10850

Northwestern Great Plains Shrubland

BpS Model/Description Version: Aug. 2020

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| --- | --- | --- | --- |
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Vegetation Type

Shrubland

Map Zones

29, 30

Geographic Range

This type should be confined to ephemeral drainages and mesic sites and north facing-slopes within mountain ranges and hillsides around the Little Rockies in map zone (MZ) 20. Northeastern and southeastern Montana, western North Dakota and South Dakota, northeastern Wyoming, western Nebraska. This ecological system ranges from South Dakota into southern Canada on moderately shallow to deep, fine to sandy loam soils. In MZ30, this would occur in section 331. Not much of this should be mapped; most should be mapped to 1141. This type should be very, very infrequent. This could occur in the Badlands of western North Dakota. This type occurs in Theodore Roosevelt National Monument in North Dakota, usually on mesic sites, benches of slopes, and north-facing slopes. There are also stands at Badlands National Park and Wind Cave National Monument in South Dakota. We mapped and described it as plant associations under the USGS-NPS National Vegetation Mapping Program and reported it in 2000 (see http://biology.usgs.gov/npsveg/).

Biophysical Site Description

Occur as small patches within northern mixedgrass prairie occupying microsites associated with higher available moisture or moderately steep slopes, north and south aspects. In North Dakota, usually on mesic sites, benches of slopes, and north-facing slopes. Occupy slope shoulders and drainageways, draws. Sites where moisture more available. Skunkbrush more associated with south aspect slopes. Chokecherry and serviceberry and snowberry associated with drainages, draws along the foothills of the Beartooth mountains. Horizontal juniper associated with north aspect slopes. Buffaloberry associated with north aspect slopes. Each of the shrub species associated with own habitat type with moisture gradient. Skunkbrush is dry end, and snowberry/chokecherry is wet end. This Biophysical Setting (BpS) is capturing a broad moisture regime from dry to mesic.

Elevations range from 1,300-4,000ft and up to 4,500ft east side of the Judiths and 5,000ft south side of the Snowies. Temperatures range between extremes of hot summers and cold winters that are typical of a continental climate. Precipitation increases from west (11in) to east (16in). Two-thirds of the precipitation occurs during the growing season (April-June).

Soils vary but are generally entisols in the west and mollisols in the east. Soils in the northern Great Plains, west of the Missouri River in the Dakotas, northwestern Nebraska, northeastern Wyoming, and Montana are formed from sedimentary sandstone and shales, especially the badlands-type topography. These soils range from clayey, fine-loamy, to fine silty soils of mixed origin on level and undulating lands with minor contributions from loess, alluvium, and mountain outwash.

Many of these shrubland types occur on moderate to steep slopes (west- to northwest-facing) at least in the badlands -- grazing is not likely a factor. They occur on southwest- and northwest-facing slopes and moderate to steep slopes. The skunkbrush, however, is more associated with the southerly aspects.

Vegetation Description

This vegetation type is characterized by the dominance of snowberry, chokecherry, serviceberry, skunkbrush, buffaloberry, and horizontal juniper. Ninebark may also be present on some sites. There is an understory of cool-season grasses such as western wheatgrass, needlegrasses, Sandberg bluegrass, little bluestem, threadleaf sedge, and forbs.

(Silver sagebrush was also an important component historically; however, silver sagebrush is covered in 1162 Floodplains Systems and 1148 Western Great Plains Sand Prairie. Silver sagebrush associated with valley bottom/terraces along streams and drainageways.)

This melds into 1141 needle-and-thread and western wheatgrass.

