

## **Ecological site F057XY023MN Dry Sandy Upland Coniferous Forest**

Last updated: 10/03/2023  
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### **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)

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 Histisols 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**

Dry Sandy Upland Coniferous Forest are widespread throughout the entire MLRA 57, and typically occur on summit, shoulders and backslope hillslope positions on outwash plains and dune fields. These sites typically exist on soils with coarser textures of sand, coarse sand, loamy sand, loamy coarse sand, fine sand, or loamy fine sand within a depth of 50 centimeters.

## Associated sites

F057XY017MN	<b>Steep Loamy Upland Forest</b> These sites occur on shoulders and backslope hillslope positions with slopes greater than 15 percent on outwash plains and moraines. These sites typically exist on soils with sandy textures of sand, coarse sand, loamy sand, loamy coarse sand, fine sand, or loamy fine sand within a depth of 50 centimeters. The underlying material is generally coarse textured and generally has 0 to 35 percent rock fragments, but areas of sand capped glacial till can be included.
F057XY015MN	<b>Wet Mixed Forest</b> 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.

## Similar sites

F057XY022MN	<b>Sandy Upland Moist Mixed Forest</b> These sites occur on summit, shoulders and backslope hillslope positions on outwash plains, moraines and till plains. These sites typically exist on soils with medium textures of sandy loam, fine sandy loam or loam within a depth of 50 centimeters but can also include very fine sandy loam or loamy very fine sand in some cases. The underlying material is coarse textured and generally has 5 to 35 percent rock fragments.
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Table 1. Dominant plant species

Tree	(1) <i>Pinus banksiana</i> (2) <i>Pinus resinosa</i>
Shrub	(1) <i>Vaccinium angustifolium</i> (2) <i>Amelanchier</i>
Herbaceous	(1) <i>Maianthemum canadense</i> (2) <i>Piptatheropsis pungens</i>

## Physiographic features

Dry Sandy Upland Coniferous Forest are widespread throughout the entire MLRA 57, and typically occur on summit, shoulders and backslope hillslope positions on outwash plains and dune fields.

Table 2. Representative physiographic features

Hillslope profile	(1) Summit (2) Shoulder (3) Backslope
Landforms	(1) Dune field (2) Outwash plain (3) Hillslope
Runoff class	Very low to medium
Flooding frequency	None
Ponding frequency	None
Elevation	182–619 m
Slope	1–15%
Water table depth	127 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. The

freeze-free period averages 150 days and ranges from 120 to 175 days.

Table 3. Representative climatic features

Frost-free period (characteristic range)	97-105 days
Freeze-free period (characteristic range)	124-135 days
Precipitation total (characteristic range)	686-711 mm
Frost-free period (actual range)	89-109 days
Freeze-free period (actual range)	120-143 days
Precipitation total (actual range)	686-711 mm
Frost-free period (average)	100 days
Freeze-free period (average)	130 days
Precipitation total (average)	686 mm

