Ecological site F094DY004WI
Mucky Peat Bogs

Accessed: 05/01/2024

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

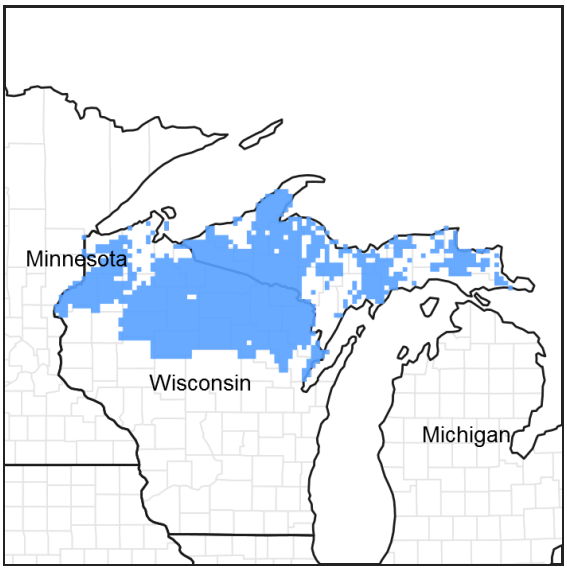


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 094D–Northern Highland Sandy Pitted Outwash

The Northern Highland Sandy Drift region (also referred to as MLRA 94D) lies mostly in northern Wisconsin with a few narrow outwash channels extending into the upper peninsula of Michigan. MLRA 94D encompasses 1.364 million acres and is surrounded by much larger, geologically different MLRAs. MLRA 94D is characterized mainly by sandy and gravelly soils formed in outwash sediments deposited by melt-water streams from late Wisconsin-Age glaciers, which receded from the area about 10,000 years before present (Attig 1985). The Mucky Peat Bogs ecological site occupies about 80,000 acres in MLRA 94D.

Classification relationships

This ecological site is one of four non-floodplain peatland ecological sites that are closely identified with MLRA 94D but occur beyond the borders of 94D. The soil components (all Histosols) found on this site occur across the northern tier of states from the northeast to the Midwest, as do other many peatland soil series. Most of Histosol soil series were first correlated in Michigan, as were some in Minnesota, but it was common practice to correlate these peatland soils across the widest extent possible, while accounting for local or regional variation in the map unit descriptions.

Ecological site concept

ATTENTION: This ecological site meets the NESH 2014 requirements for PROVISIONAL. A provisional ecological site is established after broad ecological site concepts are identified and an initial state-and-transition model is drafted. Following quality control and quality assurance reviews of the ecological site concepts, an identification number and name for the provisional ecological site are entered into ESIS. A provisional ecological site may include literature reviews, land use history information, some soils data, legacy data, ocular estimates for canopy and/or species composition by weight, and even some line-point intercept information. A provisional ecological site does not meet the NESH 2014 standards for an Approved ESD, but does provide the conceptual framework of soil-site correlation for the development of the ESD. For more information about this ecological site, please contact your local NRCS office.

The modal concept for Mucky Peat Bogs is a peatland that has highly acidic conditions but receives enough nutrients and drains well enough to produce a growing forest of black spruce (Picea mariana) and tamarack (Larix laricina). On this ecological site, Sphagnum moss thickness has not reached the level where access to nutrients is severely restricted as it is on Peat Bog ecological sites. Also, sufficient aeration of the root zone occurs on this site to allow for moderately productive tree growth for at least the aforementioned species. The resulting closed canopy forest can prevent Sphagnum moss from dominating the site, as those moss plants are shade intolerant. Also, the understory in general has fewer species compared to more nutrient-rich or open-canopy sites. The organic soils on this site have thin moss peat layer over well decomposed organic material of mainly herbaceous origin and the soil pH is below 4.5, an indication of low groundwater input from mineral uplands. However with abundant trees, nitrogen-fixing lichen habitat is increased, and therefore more productivity boosting nitrogen is leached into root zone from lichens on this site than on less densely forested sites.

Table 1. Dominant plant species

Tree	(1) *Picea mariana* (2) *Larix laricina*
Shrub	(1) *Chamaedaphne calyculata* (2) *Nemopanthus mucronatus*
Herbaceous	(1) *Sphagnum magellanicum* (2) *Carex trisperma*

Physiographic features

Mucky Peat Bogs often lie a little lower on the landscape than Peat Bogs. This elevational difference between Mucky Peat Bogs and Peat Bogs occurs on both large glacial landforms and within larger peatland complexes. Even this slight amount of relief results in a richer site for Mucky Pet Bogs due to increased groundwater inflow.

