15170

Paleozoic Plateau Bluff and Talus

BpS Model/Description Version: Aug. 2020

Vegetation Type

Forest and Woodland

Map Zones

42, 49, 50

Geographic Range

This system is found in the region of southeastern MN, southwestern WI, and northern IA and IL that has escaped recent glaciation. This region is also known as the "driftless area." It is especially prevalent along the Mississipi and Wisconsin Rivers and tributaries within this region.

In LANDFIRE MZs 41 and 50, this system is geographically limited to section 222L.

Biophysical Site Description

This system is found predominantly on dry bluff tops, upper slopes, cliffs and talus fields in the “driftless area” of MN, WI, IA and IL (Section 222L). Characteristic substrate conditions are loess-covered dolomite caps over sandstone (Kline and Cottam 1979). The juxtaposition of more slowly-eroding dolomite over easily eroded sandstone creates deeply-dissected terrain and fairly steep slopes. Bedrock is primarily sedimentary dolomite, limestone, and sandstone of Paleozoic origin, but also includes quartzite of Proterozoic (Precambrian) origin in the Baraboo Hills of Wisconsin.

Soils range from thin to moderately deep primarily loess deposits and can range from moderately to excessively well-drained, often with a high mineral content. Slopes range from extremely steep on cliffs to moderate on mid and upper slopes to nearly flat on bluff tops.

A combination of landform, slope and bedrock geology is most likely required for mapping this system. In particular, limiting this system to sites where landform indicates ridgetops, upper slopes, or where slopes exceed 30-40% in Section 222L would capture the main distribution of this system.

Vegetation Description

This system is composed of several fairly distinct communities, the composition of which is primarily a function of site characteristics and landscape position. These communities are only partially linked by processes of succession and disturbance.

Dry and dry-mesic prairies primarily occurred on exposed south and west facing slopes and bluff tops where well-drained and often thin soils (McClain &nd Ebinger 2002) and high fire frequency would have limited establishment of trees. Characteristic species include Schizachyrium scoparium, Andropogon gerardii, Pulsatilla patens, Artemisia caudate, Oligoneuron album, Symphyotrichum pretense, Bouteloua curtipendula, Dichanthelium linearifolium, Solidago nemoralis, Lithospermum incisum, Amorpha canescens, Sporobolus heterolepis, Geum triflorum, Viola pedata and Dodecatheon meadia (Baskin and Baskin 2000, Curtis 1959, McClain and Ebinger 2002).

Red cedar glades, dominated by Juniperus virginiana, occurred on steep, rocky sites or other dry landscape positions where lower fire frequency would have permitted establishment of this fire sensitive species (Baskin & Baskin 2000). Understories of very open stands would have been occupied by the dry prairie species mentioned above, whereas closed stands would have had a poorly-developed understory due to the significant shade cast by the overstory (Curtis 1959).

Oak savannas and woodlands would have occurred on deeper soils on moderately-drained side slopes and bluff tops, where edaphic conditions would permit the establishment of tree species and where fire return intervals were short to moderate. A mixture of oaks was present on these sites, with Quercus alba (white oak) dominating across a wide range of conditions, Quercus velutina occasionally codominating, Quercus rubra (red oak) becoming more prevalent on more mesic loamier sites, and Quercus macrocarpa (bur oak) becoming more prevalent on blufftops with limestone substrates or on lower slopes bordering on broad valleys where fire frequency would have been sufficient to maintain savanna conditions (Curtis 1959, Kline and Cottam 1979, Wilde et al. 1948). Quercus muehlenbergii (chinkapin oak) would have occupied rocky exposed sites in the southern range of this system (Kline and Cottam 1979, Burns and Honkala 1990). Populus tremuloides (trembling aspen) and Populus grandidentata (bigtooth aspen) were present alongside the oaks on more mesic sites with indications of relatively recent 1qdisturbance (Kline and Cottam 1979). Carya ovata (shagbark hickory) was also occasionally present (Wilde et al. 1948).

Southern mesic hardwoods would have occurred on north and east facing slopes with deeper, loamier soils where landscape position would have provided protection from fire. Dominant species include Acer saccharum (sugar maple) and Tilia americana (basswood). Other codominant or occasional species include Quercus alba (white oak), Quercus rubra (red oak), Carya ovata (shagbark hickory), Carya cordiformis (bitternut hickory), Acer rubrum (red maple), Ulmus americana (elm), Celtis occidentalis (hackberry) and Ostrya virginiana (hop hornbeam) (Curtis 1959, Kline and Cottam 1979, Wilde et al. 1948).

