USDA Natural Resources Conservation Service

# Ecological site F088XY012MN
# Very Dry Sandy Upland Coniferous Forest

Last updated: 8/12/2024
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): 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 very dry jack pine-red pine woodland and located on dunes, beach ridges, and outwash plains. Soils are course textured, well drained to excessively drained, and have a low available water capacity. The greater depth to water table differentiates this site from the Dry Sandy Upland Forest. Historically, fire was a common disturbance that influenced plant community composition.

## Associated sites

| | |
|---|---|
| F088XY012MN | **Very 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. The depth to water table is shallower in the Dry Sandy Upland Coniferous Forest. |

## Similar sites

| | |
|---|---|
| F088XY012MN | **Very 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. The depth to water table is shallower in the Dry Sandy Upland Coniferous Forest. |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | (1) *Pinus banksiana*<br>(2) *Pinus resinosa* |

| | |
|---|---|
| Shrub | (1) *Vaccinium angustifolium*<br>(2) *Amelanchier* |
| Herbaceous | (1) *Maianthemum canadense*<br>(2) *Pteridium aquilinum* |

## Physiographic features

This upland site is located on dunes, beach ridges, and outwash plains. No flooding or ponding occurs. The available water capacity ranges from 2-4.5 inches (5 - 11 centimeters) and the vegetation consists of tree species tolerant of dry soil conditions.

**Table 2. Representative physiographic features**

| | |
|---|---|
| Slope shape across | (1) Convex |
| Slope shape up-down | (1) Linear |
| Landforms | (1) Dune<br>(2) Beach ridge<br>(3) Outwash plain |
| Runoff class | Negligible to low |
| Flooding frequency | None |
| Ponding frequency | None |
| Elevation | 590–2,030 ft |
| Slope | 1–8% |
| Ponding depth | 0 in |
| Water table depth | 80 in |
| 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) | 25-28 in |
| Frost-free period (actual range) | 75-112 days |
| Freeze-free period (actual range) | 114-141 days |
| Precipitation total (actual range) | 24-28 in |
| Frost-free period (average) | 96 days |
| Freeze-free period (average) | 128 days |
| Precipitation total (average) | 26 in |

