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Applying the Natural Heritage Inventory Classification System to Characterize the Natural Communities in the Ongoing Peatlands Study

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Final Report
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Background

This project complements the “Biodiversity in Selected Natural Communities Related to Global Climate Change” (Peatlands Project) grant funded by the Wisconsin Focus on Energy program. During the Peatlands Project, biologists collected composition data, including plant species lists, disturbances and threats, and cover classes for each vegetative stratum, on peatland communities. These data were collected using varying levels of survey intensity to provide a broad range of information and quantification. Intensive surveys were conducted at non-randomly selected peatlands that met specified criteria and were distributed by ecological section (Figure 1). Extensive surveys were conducted at randomly selected peatlands stratified by ecological province and distributed throughout the state (Figure 2). A proposed but unfunded component of the Peatlands Project was to characterize the natural communities for each of the peatland study sites using the NHI classification system.

This project provided a representative survey of occurrences of peatland communities as well as updated existing high quality natural community information that is housed in the NHI database, past inventory reports, and other efforts such as county surveys that have been used to identify potential State Natural Areas. This information helps to fill a crucial gap in current knowledge of the size, context, condition and overall quality of these communities.

Wisconsin peatlands provide a unique opportunity to detect changes related to global climate change in a natural system. For example, the rate of natural vegetation growth and change in forested peatlands is very slow. Black spruce, tamarack and white cedar trees have minimal growth rates in most peatland habitats, adding perhaps only fractions of an inch in diameter and perhaps several feet in height over years, even decades. Many closed peatlands contain unmerchantable timber, and harvest on some public lands (e.g., national forests) has been restricted through moratoriums.



Methods

The primary goal of this project was to collect, analyze, and incorporate baseline data on the distribution, types, and condition of Wisconsin’s peatland communities in a standardized format. Natural communities were delineated using Geographic Information System according to NatureServe methodology. These data can be used for comparison in future biotic climate change studies as well as by other users of NHI data. Natural communities that are considered peatlands include Black Spruce Swamps, Bog Relicts, Boreal Rich Fens, Muskegs, Open Bogs, Poor Fens (including Central Poor Fens), Tamarack Poor Swamps, Tamarack Rich Swamps,

Northern Wet-mesic Forests, Southern Sedge Meadows, and Northern Sedge Meadows (Appendix 1).

This project also included further field investigation on both Intensive and Extensive Sites, as defined in the Peatlands Project, by focusing first on a comprehensive community assessment of the 13 Intensive Sites, then on follow-up work for a portion of the 200 Extensive Sites as time and funding allowed.



Results

1. Analyzed peatlands community data collected through the “Biodiversity in Selected Natural Communities Related to Global Climate Change” grant funded by the Wisconsin Focus on Energy program
 - (a) Prioritized sites for entry into the NHI database by reviewing the information collected for high quality natural community data.
 - (b) Characterized the natural communities for selected peatland study sites using the NHI classification system. All of the natural communities types located on peatland study sites, including non-peatland natural communities, are listed in Table 1.
 - (c) Refined natural community boundaries to reflect actual boundaries of the various peatland communities present on the priority sites and added new natural communities that were determined through field surveys.
2. Incorporated priority data for high quality peatland communities into the NHI database using standard methodology
 - (a) Reviewed NHI files for data collected during the Peatlands grant, and files in regional offices that contained data related to the Peatlands study sites.
 - (b) Tracked information sources in a database to aid in data processing and to maintain information about data sources.
 - (c) Processed priority data into the NHI database using standardized methodology and shared results with users. Trained NHI staff interpreted the data and transcribed them onto electronic forms and into spatial representations using standardized NHI methodology. A total of 164 natural community element occurrences were mapped in the NHI database, including 58 natural community element occurrences on Intensive Sites (Table 2). All results were quality assured.

3. Performed further field investigation on both Intensive and Extensive Sites, as defined in the previous grant
 - (a) Performed a comprehensive community assessment, including delineating the natural community types, of all 13 Intensive Sites and follow-up work for 18 Extensive Sites.
4. Match was provided by the Bureau of Endangered Resources in the form of maintenance and support for the NHI database and applications (e.g. NHI Data Portal)
 - (a) Data development, problem resolution, patching of underlying code, and keeping the applications current with DNR's information system standards and to meet NatureServe network standards to assure that the NHI information system functions at an optimal level, returning high quality information to users.



