13850

Western Great Plains Wooded Draw and Ravine

BpS Model/Description Version: Aug. 2020

Update: 4/20/2018

|  |  |  |  |
| --- | --- | --- | --- |
| **Modelers** |  | **Reviewers** |  |
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| None | None | None | None |

Vegetation Type

Mixed Upland and Wetland

Map Zones

31, 39, 40, 42

Model Splits or Lumps

This BpS is lumped with: 1085

Geographic Range

This system is predominately west of the Missouri River in North Dakota and South Dakota, with minor extensions east of the Missouri River and south into Nebraska. (It 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. This BpS also extends along drainages east to the Missouri River, and west and north.

In map zones (MZ)s 39 and 40, it occurs mostly on the western edge, the Missouri River floodplain, and extensions that come out. But when it crosses out of the floodplain and into current farmland, it becomes more difficult to determine if it is a woody draw or another system. There might have been some in ECOMAP subsections 331Mc, 331Ea.

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

Biophysical Site Description

The true wooded draw is a small, mesic island surrounded by upland grasses.

This BpS occurs in major tributaries and upland drainages with extensions onto steep north-facing slopes. The vegetation type is best developed in topographic conditions that favor snow trapment and protection from fires in the adjacent grasslands. It 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.

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).

Vegetation Description

This system contains an intricate mix of western grassland and shrubland species, with elements of eastern deciduous woodlands. The northern extent occasionally supports quaking aspen, while the southern extent supports Juniper species, and the western extent includes ponderosa pine.

Green ash and chokecherry are dominant species, as well as buffaloberry (buffaloberry might not occur as far east as MZs 39 and 40, however), snowberry and American elm. On the north end into North Dakota, aspen and bur oak would start occurring, and paper birch in Theodore Roosevelt NP. Also tend to be small, incidental communities in the Little Missouri National Grasslands. In southern extent, those would not be present as much. Rocky Mountain juniper also occurs in places, although it might not occur in MZs 39 and 40, and tends to be an understory shrub in Montana. Canada wildrye and woods rose might also be present. *Muhlenbergia racemosa* is also common.

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 BpS forms an intimate association with adjacent mixedgrass prairie and shrublands where non-typical-replacement fires are relatively frequent due to productive grass fuels and cycles of moisture and drought. Fires could go through the tree stands without topkill. Most years, the fires occur and meander but they're not intense enough to crown.

The adjacent grassland areas are the greatest source of fires for the woody draw system. However, woody draws play an important role in breaking up the fire frequency and continuity from grassland areas; it influences their extent. Fires can homogenize the area, but the continuity is broken by the woody draws.

Native Americans used low intensity fires and burned in the spring when fire was more manageable. They also used fires for other purposes. In these conditions, woody draws could be an important influence in the distribution and continuity of fires (Jack Butler, US Forest Service, personal communication).

Stand-replacement fires were fairly infrequent, otherwise there would have been even-aged stands. Less frequent stand replacement fires were generally associated with periods of exceptionally high moisture conditions immediately followed by severe dry conditions. Mixed fires opened the canopy to allow for different age classes. Low and mixed severity fire probably occurs on average every 10yrs in the grasslands. However, the fires probably stopped at the boundaries of the woody draws, since they would be more mesic and greener in this system. Also, the topography would have stopped fire, as draws are more broken and therefore protected by grassland fire (Jack Butler, USFS, personal communication), making them less frequent in the draws.

Deciduous trees in the Badlands of the Dakotas in woody draws are reported to be no older than 50yrs and juniper no older than 100yrs (Warner 1993). 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 (from Badlands National Park Fire Management Plan).

Drought and moist cycles are major factors that interact with both fire and native grazing. This system is dependent on drought in order to have a fire. In drought periods, especially in late fall/summer, conditions were dry enough for stand-replacing fires.

The grazing/fire interaction was more pronounced in the east of map zones (MZ)s 39 and 40, because of water sources - bison and ungulates congregated near water during drought, and there were more water sources in the east.

Rocky Mountain juniper or ponderosa pine invade woody draws and enhance the flammability of system; fire carries through system. Juniper would then be lost, and smaller pines would be lost.

There is bur oak 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, in times with higher moisture. *Fraxinus* is even more tolerant than bur oak, so it would sprout up as well after high intensity fire. In periods with more fires, bur oak dominates. Without fire, elm and ash dominate.

