14200

Northern Tallgrass Prairie

BpS Model/Description Version: Aug. 2020

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

Herbaceous

Map Zones

41

Model Splits or Lumps

This BpS is lumped with: 1488 and 1421

Geographic Range

Northern Central tallgrass prairie is found in sections (Cleland et al. 2007) 222Ma, 222Mb, 222Na, 222L, 222K and 222Jb, Jh and Ji, 251 Ba and 251 Aa. This type is found across central midwestern states with typical prairie border forests and prairie peninsula regions of eastern states Iowa, northwest Missouri, Minnesota, Wisconsin, Illinois, Indiana, Kentucky and Ohio. The system interfaces and mingles on the east with the oak savanna and on the west with mixed grass prairie. It is distributed with north central sand and gravel tallgrass which represents the dry prairie segment.

Biophysical Site Description

Within the area of the prairie border forests (Abrams 1992), prairie vegetation dominated the landscape with oak-hickory forests existing within fire-protected ravines or along stream corridors forming gallery forests (Abrams 1992). While the region is strongly influenced by dry continental air flow patterns and periodic drought, historic fire frequency determined the prairie-forest boundary with much variation based on topography, fuel breaks, ignition sources, and climate (Whitney 1994, Anderson and Bowles 1999). Much has been written concerning these systems and excellent reviews can be found in Curtis (1959), Whitney (1994) and Anderson, Fralish and Baskin (1999). The area is primarily mollic grassland soils incorporating mesic and hydric prairie types (Curtis 1959). Mesic prairies occurred on flat and rolling topography including some on glacial outwash with porous subsoil of sand and gravel. Rolling areas were characterized by glacial till of recessional moraines or on residual aeolian loess deposits. Soil profiles consist of a black surface layer rich in organic material with high water-holding capacity. Wet prairies were found on poorly drained soils in drainage ways and concave positions on uplands and in lowlands along waterways or in areas subject to inundation. Lowland prairies were in and along waterways or in areas subject to frequent inundation. Soils are rich in organic matter and show evidence of inundation in a gleying layer 3-4ft below the surface. The region is strongly influenced by dry continental air flow patterns and periodic drought (Whitney 1994).

Vegetation Description

Dominated by big bluestem (*Andropogon gerardii*), Indiangrass (*Sorghastrum nutans*) and prairie dropseed (*Sporobolus heterolepsis*) on more mesic sites with prairie cordgrass (*Spartina pectinata*) and bluejoint grass (Calamagrostis canadensis) dominating the wet sites. Secondary species such as little bluestem (*Schizachyrium scoparium*) and porcupine grass (*Stipa spartea*) occupied the drier portions of these uplands and soil types and varied in importance. Forb families had their largest representation in Aster and legume. Conspicuous perennial forbs included the genera *Asclepias, Aster, Echinacea, Helianthus, Solidago, Liatris, Dalea*, and *Viola*. Prairie shrubs include the genera *Amorpha, Rosa* spp. and *Ceanothus.*

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| ANGE | *Andropogon gerardii* | Big bluestem |
| SONU2 | *Sorghastrum nutans* | Indiangrass |
| SPHE | *Sporobolus heterolepis* | Prairie dropseed |
| SPPE | *Spartina pectinata* | Prairie cordgrass |

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

Disturbance Description

Frequent fires impacted this prairie system every 1-3yrs, maintaining grass and forb vegetation. Insect and small mammal herbivory impacts composition and dominance. Large mammals were present in low densities, main grazers were elk and deer, but impacts were likely minimal. Fire played an important role in the maintenance of the tallgrass prairie (Curtis 1959, Vogl 1964, Anderson 1990). Fire could occur throughout the year with larger, less frequent fires occurring during the dormant season, and smaller, more frequent fires occurring during the growing season. Native American burning, essential to maintaining the eastern tallgrass prairie, was bimodal in distribution, peaking in April and October with lightning ignition occurring primarily during July and August (Higgins 1986). Bison grazing as a major disturbance was likely much more limited than prairies further west. Elk probably contributed to the impact of grazing and browsing as well but it is assumed that the total contributions of these two species was still considerably less than to the west. The elk may have contributed to the reduction of young woody saplings invading prairie adjacent to protected woody areas.

Ortmann in his review suggested that in addition to fire, drought, and grazing, that insect outbreaks would have impacted all classes.

Drought would have set back woody species invasion and would have increased fire intensity. Lack of winter snowfall would have reduced woody species due to desiccation of soils (citation pending).