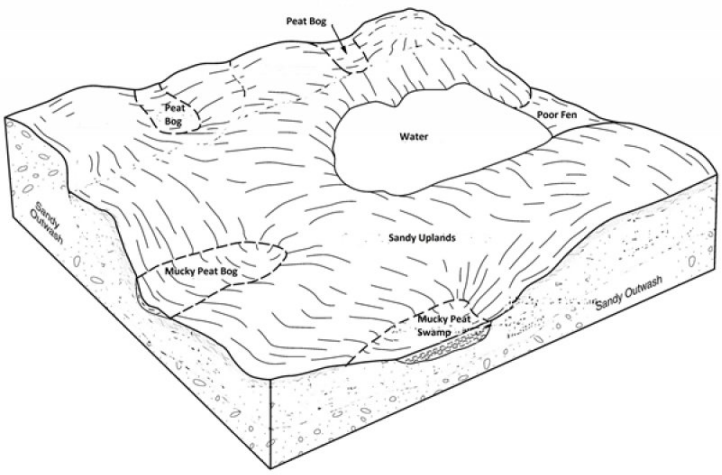


Figure 2. Peatland ecological sites on pitted outwash

Table 2. Representative physiographic features

Landforms	(1) Depression
Flooding frequency	None

Ponding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Ponding frequency	Occasional to frequent
Elevation	1,390–1,870 ft
Slope	0–2%
Ponding depth	0–6 in
Water table depth	0–12 in
Aspect	Aspect is not a significant factor

Climatic features

The climate is humid continental with very cold winters and warm summers. As is common across northern Wisconsin, two-thirds of the precipitation falls as rain during the relatively short growing season of late May to early September. Most of the rainfall is transpired by plants. Snow cover is likely in the months of November through April. Snow cover prevents deep frost penetration which promotes groundwater recharge. The microclimate on this site slightly cooler than the local climate due to wetness and cold air drainage.

Table 3. Representative climatic features

Frost-free period (average)	109 days
Freeze-free period (average)	130 days
Precipitation total (average)	33 in

Climate stations used

- (1) EAGLE RIVER [USC00472314], Eagle River, WI
- (2) MINOCQUA [USC00475516], Minocqua, WI
- (3) REST LAKE [USC00477092], Manitowish Waters, WI
- (4) RHINELANDER [USC00477113], Rhinelander, WI

Influencing water features

This is a wetland site, in which the properties are determined by the quantity and quality of water it receives, and by which means the water leaves the system. The source of most the water arriving on this site is precipitation. However, most importantly, groundwater inflow and outflow rates, as evidenced by the vegetation, are hypothetically greater on the Mucky Peat Bog ecological site than for the Peat Bog ecological site. Also, this site is likely to have a greater outflow rate through evapotranspiration because of higher plant productivity. Surface water outlets are uncommon but not unknown, and in addition, fluctuating water levels in lakes and flowages may also impact drainage on some parts of these sites. The net effect of more groundwater input and more efficient outflow is a more productive site.

Soil features

This site has Histosols with highly variable organic material depth, the deeper organic soil is the Loxley and similar soils component, and the shallowest component is Dawson and similar soils. The thickness of organic layers ranges from 17 inches to greater than 6 feet. In contrast to Peat Bog ecological sites, the live and dead Sphagnum moss thickness on these sites is only in 6 to 12 inch range, probably as a result of shading by trees. The rest of the organic soil material is black muck. Beneath the organic soil layers is the sandy substratum at some variable depth. The vegetation does not appear to change fundamentally across this site with changes in the thickness of the organic soil material, until an aerated root zone reaches the mineral soil horizons. This crosses a boundary to a different ecological site. The key soil variables on this site are pH and wetness. A pH of less than 4.5 is most common, although some soil layers may exceed that level. The water table in this soil drops low enough and long enough for a productive forest to grow. But low nutrient levels restrict the number of tree species that will thrive on the site to two--black spruce and tamarack.

