunda*, and *Pseudoroegneria spicata*.

VEGETATION

Physiognomy and Structure: This alliance is characterized by an open to dense (10-70%) cover of microphyllous evergreen shrubs, usually 0.3-1 m in height, although in Washington the shrubs may be up to 2 m tall. Cespitose graminoids are usually dominant, often matching, and sometimes exceeding, the shrubs in height or cover. Forb species may be frequent, but are usually of low canopy cover. With increasing summer rain in the eastern portion of the range, there is a corresponding increase in the proportion of sod-forming grasses as compared to bunchgrasses. Undisturbed stands in Washington and Oregon may have a nearly continuous cryptogamic soil crust of mosses and lichens.

Floristics: Shrubs are conspicuous in this alliance, but herbaceous species usually have equal or greater cover. The vegetation included in this alliance is characterized by an open to moderately dense (10-70% cover) shrub layer that is dominated (or codominated with at least 40% relative cover in mixed stands) by *Artemisia tridentata ssp. wyomingensis*. Common associated shrubs are *Artemisia frigida, Chrysothamnus* spp., *Ericameria* spp., *Gutierrezia sarothrae, Krascheninnikovia lanata, Peraphyllum ramosissimum*, and *Symphoricarpos longiflorus*. The herbaceous stratum can be diverse and have open to moderate cover, but perennial graminoids typically total <20% cover. The most widespread and common species are *Pseudoroegneria spicata*, which occurs from the Columbia Basin to the Northern Rockies, and *Pascopyrum smithii*, which is more common in the northwestern Great Plains. Other locally abundant grass associates include *Achnatherum thurberianum (= Stipa thurberiana)* (in the western portion of the range), *Achnatherum hymenoides (= Oryzopsis hymenoides), Bouteloua curtipendula, Bouteloua gracilis, Carex filifolia, Elymus lanceolatus, Hesperostipa comata (= Stipa comata), Koeleria macrantha, Leymus ambiguus*, and *Poa secunda*. Forbs form a minor and highly variable portion of this vegetation. Recurrent species include *Achillea millefolium, Balsamorhiza sagittata, Camelina microcarpa, Erigeron* spp., *Opuntia* spp., *Phlox* spp., and *Sphaeralcea coccinea*. Mosses and lichens, such as *Selaginella densa* and *Tortula ruralis*, may occur on bare ground. Where there is supplemental moisture or where the vegetation grades into forest, emergent needle-leaved evergreen or cold-deciduous trees may be scattered through these shrub-steppe communities. Recurrent tree associates include *Juniperus occidentalis, Juniperus osteosperma, Juniperus scopulorum, Pinus contorta, Pinus edulis, Pinus flexilis, Pinus ponderosa*, and *Populus tremuloides*.

ENVIRONMENT & DYNAMICS

Environmental Description: This mesic steppe and shrubland alliance is found in the western United States and southwestern Canada from the Columbia River Basin south and east across the Great Basin to the northern Rocky Mountains and northwestern Great Plains. Climates range from semi-arid in the western Great Basin to subhumid in the Rocky Mountains and northern plains. The amount and reliability of growing-season moisture increase eastward and with increasing elevation. The associations in this alliance occur in somewhat wetter areas of the range of *Artemisia tridentata ssp. wyomingensis*, generally with over 25 cm annual precipitation or with a significant proportion falling in the growing season. These communities occur at elevations of less than 1000 m in the Columbia Basin and northern Great Plains to over 2500 m in the Rocky Mountains and Great Basin ranges. The alliance occurs on flat to steeply sloping upland sites. Sites with little slope tend to have deep soils, while those with steeper slopes have shallow to moderately deep soils (USFS 1992). Soil texture is loam, sandy loam, or clay loam (Hansen and Hoffman 1988), which allows ample shallow rainfall storage and percolation of snowmelt. Coarse fragments are common in the soil profile. Hironaka et al. (1983) reported that most of their *Artemisia tridentata ssp. wyomingensis* habitat types occurred on calcareous soils, often with some form of a cemented duripan or silica-hardpan at about 1 m in depth.

In eastern Idaho and western Wyoming, *Artemisia tridentata ssp. wyomingensis* occupies somewhat dry, low-elevation sites, while *Artemisia tridentata ssp. tridentata* or *Artemisia cana* occupy deep alluvial soils of drainage bottoms at low elevation, and *Artemisia tridentata ssp. vaseyana* occupies cooler, moister upland sites at higher elevation. In addition to *Artemisia tridentata* and *Artemisia cana*, other associated vegetation types include *Atriplex confertifolia, Ericameria* spp., or *Chrysothamnus* spp. shrublands, *Abies grandis, Pinus contorta, Pinus ponderosa, Populus tremuloides*, or *Pseudotsuga menziesii* forests, *Pinus - Juniperus* woodlands, or mesic herbaceous communities.

Dynamics: Stands in this alliance represent the moister communities of the *Artemisia tridentata ssp. wyomingensis*-dominated communities in Great Basin-Intermountain Tall Sagebrush Steppe & Shrubland Macrogroup (M169). Shrub densities typically increase with overgrazing of the bunchgrass component or with increasing summer drought (West 1983c). *Artemisia tridentata* is inhibited by fire, and excessive grazing may decrease fire frequency due to consumption of herbaceous forage, resulting in increased shrub density. Conversely, invasion by non-native annual grasses (e.g., *Bromus tectorum, Bromus arvensis*) may increase fire frequency sufficiently to eliminate the shrubs from the stands (Daubenmire 1970). With a change in fire frequency, species composition will be altered as well (West 1983c). With a high fire frequency (every 2-5 years), perennial grasses and shrubs are eliminated and non-native annual grasses dominate. At fire-return intervals of 10-30 years, short-lived resprouting shrubs such as *Chrysothamnus* or *Tetradymia* spp. dominate. At fire intervals of 30-70 years, a mixture of perennial bunchgrasses and shrubs is maintained. Finally, in the complete absence of fire, deep-rooted shrubs such as *Artemisia tridentata* become the theoretical dominants.

DISTRIBUTION

Geographic Range: This mesic alliance occurs from northeastern California and eastern Oregon across the Great Basin, Utah and habitats of the Rocky Mountains to the northern Great Plains of Montana, Wyoming, and into western North and South Dakota. Associations are also reported from the intermountain parks of Colorado, and from British Columbia, Canada. The alliance has not been reported from either Arizona or New Mexico but may occur there.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** Big Sagebrush Series (Sawyer and Keeler-Wolf 1995)
- **><** SRM Cover Type #314 - Big Sagebrush-Bluebunch Wheatgrass (Shiflet 1994)
- **><** SRM Cover Type #315 - Big Sagebrush-Idaho Fescue (Shiflet 1994)
- **=** SRM Cover Type #403 - Wyoming Big Sagebrush (Shiflet 1994)
- **<** SRM Cover Type #612 - Sagebrush - Grass (Shiflet 1994)
- **><** Western Shrub and Grasslands Combinations: 55: Sagebrush-Steppe (*Artemisia-Agropyron*) (Küchler 1964)
- **><** Western Shrub: 38: Great Basin Sagebrush (*Artemisia*) (Küchler 1964)

LOWER LEVEL UNITS

Associations:

- CEGL001535 *Artemisia tridentata ssp. wyomingensis / Pseudoroegneria spicata* Shrub Grassland

- CEGL001050 *Artemisia tridentata ssp. wyomingensis - Purshia tridentata / Pseudoroegneria spicata* Shrubland
- CEGL001051 *Artemisia tridentata ssp. wyomingensis / Hesperostipa comata* Shrubland
- CEGL005479 *Artemisia tripartita ssp. tripartita / Achnatherum thurberianum* Shrubland
- CEGL000994 *Artemisia tridentata ssp. wyomingensis / Balsamorhiza sagittata* Shrubland
- CEGL001009 *Artemisia tridentata ssp. wyomingensis / Pseudoroegneria spicata* Shrubland
- CEGL001048 *Artemisia tridentata ssp. wyomingensis - Peraphyllum ramosissimum / Festuca idahoensis* Shrubland
- CEGL005478 *Artemisia tridentata ssp. wyomingensis / Festuca idahoensis* Shrubland
- CEGL001049 *Artemisia tridentata ssp. wyomingensis / Poa secunda* Shrubland
- CEGL001047 *Artemisia tridentata ssp. wyomingensis / Pascopyrum smithii* Shrub Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by D. Sarr.
Version Date: 2014/12/18

REFERENCES

References: Baker 1982b, Baker 1983c, Baker and Kennedy 1985, Bear Creek Uranium Mine Application n.d., Bighorn Coal Mine n.d., Blackburn 1967, Blackburn et al. 1968a, Blackburn et al. 1968b, Blackburn et al. 1969a, Blackburn et al. 1969b, Blackburn et al. 1969c, Blackburn et al. 1969d, Blackburn et al. 1971, Brotherson and Brotherson 1981, Brown 1971, Caicco and Wellner 1983i, Caicco and Wellner 1983j, Caicco and Wellner 1983k, Caicco and Wellner 1983l, Chappell et al. 1997, Comer 1999, Cotter-Ferguson Project n.d., Daubenmire 1970, Day and Wright 1985, DeVelice and Lesica 1993, DeVelice et al. 1991, Doescher et al. 1986, Driese et al. 1997, Earth Resource Technology n.d., Ellis and Hackney 1981, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Ferchau 1973, Fisser 1964, Fisser 1970, Francis 1983, Giese 1975, Gross 1955, Hall 1973, Hansen and Hoffman 1988, Heinze et al. 1962, Hess 1981, Hess and Wasser 1982, Hironaka 1978, Hironaka et al. 1983, Jensen et al. 1988a, Johnson and Simon 1987, Johnston 1987, Keammerer 1987, Knight 1994, Knight et al. 1987, Komarkova 1986, Küchler 1964, Leucite Hills Mine Application n.d., Lewis 1975a, Lucky McMine Application n.d., Lundberg 1977, Marr et al. 1979, McArthur and Welch 1986, McLean 1970, Moretti 1979, Moretti and Brotherson 1982, Mueggler and Stewart 1980, Nichols 1964a, Nichols 1964b, Northwest Resources Co. 1981, ORNHP unpubl. data, Poulton 1955, Sawyer and Keeler-Wolf 1995, Seminoe I Mine Application n.d., Shiflet 1994, Skull Point Mine Application n.d., Skull Point Mine Permit Renewal n.d., Smith n.d.b, Steger 1970, Stoecker-Keammerer Consultants n.d.a, Strong 1980, Sweetwater Uranium Project 1978, Sweetwater Uranium Project n.d., Terwilliger et al. 1979a, Thorne Ecological Institute 1973a, Thorne Ecological Institute 1973b, Tiedemann et al. 1987, Tisdale 1947, Tweit and Houston 1980, USFS 1992, Van Pelt 1978, West 1983c, West et al. 1984, Winward 1970

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G302. Intermountain Mesic Tall Sagebrush Steppe & Shrubland

A1528. Artemisia tripartita ssp. tripartita - Artemisia tridentata Mesic Steppe & Shrubland Alliance

Type Concept Sentence: This mesic alliance is distributed from the Columbia Basin east to the northern Rocky Mountains and is characterized by an open to moderately dense shrub layer dominated or codominated by *Artemisia tripartita* with10-25% cover and with herbaceous species having equal or greater coverage than shrubs.

OVERVIEW

Scientific Name: *Artemisia tripartita ssp. tripartita - Artemisia tridentata* Mesic Steppe & Shrubland Alliance
Common Name (Translated Scientific Name): Threetip Sagebrush - Big Sagebrush Mesic Steppe & Shrubland Alliance
Colloquial Name: Threetip Sagebrush - Big Sagebrush Mesic Steppe & Shrubland

Type Concept: This mesic shrubland and steppe alliance is distributed from the Columbia Basin east to the northern Rocky Mountains and is characterized by an open to moderately dense shrub layer dominated or codominated by *Artemisia tripartita* with10-25% cover and with herbaceous species having equal or greater coverage than shrubs. Common shrub associates include *Artemisia frigida, Artemisia tridentata ssp. tridentata, Artemisia tridentata ssp. vaseyana, Chrysothamnus viscidiflorus, Krascheninnikovia lanata, Purshia tridentata*, or *Tetradymia canescens*. The herbaceous stratum is typically dominated by graminoids and of moderate to moderately high cover (20-70%). *Pseudoroegneria spicata* and *Festuca idahoensis* are the most common associates. Other locally abundant graminoid species include *Bouteloua curtipendula, Bouteloua gracilis, Carex filifolia, Festuca campestris, Hesperostipa comata (= Stipa comata)*, and *Koeleria macrantha*. Forbs form a minor and highly variable portion of this vegetation. Recurrent species include *Achillea millefolium, Balsamorhiza sagittata, Camelina microcarpa, Erigeron* spp., *Opuntia* spp., *Phlox* spp., and *Sphaeralcea coccinea*. Climate ranges from semi-arid in intermountain basins to subhumid in higher elevations of the Rocky Mountains. Stands occur on flat to steeply sloping upland sites. Soil texture is loam, sandy loam, or clay loam, but is highly variable.

Classification Comments: This mesic shrubland and steppe alliance occurs as large patch/matrix stands in relatively mesic northern latitudes. However, in semi-arid landscapes in more southern latitudes, it frequently occurs in smaller patch stands restricted to relatively mesic sites, such as swales and basins, that receive additional moisture from surrounding slopes and at higher elevations.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Vegetation in this mesic shrubland and steppe is characterized by an open, conspicuous shrub layer with herbaceous species having equal or greater coverage with diagnostic species *Artemisia tripartita* dominant to codominant with 10-25% cover. Other characteristics shrubs include *Artemisia frigida, Artemisia tridentata ssp. tridentata, Artemisia tridentata ssp. vaseyana, Chrysothamnus viscidiflorus, Krascheninnikovia lanata, Purshia tridentata*, or *Tetradymia canescens*. The herbaceous layer is dominated by graminoids with moderate to moderately high cover (25-70%). Characteristic and often dominant grasses are *Festuca campestris, Festuca idahoensis, Hesperostipa comata, Leymus cinereus*, and *Pseudoroegneria spicata*.

VEGETATION

Physiognomy and Structure: This alliance is characterized by an open to moderately dense (10-25%) cover of microphyllous evergreen shrubs, usually 0.3-1 m in height. Cespitose graminoids are usually prominent, and exceed the shrubs in height and/or cover. Forb species may be frequent or not, but are usually of low canopy cover.

Floristics: This mesic shrubland and steppe alliance is characterized by an open to moderately dense shrub layer dominated or codominated by *Artemisia tripartita* with10-25% cover and with herbaceous species having equal or greater coverage than shrubs. Common shrub associates include *Artemisia frigida, Artemisia tridentata ssp. tridentata, Artemisia tridentata ssp. vaseyana, Chrysothamnus viscidiflorus, Krascheninnikovia lanata, Purshia tridentata*, or *Tetradymia canescens*. The herbaceous stratum is typically dominated by graminoids of moderate to moderately high cover (20-70%). *Pseudoroegneria spicata* and *Festuca idahoensis* are the most common associates. Other locally abundant graminoid species include *Bouteloua curtipendula, Bouteloua gracilis, Carex filifolia, Festuca campestris, Hesperostipa comata (= Stipa comata)*, and *Koeleria macrantha*. Forbs form a minor and highly variable portion of this vegetation. Recurrent species include Achillea millefolium, Balsamorhiza sagittata, Camelina microcarpa, Erigeron spp., *Opuntia* spp., *Phlox* spp., and *Sphaeralcea coccinea*.

ENVIRONMENT & DYNAMICS

Environmental Description: This mesic shrubland and steppe alliance is distributed from the Columbia Basin east to the northern Rocky Mountains. Climate ranges from semi-arid in intermountain basins to subhumid in higher elevations of the Rocky Mountains. The amount and reliability of growing-season moisture increase eastward and with increasing altitude, generally averaging 25-35 cm annually. These communities occur from elevations of less than 1000 m in the Columbia Basin to over 2500 m in the Rocky Mountains. The alliance occurs on flat to steeply sloping upland sites. Sites with little slope tend to have deeper soils, while those with steeper slopes have shallow to moderately deep soils. Soil texture is loam, sandy loam, or clay loam, but is highly variable (Hironaka et al. 1983). *Artemisia cana*- or *Artemisia tridentata ssp. wyomingensis*-dominated communities often occupy lower elevations, and *Artemisia tridentata ssp. vaseyana*-dominated communities occupy cooler, moister upland sites at higher elevation. Other adjacent vegetation types across the range of this alliance include *Atriplex confertifolia, Chrysothamnus* spp., or *Artemisia nova* shrublands, *Populus tremuloides, Pinus ponderosa, Pinus contorta, Abies grandis*, or *Pseudotsuga menziesii* forests, *Pinus - Juniperus* woodlands, shortgrass and mixed-grass prairie, or mesic montane meadow communities.

Dynamics: *Artemisia tripartita* is able to resprout following fire, and dominance by the shrub is favored in overgrazed ranges (Hironaka et al. 1983). Populations may have variation in this ability (Hironaka et al. 1983). *Artemisia tripartita ssp. tripartita* occurs from the Continental Divide of Wyoming to the Columbia Basin of Washington. This subspecies has an erect growth form and may reach 2 m in height. *Artemisia tripartita ssp. rupicola* occurs east of the Continental Divide in Wyoming and forms low, layered shrubs less than 0.3 m in height (Fisser 1962). Growth trials of the two subspecies under similar conditions have shown that these morphological characteristics are genetic rather than environmentally controlled (Fisser 1962).

DISTRIBUTION

Geographic Range: This alliance occurs from eastern Washington and British Columbia, across the upper Columbia Basin to various habitats in the Rocky Mountains of Montana, Wyoming, and Colorado.

Nations: CA, US
States/Provinces: BC, CO, ID, MT, OR, WA, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):

Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** SRM Cover Type #404 - Threetip Sagebrush (Shiflet 1994)

LOWER LEVEL UNITS

Associations:

- CEGL001538 *Artemisia tripartita ssp. tripartita / Pseudoroegneria spicata* Shrub Grassland
- CEGL005482 *Artemisia tripartita ssp. tripartita / Pascopyrum smithii* Shrubland
- CEGL002994 *Artemisia tripartita ssp. tripartita / Leymus cinereus* Shrub Grassland
- CEGL001536 *Artemisia tripartita ssp. tripartita / Festuca idahoensis* Shrub Grassland
- CEGL005483 *Artemisia tripartita ssp. tripartita / Poa secunda* Shrubland
- CEGL001537 *Artemisia tripartita ssp. tripartita / Festuca campestris* Shrub Grassland
- CEGL001539 *Artemisia tripartita ssp. tripartita / Hesperostipa comata* Shrub Grassland
- CEGL005481 *Artemisia tripartita ssp. tripartita / Koeleria macrantha* Shrubland

AUTHORSHIP

Primary Concept Source: D. Sarr and M.S. Reid, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by D. Sarr and M.S. Reid.
Version Date: 2014/12/18

REFERENCES

References: Caicco and Wellner 1983h, Caicco and Wellner 1983i, Caicco and Wellner 1983j, Chappell et al. 1997, Daubenmire 1970, Faber-Langendoen et al. 2017b, Fisser 1962, Hess 1981, Hironaka et al. 1983, Johnston 1987, McLean 1970, Mueggler and Stewart 1980, Shiflet 1994, Tweit and Houston 1980, WNHP unpubl. data

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G302. Intermountain Mesic Tall Sagebrush Steppe & Shrubland

A3179. Purshia tridentata - Artemisia tridentata Mesic Steppe & Shrubland Alliance

Type Concept Sentence: This mesic alliance occurs throughout the Intermountain West and is characterized by an open to moderately dense short-shrub layer dominated or codominated by *Purshia tridentata* with *Artemisia tridentata* and sometimes *Prunus virginiana* present to codominant. The understory is sparse to dense and typically dominated by perennial bunchgrasses such as *Achnatherum hymenoides, Achnatherum nelsonii, Achnatherum occidentale, Festuca campestris, Festuca idahoensis, Hesperostipa comata, Leymus cinereus, Poa secunda*, and *Pseudoroegneria spicata*.

OVERVIEW

Scientific Name: *Purshia tridentata - Artemisia tridentata* Mesic Steppe & Shrubland Alliance
Common Name (Translated Scientific Name): Antelope Bitterbrush - Big Sagebrush Mesic Steppe & Shrubland Alliance
Colloquial Name: Antelope Bitterbrush - Big Sagebrush Mesic Steppe & Shrubland

Type Concept: This mesic shrubland and steppe alliance occurs throughout the Intermountain West and occurs over a broad range of landforms and microhabitats. Stands are characterized by an open to moderately dense short-shrub layer dominated or codominated by *Purshia tridentata* with *Artemisia tridentata* and sometimes *Prunus virginiana* present to codominant. Other important shrubs include *Ericameria nauseosa (= Chrysothamnus nauseosus), Eriogonum heracleoides, Ribes cereum*, and *Symphoricarpos oreophilus*. The understory is sparse to dense and typically dominated by perennial bunchgrasses such as *Achnatherum hymenoides, Achnatherum nelsonii, Achnatherum occidentale, Festuca campestris, Festuca idahoensis, Hesperostipa comata, Leymus cinereus, Poa secunda*, and *Pseudoroegneria spicata*. Some stands may have a well-developed forb component composed of *Arabis holboellii, Achillea millefolium, Balsamorhiza sagittata, Brodiaea* spp., *Eriogonum ovalifolium, Eriogonum umbellatum, Lithospermum ruderale*, and *Pteryxia terebinthina (= Cymopterus terebinthinus)*. Mosses and lichens are important in some stands. Scattered trees may form an emergent layer of individual trees. Stands occur on flats to moderate slopes in foothills, on slopes of lakebeds with ash or pumice soils, and on drier sites within lower forest zones as shrub-steppe inclusions in forest. In Idaho, the alliance is reported from stabilized dunes. In general, it is an upland type associated with coarse, well-drained soils without high salinity or pH. Adjacent vegetation is typically *Artemisia* steppe, *Pseudoroegneria - Poa - Festuca* grasslands, or *Pinus flexilis* woodlands.

