11480

Western Great Plains Sand Prairie

BpS Model/Description Version: Aug. 2020

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|  |  |  |  |

**Reviewers**

Tim Christiansen and Derrick Holdstock (map zone [MZ] 34)

Vegetation Type

Herbaceous

Map Zones

34, 35

Geographic Range

Northeast Colorado, part of southwest Nebraska, western Kansas, southeast Wyoming, south to Oklahoma, New Mexico, and Texas. In MZ34, this system can be found throughout the MZ except, possibly, to a limited extent in ECOMAP subsection 332Fb (where it may not occur at all).

Biophysical Site Description

Soils are sandy to loamy sands in this biophysical setting (BpS). They are also highly permeable and low in organic matter. Occurs on rolling topography and along river drainages (such as the Canadian River). Precipitation ranges from 40cm-60cm (15in-24in).

Vegetation Description

Graminoid species such as sand bluestem (*Andropogon hallii*), sand dropseed (*Sporobolus cryptandrus*), prairie sandreed (*Calamovilfa longifolia*), needle and thread (*Hesperostipa* *comata*), little bluestem (*Schizachyrium scoparium*), blue grama (*Bouteloua gracilis*) (dominant), and hairy grama (*Bouteloua hirsuta*) can be found within this system. It structurally resembles a tallgrass prairie system. Shrub species that may occur include sand sagebrush (*Artemisia* *filifolia*), Harvard oak (*Quercus havardii*), soaptree yucca (*Yucca elata*), Chickasaw plum (*Prunus angustifolia*), and skunkbush sumac (*Rhus trilobata*). Also present is switchgrass (*Panicum virgatum*), western wheatgrass (*Pascopyrum smithii*), and, more rarely Indiangrass (*Sorghastrum nutans*). Herbaceous cover is variable and ranges from sparse cover (sometimes resulting in highly erodible areas) to >70%.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| ANHA | *Andropogon hallii* | Sand bluestem |
| CALO | *Calamovilfa longifolia* | Prairie sandreed |
| PAVI2 | *Panicum virgatum* | Switchgrass |
| BOGR2 | *Bouteloua gracilis* | Blue grama |
| SONU | *Sophora nuttalliana* | Silky sophora |
| HECOC8 | *Hesperostipa comata ssp. comata* | Needle and thread |
| ARFI2 | *Artemisia filifolia* | Sand sagebrush |
| PRAN3 | *Prunus angustifolia Marshall* | Chickasaw plum |

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

Disturbance Description

Grazing, drought, and fire were the primary disturbances. Fire and drought disturbances were cyclic, with the earliest and latest seral stages fluctuating widely on a scale of centuries in accordance with changes in climate. Every year, there was probably some grazing; the intensity and number of animals probably varied greatly over time. The principal large grazer of the sandhills was most likely bison that, when occurring in large numbers, would have locally disturbed large areas due both to grazing impact and physical events such as trampling and wallowing. Elk and deer were other large grazers. Other ubiquitous grazers of the sandhills would have been numerous rodent species such as pocket gophers and kangaroo rats. Prairie dogs were a minor component of the sandhills prairie, with towns located only in areas of finer textured soils.

Grazing and drought modified fire effects. Fire occurred in a mosaic pattern. The most extensive fires are likely to have occurred in years with wet springs followed by hot, dry summers when grazing pressure was low. A wet spring resulted in more productive and more continuous plant cover (i.e., fuel), which supported and expanded fires that occurred later in the season that ignited in dry conditions. In addition, litter accumulation over several fire-free years also supported widespread fire in any conditions. The litter component, a determining factor in fire size and frequency, is correlated with seral stage. Fire intervals ranged from a few years to >50yrs. Post-fire shifts in species composition depend on the timing and condition of fire.

Extended periods of severe drought are likely to affect both species composition and the stability of the sandhill soil, particularly when compounded by effects of wind, grazing, and fire. These conditions may have led to the development of blowouts, making it difficult for vegetation to re-establish quickly. In the Early Development class, immediately after a disturbance, when herbaceous cover is low, wind erosion tends to maintain that class.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 13 | 100 |  |  |
| Moderate (Mixed) |  |  |  |  |
| Low (Surface) |  |  |  |  |
| All Fires | 13 | 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

Can occur as a large patch (1,000ac). More commonly occurs as a small patch.

