14200

Northern Tallgrass Prairie

BpS Model/Description Version: Aug. 2020

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

Herbaceous

Map Zones

39, 40, 42

Model Splits or Lumps

This BpS is lumped with: 1421, 1488

Geographic Range

This would occur in The Nature Conservancy's ecoregion Northern Tallgrass Prairie or ECOMAP (Cleland et al. 2007) subsections 222Na and 251Aa down south through 251Bf. This occurs in the eastern portion of map zones (MZ)s 39 and 40.

This type encompasses Bailey's Ecoregion 251. See Samson et al. 1998.

This system is found primarily in the Northern Tallgrass ecoregion ranging along the Red River basin in Minnesota and the Dakotas to Lake Manitoba in Canada. It constitutes the northernmost extension of the "true" prairies (NatureServe 2007).

Biophysical Site Description

Soils are typically deep mollisols. Surface soil textures are primarily loam, silt loam and silty clay loam and the landscape is level to gently rolling. Glacial activity shaped the landscape of this type and landforms of the region reflect this. They are primarily glacial lakeplains, alluvial outwash fans, beach ridges. Potholes (shallow depressional wetlands) are also embedded within the tallgrass prairie landscape. These wetlands range in size from tenths to hundreds of acres.

Precipitation ranges from 17-36in.

Vegetation Description

Grassland groupings of the Northern Tallgrass Prairie are the bluestem prairie from southern Manitoba through eastern North Dakota and western Minnesota, and the wheatgrass, bluestem and needlegrass area from south-central Canada through east-central North Dakota and South Dakota (Samson et al. 1998). The northern character of this type is reflected in the greater proportion of cool-season than warm-season species that characterize the southern tallgrass prairie. *Andropogon gerardii* generally is the principal dominant in the uplands with lesser abundance of *Sorghastrum nutans* compared to tallgrass prairies further south (Carpenter 1940, Smeins and Olsen 1967) and the generally higher abundance of species such as *Elymus trachycaulus* ssp. *subsecundus, Elymus canadensis, Koeleria macrantha, Stipa spartea,* and *Sporobolus heterolepis*. The grasses are characteristically tall (~1-2m) and vegetative cover is high. Wetter areas and lowlands are dominated by species such as *Spartina pectinata* with *Carex* spp abundant in the understory. Historically, woody vegetation was limited to fire-protected areas (e.g. along larger riparian areas). In the west, cool season and mid-height grasses were more characteristic of the dominants (i.e. *Pascopyrum smithii*).

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| ANGE | *Andropogon gerardii* | Big bluestem |
| PAVI2 | *Panicum virgatum* | Switchgrass |
| ELTRS | *Elymus trachycaulus ssp. subsecundus* | Slender wheatgrass |
| SPHE | *Sporobolus heterolepis* | Prairie dropseed |
| HESP11 | *Hesperostipa spartea* | Porcupinegrass |

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

Disturbance Description

Fire and grazing were the dominant disturbances in this type.

Fire: Fire return interval (FRI) was short with stand replacement fires occurring approximately every 3-5yrs (Wright and Bailey 1982). As grassland fires go, these are high severity fires with high fuel loads during dormant season headfires. It was even possible to have more than one fire in a growing season with the high fuel loading that occurred in this region (Severson and Sieg 2006). Because rate of spread is high and residence time is low, though, the effect of fire on below-ground biota was of little if any consequence. The above-ground component is consumed during burning but the plants themselves remain (below ground) and return in approximately the same composition as occurred before the fire. With few exceptions (e.g. space for annuals, *Linum rigidum*, etc.) to germinate), before-fire composition is the same as after-fire composition with the plants generally growing more vigorously.

Fuel accumulation occurs more slowly in the more xeric mixedgrass prairie than in the more mesic tallgrass prairie (Bragg 1995) which results in a more frequent mean FRI for tallgrass prairie. Also, precipitation in the tallgrass prairie area is greater than in prairies to the west thus woody plant invasion is not as rapid, although it occurs in both ecosystems. Differences in plant production, mean fire return intervals, historic grazing conditions (the mixedgrass prairie is the center of the bison range) and species composition (and interactions among all of these) suggests that tallgrass prairie functions differently than mixedgrass.

Grazing: Bison, with peripheral help from grasshoppers, elk, antelope and a myriad of smaller animals made herbivory one of the dominating factors of the northern tallgrass prairie (Severson and Sieg 2006). With estimates of 30-60m bison in the Northern Great Plains (Isenberg 2000), herbivory by large mammals also was a significant disturbance to the grasslands. Bison herbivory occurred in a mob grazing or flash grazing method, with extensive herds migrating across the prairie as they graze. Modern rotational grazing systems simulate this by resting areas after intensive grazing. Elk, too, may have played an important role than generally believed, particularly in the eastern portion of the zone. Whether bison or elk, large mammals preferentially grazed recently burned sites.

