All Communities Glossary

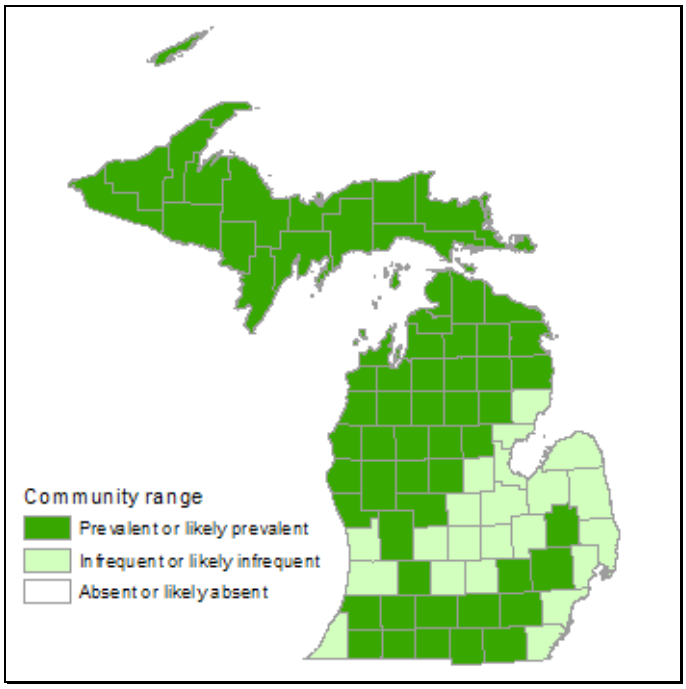
Michigan's Natural Communities

Bog

State Rank: S4

County Distribution Map

Photo by Joshua G. Cohen



Ecoregion distribution map (PDF)
County distribution map (PDF)

Overview

Bog is a nutrient-poor peatland characterized by acidic, saturated peat and the prevalence of sphagnum mosses and ericaceous shrubs. Fire and flooding are the main natural disturbance factors.

Landscape Context

Bogs occur in kettle depressions on pitted outwash and moraines and in flat areas and shallow depressions on glacial outwash and glacial lakeplain. Within kettle depressions, bogs can occupy the entire basin or occur as a mat (floating or grounded) on the margins of lakes. Bogs occurring on former glacial lakebeds and drainageways tend to be more extensive than kettle bogs, which are limited in area by the size of the glacial ice-block that formed the basin. The overall topography of bogs is flat to gently undulating with microtopography characterized by hummocks and hollows.

Soils

The organic soils are composed of saturated fibric peat that contains partially decomposed sphagnum mosses and frequently, fragments of sedges and wood. Like the surface water, peat soils are extremely acidic, cool, and characterized by low nutrient availability and oxygen levels. The water-retaining capacity of sphagnum peat is tremendous and as a result bogs are saturated, anoxic systems with water tables near the surface. Peat composition changes with depth and is influenced by the successional history of a given site. Fiber content and hydraulic conductivity of peat soils usually decrease with depth.

Natural Processes

Saturated and inundated conditions inhibit organic matter decomposition and allow for the accumulation of peat. Under cool, anaerobic, and acidic conditions, the rate of organic matter accumulation exceeds organic decay. Once sphagnum mosses become established on the peat mat, they maintain and enhance saturated and acidic conditions, which in turn promote continued peat development. Development and expansion of peatlands occur via two distinct processes: lake-filling and paludification. Lake-filling occurs in small lakes with minimal wave action, where gradual peat accumulation results in the development of a bog mat that can fill the basin or occur as a floating mat or grounded mat. Paludification is the blanketing of terrestrial systems (often forests) by the overgrowth of peatland vegetation. Paludified peatlands develop on flat areas (typically lakeplains) where peat develops vertically and spreads horizontally. For both lake-filling and paludification, peat accumulates above the water table and the bog becomes isolated from the influence of groundwater. Bogs are ombrotrophic to weakly minerotrophic peatlands, receiving inputs of water and nutrients primarily from ion-poor precipitation.

