Northern Hardwood Swamp (Global Rank G4; State Rank S2)

Overview: Distribution, Abundance, Environmental Setting, Ecological Processes

Hardwood Swamps are minerotrophic forested wetlands dominated by broad-leaved deciduous trees. Northern Hardwood Swamp occurs mostly north of the Tension Zone, within poorly drained portions of morainal landscapes, in glacial lakebeds or outwash channels, along or near lakes or streams, and at the margins of peatlands where there is some input of nutrient-enriched groundwater. Soils are mucks, mucky peats, mucky sands, or mineral and are seasonally saturated or inundated. In some ecological landscapes, such as the Central Lake Michigan Coastal, North Central Forest, and Superior Coastal Plain, the substrate may contain layers of impermeable clays, silts, or bedrock within the aerated soil zone and above the water table; in such cases these swamps may be referred to as perched wetlands.

Microtopography is an extremely important internal feature of Northern Hardwood Swamp. Within stands it contributes to species and habitat diversity. Trees sometimes occur on slight rises, with pools of standing water occupying the hollows between them, especially following spring snowmelt or after heavy rains. Though standing water is usually no longer present by mid-summer, soils may remain saturated and do not dry out to the degree that the upper horizons of Floodplain Forest soils do. In addition, Floodplain Forests experience annual episodes of scouring and deposition due to the seasonal floods of the rivers they are associated with, especially following spring snowmelt and rains. In Hardwood Swamp the seasonal flooding is characterized by less scouring and deposition, as the movement of water is more vertical and drainage tends to be slower and less violent. In some cases, such as on high groundwater-fed terraces along large rivers or in basins drained by small gradient streams (usually of stream order 1 or 2), stands may exhibit aspects of both Hardwood Swamp and Floodplain Forest.

Natural disturbances include windthrow, drought, and periodic flooding, including inundation by American beaver activity. These disturbances are partially responsible for the hummocky microtopography that characterizes some stands. The surface variability is directly related to and responsible for the understory diversity as the Hardwood Swamp flora may include species tolerant of or even dependent on periodic flooding and seasonal inundation, saturated but not inundated substrates, or site conditions that include alternating periods of wetting and drying. Black ash is adapted to short-term inundation and stagnant water but is intolerant of prolonged flooding. Under the latter circumstance, substantial death or dieback may occur. In contrast, green ash and silver maple are better adapted to moving water and to drier conditions later in the growing season. These species are more likely to thrive within river floodplains. In Hardwood Swamps, growing season frosts may occur, and the effects are very noticeable due to loss of leaves in the ashes and the prominent dieback exhibited by stands with a dense understory of frost-sensitive ferns.

Although historical abundance is hard to estimate, hardwood swamps were noted by surveyors during the federal public land survey conducted across Wisconsin during the middle of the 19th century in some of the same landscape settings they occupy now. In Michigan, “black ash swamps” occupied approximately 280,000 acres, or 0.8% of that state’s total area at the time of the public land survey in the mid-19th century (Albert and Comer 2008).

Community Description: Composition and Structure

The dominant tree species is often black ash (Fraxinus nigra), which sometimes occurs in almost pure stands. Canopy associates include red maple (Acer rubrum), yellow birch (Betula alleghaniensis), American elm (Ulmus americana), balsam poplar (Populus balsamifera), and occasionally silver maple (Acer saccharinum) and green ash (Fraxinus pennsylvanica). Though silver maple is sometimes present, this species is much more characteristic of true floodplains. Hybrid red x silver maples (Freeman’s maple – Acer x freemanii) are locally...
common in certain regions, for example, in some of the large insular swamps of east central Wisconsin. Elms have persisted in many stands as seedlings, saplings, or small trees, but they usually succumb to Dutch elm disease, either before or soon after reaching the canopy. Dead elms are sometimes present as snags or coarse woody debris and can add important, if temporary, structural diversity to stands currently lacking these important features. Conifers such as northern white-cedar (Thuja occidentalis), tamarack (Larix laricina), white spruce (Picea glauca), black spruce (P. mariana), and balsam fir (Abies balsamea) are sometimes present but are neither dominant nor co-dominant.