Discussion

This project has contributed greatly to our understanding of the range and condition of peatland natural communities throughout Wisconsin. We have been able to add many new records of natural community element occurrence to the NHI database, an important tool for researchers, community planners and regulators. The incorporation of these data into the NHI database provides a valuable baseline for the evaluation of change over time related to natural community shape, extent, structure and species composition when the sites are re-visited in 10-20 years, as proposed in the Peatlands Project proposal.

At the conclusion of this project period there is still more work that can be done with data collected during the Peatlands Project. Many of the Extensive Sites that were visited have not had their information entered into the NHI database. A quick review indicates that of the 200 Extensive Sites, about 124 still have information that may potentially lead to new or updated natural community element occurrences. These data are being stored in an Access database for quick retrieval by NHI staff, but are unavailable to users of NHI data until they have been entered into the NHI database and quality controlled.

Table 1. Natural Community Element Occurrences on peatland sites.

Natural Community Element Occurrences
Alder Thicket
Black Spruce Swamp
Boreal Forest
Emergent Marsh
Forested Seep
Hardwood Swamp
Lake--Deep, Very Soft, Seepage
Lake--deep, very soft, seepage
Lake--shallow, soft, drainage
Lake--Shallow, Soft, Seepage
Muskeg
Northern Dry Forest
Northern Dry-mesic Forest
Northern Mesic Forest
Northern Sedge Meadow
Northern Wet Forest
Northern Wet-mesic Forest
Open Bog
Poor Fen
Shore Fen
Shrub-carr
Southern Sedge Meadow
Southern Tamarack Swamp (Rich)
Springs and Spring Runs, Hard
Tamarack (Poor) Swamp

Table 2. Natural Community Element Occurrences on Intensive peatland sites.

Site Name	Natural Community Type
Bear Lake Meadow	Poor Fen
Belden Swamp Complex	Alder Thicket Black Spruce Swamp Muskeg Northern Sedge Meadow Open Bog
Bibon Swamp	Alder Thicket Black Spruce Swamp Muskeg Northern Sedge Meadow Northern Wet-mesic Forest Tamarack (Poor) Swamp
Big Bay	Black Spruce Swamp Boreal Forest Northern Dry Forest Open Bog Poor Fen Shore Fen Tamarack (Poor) Swamp
Cedarburg Bog	Emergent Marsh Lake--shallow, hard, drainage Northern Mesic Forest Northern Wet-mesic Forest Patterned Peatland Shrub-carr
Dry Lake and Pines	Lake--shallow, soft, drainage Northern Wet Forest Poor Fen
Hortonville Bog	Black Spruce Swamp Northern Wet-mesic Forest Open Bog
Kidrick Swamp	Black Spruce Swamp Muskeg Northern Mesic Forest
Lower Chippewa River SNA: Bear Creek Swamp	Shrub-carr Southern Sedge Meadow Southern Tamarack Swamp (Rich)
Mead Conifer Bogs	Alder Thicket Muskeg Northern Sedge Meadow Northern Wet Forest Shrub-carr Tamarack (Poor) Swamp
Miscauno Cedar Swamp	Northern Wet-mesic Forest
Pigeon Creek Swamp	Black Spruce Swamp Northern Sedge Meadow
Quincy Bluff and Wetlands	Central Poor Fen Central Sands Pine-Oak Forest Northern Dry Forest Pine Barrens Shrub-carr Southern Tamarack Swamp (Rich)
Swanson Lake and Pines	Black Spruce Swamp Lake--deep, very soft, seepage Lake--shallow, soft, seepage Muskeg Northern Dry-mesic Forest Open Bog

