Open Bog (Global Rank G5; State Rank S4)

Overview: Distribution, Abundance, Environmental Setting, Ecological Processes

Open Bog is defined here as the nearly treeless, most acidic portion of the peat-accumulating acid wetland communities occurring across northern Wisconsin. Besides high acidity and the lack of tree cover, Open Bog is characterized by low oxygen levels, limited nutrient availability, and a continuous carpet of living sphagnum mosses over deep layers of peat in various stages of decomposition. The peat may be composed mostly of mosses or include layers of sedges or woody plants, depending on the vegetation and disturbance history of the site. A pronounced hummock-hollow microtopography is often present. Elevation and moisture levels within these hummocky areas influence the distribution of plants and animals, and water sometimes pools in the hollows. The flora is depauperate when compared with the plant composition of the poor and rich fens, but the most acid peatlands do support plants adapted to the extreme conditions of the bog environment. Open Bog is closely related to and may intergrade seamlessly with “Muskeg,” which has a higher cover of stunted conifers and different proportions of the characteristic plants making up the flora.

The key functional characteristic of Open Bog is that the accumulation of peat effectively isolates the plant community from contact with nutrient-enriched groundwater. Over time the Open Bog becomes more acidic, more anaerobic, and the availability of key nutrients for plant growth is diminished. The community remains saturated under normal weather conditions due to the capacity of the dominant mosses for retaining water. Although not available for most Wisconsin bogs, in other upper midwestern locations such as northern Minnesota (Glaser 1987) and northern Michigan (Crum 1984), pH values are very low, generally < 4.2, and calcium availability is extremely limited (<2 ppm).

All of the acid peatland communities, including Open Bog, are circumboreal in their global distribution and reach their southernmost range limits in the Upper Midwest, including Wisconsin. Open Bog is widespread, relatively common, and often co-occurs with other peatland communities in the glaciated portions of northern Wisconsin. Landforms supporting acid peatlands in the western Great Lakes region are all the result of past glaciation and include outwash, end and ground moraines, and glacial lakebeds. The origin of the landscape settings supporting Open Bog are basically of two types: glacial kettle lakes (ice block lakes) in which a basin containing a lake is very gradually filled in from the margins by peatland vegetation. Such lakes are common in pitted (“collapsed”) outwash landforms and sometimes in end moraine. The other important setting for Open Bog are near-level but poorly-drained areas (Wright et al. 1992), often with a high, sometimes perched, water table. Characteristic landforms include the beds of extinct glacial lakes and level (uncollapsed) outwash.

Locations of Open Bog in Wisconsin. The map shows an extremely broad geographic range, due in part to the previously broad concept used to define the type. The deeper hues shading the ecological landscape polygons indicate geographic areas of greatest abundance. An absence of color indicates that the community has not (yet) been documented in that ecological landscape. The dots indicate locations where a significant occurrence of this community is present, has been documented, and the data incorporated into the Natural Heritage Inventory database.

Community Description: Composition and Structure

Tree cover is absent or very sparse, and the individuals present are generally short, spindly, and stunted. Growth is extremely slow, and it may take an individual tree 50 years or more to reach a diameter of one inch. Black spruce (Picea mariana) is the most common species, with tamarack (Larix laricina) the most frequent associate. Jack pine (Pinus banksiana) is sometimes present and in a few cases may be the most common tree species. Other trees, such as eastern white pine (Pinus strobus), northern white-cedar (Thuja occidentalis), white birch (Betula papyrifera), or red maple (Acer rubrum), may show up briefly in a bog environment, but these species seldom persist unless there are major changes to site hydrology, coupled with increased nutrient availability.

The shrub layer is important and dominated by members of the heath family, the Ericaceae. In an Open Bog situation, the ericads are of short stature, typically less than 0.5 meters in height. The most characteristic species are leatherleaf (Chamaedaphne calyculata), bog-laurel (Kalina polifolia), bog-rosemary (Andromeda glaucophylla), Labrador-tea
(Ledum groenlandicum), and small cranberry (Vaccinium oxyccoccos). Bogs that have burned may support blueberries, including early low blueberry (Vaccinium angustifolium) and velvet-leaf blueberry (V. myrtilloides).

Diversity of vascular herbs is low compared to Poor Fen and other, more minerotrophic peatland communities. The total absence of fen “indicators,” along with water chemistry, are the factors used in some regions to differentiate Open Bog from Poor Fen (e.g., in northern Minnesota; see Wright et al. 1992). Representative vascular herbs include several graminoids, especially sedges such as few-seeded sedge (Carex oligosperma), boreal bog sedge (Carex magellanica), few-flowered sedge (C. pauciflora), and tussock cotton-grass (Eriophorum vaginatum). Relatively few other vascular herbs occur in the Open Bog, but the flora may include moccasin-flower (Cypripedium acaule), round-leaved sundew (Drosera rotundifolia), and swamp false Solomon’s-seal (Smilacina trifolia). Burned bogs lose some of this hummock-hollow structure, at least temporarily, and may be dominated in the short term by sedges, especially few-seeded sedge (one of the so-called “wiregrasses”), or sometimes by a broad-leaved species, common yellow lake sedge (Carex utriculata).

