USDA Natural Resources Conservation Service

Ecological site F088XY005MN
Forestland Peatland

Last updated: 8/12/2024
Accessed: 02/07/2025

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.

MLRA notes

Major Land Resource Area (MLRA): 088X–Northern Minnesota Glacial Lake Basins

MLRA 88 consists of the lake beds of glacial Lakes Agassiz, Upham, and Aitkin. These vast glacial lake beds were formed by meltwaters associated with the last glaciation of the Wisconsin age. The large, flat, wet landscapes are filled with lacustrine lake sediments, wave-washed glacial till, and vast expanses of organic soils. This area is entirely in Minnesota and makes up about 11,590 square miles (30,019 square kilometers).

The western boundary of MLRA 88 with MLRA 56B is gradual. MLRA 56B is a portion of the Red River Valley that was formed by glacial Lake Agassiz and is dominantly prairie. The southern boundary of MLRA 88 with MLRA 57 consists of distinct moraines that formed from the glacial drift sediments of Late Wisconsin age. The eastern and southeastern boundaries are with portions of MLRAs 90A and 93A. These MLRAs are in a distinct glaciated region of sediments of the Rainy and Superior Lobes, and much of MLRA 93A is bedrock controlled (USDA-Ag Handbook 296, 2022).

Classification relationships

Relationship to Other Established Classifications:
MN DNR Native Plant Community (MN DNR, 2003); the reference community of this Provisional Ecological Site is most similar to:
FPn63 White Cedar Swamp
FPn73 Northern Alder Swamp
FPn82 Northern Rich Tamarack Swamp (Western Basin)
WFn53 Northern Wet Cedar Forest

Ecological site concept

Forested Peatland sites typically occur on level to gently sloping surfaces on all landforms through the area. Soils have greater than 16” of organic material and soil pH values are greater than 4.5.

Associated sites

F088XY003MN	**Open Peatland** Open Peatland occurs on level to gently sloping surfaces. Soils have greater than 16” of organic material and soil pH values are greater than 4.5. This site has a high water table that remain near the surface throughout the growing season, preventing the establishment of significant tree cover.
F088XY004MN	**Acid Peatland** Acid Peatland occurs in shallow wetland basins, closed depressions, and along drainage ways. Soils and water content have a pH lower than 4.5. Soils are occasionally ponded with standing water in spring but tend to recede by late summer. Soil surface layers are typically muck 8 to 16” thick over variable parent materials.

Similar sites

F088XY004MN	**Acid Peatland** Acid Peatland occurs in shallow wetland basins, closed depressions, and along drainage ways. Soils and water content have a pH lower than 4.5. Soils are occasionally ponded with standing water in spring but tend to recede by late summer. Soil surface layers are typically muck 8 to 16” thick over variable parent materials.

Table 1. Dominant plant species

Tree	(1) *Thuja occidentalis* (2) *Picea mariana*
Shrub	(1) *Rhamnus alnifolia* (2) *Alnus incana*
Herbaceous	(1) *Caltha palustris* (2) *Rubus pubescens*

Physiographic features

Forested Peatland sites typically occur on level to gently sloping surfaces on all landforms through the area. Soils have greater than 16” of organic material and soil pH values are greater than 4.5.

Table 2. Representative physiographic features

Slope shape across	(1) Linear
Slope shape up-down	(1) Linear
Landforms	(1) Depression (2) Lake plain > Bog (3) Lake plain > Depression
Runoff class	Negligible
Flooding frequency	None
Ponding duration	Long (7 to 30 days)
Ponding frequency	None to frequent
Elevation	590–2,030 ft
Slope	0–1%
Ponding depth	0–12 in
Water table depth	0 in
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation is 25 to 27 inches (635 to 711 millimeters). Most of the rainfall comes from convective thunderstorms during the growing season. Snowfall generally occurs from October through April. The average annual temperature is 43 to 46 degrees F (6 to 8 degrees C). The mean frost free period ranges from 82 to 109 days, with the mean freeze-free period ranging from 116 to 134 days.

