USDA Natural Resources Conservation Service

Ecological site F088XY008MN
Wet Mixed Forest

Last updated: 8/12/2024
Accessed: 09/27/2024

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.

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

MN DNR Native Plant Community (MN DNR, 2003); the reference community of this Provisional Ecological Site is most similar to:
MHn44 Northern Wet-Mesic Boreal Hardwood- Conifer Forest

Ecological site concept

Wet Mixed Forests typically occur on flats on the edge of uplands grading to very poorly drained peatland soils. These sites typically exist on poorly drained loamy and occasionally sandy glaciolacustrine deposits and till plains. Wet Mixed Forest sites receive runoff from adjacent sites and are subject to occasional ponding.

Associated sites

F088XY006MN	**Floodplain Forest Wet** These sites occur on occasionally or annually flooded sites on terraces and floodplains of streams and rivers. Soils consist of stratified alluvium which vary widely from silty to fine sandy soils on the occasionally flooded river terraces to coarser textured alluvium on the active floodplain sites.
F088XY007MN	**Wet Depressional Forest** These sites occur in shallow wetland basins, closed depressions and along drainage ways, and are generally in narrow transition zones between mineral uplands and peatlands. Soil surface layers are typically mucky-modified surface textures or muck less than 8” thick over variable parent materials.

Similar sites

F088XY015MN	**Loamy Upland Wet-Mesic Mixed Forest** These sites occur on summit, shoulders and backslope hillslope positions on moraines and till plains. These sites typically exist on soils with loamy textures of loam, sandy loam, sandy clay loam or fine sandy loam within a depth of 50 centimeters. The underlying parent material is generally medium textured till, sandy loam till or stratified materials with generally less than 35 percent rock fragments within a depth of 100 centimeters.

Table 1. Dominant plant species

Tree	(1) *Populus tremuloides* (2) *Fraxinus nigra*
Shrub	(1) *Corylus cornuta* (2) *Prunus virginiana*
Herbaceous	(1) *Maianthemum canadense* (2) *Aralia nudicaulis*

Physiographic features

Wet Mixed Forests typically occur on flats on the edge of uplands grading to very poorly drained peatland soils. These sites typically exist on poorly drained loamy and occasionally sandy glaciolacustrine deposits and till plains. Wet Mixed Forest sites receive runoff from adjacent sites and are subject to occasional ponding.

Table 2. Representative physiographic features

Slope shape across	(1) Linear
Slope shape up-down	(1) Linear
Landforms	(1) Lake plain > Flat (2) Till plain > Flat
Runoff class	Negligible to low
Flooding frequency	None
Ponding duration	Brief (2 to 7 days)
Ponding frequency	None to occasional
Elevation	274–518 m
Slope	0–2%
Ponding depth	0–15 cm
Water table depth	0–20 cm
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation is 25 to 28 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 110 days, with the mean freeze-free period ranging from 116 to 136 days.

Table 3. Representative climatic features

Frost-free period (characteristic range)	82-110 days
Freeze-free period (characteristic range)	116-136 days
Precipitation total (characteristic range)	635-711 mm
Frost-free period (actual range)	75-112 days
Freeze-free period (actual range)	114-141 days

Precipitation total (actual range)	610-711 mm
Frost-free period (average)	97 days
Freeze-free period (average)	127 days
Precipitation total (average)	660 mm

