14210

Central Tallgrass Prairie

BpS Model/Description Version: Aug. 2020

|  |  |  |  |
| --- | --- | --- | --- |
| **Modelers** |  | **Reviewers** |  |
| John Harrington | jaharrin@wisc.edu | Robert Dana | Robert.Dana@dnr.state.mn.us |
| Rich Henderson | Richard.Henderson@  wisconsin.gov | Dave Cleland | dcleland@fs.fed.us |
| Brad Slaughter | slaughterb@michigan.gov | Tim Christiansen | tim.christiansen@us.army.mil |
|  |  | Jim Drake | jim\_drake@natureserve.org |

**Reviewed by:** John Shuey

Vegetation Type

Herbaceous

Map Zones

49, 52

Geographic Range

Central Tallgrass Prairie is characteristic of much of the central plains states, ranging from eastern Kansas and Nebraska to northwestern Indiana, with outlying occurrences in Michigan and Ohio. This Biophysical Setting (BpS) is local in map zone (MZ) 52, where it is concentrated in two general areas within the Eastern Corn Belt Plains Ecoregion of west-central Ohio: the Darby Plains, west of Columbus, and the Sandusky Plains, concentrated in Marion County (Woods et al. 1998). Prairies occurring in the Huron/Erie Lake Plains Ecoregion of northwest Ohio are referred to BpS 1411, Great Lakes Wet-mesic Lakeplain Prairie. Elsewhere in MZ52, Central Tallgrass Prairie occupied small patches, often associated with oak savanna and oak-hickory forest, sometimes in a broader matrix of beech-maple forest.

Biophysical Site Description

Within MZ52, Central Tallgrass Prairie occupied areas of level to gently undulating, often seasonally wet, ground moraines in the Darby Plains west of Columbus, the Sandusky Plains in Marion, Crawford, and Wyandot Counties, and locally elsewhere in the Eastern Corn Belt Plains Ecoregion. 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 eolian loess deposits. Soil profiles consist of a black surface layer rich in organic material with high water-holding capacity. Within the Darby Plains, these soils are classified as mesic to aquic mollisols. This BpS often graded into wet prairie, oak savanna, and oak-hickory forest in these regions. 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 3-4in below the surface. While the region is 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 region is strongly influenced by dry continental air flow patterns and periodic drought (Whitney 1994).

Vegetation Description

Vegetation of this BpS within MZ52 is largely based on Anderson (1981). Dominant grasses are big bluestem (*Andropogon gerardii*), Indiangrass (*Sorghastrum nutans*), and switch grass (*Panicum virgatum*). 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. Characteristic forbs are tick-trefoil (*Desmodium canadense*), Sullivant’s milkweed (*Asclepias sullivantii*), wild bergamot (*Monarda fistulosa*), Virginia mountain-mint (*Pycnanthemum virginianum*), New England aster (*Aster novae-angliae*), giant sunflower (*Helianthus giganteus*), saw-toothed sunflower (*H. grosseserratus*), prairie coneflower (*Ratibida pinnata*), black-eyed Susan (*Rudbeckia hirta*), prairie dock (*Silphium terebinthinaceum*), whorled rosinweed (*S. trifoliata*), and purple coneflower (*Echinacea purpurea*). In poorly drained areas and along streams, BpS 1488 (Eastern Great Plains Wet Meadow, Prairie, and Marsh) characterized by prairie cordgrass (*Spartina pectinata*) and bluejoint grass locally occurred.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| ANGE | *Andropogon gerardii* | Big bluestem |
| SONU2 | *Sorghastrum nutans* | Indiangrass |
| PAVI2 | *Panicum virgatum* | Switchgrass |
| DECA7 | *Desmodium canadense* | Showy ticktrefoil |
| RAPI | *Ratibida pinnata* | Pinnate prairie coneflower |
| SITE | *Silphium terebinthinaceum* | Silphium terebinthinaceum |
| MOFI | *Monarda fistulosa* | Wild bergamot |
| HEGI | *Helianthus giganteus* | Giant sunflower |

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 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 were less than to the west. The elk may have contributed to the reduction of young woody saplings invading prairie adjacent to protected woody areas. Drought and reduced snowfall would have set back woody species invasion.

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

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 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, and 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 birdsfoot 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 been sharply reduced. 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, non-native shrubs, and non-native cool season grasses (brome, bluegrass, quackgrass, 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 of the prairie and would not exhibit any appreciable effect overall. Since Mixed Grass Prairie is to the west, there would be little effect except that 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 -- heavier fuels leading to higher fire intensity and a stronger grass competition for trees and shrubs to come in. Thus, it is 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, MZ41, MZ50, and MZ51). 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.