Tall shrubs such as speckled alder (Alnus incana), common winterberry (Ilex verticillata), and mountain maple (Acer spicatum) may be locally common. Other tall shrubs occurring in hardwood swamps are nannyberry (Viburnum lentago), cranberry viburnum (V. opulus ssp. trilobum), and several of the native honeysuckles, such as swamp fly honeysuckle (Lonicera oblongifolia) and mountain fly honeysuckle (L. villosa). Gooseberries and currants are also characteristic shrubs of ash swamps; these include American black currant (Ribes americanum), hairy-stem gooseberry (R. hirtellum), and swamp red currant (R. triste). Vines may be important and include Virginia creeper (Parthenocissus quinqufolia), common eastern poison-ivy (Toxicodendron radicans), river bank grape (Vitis riparia), and red honeysuckle (Lonicera dioica).

The herbaceous flora can be diverse, though this is dependent on location, presence of internal microsites, and stand history. Representative understory plants include jack-in-the-pulpit (Arisaema triphyllum), small-spire false nettle (Boehmeria cylindrica), marsh-marigold (Caltha palustris), Pennsylvania bitter-cress (Cardamine pensylvanica), small enchanter’s nightshade (Circaea alpina), rough bedstraw (Galium asprellum), orange jewelweed (Impatiens capensis), Canadian wood-nettle (Laportea canadensis), northern water-horehound (Lycopus uniflorus), ostrich fern (Matteuccia struthiopteris), marsh fern (Thelypteris palustris), naked miterwort (Mitella nuda), sensitive fern (Onoclea sensibilis), cinnamon fern (Osmunda cinnamomea), royal fern (O. regalis), Canadian clearweed (Pilea pumila), dwarf red raspberry (Rubus pubescens), swamp saxifrage (Saxifraga pensylvanica), marsh skullcap (Scutellaria galericulata), skunk-cabbage (Symlocarpus foetidus), blue marsh violet (Viola cucullata), and small white violet (V. macloskeyi).

Among the numerous graminoid plants associated with Hardwood Swamp are fowl manna grass (Glyceria striata), drooping wood-reed (Cinna latifolia), brome-like sedge (Carex bromoides), fringed sedge (C. crinata), graceful sedge (C. gracillima), swollen sedge (C. intumescens), hop sedge (C. lapulina), and common foxtail sedge (C. stipata). Water horsetail (Equisetum fluviatile) is sometimes common in stands containing persistent pools.

Stands in which springs are well developed will support additional plant species, such as purple-stem angelica (Angelica atropurpurea), American golden saxifrage (Chrysosplenium americanum), marsh pennywort (Hydrocotyle americana), and golden ragwort (Packera aurea).

Plants of conservation interest that are known from Hardwood Swamp habitats include Assiniboine sedge (Carex assiniboinensis), drooping sedge (C. prasina), showy lady’s-slipper (Cypripedium reginae), small forget-me-not (Myosotis laxa), and bog bluegrass (Poa paludigena).

Some of the animals for which Hardwood Swamp provides important habitat are American black bear (Ursus americanus), fisher (Martes pennanti), northern flying squirrel (Glaucomys sabrinus), eastern red bat (Lasiurus borealis), hoary bat (L. cinereus), woodland jumping mouse (Napaeozapus insignis), water shrew (Sorex palustris), Broad-winged Hawk (Buteo platypterus), Red-shouldered Hawk (Buteo lineatus), Ruffed Grouse (Bonasa umbellus), Veery (Catharus fuscescens), Canada Warbler (Cardellina canadensis), Northern Waterthrush (Parkesia noveboracensis), and Least Flycatcher (Empidonax minimus). Stands with high gradient spring runs
may support Louisiana Waterthrush (*Parkesia motacilla*) and stands with an open canopy and well-developed tall shrub layer sometimes support Golden-winged Warbler (*Vermivora chrysoptera*). Given the large number of fishless small ponds and pools that occur in some stands during the spring, Hardwood Swamp can be of high significance for frogs, salamanders, and various macroinvertebrates. Heavy use by migratory passerines has been noted in Northern Hardwood Swamp, especially in stands close to the Great Lakes or inland waterbodies.

