14810

Laurentian-Acadian Alkaline Conifer-Hardwood Swamp

BpS Model/Description Version: Aug. 2020

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

Woody Wetland

Map Zones

41, 50, 51, 63

Geographic Range

This system occurs throughout the upper Midwest and northeastern United States and adjacent Canadian provinces, including MI, MN, WI, Ontario, Manitoba, Quebec, NY, NH, VT, ME, and northern IL, IN, and OH (Faber-Langendoen 2001). This system also possibly occurs in PA, CT, NJ, RI, MA, New Brunswick and Nova Scotia. Within MZs 41, 50 and 51, this system occurs in Section 222J (absent in 222Ji, and local in 222Jb, Jh, Jg, and Je), local in 222Ud and Ue, 212H, 212R, 212S, 212J, 212X, 212T, 212Q, 222R, 212Z (local) 212K, 212N, 212M, 212L, 222K (local), 222L (local) and 222M (local; Cleland et al. 2007).

Biophysical Site Description

This system is characterized by dense to open, low to medium-tall forests of needle-leaf evergreen and deciduous trees on shallow organic and deep peatland soils, occurring as discontinuous pockets or stringers within upland vegetation communities having both short-return-interval fire regimes (e.g., pine and oak-pine barrens) and long-return-interval fire regimes (e.g., northern hardwoods). In Minnesota and the eastern UP they may occur in very extensive delineations occupying thousands of acres, and occur in patches several hundred to >1,000ac in size in northern WI and northern lower MI. Low hummocks and water-filled depressions may be present, especially around the edges. These edges tend to be rich fen in the closed canopy peatland. Forested rich peatlands (pH > 5.5) occur in closed wet depressions, especially in small watersheds or catchment areas, and drains and toe slopes adjacent to streams. Soils are very poorly drained, saturated throughout the growing season in normal years, and may be deep organic peat (peatlands) or less than 12in of organic peat over primarily sandy soils. Vegetative composition and structure varies depending on landform, disturbance history, and hydrology, including lateral flow of groundwater. The most typical dominant canopy species is northern white-cedar (see MNDNR 2003, Kost 2002, Christensen et al. 1959). Trees on poorly drained peats with restricted groundwater movement may be stunted.

Vegetation Description

Northern white-cedar (*Thuja occidentalis*) is the characteristic dominant canopy species in forested alkaline peatlands. It is commonly associated with balsam fir (*Abies balsamea*), black spruce (*Picea mariana*) and tamarack (*Larix laricina*). Occasional canopy species include white spruce (*Picea alba*), hemlock (*Tsuga canadensis*), white pine (*Pinus strobus*), black ash (*Fraxinus nigra*), red maple (*Acer rubrum*), yellow birch (*Betula alleghaniensis*), paper birch (*B. papyrifera*), American elm (*Ulmus americana*), quaking aspen (*Populus tremuloides*), and bigtooth aspen (*P. grandidentata*). Hemlock and white pine tend to occur on shallow peats or poorly drained mineral soils. Hardwoods also become more common on shallow peats and hydric mineral soils, or in frequently flooded zones (black ash and red maple, in particular, in flood-prone areas), and may dominate or co-dominate stands in the southern portion of BpS range. Tamarack is locally dominant, and may replace northern white-cedar where lateral flow of groundwater is minimal or absent. Shrubs are locally common, particularly in recent windfalls. Characteristic species include tag alder (*Alnus rugosa*), winterberry (*Ilex verticillata*), mountain holly (*Nemopanthus mucronatus*), red-osier dogwood (*Cornus stolonifera*), elderberry (*Sambucus canadensis*), huckleberry (*Gaylussacia baccata*), autumn willow (*Salix serissima*) and Canada yew (*Taxus canadensis*), the latter species having been significantly reduced by deer herbivory (Van Deelen et al. 1996). Low shrubs include Labrador tea (*Ledum groenlandicum*), blueberry (*Vaccinium angustifolium*), bilberry (*V. myrtilloides*), leatherleaf (*Chamaedaphne calyculata*), American fly honeysuckle (*Lonicera canadensis*), hairy honeysuckle (*L. hirsuta*), swamp fly honeysuckle (*L. oblongifolia*), wild black currant (*Ribes americanum*), swamp red currant (*R. triste*) and swamp black current (*R. lacustre*). The surface layer is dominated by mosses, primarily sphagnum. Brown mosses dominate pools. *Pleurozium schreberi* and *Callicladium haldanianum* may also be abundant. Liverworts are also abundant. The ground layer is diverse, particularly in sedges, ferns and orchids. Characteristic species include three-leaved Solomon’s seal (*Smilacina trifolia*), twinflower (*Linnaea borealis*), small northern bog orchid (*Platanthera obtusata*), lesser rattlesnake plantain (*Goodyera repens*), yellow lady's slipper (*Cypripedium parviflorum* var. *pubescens*), showy lady's slipper (*C. reginae*), starflower (*Trientalis borealis*), goldthread (*Coptis trifolia*), naked miterwort (*Mitella nuda*), dwarf raspberry (*Rubus pubescens*), creeping snowberry (*Gaultheria hispidula*), one-flowered pyrola (*Moneses uniflora*), *Carex leptalea*, *C. disperma*, *C. gynocrates*, *C. trisperma*, *C. interior*, *C. eburnea*, *C. vaginata*, bulbet fern (*Cystopteris bulbifera*), and oak fern (*Gymnocarpium dryopteris*). Shrub and groundlayer density and structure is variable, depending on canopy closure, microtopography and hydrology. Vegetation data taken primarily from Kost (2002) and MNDNR (2003).

