USDA Natural Resources Conservation Service

Ecological site F057XY021MN
Loamy Upland Moist Hardwood Forest

Last updated: 10/03/2023
Accessed: 05/12/2025

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): 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 2.5 meters thick in some areas. Elevation ranges from 300 to 500 meters across the area. (USDA-NRCS 2006)

Prior to settlement, the vegetation in this area was mainly a mixture of deciduous trees and conifers. White Pine and red pine grew on moraines. Jack pine was dominant on outwash plains and sandy lake plains. Red oak, sugar maple, and basswood grew in sheltered areas close to lakes. Forested lowlands were dominated by black spruce, tamarack, white cedar, and black ash. Wetlands that were not forested were dominated by sedge meadow communities. The western part of the area was dominated by tall prairie grasses. Most of this area is still forested today, aspen as become the most common species both in pure stands and mixed stands with birch, maple, oak, white spruce, and red pine. (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

Loamy Upland Moist Hardwood Forest are widespread throughout the entire MLRA 57, and typically 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.

Associated sites

F057XY017MN	**Steep Loamy Upland Forest** These sites occur on summit, shoulders and backslope hillslope positions with slopes greater than 15 percent on moraines These sites typically exist on soils with loamy textures of loam, silt loam, silty clay loam, clay loam, sandy clay loam, sandy loam, fine sandy loam or very fine sandy loam within a depth of 50 centimeters.
F057XY015MN	**Wet Mixed Forest** These sites occur on footslope and toeslope hillslope positions, drainageways surrounded by uplands or on the edge of uplands grading to very poorly drained peatland soils. These sites typically exist on loamy and occasionally sandy moraines and till plains. Parent material is calcareous fine to loamy textured glacial till, stratified material and occasionally sandy. Soils are somewhat poorly to poorly drained soils with grey soil color or grey-mottles shallow within the soil profile indicative of high local water tables.

Similar sites

F057XY020MN	**Fine Upland Moist Hardwood Forest** These sites occur on summit, shoulders and backslope hillslope positions on moraines and till plains, and occasionally on gentle to steeper sloping areas of glacial lake plains. These sites typically exist on soils with fine textured clayey and silty textures of clay, silty clay, silty clay loam, silt loam, very fine sandy loam or loamy very fine sand within a depth of 50 centimeters. The underlying parent material is generally fine or medium textured glacial till; or fine textured clayey or silty glacial lacustrine sediments with generally less than 5 percent rock fragments within a depth of 100 centimeters. .

Table 1. Dominant plant species

Tree	(1) *Acer saccharum* (2) *Tilia americana*
Shrub	(1) *Cornus* (2) *Corylus cornuta*
Herbaceous	(1) *Aralia nudicaulis* (2) *Eurybia macrophylla*

Physiographic features

Loamy Upland Moist Hardwood Forest are widespread throughout the entire MLRA 57, and typically occur on summit, shoulders and backslope hillslope positions on moraines and till plains.

Table 2. Representative physiographic features

Hillslope profile	(1) Summit (2) Backslope (3) Shoulder
Landforms	(1) Moraine (2) Till plain
Runoff class	Medium to high
Flooding frequency	None
Ponding frequency	None
Elevation	183–610 m
Slope	0–25%

Water table depth	51–152 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)	95-117 days
Freeze-free period (characteristic range)	125-145 days
Precipitation total (characteristic range)	660-762 mm
Frost-free period (actual range)	80-129 days
Freeze-free period (actual range)	122-155 days
Precipitation total (actual range)	660-762 mm
Frost-free period (average)	106 days
Freeze-free period (average)	135 days
Precipitation total (average)	711 mm

