14790

Central Interior and Appalachian Swamp Systems

BpS Model/Description Version: Aug. 2020

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Vegetation Type

Woody Wetland

Map Zones

60, 61, 63, 64, 65, 66

Geographic Range

These wetlands are scattered throughout the north-central Midwest (south of the Laurentian region) and the north-central Appalachians and southern New England at low to mid elevations.

Biophysical Site Description

Central Interior and Appalachian Swamp Systems are primarily associated with glacial landscapes, with occasional outliers south of the extent of the Wisconsinan glaciation. This Biophysical Setting (BpS) can be found in several landscapes. Some swamp systems are found in surface-water depressions where the vegetation is separated from the water-table and the hydrology is driven by surface water. These types of systems are found commonly over clay or bedrock where there would be a perched water table. These sites experience significant seasonal hydrologic fluctuation, with the water table typically above the soil surface in spring and significantly below the surface during summer. Forested wetlands primarily impacted by surface water are common over broad areas of glacial lakeplain. Also, swamp systems are found in ground-water depressions where groundwater is influencing the hydrology of the swamp. This type of system would be found over a coarse-textured soil substrate. These sites experience less hydrologic fluctuation than the surface-water depressional sites, and typically occupy relatively small areas relative to surface water influenced sites (Mitsch and Gosselink 2000).

Vegetation Description

This systems group is broadly defined, encompassing lowland forests dominated by hardwoods, conifers, or a mixture of hardwoods and conifers, and kettleholes supporting acidic peat swamps (NatureServe 2007). Various expressions are characteristic, based on landscape position, substrate, hydrology, pH, and minerotrophy.

Many occurrences are dominated by lowland hardwoods, including red maple (*Acer rubrum*), black ash (*Fraxinus nigra*), silver maple (*A. saccharinum*), and green ash (*F. pennsylvanica*) (Fike 1999; Thompson and Sorenson 2000; Edinger et al. 2002; Gawler and Cutko 2004; Sperduto and Nichols 2011; NatureServe 2007). Canopy associates can include yellow birch (*Betula alleghaniensis*), American elm (*Ulmus americana*), slippery elm (*U. rubra*), cottonwood (*Populus deltoides*), swamp white oak (*Quercus bicolor*), bur oak (*Q. macrocarpa*), pin oak (*Q. palustris*), and sycamore (*Platanus occidentalis*).

Substrate characteristics (e.g., organic vs. inorganic soils) and hydrology shape vegetative composition and structure at any particular site. For example, black ash favors organic deposits that are not subject to extreme hydrologic fluctuations, whereas silver maple, green ash, cottonwood, and sycamore favor sites that experience seasonal inundation. Conifers, including hemlock (*Tsuga canadensis*) and white pine (*Pinus strobus*) may be important in some stands.

Shrubs and herbs that occur in swamps under a range of conditions include highbush blueberry (*Vaccinium* *corymbosum*), common winterberry (*Ilex* *verticillata*), mountain holly (*Ilex* *mucronata*), meadowsweet (*Spiraea* *alba* var. *latifolia*), rosy meadowsweet (*Spiraea* *tomentosa*), speckled alder (*Alnus* *incana* ssp. *rugosa*), viburnums (*Viburnum* spp.), dogwoods (*Cornus* spp.), Virginia marsh-St. John's-wort (*Triadenum* *virginicum*), marsh fern (*Thelypteris* *palustris* var. *pubescens*), swamp yellow-loosestrife (*Lysimachia* *terrestris*), and New York American-aster (*Symphyotrichum* *novi-belgii*) (Sperduto and Nichols 2011).

Swamps with higher pH (usually ≥mid-5s) and/or nutrient levels may be characterized by red maple (*Acer rubrum*), black ash (*Fraxinus nigra*), white ash (*Fraxinus americana*), swamp white oak (*Quercus bicolor*), American elm (*Ulmus americana*), and American larch (*Larix* *laricina*). Other species indicative of relatively minerotrophic conditions include red-osier dogwood (*Swida* *sericea*), southeastern silky dogwood (*Swida* *amomum* var. *amomum*), common elderberry (*Sambucus nigra* ssp. *canadensis*), poison-sumac (*Toxicodendron vernix*), poison-ivy (*Toxicodendron radicans*), smooth arrowwood (*Viburnum dentatum* var. *lucidum*), sensitive fern (*Onoclea* *sensibilis*), spotted touch-me-not (*Impatiens* *capensis*), white turtlehead (*Chelone* *glabra*), spotted water-hemlock (*Cicuta* *maculata*), bulblet-bearing water-hemlock (*Cicuta* *bulbifera*), dwarf raspberry (*Rubus* *pubescens*), fowl mannagrass (*Glyceria striata*), and wood horsetail (*Equisetum* *sylvaticum*) (Sperduto and Nichols 2011).

Seepage indicators in seepage swamps include *Micranthes* *pensylvanica* (swamp small-flowered-saxifrage), *Geum rivale* (water avens), *Caltha palustris* (marsh-marigold), *Chrysosplenium americanum* (golden-saxifrage), *Cardamine pensylvanica* (Pennsylvania bitter-cress), *Hydrocotyle americana* (American marsh-pennywort), *Circaea alpina* (small enchanter’s-nightshade), *Packera* *schweinitziana* (New England groundsel), *Symplocarpus* *foetidus* (skunk-cabbage), *Glyceria* *melicaria* (northeastern mannagrass), lake sedge (*Carex lacustris*), and *Lindera benzoin* (northern spicebush). Seepage swamps influenced to a greater degree by base-rich groundwater contain more species indicative of richer conditions including *Rhamnus alnifolia* (alder-leaved buckthorn), *Cardamine bulbosa* (bulbous bitter-cress), *Liparis loeselii* (Loesel’s wide-lipped orchid), *Carex bebbii* (Bebb’s sedge), and *Lysimachia thyrsiflora* (tufted yellow-loosestrife) (Sperduto and Nichols 2011).

Swamps with lower pH and/or nutrient levels are typically poorly to very poorly drained and occur on shallow to deep muck and peat soils. Seasonal water level fluctuations are characteristic, but there is little or no streambank overflow or pronounced seepage influence. They usually occur in stagnant headwater basins with pHs in the low 4s to low 5s. Characteristic tree species include red maple (*Acer* *rubrum*), black gum (*Nyssa* *sylvatica*), yellow birch (*Betula* *alleghaniensis*), hemlock (*Tsuga* *canadensis*), and less frequently red spruce (*Picea* *rubens*). Shrubs can include *Vaccinium corymbosum* (highbush blueberry) *Ilex verticillata* (common winterberry), *Ilex* *mucronata* (mountain holly), *Viburnum* *dentatum* var. *lucidum* (smooth arrowwood), *Ilex laevigata* (smooth winterberry), *Spiraea* *alba* var. *latifolia* (meadowsweet), *Chamaedaphne calyculata* (leatherleaf), and *Kalmia angustifolia* (sheep laurel). *Osmundastrum cinnamomeum* (cinnamon fern) is typically abundant in the herbaceous layer, with lesser quantities of three-seeded sedge (*Carex trisperma*) and other herbs. *Sphagnum* moss is often common in the wetter hollows and hummock-sides (Sperduto and Nichols 2011).

Included within this group of systems are acidic peatland communities dominated by low, ericaceous shrubs, primarily leatherleaf (*Chamaedaphne calyculata*), on shallow to deep layers of sphagnum peat. These bogs often include a scattered low canopy of tamarack, pitch pine or pond pine,and black spruce (*Picea mariana*). The low nutrient status and high acidity of the peat substrate supports low vascular plant richness and diversity. Characteristic species include cranberries (*Vaccinium* spp.), sundews (*Drosera* spp.), and pitcher plant (*Sarracenia purpurea*).

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| ACRU | *Acer rubrum* | Red maple |
| FRPE | *Fraxinus pennsylvanica* | Green ash |
| TSCA | *Tsuga canadensis* | Hemlock |
| FRNI | *Fraxinus nigra* | Black ash |
| QUPA2 | *Quercus palustris* | Pin oak |
| PLOC | *Platanus occidentalis* | American sycamore |
| QUBI | *Quercus bicolor* | Swamp white oak |
| ULAM | *Ulmus americana* | American elm |

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

Disturbance Description

The dominant disturbance in this BpS is seasonal water table fluctuation, leading to varying periods of inundation. Spring flooding restricts seed germination and diversity of shrubs and ground layer species. Summer drought is an additional stressor. Shallowly rooted trees are subject to windthrow, particularly those rooted in unstable organic substrates and are susceptible to hurricane damage. Beaver inundation will lead to stand replacement. Fire mostly originates from adjacent uplands and the type of fire will be determined by the forest type adjacent to the wetland.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 1014 | 57 |  |  |
| Moderate (Mixed) |  |  |  |  |
| Low (Surface) | 1356 | 43 |  |  |
| All Fires | 580 | 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

These systems typically occur as small to large patches, the largest patches occurring on glacial clay and sand-clay lakeplain or outwash plains.

Adjacency or Identification Concerns

These systems commonly occur as small to large patches in a matrix of fire-resistant systems, including northern hardwood and hemlock-hardwood forests in Braun’s (1950) hemlock-white pine-northern hardwoods forest region. Outlying examples may occur south of the extent of the Wisconsinan glaciation (NatureServe 2007); these may be associated with fire-adapted systems, including oak-chestnut and oak-pine systems. The majority of pre-European settlement acreage has been drained and converted to agriculture.

Issues or Problems

These wetlands may be simplified by anthropogenic disturbances, including hydrologic alteration, grazing, and introduction of invasive species. Invasive species occurring in these systems include glossy buckthorn (*Rhamnus frangula*), garlic mustard (*Alliaria petiolata*), Japanese barberry (*Berberis thunbergii*), and multiflora rose (*Rosa multiflora*). Also, the introduction of Dutch elm disease into North American forests has largely eliminated large elms from native ecosystems.

Native Uncharacteristic Conditions

Strong dominance by red maple may indicate previous disturbance (grazing or pasturing, hydrologic alteration, beaver flooding, etc.).

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 | 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 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Tree | 0-5 | B | B | B | B | B | B | B | B | B | B |
| Tree | 5-10 | B | B | B | B | B | B | B | B | B | B |
| Tree | 10-25 | C | C | C | C | C | C | C | C | C | C |
| Tree | 25-50 | C | C | C | C | C | C | C | C | C | C |
| Tree | >50 | C | C | C | C | C | C | C | C | C | C |

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 24 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| CEOC2 | Cephalanthus occidentalis | Common buttonbush | Low-Mid |
| COSE16 | Cornus sericea | Red-osier dogwood | Low-Mid |
| ILVE | Ilex verticillata | Common winterberry | Low-Mid |
| ACRU | Acer rubrum | red maple | Upper |
| VACO | Vaccinium corymbosum | highbush blueberry | Mid |
| VIBUR | Viburnum spp. |  | Low-Mid |
| CAREX | Carex spp |  | Low |
| CACA4 | Calamagrostis canadensis var. *canadensis*) | robust bluejoint | Low |
| COAM2 | Cornus amomum | Silky dogwood | Low-Mid |

Description

This stage is an early successional stand following flooding or a rare stand-replacing fire. Shrubs increase in dominance over time, although open grass- and sedge-dominated wet meadow may be dominant for the first 10yrs+, particularly in areas in which existing shrubs were flood-killed. Open to dense thicket dominated by species such as *Ilex verticillata* (winterberry), *Vaccinium corymbosum* (highbush blueberry), *Lindera benzoin* (spicebush), *Viburnum* spp., *Alnus incana* ssp. *rugosa* (speckled alder) *Cephalanthus occidentalis* (buttonbush), *Corylus cornuta* (hazelnut), *Salix* spp.(willows), and *Cornus* spp. (dogwoods).