Disturbance from the interaction of fire and grazing, when combined with climatic gradients and landscape features (geography, hydrology and topography), created a mosaic of vegetative structure across the Northern Tallgrass Prairie landscape. Without these disturbances, Northern Tallgrass Prairie most likely would have succeeded to shrubland or woodland. Changes in the location of the prairie-forest ecotone may have occurred over the millennia. In the absence of human intervention (e.g. prescribed fire, aggressive woody plant removal, etc.) much of the Northern Tallgrass Prairie could succeed to shrubland or woodland.

Fire and grazing disturbances would have similar effects in temporary and seasonal wetlands, as well as in the wet meadow zone of the semi-permanent wetlands. Ponded wetlands would add to the patchy/mosaic nature of the fire effects over the landscape. Pothole hydrology is highly influenced by annual and long term climatic gradients; wet and drought cycles have persisted through history.

The climate would have also played a pivotal role in the development of the grasslands, especially considering that periodic droughts would have limited growth and expansion of trees. It is important to consider the climatic extremes in portions such as the tallgrass prairie of the Dakota's and western Minnesota to understand the distribution of grasslands, not the long-term averages. As an example, the drought of the 1930’s would have significantly impacted the vegetation on the landscape, especially reducing woody vegetation. Also, during drought years, other factors such as grazing and fire would have even had a stronger impact on the vegetation.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 6 | 100 |  |  |
| Moderate (Mixed) |  |  |  |  |
| Low (Surface) |  |  |  |  |
| All Fires | 6 | 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

Disturbance varied widely in size. Fires would have ranged from 10s-1000s of acres. Most fires were stand replacement in nature. Once ignited, dormant season fires would have spread over a large area until reaching a major firebreak (e.g. previously burned area, major river, rugged terrain, etc.) or a weather event (precipitation, wind direction change, humidity change, etc.). Growing season (mid-May to mid-August) fires may have been frequent but smaller in size than dormant season fires due to the greenness of the fuel and rain following lightning ignition. Growing season fires during drought years would have been much like dormant season fires. Mosaic fires were probably a result of patchy disturbed areas, topography, geography, hydrology and climate.

Bison herbivory occurred in a mob grazing or flash grazing method, with extensive herds migrating across the prairie as they graze. Modern rotational grazing systems simulate this by resting areas after intensive grazing.

Adjacency or Identification Concerns

Depending on historic drought conditions, the ecotone between 1420 (and adjacent savannas) and 1132 may have shifted latitudinally. Northern Tallgrass Prairie is similar to the Central Tallgrass Prairie which abuts and grades into the Northern Mixed Prairie to the west, and into Oak Savanna to the east, and aspen parklands to the north and east.

This system is similar to Western Tallgrass Biophysical Setting (BpS) 1150. Models are very similar.

Within Northern tallgrass prairie, saline areas with high water tables exist and have formed unique vegetative communities.

The vast majority of the Northern Tallgrass Prairie has been converted to agricultural production or urbanization, leaving less than one percent of the native sod (Samson and Knopf 1998).

An estimated 98% of historic wetlands of this zone have been lost. Remaining wetlands are often highly degraded (i.e., sediment-filled, invaded by non-native plants, poor water quality due to agricultural runoff).

There was also some debate in map zones (MZ)s 39 and 40 as to whether or not potholes should be lumped into the tallgrass systems. It was decided that they would be split out. When there is water, the potholes are a system. Drought converts the aquatic system to terrestrial. The system goes in and out of existence based on weather patterns. There is also a temporal shift where potholes might go out of existence. Permanent wetlands are further east, but further northwest through to western Dakota, they go in and out of this pothole state.

Cattle grazing practices (equal use across pastures) have resulted in more continuous plant matter (= fuel) causing more uniform fires across the landscape where, with bison grazing, fires may have been more patchy. Heavier grazing also may have altered the species composition, perhaps favoring more cool-season species over warm-season species which would affect both mean fire return interval and the season during which fires might occur. Differences in bison and cattle grazing may have affected the invasibility of prairie by woody plants which, ultimately, would affect fire conditions.

Unmanaged prairie remnants are heavily invaded with woody vegetation and invasive species such as smooth brome, Kentucky bluegrass, and noxious weeds such as Canada thistle, leafy spurge, plumeless thistle, bull thistle, etc. Wetlands are often dominated by monotypic stands of non-native reed canary grass varieties or narrow-leaf and/or hybrid cattail.

Invasive woody species such as buckthorn, Russian olive, and salt cedar pose significant threats in tallgrass prairie.

Grassland areas that are heavily invaded with smooth brome or Kentucky bluegrass may appear similar to native sod areas simply because of grass presence, regardless of species composition or structure.