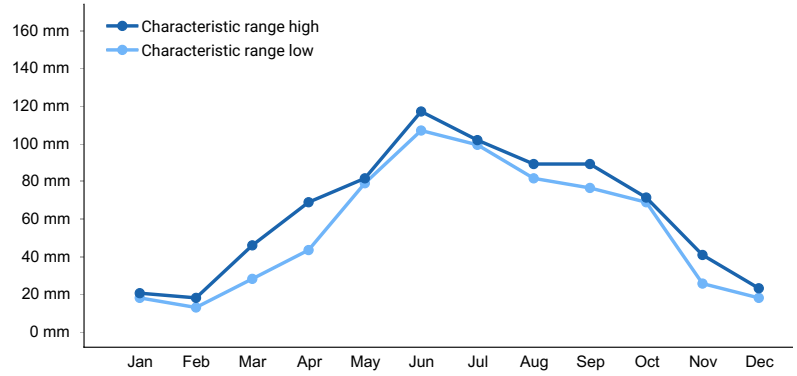


Figure 1. Monthly precipitation range

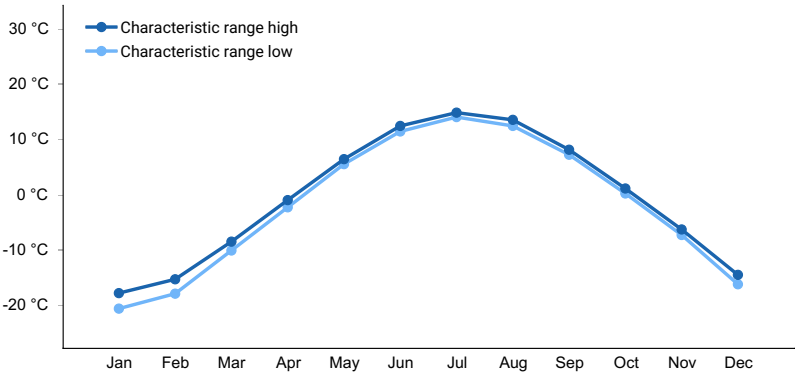


Figure 2. Monthly minimum temperature range

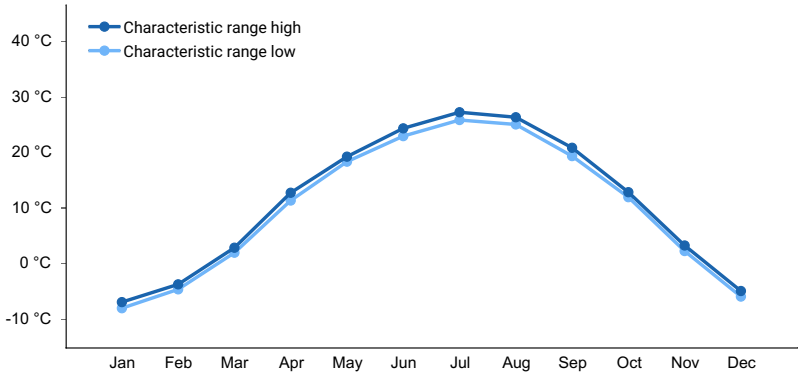


Figure 3. Monthly maximum temperature range

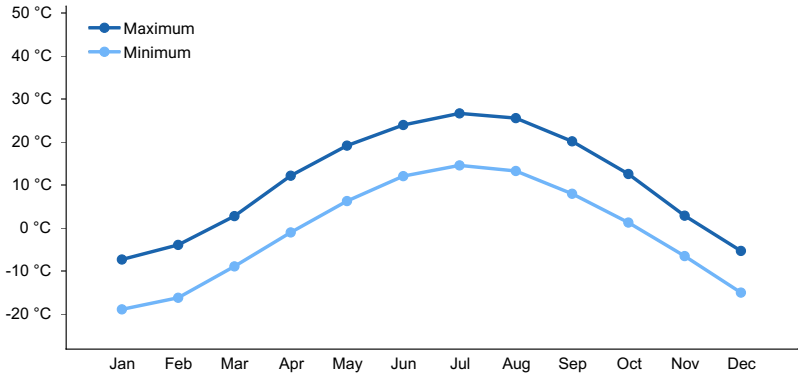


Figure 4. Monthly average minimum and maximum temperature

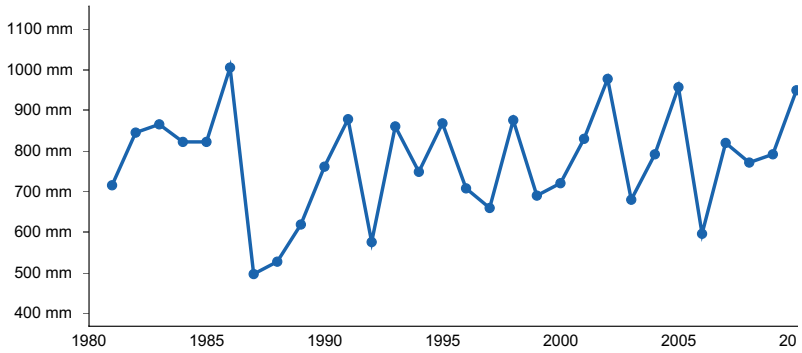


Figure 5. Annual precipitation pattern

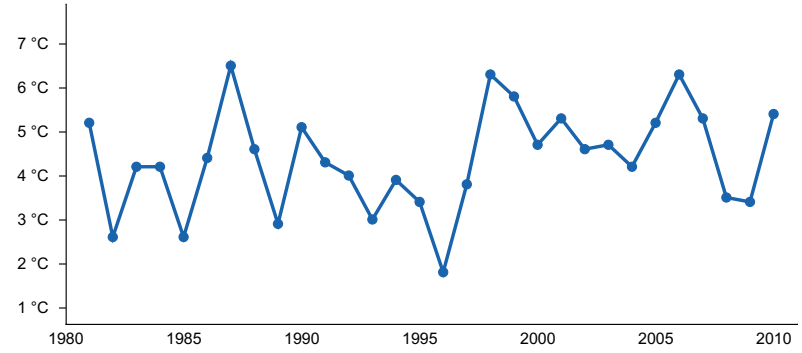


Figure 6. Annual average temperature pattern

Climate stations used

- (1) BEMIDJI [USC00210643], Bemidji, MN
- (2) BLACKDUCK [USC00210809], Blackduck, MN
- (3) COLLEGEVILLE ST JOHN [USC00211691], Avon, MN

- (4) LONG PRAIRIE [USC00214861], Long Prairie, MN
- (5) NEW YORK MILLS [USC00215902], New York Mills, MN
- (6) TAMARAC WILDLIFE REF [USC00218191], Rochert, MN

Influencing water features

None

Wetland description

Not Applicable

Soil features

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. Soils are well to moderately well drained with rust and gray redoximorphic features and or depth to seasonal water table between 50 to greater than 150 centimeters. Soil series representing this ecological site include: Balmlake, Kandota, Nebish, Snellman, Wykeham, and Holdingford, among others.

