13130

North-Central Interior Beech-Maple Forest

BpS Model/Description Version: Aug. 2020

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

Forest and Woodland

Map Zones

49, 52, 62

Geographic Range

This mesic forest type is distributed in northeastern OH and northwestern PA on the glaciated Allegheny plateau, and is replaced by the South-Central Interior Mesophytic Forest ESP/BpS (1321) south of the extent of the Wisconsinan glaciation.

In MZ62, this type is limited to Subsections 222Ia (Lake Erie Plain), Fa (Allegheny Plateau), Fb (Grand River-Pymatuning Lowlands), and Fc (Akron Kames).

This mesic forest type is of limited occurrence in MZ49. In IN, North-Central Interior Beech-Maple Forest occurs in the Southern Michigan/Northern Indiana Drift Plains Level III Ecoregion in Level IV Ecoregions 56d (Michigan Lake Plain) and 56b (Elkhart Till Plains) (Woods et al. 1998). In IL, North-Central Interior Beech-Maple Forest is restricted to a few counties in the east-central part of the state, bordering IN. Here, BpS 1313 occurs primarily in two Level IV Ecoregions within the Interior River Valleys and Hills Level III Ecoregion: the Wabash River Bluffs and Low Hills Ecoregion (72m, concentrated in Clark County) and Glaciated Wabash Lowlands (72b, concentrated in Vermilion County).

Biophysical Site Description

The North-Central Interior Beech-Maple forest occurred on ground moraines and end moraines in areas of gently rolling topography and on gentle north- and northeastern-facing slopes, distributed throughout that portion of the Allegheny plateau impacted by the Wisconsinan glaciation. Sites supporting 1313 are typically protected from fire.

Plants in these communities have access to predictable supplies of water and nutrients, but they are often limited by light because of the dense forest canopy. Typical sites are buffered from seasonal drought by fine-textured moisture-retaining soils or dense subsoil layers. Essential nutrients are mineralized from decaying organic matter at twice the rate of that in fire-dependent forest or wet forest communities.

Vegetation Description

Sites are characterized by continuous, often dense, canopies of deciduous trees and understories of shade-adapted shrubs and herbs. Dominant tree species in the canopy and subcanopy include sugar maple (Acer saccharum), beech (Fagus grandifolia), basswood (Tilia americana), northern red oak (Quercus rubra), black cherry (Prunus serotina), tulip-tree (Liriodendron tulipifera), red elm (Ulmus rubra), American elm (U. americana), ironwood (Ostrya virginiana), bitternut hickory (Carya cordiformis), muscle wood (Carpinus caroliniana), paw-paw (Asimina triloba) and witch-hazel (Hamamelis virginiana). Canopy associates may include white oak (Quercus alba), hackberry (Celtis occidentalis (most frequent in Ohio west of this map zone)), butternut (Juglans cinerea), black walnut (J. nigra), yellow birch (Betula alleghaniensis), Kentucky coffee-tree (Gymnocladus dioicus (rare in this map zone for OH, more of a calcareous species)) and cucumber-tree (Magnolia acuminata). The sparse shrub layer is dominated by young sugar maple and other tree species in addition to prickly gooseberry (Ribes cynosbati), chokecherry (Prunus virginiana), alternate leaved dogwood (Cornus alternifolia), prickly ash (Zanthoxylum americanum) and red-berried elder (Sambucus racemosa) (MNDNR 2005).

The ground flora is dominated by spring-flowering herbs, including ephemerals, which complete their life cycle in the spring before the canopy trees have leafed out and cast a dense shade on the understory. Common ground cover species include Dutchman's breeches (Dicentra cucullaria), cut-leaved toothwort (Cardamine concatenata), bloodroot (Sanguinaria canadensis), yellow fawn lily (Erythronium americanum), Virginia waterleaf (Hydrophyllum virginianum), violet (Viola pubescens), wild leek (Allium tricoccum), blue cohosh (Caulophyllum thalictroides), early meadow-rue (Thalictrum dioicum), bedstraw (Galium aparine), sweet cicely (Osmorhiza claytonii), jack-in-the-pulpit (Arisaema triphyllum), sharp-lobed hepatica (Hepatica acutiloba), yellow mandarin (Disporum lanuginosum), trilliums (Trillium spp.), wood anemone (Anemone quinquefolia), false Solomon’s-seal (Smilacina racemosa), Solomon’s seal (Polygonatum pubescens), millet grass (Milium effusum), Poa spp., intermediate fern (Dryopteris intermedia) and sedges (Carex spp.) (Andreas 1980, PNDI 1999, MNDNR 2005).