Very little of classes A and B remain on the landscape today; most is in classes C or D.

Issues or Problems

Adjusted native grazing in class A in BpS 14200 from 0.6 to 0.3 to get reference conditions to improve in LANDSUM (M.H. Weber 1/17/08 at MFSL). There was some debate in MZs 39 and 40 as to whether or not potholes should be lumped into the tallgrass systems. It was decided that they would be split out. When there is water, the potholes are a system. Drought converts the aquatic system to terrestrial. The system goes in and out of existence based on weather patterns. There is also a temporal shift where potholes might go out of existence. Permanent wetlands are further east, but further northwest through to western North Dakota, they go in and out of this pothole state.

Modelers for MZs 39 and 40 used best professional judgment to estimate the historic tallgrass prairie conditions. This area is highly converted to cropland and good examples of historic vegetation communities are rare. We did not change many of the model dominant species or class indicator species. These do vary across the North Tallgrass prairie group and there may be literature or experts who could help refine these for the whole system. We did not feel comfortable with some of the species listed but much of our knowledge is based on the present conditions and our experience with our local work areas.

Native Uncharacteristic Conditions

Some riparian areas may contain woody cover that would have been protected from fire and experienced minimum grazing intensity.

Cattle grazing practices (equal use across pastures) have resulted in more continuous plant matter.

Comments

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 | B | B | B | B | B | B |
| Herb | 0.5-1.0 | A | A | A | A | B | B | B | B | B | B |
| Herb | >1.0 | A | A | A | A | B | B | B | B | B | B |
| Shrub | 0-0.5 | C | C | C | C | UN | UN | UN | UN | UN | UN |
| Shrub | 0.5-1.0 | C | C | C | C | UN | UN | UN | UN | UN | UN |
| Shrub | 1.0-3.0 | C | C | C | C | UN | UN | UN | UN | UN | UN |
| Shrub | >3.0 | C | C | C | C | UN | UN | UN | UN | UN | UN |
| Tree | 0-5 | D | D | D | D | UN | UN | UN | UN | UN | UN |
| Tree | 5-10 | D | D | D | D | UN | UN | UN | UN | UN | UN |
| Tree | 10-25 | D | D | D | D | 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 31 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ANGE | Andropogon gerardii | Big bluestem | Upper |
| PAVI2 | Panicum virgatum | Switchgrass | Upper |
| HESP11 | Hesperostipa spartea | Porcupinegrass | Upper |
| SONU2 | Sorghastrum nutans | Indiangrass | Upper |

Description

This is the post-fire, post-grazing community from immediately after a replacement fire until one year after the fire. Immediately following the fire, there are no above ground plants and no litter. Plants emerge within weeks and typically, within a year, the grasses range from 1-1.75m high. For a spring burn, ideally this stage would only last three months; therefore, this stage was modeled to end at one year. This also represents the post-grazing stage with grasses and forbs grazed and kept to a low stature. Graminoids are abundant but the forb component is higher in this stage than others. Dominant species are those common to the Northern Tallgrass Prairie - *Andropogon gerardii, Panicum virgatum, Koeleria macrantha*, and *Stipa spartea*; they are present but much shorter and in somewhat less abundance. Some forbs are more abundant in the immediate post-fire vegetation. There was a wide diversity of early successional forbs, such as *Artemisia ludoviciana* and *Ambrosia artemisifolia. Carex* spp. are also present in the lower layer.

Annual burns and sometimes two burns in a single year (spring burns can easily be followed by fall, dormant season burns) can occur in some spots. For fire (and to some extent grazing) in pre-European times, there really are only two basic stages: (1) immediately after the fire, until fuel accumulates, and (2) any time after a year’s growth has accumulated as fuel and it is available for fire. (One can make further subdivisions, such as the time until fuel accumulates to pre-burn conditions, but this is difficult to identify, is not easily mapped, and is not an important factor in burning since a fire can occur with only one growing season’s fuel accumulation.) It seems that historically, any portion of the map zone that did not burn would have succeeded to trees some time ago and that, theoretically, there would be little if any of this sere in the pre-European landscape. Subsequent stages occur today in the absence of historic disturbances.

Further, fires in class A would not have substantially changed the community composition. In this ecosystem a “replacement” fire only removes litter and some standing plant matter, it does not change composition (except for uncommon annuals).

*Maximum Tree Size Class*  
None

Class B 59 Mid Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ANGE | Andropogon gerardii | Big bluestem | Upper |
| PAVI2 | Panicum virgatum | Switchgrass | Upper |
| SONU2 | Sorghastrum nutans | Indiangrass | Upper |
| HESP11 | Hesperostipa spartea | Porcupinegrass | Upper |

Description

This community develops post-fire after a few months or 1yr+.