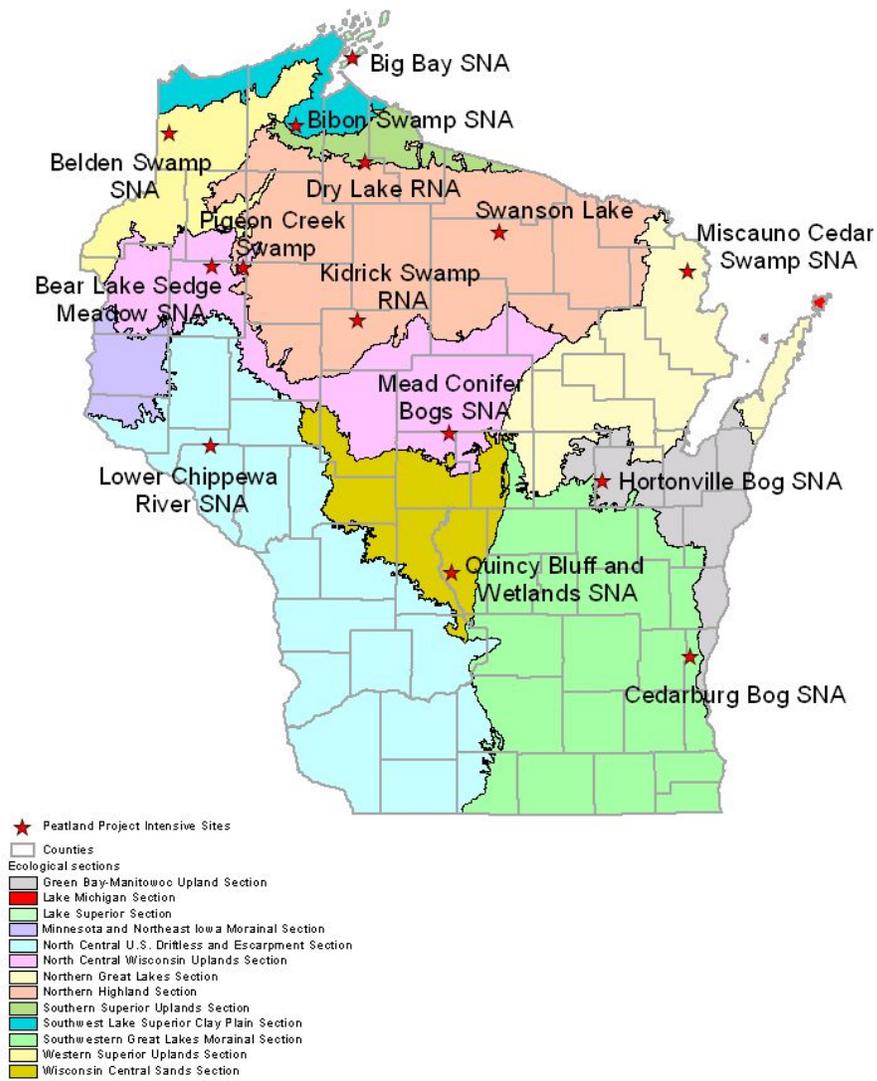
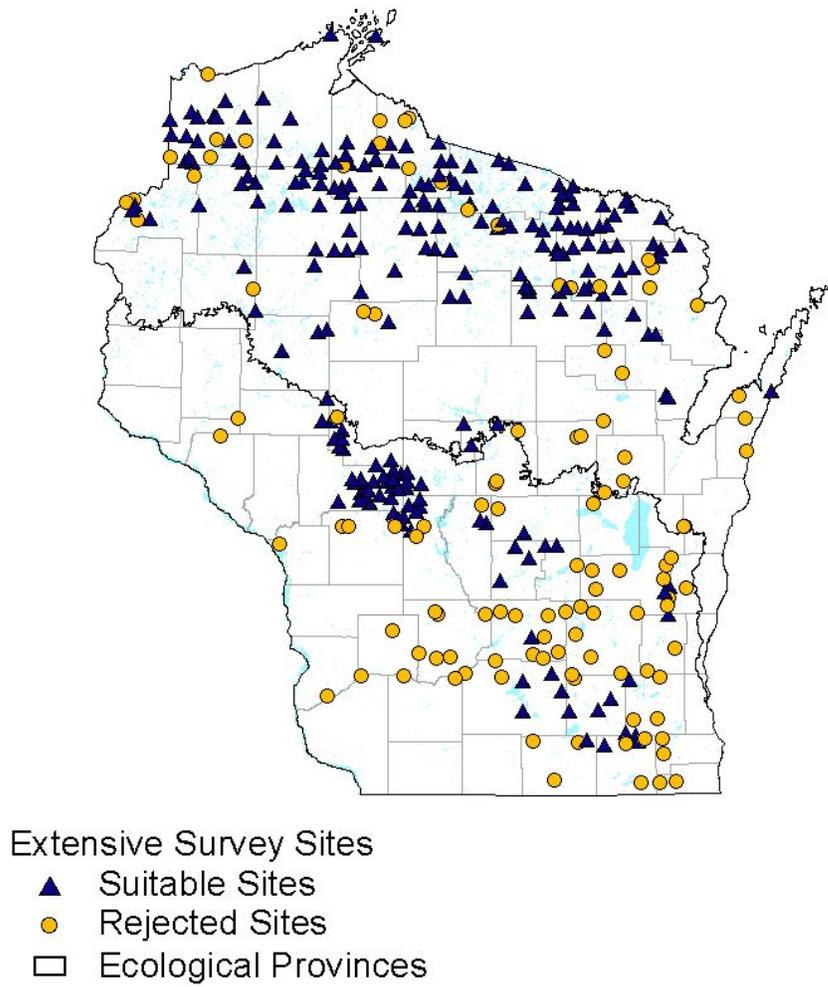