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| ACSA3 | *Acer saccharum* | Sugar maple |
| FAGR | *Fagus grandifolia* | American beech |
| FRAM2 | *Fraxinus americana* | White ash |
| TIAM | *Tilia americana* | American basswood |
| QURU | *Quercus rubra* | Northern red oak |
| CACA18 | *Carpinus caroliniana* | American hornbeam |
| PRSE2 | *Prunus serotina* | Black cherry |
| LITU | *Liriodendron tulipifera* | Tuliptree |

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

Disturbance Description

Fire Regime V characterizes this system, dominated by high-intensity, low-frequency fires that occur in greater than 1000yr intervals. Low-intensity surface fires may have been more frequent in the mid-seral stages of this BpS when more fire-prone species (such as oak) comprise a larger component of the tree canopy. Light surface fires would result in the partial loss of trees and are estimated at a rotation of about 70yrs for young stands (MNDNR 2005).

Historically, this forest type, composed of fire-sensitive species, was not disturbed by fire except during periods following catastrophic wind events or extreme drought. Grimm (1984) states “The fire regimes of deciduous forests, such as bigwoods, are much different from the commonly perceived model of fire regime, in which fuels and fire danger increase with time and in which intense crown fires cause great destruction of the forest.” In maple-basswood forests, decomposition of potential fuels is rapid, and is particularly rapid on base-rich soils (Bormann and Likens 1979), such as those of the Big Woods. Because of the dense shade, the cover of herbs and shrubs is sparse. Thus little fuel exists at the ground level, tree trunks are not very flammable, and the open tree crowns do not carry fire very well. Moreover, low solar radiation, high humidity, and low wind speeds prolong the moisture retention of ground-level fuels (Kucera 1952), thereby inhibiting the ignition and spread of fire. These forests are sometimes referred to as the “asbestos forests” because of their fireproof character (Vogl 1967). Ordinarily, only the leaf litter ever reaches a flammable state, and only patchy creeping ground fires occur (Niering et al. 1970, Barden and Woods 1973).

Two primary disturbance factors are used to model this system. Catastrophic windthrow affects mature stands and occurs on an approximately 600-700yr rotation (MNDNR 2005). Replacement fire occurs primarily in young and windthrown stands and occurs on a rotation of approximately 1,000yrs. In addition, surface fires occur in young stands < 100yrs of age which contain a significant component of oak. The disturbance probabilities by class applied in the model are contained in the VDDT documentation section.

Per the IL Fire Needs Assessment survey, Fire Return Intervals for this system (currently) are on average 7 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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 1011 | 45 |  |  |
| Moderate (Mixed) |  |  |  |  |
| Low (Surface) | 840 | 55 |  |  |
| All Fires | 459 | 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

The most common disturbance extent could best be characterized as a single-tree or small-group gap-phase dynamics. Canopy gaps averaged 380m^2 in an old-growth stand on the glaciated Allegheny Plateau (Weiskittle and Hix 2003). Replacement events would have encompassed hundreds to thousands of acres. Patch sizes would generally conform to landforms on which they are found.

Adjacency or Identification Concerns

Issues or Problems

Uncharacteristic conditions in this setting include infestation by exotic earthworms of European species that have affected or begun to affect soil conditions, herb/forb species representation, and tree regeneration (Hale et al. 1999).

Native Uncharacteristic Conditions

Historically, elm was a canopy component within the maple-beech forest (Grimm 1981). However, this species has been largely eliminated from this system due to Dutch elm disease. American elm (Ulmus americana) is now generally only present in the understory and midstory in contemporary forests, whereas historically it would have been the occasional canopy dominant.