Classification Comments: This mesic shrubland and steppe alliance occurs as large patch/matrix stands in relatively mesic northern latitudes. However, in semi-arid landscapes in more southern latitudes, it frequently occurs in smaller patch stands restricted to relatively mesic sites, such as swales and basins, that receive additional moisture from surrounding slopes and at higher elevations.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Stands in this mesic shrubland and steppe alliance are dominated or codominated by *Purshia tridentata* with *Artemisia tridentata* and sometimes *Prunus virginiana* present to codominant. Characteristic herbaceous species are *Achnatherum hymenoides, Achnatherum nelsonii, Achnatherum occidentale, Carex pensylvanica, Eriogonum umbellatum, Festuca campestris, Festuca idahoensis, Hesperostipa comata, Leymus cinereus, Poa secunda*, and *Pseudoroegneria spicata*.

VEGETATION

Physiognomy and Structure: This alliance has a moderately dense to open (20-60% cover) microphyllous evergreen (or late cold-deciduous) shrublands with the dominant shrubs varying from 0.5-3 m in height. Maximum shrub height generally decreases with latitude and altitude, reaching a minimum in subalpine stands. A second tier of microphyllous evergreen or cold-deciduous shrubs may be present. Cespitose graminoids are typical herbaceous associates and may strongly dominate the ground layer. Some regional variants may have a substantial forb component as well. Lichens and mosses may cover the ground surface in good condition stands.

Floristics: This mesic shrubland and steppe alliance is characterized by an open to moderately dense short-shrub layer dominated or codominated by *Purshia tridentata* with *Artemisia tridentata* and sometimes *Prunus virginiana* present to codominant. Other important or occasional shrubs include *Artemisia frigida, Ceanothus velutinus, Chrysothamnus viscidiflorus, Ericameria nauseosa (= Chrysothamnus nauseosus), Eriogonum heracleoides, Ribes cereum*, and *Symphoricarpos oreophilus*. Scattered trees may form an emergent layer of individual trees; species include *Cercocarpus ledifolius, Juniperus occidentalis, Juniperus osteosperma, Juniperus scopulorum, Pinus ponderosa, Pinus jeffreyi, Pinus ponderosa var. washoensis (= Pinus washoensis), Quercus garryana*, or *Yucca brevifolia*. The understory is sparse to dense and typically dominated by perennial bunchgrasses such as *Achnatherum hymenoides, Achnatherum nelsonii, Achnatherum occidentale, Elymus lanceolatus, Festuca campestris, Festuca idahoensis, Hesperostipa comata, Koeleria macrantha, Leymus cinereus, , Poa secunda*, and *Pseudoroegneria spicata*. Other graminoids include *Carex geyeri, Carex pensylvanica*, and *Muhlenbergia montana*. Some stands may have a well-developed forb component composed of *Arabis holboellii, Achillea millefolium, Balsamorhiza sagittata, Brodiaea* spp., *Eriogonum ovalifolium, Eriogonum umbellatum, Lithospermum ruderale*, and *Pteryxia terebinthina (= Cymopterus terebinthinus)*. Mosses and lichens are important in some stands. Diagnostic of this alliance is the dominance of *Purshia tridentata* in a shrub layer that is greater than 25% on average.

ENVIRONMENT & DYNAMICS

Environmental Description: This mesic shrubland and steppe alliance occurs throughout the Intermountain West over a broad range of landforms and microhabitats at elevations from 500-3000 m. Stands are often found on the margins of *Pinus ponderosa* woodlands or forests, forming the transition into sagebrush vegetation. Most of the region is arid to semi-arid with annual precipitation ranging from 15-75 cm. The entire range is under a continental temperature regime of cold winters, cool to warm summers and large diurnal variation. In the western portions of the alliance's range, summers are dry. Growing-season precipitation increases eastward and is the greatest in the Rocky Mountains. They also occur on flats to moderate slopes in foothills, on slopes of lakebeds with ash or pumice soils, and on drier sites within lower forest zones as shrub-steppe inclusions in forest. In Idaho, the alliance is reported from stabilized dunes (Chadwick and Dalke 1965). In Colorado, the alliance is found on exposed, steep (45-60% slope) mountain slopes with southerly aspects on the eastern slopes of the Front Range (Hess 1981). These sites are typically too xeric to support extensions of the surrounding coniferous forests. Parent materials are colluvial and residual metamorphic rocks which have developed into soils classified as Entisols. These soils are poorly developed and rocky, with loamy and sandy textures, and shallow A horizons over rocky C horizons. The soil surface is also moderately rocky. In general, it is an upland type associated with coarse, well-drained soils without high salinity or pH. Adjacent vegetation is typically *Artemisia* steppe, *Pseudoroegneria - Poa - Festuca* grasslands, or *Pinus flexilis* woodlands.

Dynamics: *Purshia tridentata* displays considerable plasticity in growth across its range. The variation in height and form of different populations appears to be related to ecotypic variation (Mozingo 1987). Although mycorrhizae are considered important in establishment and growth of individual plants, *Purshia tridentata* is one of the first species to colonize barren volcanic substrates following eruption. The species is valuable as winter browse for native ungulates and livestock and is used extensively. Moderate livestock utilization (<60% of the year's current growth) has been reported to stimulate twig growth the following spring (Mueggler and Stewart 1980). Sawyer and Keeler-Wolf (1995) report that stands of *Purshia tridentata* can reach 125 years of age on deep, well-drained sites, but more commonly become decadent at 30 years, and die at 40-50 years of age. Stands appear to result from either a

disturbance event (such as fire), or from rare years when many seedlings survive. This results in even-aged stands (Sawyer and Keeler-Wolf 1995).

DISTRIBUTION

Geographic Range: This alliance is found in many western U.S. states and Canada, from California north and east into Oregon, Washington, Idaho, Colorado and British Columbia. The core of its range is the Columbia Basin and Columbia Plateau, Owyhee Uplands, Snake River Plain, and the Colorado Rockies. *Purshia tridentata* is one of the most widespread shrubs in the western United States.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **>** *Purshia tridentata* (Bitter brush scrub) Alliance (Sawyer et al. 2009) [35.200.00]
- **><** Bitterbrush Series (Sawyer and Keeler-Wolf 1995)

LOWER LEVEL UNITS

Associations:

- CEGL001494 *Purshia tridentata / Festuca campestris* Shrub Grassland
- CEPP006746 *Purshia glandulosa - Artemisia tridentata* Shrubland
- CEGL001497 *Purshia tridentata / Pseudoroegneria spicata - Leymus cinereus* Shrub Grassland
- CEGL002674 *Purshia tridentata / Festuca idahoensis* Shrub Grassland
- CEGL001058 *Purshia tridentata / Achnatherum hymenoides* Shrubland
- CEGL001498 *Purshia tridentata / Hesperostipa comata* Shrub Grassland
- CEGL001059 *Purshia tridentata / Poa secunda* Shrubland
- CEGL001060 *Purshia tridentata / Prunus virginiana* Shrubland
- CEGL003124 *Purshia tridentata* Shrubland [Placeholder]
- CEGL001495 *Purshia tridentata / Pseudoroegneria spicata* Shrub Grassland
- CEGL003477 *Purshia tridentata - Artemisia tridentata / Eriogonum umbellatum* Shrubland
- CEGL003478 *Purshia tridentata - Artemisia tridentata / Achnatherum hymenoides* Shrubland
- CEGL005610 *Purshia tridentata - Ericameria nana / Penstemon deustus* Shrubland
- CEGL003479 *Purshia tridentata - Artemisia tridentata / Achnatherum nelsonii* Shrubland
- CEGL003480 *Purshia tridentata - Artemisia tridentata - Symphoricarpos rotundifolius* Shrubland
- CEGL003481 *Purshia tridentata - Artemisia tridentata - Tetradymia canescens* Shrubland
- CEGL001492 *Purshia tridentata / Carex pensylvanica - Achnatherum occidentale* Shrub Grassland
- CEGL005612 *Purshia tridentata / Achnatherum thurberianum* Shrubland
- CEGL005613 *Purshia tridentata / Leymus cinereus* Shrub Grassland
- CEPP006747 *Purshia glandulosa* Shrubland
- CEGL005611 *Purshia tridentata - Philadelphus lewisii / Poa secunda* Shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by D. Sarr.
Version Date: 2014/12/18

REFERENCES

References: Buttery 1955, Caicco and Wellner 1983e, Chadwick and Dalke 1965, Chappell et al. 1997, Copeland 1978, Daubenmire 1970, Daubenmire 1975, Day 1985, Day and Wright 1985, Evens et al. 2014, Faber-Langendoen et al. 2017b, Franklin and Dyrness 1973, Hall 1973, Hess 1981, Hess and Wasser 1982, Hironaka et al. 1983, Johnson and Clausnitzer 1992, Johnson and Simon 1987, Johnston 1987, Lewis 1975a, Marr et al. 1980, Moseley 1987c, Mozingo 1987, Mueggler and Stewart 1980, Poulton 1955, Reid et al. 1994, Roughton 1966, Roughton 1972, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Tisdale 1947, Tweit and Houston 1980, Volland 1976, WNHP unpubl. data, Wasser and Hess 1982

3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
3.B.1.Ne.3.c. M169 Great Basin-Intermountain Tall Sagebrush Steppe & Shrubland

G304. Intermountain Mountain Big Sagebrush Steppe & Shrubland

Type Concept Sentence: This sagebrush shrubland and shrub-steppe group is found at montane and subalpine elevations across the western U.S. where the open to dense shrub layer is composed primarily of *Artemisia tridentata ssp. vaseyana, Artemisia cana ssp. bolanderi, Artemisia cana ssp. viscidula*, and related taxa such as *Artemisia tridentata ssp. spiciformis* and *Artemisia rothrockii* with *Symphoricarpos* spp. often codominant and there is usually an abundant perennial herbaceous layer (over 25% cover).

OVERVIEW

Scientific Name: *Artemisia tridentata ssp. spiciformis - Artemisia tridentata ssp. vaseyana - Artemisia cana ssp. viscidula* Steppe & Shrubland Group
Common Name (Translated Scientific Name): Spiked Big Sagebrush - Mountain Big Sagebrush - Mountain Silver Sagebrush Steppe & Shrubland Group
Colloquial Name: Mountain Big Sagebrush - Mixed Steppe & Shrubland

Type Concept: This group includes sagebrush communities occurring at foothills (in Wyoming) to montane and subalpine elevations across the western U.S. from 1000 m in eastern Oregon and Washington to over 3000 m in the Southern Rockies. In Montana, it occurs on mountain "islands" in the north-central portion of the state and possibly along the Boulder River south of Absarokee and at higher elevations. In British Columbia, it occurs between 450 and 1650 m in the southern Fraser Plateau and the Thompson and Okanagan basins. Across its range of distribution, this is a compositionally diverse group. It is composed primarily of *Artemisia tridentata ssp. vaseyana*, and related taxon *Artemisia tridentata ssp. spiciformis* often with *Symphoricarpos* spp. present to codominant. Also included, but less common, are stands dominated by *Artemisia cana ssp. bolanderi, Artemisia cana ssp. viscidula*, and *Artemisia rothrockii* (a California endemic). Additionally there are mixed shrub stands codominated by *Amelanchier* spp., *Chamaebatiaria millefolium, Chrysothamnus viscidiflorus, Ericameria nauseosa, Peraphyllum ramosissimum, Purshia tridentata*, and *Ribes cereum*. *Artemisia tridentata ssp. wyomingensis* may be present to codominant if the stand is clearly montane as indicated by montane indicator species such as *Artemisia tridentata ssp. vaseyana, Danthonia intermedia, Festuca thurberi*, or *Leucopoa kingii*.

Most stands have an abundant perennial herbaceous layer (over 25% cover, and in many cases over 50% cover), but this group also includes *Artemisia tridentata ssp. vaseyana* shrublands that lack a significant herbaceous layer. Other common graminoids include *Achnatherum lettermanii, Achnatherum occidentale, Achnatherum pinetorum, Bromus carinatus, Calamagrostis rubescens*, Carex geyeri, *Elymus trachycaulus, Festuca arizonica, Festuca campestris, Festuca idahoensis, Hesperostipa comata, Leucopoa kingii, Muhlenbergia montana, Pascopyrum smithii, Poa fendleriana, Poa secunda*, and *Pseudoroegneria spicata*. In many areas, wildfires can maintain an open herbaceous-rich steppe condition, although at most sites, shrub cover can be unusually high for a steppe system (>40%), with the moisture providing equally high grass and forb cover.

Classification Comments: *Artemisia cana* is often found in mesic to wet swales and toeslopes. Some *Artemisia cana ssp. viscidula* communities are included in this group, when they are not composed of more obligate wetland taxa, such as *Juncus*, wetland Carices, and such.

Similar NVC Types:
- G303 Intermountain Dry Tall Sagebrush Steppe & Shrubland
- G302 Intermountain Mesic Tall Sagebrush Steppe & Shrubland

Diagnostic Characteristics: This montane and subalpine sagebrush shrubland and shrub-steppe group is dominated by diagnostic shrub species *Artemisia tridentata ssp. vaseyana, Artemisia cana ssp. bolanderi, Artemisia cana ssp. viscidula*, and related taxa such as *Artemisia tridentata ssp. spiciformis* and *Artemisia rothrockii* (a California endemic). *Symphoricarpos* spp. are often codominant, but other shrubs may be present, forming a mixed canopy. There is usually an abundant perennial herbaceous layer (over 25% cover). Characteristic montane and subalpine herbaceous species include *Achnatherum lettermanii, Achnatherum occidentale, Achnatherum pinetorum, Bromus carinatus, Calamagrostis rubescens, Carex geyeri, Carex exserta, Danthonia intermedia, Danthonia parryi, Elymus trachycaulus, Festuca arizonica, Festuca campestris, Festuca idahoensis, Festuca thurberi, Leucopoa kingii*, and *Muhlenbergia montana*.

VEGETATION

Physiognomy and Structure: Microphyllous-leaved evergreen and broad-leaved, cold-deciduous shrub-steppe group with open to dense cover of sagebrush species and an abundant perennial herbaceous layer of graminoid and forb species.

Floristics: Vegetation types within this group are usually less than 1.5 m tall and dominated by *Artemisia tridentata ssp. vaseyana, Artemisia tridentata ssp. spiciformis*, or *Artemisia cana ssp. viscidula*, often with *Symphoricarpos* spp. present to codominant. Also included, but less common, are stands dominated by *Artemisia cana ssp. bolanderi, Artemisia cana ssp. viscidula*, and *Artemisia rothrockii* (a California endemic). Additionally, there are mixed shrub stands codominated by *Amelanchier* spp., *Chamaebatiaria millefolium, Peraphyllum ramosissimum*, and *Purshia tridentata*. A variety of other shrubs can be found in some occurrences, but these are seldom dominant. They include *Amelanchier alnifolia, Artemisia arbuscula, Ceanothus velutinus, Chrysothamnus viscidiflorus, Ericameria nauseosa, Ribes cereum*, and *Rosa woodsii*. *Artemisia tridentata ssp. wyomingensis* may be present to codominant if the stand is clearly montane to subalpine as indicated by montane indicator species such as *Artemisia tridentata ssp. vaseyana, Danthonia intermedia, Festuca thurberi*, or *Leucopoa kingii*. The shrub canopy cover ranges from 10 to 80%. The herbaceous layer is usually well-represented (over 25% cover, and in many cases over 50% cover), but bare ground may be common in particularly arid or disturbed occurrences. Additional characteristic graminoids may include *Achnatherum lettermanii, Achnatherum occidentale, Achnatherum pinetorum, Bromus carinatus, Calamagrostis rubescens, Carex geyeri, Carex exserta, Danthonia parryi, Elymus trachycaulus, Festuca arizonica, Festuca campestris, Festuca idahoensis, Hesperostipa comata, Muhlenbergia montana, Pascopyrum smithii, Poa fendleriana, Poa secunda*, and *Pseudoroegneria spicata*. Forbs are often numerous and an important indicator of health. Common forbs include *Achillea millefolium, Antennaria rosea, Artemisia ludoviciana, Balsamorhiza sagittata, Eriogonum umbellatum, Fragaria virginiana, Hymenoxys hoopesii (= Helenium hoopesii)*, and several species of *Astragalus, Castilleja, Erigeron, Geum, Lupinus, Penstemon, Phlox*, and *Potentilla*.

ENVIRONMENT & DYNAMICS

Environmental Description: This group occurs in many of the western United States, usually at middle elevations (1000-2500 m). The climate regime is cool, semi-arid to subhumid, with yearly precipitation ranging from 25 to 90 cm/year. Much of this precipitation falls as snow. Temperatures are continental with large annual and diurnal variation. In general, this group shows an affinity for mild topography, fine soils, and some source of subsurface moisture. Soils generally are moderately deep to deep, well-drained, and of loam, sandy loam, clay loam, or gravelly loam textural classes; soils often have a substantial volume of coarse fragments, and are derived from a variety of parent materials. This group primarily occurs on deep-soiled to stony flats, ridges, nearly flat ridgetops, and mountain slopes. All aspects are represented, but the higher elevation occurrences may be restricted to south- or west-facing slopes.

Dynamics: Healthy sagebrush shrublands are very productive, are often grazed by domestic livestock, and are strongly preferred during the growing season (Padgett et al. 1989). Prolonged livestock use can cause a decrease in the abundance of native bunch grasses and increase in the cover of shrubs and non-native grass species such as *Poa pratensis*. *Artemisia cana* resprouts vigorously following spring fire, and prescribed burning may increase shrub cover. Conversely, fire in the fall may decrease shrub abundance (Hansen et al. 1995). *Artemisia tridentata* is generally killed by fires and may take over ten years to form occurrences of some 20% cover or more. The condition of most sagebrush steppe has been degraded due to fire suppression and heavy livestock grazing. It is unclear how long restoration will take to restore degraded occurrences.

DISTRIBUTION

Geographic Range: This group is found at montane and subalpine elevations across the western U.S. from 1000 m in eastern Oregon and Washington to over 3000 m in the Southern Rockies. In British Columbia, it occurs in the southern Fraser Plateau and the Thompson and Okanagan basins. This group also occurs in central Montana in the Rocky Mountain island ranges

Spatial Scale & Pattern [optional]: Matrix
Nations: CA, US
States/Provinces: AZ?, BC, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]: 6:C, 7:C, 8:C, 9:C, 12:C, 18:C, 19:C, 20:C, 26:C, 68:C
USFS Ecoregions (2007): 313A:CC, 313B:CP, 315A:CC, 315H:CC, 321A:??, 322A:CC, 331B:C?, 331F:CC, 331G:CC, 331J:CC, 331M:C?, 331N:CP, 341A:CC, 341B:CC, 341C:CC, 341D:CC, 341E:CC, 341F:CC, 341G:CC, 342A:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:CC, 342I:CC, 342J:CC, M242C:CC, M242D:CC, M261A:CC, M261D:CC, M261E:CC, M261F:C?, M261G:CC, M313A:CP, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M341A:CC, M341B:CC, M341C:CC, M341D:CC
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

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

SYNONYMY

- **=** Mountain Big Sagebrush (402) (Shiflet 1994)
- **=** Western Intermountain sagebrush steppe (West 1983c)

LOWER LEVEL UNITS

Alliances:
- A3208 *Artemisia tridentata ssp. vaseyana* - Mixed Steppe & Shrubland Alliance
- A1098 *Artemisia rothrockii* Shrubland Alliance
- A3200 *Artemisia cana ssp. bolanderi - Artemisia cana ssp. viscidula* Steppe & Shrubland Alliance
- A3207 *Artemisia tridentata ssp. spiciformis - Artemisia tridentata ssp. vaseyana* Steppe & Shrubland Alliance

AUTHORSHIP

Primary Concept Source: N.E. West (1983c)
Author of Description: M.E. Hall and K.A. Schulz
Acknowledgments:
Version Date: 11/06/2015
Classif Resp Region: West
Internal Author: MEH 2-10, mod. KAS 11-15

REFERENCES

References: Faber-Langendoen et al. 2017a, Hansen et al. 1995, Hironaka et al. 1983, Johnston 2001, Mueggler and Stewart 1980, Padgett et al. 1989, Shiflet 1994, West 1983c

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G304. Intermountain Mountain Big Sagebrush Steppe & Shrubland

A3208. Artemisia tridentata ssp. vaseyana - Mixed Steppe & Shrubland Alliance

Type Concept Sentence: This alliance is widespread in mountainous areas across the western U.S. The vegetation is characterized by a moderate to dense shrub layer in which *Artemisia tridentata ssp. vaseyana* is codominant with non-sagebrush shrub species *Amelanchier utahensis, Holodiscus dumosus, Purshia tridentata*, or *Symphoricarpos oreophilus*. Perennial graminoids typically dominate the open to moderately dense herbaceous layer. This alliance forms large, continuous stands on mid-elevation mountain slopes and foothills, and can extend above the lower treeline as patches within montane or subalpine coniferous forests.

OVERVIEW

Scientific Name: *Artemisia tridentata ssp. vaseyana* - Mixed Steppe & Shrubland Alliance
Common Name (Translated Scientific Name): Mountain Big Sagebrush - Mixed Steppe & Shrubland Alliance
Colloquial Name: Mountain Big Sagebrush - Mixed Steppe & Shrubland

Type Concept: This alliance is widespread in mountainous areas across the western U.S. The vegetation included in this alliance is characterized by an open to dense (10-70% cover) shrub layer in which *Artemisia tridentata ssp. vaseyana* is codominant, usually with 40-60% relative cover with non-sagebrush shrub species such as *Amelanchier utahensis, Holodiscus dumosus, Purshia tridentata*, or *Symphoricarpos oreophilus*. Perennial graminoids typically dominate the open to moderately dense herbaceous layer. The most widespread species are *Pseudoroegneria spicata* and *Festuca idahoensis*, which occur from the Columbia Basin to the northern Rockies, although they may not be the most abundant species in individual stands. Other locally important species may include *Achnatherum occidentale (= Stipa occidentalis), Bouteloua gracilis, Bromus carinatus, Elymus trachycaulus, Festuca thurberi, Festuca viridula, Koeleria macrantha, Leucopoa kingii (= Festuca kingii), Leymus cinereus, Pascopyrum smithii, Poa fendleriana*, and *Poa secunda*. The forb layer is variable and can be very diverse. Species of *Castilleja, Potentilla, Erigeron, Phlox, Astragalus, Geum, Lupinus*, and *Eriogonum* are characteristic. The alliance forms large, continuous stands on mid-elevation mountain slopes and foothills, and can extend above the lower treeline as patches within montane or subalpine coniferous forests. Sites are variable and range from flats to steep slopes to ridgetops with deep to shallow rocky soil.