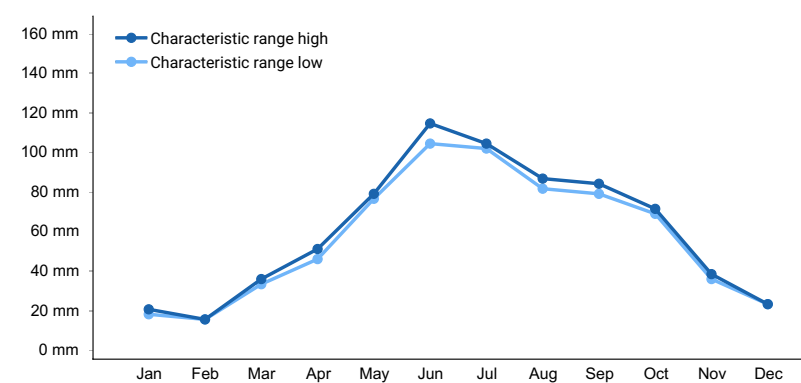


Figure 1. Monthly precipitation range

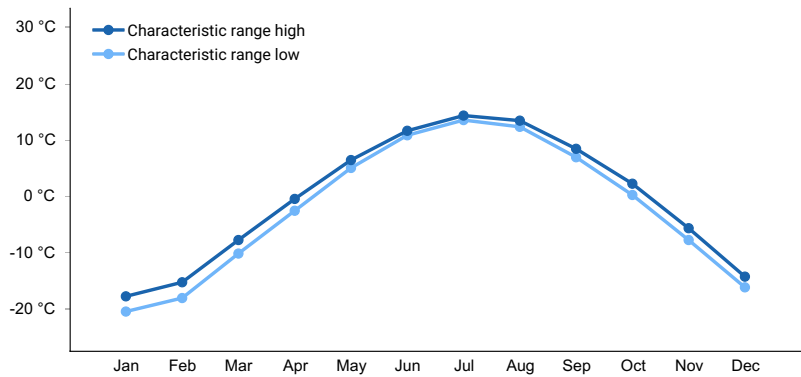


Figure 2. Monthly minimum temperature range

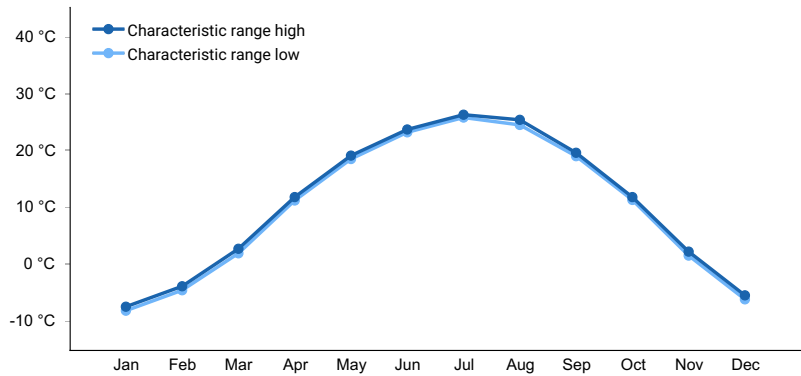
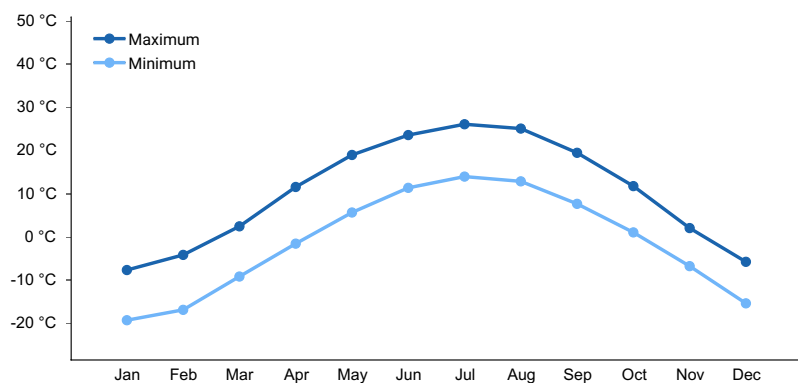
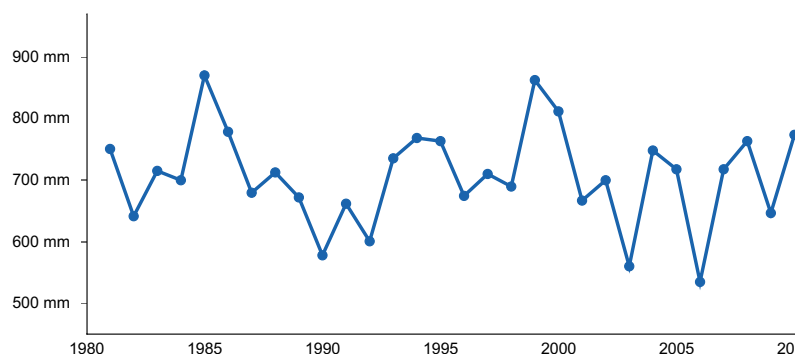