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

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 8 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PRSE2 | Prunus serotina | Black cherry | Upper |
| TIAM | Tilia americana | American basswood | Upper |
| QURU | Quercus rubra | Northern red oak | Upper |
| ACSA3 | Acer saccharum | Sugar maple | Upper |

Description

Characterized by early-seral young forest following a catastrophic wind or fire event. This is young forest dominated by canopy species that respond rapidly to increased light availability, including northern red oak, basswood, black cherry, and, locally, trembling aspen (Red maple is a more important early successional species than trembling aspen). Sugar maple is not likely to establish immediately following fire, but regeneration may be heavy following windthrow events. Also, Populus grandidentata make take the place of Populus tremuloides in this model as a very early successional species.

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

Class B 8 Mid Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ACSA3 | Acer saccharum | Sugar maple | Upper |
| TIAM | Tilia americana | American basswood | Upper |
| QURU | Quercus rubra | Northern red oak | Upper |
| FAGR | Fagus grandifolia | American beech | Upper |

Description

Characterized by mid-succession maturing forests. In this stage there is the gradual decline of northern red oak and it is replaced by sugar maple and beech. American elm and basswood increase while aspen senesces. Red maple and/or sugar maple tends to be the successional tree species on lands that look like they might have been beech-maple at one time but are now dominated by red maple.

*Maximum Tree Size Class*  
Medium 9-21"DBH

Class C 14 Mid Development 2 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ACSA3 | Acer saccharum | Sugar maple | Upper |
| FAGR | Fagus grandifolia | American beech | Upper |
| TIAM | Tilia americana | American basswood | Upper |
| FRAM2 | Fraxinus americana | White ash | Upper |

Description

Characterized by late-successional maturing forests. Forest dominated by sugar maple, beech, basswood, white ash, tulip-poplar, black cherry, ironwood, northern red oak.

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

Class D 70 Late Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ACSA3 | Acer saccharum | Sugar maple | Upper |
| FAGR | Fagus grandifolia | American beech | Upper |
| TIAM | Tilia americana | American basswood | Upper |
| FRAM2 | Fraxinus americana | White ash | Upper |

Description

These old late-seral forests are the end point of succession. Forest dominated by sugar maple, beech, basswood, white ash, tulip-poplar, ironwood and northern red oak. Small gap disturbances predominate to maintain a high proportion of the acreage in this class.

Upper Layer Lifeform is not the dominant lifeform. In this late seral stage there would be a multi-layer canopy and sub-canopy (created through small-scale windthrow). Therefore, although the min tree height is set at 25m in order to make this class exclusive from Class C tree height would range from 10-50 m.

*Maximum Tree Size Class*  
Very Large >33"DBH

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Mid1:ALL | 35 |
| Mid1:ALL | 36 | Mid2:CLS | 75 |
| Mid2:CLS | 76 | Late1:CLS | 150 |
| Late1:CLS | 151 | Late1: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** |
| Replacement Fire | Early1:ALL | Early1:ALL | 0.001 | 1000 | Yes | 0 |
| Replacement Fire | Mid1:ALL | Early1:ALL | 0.001 | 1000 | Yes | 0 |
| Surface Fire | Mid1:ALL | Mid1:ALL | 0.014 | 71 | No | 0 |
| Replacement Fire | Mid2:CLS | Early1:ALL | 0.001 | 1000 | Yes | 0 |
| Wind or Weather or Stress | Mid2:CLS | Early1:ALL | 0.0015 | 667 | Yes | 0 |
| Replacement Fire | Late1:CLS | Early1:ALL | 0.001 | 1000 | Yes | 0 |
| Wind or Weather or Stress | Late1:CLS | Early1:ALL | 0.0015 | 667 | Yes | 0 |
| Wind or Weather or Stress | Late1:CLS | Late1:CLS | 0.2 | 5 | No | 0 |

References

Andreas, B.K. 1989. The vascular flora of the glaciated Allegheny Plateau region of Ohio. Ohio Biol. Surv. Bull. NS. 8 (1). 191 pp.

