14950

Western Great Plains Depressional Wetland Systems

BpS Model/Description Version: Aug. 2020

Update: 6/22/2018

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|  |  |  |  |

Vegetation Type

Herbaceous Wetland

Map Zones

31, 39, 40

Geographic Range

This systems group occurs across the western Great Plains from North Dakota and Kansas west to Montana and south to Texas.

This system occurs in ECOMAP sections 331F and subsection 332Bd (Cleland et al. 2007). It occurs in northern part of map zone (MZ)31 and west of the sandhills, subsections 331Fs and 331Fh. There might be some of this system in subsection 332Bd and other areas of MZs 39 and 40.

These probably do also occur in the Dakotas.

This includes wetlands in the Sandhills.

Biophysical Site Description

These are semi-arid unglaciated depressional wetlands. For MZs 30, 39, and 40, this system includes wetlands that form in upland and lowland depressions across the western Great Plains. Isolated depression wetlands (including playa lakes) form in small basins within upland landscapes that are rarely linked to outside groundwater sources and do not have an extensive watershed. Open depression wetlands form in lowlands, including lake borders and stream margins, that have more open basins, usually have a larger watershed, and a permanent water source throughout most of the year (except during exceptional drought years). The isolated depressions are typified by the presence of an impermeable layer such as a dense clay, hydric soil and are usually recharged by rainwater and nearby runoff. (Nature Serve 2007).

Isolated ponds and lakes can experience periodic drawdowns during drier seasons and years and are often replenished by spring rains. In areas of saline soils, both isolated and open depressions will be more brackish, with associated vegetation differences. Salt encrustations can occur on the surface in some of these depressions. Soils are severely affected by the saline conditions and have poor structure.

The system includes submergent and emergent marshes, and associated wet meadows and wet prairies. These types can also drift into stream margins that are more permanently wet and linked directly to basin via groundwater flow from/into the pond or lake. Isolated ponds and lakes can experience periodic drawdowns during drier seasons and years and are often replenished by spring rains.

Vegetation Description

In MZs 31, 39, and 40, *Eleocharis* spp., *Hordeum jubatum*, and common forbs such as *Coreopsis tinctoria*, *Symphyotrichum subulatum* (=*Aster subulatus*), and *Polygonum pensylvanicum* (=*Polygonum bicorne*) are common vegetation in the wetter and deeper depressions, while *Pascopyrum smithii* and *Buchloe dactyloides* are more common in shallow depressions in rangeland. Open depression wetlands include submergent and emergent marshes with *Typha* spp. and *Schoenoplectus* spp. and associated wet meadows and wet prairies. In areas of saline soils, both isolated and open depressions will be more brackish, with associated vegetation differences. Salt encrustations can occur on the surface in some depressions, and the soils are severely affected and have poor structure. Species that typify these systems are salt-tolerant and halophytic species such as *Distichlis spicata*, *Sporobolus airoides*, and *Hordeum jubatum*. Other commonly occurring taxa include *Puccinellia nuttalliana*, *Salicornia rubra*, *Suaeda calceoliformis*, and *Spartina* spp., and shrubs such as *Sarcobatus vermiculatus* and *Krascheninnikovia lanata* (NatureServe 2007).

In MZ20, vegetation is dominated by sparse to dense cover of graminoids, up to one meter tall, although typically 0.6m or shorter. *Pascopyrum smithii* usually dominates, with *Distichlis spicata*, *Hordeum jubatum*, *Eleocharis acicularis*, or *Eleocharis palustris* complex almost co-dominant. *Juncus balticus* will be present in areas where water stands for longer after a storm or where flooding occurs. Other graminoids include *Puccinellia nuttalliana*, *Bouteloua gracilis*, *Koeleria macrantha*, and *Hesperostipa comata* (HECO questionable, since it prefers sandy soils and this type is developed on clay soils). *Spartina gracilis* has been documented in MZ20 but only in limited areas. Woody plants are rare, except for occasional *Gutierrezia sarothrae*, *Artemisia frigida*, *Artemisia cana*, or *Symphoricarpos occidentalis*. *Sarcobatus vermiculatus* and Basin wildrye (*Elymus cinereus*) can also be associated with saline playa vegetation in Montana, although they are probably not nearly as common as the listed dominants.