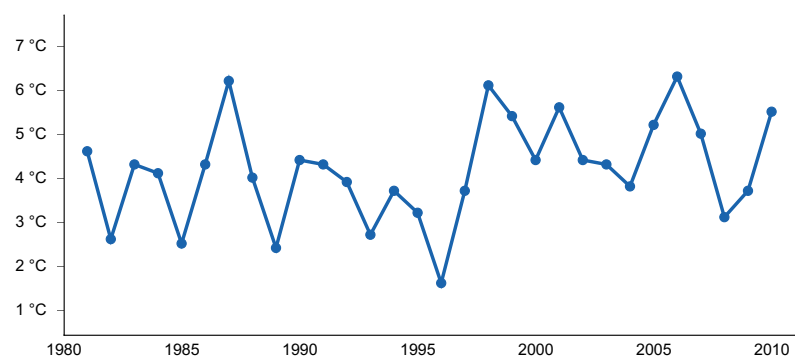
Figure 3. Monthly maximum temperature range



**Figure 4. Monthly average minimum and maximum temperature**



**Figure 5. Annual precipitation pattern**



**Figure 6. Annual average temperature pattern**

## Climate stations used

- (1) WALKER AH GWAH CHING [USC00218618], Walker, MN
- (2) DEEP PORTAGE [USC00212050], Backus, MN
- (3) ITASCA UNIV OF MINN [USC00214106], Park Rapids, MN
- (4) BEMIDJI [USC00210643], Bemidji, MN
- (5) CASS LAKE [USC00211374], Cass Lake, MN

## Influencing water features

None

## Wetland description

Not Applicable

## Soil features

The central concept soil series are Abbeylake, Clearriver, Eagleview and Zimmerman but other series are included.

These sites typically exist on soils with coarser textures of sand, coarse sand, loamy sand, loamy coarse sand, fine sand, or loamy fine sand within a depth of 50 centimeters. The underlying material is generally coarse textured and generally has 0 to 35 percent rock fragments, but areas of sand capped glacial till can be included. Soils are moderately well to excessively drained with rust and gray redoximorphic features and or depth to seasonal water table between 50 to greater than 150 centimeters. In some areas the soil surface color is somewhat dark to very dark in the upper 25cm because of incorporated organic matter, which indicates that these site were formerly occupied by deciduous woodlands and prairies.

**Table 4. Representative soil features**

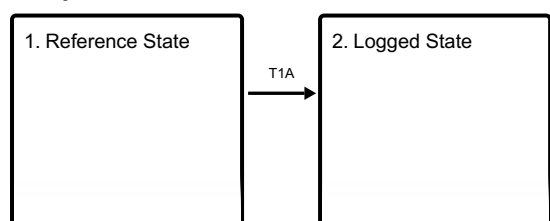
Parent material	(1) Outwash (2) Till
Surface texture	(1) Sand (2) Loamy coarse sand (3) Loamy fine sand
Drainage class	Moderately well drained to excessively drained
Permeability class	Moderately rapid to rapid
Soil depth	203 cm
Surface fragment cover <=3"	0–14%
Surface fragment cover >3"	0–8%
Available water capacity (0-381cm)	9.4–13.72 cm
Calcium carbonate equivalent (0-101.6cm)	0–15%
Soil reaction (1:1 water) (0-101.6cm)	3.5–7.8
Subsurface fragment volume <=3" (0-101.6cm)	4–25%
Subsurface fragment volume >3" (0-101.6cm)	0–4%

## Ecological dynamics

Dry Sandy Upland Coniferous Forest are widespread throughout the entire MLRA 57, and typically occur on summit, shoulders and backslope hillslope positions on outwash plains and dune fields. These sites typically exist on soils with coarser textures of sand, coarse sand, loamy sand, loamy coarse sand, fine sand, or loamy fine sand within a depth of 50 centimeters. The underlying material is generally coarse textured and generally has 0 to 35 percent rock fragments, but areas of sand capped glacial till can be included. Soils are moderately well to excessively drained with rust and gray redoximorphic features and or depth to seasonal water table between 50 to greater than 150 centimeters. In some areas the soil surface color is somewhat dark to very dark in the upper 25cm because of incorporated organic matter, which indicates that these site were formerly occupied by deciduous woodlands and prairies.

