

Ecological site F057XY004MN

Acid Peatland

Last updated: 10/03/2023
Accessed: 09/21/2026

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): 057X–Northern Minnesota Gray Drift

The Northern Minnesota Gray Drift (57) is located within the Northern Lakes Forest and Forage Region. This area is entirely in north-central Minnesota and makes up about 9,785 square miles (Figure 1). The entire area is covered by Wisconsin-age glacial drift. The glacial deposits are from four major ice lobes-Des Moines, Rainy, Superior, and Wadena. The landscape developed through a series of glaciations and the subsequent retreating and wasting of the ice sheets, which resulted in a complex pattern of moraines, outwash plains, drumlins, lake plains and drainages. Lakes, ponds and marshes are common. The thickness of the glacial till ranges from 90 to 185 meters. Some areas of these deposits are overlain by outwash or lacustrine sediments. Some depressional areas have an accumulation of organic matter. The organic deposits are more than 2.5meters thick in some areas. Elevation ranges from 300 to 500 meters across the area. (USDA-NRCS 2006) The dominant soil orders in this MLRA are Alfisols, Entisols, and Histisols, with some Mollisols in the westernmost part of the area. The soils in the area have a frigid soil temperature regime; aquic or udic soil moisture regime, and mixed mineralogy. Their natural drainage class is related to landscape position. In general, the Alfisols formed in till on moraines, Entisols formed in outwash on moraines and outwash plains, and Histosols formed in organic material over outwash or till on moraines or outwash plains. (USDA-NRCS 2006)

Classification relationships

Major Land Resource Area (MLRA): Northern Minnesota Gray Drift (57) (USDA Handbook 296, 2006) USFS Subregions: Northern Minnesota Drift & Lake Plain Section (212N); Chippewa Plains Subsection (212Na), Pine Moraines & Outwash Plains Subsections (212Nc), St. Louis Moraines Subsection (212Nb); Minnesota & NE Iowa Morainal Section (222M); Hardwood Hills Subsection (222Ma); Northern Superior Uplands Section (212L); Nashwauk Uplands Subsection (212Lc); Northern Minnesota & Ontario Peatlands Section (212M); Littlefork-Vermillion Uplands Subsection (212Ma) (Cleland et al. 2007). US EPA Level IV Ecoregion: Itasca and St. Louis Moraines (50q); Chippewa Plains (50r); Nashwauk/Marcell Moraines and Uplands (50s); Alexandria Moraines and Detroit Lakes Outwash Plain (51j); McGrath Till Plain and Drumlins (51k); Wadena/Todd Drumlins and Osakis Till Plain (51l) (U.S. Environmental Protection Agency, 2013)

Ecological site concept

The soils associated with this site concept are very deep, very poorly drained Dysic, Typic, or Terric Histosols (Loxley, Greenwood, Beseman, Merwin series). Parent material is fibric and/or herbaceous organic material more than 40 centimeters thick. The surface water on-site is very acidic (pH 4.2), and mineral concentrations (particularly Ca++) are extremely low leading to increased acid tolerant species composition.

Associated sites

F057XY006MN	Forested Peatland Forested 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 water table typically below the peat surface that drops during the summer to allow for the establishment of significant tree cover.
-------------	---

R057XY005MN	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.
--------------------	--

Similar sites

F057XY006MN	Forested Peatland Forested 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 water table typically below the peat surface that drops during the summer to allow for the establishment of significant tree cover.
--------------------	---

Table 1. Dominant plant species

Tree	(1) <i>Larix laricina</i> (2) <i>Picea mariana</i>
Shrub	(1) <i>Chamaedaphne calyculata</i> (2) <i>Ledum groenlandicum</i>
Herbaceous	(1) <i>Eriophorum vaginatum</i> (2) <i>Carex trisperma</i>

Physiographic features

This area is in the Western Lake Section of the Central Lowland Province of the Interior Plains. The landscape developed through a series of glaciations and subsequent retreating and wasting of the ice sheets. A complex pattern of moraines, outwash plains, and drainages characterizes the area. The rest of the area is drained by the Mississippi River, southward into the Gulf of Mexico. The headwaters of the Mississippi River are in the northern part of the area. The Mississippi River and its tributaries drain most of the area.