Classification Comments: Although the dominant species is shared with the different *Artemisia tridentata ssp. spiciformis - Artemisia tridentata ssp. vaseyana* Steppe & Shrubland Alliance (A3207), Young et al. (2007) show that there are substantial compositional and environmental differences which warrant separation into two different alliances. Much of the area occupied by this widespread alliance has been moderately to severely degraded by livestock grazing and subsequent invasion by *Bromus tectorum* with a consequent alteration of its fire regime. Individuals of the dominant species do not usually survive fire and usually take a decade or more to reestablish (Tirmenstein 1999c).

Internal Comments:
Other Comments:

Similar NVC Types:

- A3207 *Artemisia tridentata ssp. spiciformis - Artemisia tridentata ssp. vaseyana* Steppe & Shrubland Alliance: is not codominated by non-sagebrush shrubs.

Diagnostic Characteristics: This sagebrush mixed shrub alliance is widespread in mountainous areas across the western U.S. The vegetation included in this alliance is characterized by a moderate to dense shrub layer in which *Artemisia tridentata ssp. vaseyana* is codominant with non-sagebrush shrub species *Amelanchier utahensis, Holodiscus dumosus, Purshia tridentata*, or *Symphoricarpos oreophilus*. Perennial graminoids typically dominate the open to moderately dense herbaceous layer. Characteristic grasses are *Bromus carinatus, Elymus trachycaulus ssp. trachycaulus, Festuca idahoensis, Hesperostipa comata, Muhlenbergia montana, Poa secunda*, and *Pseudoroegneria spicata*.

VEGETATION

Physiognomy and Structure: The shrublands in this alliance are characterized by a open to dense (10-75%) cover of microphyllous evergreen shrubs, usually 1-2 m in height. Cespitose graminoids are scattered in the shrub matrix and can occasionally match the shrubs in height. A sparse, emergent layer of scale-leaved or needle-leaved evergreen trees may also be present, but in many areas no trees are present. Forb species may be frequent, but are usually of low cover. With increasing summer rain in the southeastern edge of the range, there is an increase in the importance of sod-forming grasses in comparison to bunchgrasses. In many areas, undisturbed stands in this alliance will have a cryptogamic soil crust composed of a mix of lichens, tiny mosses, and bacteria.

Floristics: The vegetation included in this alliance is characterized by a open to dense (10-70% cover) short-shrub layer in which *Artemisia tridentata ssp. vaseyana* is codominant, usually with 40-60% relative cover, with non-sagebrush shrub species such as *Amelanchier utahensis, Holodiscus dumosus, Purshia tridentata*, or *Symphoricarpos oreophilus*. Perennial graminoids typically dominate the open to moderately dense herbaceous layer. The most widespread species are *Pseudoroegneria spicata* and *Festuca idahoensis*, which occur from the Great Basin to the Rocky Mountains, although they may not be the most abundant species in individual stands. Other locally important species may include *Bromus carinatus, Elymus trachycaulus, Hesperostipa comata, Koeleria macrantha, Muhlenbergia montana, Poa fendleriana*, and *Poa secunda*. The forb layer is variable and can be very diverse. Species of *Castilleja, Potentilla, Erigeron, Phlox, Astragalus, Geum, Lupinus*, and *Eriogonum* are characteristic.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance is widespread in mountainous areas across the western U.S. and forms large, continuous stands on mid-elevation mountain slopes and foothills, and can extend above the lower treeline as patches within montane or subalpine coniferous forests. The climate regime is cool, semi-arid to subhumid, with yearly precipitation ranging from 18-60 cm. Much of the yearly precipitation falls as snow, which may cover the ground for long periods in winter. Temperatures are continental with large annual and diurnal variation. The elevation range for this alliance is large, from about 1060 m in eastern Oregon and Washington, to well over 3500 m in the mountains of northern Nevada, Idaho, and Colorado. Landscape positions are variable as well, but primarily are deep-soiled to stony flats, ridges, nearly flat ridgetops, and mountain slopes. All aspects are represented, but the higher elevation occurrences may be mainly on south- or west-facing slopes. Soils generally are moderately deep to deep, well-drained, and of loam, sandy loam, clay loam, or gravelly loam textural classes; they often have a substantial volume of coarse fragments. The soils are derived from a variety of parent materials (although sandstones, limestones, and crystalline rocks are common). In some cases, soils supporting stands of this alliance are unstable and prone to mass movement (Bramble-Brodahl 1978, Hironaka et al. 1983). In subalpine environments, these shrublands are found on deeper soils than *Artemisia arbuscula* subalpine shrublands. Although the vegetation may grow in alkaline soils at the edge of internally drained basins, *Artemisia tridentata* is a non-halophyte and requires low salinity for optimum growth.

Dynamics: Complex ecological interactions between fire regimes, grazing history, and climate patterns result in equally complex patterns of species structure and composition in *Artemisia tridentata*. These present corresponding difficulties in the classification of these shrublands, which have been compounded by the influence of human settlement and agricultural patterns. What follows is a summary of some of the influences of altered fire regimes, and grazing history on *Artemisia tridentata* shrublands and shrub herbaceous vegetation.

Artemisia tridentata ssp. vaseyana shrublands may represent either drier or more disturbed examples of the *Artemisia tridentata ssp. vaseyana* shrubland complex. Shrub densities typically increase with overgrazing of the bunchgrass component or with increasing summer drought (West 1983c). There is considerable debate over whether present shrub-dominated stands are actually degraded "steppe" (e.g., shrub-herbaceous physiognomy), and if the stands will return to steppe with changes in grazing and fire management. *Artemisia tridentata* is inhibited by fire, and excessive grazing may decrease fire frequency due to consumption of herbaceous forage, resulting in increased shrub density. Conversely, invasion by non-native annual grasses (e.g., *Bromus tectorum* at lower elevations) may increase fire frequency sufficiently to eliminate the shrubs from the stands (Hironaka et al. 1983). With a change in fire frequency, species composition will be altered as well (West 1983c). With a high fire frequency (every 2-5 years), perennial grasses and shrubs are eliminated and non-native annual grasses dominate. At fire-return intervals of 10-30 years, short-lived resprouting shrubs such as *Chrysothamnus* or *Tetradymia* spp. dominate. At fire intervals of 30-70 years, a mixture

of perennial bunchgrasses and shrubs is maintained. Finally, in the complete absence of fire, deep-rooted shrubs such as *Artemisia tridentata* become the theoretical dominants.

DISTRIBUTION

Geographic Range: This shrubland alliance occurs in mountainous regions from eastern California, Oregon, and Washington, across the Great Basin in Nevada, the northern Rocky Mountain foothills of Idaho, and in Colorado, Wyoming, and Montana. It has not been reported from Utah, Arizona, or New Mexico, but it is very likely to occur in these states at high elevations. In addition, the alliance probably extends north into Alberta, Canada.

Nations: CA?, US
States/Provinces: AB?, CA, CO, ID, MT, NV, OR, UT, WY
TNC Ecoregions [optional]: 11:C, 17:C
USFS Ecoregions (2007): 322Ac:CCC, 322Ad:CCC, 341Fa:CCC, 341Fb:CCC, 341Fc:CCC, 341Fd:CCC, 341Ff:CCC, 341Fg:CCC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Great Basin)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **<** *Artemisia tridentata ssp. vaseyana* (Mountain big sagebrush) Alliance (Sawyer et al. 2009) [35.111.00]
- **=** *Artemisia tridentata ssp. vaseyana* Shrubland Alliance (Evens et al. 2014) [probably equivalent]
- **><** Big Sagebrush Scrub (#35210) (Holland 1986b)
- **><** Big Sagebrush Series (Sawyer and Keeler-Wolf 1995)
- **<** SRM Cover Type #402 - Mountain Big Sagebrush (Shiflet 1994)
- **><** Western Shrub and Grasslands Combinations: 55: Sagebrush-Steppe (*Artemisia-Agropyron*) (Küchler 1964)
- **><** Western Shrub: 38: Great Basin Sagebrush (*Artemisia*) (Küchler 1964)

LOWER LEVEL UNITS

Associations:

- CEGL002820 *Amelanchier utahensis - Artemisia tridentata (ssp. vaseyana, ssp. wyomingensis)* Shrubland
- CEPP006855 *Artemisia tridentata ssp. vaseyana - Ephedra viridis* Shrubland
- CEGL002951 *Symphoricarpos oreophilus* Shrubland
- CEGL005484 *Chamaebatiaria millefolium / Penstemon deustus* Sparse Vegetation
- CEGL001034 *Artemisia tridentata ssp. vaseyana - Symphoricarpos oreophilus / Elymus trachycaulus ssp. trachycaulus* Shrubland
- CEGL001036 *Artemisia tridentata ssp. vaseyana - Symphoricarpos oreophilus / Festuca idahoensis* Shrubland
- CEGL005474 *Artemisia tridentata ssp. vaseyana - Chamaebatiaria millefolium / Penstemon deustus* Shrubland
- CEGL001035 *Artemisia tridentata ssp. vaseyana - Symphoricarpos oreophilus / Bromus carinatus* Shrubland
- CEGL001038 *Artemisia tridentata ssp. vaseyana - Symphoricarpos oreophilus / Pseudoroegneria spicata* Shrubland
- CEGL005827 *Artemisia tridentata ssp. vaseyana - (Purshia tridentata) / Muhlenbergia montana - (Hesperostipa comata ssp. comata)* Shrubland
- CEGL001037 *Artemisia tridentata ssp. vaseyana - Symphoricarpos oreophilus / Poa secunda* Shrubland
- CEGL001039 *Artemisia tridentata ssp. vaseyana - Symphoricarpos oreophilus / Hesperostipa comata* Shrubland
- CEGL002807 *Artemisia tridentata ssp. vaseyana - Holodiscus dumosus* Shrubland
- CEPP005794 *Artemisia tridentata ssp. vaseyana* Shrubland
- CEGL001003 *Artemisia tridentata - Ephedra* spp. Shrubland
- CEGL001032 *Artemisia tridentata ssp. vaseyana - Purshia tridentata / Pseudoroegneria spicata* Shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments: We have incorporated significant descriptive information previously compiled by D. Sarr.
Version Date: 2014/12/18

REFERENCES

References: Baker 1983c, Baker and Kennedy 1985, Blackburn 1967, Blackburn et al. 1968a, Blackburn et al. 1968c, Blackburn et al. 1969a, Blackburn et al. 1969b, Blackburn et al. 1969c, Blackburn et al. 1969d, Blackburn et al. 1971, Boyce 1977, Bramble-Brodahl 1978, Britton et al. 1981, Caicco and Wellner 1983a, Caicco and Wellner 1983f, Caicco and Wellner 1983k, Chappell et al. 1997, Cheng 2004, Cooper et al. 1999, Current 1984, Daubenmire 1970, Eddleman and Jaindl 1994, Evens et al. 2014, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2017b, Fenemore 1970, Francis 1983, Francis 1986, Franklin and Dyrness 1973, Giese 1975, Hansen et al. 1984, Harper and Jaynes 1986, Heinze et al. 1962, Hess 1981, Hess and Wasser 1982, Hironaka et al. 1983, Holecheck

and Stephenson 1983, Holland 1986b, Jameson et al. 1962, Jensen et al. 1988a, Johnson and Clausnitzer 1992, Johnson and Payne 1968, Johnson and Simon 1987, Johnston 1987, Jorgensen 1979, Komarkova 1986, Kurzius 1981, Küchler 1964, Leary and Peterson 1984, Lesica and DeVelice 1992, Lewis 1971, Lewis 1975a, Loope 1969, McArthur and Welch 1986, McLean 1970, Mooney 1985, Moretti 1979, Moretti and Brotherson 1982, Nelson and Jensen 1987, ORNHP unpubl. data, Poulton 1955, Ralston 1969, Rickard and Beatley 1965, Robertson 1971, Rzedowski 1981, Savage 1968, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Sheehy and Winward 1981, Shiflet 1994, Smith 1966, Tart 1996, Terwilliger and Smith 1978, Terwilliger and Tiedemann 1978, Tiedemann et al. 1987, Tirmenstein 1999c, Tisdale and Hironaka 1981, Tueller and Blackburn 1974, Tueller and Eckert 1987, Tueller et al. 1966, Tweit and Houston 1980, USFS 1992, Warren et al. 1982, West 1983c, Winward 1970

M093. Great Basin Saltbush Scrub

This widespread cool semi-desert macrogroup centers in the Intermountain West of the U.S. and is typically composed of saltbush shrublands. Dominants include *Atriplex canescens, Atriplex confertifolia, Atriplex corrugata, Atriplex cuneata, Atriplex gardneri, Atriplex lentiformis, Atriplex obovata, Atriplex polycarpa*, and *Atriplex spinifera*, either singly or mixed, sometimes codominated by other associated species. Substrates are typically saline, alkaline, fine-textured soils developed from shale or alluvium.

3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
3.B.1.Ne.5.b. M093 Great Basin Saltbush Scrub

G300. Intermountain Shadscale - Saltbush Scrub

Type Concept Sentence: This widespread semi-arid scrub group is found in basins, plains, alluvial flats and slopes in the intermountain western U.S. and western Great Plains and is characterized by a typically open to moderately dense shrub layer dominated or codominated by *Atriplex canescens, Atriplex confertifolia, Atriplex cuneata, Atriplex hymenelytra, Atriplex obovata, Atriplex polycarpa, Grayia spinosa*, and/or *Picrothamnus desertorum* often with other shrubs present to codominant.

OVERVIEW

Scientific Name: *Atriplex confertifolia - Atriplex canescens - Grayia spinosa* Scrub Group
Common Name (Translated Scientific Name): Shadscale Saltbush - Fourwing Saltbush - Spiny Hopsage Scrub Group
Colloquial Name: Fourwing Saltbush Scrub

Type Concept: This extensive group includes open-canopied shrublands of typically saline basins, alluvial slopes and plains across the intermountain western U.S. and western Great Plains. The vegetation is characterized by a typically open to moderately dense shrubland composed of one or more *Atriplex* species, such as *Atriplex canescens, Atriplex confertifolia, Atriplex cuneata, Atriplex hymenelytra, Atriplex obovata*, or *Atriplex polycarpa*. Other shrubs present to codominant may include *Artemisia tridentata ssp. wyomingensis, Chrysothamnus viscidiflorus, Ericameria nauseosa, Ephedra nevadensis, Krascheninnikovia lanata, Grayia spinosa, Lycium* spp., *Picrothamnus desertorum*, or *Tetradymia* spp. Northern occurrences lack *Atriplex* species and are typically dominated by *Grayia spinosa*. In Wyoming, occurrences are typically a mix of *Artemisia tridentata ssp. wyomingensis, Atriplex confertifolia, Grayia spinosa, Krascheninnikovia lanata, Sarcobatus vermiculatus*, and various *Ericameria* or *Chrysothamnus* species. Some places are a mix of *Atriplex confertifolia* and *Artemisia tridentata ssp. wyomingensis*. In the Great Basin, *Sarcobatus vermiculatus* is generally absent but, if present, does not codominate. The herbaceous layer varies from sparse to moderately dense and is dominated by perennial graminoids such as *Achnatherum hymenoides, Bouteloua gracilis, Elymus lanceolatus ssp. lanceolatus, Pascopyrum smithii, Pleuraphis jamesii, Pleuraphis rigida, Poa secunda*, or *Sporobolus airoides*. Various forbs are also present. Substrates are often saline and calcareous, medium- to fine-textured, alkaline soils, but include some coarser-textured soils.

Classification Comments: Some *Grayia spinosa*-dominated stands tends to occur on coppice dunes that have a silty component to them. If they occur on deep sand or dunes, then consider a dune group. Scrub stands dominated by *Picrothamnus desertorum* are placed in this group because *Picrothamnus desertorum* is frequently present to codominant with the widespread shrub *Atriplex confertifolia* in the Great Basin (Mozingo 1987). However, *Picrothamnus desertorum* is often short (10-25 cm tall) so could also be classified as Intermountain Dwarf Saltbush - Sagebrush Scrub Group (G301).

Similar NVC Types:
- G299 Chihuahuan Desert Lowland Basin Scrub

Diagnostic Characteristics: The vegetation is characterized by a typically open to moderately dense shrubland composed of one or more shrub species, such as *Atriplex canescens, Atriplex confertifolia, Atriplex cuneata, Atriplex hymenelytra, Atriplex obovata, Atriplex polycarpa, Grayia spinosa*, and/or *Picrothamnus desertorum*.

VEGETATION

Physiognomy and Structure: This group is a facultatively deciduous, extremely xeromorphic, subdesert short shrubland with a typically open shrub canopy and sparse to moderately dense herbaceous layer dominated by perennial graminoids.

Floristics: This widespread cool semi-desert scrub group is highly variable and ranges from almost pure occurrences of a single species to fairly complex mixtures. The characteristic mix of low shrubs and grasses is sparse, with large open spaces between the plants (Blaisdell and Holmgren 1984). Occurrences have a sparse to moderately dense cover of woody species that is often dominated by one of several shrubs such as *Atriplex canescens* (also codominated by *Artemisia tridentata, Ephedra viridis*, or *Krascheninnikovia lanata*), *Atriplex confertifolia* (also codominated by several species of *Lycium* and *Ephedra, Picrothamnus desertorum*, or *Sarcobatus vermiculatus*), *Atriplex cuneata, Atriplex obovata, Atriplex hymenelytra, Atriplex polycarpa, Grayia spinosa*, or *Picrothamnus desertorum (= Artemisia spinescens)*. Other shrubs may be present, especially in transition areas with desert or montane scrub. Species include *Acacia greggii, Artemisia frigida, Chrysothamnus* spp., *Encelia frutescens, Ericameria nauseosa, Ephedra nevadensis, Frankenia salina, Larrea tridentata, Lycium andersonii, Lycium pallidum, Parthenium confertum, Psorothamnus polydenius, Purshia stansburiana, Suaeda* spp., *Tetradymia glabrata, Tetradymia spinosa, Tiquilia latior*, and *Yucca glauca*. Dwarf-shrubs include *Gutierrezia sarothrae* and several species of *Eriogonum*, but generally do not form a distinct layer as the main shrub layer is often >0.5 m tall.

Warm-season medium-tall and short perennial grasses dominate in the sparse to moderately dense graminoid layer. The species present depend on the geographic range of the grasses, soil alkalinity/salinity, and past land use. Species may include *Achnatherum hymenoides, Bouteloua gracilis, Distichlis spicata, Elymus elymoides, Hesperostipa comata, Leymus ambiguus, Leymus salinus, Muhlenbergia torreyi, Pascopyrum smithii, Pleuraphis jamesii, Poa secunda, Pseudoroegneria spicata, Sporobolus airoides*, and *Sporobolus cryptandrus*. A number of annual species may also grow in association with the shrubs and grasses, although they are usually rare and confined to areas of recent disturbance (Blaisdell and Holmgren 1984). Forb cover is generally sparse. Perennial forbs that might occur include *Chaetopappa ericoides, Descurainia* spp., *Mentzelia* spp., *Sphaeralcea coccinea*, and *Xylorhiza venusta*. Annual natives include *Monolepis nuttalliana, Plantago* spp., or *Vulpia octoflora*. Associated halophytic annuals include *Salicornia bigelovii, Salicornia rubra*, and *Suaeda* species. Exotic annuals that may occur include *Salsola kali, Bromus rubens*, and *Bromus tectorum*. Cacti such as species of *Opuntia* and *Echinocereus* may be present in some occurrences. Trees are not usually present but some scattered *Juniperus* spp. may be found.

ENVIRONMENT & DYNAMICS

Environmental Description: This salt-desert shrubland group is matrix-forming in the Intermountain West. This group composes arid to semi-arid shrublands on lowland and upland sites usually at elevations between 1520 and 2200 m (4987-7218 feet). Sites can be found on all aspects and include valley bottoms, alluvial and alkaline flats, mesas and plateaus, playas, drainage terraces, washes and interdune basins, bluffs, and gentle to moderately steep sandy or rocky slopes. Slopes are typically gentle to moderately steep but are sometimes unstable and prone to surface movement. Many areas within this group are degraded due to erosion and may resemble "badlands." Soil surface is often very barren and interspaces between the characteristic plant clusters are commonly covered by a microphytic crust (West 1982).

Climate: This is typically a vegetation group of extreme climatic conditions, with warm to hot summers and freezing winters. Annual precipitation ranges from approximately 13-33 cm. In much of the group, the period of greatest moisture will be mid to late summer, although in the more northern areas, a moist period is to be expected in the cold part of the year. However, plotted seasonality of occurrence is probably of less importance on this desert vegetation than in other types because desert precipitation comes with an extreme irregularity that does not appear in graphs of long-term seasonal or monthly averages (Blaisdell and Holmgren 1984). *Soil/substrate/hydrology:* Soils are shallow to moderately deep, poorly developed, and a product of an arid climate and little precipitation. Soils are often alkaline or saline. Vegetation within this group is tolerant of these soil conditions but not restricted to it. The shallow soils of much of the area are poorly developed Entisols. Vegetation within this group can occur on level pediment remnants where coarse-textured and well-developed soil profiles have been derived from sandstone gravel and are alkaline, or on Mancos shale badlands, where soil profiles are typically fine-textured and non-alkaline throughout (West and Ibrahim 1968). They can also occur in alluvial basins where parent materials from the other habitats have been deposited over Mancos shale and the soils are heavy-textured and saline-alkaline throughout the profile (West and Ibrahim 1968).

Dynamics: West (1982) stated that "salt desert shrub vegetation occurs mostly in two kinds of situations that promote soil salinity, alkalinity, or both. These are either at the bottom of drainages in enclosed basins or where marine shales outcrop." However, salt-desert shrub vegetation may be an indication of climatically dry as well as physiologically dry soils (Blaisdell and Holmgren 1984). Not all salt-desert shrub soils are salty, and their hydrologic characteristics may often be responsible for the associated vegetation (Naphan 1966). Species of the salt-desert shrub complex have different degrees of tolerance to salinity and aridity, and they tend to sort themselves out along a moisture/salinity gradient (West 1982). Species and communities are apparently sorted out along physical, chemical, moisture, and topographic gradients through complex relations that are not understood and are in need of further study (Blaisdell and Holmgren 1984).