Natural disturbance factors influencing bogs include fire, flooding, windthrow, and insects. Surface fire can contribute to the maintenance of bogs by killing encroaching trees. Fire severity and frequency in bogs is closely related to fluctuations in water level and landscape context; sites adjacent to fire-prone uplands burn more frequently. Prolonged periods of lowered water table can allow the surface peat to dry out sufficiently to burn. Flooding contributes to the development, expansion, and maintenance of bogs. Dam-building activities of beaver can result in blocked drainage and flooding, which facilitate sphagnum peat development and expansion and can also cause grounded bog mats to become loosened from the bottom and float. Roots of peatland trees are physiologically active near the surface and are quickly killed when the water table rises following prolonged flooding. Trees growing in bogs are particularly susceptible to windthrow because sphagnum peat provides a poor substrate for anchoring trees and the anaerobic conditions associated with saturated soils limit rooting depth. Tree survival in bogs is also limited by insects and parasites. Insect outbreaks of the larch sawfly (*Pristiphora erichsonii*) cause heavy mortality of tamarack (*Larix laricina*). The plant parasite dwarf mistletoe (*Arceuthobium pusillum*) kills black spruce (*Picea mariana*). Native ericaceous shrubs can limit the establishment and growth of conifer trees within bogs through both competitive inhibition and the production of allelopathic

compounds.

Vegetation

Bogs are characterized by a continuous carpet of sphagnum moss, a species-poor herbaceous layer, low ericaceous, evergreen shrubs, and widely scattered and stunted conifer trees. The ubiquitous moss layer of bogs is dominated by sphagnum mosses, especially *Sphagnum magellanicum*, *S. angustifolium*, and *S. fuscum*. The shrub layer is dominated by low, ericaceous shrubs with leatherleaf (*Chamaedaphne calyculata*) as the most prevalent species. The following heath shrubs are important components of bogs: bog rosemary (*Andromeda glaucophylla*), huckleberry (*Gaylussacia baccata*), sheep-laurel (*Kalmia angustifolia*), bog laurel (*K. polifolia*), Labrador tea (*Rhododendron groenlandicum*), low sweet blueberry (*Vaccinium angustifolium*), Canada blueberry (*V. myrtilloides*), large cranberry (*V. macrocarpon*), and small cranberry (*V. oxycoccos*). The tall shrub layer of bogs is less dense than the low shrub layer and is often restricted to the periphery of the bog. Tall shrubs typical of bogs include black chokeberry (*Aronia prunifolia*), mountain holly (*Ilex mucronata*), bog willow (*Salix pedicellaris*), steeplebush (*Spiraea tomentosa*), smooth highbush blueberry (*Vaccinium corymbosum*), and wild-raisin (*Viburnum cassinoides*). South of the climatic tension zone, buttonbush (*Cephalanthus occidentalis*), poison sumac (*Toxicodendron vernix*), and highbush blueberry frequently occur within bogs or along their margins. The herbaceous layer of bogs is dominated by cyperaceous plants. Sedges that are characteristic of bogs include few-seed sedge (*Carex oligosperma*), few-flower sedge (*C. pauciflora*), and wiregrass sedge (*C. lasiocarpa*). Additional graminoids include twig-rush (*Cladium mariscoides*), three-way sedge (*Dulichium arundinaceum*), cotton-grasses (*Eriophorum* spp.), white beak-rush (*Rhynchospora alba*), and bulrushes (*Scirpus* spp.). Insectivorous plants are common features of bogs and may include round-leaved sundew (*Drosera rotundifolia*), spoon-leaf sundew (*D. intermedia*), pitcher-plant (*Sarracenia purpurea*), and flat-leaved bladderwort (*Utricularia intermedia*). Trees within bogs are widely scattered and stunted (seldom reaching six meters in height). The most commonly occurring trees are black spruce (*Picea mariana*) and tamarack (*Larix laricina*), with jack pine (*Pinus banksiana*), white pine (*Pinus strobus*), and red maple (*Acer rubrum*) as occasional associates and the latter being more prevalent south of the climatic tension zone.

Noteworthy Animals

In general, the population of animals is low in bogs because of the low productivity and unpalatability of bog vegetation, and the high acidity of bog water. Swamp sparrow (*Melospiza georgiana*) and song sparrow (*M. melodia*) are typical bog songbirds. Common herptiles that frequent bogs include eastern American toad (*Bufo a. americanus*), northern leopard frog (*Rana pipiens*), and garter snake (*Thamnophis s. sirtalis*). Bogs provide important habitat for small mammals such as short-tailed shrew (*Blarina brevicauda*), beaver (*Castor canadensis*), meadow vole (*Microtus pennsylvanicus*), mink (*Mustela vison*), muskrat (*Ondatra zibethicus*), and masked shrew (*Sorex cinereus*). Both muskrats and beaver can profoundly influence the hydrology of bogs. Muskrats create open water channels through the bog peat and beavers can cause substantial flooding through their dam-building activities. Numerous butterflies and moths are restricted to bogs and fens because their food plants occur within these peatland systems.