Native Uncharacteristic Conditions

Many small trees and shrubs would be uncharacteristic of this system historically but occur 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 forb 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 | A | A | A | B | B | B |
| Herb | 0.5-1.0 | A | A | A | A | A | A | A | B | B | B |
| Herb | >1.0 | A | A | A | A | A | A | A | B | B | B |
| Shrub | 0-0.5 | B | B | B | UN | UN | UN | UN | UN | UN | UN |
| Shrub | 0.5-1.0 | C | C | C | UN | UN | UN | UN | UN | UN | UN |
| Shrub | 1.0-3.0 | C | C | C | UN | UN | UN | UN | UN | UN | UN |
| Shrub | >3.0 | C | C | C | UN | UN | UN | UN | UN | UN | UN |
| Tree | 0-5 | C | C | C | 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 39 Early Development 1 - Open

.

Indicator Species

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

Upper-layer lifeform is not the dominant lifeform. Open refers to absence of tree or shrub canopy cover.

*Maximum Tree Size Class*  
None

Class B 59 Mid Development 1 - Open

Indicator Species

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

Description

Unburned Stage -- Duration: 2-4yrs. This unburned stage continues to be dominated by big bluestem (*Andropogon gerardii*), Indiangrass (*Sorghastrum nutans*), and prairie dropseed on more mesic sites with prairie cordgrass (*Spartina pectinata*) and bluejoint grass 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 *Ceonothus* -- annually increase in size. Litter accumulates annually. Annuals, biennials, and short-lived perennials gradually become less abundant.

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

Upper-layer lifeform is not the dominant lifeform. SPHE refers to Sporobolus heterolepsis.

*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 |
| SONU2 | Sorghastrum nutans | Indiangrass | Middle |
| COAM3 | Corylus americana | American hazelnut | Upper |
| QUMA2 | Quercus macrocarpa | Bur oak | Upper |

Description

Unburned Thatch Accumulation Stage – Duration: 5-20yrs. Continuation of unburned state from Class B; however, with lack of fire for the long term, 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 will start to lose vigor and become less competitive, and then shrubs or trees might start moving in, which would be uncharacteristic because that would be due in part to lack of fire.

Upper-layer lifeform is not the dominant lifeform. Herbaceous layer is still dominant but grass cover declining due to thatch. Vegetation cover will not be as dense.

*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 |

References

Anderson, D. 1981. Ohio plant community classification and survey. Ohio Department of Natural Resources Division of Natural Areas and Preserves Natural Heritage Program, Columbus, Ohio.

Anderson, R.C. 1990. The Historic Role of Fire in the North American Grassland. In: Collins, S.L and L.L. Wallace, eds. Fire in North American Tallgrass Prairie. University of OK Press.

Anderson, R.C. and M.L. Bowles. 1999. Deep-soil savannas and barrens of the Midwestern United States. In Anderson, R.C., J.S. Fralish and J.M. Baskin, eds. Savannas, Barrens, and Rock Outcrop Plant Communities of North America. Cambridge, UK: 155-170.

Anderson, R.C., J.S. Fralish, and J.M. Baskin, eds. 1999. Savannas, Barrens, and Rock Outcrop Plant Communities of North America. Cambridge, UK: 155-170.

Curtis, J.T. 1959. The Vegetation of Wisconsin. University of WI Press.

Engle, D.M. and T.G. Bidwell. 2001. Viewpoint: the response of central North American prairies to seasonal fire. Journal of Range Management. 54. 2-10.

Higgins, K.F. 1986. Interpretation and Compendium of Historical Fire Accounts in the Northern Great Plains. Resource Publication 161. US Dept of the Interior Fish and Wildlife Service.

Jacquart, E., M. Homoya, and L. Casebere. 2002. Natural communities of Indiana: 7/1/02 working draft. Indiana Department of Natural Resources, Division of Nature Preserves, Indianapolis, IN.

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

Vogl, R.J. 1964. Vegetation history of Crex Meadows, a prairie savanna in northwestern Wisconsin. American Midland Naturalist 72: 157-175.

Vogl, R.J. 1974. Effects of fire on grasslands. In: Kozlowski, T.T. and C.E. Ahlgren, eds. Fire and Ecosystems. Academic Press, New York.

Whitney, G.G. 1994. From Coastal Wilderness to Fruited Plain: a history of environmental change in temperate North America from 1500 to the present. Cambridge University Press, Cambridge, UK.

Woods, A.J., J.M. Omernik, C.S. Brockman, T.D. Gerber, W.D. Hosteter, and S.H. Azevedo. 1998. Ecoregions of Indiana and Ohio (2-sided color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey, scale 1: 500,000.

Woods, A.J., J.M. Omernik, C.L. Pederson, and B.C. Moran. 2006. Ecoregions of Illinois (2-sided color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey, scale 1: 500,000.