13850

Western Great Plains Wooded Draw and Ravine

BpS Model/Description Version: Aug. 2020

Updated: 4/20/2018

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

Forest and Woodland

Map Zones

29, 30

Model Splits or Lumps

This BpS is lumped with: 1013

Geographic Range

Predominately west of the Missouri River in North Dakota and South Dakota, with minor extensions east of the Missouri River and south into Nebraska. Also extends into Wyoming and Montana.) It occurs in upland draws and ravines scattered throughout the Northern Mixed Grass Prairie and Northern Great Plains Steppe. This Biophysical Setting (BpS) is probably best developed in the Little Missouri Badlands of western North Dakota, map zone (MZ) 30, Section 331Md. This BpS also extends along drainages east to the Missouri River into MZ30, Section 331Mc, and west and north into section 331Me and 331Ea, possibly all way west to MZ20, (although this is speculation), and likely into MZ29, Section 331 Mi.

The bur oak component is also by Sturgis, East of Black Hills, where grass meets the Black Hills.

See Adjacency/Identification Concerns box regarding smaller second and third order prairie streams and where they occur or what they are classified as.

Biophysical Site Description

This BpS occurs in major tributaries and upland drainages with extensions onto steep north-facing slope. The vegetation type is best developed in topographic conditions that favor snow trapment and protection from fires in the adjacent grasslands. This BpS is heavily influenced by topographic situations that produce a combination of deeper soils, supplemental moisture from run-off and snow catchment. Soils on toeslopes and north facing backslopes are deep and well developed, while slopes on south facing backslopes tend to be dry, coarse textured and not well developed.

Bur oak occurs on sideslopes.

In Theodore Roosevelt National Park, it occurs in ravines or draws or on moderately steep north-facing slopes throughout much of the Park (Hansen et al. 1984).

The POTR/BEOC (aspen/paper birch) habitat type in Theodore Roosevelt National Park in North Dakota, occurs on upper slopes facing northwest to east. Stands of the *Fraxinus/Prunus* habitat type are lower on the same slopes (Hansen et al. 1984).

Vegetation Description

Intricate mix of western grassland and shrubland species, with elements of eastern deciduous woodlands. Northern extent occasionally supports quaking aspen, while southern extent supports Juniper species and western extent includes ponderosa pine.

Green ash, chokecherry are dominant species, as well as buffaloberry, snowberry and American elm. Aspen, bur oak, and paper birch appear on north end into North Dakota, in Theodore Roosevelt NP. There also tend to be small, incidental communities in the Little Missouri National Grasslands. In the southern extent, would not see those as much. Rocky Mountain juniper also occurs in places but tends to be an understory shrub in Montana. Should also have Canada wildrye and woods rose. Variable across distribution. *Muhlenbergia racemosa* (green muhly) also common.

The bur oak type, even though lumped into this BpS and others, occurs here. Green ash on bottom, and backslopes could have oak within it, in higher elevation (in MZs 29 and 30) areas such as Black Hills and Missouri River Badlands. On eastern edge of Black Hills, bur oak is predominant species in drainages extending into prairie and extends west into extreme southeastern corner of Montana.

*Quercus macrocarpa/Prunus virginiana* habitat type forms relatively extensive communities on backslopes of intermittent streams and drainageways. This habitat type was limited to glaciated areas. The *Populus tremuloides*/QUMA2 community type occupied erosive slopes. Once these areas become stabilized, the QUMA2/PRVI habitat type will probably result because QUMA2 reproduces in the understory. The QUMA2/*Corylus* species habitat type is found in the Killdeer Mountains and adjacent areas. This habitat type is on gentle slopes and the soils are more leached than many of the other types. The *Betula papyrifera*-*Corylus Cornuta* community type occupies similar sites and is seral to QUMA2/*Corylus* species habitat type (Girard et al. 1989).

Other dominant species: poison ivy

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| FRPE | *Fraxinus pennsylvanica* | Green ash |
| ULAM | *Ulmus americana* | American elm |
| ACNE2 | *Acer negundo* | Boxelder |
| PRVI | *Prunus virginiana* | Chokecherry |
| SYOC | *Symphoricarpos occidentalis* | Western snowberry |
| CASP7 | *Carex sprengelii* | Sprengel's sedge |
| ELYMU | *Elymus* | Wildrye |
| QUMA2 | *Quercus macrocarpa* | Bur oak |

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

Disturbance Description

The Wooded Draw Biophysical Setting (BpS) forms an intimate association with adjacent mixed grass prairie and shrublands where non-typical replacement fires are relatively frequent due to productive grass fuel and cycles of moisture and drought. Fires could go through the tree stands without topkill. Most years, fires occur and meander but are not intense enough to crown.