Many of the trees, including weak sprouters such as green ash and American elm, could be killed by drought and fire together.

There are also probably higher concentrations of ungulates during a drought, since that would be the only area that might still be "green." Therefore, it is an interacting impact of drought and animals. Native ungulates play a role in stand regeneration on sites where deer and elk and bison concentrate for food, cover and shelter. They were good "lounging" areas for native ungulates.

Heart rot can occur with Fraxinus spp.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 91 | 36 | 30 | 100 |
| Moderate (Mixed) | 65 | 50 |  |  |
| Low (Surface) | 231 | 14 | 10 | 225 |
| All Fires | 33 | 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

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 and 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 system. In drier years, fires will burn through system.

Adjacency or Identification Concerns

This system occurs in upland draws and ravines scattered throughout the Northern mixedgrass prairie. There may be intermediates of this type of green ash communities and cottonwood stands, 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 system would be adjacent to BpS 1132 and 1141. With the right conditions and a break in these systems, BpS 1385 will occur.

In the eastern part of MZs 39 and 40, there are more riparian systems instead of woody draw/ravine systems. The topographic situations become less important moving east, because the precipitation is increasing. The true wooded draw is a small, mesic island surrounded by upland grasses. Moving east, it develops more into an overall woodland system, i.e. streambank, creek, more riparian, more gallery forests. In the middle of MZs 39 and 40, there are more permanent and more mesic systems. The woody draws are more smaller extent, narrow fingers associated with drainages and upland depressions, around badlands type topography versus going east.

Much of the area of this system is now farmed and are shelterbelts in the east of MZs 39 and 40, whereas in the west it has since regenerated.

This system 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, boxelder, green ash (Wooded Draw/Ravine) and willows, depending on how far east one goes; sometimes they have very few woody plants other than silver sagebrush. 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. This may not happen very often naturally, so these types of drainages would be in silver sagebrush a lot of the time. This is especially true now due to fewer impoundments in the headwaters of these prairie streams. Drainages that don't have the area for a good flood might 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 western part of the Great Plains. Assigning the drainage to one or the other type of system would depend on basin size.

Eastern red cedar might be moving into the east of MZs 39 and 40, as well as Russian olive. Kentucky bluegrass has taken over in grazed sites, and leafy spurge is dominant in the Little Missouri grasslands.

The invasion of Rocky Mountain juniper also goes into the upper reaches on north-facing slopes. There has been an invasion of juniper from the woody draws into the grasslands. It's a large problem in Nebraska and an increasing problem in South Dakota. Juniper would have occurred historically in the woody draws and Missouri River Breaks, but now it's encroaching and spreading throughout, partly because it is being planted for shelterbelts. As a result, there are seed sources now everywhere invading grasslands from Texas to Canada.

There has also been a substantial reduction currently in regeneration (green ash, box elder, elm and shrubs), and an increase in grazing-resistant species and thorny species.

Farming, ranching and intense agriculture occurs in MZs 39 and 40.

Grazing by domestic livestock has reduced regeneration and 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 getting decadent, there can be a loss of the whole stand. Combination of drought and grazing/trampling could cause loss of stand.

There's probably less of this system currently than there was historically. Due to grazing, this system probably appears departed from its reference condition. Where this system is located, its extent is reduced; now there are smaller remnants. They haven't completely been converted, although they are shrunken and more restricted in areas. The distribution might be okay, but maybe only the central area of the draw remains. Farming occurs right up to the banks of the draws in MZs 39 and 40.

In many of the woody draws on Buffalo Gap and Oglala National Grasslands, cattle will hang out in the draws and prevent almost all surface vegetation from growing, which will increase erosion, compact soil, and affect flammability for those fires that do occur. This leads to an overabundance of Rocky Mountain Juniper in some draws. Fires burning up these draws could be high severity and take out everything aboveground.

During review of lumping of 1085 Northwestern Great Plains Shrubland, some questioned whether, where snowberry, chokecherry, and other mesic shrubs in draws and drainageways, there are early seral to tree-dominated woody draws in the absence of fire, or if there are changes to longer fire intervals.

Issues or Problems

There is a lack of research on mean fire return interval (MFRI) in this system.

The long, linear nature of this system’s distribution makes it difficult to map. Consequently, it is often listed as a complex in relatively small-scale mapping efforts.

Native Uncharacteristic Conditions

There is less regeneration and less open canopy conditions today.