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| THOC2 | *Thuja occidentalis* | Arborvitae |
| ABBA | *Abies balsamea* | Balsam fir |
| PIMA | *Picea mariana* | Black spruce |
| LALA | *Larix laricina* | Tamarack |
| PIST | *Pinus strobus* | Eastern white pine |
| FRNI | *Fraxinus nigra* | Black ash |
| ACRU | *Acer rubrum* | Red maple |
| TSCA | *Tsuga canadensis* | Eastern hemlock |

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

Disturbance Description

Fire Regime Group characterized by low frequency, high severity fires. Conifer- and hardwood-conifer dominated lowland forests occur as isolated to extensive patches occurring in landscapes dominated by both fire-prone and fire-resistant upland matrix systems, and the fire regime is generally driven by the return interval of these upland vegetation types. Fires may occur following drought cycles and may be severe, but sites are typically very wet and fires are infrequent. Windthrow disturbances occur as a result of shallow rooting, affecting single trees and small to large patches of trees. Insect and disease outbreaks primarily affect mature or overmature dominant trees in both closed and open canopies, impacting black spruce, white spruce, tamarack, and balsam fir in particular. Also, changes in hydrology, such as flooding or draining due to the construction or destruction of beaver dams, are another important disturbance in this system and typically change the entire unit into a wetland with an open succession pathway. Non-replacement mixed-severity fires can occur randomly in any class and are randomly associated with lightning strikes or small fires in the surrounding vegetation. Frequency will be about twice that of replacement-stand fires, which were estimated to occur in Minnesota on a 920 year interval (Minnesota DNR 2003). Catastrophic windthrow may have occurred on a 400-1000yr+ rotation, with a median of 700yrs. Light windthrow (small patches) occurred on a rotation of 40-380yrs, with a median of 85yrs.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 996 | 100 |  |  |
| Moderate (Mixed) |  |  |  |  |
| Low (Surface) |  |  |  |  |
| All Fires | 996 | 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

This BpS can range from thousands of acres to less than five acres in size. The largest delineations typically occur in central and northern MN and the eastern Upper Peninsula of MI. Scattered large delineations also occur in northern Wisconsin, the western Upper Peninsula and northern Lower Peninsula of MI, and northern WI. Delineations in the southern portion of the Great Lakes region are generally small (<100ac) and widely distributed. These areas are generally homogeneous in vegetation composition, but can vary considerably in overstory coverage even within the same delineation. They may also contain scattered, better-drained islands with mineral soils and hardwoods in the larger delineations.

Adjacency or Identification Concerns

This concept includes "cedar swamps" and associated hardwood-conifer dominated lowland forests on alkaline substrates.

Issues or Problems

Separation of a cedar-dominated lowland/peatland was also discussed but it was decided to not attempt to separate at this scale. [BSS: acidic peatlands were eliminated from the coarse model. Current model focuses on cedar and hardwood-conifer dominated alkaline lowland forests.] Fire response was also determined to not be sufficiently different at this time. Present maps of this BpS were also determined to be lacking in accuracy. There was consensus that a great deal more acres actually exist than are shown for MI and WI.