Table 2. Representative physiographic features

Landforms	(1) Moraine (2) Depression (3) Outwash plain (4) Bog
Runoff class	Negligible to very low
Flooding frequency	None
Ponding duration	Long (7 to 30 days) to very long (more than 30 days)
Ponding frequency	Occasional to frequent

Elevation	180 – 500 m
Slope	0 %
Ponding depth	0 – 20 cm
Water table depth	0 – 20 cm
Aspect	Aspect is not a significant factor

Climatic features

In general, MLRA 57 has cold winters and warm summers. About 65 percent of the annual precipitation falls as rain during the 5-month growing season (May through September), and an additional 18 percent falls as snow.

Table 3 Representative climatic features

Frost-free period (characteristic range)	80-110 days
Freeze-free period (characteristic range)	120-140 days
Precipitation total (characteristic range)	660-740 mm
Frost-free period (actual range)	80-120 days
Freeze-free period (actual range)	120-140 days
Precipitation total (actual range)	660-740 mm
Frost-free period (average)	100 days
Freeze-free period (average)	130 days
Precipitation total (average)	710 mm

- (1) BLACKDUCK [USC00210809], Blackduck, MN
- (2) GRAND RPDS FOREST LAB [USC00213303], Grand Rapids, MN
- (3) POKEGAMA DAM [USC00216612], Cohasset, MN
- (4) LEECH LAKE [USC00214652], Bena, MN
- (5) MARCELL 5NE [USC00215175], Bigfork, MN
- (6) LITTLEFORK 10 SW [USC00214809], Big Falls, MN
- (7) KABETOOGAMA [USC00214191], Orr, MN

- (8) ORR 3E [USC00216211], Orr, MN

Influencing water features

Water is received through precipitation, runoff from adjacent uplands, and groundwater. Water levels are greatly influenced by precipitation rates and runoff from upland sites. Water leaves the site primarily through evapotranspiration, groundwater recharge, and less often, stream outflow. These sites are wetlands.

The hydrology of acid peatland sites significantly impacts their ecological development. Groundwater movement into these sites brings in water that is exposed to surrounding acidic parent materials, such as sand deposits. This interaction keeps the soils acidic.

Wetland description

Under the Cowardin System of Wetland Classification, or National Wetlands Inventory (NWI), the wetlands can be classified as:

- 1) Palustrine, forested, needle-leaved evergreen, saturated, or
- 2) Palustrine, scrub-shrub, broad-leaved deciduous, saturated, or
- 3) Palustrine, scrub-shrub, broad-leaved evergreen, saturated, or
- 4) Palustrine, emergent, persistent, saturated

Under the Hydrogeomorphic Classification System (HGM), the wetlands can be classified as:

- 1) Depressional, acidic, forested/organic, or
- 2) Depressional, acidic, scrub-shrub/organic

Permeability of the soil is very slow to moderately slow.

Hydrologic Group: A/D, B/D, C/D

Hydrogeomorphic Wetland Classification: Depressional acidic forested/organic; Depressional acidic scrub-shrub/organic

Cowardin Wetland Classification: PFO4B, PSS4B, PSS3B, PEM1B

Soil features

The soils associated with this site concept are very deep, very poorly drained Dysic, Typic, or Terric Histosols (Loxley, Beseman, Merwin series). Parent material is fibric and/or herbaceous organic material more than 40 centimeters thick. These sites usually formed in depressions on glacial moraines and lacustrine and outwash plains, 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.

Table 4. Representative soil features

Parent material	(1) Organic material (2) Till
Surface texture	(1) Muck (2) Peat
Drainage class	Very poorly drained
Permeability class	Moderately slow to rapid
Soil depth	200 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified

Available water capacity (0-152.4cm)	35.56 – 53.34 cm
Soil reaction (1:1 water) (0-101.6cm)	5.1 – 8.4
Subsurface fragment volume <=3" (Depth not specified)	0 – 10 %
Subsurface fragment volume >3" (Depth not specified)	Not specified

