USDA Natural Resources Conservation Service

Ecological site F094DY003WI
Mucky Peat Swamps

Accessed: 05/06/2024

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 (MLRA 94D) is well known for its lakes, wetlands and forests. The landscape is dominated by sandy soils with many peat-filled depressions. Surface water in the form of lakes, rivers, streams and impoundments or flowages occupy about 13% of the 1.346 million acres in MLRA 94D. The Mucky Peat Swamps ecological site occupies about 80,000 acres of MLRA 94D.

Classification relationships

Mucky Peat Swamps is one of four peatland (non-floodplain) ecological sites found in MLRA 94D. MLRA 94D is similar to the Northern Highland Pitted Outwash subsection of the US Forest Service and the WI DNR Northern Highland ecological landscape. Mucky peat Swamps ecological site is similar to White Cedar-Black Ash Swamp association of the US National Vegetation Classification.

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 the Mucky Peat Swamps ecological site is that of a nutrient-rich and species-rich peatland with a closed canopy forest composed mainly of northern white cedar (Thuja occidentalis) and black ash (Fraxinus nigra). However, there may be several other tree species present depending on which disturbance factors affected the site and the time since the last disturbance. Other tree species present include balsam fir, red maple, and yellow birch. These sites have the potential for drier micro-sites which allow for the presence of upland species such as white pine and paper birch. The understory is populated with numerous shade-tolerant shrub, herbaceous, graminoid and feather moss species. There are Sphagnum moss species on this site, but they have not formed the thick mat of peat found on many other peatland sites. This is due to shading from the dense canopy and a higher base cation content of the groundwater entering the site, making it highly minerotrophic. Both of these site properties inhibit peat moss formation. Instead, the organic soils found in Mucky Peat Swamps typically have a high content of wood fragments throughout the profile, indicating a long history of productive forests on the site. Also, the soils on this site are often 1 or more pH units higher than most other peatland sites, in the range of 5.0 to 6.0.

Associated sites

F094DY001WI	**Peat Bogs**
F094DY002WI	**Poor Fens**
F094DY004WI	**Mucky Peat Bogs**
F094DY016WI	**Mucky Floodplains**

Table 1. Dominant plant species

Tree	(1) *Thuja occidentalis* (2) *Fraxinus nigra*
Shrub	(1) *Acer spicatum* (2) *Alnus rugosa*
Herbaceous	(1) *Cornus canadensis* (2) *Osmunda cinnamomea*

Physiographic features

Mucky Peat Swamps occur in depressions that are often lower in elevation than the other peatland ecological sites. They commonly have a small surface outlet. These physiographic features correlate to increased forest productivity by increasing the groundwater contribution to the site and removing water before it becomes too acidified or oxygen depleted.

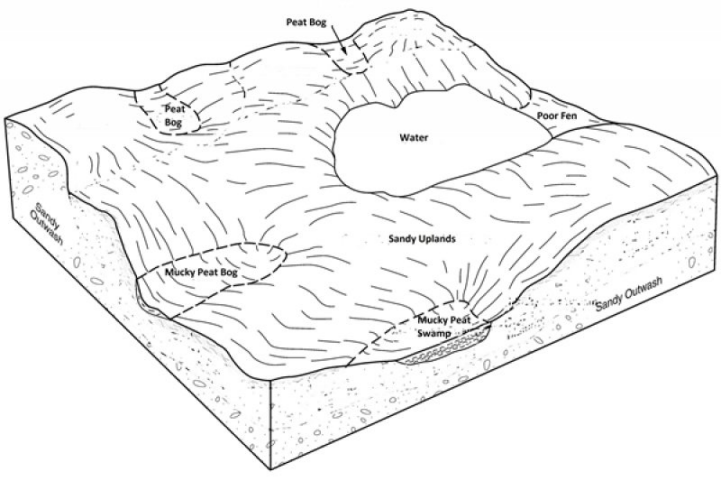


Figure 2. Peatland ecological sites in MLRA 94D

Table 2. Representative physiographic features

Landforms	(1) Depression
Ponding duration	Very brief (4 to 48 hours) to long (7 to 30 days)
Ponding frequency	Occasional to frequent
Elevation	424–549 m
Slope	0–2%
Ponding depth	0–30 cm
Water table depth	0–46 cm
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 of this site is generally cooler than the local climate in all seasons. This is due to wetness, deep shade, and cold air drainage on these sites.

Table 3. Representative climatic features

Frost-free period (average)	111 days
Freeze-free period (average)	135 days
Precipitation total (average)	838 mm

Climate stations used

- (1) EAGLE RIVER [USC00472314], Eagle River, WI
- (2) MINOCQUA [USC00475516], Minocqua, WI
- (3) WILLOW RSVR [USC00479236], Hazelhurst, WI
- (4) RHINELANDER [USC00477113], Rhinelander, WI

Influencing water features

Mucky Peat Swamps are wetland ecological sites that require a small stream as an outlet. An outlet is necessary to produce this ecological site because the soils and underlying sediments are acidic and supply relatively few nutrients. The outlet carries away acidic water thus preventing the acid accumulations and Sphagnum moss build-up found in Peat Bogs.