In drought periods, especially in late fall/summer, conditions were dry enough for stand-replacing fires.

Fire carries through system in areas where Rocky Mountain juniper or ponderosa pine invade woody draws and enhance flammability of system. Juniper and smaller pines would then be lost.

Bur oak is in some of the woody draws. Because it is fire-tolerant, a strong sprouter, and shade intolerant, it will be enhanced by stand-replacing fire, especially in times with higher moisture.

Drought and fire together could kill much of the tree population, especially weak sprouters such as green ash and American elm.

*Fraxinus* is even more tolerant than bur oak, so would sprout up after high intensity fire. In periods with more fires, bur oak dominates. Without fire, elm and ash dominate.

Less frequent stand-replacement fires were generally associated with periods of exceptionally high moisture conditions immediately followed by severe dry conditions.

Native ungulates play a role in stand regeneration on sites where deer and elk (less so bison, which don't congregate in the woody draws) concentrate for food, cover, and shelter.

Drought and moist cycles are major factors that interact with both fire and native grazing.

Low- and mixed-severity fire probably occurs every ~10yrs.

Replacement fire: green ash trees are more than 50yrs old. Replacement fires occur every ~60yrs.

Deciduous trees in the Badlands of the Dakotas in woody draws are reported to be no older than 50yrs; juniper is no older than 100yrs (Warner 1983). The fire return intervals of 15-30yrs were estimated for more broken topography at Scotts Bluff National Monument, Nebraska (Wendtland and Dodd 1992). This return interval would have interacted with long term wet and dry periods for the area. The edges of these draws would have been impacted by the return intervals and fire frequencies of the surrounding prairie. The more mesic areas of the draws would have only been likely to burn in dry periods. When maintained by fire, the community will have a mosaic of different age classes within a watershed. Browse for ungulates will increase. Sheltering cover will remain within 25% of current levels. Canada thistle and associated non-native species related to homesteading will be reduced. The structural complexity of the community will be maintained. (Badlands National Park Fire Management Plan).

Heart rot can occur with Fraxinus spp.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 73 | 26 | 30 | 100 |
| Moderate (Mixed) | 38 | 50 |  |  |
| Low (Surface) | 81 | 24 | 10 | 100 |
| All Fires | 19 | 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

Landscape is adequate in size to contain natural variation in vegetation and disturbance regime. Western stands are usually relatively small (<50ac). Larger areas, 50-100ac, occur infrequently on the eastern and northern edge of distribution. Long, linear corridors could be <50m wide but snake through the landscape for many miles, although it is not necessarily a continuous system (dendritic scale similar to riparian scale).

Most fires meander from adjacent grasslands systems. During a drier year, fire will burn through system.

Adjacency or Identification Concerns

This system occurs in upland draws and ravines scattered throughout the Northern Mixed Grass prairie. There may be intermediates of this type of green ash community and cottonwood stand, especially in the eastern portion of the map zone along the larger, primary drainages associated with the Missouri River, and also in southern edge of Black Hills. In some cases, the type merges with north-facing Rocky Mountain juniper stands, especially at the top of draws.

This could also grade into the Floodplains or riparian areas. There might be some difficulty distinguishing the Floodplain Systems from the Riparian from the Wooded Draw/Ravines, and where to assign smaller, second and third order prairie streams. The second and third order prairie streams can sometimes have cottonwood and be like small rivers (Riparian, Floodplain); sometimes they are dominated by other woodies such as water birch, box-elder, green ash (Wooded Draw/Ravine), and willows, depending on how far east you go. Sometimes they have very few woody plants other than silver sagebrush (Floodplain box E). Streams in the eastern half of Montana, east of the Big Snowy Mountains, could probably be modeled as either a cottonwood successional sequence or a woody draw successional sequence, depending on the size of the drainage basin. If the basin is large enough, there will eventually be a flood big enough to result in cottonwood regeneration. Because that may not happen very often naturally, these types of drainages would be in class E Floodplains (silver sagebrush) a lot of the time. This is especially true now with all the impoundments in the headwaters of these prairie streams. Drainages that don't have the area for a serious flood would probably have been some sort of woody draw, dominated by green ash in the eastern third of the state or other woodies like hawthorn or chokecherry in the more western part of the Great Plains. Assigning the drainage to one or the other type of system would depend on basin size.

The bur oak type, even though lumped into this BpS and others, occurs here. Green ash on bottom, and backslopes could have oak in higher elevation in map zones [MZ]s 29 and 30, areas such as Black Hills and Missouri River Badlands. On eastern edge of Black Hills, bur oak occurs in drainages extending into prairie.