Each of the shrub species in this BpS is associated with its own habitat type and represents a broad moisture gradient from dry to mesic. Skunkbrush is dry end, and snowberry/chokecherry and buffaloberry is mesic end. All of these species don't occur together necessarily.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| SYOC | *Symphoricarpos occidentalis* | Western snowberry |
| JUHO2 | *Juniperus horizontalis* | Creeping juniper |
| SHAR | *Shepherdia argentea* | Silver buffaloberry |
| PRVI | *Prunus virginiana* | Chokecherry |
| RHTR | *Rhus trilobata* | Skunkbush sumac |
| SCSC | *Schizachyrium scoparium* | Little bluestem |
| PASM | *Pascopyrum smithii* | Western wheatgrass |
| CAFI | *Carex filifolia* | Threadleaf sedge |

Species names are from the NRCS PLANTS database. Check species codes at http://plants.usda.gov.

Disturbance Description

The northern mixedgrass prairie and shrublands are strongly influenced by wet-dry cycles. Fire, grazing by large ungulates and small mammals such as prairie dogs, and soil disturbances (i.e., buffalo wallows and prairie dog towns) are the major disturbances in this vegetation type. In MZ30, many of these shrubland types occur on moderate to steep slopes (west- to northwest-facing).

From instrumental weather records, droughts are likely to occur about 3 in every 10yrs. Historically, there were likely close interactions between fire and grazing since large ungulates tend to be attracted to post-fire communities. Conversely, fire presumably was less likely in areas recently heavily grazed by herbivory -- thus contributing to spatial and temporal variation in fire occurrence.

Average fire intervals are estimated at 8-25yrs, although in areas with very broken topography fire intervals may have been >30yrs. The model for MZ20 reflects a 30yr mean fire return interval (MFRI). The model for MZs 29 and 30 reflects a 15-20yr interval. This system's MFRI should be very similar to 1141 mixedgrass prairie, since this system is just inclusions within 1141. It might be a little less frequent because of moisture; however, it should be similar.

Fires were most common in July and August but probably occurred from about April to September. Seasonality of fires influences vegetation composition. Early-season fires (April-May) tend to favor warm-season species, while late-season fires (August-September) tend to favor cool-season species. Replacement fire in our model does remove 75% of the above-ground cover as assumed in the literature. However, we don't think loss of the above-ground cover by the replacement fire will necessarily induce a retrogression back to an earlier seral stage from the late stage because the main component of dominant grasses remains unharmed to insure the continuity of the seral stage. The shrub species, however, are sprouters. Fire would remove them, and they would resprout. The exception would be horizontal juniper and skunkbrush, which would not resprout. It would take longer for them to become reestablished.

We used different levels of native ungulate grazing intensities. We assumed that light grazing would not alter the community enough to change classes, but increasing grazing intensity would move the community back to earlier stages. Grazing return interval probably occurred every 7-10yrs, but grazing would only result in a class change maybe once every 80-100yrs. Overall, the grazing frequency was modeled at every 20yrs -- that includes grazing just occurring with no transition resulting as well as grazing taking the stage back to an earlier class. Overall, the drought-plus-grazing impact frequency was modeled as every 70yrs -- that includes the no-transition + transition to early stage.

This system 1085 differs in MFRI from 1125, which is composed mostly of Wyoming big sagebrush. BpS 1085 also has a higher grass component. Up north, where there is a heavy grass component and much less percentage cover of sagebrush than what is down south as well as relatively connected topography and a lot of wind, it would burn more frequently (Downey, personal commuication). These two systems are different as they relate in large part to setting and precipitation patterns and continuity of fuel. Eastern Montana has few breaks, versus mountainous systems that would be much less likely to have the huge sweeping fires.

In his review of the Rapid Assessment (RA) model, Ortmann suggested that in addition to fire, drought, and grazing, insect outbreaks (Rocky Mountain locust) would have impacted all classes.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 15 | 100 | 8 | 30 |
| Moderate (Mixed) |  |  |  |  |
| Low (Surface) |  |  |  |  |
| All Fires | 15 | 100 |  |  |

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is the central tendency modeled. Percent of all fires is the percent of all fires modeled in that severity class. Minimum and Maximum FIs show the relative range of fire intervals as estimated by model contributors, if known.