In MZ31, the PASM/ELXE (ELXE is a component of the ELPA3 complex) complex dominate diagnostically. That is the complex that is only in here and not generally in prairie potholes. *Hordeum jubatum* and *Polygonum coccineum* is also diagnostic, although those might occur in prairie potholes too.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| PASM | *Pascopyrum smithii* | Western wheatgrass |
| HOJU | *Hordeum jubatum* | Foxtail barley |
| ELAC | *Eleocharis acicularis* | Needle spikerush |
| ELPA3 | *Eleocharis palustris* | Common spikerush |
| JUBA | *Juncus balticus* | Baltic rush |
| PUCCI | *Puccinellia* | Alkaligrass |
| POAMS | *Polygonum amphibium var. stipulaceum* | Water smartweed |

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

Disturbance Description

Flooding, grazing, drought and fire represent significant disturbances to this group of ecosystems.

Fire: Plant communities providing saltgrass habitat are diverse and exhibit a wide range of fire frequencies. Saltgrass is found in desert shrub communities that have fire return intervals of less than 35yrs to over 100yrs (Hauser 2006). The saltgrass habitat, however, is not a dominant component in MZ39 in central and SD and southern SD in MZ31. Some saltgrass communities occur rarely in western and central southern Nebraska (i.e. Salt Creek in the vicinity of Lincoln, NE). Other depressional wetlands seem unlikely to be sufficiently frequent to require a separate section. Therefore, a different fire return interval is being modeled.

Depending on alkalinity, fire frequency would vary – high alkalinity would prevent sufficient accumulation of fuel much of the time, especially where the graminoid community is sparce or absent.

At least in Nebraska (the southern portion of the zones), fire frequency might have been similar to the surrounding prairie which is more likely to have been every 3-4yrs (Bragg 1995).

Historical fire size is dependent on the surrounding vegetation and the size of the depressional wetland. Fire could burn an entire small area if fuel occurred across it. Generally, however, fires would burn less than the entire depression if water or bare soil prevented a fire from sweeping across the center. Fire size would vary from less than a hectare to several hectare. The frequency of burning would largely mimic the mean fire return interval (MFRI) of the surrounding prairie unless the vegetation of the depressional wetland does not support graminoids that approximate the fuels of the surrounding vegetation in which case the MFRI would be longer (Collins and Uno 1983).

Hydrology: Hydrology affects this system. However, it is dry for more years than wet. The flooding frequency would put this into a different system than the surrounding grassland. It floods often enough with predictable regularity. It usually behaves like the surrounding grassland in terms of fire. It would experience more fire than other wet communities, such as prairie potholes, because it is drier. The small wetlands would burn more frequently than the large ones, since the large ones might have more bare ground or be deeper.

Drought occurs in this system, and there are regular wet/dry cycles. This system is either all wet or all dry, which is simpler than how the prairie pothole system functions.

Grazing: Grazing might have had an effect on this system. There would be trampling disturbance due to the softness of the soil. Trampling would be more severe than the surrounding grassland because of the wetness. Grazing by native ungulates such as buffalo and antelope can affect non-saline ecosystems where the grazers may be particularly likely to congregate at any time of the year but particularly during droughts. Non-alkaline sites may be more affected by grazing that alkaline sites.

Return interval for fire could be extended by ungulate grazing if ungulates graze the depressions.

Other: Episodic disturbance is caused by insect infestation (grasshoppers, range caterpillars and Mormon crickets). This was not modeled.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 20 | 100 | 10 | 100 |
| Moderate (Mixed) |  |  |  |  |
| Low (Surface) |  |  |  |  |
| All Fires | 20 | 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

In South Dakota, this system is mostly 20-100ac, and maybe as small as ten acres.

Historical fire size is very dependent upon the surrounding vegetation.