Aspen in this system could be confused for the Northwestern Great Plains Aspen Woodland and Parklands. However, aspen parklands are not extensive in this part of the United States. The range of aspen parklands just gets to the North Dakota - Manitoba border. There could be some plots that trickle into North Dakota, but we wouldn't expect many. The aspen parkland system is really in Canada, Alberta in particular (Shannon Menard, personal communication). There is a aspen/paper birch habitat type described for Theodore Roosevelt National Park.

Understory is currently often dominated by Kentucky bluegrass throughout its extent in these map zones, and leafy spurge is dominant in the Little Missouri grasslands.

Grazing by domestic livestock has reduced regeneration, e.g., increased mortality. On heavily grazed sites, stands are much more open than they were historically, with an understory of Kentucky bluegrass. There's also more compaction. Mid-story and regeneration is "missing." When trees start decaying, whole stands can be lost. A combination of drought and grazing/trampling could cause the loss of stands.

In North Dakota, system more likely to withstand grazing effects due to higher precipitation.

There's probably less of this system now than there was historically. Due to grazing, this system probably appears departed from its reference condition.

Cattle will hang out in the draws in many of the woody draws on Buffalo Gap and Oglala National Grasslands, and prevent almost all surface vegetation from growing. This increases erosion and compacts soil, affects flammability for those fires that do occur, and leads to an overabundance of Rocky Mountain juniper in some draws. Under good burning conditions, fire would be high severity and take out everything aboveground.

Issues or Problems

The long, linear nature of distribution makes them difficult to map; consequently, they are often listed as a complex in relatively small-scale mapping efforts.

Native Uncharacteristic Conditions

Comments

This model for MZs 29 and 30 was adapted from the model from Rapid Assessment (RA) R4WODR created by Jack Butler and Stefanie Wacker and reviewed by John Ortmann; however, portions of the MZs 29 and 30 model were also taken from MZ20 model for this BpS created by Peter Lesica. The VDDT model and descriptions used were those from MZ20.

This model for MZ20 was adapted from the (RA) model R4WODR Northern Great Plains Wooded Draws and Ravines created by Jack Butler and Stefanie Wacker and reviewed by John Ortmann. For MZ20, major descriptive and quantitative changes were made in order to represent Montana better. The MZ20 model was changed 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 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Herb | 0.5-1.0 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Herb | >1.0 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Shrub | 0-0.5 | A | A | A | A | A | A | A | A | A | A |
| Shrub | 0.5-1.0 | A | A | A | A | A | A | A | A | A | A |
| Shrub | 1.0-3.0 | A | A | A | A | A | A | A | A | A | A |
| Shrub | >3.0 | A | A | A | A | A | A | A | A | A | A |
| Tree | 0-5 | B | B | B | B | B | UN | UN | UN | UN | UN |
| Tree | 5-10 | UN | UN | UN | C | C | C | C | C | C | C |
| Tree | 10-25 | UN | UN | UN | C | C | C | C | C | C | C |
| 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 17 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| CASP7 | Carex sprengelii | Sprengel's sedge | Lower |
| SYOC | Symphoricarpos occidentalis | Western snowberry | Upper |
| PRVI | Prunus virginiana | Chokecherry | Upper |

Description

This class is dominated by shrubs. Cover averages ~50%, and the minimum cover would never be as low as zero percent. In the first year, herbaceous species might dominate. The herbaceous cover is high underneath the shrubs, and would probably be 25-50%.

This class is similar to a snowberry rose coulee type. It contains chokecherry and snowberry, with a mesic understory of CASP7 and various woodland forbs and poison ivy.

Grazing (dependent on weather cycles) would set this stage back to its beginning state. Deer select green ash. Elk also browse.

Grazing alone was modeled but maintaining the class and not causing a transition.

The mean fire return intervals (MFRI)s are similar to grassland systems. The grassland system is not here the entire 10yrs, nor is it throughout the partly shrub system, so replacement fires do not occur all the time. Occasionally, replacement fires burn through the grass. There are also mixed severity fires (25-75% topkill), since the shrubs aren't completely topkilled. Fires were modeled with half replacement and half mixed severity.

*Maximum Tree Size Class*  
None

Class B 15 Mid Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PRVI | Prunus virginiana | Chokecherry | Mid-Upper |
| SYOC | Symphoricarpos occidentalis | Western snowberry | Low-Mid |
| FRPE | Fraxinus pennsylvanica | Green ash | Lower |
| CASP7 | Carex sprengelii | Sprengel's sedge | Low-Mid |

Description

This class is dominated by shrubs and trees and is a mid-development stage. Its ages are 10-29yrs. Trees are coming in and growing taller in this stage, ~2/3 of a foot annually. A 30% tree canopy cover would be the average (Lesica 2001). This stage reaches approximately 30yrs of age. It is similar to class A, but the shrubs are taller and the trees are beginning to overtop the shrubs. A true tree canopy has not yet developed.