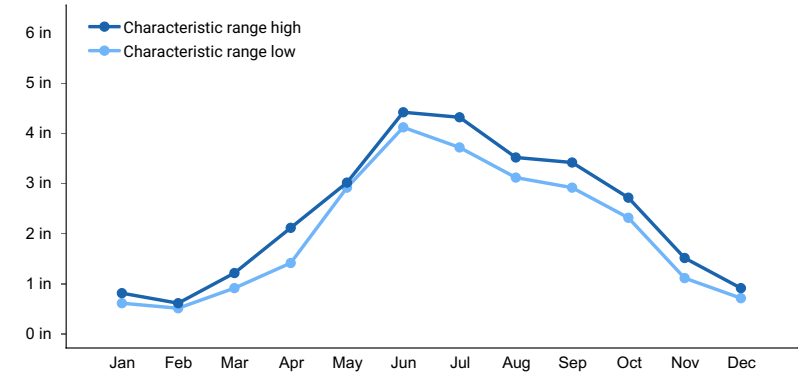



**Figure 1. Monthly precipitation range**

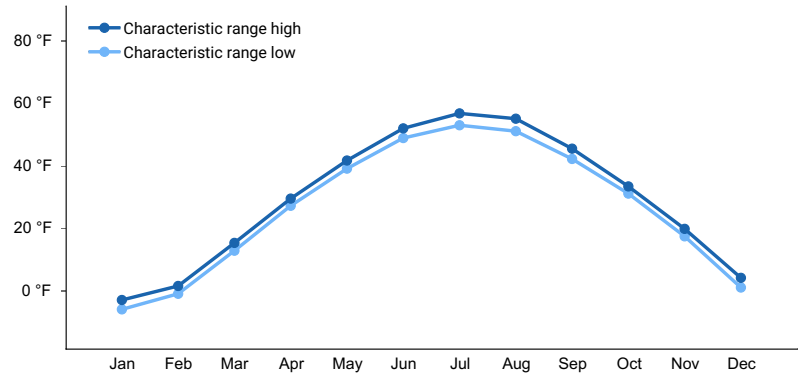



**Figure 2. Monthly minimum temperature range**

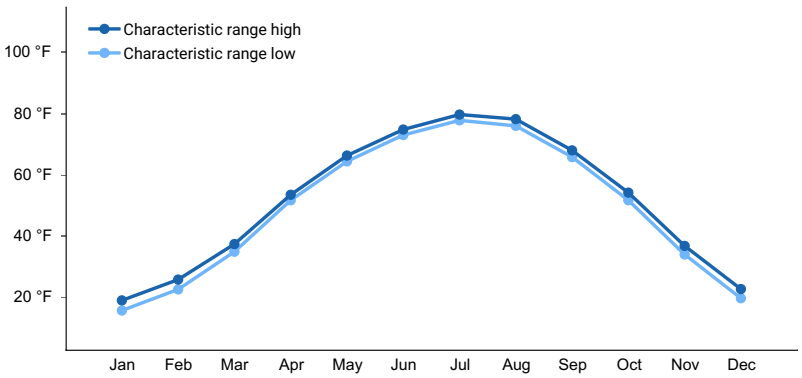



**Figure 3. Monthly maximum temperature range**

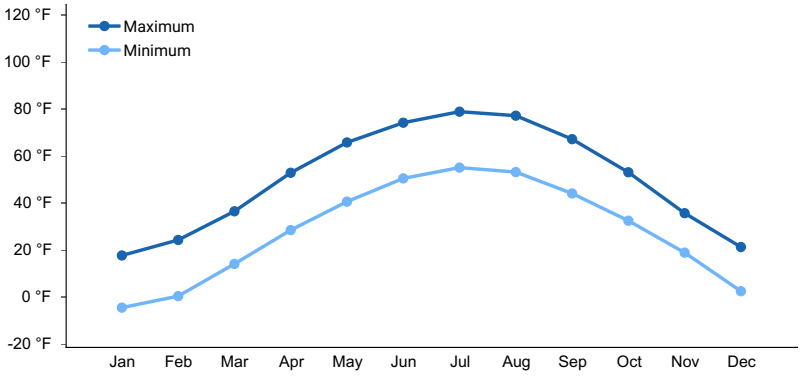



**Figure 4. Monthly average minimum and maximum temperature**

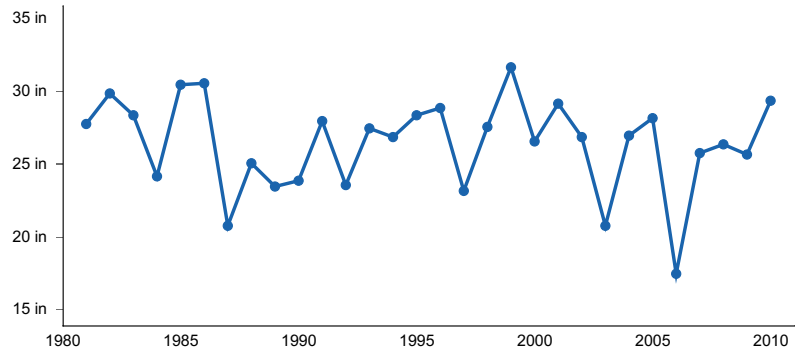



**Figure 5. Annual precipitation pattern**

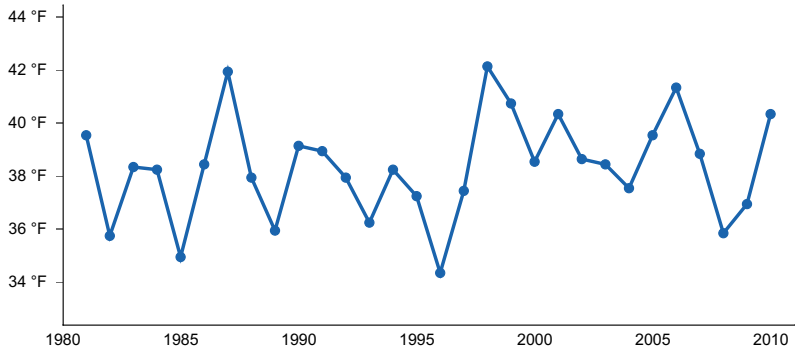



**Figure 6. Annual average temperature pattern**

## 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) RED LAKE INDIAN AGCY [USC00216795], Ponemah, MN
- (6) BAUDETTE INTL AP [USW00094961], Baudette, 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

## Influencing water features

This site is not influenced by riparian and wetland features. There is no water table present within 80 inches of the soil surface.

## Soil features

Soil parent materials include eolian sands and glaciofluvial deposits. Soils are somewhat excessively drained to excessively drained and very deep, with no water table occurring within 80 inches of the soil surface. The soil available water capacity is low and results in plant species that are highly tolerant of dry conditions.

Soils in the Very Dry Sandy Upland Coniferous Forest fall within the Alfisol and Entisol orders. These soils can be further classified as Inceptic Hapludalfs, Psammentic Hapludalfs, Lamellic Udipsamments, and Typic Udipsamments. Soil series within this ecological site include Zimmerman, Marquette, Graycalm, Sugarbush, Faunce, Menahga, Sartell, and Two Inlets.