Northern forest relicts, including Pinus strobus (white pine), Pinus resinosa (red pine), Pinus banksiana (jack pine), Tsuga canadensis (hemlock) and Betula alleghaniensis (yellow birch) primarily occupied sandstone outcrops, cliffs and deep ravines. The pines, primarily Pinus strobus, would have been especially prevalent on somewhat more exposed north and east facing sandstone outcrops (Ziegler 1995, Wilde et al. 1948) and cliffs with slopes over 40 degrees (Curtis 1959). Tsuga canadensis and Betula alleghaniensis would have been confined to sandstone outcrops in cool, protected coves and ravines.

Algific talus slopes occupy very unique and small-scale sites where limestone and dolomite talus or cracked bedrock facilitate cold air drainage throughout the growing season (Nekola 1999). Slopes tend to be steep and north-facing. The ground layer is dominated by bryophytes and pteridophytes, with overstories of Acer saccharum, Acer spicatum, Abies balsamea, Betula lutea, Betula papyrifera, Fraxinus americana, Juglans cinerea and Pinus strobus (Nekola 1999). This type is critical habitat for monkshood and the Pleistocene snail, among other endemic species.

BpS Dominant and Indicator Species

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

Disturbance Description

Fire regimes ranged from frequent replacement (FRG II) in dry prairies to frequent surface (FRG I) in oak savannas and woodlands, to much less frequent (FRG IV and V) on rocky protected sites or narrow mesic ravines.

Per the IL Fire Needs Assessment survey, Fire Return Intervals for this system (currently) are on average 5 years to maintain good quality habitat in this system and 3 years to restore degraded habitats back to this system. No information on burn severity was provided.

Fire Frequency

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

This system occupies highly variable terrain, and can therefore range from small (<1ha) to quite large (>1000 contiguous ha). Due to the complex terrain, fires spreading through this system were likely limited to hillslope facets and generally small (<100ha).

Adjacency or Identification Concerns

This system intergrades and can be confused with tallgrass prairie systems on moderate side slopes and bluff tops where contiguity of fine fuel permitted high fire frequencies, or on well-drained south and west slopes where establishment of forest systems was limited by edaphic conditions. This system can be distinguished from the tallgrass prairie types by occupying moderate to steep slopes and bluff tops with thin soils, which would lead to a drier, less productive prairie system than the tallgrass prairie types. More productive, deeper soils with high fire frequency, such as lower slopes, are more likely best represented by the tallgrass prairie systems instead of this system.

This system intergrades with North-Central Interior Dry Oak Forest and Woodland (1311) and North-Central Interior Oak Savanna (1394) on exposed south and west slopes with moderate to deep soils. It intergrades with North-Central Interior Dry-Mesic Oak Forest and Woodland (1310) on moderate to deep soils on more northerly or easterly aspects, and with North-Central Interior Maple-Basswood Forest (1314) on the most protected sites and lower mesic slopes.

This system also contains southern relics of more northerly systems, especially Laurentian-Acadian Northern Pine-Oak Forest (1362), Laurentian-Acadian Northern Hardwoods Forest (1302), and Laurentian-Acadian Pine-Hemlock-Hardwood Forest (1366). Where indicators of those systems are found in this subsections on steep slopes and bluff tops, they should be represented by this system.

Issues or Problems

Little data is available on the functional processes of this system, especially fire. Much of the literature for this system was quite old (1930s-1950s), which may have limited the ecological detail described. In particular, no literature was available that stated fire frequencies or other disturbance rates except vaguely. Disturbance and succession rates were based on best guesses as to how this system may function in the larger landscape context of similar floristic systems.

This model was mysteriously absent form the final delivered model set for MZ50. Brendan Ward uploaded latest available copy. QA/QC or review was not conducted.

Native Uncharacteristic Conditions

Anecdotal evidence suggests that Juniperus virginiana is able to readily invade dry and dry-mesic prairies near established seed sources where fire suppression has artificially lengthened fire return intervals (Baskin and Baskin 2000, Holthuijzen Sharik 1984). This has led to signficant increases in red cedar cover in sites that formerly would have lacked a significant woody component.

Many dry prairies and oak woodlands on flat ridgetops were historically converted into agricultural land uses. Lower slopes were also often converted to agriculture or pasture. The remaining sites are often very steep, or possess edaphic conditions that would have prevented agricultural land uses, such as very thin soil or rock outcroppings. Fire suppression has resulted in a major trend toward closed forest conditions, both red cedar as noted above, and oak and mesic woodlands on a larger scale.

Comments

**Model Parameters**

Deterministic Transitions

Probabilistic Transitions

*Using Track Changes in Word you may suggest changes to any of the parameters indicated in the following tables. If you wish to see how those changes impact model results, go to the “Simulation Model Review Instructions” section on* <http://www.landfirereview.org/models.html>*. If you do not wish to edit and run the actual model, the TNC LANDFIRE will do so and if requested provide the reviewer with the results.*

Succession Classes

**Mapping Rules**

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 33 Early Development 1 - All Structures

Indicator Species

Description

Dry Prairie:

This class would be dominated by herbaceous species, including Schizachyrium scoparium, Andropogon gerardii, Pulsatilla patens, Artemisia caudate, Oligoneuron album, Symphyotrichum pretense, Bouteloua curtipendula, Dichanthelium linearifolium, Solidago nemoralis, Lithospermum incisum, Amorpha canescens, Sporobolus heterolepis, Geum triflorum, Viola pedata and Dodecatheon meadia.