Scale Description

Fires would generally range from 1,000s-10,000ac or up to 100,000ac through BpS 1141. Based on topography, wind speed, fine-fuel loading, and fuel arrangement, the fires would burn in a mosaic pattern. Extent of weather influences (wet-dry cycles) would have been very widespread.

Small patches on landscape ~1ac to maybe 10ac in size -- mapped by plot, not imagery. Patches occupy microsites associated with shoulder slopes, north aspect backslopes, depressions/swales, and drainageways/draws.

Adjacency or Identification Concerns

Inclusions within the Mixedgrass Prairie. The Northern Great Plains Shrubland might be a subcomponent of the Northwestern Great Plains Mixedgrass Prairie BpS that was historically limited to predominantly sedimentary soil types and local microsites, resulting in a similar ecological model but with a longer fire cycle. This 1085 might therefore be difficult to map differently from the grassland sites. Spectrally, however, this BpS will have a unique signature – especially snowberry. The sites dominated by skunkbrush might be harder to differentiate from the grasses. This melds into needle-and-thread/western wheatgrass 1141.

Rabbitbrush may be better to fit with sagebrush BpS. They tend to occur together.

Small patches on landscape ~1ac to maybe 10ac in size -- mapped by plot, not imagery.

This BpS's shrub component may be increasing within the 1141 mixedgrass prairie due to the longer current-day MFRIs.

This type might be somewhat difficult to distinguish from 1106 Northern Rocky Mountain Foothill Deciduous Shrubland in terms of species, but they should be distinguished, as 1106 shrubs are adjacent to forest/woodlands or lower treeline, whereas 1085 is adjacent to ravines, more riparian, and grassland 1141 system.

There should not be much mapping to this BpS. Most should be in 1141. This should be very, very infrequent for MZs 29, 30, and 20 and should encompass <10% of landscape historically.

Maybe some Kentucky bluegrass in this BpS. Maybe annual bromes such as Japanese brome.

This system might appear departed currently due to increase in Class C of snowberry, mostly, shrubs today due to missed MFRIs. See Class C comments.

This may not be a separate system from the prairie matrix. Those areas that have increased shrub cover due to fire suppression should be considered part of Northwestern Great Plains Mixedgrass Prairie (CES303.674).

Issues or Problems

Native Uncharacteristic Conditions

Comments

This model was adapted from the same BpS in MZ20 created by Brian Martin and reviewed by BJ Rhodes, Shannon Downey, Steve Barrett, and others. Some descriptive additions/changes were made.

This model for MZ20 was originally adopted from the RA model R4PRMGn Northern Mixedgrass Prairie created by Cody Wienk and Lakhdar Benkobi and reviewed by David Engle (dme@mail.pss.okstate.edu) and John Ortmann (jortmann@tnc.org). Descriptive changes were first made for MZ20 by BJ Rhodes (bj\_rhodes@blm.gov), John Carlson (john\_carlson@blm.gov), Bill Volk (william\_volk@blm.gov), Rich Adams (rich\_adams@blm.gov), and Amanda Keefer (akeefer@mt.blm.gov). These reviewers, however, did not feel they had a sufficient grasp or concept of the system to change the model. Some errors were found in the original RA model that violated modeling rules and were therefore changed by Regional Lead for MZ20. Brian Martin then reviewed the model and made quantitative changes. It was changed from the original five-box model to a three-box model.