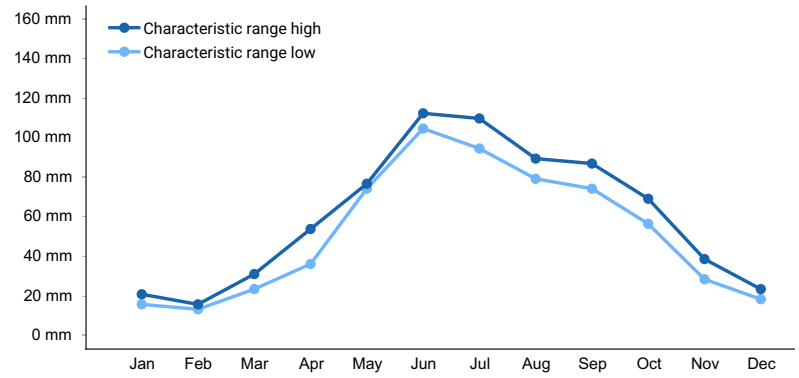


Figure 1. Monthly precipitation range

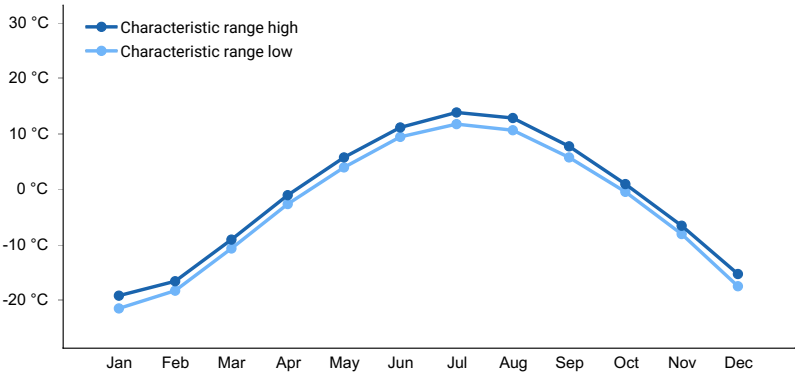


Figure 2. Monthly minimum temperature range

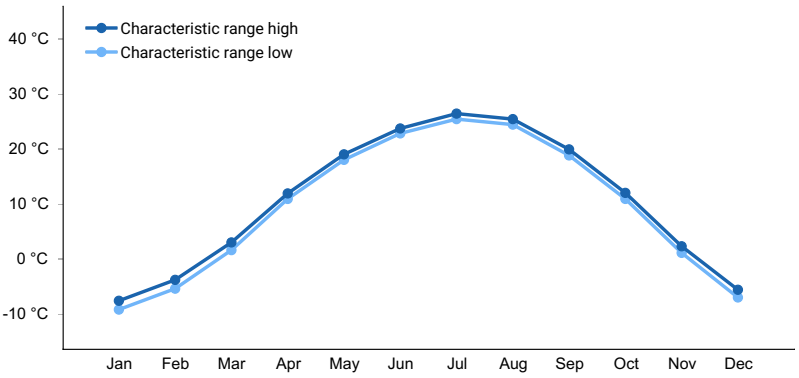


Figure 3. Monthly maximum temperature range

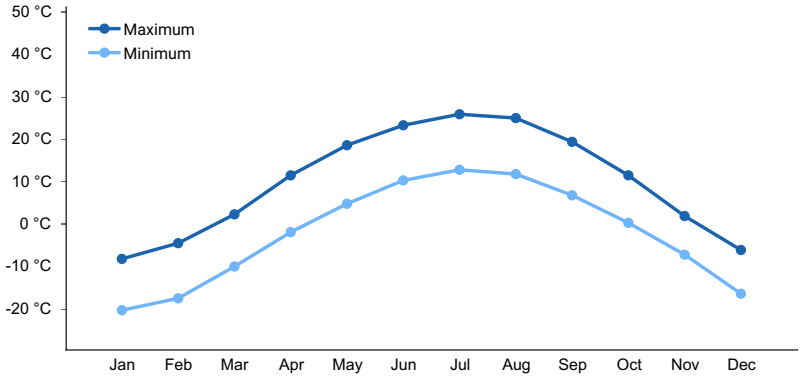


Figure 4. Monthly average minimum and maximum temperature

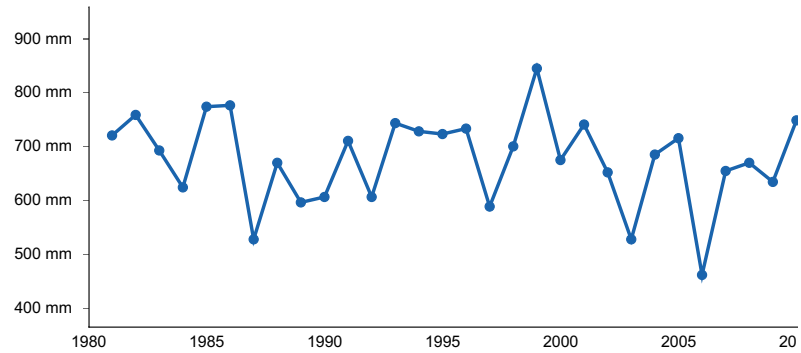


Figure 5. Annual precipitation pattern

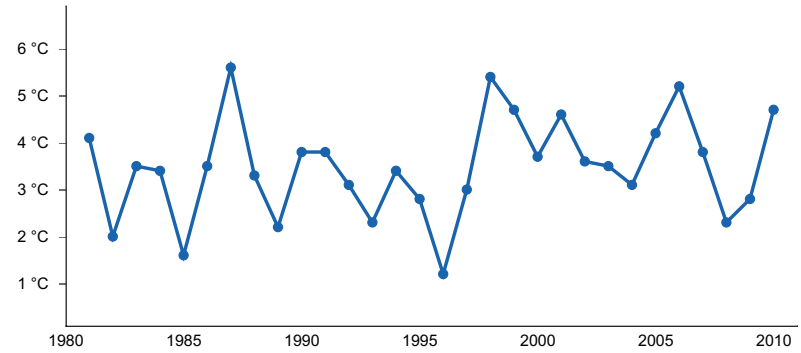


Figure 6. Annual average temperature pattern

Climate stations used

- (1) WARROAD [USC00218679], Warroad, MN
- (2) CAMP NORRIS DNR [USC00211250], Beltrami Isl State for, MN
- (3) BAUDETTE INTL AP [USW00094961], Baudette, MN
- (4) WASKISH 4NE [USC00218700], Big Falls, MN
- (5) LITTLEFORK 10 SW [USC00214809], Big Falls, MN
- (6) INTL FALLS INTL AP [USW00014918], International Falls, MN
- (7) LEECH LAKE [USC00214652], Bena, MN
- (8) POKEGAMA DAM [USC00216612], Cohasset, MN
- (9) GRAND RPDS FOREST LAB [USC00213303], Grand Rapids, MN
- (10) SANDY LAKE DAM LIBBY [USC00217460], McGregor, MN
- (11) FLOODWOOD 3 NE [USC00212842], Floodwood, MN
- (12) HIBBING CHISHOLM HIBBING AP [USW00094931], Hibbing, MN
- (13) EVELETH WWTP [USC00212645], Eveleth, MN

Influencing water features