*Maximum Tree Size Class*  
None

Class B 8 Mid Development 1 - Open

Indicator Species

Description

Red Cedar Glade: This class would be dominated by red cedar (Juniperus virginiana) with a number of dry prairie species, especially Schizachyrium scoparium, Andropogon gerardii, Bouteloua curtipendula and Solidago nemoralis. This class would arise on rocky, fire protected sites, with available seed sources of red cedar. This class could also arise on somewhat less rocky dry prairie sites where fire frequency is sufficiently low to allow establishment of fire-intolerant red cedar, in addition to requiring that seed sources are available.

Upper Layer Lifeform is not the dominant lifeform. Herbaceous species may dominate this class with 10-70% herbaceous cover.

*Maximum Tree Size Class*  
None

Class C 39 Mid Development 2 - Open

Indicator Species

Description

Oak Savanna and Woodland: This class would be dominated by Quercus alba, Quercus rubra, Quercus velutina and Quercus macrocarpa depending on site location, fire frequency, and soils. The cover of the oaks could range from very open to closed depending on fire frequency and stand development, in addition to soil suitabiilty. Stands on very steep slopes, very thin soils, or edges of bluffs would likely be more open, as would stands experiencing more frequent fire.

Upper Layer Lifeform is not the dominant lifeform. Herbaceous species may dominate this class under very open savanna conditions with 10-90% herbaceous cover.

*Maximum Tree Size Class*  
None

Class D 9 Mid Development 3 - Closed

Indicator Species

Description

Southern Mesic Hardwoods: This class would be dominated by mesic to dry-mesic species depending on the site, especially Acer saccharum, Tilia americana and Quercus rubra. Quercus alba could be present as older individuals that established in class C. As closed canopy conditions persist, the oaks would become less frequent due to their inability to recruit under a closed canopy.

This class could be distinguished from C and E using EVT.

*Maximum Tree Size Class*  
None

Class E 11 Late Development 1 - Closed

Indicator Species

Description

Northern Relict Forest: This class would be dominated by Pinus strobus on sandstone outcrops near suitable seed sources. Pinus resinosa and Pinus banksiana could be occasional associates in landscapes where sufficient seed sources exist. Betula alleghaniensis and Tsuga canadensis could establish on cool cove and ravine sandstone outcrops that are protected from fire and near suitable seed sources; however, these two species are rare to absent within the range of this system.

This class also includes algific talus slopes, with associated rare Pleistocene relict species.

This class could be distinguished from classes C and D using EVT. This type could be mapped to northern forest EVTs such as 2303 (northern hardwoods including Betula alleghaniensis), 2362 (northern pines) and 2366 (Pinus strobus and Tsuga canadensis).

*Maximum Tree Size Class*  
None

Model Parameters

References

Baskin, J.M. and C.C. Baskin. 2000. Vegetation of limestone and dolomite glades in the Ozarks and Midwest regions of the United States. Annals of the Missouri Botanical Garden 87(2): 286-294.

Burns, R.M. and B.H. Honkala. 1990. Silvics of North America. USDA Forest Service Agricultural Handbook 654.

Cahayla-Wynne, R., D.C. Glenn-Lewin. 1978. The forest vegetation of the Driftless Area, Northeast Iowa. American Midland Naturalist 100(2): 307-319.

Hansen, H.P. 1939. Postglacial vegetation of the Driftless Area of Wisconsin. American Midland Naturalist 21(3): 752-762.

Holthuijzen, A.M.A., and T.L. Sharik. 1984. Seed longevity and mechanisms of regeneration of eastern red cedar (Juniperus virginiana L.). Bulletin of the Torrey Botanical Club 111(2): 153-158.

Kline, V.M., and G. Cottam. 1979. Vegetation responses to climate and fire in the Driftless Area of Wisconsin. Ecology 60(5): 861-868.

McClain, W.E., and J.E. Ebinger. 2002. A comparison of the vegetation of three limestone glades in Calhoun County, Illinois. Southeastern Naturalist 1(2): 179-188.

Nekola, J.C. 1999. Paleorefugia and neorefugia: the influence of colonization history on community pattern and process. Ecology 80(8): 24590-2473.

Wilde, S.A., P.B. Whitford, and C.T. Youngberg. 1948. Relation of soils and forest growth in the Driftless Area of southwestern Wisconsin. Ecology 29(2): 173-180.

Ziegler, S.S. 1995. Relict eastern white pine (Pinus strobus L.) stands in southwestern Wisconsin. American Midland Naturalist 133(1): 88-100.