Ecological dynamics

The soils associated with this site concept are very deep, very poorly drained Dysic, Typic, or Terric Histosols (Loxley, Greenwood, Beseman, Merwin series). Parent material is fibric and/or herbaceous organic material more than 40 centimeters thick. These sites usually formed in depressions on glacial moraines and lacustrine and outwash plains, where underlying impermeable layers minimize groundwater movement through the peat. Slopes are less than 2%. The surface water on-site is very acidic (pH

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
-------	-------------	--------	-----------------	----------------------	------------------

Table 6. Community 1.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height M	Canopy Cover (%)	Diameter Cm	Basal Area (square M/hectare)
-------------	--------	-----------------	----------	----------	------------------	-------------	-------------------------------

Table 7. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (m)	Canopy Cover (%)
-------------	--------	-----------------	----------	------------	------------------

Table 8. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
-------	-------------	--------	-----------------	----------------------	------------------

Table 9. Community 1.2 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height M	Canopy Cover (%)	Diameter Cm	Basal Area (square M/hectare)
-------------	--------	-----------------	----------	----------	------------------	-------------	-------------------------------

Table 10. Community 1.2 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (m)	Canopy Cover (%)
-------------	--------	-----------------	----------	------------	------------------

Table 11. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
-------	-------------	--------	-----------------	----------------------	------------------

Table 12. Community 1.3 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height M	Canopy Cover (%)	Diameter Cm	Basal Area (square M/hectare)

Table 13. Community 1.3 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (m)	Canopy Cover (%)

Table 14. Community 1.4 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 15. Community 1.4 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height M	Canopy Cover (%)	Diameter Cm	Basal Area (square M/hectare)

Table 16. Community 1.4 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (m)	Canopy Cover (%)

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. 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: MN DNR APn80 Northern Spruce Bog MN DNR APn81 Northern Poor Conifer Bog MN DNR APn91 Northern Poor Fen MN DNR APn90, Northern Open Bog

Other references

Almendinger, J. C. 1997. Minnesota's Bearing Tree Database. Biological Report No. 56.

Brinson, M. M. 1993. A Hydrogeomorphic Classification for Wetlands.

Classification of Wetlands and Deepwater Habitats of the United States. Washington, DC: U.S. Fish and Wildlife Service, FWS/OBS-79/31.

Cleland, D.T.; Freeouf, J.A.; Keys, J.E., Jr.; Nowacki, G.J.; Carpenter, C; McNab, W.H. 2007. Ecological Subregions: Sections and Subsections of the Conterminous United States.[1:3,500,000], Sloan, A.M., cartog. Gen. Tech. Report WO-76. Washington, DC: U.S. Department of Agriculture, Forest Service.

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979.

Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program. MNDNR St. Paul, MN.

Interpretations - Silviculture Program APn81. Retrieved at https://www.dnr.state.mn.us/forestry/ecs_silv/interpretations.html

Minnesota Department of Natural Resources. St. Paul, Minnesota, USA.
MN DNR Forestry. Accessed 2018, June 13.

Minnesota Department of Natural Resources (2003). Field Guide to the Native Plant Communities of Minnesota: The Laurentian Mixed Forest Province.

Official Soil Series Descriptions. Available online. Accessed March 2018.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture.

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296.

USDA, NRCS. 2018. The PLANTS Database (<http://plants.usda.gov>, 26 June 2018). National Plant Data Team, Greensboro, NC 27401-4901 USA.

U.S. Environmental Protection Agency. 2013. Level III and IV ecoregions of the continental United States: Corvallis, Oregon, U.S. EPA, National Health and Environmental Effects Research Laboratory, map scale 1:3,000,000, <https://www.epa.gov/eco-research/level-iii-and-iv-ecoregions-continental-united-states>.

Wetlands Research Program Technical Report WRP-DE-4, U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS.

Contributors

Kade Anderson, Ecological Site Specialist for North Central Region
Patty Burns, Soil Scientist at Bemidji Soil Survey Office
Stacey Clark, Former Regional Ecologist for Regions 10 & 11
Ezra Hoffman, Ecological Site Specialist for North Central Region

Approval

Suzanne Mayne-Kinney, 10/03/2023

Acknowledgments

MLRA 57 technical team completed in 2022.

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	09/21/2026
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):

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:
