USDA Natural Resources Conservation Service

# Ecological site F088XY011MN
# Moist Sandy Mixed Forest

Last updated: 8/12/2024
Accessed: 12/04/2024

## 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).

## Ecological site concept

This site is a conifer-dominated woodland of jack pine, black spruce, and red pine with a mix of hardwoods including paper birch and quaking aspen. Soils are coarse textured, very deep, and somewhat poorly drained.

## Associated sites

| | |
|---|---|
| F088XY013MN | **Dry Sandy Upland Coniferous Forest**<br>The Dry Sandy Upland Coniferous Forest ecological site is located on uplands with soils that are course textured and moderately well drained to somewhat excessively drained. Available water capacity ranges from 2-5 inches. |

## Similar sites

| | |
|---|---|
| F088XY013MN | **Dry Sandy Upland Coniferous Forest**<br>The Dry Sandy Upland Coniferous Forest ecological site is located on uplands with soils that are course textured and moderately well drained to somewhat excessively drained. Available water capacity ranges from 2-5 inches. |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | (1) *Pinus banksiana*<br>(2) *Picea mariana* |
| Shrub | (1) *Amelanchier*<br>(2) *Vaccinium angustifolium* |

| | |
|---|---|
| Herbaceous | (1) *Maianthemum canadense*<br>(2) *Cornus canadensis* |

## Physiographic features

This site is often situated on flats, dunes, and pitted outwash plains. No ponding or flooding occurs, but the site does have a seasonal high water table. Runoff class is low to medium and slopes are less than 3%.

**Table 2. Representative physiographic features**

| | |
|---|---|
| Slope shape across | (1) Linear |
| Slope shape up-down | (1) Linear |
| Landforms | (1) Flat<br>(2) Dune<br>(3) Pitted outwash terrace |
| Runoff class | Negligible to very low |
| Flooding frequency | None |
| Ponding frequency | None |
| Elevation | 180–619 m |
| Slope | 0–3% |
| Ponding depth | 0 cm |
| Water table depth | 30–71 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 83 to 110 days, with the mean freeze-free period ranging from 117 to 135 days.

**Table 3. Representative climatic features**

| | |
|---|---|
| Frost-free period (characteristic range) | 83-110 days |
| Freeze-free period (characteristic range) | 117-135 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) | 128 days |
| Precipitation total (average) | 660 mm |