The winter months are a good time for soil moisture accumulation and storage within stands in this group. There is generally at least one good snowstorm per season that will provide sufficient moisture to the vegetation. The winter moisture accumulation

amounts will affect spring plant growth. Plants may grow as little as a few inches to 1 m. Unless more rains come in the spring, the soil moisture will be depleted in a few weeks, growth will slow and ultimately cease, and the perennial plants will assume their various forms of dormancy (Blaisdell and Holmgren 1984). If effective rain comes later in the warm season, some of the species will renew their growth from the stage at which it had stopped. Others, having died back, will start over as if emerging from winter dormancy (Blaisdell and Holmgren 1984). *Atriplex confertifolia* shrubs often develop large leaves in the spring, which increase the rate of photosynthesis. As soil moisture decreases, the leaves are lost, and the plant takes on a dead appearance. During late fall, very small overwintering leaves appear which provide some photosynthetic capability through the remainder of the year. Other communities are maintained by intra- or inter-annual cycles of flooding followed by extended drought, which favor accumulation of transported salts. The moisture supporting these intermittently flooded wetlands is usually derived off-site, and they are dependent upon natural watershed function for persistence (Reid et al. 1999).

In summary, desert communities of perennial plants are dynamic and changing. The composition within this group may change dramatically and may be both cyclic and unidirectional. Superimposed on the compositional change is great variation from year to year in growth of all the vegetation, the sum of varying growth responses of individual species to specific conditions of different years (Blaisdell and Holmgren 1984). Desert plants grow when temperature is satisfactory, but only if soil moisture is available at the same time. Because the amount of moisture is variable from year to year and because different species flourish under different seasons of soil moisture, seldom do all components of the vegetation thrive in the same year (Blaisdell and Holmgren 1984).

DISTRIBUTION

Geographic Range: The distribution of this widespread group centers in the Intermountain West of the U.S., and extends in limited distribution across northern New Mexico into the southern Great Plains. In Wyoming, this group occurs in the Great Divide and Bighorn basins.

Spatial Scale & Pattern [optional]: Large patch
Nations: MX?, US
States/Provinces: AZ, CA, CO, ID, KS, MT, NM, NV, OR, TX, UT, WA, WY
TNC Ecoregions [optional]: 4:?, 6:C, 8:?, 9:C, 10:C, 11:C, 18:C, 19:C, 20:C, 21:C, 26:C, 27:C, 28:C
USFS Ecoregions (2007): 313A:CC, 313B:CC, 313D:CC, 315A:CC, 315B:CP, 315H:CC, 321A:CC, 322A:CC, 331A:CP, 331B:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 331J:CC, 341A:CC, 341B:CC, 341C:CC, 341D:CC, 341E:CC, 341F:CC, 341G:CC, 342A:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:CC, 342I:CC, 342J:CC, M242C:PP, M261D:CP, M261E:CP, M261G:CC, M313A:CC, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:C?, M332A:CP, M332E:CC, M332F:CC, M332G:CP, M341A:CC, M341B:CC, M341C:CC, M341D:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Arches)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **<** Biotic Matrix of the Shadscale and Associated Communities (Fautin 1946)
- **=** Intermountain salt desert shrublands (West 1983b)
- **<** Salt Desert Shrub (414) (Shiflet 1994)

LOWER LEVEL UNITS

Alliances:
- A3174 *Atriplex polycarpa* Scrub Alliance
- A0869 *Atriplex canescens* Scrub Alliance
- A3180 *Atriplex obovata - Atriplex cuneata* Scrub Alliance
- A0870 *Atriplex confertifolia* Scrub Alliance
- A3171 *Grayia spinosa* Scrub Alliance

AUTHORSHIP

Primary Concept Source: N.E. West (1983b)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 11/06/2015
Classif Resp Region: West
Internal Author: KAS 2-10, 11-15

REFERENCES

References: Barbour and Major 1988, Blaisdell and Holmgren 1984, Branson et al. 1967, Branson et al. 1976, Brown 1982a, Brown et al. 1979, Campbell 1977, Faber-Langendoen et al. 2017a, Fautin 1946, Francis 1986, Holland and Keil 1995, Knight 1994, Knight et al. 1987, Mozingo 1987, Naphan 1966, Reid et al. 1999, Shiflet 1994, Stout et al. 2013, West 1979, West 1982, West 1983b, West and Ibrahim 1968

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G300. Intermountain Shadscale - Saltbush Scrub

A0869. Atriplex canescens Scrub Alliance

Type Concept Sentence: Stands typically have a sparse to moderately dense (10-60% cover) short-shrub canopy (approximately 1.5 m tall) that is dominated by the facultative deciduous, xeromorphic shrub *Atriplex canescens*.

OVERVIEW

Scientific Name: *Atriplex canescens* Scrub Alliance
Common Name (Translated Scientific Name): Fourwing Saltbush Scrub Alliance
Colloquial Name: Fourwing Saltbush Scrub

Type Concept: This alliance occurs primarily in arid and semi-arid areas of the southwestern U.S. from western Texas to southern and eastern California and into Chihuahua, Mexico. It is also found in the western Great Plains to the Great Basin from western Kansas, Colorado, and Wyoming to Utah, Nevada and eastern Oregon. Stands typically have a sparse to moderately dense short-shrub canopy that is dominated by *Atriplex canescens*. Associated shrubs may include *Artemisia bigelovii, Artemisia tridentata, Ephedra viridis, Krascheninnikovia lanata, Purshia stansburiana (= Purshia mexicana var. stansburiana), Psorothamnus polydenius, Parthenium confertum, Sarcobatus vermiculatus*, and species of *Chrysothamnus, Ericameria*, and *Lycium*. The herbaceous layer is sparse to moderately dense and dominated by warm-season, medium-tall and short grasses depending on geographic range of the grasses. Species may include *Bouteloua gracilis, Distichlis spicata, Elymus elymoides, Hesperostipa comata, Pleuraphis jamesii (= Hilaria jamesii), Achnatherum hymenoides (= Oryzopsis hymenoides), Muhlenbergia porteri, Scleropogon brevifolius, Pascopyrum smithii*, and *Sporobolus* spp. Overall, shrublands in this alliance occur on lowland and upland sites with elevation ranging from 75 m below sea level to 2400 m. Lowland sites include alluvial flats, drainage terraces, playas, washes and interdune basins. Upland sites include bluffs and gentle to moderately steep, sandy or rocky slopes. Stands occur on all aspects. Soils are variable with depths ranging from shallow to moderately deep, and texture ranging from sand to loam to clay.

Classification Comments: Shrublands in this alliance can grade into grasslands dominated by *Sporobolus airoides* or *Pleuraphis mutica*, or occur within a matrix of other desert shrublands. Further review of this alliance is necessary before comparisons can be made with other vegetation types. Some of the stands referenced, such as in Francis (1986), may not have enough vegetation cover to be classified as shrublands.

Given the geographic extent of this alliance, it may be warranted to split this into two alliances that reflect ecoregional variation.

Internal Comments:
Other Comments:

Similar NVC Types:
- A3151 *Atriplex canescens* Lowland Basin Desert Scrub Alliance

Diagnostic Characteristics: Nearly sparse to moderately dense stands of short shrubs dominated by *Atriplex canescens*. Due to the wide geographic range of this alliance, associated species composition is highly variable.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a sparse to moderately dense layer of facultatively deciduous, extremely xeromorphic shrubs up to 2 m in height. A sparse to dense graminoid layer of warm-season grasses may be present.

Floristics: Stands have a sparse to moderately dense (10-60% cover) short-shrub canopy (to approximately 1.5 m tall) that is dominated by the facultatively deciduous, xeromorphic shrub *Atriplex canescens*. Associated shrubs may include *Artemisia tridentata, Artemisia bigelovii, Krascheninnikovia lanata, Purshia stansburiana (= Purshia mexicana var. stansburiana), Psorothamnus polydenius, Ephedra viridis, Parthenium confertum, Sarcobatus vermiculatus*, and species of *Chrysothamnus* and *Lycium*. Dwarf-shrubs such as *Gutierrezia sarothrae* or *Eriogonum* spp. may be common in some stands. Warm-season, medium-tall and short grasses typically dominate the sparse to moderately dense (1-60% cover) graminoid layer. The species present depend on geographic range of the grasses, alkalinity/salinity and past land use. Species may include *Bouteloua gracilis, Distichlis spicata,*

Elymus elymoides, Hesperostipa comata, Pleuraphis jamesii (= Hilaria jamesii), Achnatherum hymenoides (= Oryzopsis hymenoides), Pascopyrum smithii, Muhlenbergia porteri, Scleropogon brevifolius, Sporobolus airoides, Sporobolus cryptandrus, Sporobolus flexuosus, Sporobolus nealleyi, and *Sporobolus wrightii*. Forb cover is generally sparse, but annual forbs such as *Calycoseris parryi* may be abundant in wet years. Common forbs include species of *Sphaeralcea, Dalea, Cymopterus, Chenopodium, Bassia (= Kochia), Iva, Picradeniopsis*, and *Ratibida*. Cacti from the genus *Opuntia* are associated species in some stands. Trees are typically not present, but occasionally scattered *Juniperus* spp. may occur.

ENVIRONMENT & DYNAMICS

Environmental Description: Shrublands included in this alliance occur on lowland and upland sites throughout much of the arid and semi-arid western U.S. with elevations ranging from 75 m below sea level to 2400 m. Lowland sites include alluvial flats, drainage terraces, playas, washes and interdune basins. Upland sites include bluffs and gentle to moderately steep, sandy or rocky slopes. Stands occur on all aspects. Soils are variable with depths ranging from shallow to moderately deep, and textures ranging from sands to loams to clay. The lowland sites may be moderately saline or alkaline. Bare ground usually dominates the ground surface. Francis (1986) described stands in northwestern New Mexico with approximately 80% bare soil and 15% litter.

Dynamics: *Atriplex canescens* is tolerant of saline or alkaline soils, but is not restricted to those soils. Therefore, it is not a reliable indicator of those conditions (USFS 1937). This shrub is considered good forage for deer and many classes of livestock because it is highly nutritious and palatable (USFS 1937).

DISTRIBUTION

Geographic Range: Shrublands included in this alliance occur primarily in arid and semi-arid areas of the southwestern U.S. from west Texas to southern and eastern California and into Chihuahua, Mexico. They also are found in the western Great Plains to the Great Basin, from western Kansas, Colorado, and Wyoming to Utah, Nevada and eastern Oregon.

Nations: MX, US
States/Provinces: AZ, CA, CO, ID, KS, MXCH, NM, NV, OR, TX, UT, WY
TNC Ecoregions [optional]: 6:C, 11:C, 13:C, 15:C, 17:C, 23:C
USFS Ecoregions (2007): 262A:CC, 322Ab:CCC, 322Ai:CCC, 322Aj:CCC, 322Az:CCC, 322B:CC, 322C:CC, 341Fb:CCC, 341Fc:CCC, 341Fe:CCC, 341Ff:CCC, 342B:CC, M262A:CC, M262B:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Joshua Tree, Lake Mead, Mojave); USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** *Atriplex canescens* (Fourwing saltbush scrub) Alliance (Sawyer et al. 2009) [36.310.00]
- **=** *Atriplex canescens* Shrubland Alliance (Evens et al. 2014)
- **=** *Atriplex canescens* Shrubland Alliance (Evens et al. 2012)
- **=** *Atriplex canescens* Shrubland Alliance (CNPS 2017) [36.310.00]
- **><** Desert Saltbush Scrub (#36110) (Holland 1986b)
- **=** Fourwing saltbush series (Sawyer and Keeler-Wolf 1995)
- **><** Interior Coast Range Saltbush Scrub (#36320) (Holland 1986b)
- **><** Relictual Interior Dunes (#23200) (Holland 1986b)
- **><** Sierra-Tehachapi Saltbush Scrub (#36310) (Holland 1986b)
- **><** Valley Saltbush Scrub (#36220) (Holland 1986b)

LOWER LEVEL UNITS

Associations:

- CEGL001283 *Atriplex canescens / Bouteloua gracilis* Shrubland
- CEGL001285 *Atriplex canescens - Krascheninnikovia lanata* Shrubland
- CEGL001286 *Atriplex canescens / Purshia stansburiana* Shrubland
- CEGL001284 *Atriplex canescens / Calycoseris parryi* Shrubland
- CEGL001291 *Atriplex canescens / Sporobolus airoides* Shrubland
- CEGL005385 *Atriplex canescens / Muhlenbergia porteri* Shrubland
- CEGL001289 *Atriplex canescens / Achnatherum hymenoides* Shrubland
- CEGL001288 *Atriplex canescens / Pleuraphis jamesii* Shrubland
- CEGL001281 *Atriplex canescens* Shrubland
- CEGL003828 *Atriplex canescens - Ephedra viridis* Shrubland
- CEGL001282 *Atriplex canescens - Artemisia tridentata* Shrubland

AUTHORSHIP

Primary Concept Source: K.A. Schulz after Sawyer et al. (2009)
Author of Description: M.E. Hall
Acknowledgments:
Version Date: 2014/01/08

REFERENCES

References: Aldous and Shantz 1924, BIA 1979, BLM 1979a, BLM 1979b, Baker 1984a, Beatley 1976, Beatley 1993, Betancourt and Van Devender 1981, Brown 1982a, Burk 1977, CNPS 2017, Chappell et al. 1997, Culver et al. 1996, Diamond 1993, Dick-Peddie 1993, Donart et al. 1978a, Evens and Hartman 2007, Evens et al. 2012, Evens et al. 2014, Faber-Langendoen et al. 2017b, Francis 1986, Holland 1986b, Howard 2003, Hyder et al. 1966, Johnson 1976, Johnston 1987, Keeler-Wolf and Thomas 2000, Keeler-Wolf et al. 1998a, Klipple and Costello 1960, MacMahon 1988, MacMahon and Wagner 1985, Maxwell 1975, McHargue 1973, Miller et al. 1977, Muldavin and Mehlhop 1992, Muldavin et al. 2000b, Paysen et al. 1980, Peterson 1984a, Peterson 1984b, Price et al. 1981, Roberts et al. 1992, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Shaw et al. 1989, Shute and West 1978, Soil Conservation Service 1978, Soil Conservation Service n.d., Stout et al. 2013, Thomas et al. 2004, USBOR 1976, USFS 1937, Vasek and Barbour 1988, VegCAMP and AIS 2013, Vest 1962a, Warren et al. 1982

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G300. Intermountain Shadscale - Saltbush Scrub

A0870. Atriplex confertifolia Scrub Alliance

Type Concept Sentence: Shrublands occurring across the western U.S. characterized by a sparse to moderately dense shrub layer dominated or codominated by *Atriplex confertifolia* and/or *Picrothamnus desertorum*.

OVERVIEW

Scientific Name: *Atriplex confertifolia* Scrub Alliance
Common Name (Translated Scientific Name): Shadscale Saltbush Scrub Alliance
Colloquial Name: Shadscale Saltbush Scrub

Type Concept: This shrubland alliance occurs across the western U.S. from the eastern Mojave Desert and Great Basin east to the western Great Plains and north to Montana. The vegetation included in this alliance is characterized by a sparse to moderately dense shrub layer dominated or codominated by *Atriplex confertifolia* and/or *Picrothamnus desertorum*. Shrub associates may include *Atriplex polycarpa, Ephedra nevadensis, Chrysothamnus* spp., *Krascheninnikovia lanata, Lycium* spp., *Sarcobatus vermiculatus*, and *Tetradymia* spp. The usually sparse herbaceous layer is dominated by graminoids such as *Elymus elymoides, Pleuraphis jamesii (= Hilaria jamesii), Pleuraphis rigida (= Hilaria rigida), Leymus salinus, Achnatherum hymenoides (= Oryzopsis hymenoides), Pseudoroegneria spicata, Hesperostipa* spp., and other perennial bunchgrasses. These shrublands are usually associated with margins of large playas, valley bottoms or alluvial slopes with medium- to fine-textured soils but may occur on coarser soils of erosional slopes with calcareous substrates. In most cases, the soils are alkaline and may have substantial salt accumulation.

Classification Comments: One of the associations in this alliance, *Picrothamnus desertorum* Shrubland (CEGL001452), is very poorly documented. There is only one reference source presently known for this association, Montana Natural Heritage Program, Data on File (n.d.). The Montana Heritage Program ecologist was consulted and could find no data for this association in the files. The alliance is also reported from Oregon, as described above, but further data collection and inventory efforts are needed to confirm this alliance and its characteristics as described here.

Some associations currently placed in this alliance are likely to be sparsely vegetated and would be better placed into the sparse vegetation class.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Nearly sparse to moderately dense stands of short shrubs dominated by *Atriplex confertifolia* or codominated by *Picrothamnus desertorum*. Due to the wide geographic range of this alliance, associated species composition is highly variable.

VEGETATION

Physiognomy and Structure: These are broad-leaved deciduous shrublands of somewhat sparse to moderate cover (15-60%). The deciduous character is as much drought-related as cold-related. The interstices between the shrubs may be very sparsely vegetated (<10% cover) in low desert or highly alkaline habitats or moderately vegetated (20-40%) with cespitose graminoids and forbs. In addition, these communities often harbor an ephemeral ground layer of short-lived annual forbs and graminoids which vary in abundance with local precipitation.

Floristics: *Atriplex confertifolia* and/or *Picrothamnus desertorum (= Artemisia spinescens)* are the dominant shrubs. Other codominant or associate shrub species may include *Atriplex canescens, Atriplex polycarpa, Ephedra nevadensis, Ericameria nauseosa (= Chrysothamnus nauseosus), Grayia spinosa, Krascheninnikovia lanata, Lycium* sp., *Tetradymia glabrata*, and *Tetradymia axillaris*. There is typically a depauperate understory of perennial bunchgrasses, including *Achnatherum hymenoides (= Oryzopsis hymenoides), Elymus elymoides, Hesperostipa* spp., *Pleuraphis jamesii (= Hilaria jamesii), Pleuraphis rigida (= Hilaria rigida), Pseudoroegneria spicata*, and *Psorothamnus polydenius*. *Yucca brevifolia* may form a scattered emergent tree layer in these stands.

ENVIRONMENT & DYNAMICS

Environmental Description: Extensive stands of the vegetation types in this alliance occur in the transition between the Mojave and Great Basin deserts of North America. Outlying stands also occur northward and eastward in valley bottom sites that have substantial salt accumulation. This alliance occurs at middle elevations (1000-1950 m [3300-6400 feet]) with annual precipitation averaging 10-25 cm. These shrublands are usually associated with margins of large playas, valley bottoms or alluvial slopes with medium- to fine-textured soils but may occur on coarser soils of erosional slopes with calcareous substrates. In most cases, the soils are alkaline (pH 7.5-8.5).

Dynamics: Many of the plant species commonly present in stands of this alliance grow from late winter to late spring or early summer, when soil moisture becomes depleted. *Atriplex confertifolia* shrubs often develop large leaves in the spring which increase the rate of photosynthesis. As soil moisture decreases, the leaves are lost, and the plant takes on a dead appearance. During late fall, very small overwintering leaves appear which provide some photosynthetic capability through the remainder of the year. The species is valued as winter range for native herbivores and livestock. During winter or drought periods, minor defoliation from herbivory may actually increase drought tolerance by lowering leaf area and transpiration losses.

DISTRIBUTION

Geographic Range: The plant associations in this alliance occur throughout the eastern Mojave and Great Basin deserts, northward to southern Idaho, north-central Wyoming, and south-central Montana. Stands have also been reported from the Colorado Plateau of western Colorado, Arizona, New Mexico and Utah.

Nations: US
States/Provinces: AZ, CA, CO, ID, MT, NM, NV, OR, UT, WY
TNC Ecoregions [optional]: 6:C, 11:C, 12:C, 13:C, 15:C, 17:C
USFS Ecoregions (2007): 262A:CC, 322Ab:CCC, 322Ad:CCC, 322Ae:CCC, 322Az:CCC, 341D:CC, 341Fa:CCC, 341Fb:CCC, 341Fc:CCC, 341Fd:CCC, 341Fe:CCC, 341Ff:CCC, 341Fg:CCC, 342B:CC, M261E:CC, M262A:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Lake Mead)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** *Atriplex confertifolia* (Shadscale scrub) Alliance (Sawyer et al. 2009) [36.320.00]
- **=** *Atriplex confertifolia* Shrubland Alliance (Evens et al. 2014)
- **=** *Atriplex confertifolia* Shrubland Alliance (CNPS 2017) [36.320.00]
- **<** Shadscale Scrub (#36140) (Holland 1986b)
- **=** Shadscale series (Sawyer and Keeler-Wolf 1995)

LOWER LEVEL UNITS

Associations:
- CEGL001294 *Atriplex confertifolia* Great Basin Shrubland
- CEPP005797 *Atriplex confertifolia - Suaeda moquinii* Shrubland
- CEGL001313 *Atriplex confertifolia - Sarcobatus vermiculatus* Shrubland
- CEGL001299 *Atriplex confertifolia - Atriplex polycarpa* Shrubland
- CEGL001309 *Atriplex confertifolia - Lycium pallidum / Mirabilis pudica* Shrubland
- CEGL001310 *Atriplex confertifolia - Lycium shockleyi* Shrubland
- CEGL001302 *Atriplex confertifolia / Elymus elymoides* Shrubland

- CEGL001311 *Atriplex confertifolia / Achnatherum hymenoides* Shrubland
- CEGL001307 *Atriplex confertifolia / Leymus salinus* Shrubland
- CEGL001297 *Atriplex confertifolia - Picrothamnus desertorum / Achnatherum hymenoides* Shrubland
- CEGL001301 *Atriplex confertifolia - Krascheninnikovia lanata* Shrubland
- CEGL001314 *Atriplex confertifolia / Hesperostipa comata* Shrubland
- CEGL001296 *Atriplex confertifolia - Picrothamnus desertorum / Krascheninnikovia lanata* Shrubland
- CEGL001306 *Atriplex confertifolia / Leymus salinus ssp. salmonis* Shrubland
- CEGL001300 *Atriplex confertifolia / Ericameria nauseosa* Shrubland
- CEGL001452 *Picrothamnus desertorum* Shrubland
- CEGL001312 *Atriplex confertifolia / Pseudoroegneria spicata* Shrubland
- CEGL001315 *Atriplex confertifolia / Tetradymia glabrata* Shrubland
- CEGL001295 *Atriplex confertifolia - Picrothamnus desertorum* Shrubland
- CEGL001305 *Atriplex confertifolia / Bassia americana* Shrubland
- CEGL001298 *Atriplex confertifolia - Picrothamnus desertorum / Sarcobatus vermiculatus* Shrubland
- CEGL001308 *Atriplex confertifolia - Lycium andersonii* Shrubland
- CEGL001304 *Atriplex confertifolia / Pleuraphis jamesii* Shrubland
- CEGL002992 *Picrothamnus desertorum / Elymus elymoides* Shrubland
- CEGL003762 *Atriplex confertifolia / Sporobolus cryptandrus* Shrubland
- CEGL003830 *Atriplex confertifolia* Sparse Shrubland
- CEPP005685 *Atriplex confertifolia - (Acamptopappus sphaerocephalus, Picrothamnus desertorum) / (Pleuraphis jamesii)* Scrub
- CEPP005795 *Atriplex confertifolia - Atriplex canescens* Shrubland
- CEGL005739 *Atriplex confertifolia - Ambrosia dumosa* Shrubland
- CEPP005796 *Atriplex confertifolia - Lepidium fremontii* Shrubland
- CEGL001293 *Atriplex confertifolia* Wyoming Basins Shrubland
- CEGL001303 *Atriplex confertifolia - Ephedra nevadensis* Shrubland

AUTHORSHIP

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

REFERENCES

References: Annable 1985, BLM 1979a, Baker 1982b, Baker 1983b, Baker 1983c, Baker and Kennedy 1985, Barbour and Major 1977, Beatley 1975, Beatley 1976, Billings 1949, Blackburn et al. 1968a, Blackburn et al. 1969b, Blackburn et al. 1969d, Bradley 1964, Branson and Owen 1970, Branson et al. 1976, Brotherson and Brotherson 1979, Burk 1977, CNPS 2017, Caicco and Wellner 1983c, Caicco and Wellner 1983g, Campbell 1977, Charlton 2000a, Dastrup 1963, Empire Engineering and Land Surveying 1986, Evens et al. 2014, Faber-Langendoen et al. 2017b, Faden 1977, Fautin 1946, Fenemore 1970, Graham 1937, Harper and Jaynes 1986, Holland 1986b, Ibrahim et al. 1972, Keammerer 1974b, Keammerer 1977, Keeler-Wolf and Thomas 2000, Leary and Peterson 1984, Lesica and DeVelice 1992, Lusby et al. 1963, MTNHP unpubl. data, MacMahon 1988, MacMahon and Wagner 1985, McHargue 1973, Miller et al. 1977, ORNHP unpubl. data, Paysen et al. 1980, Peterson 1984a, Potter et al. 1985, Rickard and Beatley 1965, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Schramm 1982, Simonin 2001a, Singh and West 1971, Soil Conservation Service 1978, Thomas et al. 2004, Thorne 1982, Tuhy and MacMahon 1988, Turner 1982b, USBOR 1976, Vasek and Barbour 1988, VegCAMP and AIS 2013, Vest 1962b, Ward et al. 1974, Warren et al. 1982, West 1983b, West and Ibrahim 1968, Young et al. 1977, Young et al. 1986

M499. Western North American Cool Semi-Desert Ruderal Scrub & Grassland

This upland cool semi-desert scrub and grassland macrogroup contains disturbed dry grasslands and shrublands dominated by non-native species or ruderal native species and is found from low-elevation basins to foothills throughout the western U.S. and Canada.