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 4 | 100 | 2 | 5 |
| Moderate (Mixed) |  |  |  |  |
| Low (Surface) |  |  |  |  |
| All Fires | 4 | 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

Within regions of varied topography, type patches are typically large (>1000ac) most prevalent on flat to rolling topography. 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.). Growing season 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. Mixed fires were probably limited to patchy grazed areas or areas where fuel was not uniformly cured.

Adjacency or Identification Concerns

Northern and central tallgrass prairie would be adjacent to north-central interior oak savanna, north-central oak barrens, north central interior sand and gravel prairie and sedge meadows and wet prairie.

Synonymous names for this system include: mesic prairie, wet prairie, deep soil prairie and blacksoil prairie.

This Biophysical Setting (BpS) might be confused with the north central interior sand and gravel prairie.

In the absence of historic fire invasive problems have increased dramatically, including gray dogwood, American plum, hazelnut. Exotics that have become invasive due to agricultural practices and roadside plantings include reed canary grass, leafy spurge (*Euphorbia esula*), sweet clover (*Melilotus alba*), crown vetch, yellow parsnip and birds foot trefoil. Domestic livestock grazing is also an issue.

Today this system has a severely reduced native cover (~99.9% loss) particularly for the mesic component of this type due to conversion to other uses such as agriculture. In addition to the massive reduction in extent of mesic prairie, the scale of its occurrence has also severely been altered. Currently this type occurs in fragmented small patches ranging from 1-10ac. Altering of the type is due to grazing and reduced fire resulting in greater shrub and tree component and a variety of native and non-native shrubs, and non-native cool season grasses (brome, bluegrass, quackgrass and redtop) resulting in reduced diversity.

This system has mainly been converted to agriculture and other development. Invasion of cool season grasses and shrubs often mask the identification of this type. It may be difficult to determine the difference between old fields and native prairie patches by using aerial photos or remote sensing data.

Again, species composition and structure were dependent on local factors such as topography, soil conditions, fire regime, plant competition and plant-animal interactions (Anderson and Bowles 1999).

As indicated this system interfaces and mingles on the east with oak savanna and on the west with mixed grass prairie (in Nebraska and the Dakotas). On the east there would be limited woody invasion from protected areas during periods of increased precipitation. The woody component would be limited to the edge the prairie and would not exhibit any appreciable effect overall. Since mixed grass prairie is to the west, there would be little effect except in periods of extended drought the percentage of the mixed grass species would increase.

This system differs functionally from North-Central Interior Sand and Gravel Tallgrass prairie due to fire intensity, e.g., heavier fuels leading to higher fire intensity and a stronger grass competition for trees and shrubs to come in, so it's more difficult for trees and shrubs to come into this system.

Issues or Problems

The plant/animal interactions are not fully understood for this model and numerous studies of these phenomena are ongoing. Research exists for bison/fire interaction in detail in the western range of this system (i.e. Kansas and Nebraska). Also, there is possible overlap with the North Central Interior Oak Savanna model (BpS ID 1394, map zones [MZ]s 41, 50 and 51). There is variation in oak species composition across the broad region covered by this model (i.e., bur oak [*Quercus macrocarpa*] increases in prevalence in the western portion of the range). There is also great variation in prairie type across this region. Within the western ranges of this type there was a grazing and fire interaction. As one moves east in this region fire increases to where it is the major disturbance factor for this type and grazing drops out as an influence. The species composition also changes from east to west. Much of the literature on fire in the tallgrass prairie does not include interaction with herbivory (Engle and Bidwell 2001) thus interpreting effects must be qualified. In addition, little is known about native ungulate grazing in this area. It is generally accepted that bison grazing was less in this grassland than in grasslands to the west. Even within this type grazing likely played a larger role as one moves from east to west. Further, it has been recently suggested that elk populations may have been large enough to have an effect on vegetative composition. Some woody plant invasion may have occurred but it was limited to areas close to seed sources such as along the eastern interface with the savanna and around woody pockets and river valleys.

This model in MZ41 was originally labelled as Central Tallgrass Prairie (14210), which was not totally appropriate; therefore, we re-labelled the version of this model in MZ41 to Northern Tallgrass Prairie (1420).

Native Uncharacteristic Conditions

Many small trees and shrubs would be uncharacteristic of this system historically but occurs today due to the lack of fire. Domestic livestock grazing has also severely degraded this system. Haying would also have altered the species composition, especially for forbs species. Insects may not be as prevalent in modern times due to fragmentation (hypothesis by Tim Christiansen, personal communication).