This stage results from major disturbance, including stand-replacement fire, flooding, or windthrow. Rare replacement fires and catastrophic windthrow can maintain these systems in Class A (an early shrub/herb- dominated successional stage). Flooding caused by beaver or other natural hydrologic alteration is estimated to occur every 300yrs, although this number may be much higher, and will also maintain the systems in Class A. Shrub thickets are sometimes relatively stable and long-persistent, but the concept used for this model is of a site that, due to edaphic factors, favors the development of forested wetland in the absence of major disturbance(s). As with all stages of these systems, seasonal annual spring flooding, would occur. This natural process was not explicitly modeled but it should be assumed that it is occurring annually and maintaining the swamp forest instead of allowing it to succeed to drier forest type.

*Maximum Tree Size Class*

Class B 36 Mid Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ACRU | Acer rubrum | Red maple | Upper |
| FRPE | Fraxinus pennsylvanica | Green ash | Upper |
| FRNI | Fraxinus nigra | Black ash | Upper |
| VACO | Vaccinium corymbosum | highbush blueberry | Mid |
| VIBUR | Viburnum spp. |  | Low-Mid |
| CAREX | Carex spp |  | Low |
| CACA4 | Calamagrostis canadensis var. *canadensis*) | robust bluejoint | Low |
| COAM2 | Cornus amomum | Silky dogwood | Low-Mid |

Description

Mid-development forested swamp stage. Moderate tree canopy develops from seedlings that establish under shrubs and from existing scattered trees in Class A. Typical species include silver maple (*Acer saccharinum*), red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*), black ash (*Fraxinus nigra*), American elm (Ulmus americana*), pin oak (Quercus palustris), swamp white oak (Quercus bicolor), sycamore (Platanus* *occidentalis*), cottonwood (*Populus deltoides*), and a variety of other canopy associates. General appearance is that of an open tree canopy with shrub-dominated understory, grading into forested wetland at the end of this period.

As with all stages of these systems, seasonal annual spring flooding, would occur. This natural process was not explicitly modeled but it should be assumed that it is occurring annually and maintaining the swamp forest instead of allowing it to succeed to drier forest type.

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). Flooding caused by beaver or other natural hydrologic alteration is estimated to occur every 300yrs, although this number may be much higher, and will return the systems to Class A.

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

Class C 40 Late Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ACRU | Acer rubrum | Red maple | Upper |
| FRPE | Fraxinus pennsylvanica | Green ash | Upper |
| FRNI | Fraxinus nigra | Black ash | Upper |
| VACO | Vaccinium corymbosum | highbush blueberry | Mid |
| VIBUR | Viburnum spp. |  | Low-Mid |
| CAREX | Carex spp |  | Low |
| CACA4 | Calamagrostis canadensis var. canadensis) | robust bluejoint | Low |
| COAM2 | Cornus amomum | Silky dogwood | Low-Mid |

Description

Mature forested swamp: Mature, multi-seral. This stage is dominated by the same tree species as Class B although the shrub layer is greatly reduced.

This stage is maintained by frequent windthrow of single trees or small to large patches of trees. Replacement fires were estimated to occur every 700-1000yrs; this likely varied across the region and depending on the nature of the upland matrix in any given area (fire-dependent vs. fire-intolerant). Catastrophic windthrow would also return the systems to Class A. Flooding caused by beaver or other natural hydrologic alteration is estimated to occur every 300yrs, although this number may be much higher, and will return the systems to Class A.

As with all stages of these systems, seasonal annual spring flooding, would occur. This natural process was not explicitly modeled but it should be assumed that it is occurring annually and maintaining the swamp forest instead of allowing it to succeed to drier forest type.

*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:CLS | 29 |
| Mid1:CLS | 30 | Late1:CLS | 79 |
| Late1:CLS | 80 | 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 |
| Surface Fire | Mid1:CLS | Mid1:CLS | 0.001 | 1000 | No | 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 |
| Surface Fire | Late1:CLS | Late1:CLS | 0.001 | 1000 | No | 0 |
| Replacement Fire | Late1:CLS | Early1:ALL | 0.001 | 1000 | Yes | 0 |
| Wind or Weather or Stress | Late1:CLS | Early1:ALL | 0.0145 | 69 | Yes | 0 |

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