3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
3.B.1.Ne.90.a. M499 Western North American Cool Semi-Desert Ruderal Scrub & Grassland

G600. Great Basin-Intermountain Ruderal Dry Shrubland & Grassland

Type Concept Sentence: This semi-desert interior western U.S. ruderal shrubland and grassland group includes shrubland, shrub-steppe and grassland stands that are strongly dominated (>90% relative canopy cover) by invasive, exotic species. Additionally, this group contains shrubland and shrub-steppe that are dominated or codominated by native shrub species (>10% relative cover) with a significant herbaceous understory (>10% absolute cover) that is strongly dominated (>90% relative canopy cover) by exotic herbaceous species.

OVERVIEW

Scientific Name: Great Basin-Intermountain Ruderal Dry Shrubland & Grassland Group
Common Name (Translated Scientific Name): Great Basin-Intermountain Ruderal Dry Shrubland & Grassland Group
Colloquial Name: Western Ruderal Crested Wheatgrass Grassland

Type Concept: This semi-desert interior western U.S. ruderal shrubland and grassland group includes shrubland, shrub-steppe and grassland stands that are strongly dominated (>90% relative canopy cover) by invasive, exotic species. Diagnostic invasive shrubs include *Alhagi maurorum, Cytisus striatus, Zygophyllum fabago*, or other exotic shrubs. Herbaceous stands include open to dense grasslands and forblands composed of either exotic annual or biennial grasses or forbs with low cover of perennial species (<10% absolute cover) or stands with a significant perennial herbaceous layer (>10% absolute cover) strongly dominated by exotics (>90% relative cover) with or without annuals and biennials present to dominant. There are relatively few cool, semi-arid invasive perennial graminoids such as *Agropyron cristatum*. Relatively mesic, invasive perennial hay grasses such as *Bromus inermis, Dactylis glomerata*, and *Phleum pratense* are typically absent or have low cover and are restricted to mesic microsites as they are more common in higher elevation or higher latitude, temperate climates or relatively mesic sites. Numerous exotic perennial herbaceous species may compose these stands, such as *Acroptilon repens, Cardaria draba, Centaurea calcitrapa, Centaurea diffusa, Centaurea iberica, Centaurea stoebe ssp. micranthos, Centaurea virgata, Euphorbia esula, Hypericum perforatum, Lepidium latifolium, Peganum harmala*, or a mixture of other exotic forbs and graminoids. Stands dominated by annuals may be composed of annual grasses such as *Bromus arvensis (= Bromus japonicus), Bromus hordeaceus, Bromus madritensis, Bromus tectorum, Taeniatherum caput-medusae*, or annual forbs, including *Bassia scoparia (= Kochia scoparia), Brassica nigra, Centaurea melitensis, Centaurea solstitialis, Crupina vulgaris, Cynoglossum officinale, Descurainia sophia, Erodium cicutarium, Hyoscyamus niger, Isatis tinctoria, Salsola tragus, Sisymbrium altissimum, Taraxacum officinale*, or a mixture of other exotic annual forbs and grasses. Additionally, this group contains semi-desert shrublands and shrub-steppe that are dominated or codominated by native shrub species such as *Artemisia tridentata* with a significant herbaceous understory (>10% absolute cover) that is strongly dominated (>90% relative canopy cover) by exotic herbaceous species such as *Agropyron cristatum* or *Bromus tectorum*. Stands occur in disturbed dry to mesic basins, alluvial fans, and foothills elevations up to 2200 m and are restricted to areas with the cool, semi-arid climate found in the intermountain western U.S. region. Stands can be large areas or narrow strips adjacent to roadsides or under powerlines and other disturbed areas. Soils are mostly mineral and well-drained. Due to disturbance, soils may be compacted. It is an early-successional type that may occur in areas disturbed by fire, grazing or mining. This group may grade into wetter areas and may have transition zones where mesic forbs intermix with wetter forbs and graminoids found in Western North American Ruderal Marsh, Wet Meadow & Shrubland Group (G524). This group does not include the mesic introduced hay grasses such as *Bromus inermis, Dactylis glomerata*, and *Phleum pratense* that have escaped from improved pasture and irrigated meadow to invade montane grasslands. These grasslands are classified in the more temperate Western North American Interior Ruderal Grassland & Shrubland Group (G624).

Classification Comments: This group may be difficult to determine from native degraded shrublands and grasslands when non-native species codominate. The test is that the non-native species, especially invasive species, far outweigh (>90% relative cover) native species in abundance and richness, such that a well-trained observer cannot tell what the native counterpart may have been or to do so is only speculation. Dominant and diagnostic semi-arid exotic species *Agropyron cristatum* can be present to codominant in Western North American Interior Ruderal Grassland & Shrubland Group (G624) when codominated by relatively mesic species such as *Bromus inermis* or exotic forage grasses such as *Agrostis stolonifera, Dactylis glomerata, Phleum pratense*, and *Poa pratensis* that are characteristic of more temperate climates.

This group may grade into wetter areas and may have transition zones where mesic forbs intermix with wetter forbs and graminoids found in Western North American Ruderal Marsh, Wet Meadow & Shrubland Group (G524). This group does not include the mesic introduced hay grasses such as *Bromus inermis, Dactylis glomerata*, and *Phleum pratense* that have escaped from improved pasture and irrigated meadow to invade montane grasslands. These grasslands are classified in the more temperate Western North American Interior Ruderal Grassland & Shrubland Group (G624).

Similar NVC Types:

- G648 Southern Vancouverian Lowland Ruderal Grassland & Shrubland: may include similar alliances, but is restricted to lowlands west of the Cascade Range.
- G624 Western North American Interior Ruderal Grassland & Shrubland: has similar ruderal alliances but rather than occurring in cool, semi-arid sites, stands occur in cool, temperate regions and include montane, subalpine and alpine areas. Vegetation lacks obligate wetland species and is not dominated by facultative wetland species.
- G524 Western North American Ruderal Marsh, Wet Meadow & Shrubland: has similar ruderal alliances but occurs on mesic to wet sites and vegetation either includes obligate wetland species or is dominated by facultative wetland species.
- G819 North American Warm Desert Ruderal Scrub
- G677 North American Warm Desert Ruderal Grassland: may include similar alliances, but is restricted warm, semi-arid desert regions.

Diagnostic Characteristics: This ruderal shrubland and grassland group occurs in the semi-arid interior western U.S. and includes shrubland, shrub-steppe and grassland stands that are strongly dominated (>90% relative canopy cover) by invasive, exotic species. Additionally, this group contains shrubland and shrub-steppe that is dominated or codominated by native shrub species (>10% relative cover) with a significant herbaceous understory (>10% absolute cover) that is strongly dominated (>90% relative canopy cover) by exotic herbaceous species.

VEGETATION

Physiognomy and Structure: This group includes shrubland and shrub-steppe stands that have an open to dense shrub canopy, and annual and perennial grasslands and forblands with an open to dense herbaceous layer.

Floristics: This ruderal shrubland and grassland group includes shrubland and shrub-steppe stands that have an open to dense shrub canopy (>10% absolute cover) that is strongly dominated (>90% relative canopy cover) by invasive, introduced shrub species such as *Alhagi maurorum, Cytisus striatus, Zygophyllum fabago*, or other exotic shrubs. Additionally, this group includes shrubland and shrub-steppe that is dominated or codominated by native shrub species (>10% relative cover) with a significant herbaceous understory (>10% absolute cover) that is strongly dominated (>90% relative canopy cover) by exotic herbaceous species. Herbaceous layers are composed of either exotic annuals with low cover of perennial species, or high cover of exotic perennials. Also included in this group are open to dense ruderal herbaceous stands without a shrub layer (<10% absolute cover). The herbaceous understory (>10% absolute cover) is strongly dominated (>90% relative canopy cover) by exotic herbaceous species. Herbaceous layers are composed of either exotic annuals with low cover of perennial species (<5% absolute cover), or moderate perennial cover (>10% absolute cover) dominated by of exotic perennials, either graminoids or forbs or a combination. There are relatively few cool, semi-arid perennial graminoids such as *Agropyron cristatum* (which has frequently been purposefully seeded to prevent soil erosion or provide livestock forage). The relatively mesic, invasive perennial hay grasses such as *Bromus inermis, Dactylis glomerata*, and *Phleum pratense* are typically absent or have low cover and are restricted to mesic microsites as they are more common in higher elevation or higher latitude, temperate climates or relatively mesic sites. Numerous exotic perennial herbaceous species may compose these stands such as *Acroptilon repens, Cardaria draba, Centaurea calcitrapa, Centaurea diffusa, Centaurea iberica, Centaurea stoebe ssp. micranthos, Centaurea virgata, Hypericum perforatum, Lepidium latifolium, Peganum harmala*, or a mixture of other exotic forbs and graminoids. Stands dominated by annuals may be composed of annual grasses such as *Bromus arvensis (= Bromus japonicus), Bromus hordeaceus, Bromus madritensis, Bromus tectorum, Taeniatherum caput-medusae*, or annual forbs, including *Bassia scoparia (= Kochia scoparia), Brassica nigra, Centaurea melitensis, Centaurea solstitialis, Crupina vulgaris, Cynoglossum officinale, Descurainia sophia, Erodium cicutarium, Hyoscyamus niger, Isatis tinctoria, Lepidium perfoliatum, Salsola tragus, Sisymbrium altissimum, Taraxacum officinale*, or a mixture of other exotic annual forbs and grasses.

ENVIRONMENT & DYNAMICS

Environmental Description: This interior western U.S. ruderal shrubland and grassland group is found on disturbed dry to mesic, basins, alluvial fans, and foothills elevations (up to 2200 m). Stands can be large areas or narrow strips adjacent to roadsides or under powerlines, in waste places such as abandoned agricultural fields that are no longer irrigated, oil and gas development areas, and other disturbed areas. *Climate:* This group occurs in the cool, semi-arid, continental, climate found intermountain western U.S. region. *Soil/substrate/hydrology:* Soils are mostly mineral and well-drained. Due to disturbance, soils may be compacted. It is an early-successional type that may occur in areas disturbed by fire, grazing or mining. However, it also occurs over vast acres of heavily overgrazed lands in the arid west, where livestock such as cows and horses have broken soil biotic crust, compacted soil and reduced native plant vigor.

Dynamics: Most of the invasive diagnostic species are cool-season (C3) plants such as *Agropyron cristatum* and *Bromus tectorum*. Cheatgrass expansion has radically changed fire regimes and vegetation over large areas in the Intermountain West. Cheatgrass invades native vegetation such as big sagebrush shrubland, then produces large amounts of fine fuels that readily carry fire, increasing the number, size and frequency of burns (fire-return interval = 3-5 year) which reduces cover of perennial vegetation and favors dominance by annual grasses (Young and Evans 1978, Zouhar 2003). Crested wheatgrass burns quickly and is therefore less susceptible to damage by fire than some native bunchgrass species that have a thick cespitose growth form. The fire may stay longer in the culms, resulting in heat transfer to the ground and the death of the plant (DePuit 1986). In crested wheatgrass, there is usually little heat transfer into the soil, so the tillers and root system are usually undamaged (DePuit 1986). Thus the more frequent fire regime caused by the introduction of *Bromus tectorum* also favors the maintenance of *Agropyron cristatum* over the establishment or survival of native bunchgrasses (S. Rust pers. comm. 2014).

DISTRIBUTION

Geographic Range: This ruderal group contains disturbed semi-arid grasslands, meadows, shrublands and shrub-steppe found in the interior western U.S. on disturbed dry to mesic, basins, alluvial fans, and foothills elevations (up to 2200 m). Stands do not extend up into the cool, temperate zone in included mountain ranges. This group does not extend south to the warm deserts or east into the Great Plains or west into cismontane California or the west side of the Cascades.

Spatial Scale & Pattern [optional]:
Nations: CA, US
States/Provinces: AZ, CA, CO, ID, MT, ND, NV, OR, SD, SK, UT, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Alliances:
- A4213 *Artemisia* spp. - Mixed Shrub Ruderal Understory Shrubland Alliance
- A3257 *Centaurea solstitialis - Isatis tinctoria - Salsola tragus* Ruderal Annual Forb Alliance
- A3253 *Alhagi maurorum - Zygophyllum fabago* Ruderal Shrubland Alliance
- A1814 *Bromus tectorum - Taeniatherum caput-medusae* Ruderal Annual Grassland Alliance
- A3255 *Cardaria draba - Centaurea* spp. - *Lepidium latifolium* Ruderal Perennial Forb Alliance
- A4148 *Agropyron cristatum* Western Ruderal Perennial Grassland Alliance

AUTHORSHIP

Primary Concept Source: Faber-Langendoen et al. (2015)
Author of Description: G. Kittel and K.A. Schulz
Acknowledgments:
Version Date: 04/16/2015
Classif Resp Region: West
Internal Author: GK 5-12, mod. KAS 4-13, 4-15

REFERENCES

References: DePuit 1986, Faber-Langendoen et al. 2017a, Johnson and O'Neil 2000, Maser et al. 1984, Rust pers. comm., Young and Evans 1978, Zouhar 2003

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G600. Great Basin-Intermountain Ruderal Dry Shrubland & Grassland

A4148. Agropyron cristatum Western Ruderal Perennial Grassland Alliance

Type Concept Sentence: This semi-arid interior western U.S. ruderal perennial grassland alliance is strongly dominated (>90% relative canopy cover) by invasive, exotic perennial grasses, especially *Agropyron cristatum*, which can occur as a near-monoculture or mixed grassland with other exotic perennial grasses such as *Poa pratensis* and exotic perennial forbs and annuals.

OVERVIEW

Scientific Name: *Agropyron cristatum* Western Ruderal Perennial Grassland Alliance
Common Name (Translated Scientific Name): Crested Wheatgrass Western Ruderal Perennial Grassland Alliance
Colloquial Name: Western Ruderal Crested Wheatgrass Grassland

Type Concept: This ruderal perennial grassland alliance occurs in the interior western U.S. The vegetation is strongly dominated (>90% relative canopy cover) by invasive, exotic perennial grasses, especially *Agropyron cristatum*, which can occur as a near-monoculture or mixed grassland with other exotic perennial species such as *Poa pratensis*, and exotic perennial forbs and annuals. *Agropyron cristatum* has been purposefully seeded to prevent soil erosion and provide livestock forage in many areas and has naturalized outside these plantings. Scattered shrubs may be present but have low cover (<10% absolute cover). Native perennial graminoid species may be present but cover is low (<10% relative cover). Highly invasive and wind- and animal-distributed exotic forb and annual grass species may be present, including *Sisymbrium altissimum, Descurainia sophia, Halogeton glomeratus*, and *Salsola tragus*. Although exotic forbs and annual grasses may be abundant in the herbaceous layer and contribute to its ruderal nature, exotic perennial graminoids characterize the site. Stands occur in disturbed dry to mesic basins, alluvial fans, and foothills at elevations up to 2200 m throughout the cool, semi-arid interior western U.S. Vegetation dominated by relatively mesic, invasive perennial hay grasses such as *Bromus inermis, Dactylis glomerata, Phleum pratense*, and *Poa pratensis* generally occurs at higher elevations, higher latitudes or mesic microsites such as north slopes and generally has a more temperate climate and relatively mesic site conditions.

Classification Comments: *Agropyron cristatum* is an Old World introduction that grows in many alliances, especially on disturbed sites. Ranchers have planted thousands of hectares in the arid and semi-arid West to improve forage for use by livestock; it is palatable to wildlife, including antelope, deer, elk, birds, and small rodents. It naturalizes and dominates large areas, especially from northern parts of transmontane California east to the northwestern Great Plains (Ogle 2001, Kittel et al. 2012a). In conjunction with plantings, grazing pressures and changes in fire regime have caused shifts in native sagebrush stands with native understories of *Achnatherum hymenoides, Elymus elymoides, Festuca idahoensis, Leymus cinereus*, and *Poa secunda* into non-native understories or stands of *Agropyron cristatum* and/or *Bromus tectorum*.

Internal Comments:
Other Comments:

Similar NVC Types: Western North American Interior Ruderal Grassland & Shrubland Group (G624) has similar ruderal alliances but rather than occurring in cool, semi-arid sites, stands occur in cool, temperate regions and includes montane, subalpine and alpine areas. Vegetation lacks obligate wetland species and is not dominated by facultative wetland species. Western North American Ruderal Marsh, Wet Meadow & Shrubland Group (G524) has similar ruderal alliances but occurs on mesic to wet sites and vegetation either includes obligate wetland species or is dominated by facultative wetland species. Southern Vancouverian Lowland Ruderal Grassland & Shrubland Group (G648) may include similar alliances, but is restricted to lowlands west of the Cascade Range. North American Warm Desert Ruderal Grassland Group (G677) may include similar alliances, but is restricted warm, semi-arid desert regions.

- A3254 *Agropyron cristatum - Bromus inermis - Poa pratensis* Ruderal Grassland Alliance: is very similar floristically, but is restricted to the western Great Plains.

Diagnostic Characteristics: Dominant diagnostic species for this alliance are invasive, perennial grass species such as *Agropyron cristatum*. There are relatively few cool, semi-arid perennial exotic grasses, but there are usually abundant annual exotic species present, seasonally.

VEGETATION

Physiognomy and Structure: This ruderal alliance is characterized by sparse to dense herbaceous layer dominated by perennial grasses with low cover of shrubs or annual graminoids and forbs (<5% absolute cover).

Floristics: The vegetation is strongly dominated (>90% relative canopy cover) by invasive, exotic perennial grasses, especially *Agropyron cristatum*, which can occur as a near-monoculture or mixed grassland with other exotic perennial species such as *Poa pratensis*, and exotic perennial forbs and annuals. *Agropyron cristatum* has been purposefully seeded to prevent soil erosion and provide livestock forage in many areas and has naturalized outside these plantings. Scattered shrubs may be present but have low cover (<10% absolute cover). Native perennial graminoid species such as *Hesperostipa comata* may be present but cover is low (<10% relative cover). Highly invasive and wind- and animal-distributed exotic forb and annual grass species may be present, including *Sisymbrium altissimum, Descurainia sophia, Halogeton glomeratus*, and *Salsola tragus*. Although exotic forbs and annual grasses may abundant in the herbaceous layer and contribute to its ruderal nature, exotic perennial graminoids characterize the site. Relatively mesic, invasive perennial hay grasses such as *Bromus inermis, Dactylis glomerata*, and *Phleum pratense* are absent or have low cover as they are more common in at higher elevations, higher latitudes or mesic microsites and generally occur in more temperate climates or relatively mesic sites.

ENVIRONMENT & DYNAMICS

Environmental Description: This ruderal perennial grassland alliance occurs in the interior western U.S. Stands occur in disturbed dry to mesic basins, alluvial fans, and foothills at elevations up to approximately 2200 m throughout the cool, semi-arid interior western U.S. Vegetation dominated by relatively mesic, invasive perennial hay grasses generally occurs at higher elevations, higher latitudes or mesic microsites such as north slopes and generally has a more temperate climate and relatively mesic site conditions. Stands can occur in a wide variety of human-disturbed habitats, including highway rights-of-way, revegetation projects, etc.