Figure 1. Peatland Intensive Sites



Comment [RT1]: Ecological Provinces are indicated in the key to this figure, but this doesn't really mean much. The only item highlighted in the figure is the Tension Zone.

Figure 2. Peatland Extensive Sites

Appendix 1. Peatland Natural Communities

From Wisconsin Natural Heritage Inventory (NHI) "Recognized Natural Communities – Working Document" Prepared by Eric Epstein, Emmet Judziewicz and Elizabeth Spencer

Alder Thicket

These wetlands are dominated by thick growths of tall shrubs, especially speckled alder (*Alnus incana*). Among the common herbaceous species are Canada bluejoint grass (*Calamagrostis canadensis*), orange jewelweed (*Impatiens capensis*), several asters (*Aster lanceolatus*, *A. puniceus*, and *A. umbellatus*), boneset (*Eupatorium perfoliatum*), rough bedstraw (*Galium asprellum*), marsh fern (*Thelypteris palustris*), arrow-leaved tearthumb (*Polygonum sagittatum*), and sensitive fern (*Onoclea sensibilis*). This type is common and widespread in northern and central Wisconsin, but also occurs in the southern part of the state.

Black Spruce Swamp (A split from Curtis' Northern Wet Forest)

An acidic conifer swamp forest characterized by a relatively closed canopy of black spruce (*Picea mariana*) and an open understory in which Labrador-tea (*Ledum groenlandicum*) and sphagnum mosses (*Sphagnum* spp.) are often prominent, along with three-leaved false Solomon's-seal (*Smilacina trifolia*), creeping snowberry (*Gaultheria hispidula*), and three-seeded sedge (*Carex trisperma*). The herbaceous understory is otherwise relatively depauperate. This community is closely related to Open Bogs and Muskegs, and sometimes referred to as Forested Bogs outside of Wisconsin.

Bog Relict

These boggy, acidic, weakly minerotrophic peatlands occur south of the Tension Zone within a matrix of "southern" vegetation. Bog relicts are isolated from the more extensive, better-developed and much more widespread stands of this community found in the northern part of the state. Acidophiles present can include sphagnum mosses (*Sphagnum* spp), sedges (e.g., few seeded sedge, *Carex oligosperma*), ericaceous shrubs, and insectivorous herbs. Tamarack (*Larix laricina*) is usually the most common tree and poison-sumac (*Toxicodendron vernix*) is often formidably abundant in the understory, especially in the moat (or "lagg") at the upland/wetland interface. Examples in southeastern Wisconsin are all somewhat alkaline and may resemble "shrub-fen" communities described in other states.

Boreal Rich Fen

Neutral to alkaline cold open peatlands of northern Wisconsin through which carbonate-rich groundwater percolates. Sphagnum mosses are absent or of relatively minor importance, as calciphilic species (especially the "brown" mosses) predominate. Dominant/characteristic plants include woolly sedge (*Carex lasiocarpa*), twig rush (*Cladium mariscoides*), beaked bladderwort (*Utricularia cornuta*), rushes (*Juncus* spp.), and Hudson Bay cotton-grass (*Scirpus hudsonianus*). Shrubby phases also occur, with bog birch (*Betula pumila*), sage willow (*Salix candida*), and speckled alder (*Alnus incana*) present in significant amounts.

Calcareous Fen

An open wetland found in southern Wisconsin, often underlain by a calcareous substrate, through which carbonate-rich groundwater percolates. The flora is typically diverse, with many calciphiles. Common species are several sedges (*Carex sterilis* and *C. lanuginosa*), marsh fern (*Thelypteris palustris*), shrubby cinquefoil (*Potentilla fruticosa*), shrubby St. John's-wort (*Hypericum kalmianum*), Ohio goldenrod (*Solidago ohioensis*), grass-of-parnassus (*Parnassia glauca*), twig-rush (*Cladium mariscoides*), brook lobelia (*Lobelia kalmii*), boneset (*Eupatorium perfoliatum*), swamp thistle (*Cirsium muticum*), and asters (*Aster* spp.). Some fens have significant prairie or sedge meadow components, and intergrade with those communities.