Table 3. Representative climatic features

Frost-free period (characteristic range)	82-109 days
Freeze-free period (characteristic range)	116-134 days
Precipitation total (characteristic range)	25-27 in
Frost-free period (actual range)	75-110 days

Freeze-free period (actual range)	114-138 days
Precipitation total (actual range)	24-28 in
Frost-free period (average)	95 days
Freeze-free period (average)	127 days
Precipitation total (average)	26 in

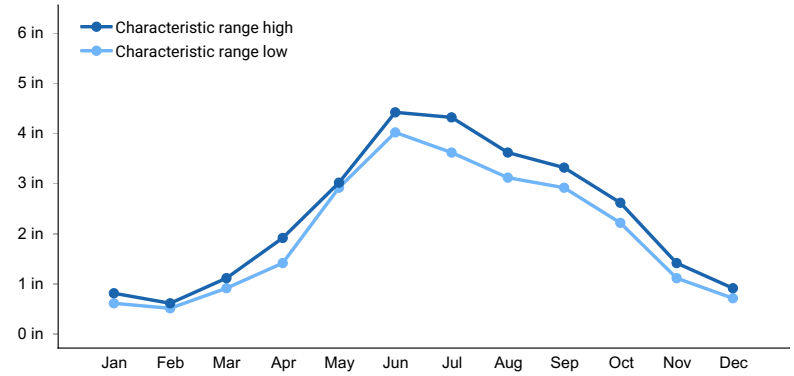


Figure 1. Monthly precipitation range

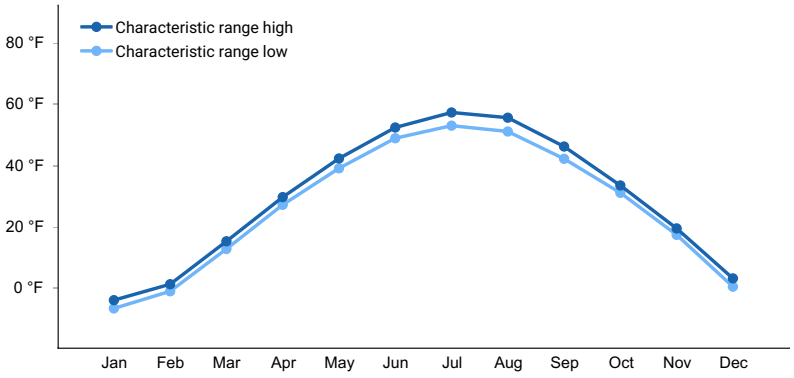


Figure 2. Monthly minimum temperature range

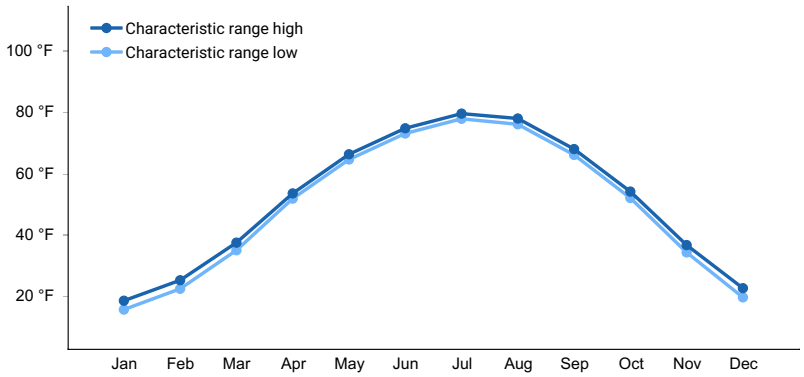


Figure 3. Monthly maximum temperature range

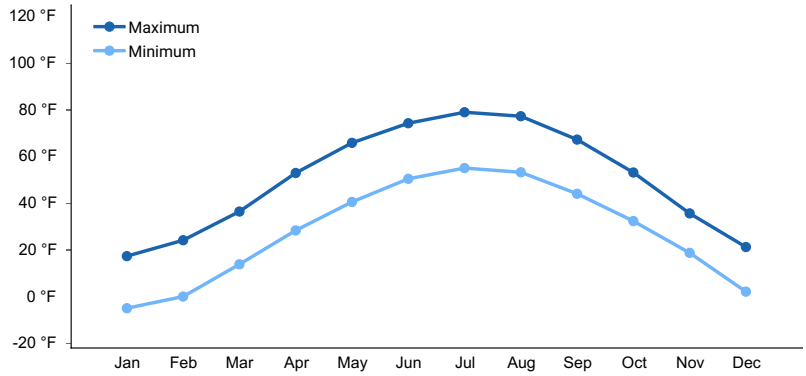


Figure 4. Monthly average minimum and maximum temperature

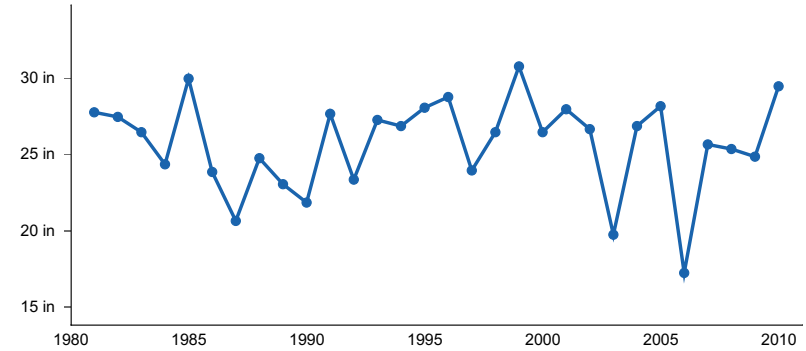


Figure 5. Annual precipitation pattern

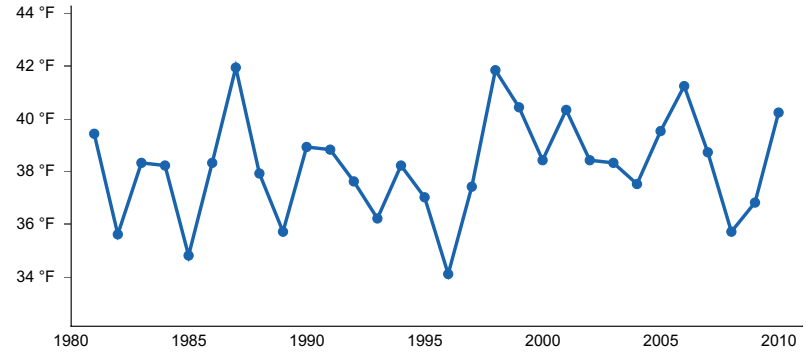


Figure 6. Annual average temperature pattern

Climate stations used

- (1) INTL FALLS INTL AP [USW00014918], International Falls, MN
- (2) LEECH LAKE [USC00214652], Bena, MN
- (3) CAMP NORRIS DNR [USC00211250], Beltrami Isl State for, MN
- (4) BAUDETTE INTL AP [USW00094961], Baudette, MN
