13100

North-Central Interior Dry-Mesic Oak Forest and Woodland

BpS Model/Description Version: Aug. 2020

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

Forest and Woodland

Map Zone

44, 50

Geographic Range

This system spans from the central Great Plains, south to the Ozarks and east to Ohio. The northern boundary of this system occurs in Minnesota and Wisconsin, south of the Tension Zone (i.e., in Province 222).

Biophysical Site Description

This system occurs most commonly on interlobates where outwash, ice-contact, and end moraine landforms are situated between former glacial lobes. Other landforms suitable for development of the dry-mesic oak forest are sandy ground moraine and lake plains. Common to all these landforms is well-drained, acidic soil characterized by loamy sand and sandy loam. Dry landscape settings, such as on western and southern aspects and upper slopes and ridge tops, are conducive to the development of North-Central Interior Dry Oak Forest and Woodland (1311) or North-Central Interior Oak Savanna (1394) rather than this system (Curtis 1959). Eastern and northern slopes with sufficient fire frequency to minimize the mesophytic species are more conducive to the development of this system. With fire suppression, this system expanded into sites formerly occupied by disturbance maintained savannas (Leach & Givnish 1999). Historically, this system represented a small percentage of the oak forest and savanna types (Curtis 1959).

For LANDFIRE mapping, SSURGO map units with moderate to high silt percentages (>40%) on uplands, with taxonomic particle sizes of “fine-silty” or “fine-loamy over sandy” may prove useful for mapping this system. Sites expected to have higher fire frequencies on “fine-loamy” may be included for mapping this system, whereas lower frequencies on these sites would likely indicate North-Central Interior Maple-Basswood Forest (1314). Soil orders are generally Alfisols with Mollisols becoming more important at the interface with prairie and savanna systems.

Vegetation Description

Typically, the vegetation consists of forests dominated by oaks, especially white oak (*Quercus alba*) and red oak (*Quercus rubra*). Black oaks were present on more xeric, sandier sites, whereas red oak was generally more abundant on more mesic, loamier sites. Bur oak was occasionally present on sites with higher fire frequency or on thin calcareous soils (Curtis 1959). White oak spans the range of edaphic conditions encapsulated by this system (Shea et al. 2014). *Prunus serotina* capitalizes on canopy gaps but rarely achieves significant canopy dominance (McCune and Cottam 1985). Other hardwood species, including *Juglans nigra*, *Juglans cinerea*, *Celtis occidentalis*, *Ulmus Americana*, and *Acer negundo*, were occasionally found in this system on more mesic sites with lower fire frequencies. Common low woody shrubs include brambles (*Rubus* spp.), black currant (*Ribes cynosbati*), and roses (*Rosa* spp.). Graminoid species such as *Carex pensylvanica*, *Danthonia spicata*, and *Andropogon gerardii* are also common.

BpS Dominant and Indicator Species (in zone 50)

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| QUAL | *Quercus alba* | White oak |
| CAOV2 | *Carya ovata* | Shagbark hickory |
| QURU | *Quercus rubra* | Northern red oak |
| ULRU | *Ulmus rubra* | Slippery elm |
| FRAM2 | *Fraxinus americana* | White ash |

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

Disturbance Description

The North-Central Interior Dry-Mesic Oak Forest and Woodland (oak-hickory forest) is predominantly Fire Regime Group I, characterized by low-severity surface fires. Historically, oak woodland and forest occurred in a contiguous matrix integrated with oak savannas, grassland prairies, and mesic forests. Fire frequency and intensity determined the proportion of each of these ecosystems across the landscape matrix. Grassland prairies burned often with fire rotations ~5yrs and were probably associated with flat-to-slightly rolling terrain that effectively carried fire (Anderson 1999). Oak savannas occurred where fire frequency was a bit less, probably 5-15yrs. Woodlands developed within a moderate burning regime, with fire return times averaging every 15-25yrs. Closed-canopy oak forests would develop where fire return intervals (FRIs) stretched beyond 25yrs. If fire is excluded for several decades, more shade-tolerant and fire-sensitive species would gradually replace overstory oaks and oak regeneration is limited (Nowacki and Abrams 2008). These FRIs are estimates based on ecological knowledge; due to a lack of historical evidence at a broad scale, they have not been confirmed empirically (McEwan et al. 2011).