Central Poor Fen

These open, acidic, low nutrient peatlands occur within the Central Sand Plains of Wisconsin. Central poor fens are floristically depauperate and generally sedge dominated, (*Carex oligosperma*, *C. lasiocarpa*, and *C. utriculata*) Bluejoint grass (*Calamagrostis canadensis*) is a frequent associate and may co-dominate in some stands. Sphagnum spp. carpets are common but typically lack pronounced hummocks and hollows. Shrubs are present but not dominant, Hard-hack (*Spiraea tomentosa*) is the most consistent in presence, and cover of ericads is generally low. Other characteristic associates include wool grass (*Scirpus cyperinus*), cotton-grasses (*Eriophorum* spp.), swamp-candles (*Lysimachia terrestris*) and Kalm's St. John's-wort (*Hypericum kalmianum*). This community often intergrades with Tamarack (poor) Swamp. Disturbance of this community through mowing may significantly alter community composition, as recolonization by at least some of the vascular plants is very slow. Many plants characteristic of poor fen communities farther north are rare or absent in these central sands peatlands.

Coastal Plain Marsh

Sandy to peaty-mucky lakeshores, pondshores, depressions, and ditches in and around the bed of extinct glacial Lake Wisconsin may harbor assemblages of wetland species including some which are significantly disjunct from their main ranges on the Atlantic Coastal Plain. There is often a well-developed concentric zonation of vegetation. Frequent members of this community are sedges in the genera *Cyperus*, *Eleocharis*, *Fimbristylis*, *Hemicarpha*, *Rhynchospora* and *Scirpus*; rushes (*Juncus* spp.); milkworts (*Polygala cruciata* and *P. sanguinea*), toothcup (*Rotala ramosior*), meadow-beauty (*Rhexia virginica*), grass-leaved goldenrod (*Euthamia graminifolia*), hardhack (*Spiraea tomentosa*), lance-leaved violet (*Viola lanceolata*), and yellow-eyed grass (*Xyris torta*).

Forested Seep

These are shaded seepage areas with active spring discharges in (usually) hardwood forests that may host a number of uncommon to rare species. The overstory dominant is frequently black ash (*Fraxinus nigra*), but yellow birch (*Betula allegheniensis*), American elm (*Ulmus americana*) and many other tree species may be present including conifers such as hemlock (*Tsuga canadensis*) or white pine (*Pinus strobus*). Understory species include skunk cabbage (*Symplocarpus foetidus*), water-pennywort (*Hydrocotyle americana*), marsh blue violet (*Viola cucullata*), swamp saxifrage (*Saxifraga pennsylvanica*), golden saxifrage (*Chrysosplenium americanum*), golden ragwort (*Senecio aureus*), silvery spleenwort (*Athyrium thelypteroides*) and the rare sedges (*Carex scabrata* and *C. prasina*). Most documented occurrences are in the Driftless Area, or locally along major rivers flanked by steep bluffs.

Comment [RT2]: A different font size is used for this Forested Seep write-up.

Great Lakes Ridge and Swale (Formerly Forested Ridge and Swale)

This is a complex of semi- to fully-stabilized, often forested beach / dune ridges alternating with wet open to forested swales, found on the shores of the Great Lakes but best-developed along Lake Michigan. Both parallel the coast and offer exceptionally complex and diverse habitats for wetland, upland, and Great Lakes shoreline plants. Ridges may support assemblages similar to boreal, northern mesic, or northern dry-mesic forests. Water depth is a controlling factor in the swales, and the vegetation may run the gamut from open (emergent marsh, fen, or sedge meadow), shrub (bog birch, alder), or forested wetlands (often white cedar, black ash are prominent in these).

Hardwood Swamp (this is a split from Curtis' Northern Wet-Mesic Forest)

These are northern deciduous forested wetlands that occur along lakes or streams, or in insular basins in poorly drained morainal landscapes. The dominant tree species is black ash (*Fraxinus nigra*), but in some stands red maple (*Acer rubrum*), yellow birch (*Betula allegheniensis*), and (formerly) American elm (*Ulmus americana*) are also important. The tall shrub speckled alder (*Alnus incana*) may be locally common. The herbaceous flora is often diverse and may include many of the same species found in Alder Thickets. Typical species are marsh-marigold (*Caltha palustris*), swamp raspberry

Comment [RT3]: See Comment 2 above for what is contained within the ().