The mosses, despite the diminutive stature of individual plants, exert a strong influence on all other plants comprising the bog vegetation and could therefore be considered the real community dominants. They affect the presence, abundance, and vigor (or stature) of all other plants and animals inhabiting acid peatland environments. In the Open Bog, mosses in the genus Sphagnum are especially important (Christy 1982, Crum 1984, Glaser 1984). Among the representative species are Sphagnum angustifolium, S. capillifolium, S. fimbriatum, S. fuscum, S. magellanicum, and S. recurvum. Other genera may also be present, including species such as Hylocomium splendens, Pleurozium schreberi, and Polytrichum strictum. Lichens, including several Cladonia species, sometimes occur on the tops of the moss hummocks.

No small mammals inhabiting peatlands are restricted to the Open Bog, but species found commonly in bog habitats include cinereus shrew (Sorex cinereus), southern red-backed vole (Clethrionomys gapperi), and meadow vole (Microtus pennsylvanicus). The examples offered here occur in a number of peatland types and are more common in other communities. The southern bog lemming (Synaptomys cooperi) can be common in acid bogs and weakly minerotrophic fens (Anderson 2008). Resident birds include Sandhill Crane (Antigone canadensis), Northern Harrier (Circus cyaneus), and Savannah Sparrow (Passerculus sandwichensis). Bogs that are integral parts of large open peatland complexes may support area-sensitive birds, including rarities such as Sharp-tailed Grouse (Tympanuchus phasianellus) and Short-eared Owl (Asio flammeus). The high acidity and low productivity of bog and poor fen habitats are not conducive to supporting abundant herptile populations.

**Conservation and Management Considerations**

The overriding conservation need is protection of peatland hydrology, especially from activities that alter water levels or that direct nutrients or sediments into the peatland. Conservation projects focused on Open Bog protection need to consider the entire basin within which the community is situated and the impacts of activities in the watershed surrounding the wetlands. Ditching and diking have significant impacts on bog vegetation, either by encouraging the growth of shrubs, by inundating the acid peat, or by creating conduits that facilitate the movement of nutrients, sediments, and invasive species.

In some regions, such as central Wisconsin in the Central Sand Plains Ecological Landscape, the peatlands have been exploited as a source of “peat moss.” The living mosses are harvested during the growing season, dried, and then used...
This unnamed kettle lake is ringed by boggy vegetation. In addition to the open bog community, concentric zones of poor fen, northern tamarack swamp, and alder thicket are also present. Northern Highland-American Legion State Forest, Vilas County, Northern Highland Ecological Landscape. Photo by Eric Epstein, Wisconsin DNR.

for various purposes. At this time, these uses are almost entirely decorative. Though the mosses—at least some of them—regenerate on a “rotation” of seven to nine years, the impacts on other biota, such as nesting birds, need to be better understood and also factored into harvest plans on public lands. As peat no longer accumulates under this management regime, long-term effects on the community also require clarification. Other commercial uses of boggy peatlands include cranberry and “wild” rice production. Cranberry cultivations require the conversion of open peatlands to beds into which the desired varieties of cranberry are planted in monocultures. These are usually adjacent to constructed reservoirs in which water is stored for irrigation purposes, to use as a spray to protect the vulnerable cranberry plants from growing season frosts, and to facilitate harvest of the fruits in the fall by releasing water into the beds to float the ripe cranberries.

Grazing has impacted some peatlands in parts of Wisconsin, but forage values for livestock are limited, the footing is challenging for hoofed mammals, and associated problems have been local. Relatively few serious invasive plant issues have been documented in Open Bog.

Southern Wisconsin’s “Bog Relicts” bear some floristic resemblance to the acid peatlands of the north and may support a few animal species more characteristic of similar habitats in northern Wisconsin, but the “relicts” are mostly small and isolated, and many have suffered from hydrological disruptions that altered water chemistry, water quantity, and plant composition and disrupted successional processes. The “relicts” require further study and are in need of additional classification work because in these southern “bogs” the peat seldom effectively isolates the plant community completely from the influence of mineral-laden groundwater. Such communities are “boggy,” but it is doubtful that many of them will be classified as Open Bog as defined and described here.

There is, or until recently was, a tendency to treat the open peatlands as wastelands of little intrinsic value. Attempts to change the peatlands to something considered more productive have been made in a number of locations, and these have sometimes been conducted or encouraged by managers of public lands. There is a need to assess the abundance and condition of all peatlands across the state, including Open Bog, before embarking on more ambitious plans to fundamentally alter them across all of the landscapes in which they occur.

The other major need from the standpoint of characterizing this community is to identify the dominant, characteristic, and rare nonvascular plants—the peat mosses—and associate them with site-level water chemistry, landform, and hydrology. Limited information is available from Wisconsin peatlands, so we have relied on work done in Michigan, Minnesota, and Ontario.

Stands often referred to as “bogs” but which occur in insular kettle basins heavily dominated by dense stands of leatherleaf may deserve their own type or in some cases may represent a successional or developmental peatland stage. Such communities may be the result of severe fires, perhaps during the Cutover, that burned deeply into decades or centuries of accumulated peat.

Additional Information

For additional information on Open Bog and other acid peatland communities, see the descriptions in this chapter for Muskeg, Black Spruce Swamp, Northern Tamarack Swamp, Poor Fen, Central Poor Fen, and Bog Relict. The U.S. National Vegetation Community types corresponding most closely to Wisconsin’s Open Bog are CEGL005256 Open Graminoid / Sphagnum Bog and CEGL005277 Leatherleaf Poor Fen (Faber-Langendoen 2001).

Also see:
Crum (1984)
Glaser (1987)
Klinger (1996)