Historically, grazing would have similarly maintained open conditions in savannas (Anderson 2006). Ice damage, periodic insect defoliation, and the passenger pigeon (now extinct) may have contributed to increased oak canopy openings that facilitated light penetration to the forest floor, and, ultimately, greater possibility of germination and recruitment of oaks (McEwan et al. 2011).

Archeological and ecological evidence suggests that Native Americans played a critical role in the development and maintenance of oak-hickory landscapes through fire ignition (Abrams and Nowacki 2008). However, the spatial extent of indigenous fire impact is unknown (Munoz et al 2014). Lightning strikes would have provided an additional source of ignition. Regardless of the source, fire was historically an important control on ecological systems in this region, including dry-mesic oak forest and woodland.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 120 | 20 |  |  |
| Moderate (Mixed) | 48 | 48 |  |  |
| Low (Surface) | 74 | 32 |  |  |
| All Fires | 23 | 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

In Wisconsin, pre-European-American-settlement oak woodlands and forests occurred infrequently in small patches, within a larger matrix of oak savanna (Bolliger et al. 2004). Fire, the dominant disturbance, occurred frequently across large-scale landscapes.

Adjacency or Identification Concerns

Oak forest patches are virtually always integrated in the larger landscape scale with mesic maple-dominated forests and oak savannas. Mesic maple forests were relegated to those areas where fire was restricted through facilitation by an edaphic factor such as heavy-textured soil or high water table or by natural fire breaks such as bodies of water and slightly protected depressions (Curtis 1959). Prolonged intervals (100-150yrs) without fire were needed for maples to manifest their dominance. Oak forests also graded into savannas (i.e., oak openings) when FRIs shortened to the point where woody regeneration of overstory tree species was limited. Exposed areas where wind could carry flames at great distances tend to exhibit more savanna vegetation structure than a closed oak forest. In areas where flat outwash extended beyond ice-contact terrain or end moraine, savannas would typically occur in the former, abutting a closed forest on the latter landforms. (NOTE: Red maple problem is more prevalent in eastern United States; not sure the extent of it in dry-mesic oak forests in Wisconsin -- need more literature or input from foresters.)

Issues or Problems

This system has largely converted to closed-canopy forests progressively increasing in mesophytic species. As these systems become increasingly mesophytic, the ability to get fire back on the landscape becomes increasingly difficult (Nowacki and Abrams 2008).

Native grazing, due to higher deer densities than historically (at least in Wisconsin), further suppress recruitment of oaks and exacerbates the trend toward closed-canopy mesophytic species. Invasive species, including buckthorn (*Rhamnus cathartica*) and honeysuckle (*Lonicera* spp.), are becoming increasingly prevalent in the understories of some stands (Schulte et al. 2011).

Native Uncharacteristic Conditions

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 | A | A | A |
| Herb | 0.5-1.0 | A | A | A | A | A | A | A | A | A | A |
| Herb | >1.0 | A | A | A | A | A | A | A | A | A | A |
| Shrub | 0-0.5 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Shrub | 0.5-1.0 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Shrub | 1.0-3.0 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Shrub | >3.0 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Tree | 0-5 | B | B | B | UN | UN | UN | UN | UN | E | E |
| Tree | 5-10 | B | B | C | C | C | C | UN | UN | E | E |
| Tree | 10-25 | B | B | C | C | C | C | D | D | E | E |
| Tree | 25-50 | UN | UN | UN | UN | UN | UN | UN | UN | E | E |
| Tree | >50 | UN | UN | UN | UN | UN | UN | UN | UN | E | E |

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 2 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ANGE | Andropogon gerardii | Big bluestem | Upper |
| SCHIZ4 | Schizachyrium | Little bluestem | Upper |
| SONU2 | Sorghastrum nutans | Indiangrass | Upper |

Description

Prairie. Class A is grassland prairie maintained by frequently recurring fire. If fire is absent for a few years, tree seedlings and sprouts would recruit into trees and form savannas. Heavy grazing, though unlikely to have large-scale impact, would have kept certain patches from progressing to a woody shrub vegetation stage and would have maintained Class A.