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 | A | A | A | A | A | A | A | A | A | A |
| Shrub | 0.5-1.0 | A | A | A | A | A | A | A | A | A | A |
| Shrub | 1.0-3.0 | A | A | A | A | A | A | A | A | A | A |
| Shrub | >3.0 | A | A | A | A | A | A | A | A | A | A |
| Tree | 0-5 | A | A | A | A | A | A | A | A | A | A |
| Tree | 5-10 | B | B | B | B | B | B | B | C | C | C |
| Tree | 10-25 | D | D | D | D | D | D | D | 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 14 Early Development 1 - All Structures

DBH

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| LALA | Larix laricina | Tamarack | Upper |
| ALIN2 | Alnus incana | Gray alder | Mid-Upper |
| ILVE | Ilex verticillata | Common winterberry | Mid-Upper |
| VACO | Vaccinium corymbosum | Highbush blueberry | Middle |

Description

Early successional stand following flooding or stand-replacing fire (rare). Shrubs increase dominance over time, although open grass- and sedge-dominated wet meadow may be dominant at first, particularly in areas in which existing shrubs were flood-killed. Open to dense thicket dominated by tag alder and winterberry, potentially associated with willows, nannyberry and mountain holly. Early successional trees establish (particularly tamarack and black ash) in the absence of additional disturbance; northern white-cedar and/or white pine may establish from seed following catastrophic fire.

This stage results from major disturbance, including stand-replacement fire, flooding, or windthrow. Catastrophic windthrow is possible. Replacement fire frequency likely varied across the region and depending on the nature of the upland matrix in any given area (fire-dependent vs. fire-intolerant).

Alder-dominated thickets are sometimes relatively stable and long-persistent, but the concept used for this BpS is of a site that, due to edaphic factors, favors the development of forested wetland in the absence of major disturbance(s). In reality, a variety of early successional communities can result from major disturbance of conifer or conifer-hardwood dominated alkaline lowland forest.

*Maximum Tree Size Class*  
Sapling >4.5ft; <5" DBH

Class B 11 Early Development 2 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| THOC2 | Thuja occidentalis | Arborvitae | Upper |
| PIMA | Picea mariana | Black spruce | Upper |
| LALA | Larix laricina | Tamarack | Upper |
| ACRU | Acer rubrum | Red maple | Mid-Upper |

Description

Scattered tree canopy develops from hardwood and conifer seedlings that establish under shrubs. Typical species include black ash, tamarack, northern white-cedar, and balsam fir. General appearance is of a shrub-dominated system with an open tree canopy, grading into forested wetland at the end of this period.

Catastrophic windthrow is possible. Replacement fire frequency likely varied across the region and depending on the nature of the upland matrix in any given area (fire-dependent vs. fire-intolerant).

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

Class C 21 Mid Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| THOC2 | Thuja occidentalis | Arborvitae | Upper |
| PIMA | Picea mariana | Black spruce | Upper |
| LALA | Larix laricina | Tamarack | Upper |
| ACRU | Acer rubrum | Red maple | Mid-Upper |

Description

Mid-aged stands dominated by cedar with some black spruce, balsam fir, and tamarack; may include red maple; some shrub layer. Scattered successional species (e.g., quaking aspen, paper birch) present in the canopy, but declining as stands age.

This stage matures in the absence of major disturbance(s). Catastrophic windthrow is possible. Replacement fire frequency likely varied across the region and depending on the nature of the upland matrix in any given area (fire-dependent vs. fire-intolerant).

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

Class D 54 Late Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| THOC2 | Thuja occidentalis | Arborvitae | Upper |
| PIMA | Picea mariana | Black spruce | Upper |
| FRNI | Fraxinus nigra | Black ash | Upper |
| ABBA | Abies balsamea | Balsam fir | Mid-Upper |

Description

Mature, multi-seral stands typically dominated by northern white-cedar, with black spruce and balsam fir usually important. Other canopy species may include tamarack (but this typically in open microsites and peripherally), white pine, hemlock, and a variety of hardwoods, the latter in low numbers except where favored due to hydrology (streambanks, frequently flooded areas) or substrate (thin organic or mineral soils). Canopy cover may be lower in areas associated with active groundwater discharge or peat deposition (these grade into open rich fen).