The immediate post-fire community differs briefly (~3mos) from pre-burn conditions except for litter. It would be difficult to map the burned area one growing season after a burn (<1yr).

Class B occurs in the absence of fire, grazing, or other disturbance. The structure is more closed and taller, and there is some thatch buildup but this is still limited due to the limited time since fire. Tall grasses are still dominant, woody vegetation (shrubs and trees) are widely scattered and limited to micro sites that escaped fire or to mature fire resistant trees. Both of these occur more commonly in the eastern parts of this Type. Dominant species are still those common to the Northern Tallgrass Prairie - *Andropogon gerardii, Panicum virgatum, Sorghastrum nutans* and *Stipa spartea.* *Carex* spp. are also present in the lower layer. This above describes little difference between shortly after and 1+yr after a fire.

*Maximum Tree Size Class*  
None

Class C 8 Late Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| HESP11 | Hesperostipa spartea | Porcupinegrass | Middle |
| ANGE | Andropogon gerardii | Big bluestem | Upper |
| PAVI2 | Panicum virgatum | Switchgrass | Upper |

Description

This class reflects fuel accumulation beyond that normal for tallgrass prairie. Grasses are dominant, at least 75%. Historically, at least theoretically, this would not have been a significant component of the ecosystem because once woody plants are established, there is little that will get rid of them. The result is permanent, established woody areas in protected areas but with less of the landscape transitioning to this class. Historically, woody plants were not reported to be expanding their range. Sites in this class are beyond the normal fire return interval. Litter buildup is high and fires in this class would likely be intense. Woody vegetation is still limited but increases with time since fire. This class will have more of a woody component than other classes except class E, but the woody component is mostly shrubs (e.g., *Prunus, Sumac, Cornus*, etc). Dominant species are those common to the Northern Tallgrass Prairie: *Andropogon gerardii, Koeleria macrantha, Panicum virgatum*, and Stipa spartea.

*Maximum Tree Size Class*  
None

Class D 2 Late Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| POTR5 | Populus tremuloides | Quaking aspen | Upper |
| QUMA2 | Quercus macrocarpa | Bur oak | Upper |
| ANGE | Andropogon gerardii | Big bluestem | Middle |
| RHGL | Rhus glabra | Smooth sumac | Upper |

Description

This class reflects both fuel accumulation and establishment of woody plants. The dominant lifeform is still a grassland component; however, woody vegetation has encroached to the point of (primary shrub, some trees) reaching a state where they can no longer be removed by fire. Grasses comprise 60% and shrubs/trees 40%.

Shrub/scrub where woody species have been able to become savanna live because off disturbance (fire and/or intense grazing). Quaking aspen (*Populus tremuloides*), bur oak (*Quercus macrocarpa*), willow (*Salix* spp.), hazel (*Corylus* spp.) and alder (*Alnus* spp.) are the most common and can form dense thickets, although the bur oak and quaking aspen are small in size and make up 2-5% of the class. Dogwood might also be present. Grasses are still abundant in the understory and include *Andropogon gerardii, Panicum virgatum, Koeleria macrantha,* and *Stipa spartea*.

Replacement fire is modeled to occur frequently. However, present data suggest that, at least with deciduous species, fire does not remove the woody plants; thus, a fire of any type in this category might have kept it in D but just reduced the size of the woody plants. However, it is also thought that, historically, this class would not have occurred frequently and, therefore, fire would still be frequent through the landscape. Grazing was also modeled in this same way.

*Maximum Tree Size Class*  
None

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Mid1:CLS | 1 |
| Mid1:CLS | 2 | Late1:CLS | 7 |
| Late1:CLS | 8 | Late1:ALL | 11 |
| Late1:ALL | 12 | 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 | 0.125 | 8 | Yes | 0 |
| Native Grazing | Early1:ALL | Early1:ALL | 0.3 | 3 | Yes | 0 |
| Replacement Fire | Mid1:CLS | Mid1:CLS | 0.1 | 10 | No | 0 |
| Replacement Fire | Mid1:CLS | Early1:ALL | 0.1 | 10 | Yes | 0 |
| Native Grazing | Mid1:CLS | Mid1:CLS | 0.15 | 7 | No | 0 |
| Native Grazing | Mid1:CLS | Early1:ALL | 0.15 | 7 | Yes | 0 |
| Replacement Fire | Late1:ALL | Early1:ALL | 0.1429 | 7 | Yes | 0 |
| Native Grazing | Late1:ALL | Early1:ALL | 0.1429 | 7 | Yes | 0 |
| Native Grazing | Late1:CLS | Early1:ALL | 0.1429 | 7 | Yes | 0 |
| Replacement Fire | Late1:CLS | Early1:ALL | 0.2 | 5 | Yes | 0 |

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