Table 4. Representative soil features

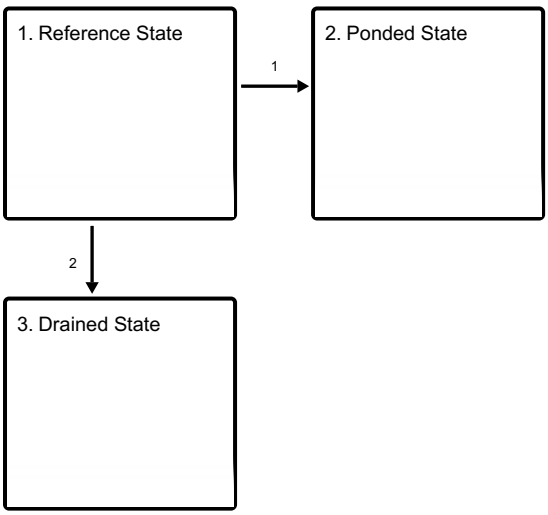
Surface texture	(1) Mucky peat
Drainage class	Very poorly drained
Permeability class	Moderately slow to moderately rapid
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	10–15 in
Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	4–4.6
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

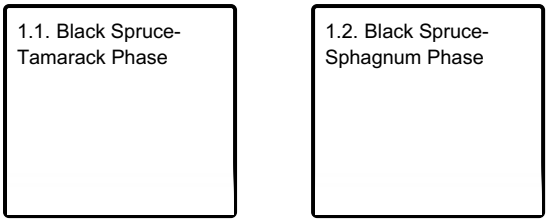
Mucky Peat Bog ecological sites are related to Peat Bogs in that they have many species in common but Mucky Peat Bogs are much richer sites in terms of tree growth rate. Again, this is likely due to the greater groundwater contribution found in Mucky Peat Bogs over Peat Bogs. On productive forest sites, as tree canopy cover increases, Sphagnum dominance decreases, due to less light penetration to the ground. Less Sphagnum means less negative feedback to tree growth. Sphagnum moss is very efficient at intercepting nutrients from precipitation before they reach the root zone, and this cation-exchange process also acidifies the soil; both processes are adverse to trees. On the other hand, as lichen habitat increases through more trees per acre, nutrients leached from lichens into the soil further increase forest productivity. Also, a productive forest transpires enough water to maintain an aerated root zone. Thus, these two positive feedbacks enhance forest productivity on this site.

State and transition model

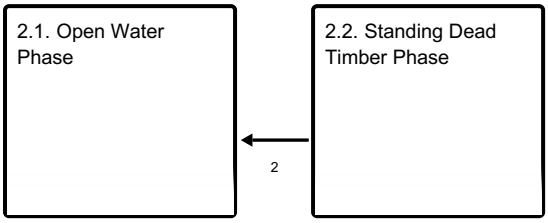
Ecosystem states



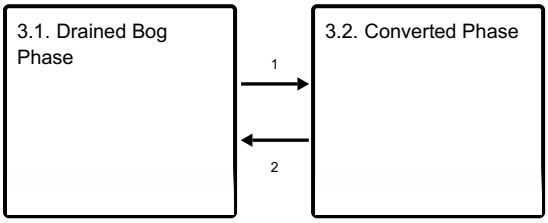
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Reference State

The reference state of Mucky Peat Bogs is a productive, growing forest of the bog conifers--black spruce and tamarack. Occasionally, other conifer species (Pinus or Picea)occur on these sites, but these seldom dominate a stand. There are two main phases of the reference state. They are based on greater than or less than 75% canopy cover, but on this ecological site these phases are often interspersed. The level of canopy cover on these sites is affected by various disturbance factors such as wet-dry cycles, insect infestations and wind damage. Sphagnum moss thickness is strongly correlated to canopy cover. With more canopy cover there is less light to the forest floor, thus slower moss accumulation, and conversely, more light favors the moss and also turns it various shades of red, yellow, and brown.

Community 1.1
Black Spruce-Tamarack Phase

These sites have greater 75% canopy cover. This indicates a lower disturbance frequency, the forest had time to mature over most of the site.

Community 1.2
Black Spruce-Sphagnum Phase

This phase has greater than 50%, but less than 75% canopy cover, indicating a Mucky Peat Bog site which somewhat more prone to- or slower to recover from disturbance.

