13100

North-Central Interior Dry-Mesic Oak Forest and Woodland

BpS Model/Description Version: Aug. 2020

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Vegetation Type

Forest and Woodland

Map Zones

47

Geographic Range

This system occurs throughout the glaciated regions of the Midwest. MZ47 lies at the edge of the system's range. Glaciated areas of MZ47 include subsections 222Hb, 222Hc, 222He, 223Fe, 223Ff, 223Gc and 223Ge.

Biophysical Site Description

This system is found throughout the glaciated regions of the Midwest, typically in gently rolling landscapes. It can occur on uplands within the prairie matrix and near floodplains, or on rolling glacial moraines and among kettle-kame topography. Soils are typically well-drained Mollisols or Alfisols that range from loamy to sandy loam in texture (NatureServe 2007). Dry landscape settings, such as on western and southern aspects and upper slopes and ridge tops are conducive to the development of this system.

Vegetation Description

Typically, the vegetation consists of forests dominated by oaks, especially white oak (Quercus alba), black oak (Quercus velutina), and red oak (Quercus rubra). Along with oaks are varying amounts of hickory (Carya glabra and Carya ovata), red maple (Acer rubrum), black cherry (Prunus serotina), and sassafras (Sassafras albidum). American chestnut (Castanea dentata) was once an important canopy component. Currently, due to decades of fire suppression, subcanopies and shrub layers are well-developed by witch-hazel (Hamamelis virginiana), flowering dogwood (Cornus florida), and hop-hornbeam (Ostrya virginiana). Common low woody shrubs include brambles (Rubus spp.), black currant (Ribes cynosbati), and both native and invasive roses (Rosa spp.). Graminoid species such as Carex pensylvanica, Danthonia spicata, Andropogon gerardii are also common.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| QUAL | *Quercus alba* | White oak |
| QUVE | *Quercus velutina* | Black oak |
| CAGL8 | *Carya glabra* | Pignut hickory |
| CAOV2 | *Carya ovata* | Shagbark hickory |
| CADE12 | *Castanea dentata* | American chestnut |
| QURU | *Quercus rubra* | Northern red oak |
| ACRU | *Acer rubrum* | Red maple |
| SAAL5 | *Sassafras albidum* | Sassafras |

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 I, characterized by low-severity surface fires. Historically, indigenous fires accounted for over 95% of the ignitions over these landscapes. Native Americans played a critical role in the development and maintenance of oak-hickory landscapes through fire ignition. Natives burned these landscapes for a variety of reasons. Fire encouraged open habitats which, in turn, increased food-producing plants (forbs, mast) and ungulate herbivores (meat). Also, lightning-strike ignitions, though limited in frequency, would have provided an additional source of ignition.

Vegetation types varied based on fire frequency and intensity. Grassland prairies burned often with fire rotations approximately less than five years and were probably associated with flat-to-slightly rolling terrain that effectively carried fire. These grasslands, deliberately maintained by Native Americans for hunting purposes, were probably scattered throughout the forest matrix. Oak-hickory grubs (tree-sprout and shrub thickets) occurred where fire frequency was a bit less, probably 5-10yrs. Also, grub conditions would arise immediately after catastrophic burns that would top-kill tree-dominated communities. Savannas and woodlands developed within a moderate burning regime, with fire return times averaging every four to 17yrs (Henderson and Long, 1984). Closed-canopy oak-hickory forests would develop where fire return intervals stretched beyond 15yrs. Shade-tolerant, fire-sensitive maples (and associated late-successional trees) would regenerate and form understories beneath oak-hickory canopies when fire was excluded over several decades (25-40yrs). With continued fire exclusion, maple and other late-successional species would gradually replace overstory oaks and hickories through gap capture (Sutherland and Hutchinson 2003). A mosaic of vegetation types comprised oak-hickory landscapes contingent on fire history (Cutter and Guyette 1994). From a gross landscape perspective, oak-hickory forests occurred in a contiguous matrix integrated with oak savannas, grassland prairies, and mesic forests dominated by red and sugar maple. Fire frequency and intensity determined the proportion of each of these landscape ecosystems across the landscape matrix. Historically, buffalo grazing would have similarly maintained open conditions in very localized patches within savannas.

Ice-damage, periodic insect defoliation, and the extinct passenger pigeon may have likely contributed to increased oak canopy openings that facilitated light penetration to the forest floor, and, ultimately, greater possibility of germination and recruitment of oaks.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 166 | 6 |  |  |
| Moderate (Mixed) | 164 | 6 |  |  |
| Low (Surface) | 11 | 88 |  |  |
| All Fires | 10 | 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

Pre-European oak-hickory forests covered hundreds of thousands of contiguous acres. When considered as a matrix with savannas and prairies, estimated acreage increases significantly.

Adjacency or Identification Concerns

Though often contiguous, oak-hickory patches are virtually always integrated in the larger landscape scale with mesic maple-dominated forests and dry 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. Prolonged intervals (100 to 150yrs) without fire were needed for maples to manifest their dominance. Oak-hickory forests also graded into savannas (i.e. oak openings) when fire intervals 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 close oak-hickory 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.