Table 4. Representative soil features

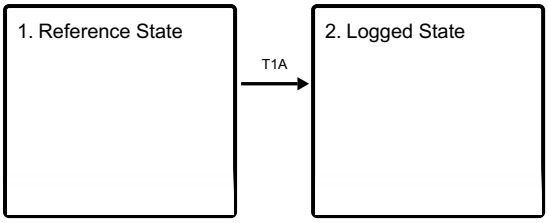
Parent material	(1) Glaciolacustrine deposits (2) Till
Surface texture	(1) Sandy loam (2) Loam (3) Fine sandy loam (4) Sandy clay loam
Drainage class	Moderately well drained to well drained
Permeability class	Moderately slow to moderately rapid
Soil depth	203 cm
Surface fragment cover <=3"	0–9%
Surface fragment cover >3"	0–6%
Available water capacity (0-152.4cm)	10.67–19.3 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%
Soil reaction (1:1 water) (0-101.6cm)	5.1–8.4
Subsurface fragment volume <=3" (0-101.6cm)	0–11%
Subsurface fragment volume >3" (0-101.6cm)	0–6%

Ecological dynamics

Plant communities typically dominated by sugar maple, basswood, and northern red oak, or mixtures of paper birch, sugar maple, basswood, and quaking aspen. Understory typically includes sugar maple saplings as well as beaked hazelnut, chokecherry, pagoda dogwood, fly honeysuckle, and balsam fir; with the forb layer including wild sarsaparilla, large leaf aster, mountain rice grass, and rose twisted stalk to mention a few.

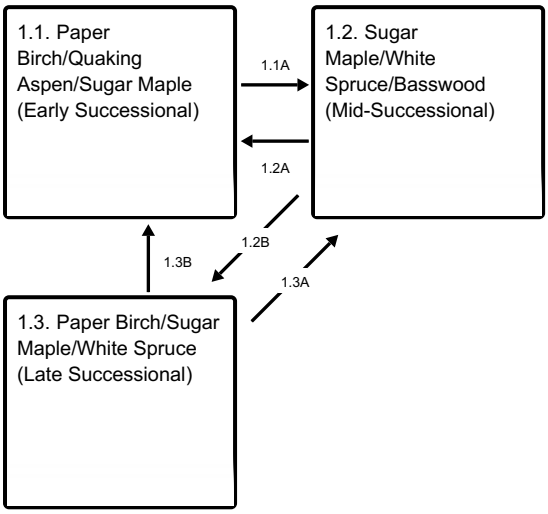
State and transition model

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)

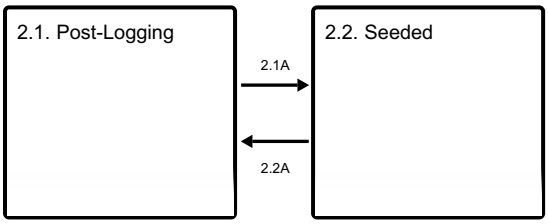
1.2A - Increased low intensity fire frequency and blow downs (<35 years)

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 Loamy Upland Moist Hardwood Forest ecological site consists of three forested plant communities in varying successional levels.

Community 1.1
Paper Birch/Quaking Aspen/Sugar Maple (Early Successional)

Young forests recovering from fire or wind, notable quaking aspen dominance (0-55 years).

Dominant plant species

- paper birch (*Betula papyrifera*), tree
- quaking aspen (*Populus tremuloides*), tree
- sugar maple (*Acer saccharum*), tree
- northern red oak (*Quercus rubra*), tree
- basswood (*Tilia*), tree

Community 1.2
Sugar Maple/White Spruce/Basswood (Mid-Successional)

A transitional period marked with a decline in quaking aspen stand replacement. Along with development of understory coniferous species (55-95 years).

Dominant plant species

- sugar maple (*Acer saccharum*), tree
- white spruce (*Picea glauca*), tree
- basswood (*Tilia*), tree

Community 1.3
Paper Birch/Sugar Maple/White Spruce (Late Successional)

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

Dominant plant species

- paper birch (*Betula papyrifera*), tree
- sugar maple (*Acer saccharum*), tree
- white spruce (*Picea glauca*), tree
- quaking aspen (*Populus tremuloides*), tree
- northern red oak (*Quercus rubra*), tree

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. Shrubs dominate immediately post logging and often prevent tree's from re-establishing quickly.

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.

Community 2.2
Seeded

Reseeded to a forested site with desired timber species.

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.

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:
MHn35 Northern Mesic Hardwood Forest

Other references

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Contributors

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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	05/12/2025
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):**

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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:**