Barden, L.S.., and F.W. Woods. 1973. Characteristics of lightning fires in

southern Appalachian forests. Proc. Of Tall Timbers Fire Ecol. Conf.

13: 345-361.

Bormann, F.H. and Likens, G.E., 1979. Catastrophic disturbance and the steady state in northern hardwood forests. American Scientist. 67: 660-669.

Canham, Charles D. and Orie L. Loucks. 1984. Catastrophic windthrow in presettlement forests of Wisconsin. Ecology. 65(3): 803-809.

Cleland, D.T., S.C. Saunders, T.R. Crow, D.I. Dickmann, A.L. Maclean, J.K. Jordan, R.L. Watson and A.M. Sloan. 2004. Characterizing historical and modern fire regimes in the lake states: a landscape ecosystem approach. Landscape Ecology. 19: 311–325.

Cohen, J.G. 2004. Natural community abstract for mesic southern forest. Michigan Natural Features Inventory, Lansing, MI. 12 pp.

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

Fike, J. 1999. Terrestrial and palustrine plant communities of Pennsylvania. Pennsylvania Department of Conservation and Natural Resources, Bureau of Forestry, Harrisburg, Pennsylvania.

Frelich, Lee E. and Craig G. Lorimer. 1991. Natural disturbance regimes in hemlock-hardwood forests of Upper Great Lakes region. Ecological Monographs. 61: 145-164.

Grimm, Eric C. 1981. Chronology and dynamics of vegetation change in the prairie-woodland region of southern Minnesota, USA. New Phytologist. 93: 311-350.

Grimm, E.C. 1984. Fire and other factors controlling the Big Woods vegetation of Minnesota in the mid-nineteenth century. Ecological Monographs. 54: 291-311.

Hale, C., L. Frelich and P. Reich. 1999. Unpublished. Research proposal concerning earthworms and population dynamics and diversity of native plant species. University of Minnesota, St. Paul, Minnesota.

Kucera, C. L. 1952. An ecological study of a hardwood forest area in central Iowa. Ecological Monographs 22: 283299.

Minnesota Department of Natural Resources (2005). Field Guide to the Native Plant Communities of Minnesota: The Eastern Braodleaf Forest Province. Ecological Land Lcassification Program. Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program. MNDNR St. Paul, MN.

Niering, W.A.; Godwin, R.H.; Taylor, S. 1970. Prescribed burning in southern New England: Introduction to long-range studies. Tall Timbers Fire Ecology

Conference. 10: 267-286.

Runkle, James Reade. 1982. Patterns of disturbance in some old growth mesic forests of eastern North America. Ecology. 63(5): 1533-1546.

Schmidt, Kirsten M., James P. Menakis, Colin C. Hardy, Wendel J. Hann and David L. Bunnell. 2002. Development of coarse-scale spatial data for wildland fire and fuel management. Gen. Tech. Rep. RMRS-GTR-87. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station: 41 pp+CD.

Schneider, G.J. and K.E. Cochrane. 1998. Plant community survey of the Lake Erie Drainage. Ohio Department of Natural Resources, Division of Natural Areas and Preserves, Columbus, Ohio.

USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (2002, December). Fire Effects Information System, [Online]. Http: //www.fs.fed.us/database/feis/.

Vogl, R.J. 1967. Controlled burning for wildlife in Wisconsin. Proc, Tall Timbers

Fire Ecol Conf 6: 47-96.

Webb, T. III, P.J. Bartlein, S.P. Harrison, K.H. Anderson. 1993. Vegetation, lake levels, and climate in eastern North America for the past 18,000 years. In: Wright, H.E. Jr., J.E. Kutzbach, T. Webb III, W.F. Ruddiman, F.A. Street-Perrot and P.J. Bartlein, eds. Global Climates Since the Last Glacial Maximum. Minneapolis, MN: University of Minnesota Press: 415-467.

Weiskittel, A.R., and D.M. Hix. 2003. Canopy gap characteristics of an oak-beech-maple old-growth forest in northeastern Ohio. Ohio Journal of Science 103: 111-115.