(*Rubus pubescens*), skullcap (*Scutellaria galericulata*), orange jewelweed (*Impatiens capensis*), and many sedges (*Carex* spp.). Soils may be mucks or mucky sands.

Interdunal Wetland

Wind-created hollows that intersect the water table within active dune fields along the Great Lakes. These may be colonized by wetland plants, including habitat specialists that are of high conservation significance. Common members of this wetland community on Lake Superior are twig-rush (*Cladium mariscoides*), species of rushes (especially *Juncus balticus*), pipewort (*Eriocaulon septangulare*), the sedge (*Carex viridula*), ladies-tress orchids (*Spiranthes* sp.) and bladderworts (*Utricularia cornuta* and *U. resupinata*).

Moist Sandy Meadow (formerly called Sand Meadow)

This type is included primarily as a placeholder for anomalous herb-dominated assemblages on moist sandy soils in central Wisconsin. Available descriptive information is very limited at this time. Stand size is generally small, seldom, if ever, exceeding more than a few acres. The flora consists of a mixture of plant species typically found in wet prairie, sedge meadow, coastal plain marsh, and pine or oak barrens communities. No one group of associates is clearly dominant. Past human disturbance is evident in some occurrences but native species are prevalent.

Due to a high water table, stands are subject to periodic inundation for short periods of time in the spring and following heavy rain events. This dynamic appears to be at least partially responsible for maintaining the type, but periodic fire, mowing, and browsing may also be important factors.

Muskeg

Muskegs are cold, acidic, sparsely wooded northern peatlands with **composition** similar to the Open Bogs (*Sphagnum* spp. mosses, *Carex* spp., and ericaceous shrubs), but with scattered stunted trees of black spruce (*Picea mariana*) and tamarack (*Larix laricina*). Plant diversity is typically low, but the community is important for a number of boreal bird and butterfly species, some of which are quite specialized and not found in other communities.

Comment [RT4]: Why in bold?

Northern Sedge Meadow

This open wetland community is dominated by sedges and grasses. There are several common subtypes: Tussock meadows, dominated by tussock sedge (*Carex stricta*) and Canada bluejoint grass (*Calamagrostis canadensis*); Broad-leaved sedge meadows, dominated by the robust sedges (*Carex lacustris* and/or *C. utriculata*); and Wire-leaved sedge meadows, dominated by such species as woolly sedge (*Carex lasiocarpa*) and few-seeded sedge (*C. oligosperma*). Frequent associates include marsh bluegrass (*Poa palustris*), manna grasses (*Glyceria* spp.), panicled aster (*Aster lanceolatus*), spotted joy-pye-weed (*Eupatorium maculatum*), and the bulrushes (*Scirpus atrovirens* and *S. cyperinus*).

Comment [RT5]: See Comment 4

Northern Wet Forest (revised from Curtis, with **Black Spruce** and **Tamarack Swamps** split out)

These weakly minerotrophic conifer swamps, located in the North, are dominated by black spruce (*Picea mariana*) and tamarack (*Larix laricina*). Jack pine (*Pinus banksiana*) may be a significant canopy component in certain parts of the range of this community complex. Understories are composed mostly of sphagnum (*Sphagnum* spp.) mosses and ericaceous shrubs such as leatherleaf (*Chamaedaphne calyculata*), Labrador-tea (*Ledum groenlandicum*), and small cranberry (*Vaccinium oxycoccos*) and sedges such as (*Carex trisperma* and *C. paupercula*). The Natural Heritage Inventory has split out two entities, identified (but not strictly defined) by the two dominant species (see **Black Spruce Swamp** and **Tamarack Swamp**).

Northern Wet-Mesic Forest (revised from Curtis, with **Northern Hardwood Swamp** split out)

This forested minerotrophic wetland is dominated by white cedar (*Thuja occidentalis*), and occurs on rich, neutral to alkaline substrates. Balsam fir (*Abies balsamea*), black ash (*Fraxinus nigra*), and spruces (*Picea glauca* and *P. mariana*) are among the many potential canopy associates. The understory is rich in sedges (such as *Carex disperma* and *C. trisperma*), orchids (e.g., *Platanthera obtusata* and *Listera cordata*), and wildflowers such as goldthread (*Coptis trifolia*), fringed polygala (*Polygala pauciflora*), and naked miterwort (*Mitella nuda*), and trailing sub-shrubs such as twinflower (*Linnaea borealis*) and creeping snowberry (*Gaultheria hispida*). A number of rare plants occur more frequently in the cedar swamps than in any other habitat.