Adjacency or Identification Concerns

Classes of this BpS resemble occurrences of Western Great Plains Sandhill Shrubland (BpS 10940). We have modeled the two systems separately because the species composition is different. The Late Succession classes of the shrubland are dominated by Tucker sand shinnery oak whereas the shrubs in the prairie (BpS 11480) are dominated by Chickasaw plum and sand sagebrush. Shrub-dominated occurrences of today’s BpS result from current grazing and altered fire regime.

In current conditions, this BpS has much less tallgrass than reported historically (switchgrass and bluestem). There is also a greater amount of sand sage and shortgrass (blue grama) (denser, more basal area) today than there was historically. This system has largely been converted to a shortgrass sand sage plant community primarily due to long-term continuous grazing and/or overstocking. The changes in grazing in current conditions have had a much greater effect on this system than changes in fire regimes (fire suppression).

Properly stocked grazing systems that allow for adequate recovery periods following each grazing event can restore the historical climax plant community. See NRCS ESDs for sands and choppy sands.

Issues or Problems

Much of this type in Colorado, Kansas, and Nebraska has also been converted to center-pivot irrigation, plowed, and planted. Spraying of sand sage in the recent past has also had an impact on this system, because the spraying kills most forbs and shrubs.

This habitat was important to lesser prairie chicken and greater prairie chicken and plains sharp-tailed grouse.

Native Uncharacteristic Conditions

With increased shrub dominance of the grassland, this system could look like BpS 1094. Greater than 25% shrub cover is uncharacteristic.

Comments

For MZ35, this model was adopted without changes from the same BpS for MZ34. The model description for both MZs is based on the original description from MZ35.

For MZ34, this model was adapted from MZs 27 and 33, BpS1094 Western Great Plains Sandhill Shrubland, by Harvey Sprock (harvey.sprock@co.usda.gov), Steve Kettler (steve\_kettler@fws.gov), and Keith Schulz (keith\_schulz@natureserve.org). For MZ34, significant changes to the 27/33 model resulted in a change in modeler-ship.

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 | B | B | B | B | B | B | B | B |
| Herb | 0.5-1.0 | B | B | B | B | B | B | B | B | B | B |
| Herb | >1.0 | B | B | B | B | B | B | B | B | B | B |
| Shrub | 0-0.5 | B | C | C | C | C | C | C | C | C | C |
| Shrub | 0.5-1.0 | B | C | C | C | C | C | C | C | C | C |
| Shrub | 1.0-3.0 | B | C | C | C | C | C | C | C | C | C |
| Shrub | >3.0 | B | C | C | C | C | C | C | C | C | C |
| Tree | 0-5 | C | C | C | C | C | C | C | C | C | C |
| 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 23 Early Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ANHA | Andropogon hallii | Sand bluestem | Upper |
| CALO | Calamovilfa longifolia | Prairie sandreed | Upper |
| PAVI2 | Panicum virgatum | Switchgrass | Upper |
| BOGR2 | Bouteloua gracilis | Blue grama | Lower |

Description

This class represents an array of early species, including annuals and resprouting perennials. Class A is a mix of bare sand, including blowouts and sand draws, and extensive areas of sparse vegetative cover ranging up to 20%. The persistence of this class depends on continual disturbances, such as wind erosion, drought, and grazing, that inhibit the establishment of vegetation. This class lasts for 3yrs. Buckwheat (*Eriogonum annuum*) and horseweed (*Conyza* *canadensis*) may dominate after disturbance.

Frequent wind/weather stress in this class refers to high-wind events, which occur normally. But, fire and drought are what create the conditions to have the wind affect the class and reset it.

Native grazers can accelerate or maintain this stage, or slow this process, depending on when the grazing occurs and its intensity. Because all these effects occur naturally and frequently, they were not modeled.

If there are good climatic conditions, this stage can cycle more quickly, so this was modeled as alternate succession.