- (5) RED LAKE INDIAN AGCY [USC00216795], Ponemah, MN
- (6) WASKISH 4NE [USC00218700], Big Falls, MN
- (7) BIG FALLS [USC00210746], Big Falls, MN
- (8) LITTLEFORK 10 SW [USC00214809], Big Falls, MN
- (9) WARROAD [USC00218679], Warroad, MN
- (10) POKEGAMA DAM [USC00216612], Cohasset, MN
- (11) SANDY LAKE DAM LIBBY [USC00217460], McGregor, MN
- (12) FLOODWOOD 3 NE [USC00212842], Floodwood, MN
- (13) HIBBING CHISHOLM HIBBING AP [USW00094931], Hibbing, MN

Influencing water features

Water is received through precipitation, runoff from adjacent uplands, and subsurface flow. Seasonal variation in

water table is the most important site factor defining Forested Peatlands. Water levels are greatly influenced by ground water, precipitation rates and runoff from upland sites. Water tables limit the amount of oxygen available to plant roots. Oxygen levels determine the extent to which root respiration can take place, the level of organic litter decomposition, and the release of important nutrients for uptake by plants (MN DNR, 2011). Forested Peatlands are wetter, less hydrologically variable ecosystems when compared to the Wet Depressional ecological site which has a greater variety of species adapted to its variation in water saturation.