Comments

This model for MZs 31, 39, 40 was adapted from the model from the same BpS from MZs 29 and 30, created by Jack Butler and Lee Blaschke, and reviewed by Carolyn Hull-Sieg, Mary Lata, and Linda Vance. Model changed slightly quantitatively due to refinement of model and some changes moving east.

This model for MZ 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 16 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 mostly dominated by shrubs, although grasses are present, too. Cover averages ~50%, and the minimum cover would never be as low as 0%. In the first year, herbaceous species might dominate. The herbaceous cover is high underneath the shrubs and would probably be ~25-50% cover. This class succeeds to B after approximately 10-30yrs. The 10yr interval would have to involve fairly favorable conditions. With wet/dry cycles, there would need to be the right combination. On the eastern edge of MZs 39 and 40, however, 10yrs is probably more likely, but on the western edge of MZs 39 and 40, 30yrs is more likely.

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 could set this stage back to its beginning state, although it was not modeled as such. Grazing is dependent on weather cycles, as well (although deer select green ash). There is also elk browsing.

The combined effect of drought and grazing was modeled as Optional 1. This might be more pronounced moving further east. Further west, the distribution of animals is controlled by permanent water sources. During drought, the grazing is more concentrated near water. In the west, grazing is less pronounced due to water scarcity, therefore, the systems that are closest to permanent sources of water are probably more impacted.

Grazing alone was modeled as occurring frequently.

The MFRIs are similar to grassland systems, but because there has not been a grassland system here the entire 20yrs, nor throughout the system (partly shrubs), replacement fires do not occur all of the time. Occasionally, there are replacement fires through the grass. There are also mixed severity fires (25-75% topkill) since the shrubs aren't completely topkilled. Fires were modeled as half replacement and half mixed severity. Fire is more frequent in this stage than in classes B or C because grassland is adjacent.

*Maximum Tree Size Class*  
None

Class B 29 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. As the community develops, seeds, shrubs and trees change the microclimatic conditions. Trees are coming in and growing taller in this stage, approximately 2/3 of a foot annually. Average canopy cover is 30% (Lesica 2001). This stage reaches ~30yrs of age. Shrubs are taller in this class, 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 because fires might not burn through this stage. Some replacement fires will take out stands, although less frequently, depending on the year and drought conditions. Some fires might maintain the stand. Most of the fires would be mixed and low severity, although the frequency of types would be similar, with less mortality on larger trees. During episodes of drought and grazing, no fuels are available for fire. Fire was therefore modeled and 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. Native grazing was modeled to occur on 25% of the class each year (or affecting the whole class every four years).

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

Class C 55 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 approximately 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.

There is not much ladder fuel in this well-developed mature class. As it moves towards closed canopy situation, there is less understory vegetation and less continuity for a fire to move through. While it is open, there would be more grass fuels. Low severity fires don't really get into the woody draws except on the edges or peripheral areas, would be difficult to measure in this class, and would probably be inconsequential; therefore, they were not included in the model. There would have to be a combination of lot of biomass, ladder fuels, and the right conditions for a replacement fire Replacement fire was therefore modeled. It's possible that, with successive grass fires, enough buildup would eventually cause a replacement fire. There would have to be high biomass followed by hot, dry conditions.

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). In Montana, this is more prominent than in the Dakotas. In the Dakotas, canopy closure could be 90%. In Montana, open canopy would be ~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 farther east, in the Dakotas, Nebraska, and as one gets 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 therefore not modeled for those map zones.

*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 | 20 |
| Mid1:ALL | 21 | Late1:ALL | 30 |
| Late1:ALL | 31 | 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 | No | 0 |
| Native Grazing | Early1:ALL | Early1:ALL | 0.35 | 3 | 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 |
| Native Grazing | Mid1:ALL | Mid1:ALL | 0.25 | 4 | No | 0 |
| Mixed Fire | Late1:ALL | Late1:ALL | 0.005 | 200 | No | 0 |
| Replacement Fire | Late1:ALL | Early1:ALL | 0.005 | 200 | Yes | 0 |
| Native Grazing | Late1:ALL | Mid1:ALL | 0.05 | 20 | Yes | 0 |
| Optional 1 | Late1:ALL | Late1:ALL | 0.1 | 10 | No | 0 |

Optional Disturbances

Optional 1: grazing and drought together

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