Dynamics: *Agropyron cristatum* burns quickly and is less susceptible to fire damage than native bunchgrasses. Its heat transfer is minimal into the soil, so the tillers and root system are usually undamaged. Tracks of *Agropyron cristatum* carry fires easily; they may promote the expansion and persistence of the type (Johnson 1986c). Managers plant *Agropyron cristatum* extensively in the Great Basin after burns and for erosion control. Its persistence following plantings involves shifts in the ecological function. Established plants replace natives; some plantings have resulted in pure stands (Johnson 1986c). Bakker et al. (2003) found that the control of *Agropyron cristatum* was possible without suppressing native bunchgrasses by both annual and early spring spraying with a generalist herbicide (glyphosate). This herbicide selectively killed the cool-season *Agropyron cristatum*. Bakker et al. (2003) found *Agropyron cristatum* persisting over 4 years in spite of annual herbicide application, and cover in control plots particularly increased with increased summer precipitation. They suggested that management focus on controlling *Agropyron cristatum* during dry years and on establishing native species during wet years.

DISTRIBUTION

Geographic Range: This alliance occurs at plains, basins, and foothill elevations (up to 2200 m) throughout the cool, semi-arid interior western U.S.

Nations: US
States/Provinces: AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]: 4:C, 11:C
USFS Ecoregions (2007): 341D:CC, 341F:CC, 342B:CC, M261G:CC
Omernik Ecoregions:
Federal Lands [optional]: USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **=** *Agropyron cristatum* (Crested wheatgrass rangelands) Semi-natural Stands (Sawyer et al. 2009) [42.030.00]
- **=** *Agropyron cristatum* Herbaceous Semi-Natural Alliance (CNPS 2017) [42.030.00]
- **<** Crested wheatgrass series (Sawyer and Keeler-Wolf 1995)
- **<** Great Basin Grassland (#43000) (Holland 1986b)

LOWER LEVEL UNITS

Associations:

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2014)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Allen-Diaz and Bartolome 1998, Asay and Knowles 1985, Bakker et al. 2003, CNPS 2017, Coffin et al. 1996, Dillman 1946, Eckert et al. 1961, Faber-Langendoen et al. 2017b, Garrison et al. 1977, Holland 1986b, Johnson 1986c, Kittel et al. 2012a, Ogle 2001, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, USFS 1937, Whitson et al. 2000, Zlatnik 1999d

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G600. Great Basin-Intermountain Ruderal Dry Shrubland & Grassland

A4213. Artemisia spp. - Mixed Shrub Ruderal Understory Shrubland Alliance [Low - Poorly Documented]

Type Concept Sentence: Sagebrush shrublands with native shrubs in the overstory canopy and non-native herbaceous species in the understory; a wide spread example is *Artemisia tridentata / Bromus tectorum* shrubland.

OVERVIEW

Scientific Name: *Artemisia* spp. - Mixed Shrub Ruderal Understory Shrubland Alliance
Common Name (Translated Scientific Name): Sagebrush species - Mixed Shrub Ruderal Understory Shrubland Alliance
Colloquial Name: Great Basin-Intermountain Ruderal Understory Shrubland

Type Concept: This alliance covers those native shrublands that have had their herbaceous component completely replaced by non-native, invasive herbaceous species. Overstory shrubs include *Artemisia tridentata* (all subspecies), *Artemisia tridentata ssp. spiciformis (= Artemisia spiciformis), Artemisia arbuscula*, and *Artemisia tripartita*. Understory dominant herbaceous non-native species include graminoids *Bromus tectorum, Agropyron cristatum, Agrostis stolonifera, Taeniatherum caput-medusae, Poa bulbosa, Bromus diandrus*, and forbs *Sisymbrium altissimum, Descurainia pinnata, Onopordum acanthium, Cirsium* spp., *Centaurea* spp., *Lepidium* spp., and many others. Native herbaceous species may be present, but occur in very low abundance, less than 10% relative cover of all herbaceous cover. These stands occur in all areas where native sagebrush stands occur throughout the western US.

Classification Comments:

Internal Comments: GK 9-16: CA & OR confirmed and MT & NM added.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Stands are dominated in the understory layer by non-natives, such that the native association cannot be determined.

VEGETATION

Physiognomy and Structure:

Floristics:

ENVIRONMENT & DYNAMICS

Environmental Description:

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is found throughout the western U.S.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low - Poorly Documented.

SYNONYMY

LOWER LEVEL UNITS

Associations:

- CEGL005480 *Artemisia tripartita ssp. tripartita / Bromus tectorum* Ruderal Shrubland
- CEGL002528 *Artemisia tridentata ssp. vaseyana / Poa pratensis* Ruderal Shrubland
- CEGL005593 *Chrysothamnus viscidiflorus / Poa secunda - Bromus tectorum* Ruderal Shrubland
- CEGL005591 *Chrysothamnus viscidiflorus / Bromus tectorum* Ruderal Shrubland
- CEGL002985 *Artemisia arbuscula ssp. longicaulis / Bromus tectorum* Ruderal Shrubland
- CEGL002699 *Artemisia tridentata - (Ericameria nauseosa) / Bromus tectorum* Ruderal Shrubland
- CEGL002937 *Ericameria nauseosa / Bromus tectorum* Ruderal Shrubland
- CEGL005472 *Artemisia arbuscula ssp. arbuscula / Bromus tectorum* Ruderal Shrubland
- CEGL005475 *Artemisia tridentata ssp. vaseyana / Bromus tectorum* Ruderal Shrubland
- CEGL005590 *Chrysothamnus viscidiflorus / Agropyron cristatum* Ruderal Shrubland
- CEGL005477 *Artemisia tridentata ssp. wyomingensis / Bromus tectorum* Ruderal Shrubland
- CEGL002083 *Artemisia tridentata ssp. wyomingensis* / Disturbed Understory Ruderal Shrubland
- CEGL002339 *Artemisia tridentata ssp. vaseyana / Poa (pratensis, compressa)* Ruderal Shrub Grassland
- CEGL002355 *Ephedra viridis / Bromus tectorum* Ruderal Shrubland
- CEGL002185 *Artemisia tridentata ssp. wyomingensis / (Agropyron cristatum, Psathyrostachys juncea)* Seeded Grasses Ruderal Shrubland
- CEGL002933 *Chrysothamnus viscidiflorus / Poa pratensis* Ruderal Shrub Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2015)
Author of Description: G. Kittel
Acknowledgments:
Version Date: 2016/09/28

REFERENCES

References: Faber-Langendoen et al. 2017b, Hickman 1993, Sawyer et al. 2009

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G600. Great Basin-Intermountain Ruderal Dry Shrubland & Grassland

A1814. Bromus tectorum - Taeniatherum caput-medusae Ruderal Annual Grassland Alliance

Type Concept Sentence: This cool, semi-arid interior western U.S. ruderal annual grassland alliance is strongly dominated (>90% relative canopy cover) by invasive, exotic annual grass species such as *Bromus tectorum*, and less commonly *Bromus arvensis, Bromus hordeaceus, Bromus madritensis*, or *Taeniatherum caput-medusae*. It occurs in disturbed dry to mesic basins, alluvial fans, and foothills at elevations up to 2200 m.

OVERVIEW

Scientific Name: *Bromus tectorum - Taeniatherum caput-medusae* Ruderal Annual Grassland Alliance
Common Name (Translated Scientific Name): Cheatgrass - Medusa-head Ruderal Annual Grassland Alliance
Colloquial Name: Ruderal Cheatgrass - Medusa-head Annual Grassland

Type Concept: This interior western U.S. ruderal annual grassland alliance is strongly dominated (>90% relative canopy cover) by invasive, exotic annual grass species such as *Bromus tectorum*, and less commonly *Bromus arvensis (= Bromus japonicus), Bromus hordeaceus, Bromus madritensis, Onopordum acanthium, Taeniatherum caput-medusae*, or a mixture of other exotic annual grasses. Cover of perennials is low (<5% absolute cover). Stands occur in disturbed dry to mesic basins, alluvial fans, and foothills at elevations up to 2200 m throughout the cool, semi-arid interior western U.S. region. It is an early-successional type that may occur in areas disturbed by fire, grazing or mining.

Classification Comments: This alliance includes grasslands dominated by other Eurasian introduced annual *Bromus* species. It is distinct from the annual *Bromus* communities found along the Pacific coast with Mediterranean or maritime climates because it does not have the introduced annual oatgrass (*Avena barbata* and *Avena fatua*), or other species typical of the California annual grassland (Sawyer and Keeler-Wolf 1995).

Internal Comments:
Other Comments:

Similar NVC Types: Western North American Interior Ruderal Grassland & Shrubland Group (G624) has similar ruderal alliances but rather than occurring in cool, semi-arid sites, stands occur in cool, temperate regions and includes montane, subalpine and alpine areas. Vegetation lacks obligate wetland species and is not dominated by facultative wetland species. Western North American Ruderal Marsh, Wet Meadow & Shrubland Group (G524) has similar ruderal alliances but occurs on mesic to wet sites and vegetation either includes obligate wetland species or is dominated by facultative wetland species. Southern Vancouverian Lowland Ruderal Grassland & Shrubland Group (G648) may include similar alliances, but is restricted to lowlands west of the Cascade Range. North American Warm Desert Ruderal Grassland Group (G677) may include similar alliances, but is restricted warm, semi-arid desert regions.

Diagnostic Characteristics: This disturbed grassland alliance is strongly dominated (>90% relative canopy cover) by invasive, exotic annual grass species such as *Bromus tectorum*, and less commonly *Bromus arvensis, Bromus hordeaceus, Bromus madritensis, Taeniatherum caput-medusae*, or a mixture of other exotic annual grasses. Cover of perennials is low (<5% absolute cover). Stands are restricted lower elevation sites (up to 2200 m) throughout the cool, semi-arid interior western U.S.

VEGETATION

Physiognomy and Structure: This alliance is characterized by sparse to dense annual grasslands with low cover of shrub or perennial graminoids or forbs (<5% absolute cover).

Floristics: This interior western U.S. ruderal annual grassland alliance is strongly dominated (>90% relative canopy cover) by invasive, exotic annual grass species such as *Bromus tectorum*, and less commonly *Bromus arvensis (= Bromus japonicus), Bromus hordeaceus, Bromus madritensis, Taeniatherum caput-medusae*, or a mixture of other exotic annual grasses. Cover of perennials is low (<5% absolute cover).

ENVIRONMENT & DYNAMICS

Environmental Description: Stands occur in disturbed dry to mesic basins, alluvial fans, and foothills at elevations up to 2200 m. Climate is cool, semi-arid. Substrates are variable.

Dynamics: *Bromus tectorum* is an annual grass and is able to complete its lifecycle in the spring before drying out mid-summer. Its fine structure makes it extremely flammable when dry, and it will increase the fire frequency of a site (FEIS 2001). Frequent fires favor *Bromus tectorum* because they eliminate competing perennial vegetation and increase soil nitrogen, but do not kill all the *Bromus tectorum* seeds, which survive in the unburned organic material (FEIS 2001). This altered ecological process has promoted the spread of *Bromus tectorum* and other exotic annual bromes at the expense of sagebrush shrublands in large parts of the western U.S. (Young and Evans 1973, 1978, Daubenmire 1975).

T. Naumann (pers. comm. 2005) reported successful restoration of cheatgrass-invaded systems by the use of prescribed fire, timed and controlled so as to destroy the seeds of *Bromus tectorum* while stimulating growth in remnant native warm-season grasses. She also reported that prescribed fire was least successful in areas of shallow soils, presumably because native grasses cannot develop sufficient root mass to compete with cheatgrass. Work by Redente and others (e.g., Redente et al. 1992) indicates that, under some circumstances, native grass and shrub species can regain competitive advantage over annuals such as *Bromus tectorum* if a source of carbon, such as sugar or sawdust, is added to the system. Amending the soil with carbon increases the activity of soil microbes and results in the reduction of plant-available nitrogen.

This type is most common where disturbances have eliminated or largely set back the native vegetation. Where the brome grasses are invading native vegetation, the types may still be tracked as native types, since the native species may still persist. A recent study (Karl et al. 1999) found that, despite strong seed and seedling production by the exotic brome grasses (*Bromus arvensis, Bromus tectorum*), the large amount of herbaceous biomass produced by the two vegetatively propagating native grasses *Bouteloua gracilis* and *Pascopyrum smithii* suggests that these native grasses may well maintain their ecological importance in the stands.

Evans et al. (2001) studied the invasion by cheatgrass of an undisturbed native grassland in Canyonlands National Park (Virginia Park). Their study showed that *Bromus* may cause a short-term decrease in nitrogen loss by decreasing substrate availability and denitrification enzyme activity, but in the long term, nitrogen loss is likely to be greater in invaded sites because of increased fire frequency and greater nitrogen volatilization during fire. A study by Englund (2004) at the same site showed decreasing levels of soil organic carbon as *Bromus tectorum*, with its shallow root systems, replaced perennial grasses with their more massive root systems.

In Nevada, Beatley (1976) found dense stands of the introduced winter annual grass *Bromus tectorum* growing in disturbed *Artemisia* shrublands. *Bromus rubens* is more common in lower elevation sites and *Bromus tectorum* is most common in higher elevation sagebrush and pinyon-juniper communities.

DISTRIBUTION

Geographic Range: This exotic annual grassland is restricted to the cool, semi-arid interior western U.S.

Nations: CA?, US
States/Provinces: AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
TNC Ecoregions [optional]: 11:C
USFS Ecoregions (2007): 341Fd:CCC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Death Valley, Joshua Tree); USFWS (Minidoka)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **>** *Bromus tectorum* (Cheatgrass grassland) Semi-natural Stands (Sawyer et al. 2009) [42.020.00]
- **>** *Bromus tectorum* Semi-Natural Herbaceous Stands (Evens et al. 2012)
- **>** *Bromus tectorum* Semi-natural Herbaceous Alliance (Evens et al. 2014)

LOWER LEVEL UNITS

Associations:
- CEGL003019 *Bromus tectorum* Ruderal Grassland
- CEGL005614 *Sisymbrium altissimum - Bromus tectorum* Ruderal Grassland
- CEGL005604 *Poa secunda - Bromus tectorum* Ruderal Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Beatley 1976, Daubenmire 1975, Englund 2004, Evans et al. 2001, Evens and San 2006, Evens et al. 2012, Evens et al. 2014, FEIS 2001, Faber-Langendoen et al. 2017b, Karl et al. 1999, Naumann pers. comm., Redente et al. 1992, Sawyer and Keeler-Wolf 1995, Sawyer et al. 2009, Thompson 2001, USFS 1937, VegCAMP and AIS 2013, Von Loh 2000, Whitson et al. 2000, Young and Evans 1973, Young and Evans 1978

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G600. Great Basin-Intermountain Ruderal Dry Shrubland & Grassland

A3255. Cardaria draba - Centaurea spp. - Lepidium latifolium Ruderal Perennial Forb Alliance

Type Concept Sentence: This cool, semi-arid interior western U.S. ruderal herbaceous alliance is strongly dominated (>90% relative canopy cover) by invasive, exotic perennial forbs such as *Acroptilon repens, Cardaria draba, Centaurea calcitrapa, Centaurea diffusa, Centaurea iberica, Centaurea stoebe ssp. micranthos, Centaurea virgata, Euphorbia esula, Hypericum perforatum, Lepidium latifolium, Linaria dalmatica, Linaria vulgaris*, or *Peganum harmala* and occurs in disturbed dry to mesic basins, alluvial fans, and foothills at elevations up to 2200 m.

OVERVIEW

Scientific Name: *Cardaria draba - Centaurea* spp. - *Lepidium latifolium* Ruderal Perennial Forb Alliance
Common Name (Translated Scientific Name): Whitetop - Knapweed species - Broadleaf Pepperweed Ruderal Perennial Forb Alliance
Colloquial Name: Ruderal Perennial Forb Meadow & Grassland

Type Concept: This interior western U.S. ruderal perennial herbaceous alliance is strongly dominated (>90% relative canopy cover) by invasive, exotic perennial forbs such as *Acroptilon repens, Cardaria draba, Centaurea calcitrapa, Centaurea diffusa, Centaurea iberica, Centaurea stoebe ssp. micranthos, Centaurea virgata, Euphorbia esula, Hypericum perforatum, Lepidium latifolium, Linaria dalmatica, Linaria vulgaris, Peganum harmala*, or a mixture of other exotic perennial forbs. Stands occur in disturbed dry to mesic basins, alluvial fans, and foothills at elevations up to 2200 m throughout the cool, semi-arid intermountain western U.S. region. It is an early-successional type that may occur in areas disturbed by fire, grazing or mining.

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types: Western North American Interior Ruderal Grassland & Shrubland Group (G624) has similar ruderal alliances but rather than occurring in cool, semi-arid sites, stands occur in cool, temperate regions and includes montane, subalpine and alpine areas. Vegetation lacks obligate wetland species and is not dominated by facultative wetland species. Western North American Ruderal Marsh, Wet Meadow & Shrubland Group (G524) has similar ruderal alliances but occurs on mesic to wet sites and vegetation either includes obligate wetland species or is dominated by facultative wetland species. Southern Vancouverian Lowland Ruderal Grassland & Shrubland Group (G648) may include similar alliances, but is restricted to lowlands west of the Cascade Range. North American Warm Desert Ruderal Grassland Group (G677) may include similar alliances, but is restricted warm, semi-arid desert regions.

Diagnostic Characteristics: This disturbed ruderal herbaceous alliance is strongly dominated (>90% relative canopy cover) by invasive, exotic perennial forb species such as *Acroptilon repens, Cardaria draba, Centaurea calcitrapa, Centaurea diffusa, Centaurea iberica, Centaurea stoebe ssp. micranthos, Centaurea virgata, Euphorbia esula, Hypericum perforatum, Lepidium latifolium, Linaria dalmatica, Linaria vulgaris, Peganum harmala*, or a mixture of other exotic perennial forbs.

VEGETATION

Physiognomy and Structure: This ruderal alliance is characterized by sparse to dense herbaceous layer dominated by annual forbs with low cover of shrubs or perennial graminoids and forbs (<5% absolute cover).

Floristics: This interior western U.S. ruderal perennial herbaceous alliance is strongly dominated (>90% relative canopy cover) by invasive, exotic perennial forbs such as *Acroptilon repens, Cardaria draba, Centaurea calcitrapa, Centaurea diffusa, Centaurea iberica, Centaurea stoebe ssp. micranthos, Centaurea virgata, Euphorbia esula, Hypericum perforatum, Lepidium latifolium, Linaria dalmatica, Linaria vulgaris, Peganum harmala*, or a mixture of other exotic perennial forbs.

ENVIRONMENT & DYNAMICS

Environmental Description: This ruderal perennial herbaceous alliance occurs in the interior western U.S. Stands occur in disturbed dry to mesic basins, alluvial fans, and foothills at elevations up to 2200 m throughout the cool, semi-arid intermountain western U.S. region. It is an early-successional type that may occur in areas disturbed by fire, grazing or mining.

Dynamics:

DISTRIBUTION

Geographic Range: This ruderal herbaceous alliance occurs in lowland and foothill sites throughout the cool, interior western U.S.

Nations: CA, US
States/Provinces: AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **>** *Lepidium latifolium* (Perennial pepper weed patches) Semi-natural Stands (Sawyer et al. 2009) [52.205.00]
- **>** *Lepidium latifolium* Semi-Natural Stands (Perennial pepper weed patches) (Buck-Diaz et al. 2012)

LOWER LEVEL UNITS

Associations:

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Buck-Diaz et al. 2012, Faber-Langendoen et al. 2017b, Sawyer et al. 2009, Sproul et al. 2011, USFS 1937, Whitson et al. 2000

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3. Desert & Semi-Desert
3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland
G600. Great Basin-Intermountain Ruderal Dry Shrubland & Grassland

A3257. Centaurea solstitialis - Isatis tinctoria - Salsola tragus Ruderal Annual Forb Alliance

Type Concept Sentence: This cool, semi-arid interior western U.S. ruderal annual herbaceous alliance is strongly dominated (>90% relative canopy cover) by invasive, exotic annual forb species such as *Brassica nigra, Centaurea melitensis, Centaurea solstitialis, Crupina vulgaris, Cynoglossum officinale, Hyoscyamus niger, Isatis tinctoria*, or *Salsola tragus* and occurs in disturbed dry to mesic basins, alluvial fans, and foothills at elevations up to 2200 m.

OVERVIEW

Scientific Name: *Centaurea solstitialis - Isatis tinctoria - Salsola tragus* Ruderal Annual Forb Alliance
Common Name (Translated Scientific Name): Yellow Star-thistle - Dyer's Woad - Prickly Russian-thistle Ruderal Annual Forb Alliance
Colloquial Name: Ruderal Annual Forb Meadow & Grassland

Type Concept: This ruderal herbaceous alliance occurs in the interior western U.S. Vegetation is strongly dominated (>90% relative canopy cover) by invasive, exotic annual forb species such as *Brassica nigra, Centaurea melitensis, Centaurea solstitialis, Crupina vulgaris, Cynoglossum officinale, Hyoscyamus niger, Isatis tinctoria, Salsola tragus* or a mixture of other exotic annual forbs. Other exotic annual forbs are often present to dominant in disturbed stands, including *Bassia scoparia (= Kochia scoparia), Descurainia sophia, Erodium cicutarium, Lepidium perfoliatum, Onopordum acanthium, Sisymbrium altissimum*, and *Taraxacum officinale*. Cover of perennials is low (<5% absolute cover). Stands occur in disturbed dry to mesic basins, alluvial fans, and foothills at elevations up to 2200 m throughout the cool, semi-arid intermountain western U.S. region. It is an early-successional type that may occur in areas disturbed by fire, grazing or mining.

Classification Comments: The aggressive invasive species are an obvious problem resulting from conversion of native vegetation types. However, the less aggressive species such as *Salsola tragus* can be disruptive ecological processes when they flush after large precipitation events, stabilizing active dunes or providing fine fuels that can carry fire through fire-sensitive vegetation types similar to the annual bromes.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Dominant diagnostic species for this alliance are invasive species such as *Brassica nigra, Centaurea melitensis, Centaurea solstitialis, Crupina vulgaris, Cynoglossum officinale, Hyoscyamus niger, Isatis tinctoria, Salsola tragus*, or a

mixture of other exotic annual forbs. Other less aggressive non-native herbaceous species often present in these disturbed stands include *Erodium cicutarium, Bassia scoparia*, and *Taraxacum officinale*.

VEGETATION

Physiognomy and Structure: This ruderal alliance is characterized by sparse to dense herbaceous layer dominated by annual grasses with low cover of shrubs or perennial graminoids and forbs (<5% absolute cover).