Open Bog

These non-forested bogs are acidic, low nutrient, northern Wisconsin peatlands dominated by *Sphagnum* spp. mosses that occur in deep layers, often with pronounced hummocks and hollows. Also present are a few narrow-leaved sedge species such as (*Carex oligosperma* and *C. pauciflora*), cotton-grasses (*Eriophorum* spp.), and ericaceous shrubs, especially bog laurel (*Kalmia polifolia*), leatherleaf (*Chamaedaphne calyculata*), and small cranberry (*Vaccinium oxycoccus*). Plant diversity is very low but includes characteristic and distinctive specialists. Trees are absent or achieve very low cover values as this community is closely related to and intergrades with Muskeg. When this community occurs in southern Wisconsin, it is often referred to as a **Bog Relict**.

Patterned Peatland

Very rare in Wisconsin, this wetland type can be characterized as a herb- and shrub-dominated minerotrophic peatland with alternating moss and sedge-dominated peat ridges (strings) and saturated and inundated hollows (flarks). These are oriented parallel to the contours of a slope and perpendicular to the flow of groundwater. Within a patterned peatland the peat “landforms” differ significantly in nutrient availability and pH. The flora may be quite diverse and includes many sedges of bogs and fens, along with ericads, sundews, orchids, arrow-grasses (*Triglochin* spp.), and calciphilic shrubs such as bog birch (*Betula pumila*) and shrubby cinquefoil (*Potentilla fruticosa*).

Poor Fen

This acidic, weakly minerotrophic peatland type is similar to the Open Bog, but can be differentiated by higher pH, nutrient availability, and floristics. *Sphagnum* (*Sphagnum* spp.) mosses are common but don't typically occur in deep layers with pronounced hummocks. Floristic diversity is higher than in the Open Bog and may include white beak-rush (*Rhynchospora alba*), pitcher-plant (*Sarracenia purpurea*), sundews (*Drosera* spp.), pod grass (*Scheuchzeria palustris*), and the pink-flowered orchids (*Calopogon tuberosus*, *Pogonia ophioglossoides* and *Arethusa bulbosa*). Common sedges are (*Carex oligosperma*, *C. limosa*, *C. lasiocarpa*, *C. chordorrhiza*), and cotton-grasses (*Eriophorum* spp.).

Shore Fen (formerly called Coastal Fen)

This open peatland community occurs primarily along Great Lakes shorelines, especially near the mouths of estuarine streams. Along Lake Superior most stands are separated from the lake waters by a sand spit. The floating sedge mat is composed mostly of woolly sedge (*Carex lasiocarpa*); co-dominants are sweet gale (*Myrica gale*) and bogbean (*Menyanthes trifoliata*). The following herbs are common in this diverse, circumneutral, nutrient-rich community: twigrush (*Cladium mariscoides*), marsh horsetail (*Equisetum fluviatile*), a spikerush (*Eleocharis elliptica*), intermediate bladderwort (*Utricularia intermedia*), marsh bellflower (*Campanula aparinoides*), narrow-leaved willow-herb (*Epilobium leptophyllum*), water-parsnip (*Sium suave*), and bog willow (*Salix pedicellaris*). Coastal fens are distinguished from open bogs and poor fens (which may adjoin them in the same wetland complex) by the lack of *Sphagnum* spp. mosses, higher pH, and direct hydrologic connection to the Great Lakes. They are distinguished from rich fens by the absence of indicator species such as linear-

leaved sundew (*Drosera linearis*), grass-of-parnassus (*Parnassia glauca*), false asphodel (*Tofieldia glutinosa*) and a spikerush (*Eleocharis rostellata*).

Shrub-Carr

This wetland community is dominated by tall shrubs such as red-osier dogwood (*Cornus stolonifera*), meadow-sweet (*Spiraea alba*), and various willows (*Salix discolor*, *S. bebbiana*, and *S. gracilis*). Canada bluejoint grass (*Calamagrostis canadensis*) is often very common. Associates are similar to those found in Alder Thickets and tussock-type Sedge Meadows. This type is common and widespread in southern Wisconsin but also occurs in the north.