Adjacency or Identification Concerns

In MZs 31 and 39 in the Great Plains, this system is primarily adjacent to mixed-grass prairie or riparian zones or badlands. In MZs 31, 39, and 40 they might also be adjacent to or embedded within tallgrass prairie.

This system could be confused with 1482 Prairie Potholes. This system is simpler than the prairie potholes. This might also be confused with the Sandhill wetlands/lakes, which are formed in the bottom of sand dunes, directly connected to groundwater and very permanent and rarely go dry and are not as alkaline as these wetlands.

These 1495 wetlands systems would just be in the northern part of MZ31. Some portions of MZs 39 and 40 would be prairie potholes biophysical setting (BpS) 1482 in the glaciated portions. This wetland system is probably just a subsection of the prairie potholes 1482. It might even be that the variability of the prairie potholes encompasses this wetland system 1495. This system would be the semi-arid system versus potholes which would be glacial sub-humid. These are the unglaciated semi-arid wetlands.

This 1495 wetlands system in the Dakotas also has a more frequent fire return interval than prairie potholes, since this wetland system is drier.

The Nebraska Sandhill “wetlands” or lakes differ from other depressional wetlands; however, this 1495 description focuses on combining several small ecosystems (i.e. the various types of depressional wetlands) which (1) individually are very small in extent and (2) typically are embedded within a larger surrounding plant community that would dictate the general fire regime for the region. For the small wetlands in MZs 31, 39, and 40, depressional wetlands do occur but generally do not constitute a substantive portion of the total landscape as to warrant separation. Sandhills wetlands are very small; some should be included within this BpS 1495 Western Great Plains Depressional Wetland Systems, but some should just be lumped with an adjacent system such as tallgrass prairie.

The rainwater basins of Nebraska are mostly lowland prairie. They are connected to groundwater or associated with Platte River water. However, these are relatively small ecosystems and are not modeled separately but should rather just be a part of their adjacent system. They are generally embedded in the larger landscape.

These wetlands are affected by hydrological changes, grazing, and conversion to agricultural use. Species richness can vary considerably among individual examples and is especially influenced by adjacent land use. Agriculture is often adjacent and may provide nutrient and herbicide runoff (NatureServe 2007).

This system might not be that departed from how it appeared historically. There are not many exotics. It has been plowed and drained some. And it probably burns less frequently than its historical occurrence.

For saline wetlands, other than losses to human activity, the systems may be somewhat similar to historic conditions since they were probably not substantively affected by biotic factors. For non-saline ecosystems, differences could be substantial with greater woody plant cover, greater disturbance by cattle, and concomitant changes in composition and erosion.

In the southeast part of MZ31 and in Nebraska, there is a current problem with reed canary grass (PHAR).

Since the early 1900s, fire has been excluded and nonnative species such as Japanese brome (*Bromus japonicus*), smooth brome, Kentucky bluegrass, crested wheatgrass (*Agropyron cristatum*) and Canada thistle (*Cirsium arvense*) have taken a strong hold in the Great Plains mixed-grass prairies where saltgrass occurs (Hauser 2006).

Non-native invasive species (e.g. *Bromus inermis* and *B. japonicus*) may be confused with native successional species although, more likely, these species will have changed the successional dynamics both with respect to the dominant vegetation and to the likelihood of fire (e.g. if there is a greater cover of grasses).

*Bromus japonicus* is the most likely exotic to become common in this type.

Issues or Problems

There is very little research on this system and its dynamics especially in the Great Plains area.

Native Uncharacteristic Conditions

Comments

This model for MZs 31, 39 and 40 was adapted from the model from the same BpS 1495 from MZs 29 and 30 reviewed by Peter Lesica peter.lesica@mso.umt.edu and Kathy Roche kroche@fs.fed.us. For MZs 31, 39, and 40, quantitative and descriptive changes were made due to a different understanding and to better reflect these systems in the Great Plains; this included adding more frequent fire. Co-regional lead Elena Contreras also added in descriptions from NatureServe and made the quantitative changes to the model according to modeler/reviewer suggestions.