Succession Classes

**Mapping Rules**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Upper Layer Lifeform** | **Height (m)** | **Canopy Cover (%)** | | | | | | | | | |
| **0-10** | **11-20** | **21-30** | **31-40** | **41 - 50** | **51-60** | **61-70** | **71-80** | **81-90** | **91-100** |
| Herb | 0-0.5 | A | A | A | A | A | A | UN | UN | UN | UN |
| Herb | 0.5-1.0 | A | A | A | A | A | A | UN | UN | UN | UN |
| Herb | >1.0 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Shrub | 0-0.5 | B | B | C | C | C | C | C | C | UN | UN |
| Shrub | 0.5-1.0 | B | B | C | C | C | C | C | C | UN | UN |
| Shrub | 1.0-3.0 | B | B | C | C | C | C | C | C | UN | UN |
| Shrub | >3.0 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Tree | 0-5 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Tree | 5-10 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Tree | 10-25 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Tree | 25-50 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Tree | >50 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |

Succession class letters A-E are described in the Succession Class Description section. Some classes use a leafform distinction where a qualifier is added to the class letter: Brdl (broadleaf), Con (conifer), or Mix (mixed conifer and broadleaf). UN refers to uncharacteristic native or a combination of height and cover that would not be expected under the reference condition. NP refers to not possible or a combination of height and cover which is not physiologically possible for the species in the BpS.

**Description**

Class A 53 Early Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| SCSC | Schizachyrium scoparium | Little bluestem | Upper |
| CAFI | Carex filifolia | Threadleaf sedge | Upper |
| PASM | Pascopyrum smithii | Western wheatgrass | Upper |
| STIPA | Stipa | Stipa | Upper |

Description

Graminoids such as little bluestem, western wheatgrass, stipa, bluebunch wheatgrass, sideoats grama, and upland sedges dominate this class. This class is a combination of grasses and very short-stature vegetation resulting also from prairie dog disturbance (maybe only in draws -- snowberry).

A variety of forb species such as fetid marigold, scarlet globemallow, scarlet gaura, skeleton weed, and dotted gayfeather tend to dominate this class.

Some sprouting of snowberry, chokecherry, and serviceberry (0-10% shrub cover).

The fuel in this class would be initially too sparse to carry fire, but then fuels increase.

This class succeeds to mid-open state.

Replacement fire occurs and sets this class back to its beginning stage.

Grazing, the combination of drought and grazing, and drought modeled as wind/weather/stress all occur and maintain this class but don't set it back to its beginning state.

Prairie dog impact occurs and returns this class to its beginning. The only shrub that prairie dogs might impact in this BpS would be the snowberry sites and draws/drainageways.

*Maximum Tree Size Class*  
None

Class B 29 Mid Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| SYOC | Symphoricarpos occidentalis | Western snowberry | Upper |
| JUHO2 | Juniperus horizontalis | Creeping juniper | Upper |
| PASM | Pascopyrum smithii | Western wheatgrass | Lower |
| STIPA | Stipa | Stipa | Lower |

Description

More open community than late stage. Seedling shrubs. Dominant shrubs coming in -- snowberry, chokecherry, skunkbrush, creeping juniper, and buffaloberry.

Western wheatgrass, needlegrasses, little bluestem, and upland sedges are common graminoids. Bluebunch wheatgrass can be locally common with skunkbrush. Common forbs include scurfpea, prairie coneflower, Rocky Mountain beeplant, scarlet globemallow, and dotted gayfeather. Herbaceous cover is ~30-70% and ~0.5m in height.

This class succeeds to the late development stage.

Replacement fires occur.

Grazing as well as the combination of drought and grazing occur and cause a transition back to the early stage. Grazing, the combination of drought and grazing, and drought modeled as wind/ weather stress can also occur while maintaining this class in this stage.

Prairie dog impact occurs.

*Maximum Tree Size Class*  
None

Class C 18 Late Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| SYOC | Symphoricarpos occidentalis | Western snowberry | Upper |
| JUHO2 | Juniperus horizontalis | Creeping juniper | Upper |
| SHAR | Shepherdia argentea | Silver buffaloberry | Upper |
| SCSC | Schizachyrium scoparium | Little bluestem | Lower |

Description

Denser, higher canopy cover. Mature canopy. Vegetation community is similar to previous class. Forbs are present still. Litter layer tends to be relatively continuous. Herbaceous cover 50-65% and 0.5m in height.