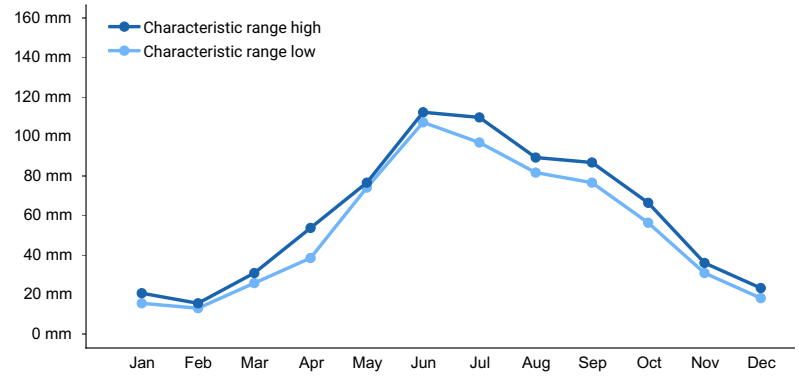



**Figure 1. Monthly precipitation range**

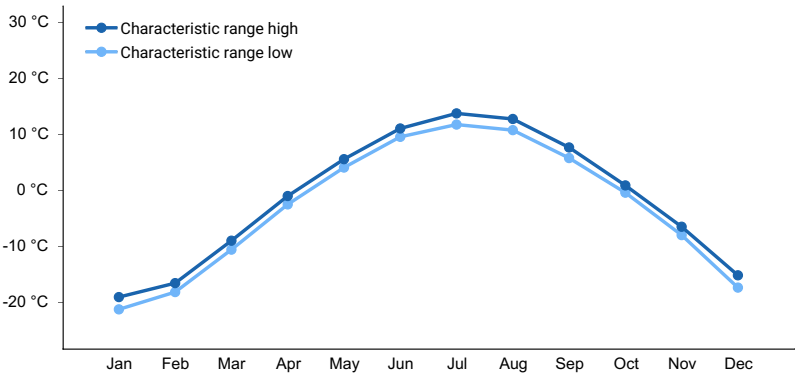



**Figure 2. Monthly minimum temperature range**

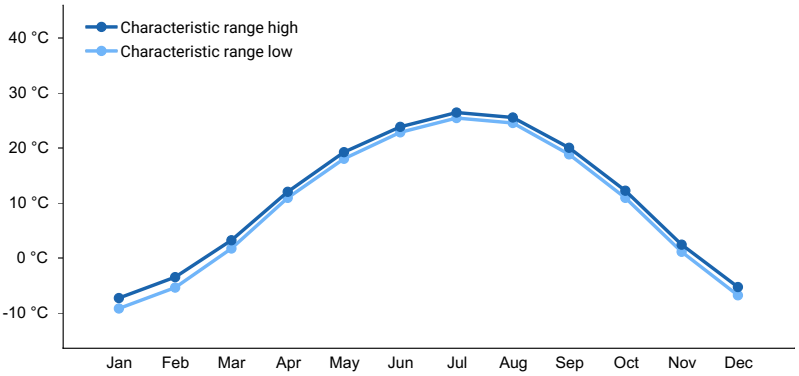



**Figure 3. Monthly maximum temperature range**

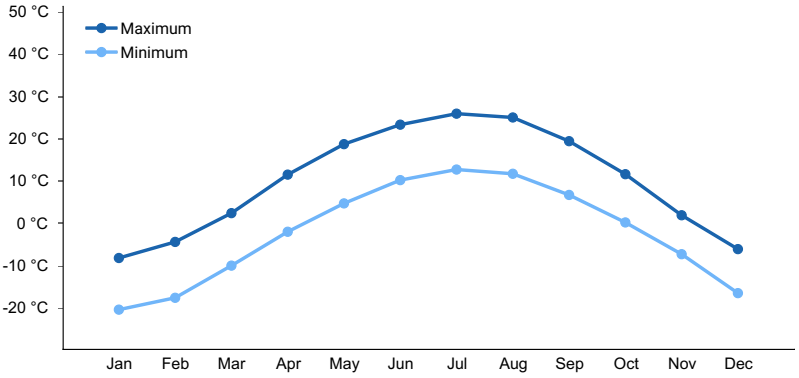



**Figure 4. Monthly average minimum and maximum temperature**

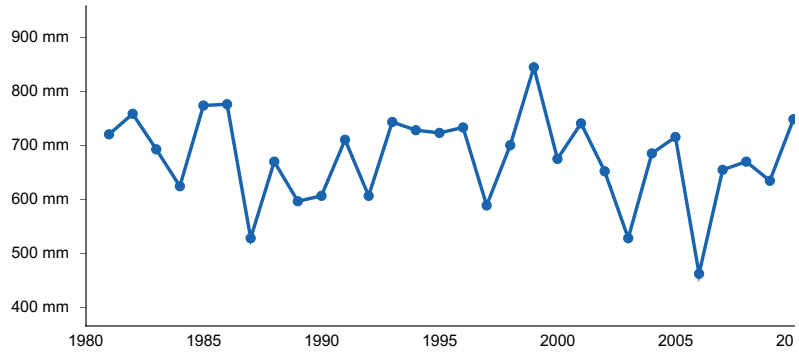



**Figure 5. Annual precipitation pattern**

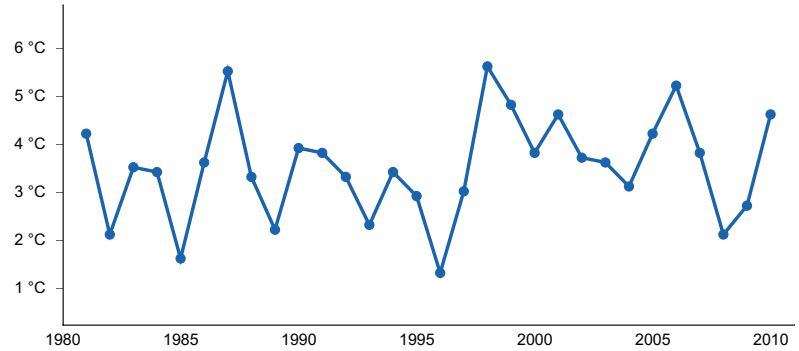



**Figure 6. Annual average temperature pattern**

## Climate stations used

- (1) INTL FALLS INTL AP [USW00014918], International Falls, MN
- (2) LITTLEFORK 10 SW [USC00214809], Big Falls, MN
- (3) BIG FALLS [USC00210746], Big Falls, MN
- (4) WASKISH 4NE [USC00218700], Big Falls, MN
- (5) BAUDETTE INTL AP [USW00094961], Baudette, MN
- (6) CAMP NORRIS DNR [USC00211250], Beltrami Isl State for, MN
- (7) WARROAD [USC00218679], Warroad, MN
- (8) EVELETH WWTP [USC00212645], Eveleth, MN
- (9) HIBBING CHISHOLM HIBBING AP [USW00094931], Hibbing, MN
- (10) FLOODWOOD 3 NE [USC00212842], Floodwood, MN
- (11) SANDY LAKE DAM LIBBY [USC00217460], McGregor, MN
- (12) GRAND RPDS FOREST LAB [USC00213303], Grand Rapids, MN
- (13) POKEGAMA DAM [USC00216612], Cohasset, MN
- (14) LEECH LAKE [USC00214652], Bena, MN

## Influencing water features

This site does not flood or pond but does have a seasonal high water table of 12 - 28 inches (30-71 centimeters).