Wetland description

Under the Cowardin System of Wetland Classification, or National Wetlands Inventory (NWI), these sites could be classified as:
1) Palustrine, scrub-shrub, broad-leaved deciduous, saturated, or
2) Palustrine, moss-lichen, saturated, or
3) Palustrine, scrub-shrub, broad-leaved evergreen, saturated, or
4) Palustrine emergent, persistent, saturated
5) Palustrine, forested, needle-leaved evergreen, saturated, or

Under the Hydrogeomorphic Classification System (HGM), these sites could be classified as:
1) Depressional, forested/organic, or
2) Depressional, scrub-shrub/organic

Permeability of the soil is moderately slow to slow
Hydrologic Group: A/D, B/D, C/D

Soil features

Parent material is fibric and/or herbaceous organic material more than 40 centimeters thick. Where underlying impermeable layers minimize groundwater movement through the peat. The main source of water to the site is precipitation, since the site formed through a buildup of peat over thousands of years, causing the soil surface to develop a crest shape with sloping concave sides.

All soils in the Forestland Peatland ecological site are Histosols. The soils for this site can be further classified as Terric Haplohemists, Terric Haplosaprists, Typic Borohemists, Typic Haplohemists, and Typic Haplosaprists.

Soil series within this site include: Tacoosh, Cathro, Rifle, Dora, Daisybay, Lupton, Markey, Mooselake, Berner, Bullwinkle, Tawas, Borohemists, and Lougee.

Table 4. Representative soil features

Parent material	(1) Organic material (2) Till
Surface texture	(1) Muck (2) Mucky peat (3) Peat
Drainage class	Very poorly drained
Permeability class	Moderately rapid
Depth to restrictive layer	0 in
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	13.8–18.9 in
Soil reaction (1:1 water) (10-40in)	5.6–8.4

Subsurface fragment volume <=3" (0-80in)	0–6%
Subsurface fragment volume >3" (0-80in)	0%

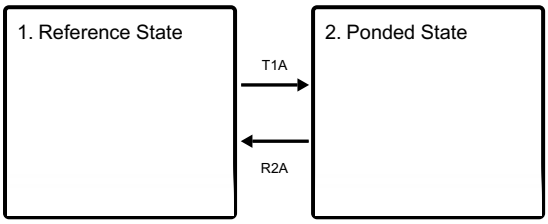
Ecological dynamics

Forested Peatland sites typically occur on level to gently sloping surfaces on all landforms through the area. Soils have greater than 16” of organic material and soil pH values are greater than 4.5. The organic material ranges in decomposition from muck, mucky peat to peat textures underlain by variable parent material. These sites are typically groundwater recharged.

Plant communities typical with Forested Peatland tend to be dominated by black spruce, tamarack, northern white cedar, and balsam fir; ericaceous shrubs such as Labrador tea, creeping snowberry, Speckled alder, and significant amounts of brown moss or minerotrophic Sphagnum cover.

State and transition model

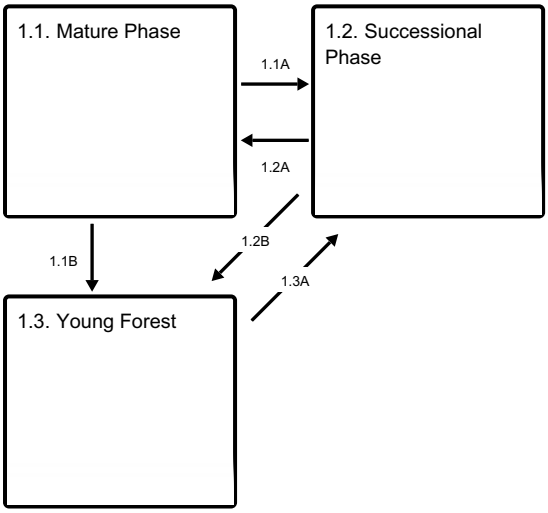
Ecosystem states



T1A - Beaver activity, roads, drainage, and other alterations in hydrology.

R2A - Draining or maintenance of water on-site causing alterations in hydrology.

State 1 submodel, plant communities



1.1A - A group or individual tree mortality

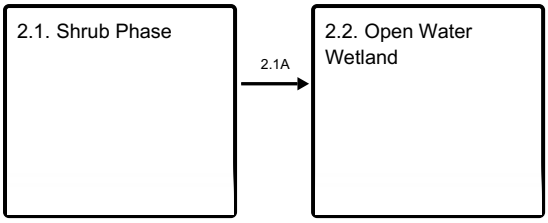
1.1B - Stand-replacing windthrow, disease, or pest outbreak.

