13442

**Boreal Jack Pine-Black Spruce Forest - Spruce-Fir**

BpS Model/Description Version: Aug. 2020

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Vegetation Type

Forest and Woodland

Map Zones

51

Model Splits or Lumps

This biophysical setting is lumped with 1301

Geographic Range

In map zone 51, this type occurs in 212 H, R and S (all subsections contained within; Cleland et al. 2007).

Biophysical Site Description

This community occurs in upland positions, often with loamy shallow soils within bedrock-controlled landforms (Heinselman 1996). The Boreal Forest dominates the Canadian landscape, although it is widespread on Isle Royale and some boreal plants and trees locally are dominant on cold, wet sites in the Upper Peninsula.

This system covers areas in northern Minnesota, Wisconsin, and Michigan. Soils are deeper and/or finer-textured than soils in the jack pine forest that allowed dense development of mixed aspen, birch, balsam fir, white spruce, and red maple forests (Frelich and Reich 1998).

The Latin derivation of "boreal" is "personification of the North Wind." It is a poetic way of describing the northern lands of rivers, lakes, forests that grow on the rock face of the earth. Boreal forests consist of a mixture of hardwood, deciduous trees, and evergreen conifers like pine and spruce, that keep their green mantles all year around. Mixed in are shrubs like juniper, sumac, and scrub willow. Deciduous trees include maple, elm, oak, and birch. Boreal forests are home to a wide diversity of flora and fauna.

Moose and deer browse in the openings; eagles and other raptors are common. Beaver and bear are evident through three of the four seasons. The boreal forests of Canada represent some of the last wild frontiers left in North America (Schaetzl 2002).

Vegetation Description

The spruce-fir is composed of a mixture of balsam fir, white spruce, paper birch, black spruce, cedar, and quaking aspen (Heinselman 1996). In areas where the landscape was interspersed with small wetlands, tamarack also was an important component of post-fire forests (Frelich and Reich 1998). Species dominance was determined by time since past disturbance, incidence of spruce budworm, neighborhood effects of seed source and dispersion (Frelich and Reich 1995), and associated successional dynamics. Almendinger and others (Minnesota Department of Natural Resources 2005) described successional trajectories within this community as having three growth stages separated by two transition periods. Initially, young stands, predominantly aspen with jack pine and birch, dominated for the first 35yrs following fire. Then, during a transition period between 35-55yrs following fire, aspen and jack pine declined and paper birch, white pine, red pine, and balsam fir increased, along with the establishment of white spruce seedlings. Once established, mature mixed forests of paper birch and white pine, with a reduced presence of balsam fir, persist up to ~100yrs. Another transition period marked by significant increase in white spruce and decline of aspen and birch occurs for a couple of decades. At around 115yrs following a fire, stable, long-lived white pine and white spruce dominated the canopy, with lesser amounts of balsam fir and paper birch present as subordinates.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| PIMA | *Picea mariana* | Black spruce |
| ABBA | *Abies balsamea* | Balsam fir |
| PIGL | *Picea glauca* | White spruce |
| THOC2 | *Thuja occidentalis* | Arborvitae |

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

Disturbance Description

Fire Regime Group IV is applicable, with fires occurring every 60-150yrs and high stand-replacement severity. Severe stand-replacing wind events affect mature stands on an approximate 1000yr interval. In the absence of fire, spruce budworm outbreaks are likely after about age 60yrs.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 110 | 100 | 50 | 200 |
| Moderate (Mixed) |  |  |  |  |
| Low (Surface) |  |  |  |  |
| All Fires | 110 | 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

None

Adjacency or Identification Concerns

This system was mapped separately from 13651 (Boreal White Spruce-Fir-Hardwood Forest-Great Lakes Inland), though there are significant similarities, especially in the description.

Issues or Problems

Hemlock occur in Wisconsin and Michigan

Native Uncharacteristic Conditions

Comments

Prior to LANDFIRE Remap this BpS was named Great Lakes Spruce-Fir.

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 | UN | UN | UN | B | B | B | B | B | B | B |
| Tree | 10-25 | UN | UN | UN | UN | UN | UN | C | C | C | C |
| Tree | 25-50 | UN | UN | UN | D | D | D | D | UN | UN | UN |
| Tree | >50 | UN | UN | UN | D | D | D | D | 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 32 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| POTR5 | Populus tremuloides | Quaking aspen | Upper |
| BEPA | Betula papyrifera | Paper birch | Upper |

Description

Class A: Early-seral aspen-birch.

*Maximum Tree Size Class*  
Seedling <4.5ft

Class B 34 Mid Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| POTR5 | Populus tremuloides | Quaking aspen | Upper |
| BEPA | Betula papyrifera | Paper birch | Upper |
| ABBA | Abies balsamea | Balsam fir | Low-Mid |
| PIGL | Picea glauca | White spruce | Low-Mid |

Description

Class B: Mid-age with aspen-birch overstory and mid-tolerant understory.

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

Class C 25 Mid Development 2 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PIGL | Picea glauca | White spruce | Upper |
| ABBA | Abies balsamea | Balsam fir | Upper |
| PIMA | Picea mariana | Black spruce | Upper |

Description

Class C: Mid-age stands dominated by white and black spruce and balsam fir.

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

Class D 9 Late Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PIGL | Picea glauca | White spruce | All |
| ABBA | Abies balsamea | Balsam fir | All |
| PIMA | Picea mariana | Black spruce | All |
| PIST | Pinus strobus | Eastern white pine | All |

Description

Class D: Old stands >200yrs. End point of succession. In nature, cover overlaps with C as trees have reached maximum height in C. Canopy cover could be greater than 60%.

*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:CLS | 40 |
| Mid1:CLS | 41 | Mid2:CLS | 100 |
| Mid2:CLS | 101 | Late1:CLS | 200 |
| Late1:CLS | 201 | Late1:CLS | 400 |

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 | 0.0067 | 149 | Yes | 0 |
| Wind or Weather or Stress | Mid1:CLS | Mid1:CLS | 0.001 | 1000 | No | 0 |
| Replacement Fire | Mid1:CLS | Early1:ALL | 0.008 | 125 | Yes | 0 |
| Wind or Weather or Stress | Mid2:CLS | Mid1:CLS | 0.001 | 1000 | Yes | 0 |
| Replacement Fire | Mid2:CLS | Early1:ALL | 0.012 | 83 | Yes | 0 |
| Wind or Weather or Stress | Late1:CLS | Mid1:CLS | 0.001 | 1000 | Yes | 0 |
| Replacement Fire | Late1:CLS | Early1:ALL | 0.012 | 83 | Yes | 0 |

References

Cleland, D.T.; Freeouf, J.A.; Keys, J.E.; Nowacki, G.J.; Carpenter, C.A.; and McNab, W.H. 2007. Ecological Subregions: Sections and Subsections for the conterminous United States. Gen. Tech. Report WO-76D [Map on CD-ROM] (A.M. Sloan, cartographer). Washington, DC: U.S. Department of Agriculture, Forest Service, presentation scale 1:3,500,000; colored

Heinselman, M. 1996. The Boundary Waters Wilderness Ecosystem. Minneapolis: University of Minnesota Press. 334 pp.

Frelich, L.E. and P.B. Reich. 1998. Disturbance severity and threshold responses in the boreal forest. Conservation Ecology [online] 2(2): 7.

Frelich, L.E. and P.B. Reich. 1995. Spatial patterns and succession in a Minnesota southern boreal forest. Ecological Monographs 65: 325-346.

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