## Soil features

Soils in this site are coarse textured, ranging from loamy find sands to very fine sandy loams. These soils developed from glaciolacustrine, outwash, and eolian sand parent material.

Soils in the Moist Sandy Mixed Forest fall within the Alfisol, Entisol, Inceptisol, and Mollisol orders. These soils can be further classified as Oxyaquic Hapludalfs, Aquic Udipsamments, Aeric Endoaquepts, and Aeric Calciaquolls. Soil series within this site include: Meehan, Redby, Barber, Cowhorn, Soderville, and Ulen.

**Table 4. Representative soil features**

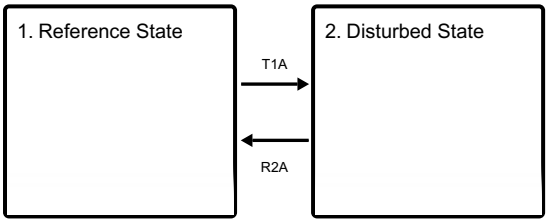
| | |
|---|---|
| Parent material | (1) Glaciolacustrine deposits<br>(2) Outwash<br>(3) Eolian sands |
| Surface texture | (1) Loamy fine sand<br>(2) Loamy sand<br>(3) Very fine sandy loam<br>(4) Fine sandy loam |
| Drainage class | Somewhat poorly drained |
| Permeability class | Rapid |
| Depth to restrictive layer | 203 cm |
| Soil depth | 203 cm |
| Surface fragment cover <=3" | 0% |
| Surface fragment cover >3" | 0% |
| Available water capacity (0-101.6cm) | 4.83–10.16 cm |
| Soil reaction (1:1 water) (0-25.4cm) | 4.5–7.3 |
| Subsurface fragment volume <=3" (0-203.2cm) | 0–2% |
| Subsurface fragment volume >3" (0-203.2cm) | 0% |

## Ecological dynamics

This site is a mixed woodland composed of jack pine, black spruce, and red pine with a mix of paper birch and quaking aspen. Historically, fire was a disturbance factor and served to promote pine regeneration.

## State and transition model

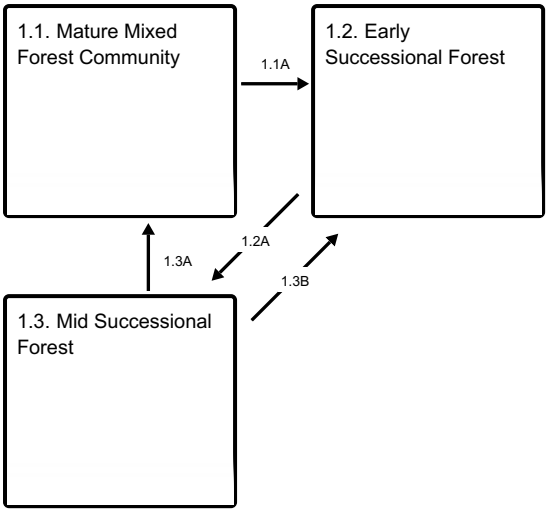
**Ecosystem states**




**T1A** - Disturbance of site

**R2A** - Management activities ; restore to the reference site

**State 1 submodel, plant communities**



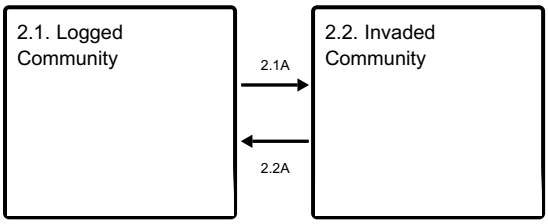

**1.1A** - Disturbances; partial canopy removal

**1.2A** - Natural succession

**1.3A** - Natural succession absent severe disturbances

**1.3B** - Site disturbance

**State 2 submodel, plant communities**




**2.1A** - Introduction of invasive plant species

**2.2A** - Non-native plant eradication

## State 1
## Reference State

The reference state is a coniferous woodland composed of pine and spruce with a mix of hardwood species such as aspen and paper birch. Canopy cover is variable and ranges from patchy to continuous. Dominant canopy species include jack pine, black spruce, red pine, and in some cases, white pine.