This site is influenced by precipitation and runoff from adjacent sites, causing seasonal ponding after heavy rainfall

and snowmelt.

Soil features

These sites typically exist on loamy and occasionally sandy flats. Parent material is calcareous fine to loamy textured glacial till, stratified material, occasionally sandy, and glaciolacustrine deposits. Soils are poorly drained with grey soil color or grey-mottles shallow within the soil profile indicative of high local water tables. Soils are occasionally ponded with standing water in spring and after heavy rainfall events for brief to long duration not exceeding 30 days.

Soils in the Wet Mixed Forest ecological site fall within the Alfisol, Entisol, Inceptisol, and Mollisols, and Vertisol orders.

Soil series within this ecological site include: Effie, Cormant, Grygla, Chilgren, Indus, Blomford, Spooner, Kab, McQuade, Deford, Wabanica, Percy, Kratka, Augsburg, Onega, Zippel, Morph, Roliss, Bearville, Wabuse, Smiley, Strandquist, Warroad, Willosippi, Jevne, Epoufette, Meadowlands, Strathcona, Boash, Grano, Hellwig, Clearwater, Waukenabo, Foglake, Typic Ochraqualfs, Sandwick, Alborn, Rosewood, Auganaush, Schisler, Melrude, Zimm, Spidercreek, Gowan, Hangaard, Joki, Aquents, Skunkcreek, Rockwell, Mavie, and Hamar.