Floristics: Vegetation in this alliance is strongly dominated (>90% relative canopy cover) by invasive, exotic annual forb species such as *Brassica nigra, Centaurea melitensis, Centaurea solstitialis, Crupina vulgaris, Cynoglossum officinale, Hyoscyamus niger, Isatis tinctoria, Salsola tragus*, or a mixture of other exotic annual forbs. Other exotic annual forbs are often present to dominant in disturbed stands, including *Bassia scoparia (= Kochia scoparia), Descurainia sophia, Erodium cicutarium, Lepidium perfoliatum, Sisymbrium altissimum*, and *Taraxacum officinale*. Cover of perennials is low (<5% absolute cover).

ENVIRONMENT & DYNAMICS

Environmental Description: This ruderal herbaceous alliance occurs in the interior western U.S. Stands occur in disturbed dry to mesic basins, alluvial fans, and foothills at elevations up to 2200 m. Climate is cool, semi-arid. Substrates are variable. It is an early-successional type that may occur in areas disturbed by fire, grazing or mining.

Dynamics:

DISTRIBUTION

Geographic Range: This ruderal herbaceous alliance occurs in lowland and foothill sites throughout the cool, interior western U.S. and Canada.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **<** *Centaurea (solstitialis, meletensis)* (Yellow star-thistle fields) Semi-natural Stands (Sawyer et al. 2009) [42.042.00]

LOWER LEVEL UNITS

Associations:
- CEGL004004 *Salsola* spp. Ruderal Grassland
- CEGL002085 *Erodium cicutarium* Ruderal Annual Grassland

AUTHORSHIP

Primary Concept Source: K.A. Schulz, in Faber-Langendoen et al. (2013)
Author of Description: K.A. Schulz
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Bentley and Talbot 1948, Faber-Langendoen et al. 2017b, Sawyer et al. 2009, USFS 1937, Wagner et al. 1978, Whitson et al. 2000

6. OPEN ROCK VEGETATION

Tropical, temperate, and boreal habitats are characterized or dominated by plant growth forms, such as *lichen, bryophyte, alga*, or *fern*, that have structural adaptations for living on stable rock surfaces or on unstable rocky substrates, such as cliffs, talus, scree, pavement, cobble, lava or boulderfields, and with associated mesomorphic grass, shrub and tree growth forms.

6.B. Temperate & Boreal Open Rock Vegetation

Rocky habitats (such as cliffs, talus, scree, pavement, cobbles, recent lava flows, or large rock outcrops) characterized by temperate, including Mediterranean, and boreal lithomorphic and lithophilic growth forms, including saxicolous *lichens, bryophytes, algae*,

and/or *ferns* and other pteridophytes. Tree growth forms typically have <10% cover, are very sparse; woody growth forms, when present, include cold-deciduous broad-leaved and needle-leaved trees and shrubs. Vegetation found on temperate and boreal rocky habitats (such as cliffs, talus, recent lava flows, or rock outcrops) at low to moderate elevations at mid-latitudes from 23°to 70°N or S latitude around the globe that are characterized by nonvascular plant growth forms that have structural adaptations for living on these habitats.

6.B.1. Temperate & Boreal Cliff, Scree & Other Rock Vegetation

Vegetation in temperate and boreal habitats found in rocky or rocklike habitats (such as cliffs, talus, scree, pavement, cobbles, lava, boulderfields, or badlands) at low elevations at mid-latitudes around the globe characterized by nonvascular plant growth forms that have structural adaptations for living on stable rock surfaces or in unstable rocky substrates. A sparse cover of vascular mesomorphic growth forms, including needle-leaved and cold-deciduous broad-leaved woody plants, may be present.

6.B.1.Na. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation

This type encompasses vegetation of eastern and boreal North America found on somewhat to strongly vertical cliffs, talus slopes, and erosional bluffs and characterized by sparse and patchy vascular vegetation and often high nonvascular and fern cover.

M116. Great Plains Cliff, Scree & Rock Vegetation

This macrogroup is found throughout the Great Plains on cliffs, bluffs, and rock outcrops, with vegetation comprised of sparse, rocky vegetation and sparse to abundant lichens.

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6. Open Rock Vegetation
6.B.1.Na. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation
6.B.1.Na.2.b. M116 Great Plains Cliff, Scree & Rock Vegetation

G567. Great Plains Cliff, Scree & Rock Vegetation

Type Concept Sentence: This group is composed of cliffs, bluffs, and rock outcrops in the Great Plains from the U.S.-Canadian border area south to Texas where vascular vegetation cover is sparse or nonexistent.

OVERVIEW

Scientific Name: *Rhus trilobata / Bouteloua gracilis - Opuntia* spp. Great Plains Cliff, Scree & Rock Vegetation Group
Common Name (Translated Scientific Name): Skunkbush Sumac / Blue Grama - Prickly-pear species Cliff, Scree & Rock Vegetation Group
Colloquial Name: Great Plains Acidic Cliff

Type Concept: This group is composed of cliffs, bluffs, and rock outcrops in the Great Plains from the U.S.-Canadian border area south to Texas. It is defined by having sparse vegetation and the abundance of exposed bedrock. The bedrock exposure can be vertical, sloping, or horizontal along rivers, at the tops of buttes, in dry canyons, or, rarely, large, low bedrock outcrops. The bedrock is usually sedimentary (sandstone, limestone, shale, gypsum, siltstone), but an area of quartzite outcrops in southwestern Minnesota is included in this group. Vegetation is generally sparse except where soil accumulates in pockets or ledges. Dominant species vary greatly depending on geology of the bedrock, climate, aspect, slope, and slope position. Common species are able to tolerate the dry to xeric conditions and poor soil development found in this group. These include *Bouteloua eriopoda* (in the southwest), *Bouteloua gracilis, Cercocarpus montanus, Juniperus* spp., *Opuntia* spp., and *Rhus trilobata*.

Classification Comments: The concept of this group is fairly distinct within the Great Plains though individual sites may have enough vegetation to be confused with dry prairie or dry woodland groups. At the edges of the distribution of this group, there could be confusion with the sparse vegetation bedrock groups in the East, i.e., Laurentian-Acadian-Great Lakes Cliff & Rock Vegetation Group (G839), Appalachian Cliff & Rock Vegetation Group (G840), Central Midwest-Interior Cliff & Rock Vegetation Group (G841), and Southeast Coastal Plain Cliff & Rock Vegetation Group (G842), and the West, i.e., Rocky Mountain Cliff, Scree & Rock Vegetation Group (G565). Characteristics of this group may overlap with that of Comanchian Barrens & Glade Group (G598), and review is needed to clarify the limits of the two concepts.

Similar NVC Types:
- G598 Comanchian Barrens & Glade
- G569 North American Warm Semi-Desert Cliff, Scree & Pavement Sparse Vegetation
- G570 Intermountain Basins Cliff, Scree & Badland Sparse Vegetation

- G841 Central Midwest-Interior Cliff & Rock Vegetation
- G840 Appalachian Cliff & Rock Vegetation
- G839 Laurentian-Acadian-Great Lakes Cliff & Rock Vegetation
- G842 Southeast Coastal Plain Cliff & Rock Vegetation
- G565 Rocky Mountain Cliff, Scree & Rock Vegetation

Diagnostic Characteristics: This group is characterized by sparse vegetation (generally less than 10% cover) on rock outcrops in the Great Plains.

VEGETATION

Physiognomy and Structure: Examples of this group have sparse vegetation. The most abundant species at a site tend to be small trees, shrubs, or grasses but can be forbs in a few cases. Trees and shrubs are typically short, and mixedgrass species dominate the herbaceous stratum.

Floristics: This group has scattered vascular species found in cracks, depressions, or ledges in the bedrock where some soil can accumulate. Dominant species vary greatly depending on geology of the bedrock, climate, aspect, slope, and slope position. Common trees and shrubs are *Juniperus monosperma* (in the southwest), *Juniperus scopulorum* (in the west), *Juniperus virginiana* (in the east and north), *Artemisia longifolia, Cercocarpus montanus*, and *Rhus trilobata*. Common grasses include *Bouteloua eriopoda* (in the southwest), *Bouteloua gracilis, Calamovilfa longifolia*, and *Schizachyrium scoparium*. Forbs tend not to be as abundant as woody vegetation and grasses but are scattered. *Eriogonum* spp., *Gutierrezia sarothrae*, and *Opuntia* spp. are typical. Nonvascular species, especially lichens, can be very common on exposed rock.

ENVIRONMENT & DYNAMICS

Environmental Description: Sites in this group have significant exposure of bedrock. The bedrock can be vertical, sloping, or horizontal along rivers, at the tops of buttes, in dry canyons, or, rarely, large, low bedrock outcrops. The bedrock is usually sedimentary (sandstone, limestone, shale, gypsum, siltstone), but an area of quartzite outcrops in southwestern Minnesota is included in this group. Soil development is usually limited to cracks, ledges, or depressions in the bedrock.

Dynamics: Drought and erosion, both from wind and water, are important in maintaining sites in this group.

DISTRIBUTION

Geographic Range: This group is found in the Great Plains from near the U.S.-Canadian border south to northern Texas and from the Rocky Mountain foothills to southwestern Minnesota, eastern Kansas and possibly northwestern Iowa and Missouri. The granitic, igneous, and metamorphic formations in the Black Hills and nearby are not included in this group.

Spatial Scale & Pattern [optional]: Small patch
Nations: CA, US
States/Provinces: CO, IA?, KS, MB, MN, MO?, MT, ND, NE, NM, OK, SD, TX, WY
TNC Ecoregions [optional]: 26:C, 27:C, 28:C, 33:C, 34:C, 35:C, 36:C, 37:P, 66:P, 67:P
USFS Ecoregions (2007): 251B:CC, 251C:C?, 251E:CP, 251F:CC, 251H:CC, 315A:CC, 315B:CC, 315F:CC, 331B:CC, 331C:CC, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 331K:CP, 331L:CC, 331M:CC, 331N:CC, 332A:CP, 332B:CC, 332C:CC, 332D:CC, 332E:CP, 332F:CC, 342F:PP, M313B:PP, M331B:PP, M331F:PP, M331I:PP
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Alliances:
- A3981 Great Plains Acidic Cliff Alliance
- A3982 Great Plains Acidic Rock Outcrop Alliance
- A3980 Great Plains Alkaline Cliff Alliance

AUTHORSHIP

Primary Concept Source: S. Menard and K. Kindscher, in Faber-Langendoen et al. (2011)
Author of Description: J. Drake
Acknowledgments:
Version Date: 05/08/2015

Classif Resp Region: Midwest
Internal Author: JD 12-10, 5-15

REFERENCES

References: Comer et al. 2003, Faber-Langendoen et al. 2017a, MNNHP 1993

6. Open Rock Vegetation
6.B.1.Na. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation
G567. Great Plains Cliff, Scree & Rock Vegetation

A3981. Great Plains Acidic Cliff Alliance

Type Concept Sentence: This alliance consists of sparsely vegetated bluffs and cliffs of sandstone or siltstone in the central and northern Great Plains.

OVERVIEW

Scientific Name: Great Plains Acidic Cliff Alliance
Common Name (Translated Scientific Name): Great Plains Acidic Cliff Alliance
Colloquial Name: Great Plains Acidic Cliff

Type Concept: This alliance consists of sparsely vegetated bluffs and cliffs of sandstone or siltstone in the central and northern Great Plains. Vascular floristic diversity is low. Forbs such as *Mentzelia decapetala* and *Penstemon glaber* tend to be more abundant than other lifeforms. Scattered shrubs, such as *Rhus trilobata* and *Cercocarpus montanus*, and grasses, such as *Pseudoroegneria spicata* and *Bouteloua gracilis*, which are more common in the surrounding grasslands and shrub communities can also occur. In general, slopes in this alliance are steep to vertical but small areas with gentle slopes or flat ledges can occur. Soils are absent or poorly developed and limited to cracks or ledges.

Classification Comments: This alliance is defined more by substrate and environmental condition (steep, acidic, rocky slopes) than by floristics. The vegetation of these sites is not well-described. Information on nonvascular species would probably be important in characterizing this alliance.

Internal Comments:
Other Comments:

Similar NVC Types:
- A3982 Great Plains Acidic Rock Outcrop Alliance: has less steep slopes and often has more pockets of soil development and plants.

Diagnostic Characteristics: This alliance consists of sparsely vegetated (generally <10% vascular plant cover) bluffs and cliffs of sandstone or siltstone in the central and northern Great Plains.

VEGETATION

Physiognomy and Structure: Vascular plant cover is <10% in examples of this alliance, though plants often have >10% cover in small, localized ledges and cliffs where soil has accumulated. Short shrubs and grasses can be present but forbs are typically the most abundant vascular lifeform.

Floristics: Vascular floristic diversity is low. Forbs such as *Mentzelia decapetala* and *Penstemon glaber* tend to be more abundant than other lifeforms. Scattered shrubs, such as *Rhus trilobata* and *Cercocarpus montanus*, and grasses, such as *Pseudoroegneria spicata* and *Bouteloua gracilis*, which are more common in the surrounding grasslands and shrub communities can also occur.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs where acidic bedrock is exposed in cliffs and bluffs. The substrate is usually sandstone but can be siltstone. Slopes are steep to vertical and there is little to no soil development. Soil that does develop or accumulate is on gently sloping or flat ledges and in cracks. These are small and localized.

Dynamics: The general lack of soil and steep slopes create very harsh conditions for plant growth and maintain stands of this alliance. Fire does not carry through this alliance, so shrubs and trees can persist, if they can find pockets of soil and survive the generally xeric conditions.

DISTRIBUTION

Geographic Range: This alliance occurs largely in the western Great Plains from western Kansas to western North Dakota and possibly southeastern Montana. Scattered occurrences may be found into eastern Kansas and Nebraska.

Nations: US
States/Provinces: CO?, KS, MT?, ND, NE, SD, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL005257 Sandstone Great Plains Dry Cliff Sparse Vegetation
- CEGL002297 Sandstone Butte Sparse Vegetation
- CEGL002290 Sandstone Great Plains Xeric Butte - Bluff Sparse Vegetation

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Faber-Langendoen et al. 2017b, Rolfsmeier and Steinauer 2010

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6. Open Rock Vegetation
6.B.1.Na. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation
G567. Great Plains Cliff, Scree & Rock Vegetation

A3982. Great Plains Acidic Rock Outcrop Alliance

Type Concept Sentence: This alliance consists of sparsely vegetated, flat to moderately sloping outcrops of acidic bedrock in the central and northern Great Plains with one disjunct site in central Wisconsin.

OVERVIEW

Scientific Name: Great Plains Acidic Rock Outcrop Alliance
Common Name (Translated Scientific Name): Great Plains Acidic Rock Outcrop Alliance
Colloquial Name: Great Plains Acidic Rock Outcrop

Type Concept: This alliance consists of outcrops of acidic bedrock in the central and northern Great Plains with one disjunct site in central Wisconsin. Species vary widely across the range of this alliance but typically consist of Great Plains taxa that can tolerate the shallow, dry soils. Total vegetation cover is sparse across the outcrops but can be moderate or even dense in small pockets where soil accumulates. Substrate varies from granite and quartzite (in Minnesota and Wisconsin) to siltstone, sandstone, shale, and even pockets of gypsum. The outcrops are generally flat to moderately sloping but soil development is limited to cracks or depressions.

Classification Comments: This alliance is defined more by substrate and environmental condition (relatively flat, acidic, rocky slopes) than by floristics. The vegetation of these sites is not well-described, with the exception of Quartzite - Granite Rock Outcrop Sparse Vegetation (CEGL002298) in Minnesota and Wisconsin. The Wisconsin stands lack many of the Great Plains species and, although on a similar substrate, may warrant being placed in a separate association.

Internal Comments:
Other Comments:

Similar NVC Types:
- A3981 Great Plains Acidic Cliff Alliance: has steeper slopes and fewer areas of soil development and plants.

Diagnostic Characteristics: This alliance consists of outcrops of acidic bedrock in the central and northern Great Plains with one disjunct site in central Wisconsin. Occurrences may contain areas of steep slopes but are not characterized by the steep slopes of cliffs and bluffs.

VEGETATION

Physiognomy and Structure: There is little vegetation on most examples of this alliance. Scattered short shrubs <1 m tall and short grasses and forbs generally <0.5 m tall occur where pockets of soil have accumulated.

Floristics: This alliance has little vegetation cover but a variety of species can be found, depending on the surrounding vegetation. Species of the nearby tallgrass or mixedgrass prairies can be found in cracks and depressions where soil has collected. Forbs can include *Oenothera caespitosa, Opuntia* spp., *Selaginella rupestris*, and *Phemeranthus parviflorus (= Talinum parviflorum)*. In Nebraska, Astragalus spatulatus, Cryptantha cana, Ericameria parryi var. howardii, Paronychia jamesii, Paronychia sessiliflora, Penstemon eriantherus, Penstemon glaber, Phlox hoodii, Stephanomeria runcinata, and *Tetraneuris acaulis* are considered diagnostic of this alliance.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs where acidic bedrock is exposed in flat to moderately sloping outcrops. This can be irregularly eroded escarpments or ravines or even ridgetops. The substrate is usually sandstone but can be siltstone. Slopes are not steep over entire stands but there is little to no soil development. Soil that does develop or accumulate is on gently sloping or flat ledges and in cracks. These are small and localized.

Dynamics: The general lack of soil and sloping nature of many sites create very harsh conditions for plant growth and maintain stands of this alliance. Fire does not carry through this alliance, so shrubs and trees can persist, if they can find pockets of soil and survive the generally xeric conditions. In Minnesota and Wisconsin, where precipitation is higher and evaporation lower, rain can collect in small depressions on generally flat outcrops and may allow the formation of ephemeral wetlands (Minnesota DNR 2010).

DISTRIBUTION

Geographic Range: This alliance is found from the central Great Plains in Kansas and Nebraska to southwestern Minnesota, southern Manitoba, and eastern Wyoming. There is one disjunct area in central Wisconsin currently grouped with this alliance but with somewhat different floristics.

Nations: CA, US
States/Provinces: KS, MB, MN, ND, NE, SD, WI, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

- **=** Crystalline Bedrock Outcrop (Prairie) Type [ROs12a] (Minnesota DNR 2010b)

LOWER LEVEL UNITS

Associations:
- CEGL002298 Quartzite - Granite Rock Outcrop Sparse Vegetation
- CEGL005261 Redbeds (Siltstone, Sandstone, Gypsum) Sparse Vegetation
- CEGL002294 Shale Barren Slopes Sparse Vegetation
- CEGL002047 Siltstone - Sandstone Rock Outcrop Sparse Vegetation

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Anderson 1999b, Faber-Langendoen et al. 2017b, Minnesota DNR 2010b, Rolfsmeier and Steinauer 2010, Younkin 1970

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6. Open Rock Vegetation
6.B.1.Na. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation
G567. Great Plains Cliff, Scree & Rock Vegetation

A3980. Great Plains Alkaline Cliff Alliance

Type Concept Sentence: This alliance consists of sparsely vegetated bluffs and cliffs of limestone or dolostone in the central and northern Great Plains.

OVERVIEW

Scientific Name: Great Plains Alkaline Cliff Alliance
Common Name (Translated Scientific Name): Great Plains Alkaline Cliff Alliance
Colloquial Name: Great Plains Alkaline Cliff

Type Concept: This alliance consists of sparsely vegetated bluffs and cliffs of limestone or dolostone in the central and northern Great Plains. Species vary from site to site but may include the shrubs *Rhus trilobata* and *Rosa arkansana*, the forbs *Mentzelia decapetala, Eriogonum pauciflorum, Gutierrezia sarothrae*, and the grasses *Schizachyrium scoparium* and *Achnatherum hymenoides*. Soils are generally absent or poorly developed or limited to cracks and ledges.

Classification Comments: This alliance is defined more by substrate and environmental condition (steep, alkaline, rocky slopes) than by floristics. The vegetation of these sites is not well-described.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: This alliance consists of sparsely vegetated bluffs and cliffs of limestone or dolostone in the central and northern Great Plains.

VEGETATION

Physiognomy and Structure: Vascular plant cover is <10% in examples of this alliance, though plants often have >10% cover in small, localized ledges and cliffs where soil has accumulated. Short shrubs and grasses can be present but forbs are typically the most abundant vascular lifeform.

Floristics: Species vary from site to site but may include the shrubs *Rhus trilobata* and *Rosa arkansana*, the forbs *Mentzelia decapetala, Eriogonum pauciflorum, Gutierrezia sarothrae*, and the grasses *Schizachyrium scoparium* and *Achnatherum hymenoides*.

ENVIRONMENT & DYNAMICS

Environmental Description: This alliance occurs where alkaline bedrock is exposed in cliffs and bluffs. The substrate is limestone or dolostones. Slopes are steep to vertical and there is little to no soil development. Soil that does develop or accumulate is on gently sloping or flat ledges and in cracks. These are small and localized.

Dynamics: The general lack of soil and steep slopes create very harsh conditions for plant growth and maintain stands of this alliance. Fire does not carry through this alliance, so shrubs and trees can persist, if they can find pockets of soil and survive the generally xeric conditions.

DISTRIBUTION

Geographic Range: This alliance occurs in the central and northern Great Plains from Kansas and eastern Nebraska to eastern Wyoming and western North Dakota.

Nations: US
States/Provinces: KS, ND, NE, SD, WY
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL002296 Limestone Butte Sparse Vegetation

- CEGL002046 Limestone - Dolostone Great Plains Xeric Cliff Sparse Vegetation

AUTHORSHIP

Primary Concept Source: J. Drake, in Faber-Langendoen et al. (2013)
Author of Description: J. Drake
Acknowledgments:
Version Date: 2014/12/18

REFERENCES

References: Faber-Langendoen et al. 2017b

M115. Great Plains Badlands Vegetation

This badlands macrogroup is found in the northern Great Plains where erodible parent material is dissected into dry, sparsely vegetated, generally steep slopes, usually above rivers or perennial or intermittent streams. The dominant vegetation is a mix of shrubs, forbs, and grasses with each dominating some areas.

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6. Open Rock Vegetation
6.B.1.Na. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation
6.B.1.Na.3.a. M115 Great Plains Badlands Vegetation

G566. Great Plains Badlands Vegetation

Type Concept Sentence: This group is relatively distinct from others due to the sparse vegetation and unique substrate within the Northern Great Plains. Sites with vegetation cover near the cut-off between sparse vegetation and vegetated types could be confusing as could patches with higher vegetation cover within a badlands area.