This stage is maintained by frequent windthrow of single trees or small to large patches of trees. Catastrophic windthrow is also possible. Replacement fire frequency likely varied across the region and depending on the nature of the upland matrix in any given area (fire-dependent vs. fire-intolerant).

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

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Early2:CLS | 29 |
| Early2:CLS | 30 | Mid1:CLS | 55 |
| Mid1:CLS | 56 | Late1:CLS | 115 |
| Late1:CLS | 116 | 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 |
| Wind or Weather or Stress | Early1:ALL | Early1:ALL | 0.003 | 333 | No | 0 |
| Replacement Fire | Early2:CLS | Early1:ALL | 0.001 | 1000 | Yes | 0 |
| Wind or Weather or Stress | Early2:CLS | Early1:ALL | 0.003 | 333 | Yes | 0 |
| Replacement Fire | Mid1:CLS | Early1:ALL | 0.001 | 1000 | Yes | 0 |
| Wind or Weather or Stress | Mid1:CLS | Early1:ALL | 0.0045 | 222 | Yes | 0 |
| Replacement Fire | Late1:CLS | Early1:ALL | 0.001 | 1000 | Yes | 0 |
| Wind or Weather or Stress | Late1:CLS | Early1:ALL | 0.0045 | 222 | Yes | 0 |

References

Brown, James K. and Smith, Jane Kapler, eds. 2000. Wildland fire in ecosystems: effects of fire on flora. Gen. Tech. Rep. RMRS-GTR-42-vol. 2. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station. 257 pp.

Christensen, E.M., J.J. Clausen and J.T. Curtis. 1959. Phytosociology of the lowland forests of northern Wisconsin. The American Midland Naturalist. 62: 232-247.

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

Cleland, D.T., T.R. Crow, S.C. Saunders, D.I. Dickmann, A.L. MacLean, J.K. Jordan, R.L. Watson and A.L. Sloan. 2004. Characterizing historical and modern fire regimes in Michigan (USA): a landscape ecosystem approach. Landscape Ecology. 19(3): 311-325.

Faber-Langendoen, D., ed. 2001. Plant communities of the Midwest: Classification in an ecological context. NatureServe, Arlington, VA. 61 pp. plus appendix (705 pp.).

Frelich, Lee E. 2002. Forest dynamics and disturbance regimes: Studies from temperate

evergreen-deciduous forests. Cambridge University Press, Cambridge, UK. 266 pp.

Futyma, R.P. and N.G. Miller. 2001. Postglacial history of a marl fen: Vegetational stability at Byron-Bergen Swamp, New York. Canadian Journal of Botany. 79: 1425-1438.

Iverson, Louis R., Anantha M. Prasad, Betsy J. Hale and Elaine K. Sutherland. 1999. Atlas of current and potential future distributions of common trees of the eastern United States. General Technical Report NE-265. Radnor, PA: USDA Forest Service, Northeastern Research Station. 245 pp.

Kost, M.A. 2002. Natural community abstract for rich conifer swamp. Michigan Natural Features Inventory, Lansing, MI. 9 pp.

Kuchler, A.W. 1964. Conifer Bog (Larix-Picea-Thuja). #94 In: Manual to accompany the map Potential Natural Vegetation of the United States. New York, NY: The American Geographical Society. 156 pp.

Kudray, Greg. 2002. Field guide: Hiawatha National Forest ecological classification system (September 30, 2002, DRAFT). Helena, MT: Ecological Inventory and Analysis, USA.

Minnesota Department of Natural Resources. 2003. Field guide to the native plant communities of Minnesota: the Laurentian Mixed Forest province. St. Paul, MN: Ecological Land Classification Program, Minnesota County Biological Survey and Natural Heritage and Nongame Research Program. 352 pp.

Schmidt, Kirsten M., James P. Menakis, Colin C. Hardy, Wendel J. Hann and David L. Bunnel. 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.

USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (2002, December). Fire Effects Information System [Online: May 26, 2004]. http://www.fs.fed.us/database/feis/.

Van Deelen, T.R., K.S. Pregitzer and J.B. Haufler. 1996. A comparison of presettlement and present-day forests in two northern Michigan deer yards. American Midland Naturalist. 135: 181-194.