Currently, under the past century's practice of fire suppression, oak-hickory forests are succeeding into a red maple-dominated forest. Prolific sprouting ability, light, wind-carried fruits, and the tendency to cast dense shade has enabled red maple to outcompete white and black oak in these systems. Without fire as a natural disturbance that prevents establishment of fire-sensitive species, mesophytic species are free to invade and recruit into the overstory. Implications to forestry, wildlife, and pest and disease outbreaks become apparent. Invasive shrubs such as autumn-olive, common buckthorn, multiflora rose, and honeysuckle rigorously compete against oaks in the low understory. Regeneration is inhibited by such exotics, and changes in nutrient cycling may also occur because some exotics are nitrogen fixers.

Issues or Problems

Native Uncharacteristic Conditions

Though present historically, red maple has been typified as the "native invasive" in oak hickory forests. Its abundance in these systems measured in both stem density and basal area has grown considerably due to fire suppression and the marked increase in fire return interval. Abundance of aspen, sassafras, and black cherry can also be attributed to fire suppression and poor silvicultural practices. Currently, an overabundance of deer is limiting oak regeneration in remnant oak forests in some areas.

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

Grassland prairie maintained by frequently recurring fire. Native Americans used these lands for hunting and agriculture/native plant gathering. If fire is absent for a few years, tree seedlings and sprouts will establish and move the community to the mid-seral, open stage. 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 this maintained class.

*Maximum Tree Size Class*  
None

Class B 7 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 |
| SAAL5 | Sassafras albidum | Sassafras | Mid-Upper |
| CAGL8 | Carya glabra | Pignut hickory | Upper |

Description

This is an early tree regeneration (root and stump sprouts) phase.

Areas that receive frequent surface or mixed fires will be populated by fire-adapted species such as oaks and hickories. These fires will top-kill seedlings and sprouts and a proportion of the saplings. These communities will develop into the mid-seral, open oak-hickory forest.

*Maximum Tree Size Class*  
Pole 5-9" DBH

Class C 27 Mid Development 2 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| QUAL | Quercus alba | White oak | Upper |
| QUVE | Quercus velutina | Black oak | Upper |
| SAAL5 | Sassafras albidum | Sassafras | Upper |
| QUMA2 | Quercus macrocarpa | Bur oak | Upper |

Description

This class is defined as oak-hickory savanna and woodland. The canopy closure is less than 60%.

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

Class D 61 Late Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| QUAL | Quercus alba | White oak | Upper |
| QUVE | Quercus velutina | Black oak | Upper |
| QURU | Quercus rubra | Northern red oak | Upper |
| CAGL8 | Carya glabra | Pignut hickory | Upper |

Description

Class D is defined as oak-hickory forest. Open understories of oak seedlings exist.

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

Class E 3 Late Development 2 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ACRU | Acer rubrum | Red maple | Upper |
| ACSA3 | Acer saccharum | Sugar maple | Upper |
| TIAM | Tilia americana | American basswood | Upper |
| QUAL | Quercus alba | White oak | Upper |

Description

Maple 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 | 5 |
| Mid1:OPN | 6 | Mid2:OPN | 50 |
| Mid2:OPN | 51 | Mid2:OPN | 999 |
| Late1:OPN | 51 | Late1:OPN | 999 |
| Late2:CLS | 101 | 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 | 0.2 | 5 | Yes | 0 |
| Alternative Succession | Mid1:OPN | Late1:OPN | 1 | 1 | Yes | 30 |
| Replacement Fire | Mid1:OPN | Early1:ALL | 0.002 | 500 | Yes | 0 |
| Mixed Fire | Mid1:OPN | Early1:ALL | 0.005 | 200 | Yes | 0 |
| Native Grazing | Mid1:OPN | Mid1:OPN | 0.01 | 100 | No | 0 |
| Wind or Weather or Stress | Mid1:OPN | Early1:ALL | 0.01 | 100 | Yes | 0 |
| Surface Fire | Mid1:OPN | Mid1:OPN | 0.1 | 10 | No | 0 |
| Alternative Succession | Mid2:OPN | Late1:OPN | 1 | 1 | Yes | 20 |
| Replacement Fire | Mid2:OPN | Early1:ALL | 0.002 | 500 | Yes | 0 |
| Native Grazing | Mid2:OPN | Mid2:OPN | 0.01 | 100 | No | 0 |
| Mixed Fire | Mid2:OPN | Mid2:OPN | 0.01 | 100 | No | 0 |
| Surface Fire | Mid2:OPN | Mid2:OPN | 0.1 | 10 | No | 0 |
| Alternative Succession | Late1:OPN | Late2:CLS | 1 | 1 | Yes | 50 |
| Replacement Fire | Late1:OPN | Early1:ALL | 0.001 | 1000 | Yes | 0 |
| Mixed Fire | Late1:OPN | Mid2:OPN | 0.005 | 200 | Yes | 0 |
| Surface Fire | Late1:OPN | Late1:OPN | 0.1 | 10 | No | 0 |
| Replacement Fire | Late2:CLS | Early1:ALL | 0.001 | 1000 | Yes | 0 |
| Mixed Fire | Late2:CLS | Late1:OPN | 0.005 | 200 | Yes | 0 |
| Wind or Weather or Stress | Late2:CLS | Late2:CLS | 0.007 | 143 | No | 0 |
| Surface Fire | Late2:CLS | Late1:OPN | 0.01 | 100 | Yes | 0 |

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