Soil features

The soils found on this ecological site are Histosols of the Lupton and similar soils map unit component. The majority of the organic soil material is of woody origin; it has a reddish hue and many fragments of wood are clearly visible, even though it qualifies to be well-decomposed sapric material by rubbed fiber content. The reddish hue will darken noticeably on exposure to air. The pH of the organic material is greater 4.5 in all parts, indicating that Sphagnum mosses are not the key species on this site. Typically however, there is a thin feather moss-derived mucky peat surface layer on these soils and the rest of the profile to 80 inches is muck with about 20% wood fragments throughout. If hemic material or mucky peat layers predominate, the soil would classify as the Carbondale component, which has edaphic properties similar to the Lupton component. Also, there are areas on these sites where the organic layers are thinner, but that usually does not affect the vegetation unless mineral

horizons occur within the root zone.

Figure 7. Lupton mucky peat--Oa1 9 to 33 cm

Table 4. Representative soil features

Surface texture	(1) Mucky peat
Drainage class	Very poorly drained
Permeability class	Moderately slow to moderately rapid
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	25.4–38.1 cm
Calcium carbonate equivalent (0-101.6cm)	0%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	4.8–5.8
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The information contained in the State and Transition Diagram (STD) and the Ecological Site Description was developed using archeological and historical data, professional experience, and scientific studies. The information presented is representative of a very complex set of plant communities. Not all scenarios or plants are included. Key indicator plants, animals and ecological processes are described to inform land management decisions.

This is a wetland ecological site and as such, the ecological dynamics of the site are governed by the water budget; i.e. the sources and rates of inflow to the site and the methods and rates of outflow. As stated previously, this site has a surface outlet. Flooding, by definition, is not a factor on these sites because they are typically located above the source of a stream, thus there is no upstream channel from which floods arise. If sites are subject to flooding, then it's referred to as a Mucky Floodplain ecological site. However, excess water does arrive on Mucky Peat Swamps from runoff during snowmelt or periods of above average rainfall in the watershed, in addition to the high

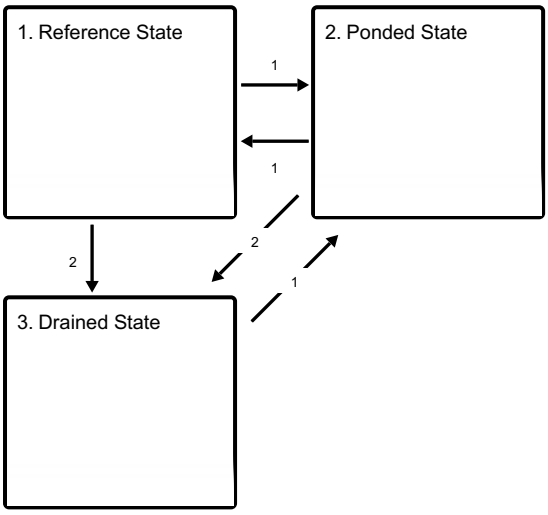
groundwater inflow. Also, a disturbance factor such as a beaver dam on the small outlet stream or human construction activities, most commonly road-building, may inadvertently increase ponding depth and duration. At other times or in other places, this site may become water deprived due to extended drought conditions, or drainage caused again by human construction activities.

The reference state is the most common land use on this site. There are two main phases in the reference state: a conifer-dominant phase in which white cedar and balsam fir predominate, and a hardwood-dominant phase in which black ash and red maple are more abundant. Undoubtedly, presence or absence of browsing by whitetail deer is the key disturbance factor on this site. However, past logging practices may also have a direct bearing on which phase is present. Then there are insects and diseases to contend with; and they can play a significant role in determining dominance at a given site.

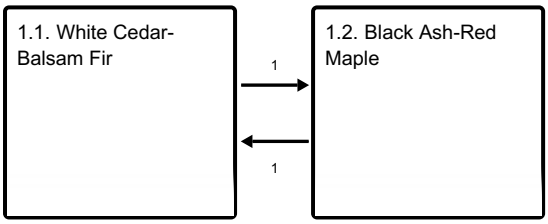
The species that form the core of each phase have adaptions to the overall rigors of the site. Given the relative uniformity of the soils, the phases appear to be a response to the complex and figuratively steep disturbance gradient on this site. The White Cedar-Balsam Fir Phase has a complement of long-lived, shade-tolerant, or disease-resistant species, while the Black Ash-Red Maple Phase has more fast-growing, light-demanding species.