*Maximum Tree Size Class*  
None

Class B 12 Mid Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| QUAL | Quercus alba | White oak | Upper |
| QUVE | Quercus velutina | Black oak | Upper |
| ANGE | Andropogon gerardii | Big bluestem | Lower |
| SCHIZ4 | Schizachyrium | Little bluestem | Lower |

Description

Savanna. Savanna conditions occurred where fire was fairly frequent, allowing some trees to develop.

*Maximum Tree Size Class*  
Large 21-33" DBH

Class C 20 Mid Development 2 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| QUAL | Quercus alba | White oak | Upper |
| QURU | Quercus rubra | Northern red oak | Upper |
| QUVE | Quercus velutina | Black oak | Upper |

Description

Woodland. This class is defined as oak woodland where fire occurred every 15-25 yrs. The canopy closure was <80%.

*Maximum Tree Size Class*  
Large 21-33" DBH

Class D 57 Mid Development 3 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| QUAL | Quercus alba | White oak | Upper |
| QURU | Quercus rubra | Northern red oak | Upper |
| PRSE2 | Prunus serotina | Black cherry | Upper |

Description

Oak forest. Class D is defined as oak forest. The age class is 51 indefinite years as long as surface fire occurs periodically. If the late-succession open forest type persists for 50yrs without any type of fire, it will convert to a late-succession mixed mesophytic closed forest type. This conversion is a result of species shift from dominant oaks to dominant maple and elm, which do not support fire as readily.

*Maximum Tree Size Class*  
Large 21-33" DBH

Class E 9 Late Development 2 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ACSA3 | Acer saccharum | Sugar maple | Upper |
| TIAM | Tilia americana | American basswood | Upper |
| QUAL | Quercus alba | White oak | Upper |
| ULRU | Ulmus rubra | Slippery elm | Upper |

Description

Mesophytic forest. Mesic forests develop during the absence of fire. Dense understories of shade-tolerant species develop.

*Maximum Tree Size Class*  
Large 21-33" DBH

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Mid1:OPN | 4 |
| Mid1:OPN | 5 | Mid2:OPN | 14 |
| Mid2:OPN | 15 | Mid3:CLS | 24 |
| Mid3:CLS | 25 | Late2:CLS | 149 |
| Late2:CLS | 150 | Late2: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** |
| Native Grazing | Early1:ALL | Early1:ALL | 0.01 | 100 | No | 0 |
| Replacement Fire | Early1:ALL | Early1:ALL | 0.1 | 10 | Yes | 0 |
| Native Grazing | Mid1:OPN | Mid1:OPN | 0.01 | 100 | No | 0 |
| Replacement Fire | Mid1:OPN | Early1:ALL | 0.025 | 40 | Yes | 0 |
| Surface Fire | Mid1:OPN | Mid1:OPN | 0.03 | 33 | No | 0 |
| Replacement Fire | Mid2:OPN | Early1:ALL | 0.005 | 200 | Yes | 0 |
| Mixed Fire | Mid2:OPN | Mid1:OPN | 0.015 | 67 | Yes | 0 |
| Surface Fire | Mid2:OPN | Mid2:OPN | 0.02 | 50 | No | 0 |
| Replacement Fire | Mid3:CLS | Early1:ALL | 0.002 | 500 | Yes | 0 |
| Surface Fire | Mid3:CLS | Mid3:CLS | 0.01 | 100 | No | 0 |
| Mixed Fire | Mid3:CLS | Mid1:OPN | 0.01 | 100 | Yes | 0 |
| Mixed Fire | Mid3:CLS | Mid2:OPN | 0.02 | 50 | Yes | 0 |
| Replacement Fire | Late2:CLS | Mid3:CLS | 0.001 | 1000 | Yes | 0 |
| Replacement Fire | Late2:CLS | Mid2:OPN | 0.001 | 1000 | Yes | 0 |
| Replacement Fire | Late2:CLS | Mid1:OPN | 0.001 | 1000 | Yes | 0 |
| Replacement Fire | Late2:CLS | Early1:ALL | 0.001 | 1000 | Yes | 0 |
| Wind or Weather or Stress | Late2:CLS | Late2:CLS | 0.01 | 100 | No | 0 |

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