The MFRI is similar to that in a grassland system, although this system might experience somewhat less frequent intervals; occasionally fires might not burn through this stage. Some will be replacement fires and take out the stand, although this occurrence would be less frequent, depending on the year and drought. Some fires might maintain the stand, but most of the fires would be mixed- and low-severity, although the frequency of types would be similar. There would be less mortality on larger trees. There would be no fuel for fire during episodes of drought and grazing. Fire was split 30/50/20 percent between low, mixed and replacement fires. The low and mixed fires do not cause a transition to another stage.

The combined effect of drought and grazing was modeled to occur but not causing a transition, and rather maintaining this class.

*Maximum Tree Size Class*  
Sapling >4.5ft; <5"DBH

Class C 68 Late Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| FRPE | Fraxinus pennsylvanica | Green ash | Upper |
| PRVI | Prunus virginiana | Chokecherry | Mid-Upper |
| SYOC | Symphoricarpos occidentalis | Western snowberry | Middle |
| CASP7 | Carex sprengelii | Sprengel's sedge | Lower |

Description

This class begins at ~30yrs old and persists. This includes both open and closed stages of this system in this age range. An average canopy closure would be ~ 50%. Height can be between 40-70ft and DBH ~45in (USDA Forest Service 2002), although most old-mature ash trees in this type in Montana are 20-40ft high with a basal diameter of 20-30in. Tree canopy in this stage is now formed. It takes on aspects of a woodland instead of a shrubland; the first two classes are more shrub communities.

The MFRI is similar to that in a grassland system, although this system might experience somewhat less frequent intervals, as occasionally fires might not burn through this stage. Some replacement fires will take out the stand, although this would be less frequent and dependent on the year and drought conditions. Some fires might maintain the stand; most would be mixed- and low-severity, although the frequency of types would be the same. There would be less mortality on larger trees. Fire was therefore modeled at an overall frequency of 20yrs, but split 30/50/20 percent between low, mixed and replacement fires. The low and mixed fires do not cause a transition to another stage.

The combined effect of drought and grazing was modeled to occur but not causing a transition, and rather maintaining this class.

Disease might occur in this stage, which opens the stand (Lesica et al. 2003). This is more prominent in Montana than in the Dakotas. In the Dakotas, canopy closure could be 90%. In Montana, open canopy would be about 40-45%, and the relatively open nature of stands is probably due, in large part, to high rates of heart-rot disease. Disease is not as common further east, in the Dakotas and Nebraska, and as one gets further east into higher precipitation zones. In the east, canopy cover would be higher and more closed (therefore, canopy cover increased to 100% for MZs 29 and 30). Disease was modeled as occurring on 20% of this class each year and causing no transition, keeping it a more open stand. It does not cause a transition to another stage (i.e., B), however, because it was questionable as to whether the disease-caused, open, mature stand would be the same as the 9-30yr old stand.

*Maximum Tree Size Class*  
Large 21-33"DBH

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Mid1:ALL | 9 |
| Mid1:ALL | 10 | Late1:ALL | 29 |
| Late1:ALL | 30 | Late1:ALL | 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** |
| Replacement Fire | Early1:ALL | Early1:ALL | 0.0333 | 30 | Yes | 0 |
| Mixed Fire | Early1:ALL | Early1:ALL | 0.0333 | 30 | No | 0 |
| Optional 1 | Early1:ALL | Early1:ALL | 0.1 | 10 | Yes | 0 |
| Native Grazing | Early1:ALL | Early1:ALL | 0.25 | 4 | No | 0 |
| Replacement Fire | Mid1:ALL | Early1:ALL | 0.01 | 100 | Yes | 0 |
| Surface Fire | Mid1:ALL | Mid1:ALL | 0.015 | 67 | No | 0 |
| Mixed Fire | Mid1:ALL | Mid1:ALL | 0.025 | 40 | No | 0 |
| Optional 1 | Mid1:ALL | Mid1:ALL | 0.1 | 10 | No | 0 |
| Replacement Fire | Late1:ALL | Early1:ALL | 0.01 | 100 | Yes | 0 |
| Surface Fire | Late1:ALL | Late1:ALL | 0.015 | 67 | No | 0 |
| Mixed Fire | Late1:ALL | Late1:ALL | 0.025 | 40 | No | 0 |
| Optional 1 | Late1:ALL | Late1:ALL | 0.1 | 10 | No | 0 |
| Insects or Disease | Late1:ALL | Late1:ALL | 0.1 | 10 | No | 0 |

Optional Disturbances

Optional 1: grazing and drought together

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