OVERVIEW

Scientific Name: *Sarcobatus vermiculatus / Eriogonum pauciflorum - Gutierrezia sarothrae* Badlands Group
Common Name (Translated Scientific Name): Greasewood / Few-flower Buckwheat - Broom Snakeweed Badlands Group
Colloquial Name: Hooker's Sandwort Barrens

Type Concept: This group includes badlands vegetation in the Northern Great Plains of the United States and Canada. Examples are found on slopes of easily erodible clay and poorly consolidated shale interspersed with sandstone, lignite lenses, and occasional scoria outcrops. Vegetation cover is typically sparse but can be moderate in small areas with shallower slopes. The dominant vegetation is a mix of shrubs, forbs and grasses with each dominating some areas. There is typically zonation of vegetation from the top of a slope to the bottom with different groups of species most common in certain zones. Typical species found in Great Plains badlands are *Sarcobatus vermiculatus, Atriplex* spp., *Artemisia longifolia, Artemisia tridentata, Gutierrezia sarothrae, Eriogonum pauciflorum*, and *Pseudoroegneria spicata*.

Classification Comments: This group is relatively distinct from others due to the sparse vegetation and unique substrate within the Northern Great Plains. Sites with vegetation cover near the cut-off between sparse vegetation and vegetated types could be confusing.

Similar NVC Types:

Diagnostic Characteristics: Examples are found on relatively unique sites with sparse vegetation, badlands topography, and badlands parent material.

VEGETATION

Physiognomy and Structure: Great Plains Badlands are typically sparsely vegetated (<10% total vegetation cover). The sloping, eroding sites, lack of soil development, and lack of available moisture for plants limits the species that can grow. Small areas with shallower slopes, including step-in-slopes, toeslopes, etc., may have moderate vegetation cover. Dominant plants are usually shrubs and forbs, though grasses can dominate some areas. Dominant plants rarely grow more than about 1 m tall.

Floristics: Dominant species can be shrubs, grasses or forbs. Common shrubs include *Sarcobatus vermiculatus, Artemisia tridentata, Atriplex confertifolia*, and *Ericameria nauseosa*; common grasses include *Achnatherum hymenoides, Pseudoroegneria spicata*, and *Pascopyrum smithii* (on more mesic sites); common forbs include *Arenaria hookeri, Artemisia longifolia, Eriogonum pauciflorum, Gutierrezia sarothrae*, and *Grindelia squarrosa*.

ENVIRONMENT & DYNAMICS

Environmental Description: A combination of factors, such as elevation, rainfall, carving action of streams and parent material, can contribute to the development of this group. Sites that harbor it are primarily a type of mature dissection with finely textured drainage patterns and steep slopes. This group contains extremely dry and easily erodible, consolidated clayey soils with bands of sandstone or isolated consolidates. This group is found within an arid to semi-arid climate with infrequent, but torrential, rains that cause erosion.

Dynamics: Examples of this group are affected by erosion and drought.

DISTRIBUTION

Geographic Range: This group is found in the Northern Great Plains region of the United States and Canada with some of the best developed examples in western North Dakota, southwestern South Dakota, and southeastern Montana.

Spatial Scale & Pattern [optional]: Large patch
Nations: CA, US
States/Provinces: AB, CO, MB?, MT, ND, NE, SD, SK, WY
TNC Ecoregions [optional]: 26:C
USFS Ecoregions (2007): 331E:CP, 331F:CC, 331G:CC, 331K:CC, 331L:CC, 331M:CC
Omernik Ecoregions:
Federal Lands [optional]: NPS (Badlands, Theodore Roosevelt)

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Alliances:
- A3979 *Eriogonum pauciflorum - Gutierrezia sarothrae* Badlands Alliance
- A3978 *Sarcobatus vermiculatus* Great Plains Badlands Alliance
- A1642 *Arenaria hookeri* Rock Alliance
- A1874 *Artemisia longifolia* Badlands Alliance

AUTHORSHIP

Primary Concept Source: S. Menard and K. Kindscher, in Faber-Langendoen et al. (2011)
Author of Description: J. Drake
Acknowledgments:
Version Date: 01/03/2011
Classif Resp Region: Midwest
Internal Author: JD 12-10, 5-15

REFERENCES

References: Brown 1971, Comer et al. 2003, Faber-Langendoen et al. 2017a

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6. Open Rock Vegetation
6.B.1.Na. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation
G566. Great Plains Badlands Vegetation

A1642. Arenaria hookeri Rock Alliance

Type Concept Sentence: This alliance is known from northeastern Colorado on hot, dry sites such as exposed siltstone barrens and ravines on convex slopes where erosion is active and moisture penetration is minimal. Stands have a sparse, short herbaceous layer of mostly perennial, mat-forming cushion plants, particularly *Arenaria hookeri*, and a few grasses.

OVERVIEW

Scientific Name: *Arenaria hookeri* Rock Alliance
Common Name (Translated Scientific Name): Hooker's Sandwort Rock Alliance
Colloquial Name: Hooker's Sandwort Barrens

Type Concept: Stands of this alliance have a sparse, short herbaceous layer of mostly perennial, mat-forming cushion plants and a few grasses. These vegetation mats are surrounded by bare ground. These perennials are very drought-tolerant. The diagnostic cushion plant is the perennial forb *Arenaria hookeri*. Other characteristic plants include *Astragalus gilviflorus, Astragalus sericoleucus, Astragalus spatulatus, Comandra umbellata, Ipomopsis spicata, Oenothera flava, Penstemon* spp., and *Phlox hoodii*.

The characteristic graminoid is the medium-tall bunchgrass *Achnatherum hymenoides (= Oryzopsis hymenoides)*. Wet springs bring an abundance of cool-season annuals. Common annuals include *Vulpia octoflora* and *Plantago patagonica*. Vegetation in this alliance has been described from the Pawnee National Grasslands in northeastern Colorado at elevations between 1300 and 1935 m. Stands are restricted to hot, dry sites such as exposed siltstone barrens and ravines on convex slopes where erosion is active and moisture penetration is minimal. Soils are shallow with little development, fine-textured and often gravelly.

Classification Comments: These stands likely have less than 25% canopy cover and may be better classified in a sparsely vegetated herbaceous alliance. Little stand cover data are available to describe this alliance. More survey and sampling is needed.

Internal Comments:
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Sparsely vegetated slopes on siltstone or clay with cushion plants, particularly *Arenaria hookeri*, dominant.

VEGETATION

Physiognomy and Structure: Vegetation included in this alliance has a very sparse to sparse perennial forb layer of low cushion plants. Sparse perennial grasses may be present. Annual grasses and forbs are seasonally present to abundant.

Floristics: Stands have a sparse herbaceous layer less than 0.5 m tall that is vegetated mostly with perennial, mat-forming cushion plants and a few grasses. These vegetation mats are surrounded by bare ground. These perennials are very drought-tolerant. The diagnostic cushion plant is the perennial forb *Arenaria hookeri*. Other characteristic plants include *Astragalus gilviflorus, Astragalus sericoleucus, Astragalus spatulatus, Comandra umbellata, Ipomopsis spicata, Oenothera flava, Penstemon* spp., and *Phlox hoodii*. The characteristic graminoid is the medium-tall bunchgrass *Achnatherum hymenoides (= Oryzopsis hymenoides)*. Wet springs bring an abundance of cool-season annuals. Common annuals include *Vulpia octoflora* and *Plantago patagonica*.

ENVIRONMENT & DYNAMICS

Environmental Description: Vegetation included in this alliance occurs on barren clay and siltstone outcrops in the shortgrass steppe of northeastern Colorado at elevations between 1300 and 1935 m. Climate is semi-arid, continental with mean annual precipitation between 25 and 35 cm. Stands are restricted to hot, dry sites such as exposed siltstone barrens and ravines (Hazlett 1998). Soils are shallow with little development, fine-textured and often gravelly. Badaracco (1971) described stands on exposed Brule clays especially on convex slopes where erosion is active and moisture penetration is minimal. In Nebraska, a similar community is found in the badlands where substrates "are largely clays and marls, which absorb little storm water, and are subject to excessive erosion" (Pound and Clements 1900). Adjacent vegetation is shortgrass steppe dominated by *Bouteloua gracilis* and *Bouteloua dactyloides*, or possibly a more mesic midgrass stand dominated by *Schizachyrium scoparium, Pascopyrum smithii*, or *Bouteloua gracilis* at the foot of the slope.

Dynamics: The harsh environmental conditions allow only drought-tolerant perennials and annual plants to survive. Most perennials are low, deep tap-rooted cushion plants.

DISTRIBUTION

Geographic Range: This alliance occurs on siltstone and clay breaks in the shortgrass steppe of northeastern Colorado and possibly the badlands of Nebraska. It likely occurs in other neighboring states where geologic substrates are similar.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** Clay barrens (Badaracco 1971)
- **?** Mat formation of buttes and cliffs (Pound and Clements 1900)
- **?** Siltstone barren (Hazlett 1998)

LOWER LEVEL UNITS

Associations:
- CEGL001951 *Arenaria hookeri* Barrens Vegetation

AUTHORSHIP

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

REFERENCES

References: Badaracco 1971, Faber-Langendoen et al. 2017b, Hazlett 1998, Moran 1981a, Pound and Clements 1900

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6. Open Rock Vegetation
6.B.1.Na. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation
G566. Great Plains Badlands Vegetation

A1874. Artemisia longifolia Badlands Alliance

Type Concept Sentence: This vegetation is known from badlands in the northwestern Great Plains on moderately to steeply sloping acid-shale barrens and clay with sparse to moderate cover by forbs, especially *Artemisia longifolia* with *Eriogonum pauciflorum* sometimes codominating.

OVERVIEW

Scientific Name: *Artemisia longifolia* Badlands Alliance
Common Name (Translated Scientific Name): Longleaf Wormwood Badlands Alliance
Colloquial Name: Longleaf Wormwood Badlands

Type Concept: This vegetation is known from badlands in the northwestern Great Plains on acid-shale barrens and clay slopes. The vegetation layer is usually sparse (<10% cover) but may range up to 20%. It is less than 1 m tall and is dominated by the perennial forb *Artemisia longifolia* with *Eriogonum pauciflorum* sometimes codominating. Scattered graminoids and other forbs are also typically present and may include *Achnatherum hymenoides (= Oryzopsis hymenoides), Calamagrostis montanensis, Calamovilfa longifolia, Gutierrezia sarothrae, Schizachyrium scoparium, Solidago missouriensis, Stellaria media*, and *Thermopsis rhombifolia*. Scattered *Rosa arkansana* shrubs are often present. Stands occur on dry scree slopes, as well as acid-shale barrens. Sites are common on moderate to steep, highly eroded slopes with southern and western aspects. Substrates may be deep but are poorly developed, fine-textured soils.

Classification Comments:

Internal Comments:
Other Comments:

Similar NVC Types:
- A3979 *Eriogonum pauciflorum - Gutierrezia sarothrae* Badlands Alliance

Diagnostic Characteristics: This alliance is characterized by sparse to open vegetation on badland slopes dominated by *Artemisia longifolia*.

VEGETATION

Physiognomy and Structure: Stands have a sparse layer of perennial forbs to 0.8 m tall. Scattered perennial graminoids and occasional shrubs may also be present.

Floristics: The sparse vegetation layer is less than 1 m tall and is dominated by the perennial forb *Artemisia longifolia* with *Eriogonum pauciflorum* sometimes codominating. Scattered graminoids and other forbs are also typically present and may include *Achnatherum hymenoides (= Oryzopsis hymenoides), Calamagrostis montanensis, Calamovilfa longifolia, Schizachyrium scoparium, Solidago missouriensis, Stellaria media*, and *Thermopsis rhombifolia*. Occasional *Rosa arkansana* shrubs are often present.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands included in this minor alliance are found in the northwestern Great Plains on acid-shale barrens. This vegetation is known from badlands in the northwestern Great Plains. Elevation in Montana is approximately 1000 m. The climate is semi-arid, temperate continental. Mean annual precipitation is approximately 32 cm. Two-thirds of the annual precipitation occurs in the spring and early summer. Stands occur on dry scree slopes and acid-shale barrens. Sites are common on

moderate to steep, highly eroded slopes with southern and western aspects. Substrate may be deep, but are poorly develop, fine-textured soils derived from acidic marine shales (pH <5). Because of a large coarse fraction of shale fragments, these soils may be better drained than expected (DeVelice et al. 1995).

Dynamics:

DISTRIBUTION

Geographic Range: Stands in this sparsely vegetated alliance occur in badlands in the northwestern Great Plains in Montana, Wyoming, North Dakota, and South Dakota, and adjacent Canada.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **?** *Artemisia longifolia / Oryzopsis hymenoides* Community Type (DeVelice et al. 1995)
- **?** shale barren communities (Harvey 1982)
- **?** shale barren communities (Jorgensen 1979)

LOWER LEVEL UNITS

Associations:
- CEGL002195 *Artemisia longifolia* Badlands Sparse Vegetation
- CEGL001521 *Artemisia longifolia - Calamovilfa longifolia* Sparse Vegetation

AUTHORSHIP

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

REFERENCES

References: DeVelice et al. 1995, Faber-Langendoen et al. 2017b, Harvey 1982, Jorgensen 1979

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6. Open Rock Vegetation
6.B.1.Na. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation
G566. Great Plains Badlands Vegetation

A3979. Eriogonum pauciflorum - Gutierrezia sarothrae Badlands Alliance

Type Concept Sentence: This alliance contains sparsely vegetated, forb-dominated communities on badland landscapes in the northwestern Great Plains on clays, shales, and poorly consolidated sandstones or conglomerates or on the colluvial slopes at the base of such slopes. Rapid erosion prevents the development of soils and this along with the arid climate limit vegetation development to 1-10% cover. Consistent species in this alliance are *Eriogonum pauciflorum* and *Gutierrezia sarothrae*.

OVERVIEW

Scientific Name: *Eriogonum pauciflorum - Gutierrezia sarothrae* Badlands Alliance
Common Name (Translated Scientific Name): Few-flower Buckwheat - Broom Snakeweed Badlands Alliance
Colloquial Name: Few-flower Buckwheat - Broom Snakeweed Badlands

Type Concept: This alliance contains sparsely vegetated, forb-dominated communities on badland landscapes in the northwestern Great Plains. Total vegetation cover is generally nearly absent to sparse (1-10% cover). Consistent species in this alliance are *Eriogonum pauciflorum* and *Gutierrezia sarothrae*. Other species possible are *Atriplex argentea, Cryptantha thyrsiflora, Opuntia polyacantha*, and the forb *Grindelia squarrosa*. *Atriplex canescens* dwarf-shrubs may be observed throughout the type but are typically short-statured and scattered in distribution. These communities occur on clays, shales, and poorly consolidated sandstones or conglomerates or on the colluvial slopes at the base of such slopes, all of which are easily eroded by wind and water. The rapid erosion prevents the development of soils and this along with the arid climate limit vegetation development.

Classification Comments:

Internal Comments: MSR 1-16: CO? added.
Other Comments:

Similar NVC Types: This alliance has some similarities to *Artemisia longifolia* Badlands Alliance (A1874). While there is species overlap between the two, this alliance lacks significant *Artemisia longifolia* and tends to occur on less steep sites.
- A1874 *Artemisia longifolia* Badlands Alliance: is usually dominated by *Artemisia longifolia* and tends to occur on steeper slopes.

Diagnostic Characteristics: Stands in this alliance occur on badlands formed from easily erodible clays, shales, and poorly consolidated sedimentary rocks. Vegetation is sparse and typically dominated by *Eriogonum pauciflorum* and *Gutierrezia sarothrae*.

VEGETATION

Physiognomy and Structure: Vegetation in this alliance is sparse (1-10% cover) and composed chiefly of short to medium-tall forbs.

Floristics: Total vegetation cover is generally nearly absent to sparse (1-10% cover). Consistent species in this alliance are *Eriogonum pauciflorum* and *Gutierrezia sarothrae*. Other species possible are *Atriplex argentea, Cryptantha thyrsiflora, Opuntia polyacantha*, and the forb *Grindelia squarrosa*. *Atriplex canescens* dwarf-shrubs may be observed throughout the type but are typically short-statured and scattered in distribution.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands of this alliance occur on clays, shales, and poorly consolidated sandstones or conglomerates or on the colluvial slopes at the base of such slopes, all of which are easily eroded by wind and water. The rapid erosion prevents the development of soils and this along with the arid climate limit vegetation development. Slopes are usually moderate.

Dynamics:

DISTRIBUTION

Geographic Range: This alliance is found in the northwestern Great Plains of the United States and adjacent Canada.

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

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Moderate.

SYNONYMY

LOWER LEVEL UNITS

Associations:
- CEGL002050 Eroding Great Plains Badlands Sparse Vegetation
- CEGL005270 *Eriogonum pauciflorum - Gutierrezia sarothrae* Badlands Sparse Vegetation

AUTHORSHIP

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

REFERENCES

References: Faber-Langendoen et al. 2017b

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6. Open Rock Vegetation
6.B.1.Na. Eastern North American Temperate & Boreal Cliff, Scree & Rock Vegetation
G566. Great Plains Badlands Vegetation

A3978. Sarcobatus vermiculatus Great Plains Badlands Alliance

Type Concept Sentence: This greasewood alliance is found in the Badlands regions of the northwestern Great Plains on weakly consolidated sedimentary rocks, where eroded slopes contain interbedded clay and silt shales. Stands have a sparse to moderate woody layer (15-40% cover) dominated by the deciduous, facultative halophytic shrub *Sarcobatus vermiculatus*.

OVERVIEW

Scientific Name: *Sarcobatus vermiculatus* Great Plains Badlands Alliance
Common Name (Translated Scientific Name): Greasewood Great Plains Badlands Alliance
Colloquial Name: Great Plains Greasewood Badlands

Type Concept: This greasewood alliance is found in the Badlands regions of the northwestern Great Plains. Stands have a sparse to moderate woody layer (15-40% cover) dominated by the deciduous, facultative halophytic shrub *Sarcobatus vermiculatus*. Other characteristic shrubs and dwarf-shrubs include *Artemisia tridentata, Atriplex canescens, Ericameria nauseosa (= Chrysothamnus nauseosus)*, and *Gutierrezia sarothrae*. The herbaceous layer ranges from absent to moderately sparse cover (<25%) of scattered tall and medium-tall bunchgrasses, such as *Pseudoroegneria spicata, Achnatherum hymenoides (= Oryzopsis hymenoides)*, and the sod grass *Bouteloua gracilis*. Annual grasses, especially the exotic *Bromus tectorum* and *Bromus arvensis (= Bromus japonicus)*, may be present. Forbs are sparse, except on disturbed, weedy sites. Forb species may include *Eriogonum pauciflorum, Suaeda calceoliformis*, or *Sphaeralcea coccinea*. Occasionally, cacti such as *Opuntia fragilis* or *Opuntia polyacantha* may also be present. Stands are found on weakly consolidated sedimentary rocks, where eroded slopes contain interbedded clay and silt shales. Slopes range from 0-80%, and average about 35-40%, with a southwest- to southeast-facing aspect. A thin, highly saline crust 1-5 cm in depth may form on the surface. Soil pH is around 8.0.

Classification Comments: This alliance contains just one association (CEGL001367) at present. Other *Sarcobatus vermiculatus*-dominated communities that occur near CEGL001367 are associated with intermittent wetlands/riparian zones. The boundary between the lower parts of this alliance and the higher parts of those communities needs better delineation.

Internal Comments: MSR 1-16: CO? added.
Other Comments:

Similar NVC Types:

Diagnostic Characteristics: Shrub-dominated stands on eroded badlands habitat in the western Great Plains. Total vegetation cover ranges from sparse to moderate and *Sarcobatus vermiculatus* is the dominant shrub.

VEGETATION

Physiognomy and Structure: Vegetation in this alliance in composed of a sparse to moderate (15-40% cover) woody layer dominated by deciduous shrubs 0.5-1.5 m tall. The herbaceous layer ranges from absent to moderately sparse (0-25%) and is largely medium-tall bunch grasses.

Floristics: Stands have a sparse to moderate woody layer (15-40% cover) dominated by the deciduous, facultative halophytic shrub *Sarcobatus vermiculatus*. Other characteristic shrubs and dwarf-shrubs include *Artemisia tridentata, Atriplex canescens, Ericameria nauseosa (= Chrysothamnus nauseosus)*, and *Gutierrezia sarothrae*. The herbaceous layer ranges from absent to moderately sparse cover (<25%) of scattered tall and medium-tall bunchgrasses, such as *Pseudoroegneria spicata, Achnatherum hymenoides (= Oryzopsis hymenoides)*, and the sod grass *Bouteloua gracilis*. Annual grasses, especially the exotic *Bromus tectorum* and *Bromus arvensis (= Bromus japonicus)*, may be present. Forbs are sparse, except on disturbed, weedy sites. Forb species may include *Eriogonum pauciflorum, Suaeda calceoliformis*, or *Sphaeralcea coccinea*. Occasionally, cacti such as *Opuntia fragilis* or *Opuntia polyacantha* may also be present.

ENVIRONMENT & DYNAMICS

Environmental Description: Stands are found on weakly consolidated sedimentary rocks, where eroded slopes contain interbedded clay and silt shales. Slopes range from 0-80%, and average about 35-40%, with a southwest- to southeast-facing aspect. A thin, highly saline crust 1-5 cm in depth may form on the surface (Brown 1971). Soil pH is around 8.0.

Dynamics:

DISTRIBUTION

Geographic Range: This community is found in the badlands regions of southeastern Montana and western South Dakota, and possibly in northeastern Wyoming and western North Dakota.

Nations: US

States/Provinces: CO?, MT, ND, SD, WY?
TNC Ecoregions [optional]:
USFS Ecoregions (2007):
Omernik Ecoregions:
Federal Lands [optional]:

CONFIDENCE LEVEL

USNVC Confidence Level with Comments: Low.

SYNONYMY

- **><** *Sarcobatus vermiculatus/Agropyron spicatum* Habitat Type (Hansen et al. 1988a)
- **><** *Sarcobatus vermiculatus* Series (Johnston 1987)

LOWER LEVEL UNITS

Associations:
- CEGL001367 *Sarcobatus vermiculatus / Pseudoroegneria spicata* Shrubland

AUTHORSHIP

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

REFERENCES

References: Brown 1971, Faber-Langendoen et al. 2017b, Hansen 1985, Hansen and Hoffman 1988, Hansen et al. 1988a, Johnston 1987

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