Southern Sedge Meadow

Widespread in southern Wisconsin, this open wetland community is most typically dominated by tussock sedge (*Carex stricta*) and Canada bluejoint grass (*Calamagrostis canadensis*). Common associates are water-horehound (*Lycopus uniflorus*), panicked aster (*Aster simplex*), blue flag (*Iris virginica*), Canada goldenrod (*Solidago canadensis*), spotted joe-pye-weed (*Eupatorium maculatum*), broad-leaved cat-tail (*Typha latifolia*), and swamp milkweed (*Asclepias incarnata*). Reed canary grass (*Phalaris arundinacea*) may be dominant in grazed and/or ditched stands. Ditched stands can succeed quickly to Shrub-Carr.

Tamarack (poor) Swamp (formerly called Tamarack Swamp, this is a split from Curtis' **Northern Wet Forest**)

These weakly to moderately minerotrophic conifer swamps are dominated by a broken to closed canopy of tamarack (*Larix laricina*) and a frequently dense understory of speckled alder (*Alnus incana*). The understory is more diverse than in Black Spruce Swamps and may include more nutrient-demanding species such as winterberry holly (*Ilex verticillata*) and black ash (*Fraxinus nigra*). The bryophytes include many genera other than Sphagnum. Stands with spring seepage sometimes have marsh-marigold (*Caltha palustris*) and skunk-cabbage (*Symplocarpus foetidus*) as common understory inhabitants. These seepage stands have been separated out as a distinct type or subtype in some nearby states and provinces.

Tamarack (rich) Swamp (formerly called Tamarack Fen)

This forested wetland community type is a variant of the Tamarack Swamp, but occurs south of the Tension Zone within a matrix of "southern" vegetation types. Poison-sumac (*Toxicodendron vernix*) is often a dominant understory shrub. Successional stages and processes are not well understood but fire, windthrow, water level fluctuations, and periodic infestations of larch sawfly are among the important dynamic forces influencing this community. Groundwater seepage influences the composition of most if not all stands. Where the substrate is especially springy, skunk cabbage (*Symplocarpus foetidus*), marsh marigold (*Caltha palustris*), sedges, and a variety of mosses may carpet the forest floor. Drier, more acid stands may support an ericad and sphagnum dominated groundlayer.

Wet Prairie

This is a rather heterogeneous tall grassland community that shares characteristics of prairies, Southern Sedge Meadow, Calcareous Fen and even Emergent Aquatic communities. The Wet Prairie's more wetland-like character can mean that sometimes very few true prairie species are present. Many of the stands assigned to this type by Curtis are currently classified as Wet-Mesic Prairies. The dominant graminoids are Canada bluejoint grass (*Calamagrostis canadensis*), cordgrass (*Spartina pectinata*), and prairie muhly (*Muhlenbergia glomerata*), plus several sedge (*Carex*) species including lake sedge (*C. lacustris*), water sedge (*C. aquatilis*), and woolly sedge (*C. lanuginosa*). Many of the herb species are shared with Wet-Mesic Prairies, but the following species are often prevalent: New England aster (*Aster novae-angliae*), swamp thistle (*Cirsium muticum*), northern bedstraw (*Galium boreale*), yellow

stargrass (*Hypoxis hirsuta*), cowbane (*Oxypolis rigidior*), tall meadow-rue (*Thalictrum dasycarpum*), golden alexander (*Zizia aurea*), and mountain-mint (*Pycnanthemum virginianum*).

White Pine - Red Maple Swamp

This swamp community is restricted to the margins of the bed of extinct glacial Lake Wisconsin in the central part of the state. It often occurs along headwaters streams and seepages in gently sloping areas. White pine (*Pinus strobus*) and red maple (*Acer rubrum*) are the dominant trees, with other species, including yellow birch (*Betula alleghiensis*), present in lesser amounts. Common understory shrubs are speckled alder (*Alnus incana*), winterberry holly (*Ilex verticillata*), and swamp dewberry (*Rubus pubescens*); characteristic herbs include skunk cabbage (*Symplocarpus foetidus*), cinnamon fern (*Osmunda cinnamomea*), gold thread (*Coptis trifolia*), and two disjuncts from the eastern United States, bog fern (*Thelypteris simulata*) and long sedge (*Carex folliculata*). Sphagnum and other mosses are common.