Table 4. Representative soil features

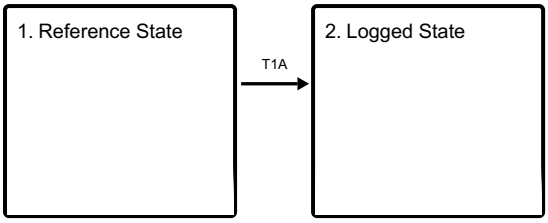
Parent material	(1) Till (2) Glaciolacustrine deposits
Surface texture	(1) Loam (2) Loamy fine sand (3) Fine sandy loam (4) Silt loam (5) Silty clay loam (6) Silt loam
Drainage class	Poorly drained
Permeability class	Moderately slow to moderately rapid
Depth to restrictive layer	0 cm
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	10.41–19.81 cm
Soil reaction (1:1 water) (0-25.4cm)	5.1–7.8
Subsurface fragment volume <=3" (0-203.2cm)	0–6%
Subsurface fragment volume >3" (0-203.2cm)	0–1%

Ecological dynamics

The reference state consists of three communities in varying successional levels depending natural disturbances. Plant species remain mostly consistent but can be found in different canopy layers depending on community phase. Plant community 1.1 is characterized by young forests after a disturbance event (i.e fire or windthrow). Dominant tree species would be quaking aspen, paper birch, and balsam fir. Community 1.2 represents the time frame where quaking aspen is declining and the confers are increasing due to lack of disturbance. Community 1.3 represents the mature forest with no disturbance with a fire return interval of 95 or more years. Paper birch and quaking aspen may be present in the overstory in 1.3 but maple will be more dominant in a late successional stand. State 2 represents a state that is managed for timber production.

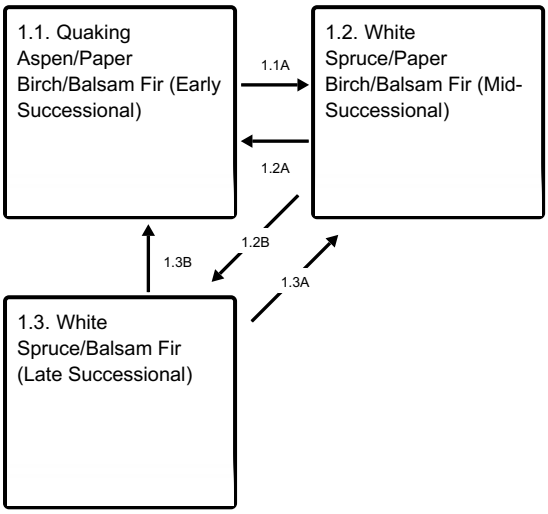
State and transition model

Ecosystem states



T1A - Mechanical removal of tree species for timber harvest.

State 1 submodel, plant communities



1.1A - Lack of fire/blow downs (35-95 years)

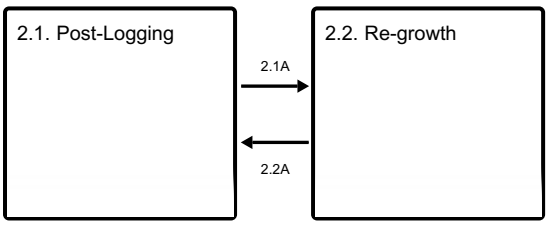
1.2A - Increased low intensity fire frequency and blow downs (<35 years)

1.2B - Lack of fire/blow downs (95-195 years)

1.3B - Stand replacing fire

1.3A - Increased low intensity fire frequency and blow downs (<95 years)

State 2 submodel, plant communities



2.1A - Planting of desired species and herbicide use.

2.2A - Harvest of tree species upon desired growth stage.

State 1
Reference State

The reference state of the Wet Mixed Forest ecological site consists of three communities in varying successional levels depending on fire, grazing and land use regimes. Plant species remain mostly consistent but can be found in different canopy layers depending on community phase.

Dominant plant species

- quaking aspen (*Populus tremuloides*), tree
- white spruce (*Picea glauca*), tree

- paper birch (*Betula papyrifera*), tree
- balsam fir (*Abies balsamea*), tree
- Canada mayflower (*Maianthemum canadense*), other herbaceous
- wild sarsaparilla (*Aralia nudicaulis*), other herbaceous
- dwarf raspberry (*Rubus arcticus ssp. acaulis*), other herbaceous
- bigleaf aster (*Eurybia macrophylla*), other herbaceous

Community 1.1
Quaking Aspen/Paper Birch/Balsam Fir (Early Successional)

Young forests recovering from fire or wind, notable quaking aspen dominance (0-35 years).