Rare Plants

Carex wiegandii (Wiegand's sedge, state threatened)
Eleocharis radicans (spike-rush, presumed extirpated from Michigan)
Empetrum nigrum (black crowberry, state threatened)

Isotria verticillata (whorled pogonia, state threatened)
Platanthera ciliaris (orange or yellow fringed orchid, state threatened)
Platanthera leucophaea (eastern prairie fringed orchid, state endangered)
Rubus acaulis (dwarf raspberry, state endangered)
Sarracenia purpurea f. heterophylla (yellow pitcher-plant, state threatened)

Rare Animals

Acris crepitans blanchardi (Blanchard's cricket frog, state special concern)
Alces alces (moose, state threatened)
Appalachia arcana (secretive locust, state special concern)
Ardea herodias (great blue heron, protected by the Migratory Bird Treaty Act of 1918)
Atlanticus davisi (Davis's shield-bearer, state special concern)
Boloria freija (Freija fritillary, state special concern)
Boloria frigga (Frigga fritillary, state special concern)
Botaurus lentiginosus (American bittern, state special concern)
Calephelis mutica (swamp metalmark, state special concern)
Canis lupus (gray wolf, state threatened)
Circus cyaneus (northern harrier, state special concern)
Clemmys guttata (spotted turtle, state threatened)
Coturnicops noveboracensis (yellow rail, state threatened)
Cryptotis parva (least shrew, state threatened)
Elaphe o. obsoleta (black rat snake, state special concern)
Emydoidea blandingii (Blanding's turtle, state special concern)
Erebia discoidalis (red-disked alpine, state special concern)
Erynnis baptisiae (wild indigo duskywing, state special concern)
Falcipennis canadensis (spruce grouse, state special concern)
Falco columbarius (merlin, state threatened)
Gavia immer (common loon, state threatened)
Haliaeetus leucocephalus (bald eagle, state threatened)
Liodessus cantralli (Cantrall's bog beetle, state special concern)
Lynx canadensis (lynx, state endangered)
Merolonche dolli (Doll's merolonche moth, state special concern)
Neoconocephalus lyrists (bog conehead, state special concern)
Nerodia erythrogaster neglecta (copperbelly watersnake, federal threatened and state endangered)
Oecanthus laricis (tamarack tree cricket, state special concern)
Orchelimum concinnum (red-faced meadow katydid, state special concern)
Pandion haliaetus (osprey, state threatened)
Paroxya hoosieri (Hoosier locust, state special concern)
Picoides arcticus (black-backed woodpecker, state special concern)
Pseudacris triseriata maculata (boreal chorus frog, state special concern)
Sistrurus c. catenatus (eastern massasauga, federal candidate species and state special concern)
Somatochlora incurvata (incurvate emerald, state special concern)
Sorex fumeus (smoky shrew, state special concern)
Terrapene c. carolina (eastern box turtle, state special concern)
Williamsonia fletcheri (ebony boghaunter, state special concern)

Biodiversity Management Considerations

The primary mechanism for preserving bogs is to maintain their hydrology. Reducing access to peatland systems will help decrease detrimental impacts caused by off-road vehicles. Minimizing

impacts to hydrologic regimes can be accomplished by avoiding surface water inputs from drainage ditches, agricultural fields, road construction, and logging in the adjacent uplands, and maintaining native vegetation types in the uplands around the community. In forested landscapes, establishing no-cut buffers around bogs and avoiding road construction and complete canopy removal in stands immediately adjacent to wetlands can help protect the hydrologic regime. In fire-prone landscapes, where shrub and tree encroachment threatens to convert open wetlands to shrub-dominated systems or forested swamps, prescribed fire or selective cutting can be employed to maintain open conditions. Ideally, prescribed fires conducted in adjacent fire-dependent upland communities would be allowed to carry into open wetlands such as bogs when safety permits. Silvicultural management of bogs to preserve open canopy should be employed during winter to minimize damage to peat and impacts to the hydrologic regime.