State and transition model

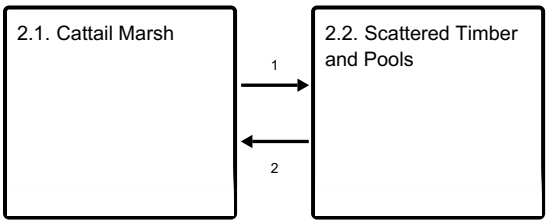
Ecosystem states



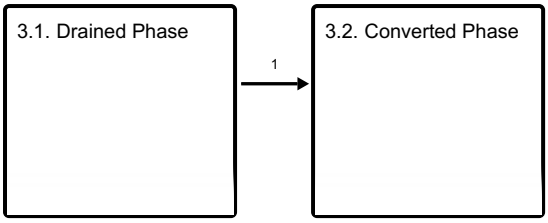
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Reference State

There are two main phases of the reference state: White Cedar-Balsam Fir Phase and Black Ash-Red Maple Phase. They exhibit either conifer dominance or hardwood dominance on basically the same soil component. However, due to highly variable patterns of disturbance on some Mucky Peat Swamp ecological sites, intermediate phases exist that have characteristics of both.

Community 1.1
White Cedar-Balsam Fir

Conifer dominance likely means the site is not subject to frequent stand-sized disturbances. This is a forest that has been allowed to mature undisturbed for decades. It perpetuates itself through gap replacement and can persist for hundreds of years as the long-lived white cedar trees become increasingly more dominant.

Community 1.2
Black Ash-Red Maple

Hardwood dominance occurs on these sites largely because succession to shade-tolerant, shade-producing, and slower growing species such as white cedar is set back by frequent disturbance.

Pathway 1
Community 1.1 to 1.2

The pathway to increased hardwood presence is through disturbance, which can be either large-scale events such as logging or massive windthrow or frequent small-scale events that add up to cover a large portion of the stand. These disturbances take out the larger conifers, and that opens the canopy for sunlight to penetrate to the understory, which in turn promotes shrub and hardwood release.

Pathway 1
Community 1.2 to 1.1

Conifer dominance occurs on sites that remain disturbance-free for several decades as this will give the conifer understory an opportunity to develop and eventually replace the hardwood overstory. The hardwoods are faster-growing than the conifers, but less shade-tolerant thus any disturbance that thins the overstory favors the hardwoods. And conversely, stability favors the conifers.

State 2
Ponded State

This state occurs on sites where inflow exceeds outflow for an extended period. This can be due to above average precipitation, human construction activities such as road-building or beaver dams on the outlet stream.

Community 2.1
Cattail Marsh

In deeper water on these richer sites cattails (Typha spp.) are the dominant species. There are also many other plant species, both emergent and submergent, associated with this community phase; as well as a richer fauna that includes reptiles, amphibians, waterfowl, and shore birds.

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***)	49-99 per hectare
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.**

Community 2.2
Scattered Timber and Pools

This phase is part forested, part open water. Some parts of this site are ponded long enough to kill the woody vegetation, other areas have only shrubs, while other parts retain the tree cover.

Pathway 1
Community 2.1 to 2.2

Partial drainage can occur before all the timber has drowned out.

Pathway 2
Community 2.2 to 2.1

Increased and prolonged inundation.

State 3
Drained State

This state is due mainly to artificial drainage of wetlands, but may occur as a result prolonged drought in the wetland watershed.

Community 3.1
Drained Phase

These sites have been both intentionally and inadvertently drained by construction activities such as road-building, or they can dry up due to prolonged drought.

Community 3.2
Converted Phase

These sites have been converted to non-forested land uses such as roads or road ditches. This usually requires the excavation of peat down to a mineral substratum.

Pathway 1
Community 3.1 to 3.2

Typically, a peatland site is drained before it is converted to another land use.

Transition 1
State 1 to 2

This transition occurs when inflows exceed outflows for an extended period of time. Excessive precipitation and beaver dams are two of the natural causative factors. Road construction is the most common human caused factor of hydrologic change. Ditches, dugouts, compaction, and subsidence all lead to ponding on these sites.

Transition 2
State 1 to 3

This transition is the result of artificial drainage or extended drought. Both of which can lead to subsidence or peat fires.

Transition 1
State 2 to 1

Natural drainage may lead to restored forested site, but that will likely take a long time. Open meadow vegetation will persist by initially out-competing woody vegetation until micro-sites for seedlings are created. When the overstory starts to shade out competing understory vegetation, transition is more rapid.

Transition 2
State 2 to 3

This transition is caused by artificial drainage.

Transition 1
State 3 to 2

This transition can caused by subsidence or peat which lowers the ground surface and makes ponding more likely.

Additional community tables

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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:

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

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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:

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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:**