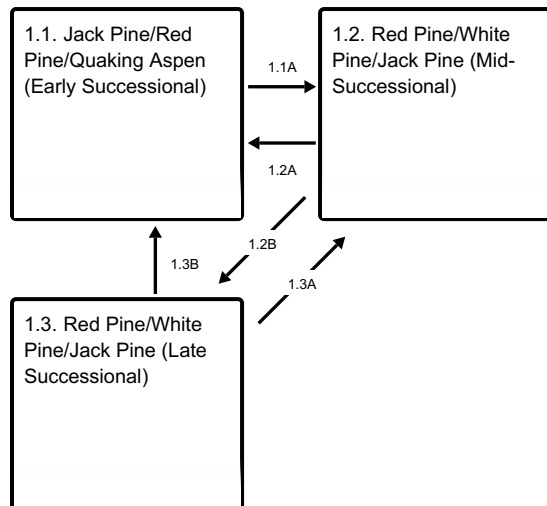
## State and transition model

### 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)

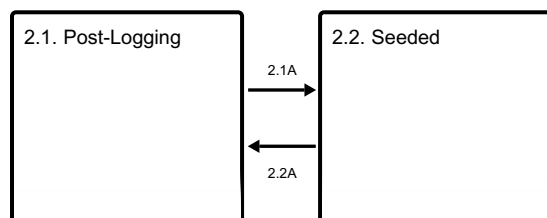
**1.2A** - Increased low intensity fire frequency and blow downs (<35 years)

**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 this site consists of three forested plant communities in varying successional levels.

### Community 1.1 Jack Pine/Red Pine/Quaking Aspen (Early Successional)

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

#### Dominant plant species

- jack pine (*Pinus banksiana*), tree
- red pine (*Pinus resinosa*), tree
- quaking aspen (*Populus tremuloides*), tree

### Community 1.2 Red Pine/White Pine/Jack Pine (Mid-Successional)

A transitional period marked with a decline in jack pine. Replacement by red pine and some white pine (55-75 years).

#### Dominant plant species

- jack pine (*Pinus banksiana*), tree
- red pine (*Pinus resinosa*), tree
- eastern white pine (*Pinus strobus*), tree

## **Community 1.3**

### **Red Pine/White Pine/Jack Pine (Late Successional)**

Mature forest with dominated by red pine (75+ years).

#### **Dominant plant species**

- eastern white pine (*Pinus strobus*), tree
- jack pine (*Pinus banksiana*), tree
- red pine (*Pinus resinosa*), tree
- white spruce (*Picea glauca*), tree
- paper birch (*Betula papyrifera*), 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:

FDn12 (a or b) Northern Dry-Sand Pine woodland

FDc12 Central Poor Dry Pine Woodland

FDn33 Northern Dry-Mesic Mixed Woodland (dunes, sand cap glacial tills and glossics)

FDc23 Central Dry Pine Woodland (darkened surface due to prairie influence)

FDc34 Central Dry-Mesic Pine-Hardwood Forest (sand cap or glossic)

### **Other references**

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.

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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:**

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2. **Presence of water flow patterns:**

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3. **Number and height of erosional pedestals or terracettes:**

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

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5. **Number of gullies and erosion associated with gullies:**

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6. **Extent of wind scoured, blowouts and/or depositional areas:**
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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:

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17. **Perennial plant reproductive capability:**

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