Dominant plant species

- quaking aspen (*Populus tremuloides*), tree
- paper birch (*Betula papyrifera*), tree
- balsam fir (*Abies balsamea*), tree
- beaked hazelnut (*Corylus cornuta var. cornuta*), shrub
- chokecherry (*Prunus virginiana*), shrub
- serviceberry (*Amelanchier*), shrub
- northern bush honeysuckle (*Diervilla lonicera*), shrub
- mountain maple (*Acer spicatum*), shrub
- Canada mayflower (*Maianthemum canadense*), other herbaceous
- wild sarsaparilla (*Aralia nudicaulis*), other herbaceous
- fragrant bedstraw (*Galium triflorum*), other herbaceous
- dwarf red blackberry (*Rubus pubescens*), other herbaceous
- bigleaf aster (*Eurybia macrophylla*), other herbaceous

Community 1.2
White Spruce/Paper Birch/Balsam Fir (Mid-Successional)

A transitional period marked with a decline in quaking aspen stand replacement. Along with development of understory coniferous species (35-95 years).

Dominant plant species

- white spruce (*Picea glauca*), tree
- paper birch (*Betula papyrifera*), tree
- balsam fir (*Abies balsamea*), tree
- chokecherry (*Prunus virginiana*), shrub
- mountain maple (*Acer spicatum*), shrub
- Canada mayflower (*Maianthemum canadense*), other herbaceous
- bigleaf aster (*Eurybia macrophylla*), other herbaceous

Community 1.3
White Spruce/Balsam Fir (Late Successional)

Mature forest with prominent mixed canopy (95+ years).

Dominant plant species

- white spruce (*Picea glauca*), tree
- balsam fir (*Abies balsamea*), tree
- bigleaf aster (*Eurybia macrophylla*), other herbaceous
- Canada mayflower (*Maianthemum canadense*), other herbaceous

Pathway 1.1A
Community 1.1 to 1.2

Lack of fire/blow downs (35-95 years)

Pathway 1.2A
Community 1.2 to 1.1

Increased low intensity fire frequency and blow downs (<35 years)

Pathway 1.2B
Community 1.2 to 1.3

Lack of fire/blow downs (95+ years)

Pathway 1.3B
Community 1.3 to 1.1

Stand replacing fire

Pathway 1.3A
Community 1.3 to 1.2

Increased low intensity fire frequency and blow downs (<95 years)

State 2
Logged State

Removal of tree species for timber harvest leaves an open canopy with very disturbed understory vegetation.

Dominant plant species

- speckled alder (*Alnus incana ssp. rugosa*), shrub
- wild sarsaparilla (*Aralia nudicaulis*), other herbaceous
- bigleaf aster (*Eurybia macrophylla*), other herbaceous

Community 2.1
Post-Logging

Removal of tree species for timber harvest leaves an open canopy with very disturbed understory vegetation. Shrubs dominate immediately post logging and often prevent tree's from re-establishing quickly.

Dominant plant species

- speckled alder (*Alnus incana ssp. rugosa*), shrub
- wild sarsaparilla (*Aralia nudicaulis*), other herbaceous
- bigleaf aster (*Eurybia macrophylla*), other herbaceous

Community 2.2
Re-growth

Practices, such as re-seeding desired species and allowing broadleaved trees to coppice to gain with desired timber species. Other practices may occur which favors re-growth of timber species.

Dominant plant species

- quaking aspen (*Populus tremuloides*), tree
- paper birch (*Betula papyrifera*), tree
- balsam fir (*Abies balsamea*), tree
- red maple (*Acer rubrum*), tree

Pathway 2.1A
Community 2.1 to 2.2

Planting of desired species for future timber harvest and herbicide use to prevent shrubs from dominating.

Pathway 2.2A
Community 2.2 to 2.1

Harvest of tree species upon desired growth stage.

Transition T1A
State 1 to 2

Mechanical removal of tree species for timber harvest.

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	09/27/2024
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:**