**Conservation and Management Considerations**

Maintaining site hydrology integrity is a key factor if the community is to remain viable. Black ash is sensitive to excessive changes in water levels. American beaver activity may lead to the inundation and death of entire stands, and poorly designed or improperly installed roads and culverts may do the same. Sites that are fed by springs are susceptible to rutting, soil compaction, and channeling of water when disturbed by construction activities or heavy equipment. Severe windstorms may result in areas of extensive blowdown, which creates the pit-and-mound microtopography that is important to many of the understory plants and some animals. American beaver, though they may drown entire stands, can also fell individual trees, creating small canopy gaps that may encourage the growth of some tree species and produce favorable light conditions for some understory species.

Heavy logging can lead to “swamping,” whereby the trees are replaced by wetland shrubs such as speckled alder or sometimes by coarse herbs such as common lake sedge (*Carex lacustris*), cat-tails (*Typha spp.*), or reed canary grass (*Phalaris arundinacea*). Removal of the trees leads to reduced evapotranspiration, which may raise the water table, killing or damaging any remaining trees and preventing regeneration. Long-term recovery prospects are uncertain. Some heavily logged conifer swamps, many of which were previously dominated by northern white-cedar, are now dominated by black ash, sometimes with other hardwoods and balsam fir. Few details are available on the recovery potential or future successional trajectories of such stands. Given the sensitivity of northern white-cedar to deer browse, a return to northern white-cedar dominance is unlikely in the short term. Eventually, the development of reliable and cost-effective methods of re-establishing conifers in swamps that were formerly conifer-dominated or with mixed conifer-hardwood composition will be needed.

Ash-dominated hardwood swamps are highly threatened by the recent arrival of the emerald ash borer (*Agrilus planipennis*), an exotic insect from Asia. This extremely serious forest pest was first observed in Wisconsin in 2008 and has been confirmed in 39 Wisconsin counties as of September 2016. It will almost certainly continue to spread. All North American ashes are vulnerable to emerald ash borer attack, and the effects in some ash forests east of Wisconsin (e.g., in southeastern Michigan) have been devastating. Past problems and changes caused by Dutch elm disease fungus (*Ophiostoma ulmi*) may be less noticeable now, but the resulting conservation challenges still exist. See the Wisconsin’s Emerald Ash Borer Information Source website (WDATCP 2016) for up-to-date information on its current distribution in Wisconsin.

Other invasives posing problems for Hardwood Swamps are reed canary grass, purple loosestrife (*Lythrum salicaria*), and glossy buckthorn (*Rhamnus frangula*). In stands inundated by American beaver or anthropogenic actions, invasions by cat-tails and common reed (*Phragmites australis*) have been noted. Canopy gaps created by logging, windthrow, or disease (e.g., Dutch elm disease) may be points of entry for reed canary grass and other problematic species, which may negatively affect tree regeneration and reduce understory diversity.
To date hardwood swamps have received little attention from biologists in Wisconsin, yet they are distinctive communities with unique functional characteristics that provide significant habitat for diverse assemblages of native plants and animals. Additional sampling is needed across the state range of Hardwood Swamp to better document composition, structure, stand histories, and hydrology. Because of the serious threat posed by the spread of the emerald ash borer and the actions that may be taken to address that problem in the near future, there is some urgency in moving ahead to conduct such studies.

Additional Information
More information on similar or related natural communities may be found in the descriptions for Southern Hardwood Swamp, Floodplain Forest, Northern Wet-mesic Forest, Forested Seep, and Alder Thicket. The U.S. National Vegetation Classification (US NVC) type most closely resembling Hardwood Swamp is CEGL002105 Black Ash / Mixed Hardwood Swamp. CEGL002071 Red Maple - Ash - Birch Swamp Forest also bears some resemblance to Hardwood Swamp (although this seems more often to be a successional stage of Hardwood Swamp as we currently define and describe it in Wisconsin).

Also see:
Christensen et al. (1959)
Comer et al. (1995)
Kost et al. (2007)
WDNR (2016a)


For a list of terms used, please visit the Glossary.

For a reference list, please see the Literature Cited.