State 2
Ponded State

The Ponded State in Mucky Peat Bogs is relatively rare. It occurs mainly as a result of road construction activity, although excess precipitation may prolong ponding long to drown trees in some patches. Also, the hydrology of these sites can be impacted by nearby actions such as diversion of runoff. There are two phases of the Ponded State, one is predominantly open water with both emergent and submergent vegetation, the other phase is less wet, with scattered pools of water and standing dead timber in and around the pools, some trees within this phase remain alive. This state does not include naturally occurring pond bogs, i.e. remnants of the lake-fill process, which

were not previously forested.

Community 2.1
Open Water Phase

This site has deeper water provides habitat for more aquatic species. Potentially, this includes aquatic invasive species such as Eurasian milfoil and curly pondweed; but low nutrient levels are a check on them.

Community 2.2
Standing Dead Timber Phase

The Standing Dead Timber Phase is subject to repeated cycles of inundation and drainage. Water occurs in pools, separated by normal bog vegetation. Both standing dead and fallen timber occurs in and near the randomly-scattered, open water pools.

Table 5. Woody ground cover

Downed wood, fine-small (<0.40" diameter; 1-hour fuels)	–
Downed wood, fine-medium (0.40-0.99" diameter; 10-hour fuels)	–
Downed wood, fine-large (1.00-2.99" diameter; 100-hour fuels)	–
Downed wood, coarse-small (3.00-8.99" diameter; 1,000-hour fuels)	–
Downed wood, coarse-large (>9.00" diameter; 10,000-hour fuels)	–
Tree snags** (hard***)	–
Tree snags** (soft***)	–
Tree snag count** (hard***)	20-40 per acre
Tree snag count** (hard***)	

*** Decomposition Classes: N - no or little integration with the soil surface; I - partial to nearly full integration with the soil surface.**

**** >10.16cm diameter at 1.3716m above ground and >1.8288m height--if less diameter OR height use applicable down wood type; for pinyon and juniper, use 0.3048m above ground.**

***** Hard - tree is dead with most or all of bark intact; Soft - most of bark has sloughed off.**

Pathway 2
Community 2.2 to 2.1

More water introduced to this site will completely inundate the area into the Open Water Phase.

State 3
Drained State

The Drained State is another relatively rare occurrence on Mucky Peat Bogs. The main cause once again is water manipulation by humans. The naturally occurring cause is drought, which affects the hydrology of the entire area. Drained areas are often subject to colonization by unwanted species. The two phases of this state are drained bog and a converted condition. The drained bog is an area that is drier than normal for an extended period due to once again, human manipulation or drought. Converted areas are no longer bogs, but roads or ditch banks or some artifact of construction activities traversing the larger site. These areas affect a zone surrounding them by increasing light penetration and by the lateral effect of the drainage project.

Community 3.1
Drained Bog Phase

The Drained Bog Phase retains much of the bog vegetation and may even show increased forest productivity. However if the water table is lowered too much, significant subsidence can occur leading to an unstable, disturbance-prone site.

Community 3.2
Converted Phase

To accomplish site conversion, the Mucky Peat Bog vegetation and typically, the organic soil is removed. These sites are seldom converted to agricultural land, conversion to roadways is the most common. It requires deep ditches with outlets to effectively drain these sites. Then the peat is excavated and the area backfilled with mineral material to create stable base on which to build. This costly practice is only for the most critical of needs, in this area it is mainly roads. Sites converted to roadways often lead to the wet side-dry side effect, where one side ponds frequently and kills the woody vegetation. And the other side dries out, subsides and becomes disturbance-prone.

Pathway 1
Community 3.1 to 3.2

A site is converted when it no longer supports Mucky Peat Bog vegetation. This is usually accomplished by mechanical means, but fire can also decimate drained bogs. Post-disturbance, these sites are subject to colonization by invasive species.

Pathway 2
Community 3.2 to 3.1

There is the possibility that the site will revert to drained bog phase if abandoned.

Transition 1
State 1 to 2

This transition occurs when the site receives too much water through sometimes natural, but mostly artificial means.

Transition 2
State 1 to 3

This transition occurs when the site is drained either naturally occurring events like extreme drought or human activities such as construction. There is very little conversion to agricultural land or cranberry bog on these sites but they may be affected by nearby conversion.

Additional community tables

Other references

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Contributors

Mark Krupinski

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

    Sub-dominant:

    Other:

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or**

decadence):

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

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17. **Perennial plant reproductive capability:**