Currently, there is <20% in Class A. There is probably only about 5% in this class.

*Maximum Tree Size Class*  
None

Class B 69 Late Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ANHA | Andropogon hallii | Sand bluestem | Upper |
| CALO | Calamovilfa longifolia | Prairie sandreed | Upper |
| PAVI2 | Panicum virgatum | Switchgrass | Upper |
| PRAN3 | Prunus angustifolia Marshall | Chickasaw plum | Mid-Upper |

Description

Class B is sandhill grassland, the dominant historical condition. This class has a moderately dense herbaceous layer (20-80% cover) up to 1m tall. Shrubs may make up to 25% of the cover, but is more commonly 0-10%. Native grazing maintains this class. Severe, multiple-year drought moves this class to Late Development 1 - Closed by reducing grass cover and fuel loads, and by giving a competitive advantage to the usually spare shrub cover.

*Maximum Tree Size Class*  
None

Class C 8 Late Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ARFI2 | Artemisia filifolia | Sand sagebrush | Upper |
| QUHA3 | Quercus havardii | Harvard oak | Upper |
| PRAN3 | Prunus angustifolia | Chickasaw plum | Upper |
| ANHA | Andropogon hallii | Sand bluestem | Upper |
| BOGR2 | Bouteloua gracilis | Blue grama | Upper |

Description

Class C is the shrub-dominated sandhill grassland. Replacement fire returns this class to A. Dominant shrubs include *Artemisia* *filliformis*, *Quercus* *havardii*, and *Prunus* *angustifolia*. Only in rare cases do Tucker sand shinnery oak or Harvard oak dominate, and in even rarer instances it forms a tall motte, usually smaller than a few acres.

*Maximum Tree Size Class*  
None

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:OPN | 0 | Late1:OPN | 3 |
| Late1:OPN | 4 | Late1:OPN | 999 |
| Late1:CLS | 45 | 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** |
| Wind or Weather or Stress | Early1:OPN | Early1:OPN | 0.33 | 3 | No | 0 |
| Native Grazing | Early1:OPN | Early1:OPN | 0.5 | 2 | No | 0 |
| Alternative Succession | Late1:OPN | Late1:CLS | 1 | 1 | Yes | 40 |
| Wind or Weather or Stress | Late1:OPN | Late1:CLS | 0.01 | 100 | Yes | 0 |
| Replacement Fire | Late1:OPN | Early1:OPN | 0.1 | 10 | Yes | 0 |
| Native Grazing | Late1:OPN | Late1:OPN | 0.2 | 5 | No | 0 |
| Replacement Fire | Late1:CLS | Early1:OPN | 0.1 | 10 | Yes | 0 |

References

Bragg, T.B. 1986. Fire history of a North American sandhills prairie. Page 99 In Program of the Ivth International Congress of Ecology, Syracuse University, Syracuse, New York. 10-16 August 1986.

Bragg, T. B. 1997. Response of a North American sandhills grassland to spring, summer, and fall burning: Community resistance to disturbance (1984-1996). In Bushfires 97 Proceedings, B. J. McKaige, R. J. Williams, and W. M. Waggitt, editors. Parks Australia North and CSIRO Tropical Ecosystems Research Centre, Darwin, Northern Territory, Australia.

Bragg, T.B. 1998. Fire in the Nebraska Sandhills Prairie. Pages 179-194 in Fire in ecosystem management: Shifting the paradigm from suppression to prescription, T.L. Pruden and L.A. Brennan, editors. Tall Timbers Fire Ecology Conference Proceedings No. 20, Tall Timbers Research Station, Tallahassee, FL.

NatureServe. 2007. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. Data current as of 10 February 2007.

Steuter, A.A., E.M. Steinauer, G.L. Hill, P.A. Bowers and L.L. Tieszen. 1995. Distribution and diet of bison and pocket gophers in a sandhills prairie. Ecological Applications, 5(3): 756-766.

USDA-NRCS Ecosite/Range Site Descriptions, Section II, Field Office Technical Guides.

http://www.nrcs.usda.gov/Technical/efotg/.