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 | C | C | C | C | UN | UN | UN | UN | UN | UN |
| 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 | 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 40 Early Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ANGE | Andropogon gerardii | Big bluestem | Upper |
| SONU2 | Sorghastrum nutans | Indiangrass | Upper |
| SPPE | Spartina pectinata | Prairie cordgrass | Upper |
| SPHE | Sporobolus heterolepis | Prairie dropseed | Upper |

Description

Post-fire Regrowth Stage duration: one year. From blackened state, rapid regrowth of fire positive and fire neutral perennial vegetation to maximum height by end of growing season. Warm season grasses and fire positive forbs display increased height, flowering and fruiting and appear to be more abundant depending on season of the burn. Annual, biennial and short-lived perennial species occupy space opened by litter removal. Fire neutral perennial forbs maintain pre-fire composition, but may appear to be reduced. Fire negative species are reduced. No litter accumulation in this class. Open refers to absence of tree or shrub canopy cover. All surface fires are replacement in this system.

The cover in this class is defined as 0-70% for mapping purposes. However, it could go up to 100% cover.

*Maximum Tree Size Class*  
None

Class B 58 Mid Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ANGE | Andropogon gerardii | Big bluestem | Upper |
| SONU2 | Sorghastrum nutans | Indiangrass | Upper |
| SPPE | Spartina pectinata | Prairie cordgrass | Upper |
| SPHE | Sporobolus heterolepis | Prairie dropseed | Upper |

Description

Unburned Stage. This unburned stage continues to be dominated by big bluestem (*Andropogon gerardii*), Indiangrass (*Sorghastrum nutans*) and prairie dropseed (*Sporobolus heterolepis*) on more mesic sites with prairie cordgrass (*Spartina pectinata*) and bluejoint grass (*Calamagrostis canadensis*) dominating the wet sites. Secondary species such as little bluestem (*Schizachyrium scoparium*) and porcupine grass (*Stipa spartea*) occupied the drier portions of these uplands and soil types and varied in importance. Perennial forbs include genera such as *Asclepias, Aster, Echinacea, Helianthus, Solidago, Liatris, Dalea,* and *Viola*. Noticeable scattered shrubs, *Amorpha, Rosa* spp and *Coenothus*, annually increase in size. Litter accumulates annually. Annuals, biennials and short-lived perennials gradually become less abundant.

A cool fire of low intensity will probably maintain the class and won't remove all thatch; some shrubs will survive. However, if a hot fire meets an accumulation of fuels, it could be replacement. No fire for several years causes a state class change.

The cover in this class is defined for mapping purposes as 71-100%. Some shrubs might be coming up in this stage.

*Maximum Tree Size Class*  
None

Class C 2 Late Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ANGE | Andropogon gerardii | Big bluestem | Middle |
| SPPE | Spartina pectinata | Prairie cordgrass | Middle |
| SALI | Salix ligulifolia | Strapleaf willow | Upper |
| CORA6 | Cornus racemosa | Gray dogwood | Upper |

Description

Class C is an unburned thatch accumulation stage. The herbaceous layer is still dominant, but the grass cover is declining due to thatch. This class may not be as dense but it is a continuation of the unburned state from class B. With a lack of fire for the long term, however, the prairie matrix weakens and it is succeeded by woody cover of shrubs and trees, depending on proximity of woody seed sources. Without fire, the length of this stage is dependent on precipitation and temperature as well as topography and soils. It can be inferred that the effect of large ungulates, bison and elk, was highly limited in this region of this type.

As thatch builds up, grasses start to lose vigor and become less competitive, which means shrubs or trees might start moving in more. That would be uncharacteristic, however, because it would be due in part to lack of fire.

*Maximum Tree Size Class*  
None

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:OPN | 0 | Mid1:OPN | 2 |
| Mid1:OPN | 3 | Mid1:OPN | 999 |
| Late1:ALL | 6 | 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:OPN | Early1:OPN | 0.2 | 5 | Yes | 0 |
| Alternative Succession | Mid1:OPN | Late1:ALL | 0.01 | 100 | Yes | 0 |
| Wind or Weather or Stress | Mid1:OPN | Early1:OPN | 0.04 | 25 | Yes | 0 |
| Replacement Fire | Mid1:OPN | Mid1:OPN | 0.133 | 8 | No | 0 |
| Replacement Fire | Mid1:OPN | Early1:OPN | 0.2 | 5 | Yes | 0 |
| Wind or Weather or Stress | Late1:ALL | Early1:OPN | 0.04 | 25 | Yes | 0 |
| Replacement Fire | Late1:ALL | Early1:OPN | 0.08 | 13 | Yes | 0 |
| Replacement Fire | Late1:ALL | Mid1:OPN | 0.255 | 4 | Yes | 0 |

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