Historically, widespread fires following turn-of-the-century logging significantly altered many peatlands, either converting poor conifer swamp to open bog systems or destroying the peat and converting bogs to wetlands without organic soils (mineral soil wetlands). Logging of cedar and tamarack from peatland systems also favored the conversion of forested peatlands to open, ombrotrophic bogs. In landscapes where frequent fire was the prevalent disturbance factor, fire suppression has led to the conversion of open bogs to closed-canopy peatlands. Peat mining and cranberry farming have degraded numerous bogs throughout the region. In addition to direct impacts to vegetation, alteration of peatland hydrology from road building, creation of drainage ditches and dams, and runoff from logging has led to the significant change of bog composition and structure. Bog vegetation is extremely sensitive to minor changes in water levels and chemistry. Succession to more minerotrophic wetlands can occur as the result of increased alkalinity and raised water levels, which can cause the increased decomposition of acidic peats. Lowering of water tables from drainage can allow for tree and shrub encroachment into open bogs and the eventual succession to closed-canopy peatland. Dust-fall and atmospheric deposition from air pollution are particularly threats to bog systems in the southern portion of their range, where bogs are surrounded by cultivated land and close to industrial and urban centers. Eutrophication from pollution and altered hydrology can detrimentally impact bogs by generating conditions favorable for the establishment of invasive plant species. Particularly aggressive invasive species that may threaten the diversity and community structure of bogs include glossy buckthorn (*Frangula alnus*), narrow-leaved cat-tail (*Typha angustifolia*), hybrid cat-tail (*Typha* x*glauca*), reed canary grass (*Phalaris arundinacea*), and reed (*Phragmites australis* subsp. *australis*). At present, most of these invasive species appear to be restricted to the margins of bogs, where they occur in moats or ditches along roads and trails that border the community. Monitoring and control efforts to detect and remove invasive species before they become widespread are critical to the long-term viability of bog.

Variation

Subtle variations in overall species composition and physiognomy occur across this community's range along north-south and east-west climatic gradients. Bogs are common throughout the northern Lower Peninsula and the Upper Peninsula and are less common south of the climatic tension zone. In the southern part of the Lower Peninsula, vegetation composition is shaped by greater minerotrophy and warmer climate. Tall shrubs are more prevalent in southern systems, as is the threat from invasive species.

Similar Natural Communities

Coastal plain marsh, intermittent wetland, inundated shrub swamp, muskeg, northern fen, patterned fen, poor conifer swamp, poor fen, prairie fen, rich tamarack swamp, and rich conifer swamp.

Relevant Literature

Coburn, H., D. Dean, and G.M. Grant. 1933. An ecological study of Bryant's Bog, Cheboygan County, Michigan. Papers of the Michigan Academy of Science, Arts, and Letters 17: 57-65.
Cohen, J.G., and M.A. Kost. 2008. Natural community abstract for bog. Michigan Natural Features Inventory, Lansing, MI. 20 pp.
Crow, H.A. 1969. An ecological analysis of a southern Michigan bog. Michigan Botanist 8: 11-27.
Dansereau, P., and F. Segadas-Vianna. 1952. Ecological study of the peat bogs of eastern North America. I. Structure and evolution of vegetation. Canadian Journal of Botany 30: 490-520.
Gates, F.C. 1942. The bogs of northern Lower Michigan. Ecological Monographs 12(3): 213-254.
Heinselman, M.L. 1963. Forest sites, bog processes, and peatland types in the Glacial Lake Region, Minnesota. Ecological Monographs 33(4): 327-374.
Schwintzer, C.R. 1981. Vegetation and nutrient status of northern Michigan bogs and conifer swamps with a comparison to fens. Canadian Journal of Botany 59: 842-853.
Schwintzer, C.R., and G. Williams. 1974. Vegetation changes in a small Michigan bog from 1917 to 1972. American Midland Naturalist 92(2): 447-459.
Vitt, D.H., and N.G. Slack. 1975. An analysis of the vegetation of sphagnum-dominated kettle hole bogs in relation to environmental gradients. Canadian Journal of Botany 53: 332-359.

For a full list of references used to create this description, please refer to the natural community abstract for bog.

More Information

Bog natural community abstract

Page Citation

Kost, M.A., D.A. Albert, J.G. Cohen, B.S. Slaughter, R.K. Schillo, C.R. Weber, and K.A. Chapman. 2007. Natural Communities of Michigan: Classification and Description. Michigan Natural Features Inventory, Report No. 2007-21, Lansing, MI.

Page updated on 11-25-2014