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 | UN | UN | UN | UN | UN | UN |
| Herb | 0.5-1.0 | A | A | A | A | UN | UN | UN | UN | UN | UN |
| Herb | >1.0 | A | A | A | A | UN | UN | UN | UN | UN | UN |
| Shrub | 0-0.5 | B | B | UN | UN | UN | UN | UN | UN | UN | UN |
| Shrub | 0.5-1.0 | B | B | UN | UN | UN | UN | UN | UN | UN | UN |
| Shrub | 1.0-3.0 | B | B | UN | UN | UN | UN | UN | UN | UN | UN |
| Shrub | >3.0 | B | B | 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 47 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PASM | Pascopyrum smithii | Western wheatgrass | Upper |
| HOJU | Hordeum jubatum | Foxtail barley | Upper |
| ELAC | Eleocharis acicularis | Needle spikerush | Upper |

Description

This class is dominated by resprouts and seedlings of grasses and post-fire associated forbs of low to medium height with variable canopy cover. This class revegetates quickly and fills up, and annuals come in quickly after disturbance.

Rhizomatous perennials are in this class. The system can be flooded out, and when the water goes down, there is bare soil. But then it is rapidly colonized by HOJU or other annuals. Then in a few years *Eliocharis* persists in the seed bank and sprouts up, western wheatgrass comes in over time, and this becomes more like a grassland, until it gets flooded again. This class would persist for probably only about five years, as vegetation establishes quickly in the Dakotas and Nebraska. It might stay as open water for a short while, but once it gets out of the open water stage, it would go to a developed grassy stage quickly.

The only way this class would persist in this class longer would be if there was some fairly heavy livestock grazing.

Fire would cause little change in species composition except possible a temporary decline in *Puccinellia* and *Hordeum* (bunch grasses).

Native grazing and herbivory could be heavy (10% of this class each year).

Replacement fire occurs with a frequency similar to that in the adjacent grassland communities and more frequent than that for prairie potholes, because this system is drier more often than prairie potholes. It is thought that it would take longer for fire to rotate among all of the wetlands than the grassland, however, which is why a less frequent interval than grassland was chosen. (Previous MZs modeled a less frequent return interval; however, that thinking was rejected for MZs 31, 39 and 40).

*Maximum Tree Size Class*  
None

Class B 53 Mid Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PASM | Pascopyrum smithii | Western wheatgrass | Upper |
| ELAC | Eleocharis acicularis | Needle spikerush | Upper |
| HOJU | Hordeum jubatum | Foxtail barley | Upper |

Description

Scattered shrubs may be present. This class establishes quickly after disturbance. Other species in MZs 31, 39, and 40 could include *Schoenoplectus* (bulrush) or *Typha*.

Drought also occurs.

Native grazing and herbivory could be heavy.

Replacement fire occurs with a frequency similar to that in the adjacent grassland communities and more frequent than that for prairie potholes, because this system is drier more often than prairie potholes. It is thought that it would take longer for fire to rotate among all of the wetlands than the grassland, however, which is why a less frequent interval than grassland was chosen.

*Maximum Tree Size Class*  
None

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Mid1:CLS | 5 |
| Mid1:CLS | 6 | Mid1: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** |
| Replacement Fire | Early1:ALL | Early1:ALL | 0.05 | 20 | Yes | 0 |
| Wind or Weather or Stress | Early1:ALL | Early1:ALL | 0.1 | 10 | No | 0 |
| Optional 1 | Early1:ALL | Early1:ALL | 0.1 | 10 | No | 0 |
| Native Grazing | Early1:ALL | Early1:ALL | 0.1 | 10 | No | 0 |
| Replacement Fire | Mid1:CLS | Early1:ALL | 0.05 | 20 | Yes | 0 |
| Optional 1 | Mid1:CLS | Mid1:CLS | 0.1 | 10 | No | 0 |
| Wind or Weather or Stress | Mid1:CLS | Early1:ALL | 0.1 | 10 | Yes | 0 |
| Native Grazing | Mid1:CLS | Mid1:CLS | 0.2 | 5 | No | 0 |

Optional Disturbances

Optional 1: drought

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