Snowberry average cover could be 65% (DiBenedetto). Maximum up to 75%, minimum ~45%. Skunkbrush cover averages ~25%. Horizontal juniper averages 44%, range of 25-65% cover. Each of the shrub species associated with own habitat type with moisture gradient. Skunkbrush is found at the dry end, and snowberry/chokecherry at the wet end.

Replacement fire occurs.

The combination of grazing and drought takes this class back to an early state, a mid-open state, or maintains this class.

Grazing alone causes a transition back to an early stage, to a mid-stage, or maintains this class.

Drought modeled as wind/weather stress also maintains this class.

It is thought that, historically, this class probably occupied even <15% of the landscape. It probably occupied ~5-10% of the landscape due to the frequency of fire in the adjacent mixedgrass prairie. Currently, however, there is probably much more of this class on the landscape due to missed MFRIs -- especially an increase in the snowberry shrubs on more mesic drainageways, draws, and depressions -- areas of higher available moisture.

*Maximum Tree Size Class*  
None

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:OPN | 0 | Mid1:OPN | 9 |
| Mid1:OPN | 10 | Late1:CLS | 20 |
| Late1:CLS | 21 | Late1:CLS | 999 |

Probabilistic Transitions

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Disturbance Type** | **Disturbance occurs In** | **Moves vegetation to** | **Disturbance Probability** | **Return Interval (yrs)** | **Reset Age to New Class Start Age After Disturbance?** | **Years Since Last Disturbance** |
| Optional 1 | Early1:OPN | Early1:OPN | 0.0035 | 286 | Yes | 0 |
| Optional 2 | Early1:OPN | Early1:OPN | 0.02 | 50 | No | 0 |
| Wind or Weather or Stress | Early1:OPN | Early1:OPN | 0.05 | 20 | No | 0 |
| Replacement Fire | Early1:OPN | Early1:OPN | 0.0667 | 15 | Yes | 0 |
| Native Grazing | Early1:OPN | Early1:OPN | 0.07 | 14 | No | 0 |
| Optional 1 | Mid1:OPN | Early1:OPN | 0.0003 | 3333 | Yes | 0 |
| Optional 2 | Mid1:OPN | Mid1:OPN | 0.003 | 333 | No | 0 |
| Optional 2 | Mid1:OPN | Early1:OPN | 0.01 | 100 | Yes | 0 |
| Native Grazing | Mid1:OPN | Mid1:OPN | 0.02 | 50 | No | 0 |
| Native Grazing | Mid1:OPN | Early1:OPN | 0.02 | 50 | Yes | 0 |
| Wind or Weather or Stress | Mid1:OPN | Mid1:OPN | 0.05 | 20 | No | 0 |
| Replacement Fire | Mid1:OPN | Early1:OPN | 0.0667 | 15 | Yes | 0 |
| Optional 2 | Late1:CLS | Mid1:OPN | 0.001 | 1000 | Yes | 0 |
| Optional 2 | Late1:CLS | Early1:OPN | 0.001 | 1000 | Yes | 0 |
| Optional 2 | Late1:CLS | Late1:CLS | 0.002 | 500 | No | 0 |
| Native Grazing | Late1:CLS | Early1:OPN | 0.002 | 500 | Yes | 0 |
| Native Grazing | Late1:CLS | Mid1:OPN | 0.003 | 333 | Yes | 0 |
| Native Grazing | Late1:CLS | Late1:CLS | 0.005 | 200 | No | 0 |
| Wind or Weather or Stress | Late1:CLS | Late1:CLS | 0.05 | 20 | No | 0 |
| Replacement Fire | Late1:CLS | Early1:OPN | 0.0667 | 15 | Yes | 0 |

Optional Disturbances

Optional 1: prairie dog disturbance

Optional 2: drought + grazing

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