### Dominant plant species

- jack pine (*Pinus banksiana*), tree
- black spruce (*Picea mariana*), tree
- red pine (*Pinus resinosa*), tree
- serviceberry (*Amelanchier*), shrub
- lowbush blueberry (*Vaccinium angustifolium*), shrub
- northern bush honeysuckle (*Diervilla lonicera*), shrub
- Canada mayflower (*Maianthemum canadense*), other herbaceous
- bunchberry dogwood (*Cornus canadensis*), other herbaceous
- twinflower (*Linnaea borealis*), other herbaceous

## Community 1.1
## Mature Mixed Forest Community

This is a mature (95+ years) mixed-canopy woodland. Black spruce is dominant mixed with jack pine, paper birch, white pine, and balsam fir. (MN DNR, 2005).

**Dominant plant species**

- jack pine (*Pinus banksiana*), tree
- paper birch (*Betula papyrifera var. papyrifera*), tree
- eastern white pine (*Pinus strobus*), tree
- balsam fir (*Abies balsamea var. balsamea*), tree

### Community 1.2
### Early Successional Forest

This community (0-55 years) is characterized by a young woodland dominated by jack pine. Hardwoods, such as quaking aspen and paper birch, are common. (MN DNR, 2005).

**Dominant plant species**

- jack pine (*Pinus banksiana*), tree
- quaking aspen (*Populus tremuloides*), tree
- paper birch (*Betula papyrifera*), tree

### Community 1.3
### Mid Successional Forest

This mixed canopy transitional community (55-95 years) is noted for an increase in red pine and paper birch and a decline in jack pine and quaking aspen. (MN DNR, 2005)

**Dominant plant species**

- red pine (*Pinus resinosa*), tree
- paper birch (*Betula papyrifera var. papyrifera*), tree

### Pathway 1.1A
### Community 1.1 to 1.2

Disturbance from fire, windthrow, or other factors that removes the canopy layer.

### Pathway 1.2A
### Community 1.2 to 1.3

Time and natural succession will transition the 1.2 community to the 1.3 community in the absence of any large disturbances.

### Pathway 1.3A
### Community 1.3 to 1.1

In the absence of large disturbances, time and natural succession will transition the community to a mature woodland.

### Pathway 1.3B
### Community 1.3 to 1.2

A large disturbance will transition the community back to an earlier successional stage.

### State 2
### Disturbed State

This is a woodland state characterized by anthropogenic disturbances such as logging. Human activities are often a conduit for the introduction and spread of invasive species. The type, severity, and duration of the disturbance will perpetuate variability in the early successional plant community. Seed sources and management activities will also

influence plant regeneration. Future field study is needed to develop a more detailed and diagnostic list of plant species for this state.

**Dominant plant species**

- quaking aspen (*Populus tremuloides*), tree
- paper birch (*Betula papyrifera*), tree
- jack pine (*Pinus banksiana*), tree
- serviceberry (*Amelanchier*), shrub

### Community 2.1
### Logged Community

Removal of canopy trees for timber harvest results a highly disturbed understory. Shrubs often initially dominate post-logging. The type and severity of disturbance, available seed sources, and any associated management inputs will determine the plant community on site.

**Dominant plant species**

- serviceberry (*Amelanchier*), shrub

### Community 2.2
### Invaded Community

This community is characterized by the presence of non-native plant species. Numerous tree, shrub and ground layer invasive species are possible. Human activities (logging, development, recreation) can introduce seeds to a site. Without management intervention, these species can alter the natural composition of the plant community.

**Dominant plant species**

- common buckthorn (*Rhamnus cathartica*), shrub
- Canada thistle (*Cirsium arvense*), other herbaceous

### Pathway 2.1A
### Community 2.1 to 2.2

Activities such as logging may introduce invasive plant species.

### Pathway 2.2A
### Community 2.2 to 2.1

Management inputs to successfully eradicate invasive plants on site.

### Transition T1A
### State 1 to 2

Disturbance of site through anthropogenic activities such as road building, dam construction, and logging.

### Restoration pathway R2A
### State 2 to 1

Restoration of each site will require a plan unique to the current site conditions. Timber stand improvement activities and/or invasive species eradication may be needed.

### Additional community tables

### Inventory data references

This is a provisional ecological site, and as such no field plots were inventoried for this project. A review of the

scientific literature and expert opinion was used to develop the plant communities and ecological dynamics contained within the state and transition model. Future field verification is needed to refine the plant communities and ecological dynamics described in this ecological site description.

## 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 | 12/04/2024 |

| | |
|---|---|
| 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:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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

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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:**

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