1.2A - Succession/Time without major disturbance.

1.2B - Stand-replacing windthrow, disease, or pest outbreak.

1.3A - Succession/Time without major disturbance.

State 2 submodel, plant communities



2.1A - Beaver dam off-site restricts water flow or contributes to ponding on-site.

State 1
Reference State

Community phases within the Reference State are related to scattered small and moderate sized canopy openings from dead and/or windthrown trees. Windthrown trees were primarily dominant, above the canopy, and more exposed to wind events.

Dominant plant species

- black spruce (*Picea mariana*), tree

Community 1.1
Mature Phase

Mature trees in the canopy story with 25-75% cover.

Community 1.2
Successional Phase

A transition period marked with an increase in canopy cover and reduction in graminoid/forb layers. Tree growth increased for some species as the dominant species start to outcompete the subcanopy species.

Community 1.3
Young Forest

Recovering from severe disturbance such as windthrow where new growth occurs. Moss, graminoid, and forb layers dominate with shrubby layer emerging. Generally, in forested peatlands, the groundlayer doesn't look appreciably different than later successional phases. A lot of the same species occur. Total stand replacement is uncommon, but individual tree gaps are more common.

Pathway 1.1A
Community 1.1 to 1.2

A group or individual tree mortality causing moderate to small canopy gaps that favor shrubby openings and greater vertical structural diversity.

Pathway 1.1B
Community 1.1 to 1.3

Stand-replacing windthrow, disease, or pest outbreak.

Pathway 1.2A
Community 1.2 to 1.1

Succession/Time without major disturbance.

Pathway 1.2B
Community 1.2 to 1.3

Stand-replacing windthrow, disease, or pest outbreak.

Pathway 1.3A
Community 1.3 to 1.2

Succession/Time without major disturbance.

State 2
Ponded State

Sites can transition to this state by relatively sudden and complete loss of the tree canopy. This can happen as a result of intensive logging, forest pests, or general forest decline.

Dominant plant species

- hairy sedge (*Carex lacustris*), grass

Community 2.1
Shrub Phase

This plant community results following disturbances that cause elimination of trees in forested swamps, enabling alder to become dominant. Potential disturbance are often logging, windthrow, or temporary changes in hydrology caused by beaver activity." Dominant shrub specie is speckled alder. Bluejoint and a variety of sedges are also dominant, along with a myriad of sun-loving wetland forb species. There may be scattered trees as well, but they comprise low cover and are not significant to the overall structure of the plant community. But even scattered trees have ecological value as nest trees and perches for birds or den trees for small mammals. With a continued lowering of the water table, it is possible for this phase to succeed to the Reference State if black ash and other trees can successfully establish.

Community 2.2
Open Water Wetland

The wetland community phase in this state is characterized as having dead or dying overstory trees, and being flooded and subsequently ponded by up to several feet of essentially permanent water (Figure 3). Depending on depth of water, there will be areas with emergent and submergent aquatic vegetation, as well as scattered remnants of the former vegetation.

Pathway 2.1A
Community 2.1 to 2.2

Beaver dam off-site restricts water flow or contributes to ponding on-site.

Transition T1A
State 1 to 2

Impoundment or maintenance of water on-site, and/or establishment of invasive species. Beaver activity, roads, drainage, and other alterations in hydrology can transition the Forest Peatland site out of Reference to an Ponded State, where water is ponded on site for longer durations from overland surface flow.

Restoration pathway R2A
State 2 to 1

Draining or maintenance of water on-site causing alterations in hydrology that can transition the Ponded state back to the Reference State, where water is on site for shorter durations and receives less nutrients from overland

surface flow causing increased tree growth. Also, natural succession (albeit slow) where more trees get established and provide the evapotranspiration necessary to draw down the water table.

Additional community tables

Inventory data references

Information presented was derived from Minnesota Department of Natural Resources Field Guide to the Native Plant Communities of Minnesota, USDA-NRCS soil survey information, and USDA Plants Database.

Other references

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Contributors

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Approval

Suzanne Mayne-Kinney, 8/12/2024

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	02/07/2025
Approved by	Suzanne Mayne-Kinney
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):**

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

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

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:**

17. **Perennial plant reproductive capability:**