**Table 4. Representative soil features**

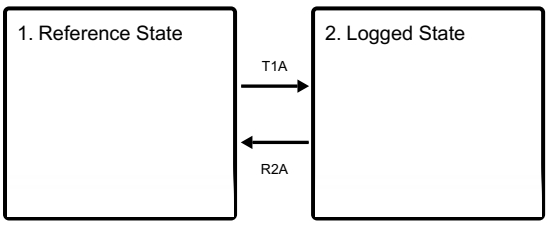
| | |
|---|---|
| Parent material | (1) Eolian sands<br>(2) Glaciofluvial deposits |
| Surface texture | (1) Loamy fine sand<br>(2) Loamy sand<br>(3) Loamy very fine sand<br>(4) Sand<br>(5) Fine sand<br>(6) Sandy loam |
| Drainage class | Somewhat excessively drained to excessively drained |
| Permeability class | Rapid |
| Depth to restrictive layer | 80 in |
| Soil depth | 80 in |
| Surface fragment cover <=3" | 0% |
| Surface fragment cover >3" | 0% |
| Available water capacity (0-40in) | 2.1–4.4 in |
| Soil reaction (1:1 water) (0-10in) | 5.1–7.3 |
| Subsurface fragment volume <=3" (0-80in) | 0–13% |
| Subsurface fragment volume >3" (0-80in) | 0–1% |

## Ecological dynamics

This site is a very dry jack pine-birch woodland. Fire was a historical disturbance that influenced plant species composition. Young woodlands post-fire are dominated by jack pine and paper birch. Mature woodlands are pine dominated with an understory variability dependent upon the fire regime. (MN DNR, 2005)

## State and transition model

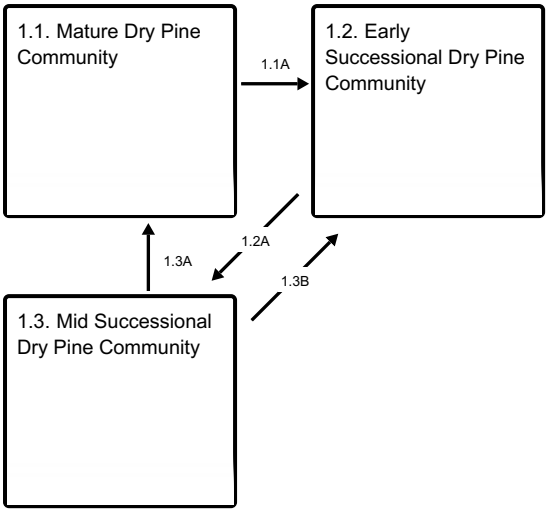
**Ecosystem states**




**T1A** - Site is logged

**R2A** - Restoration inputs; forest stand management

**State 1 submodel, plant communities**



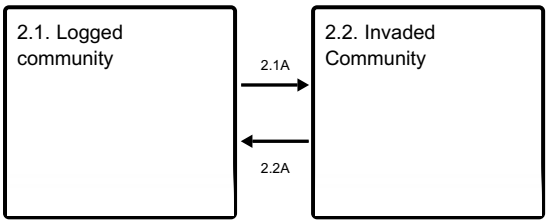

**1.1A** - Severe Disturbance

**1.2A** - Absence of disturbance (55-75 Years)

**1.3A** - No severe disturbance > 75 Years

**1.3B** - Severe site disturbance

**State 2 submodel, plant communities**




**2.1A** - Invasive species established

**2.2A** - Eradication of invasive species

## State 1
## Reference State

This is a dry jack pine - red pine woodland on course textured soils. Sites occur on undulating sandy outwash plains, lake plains, and moraines. Historically, the site was influenced by fire events which occurred approximately every 40-50 years. (MN DNR, 2005).

### Dominant plant species

- jack pine (*Pinus banksiana*), tree
- red pine (*Pinus resinosa*), tree
- eastern white pine (*Pinus strobus*), tree
- white spruce (*Picea glauca*), tree
- paper birch (*Betula papyrifera*), tree
- quaking aspen (*Populus tremuloides*), tree
- lowbush blueberry (*Vaccinium angustifolium*), shrub
- serviceberry (*Amelanchier*), shrub
- roughleaf ricegrass (*Oryzopsis asperifolia*), grass
- Canada mayflower (*Maianthemum canadense*), grass

## Community 1.1
## Mature Dry Pine Community

This community is characterized by a lack of severe disturbance for over 75 years. The plant community

composition is dominated by red pine. Jack pine, white pine, white spruce, and paper birch are also present. (MN DNR, 2005)

**Dominant plant species**

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

### Community 1.2
### Early Successional Dry Pine Community

This young woodland community is 0-55 years of age and generally dominated by jack pine. Red pine, quaking aspen, paper birch, and white pine are also on site. (MN DNR, 2005)

**Dominant plant species**

- jack pine (*Pinus banksiana*), tree
- red pine (*Pinus resinosa*), tree
- quaking aspen (*Populus tremuloides*), tree
- paper birch (*Betula papyrifera var. papyrifera*), tree
- eastern white pine (*Pinus strobus*), tree

### Community 1.3
### Mid Successional Dry Pine Community

The mid successional woodland stage (55-75 years of age) is characterized by a decline in jack pine and an increase in red pine and white pine. (MN DNR, 2005)

**Dominant plant species**

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

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

A severe disturbance, such as a catastrophic fire, will transition the reference community to an early successional community.

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

Time and natural plant community growth will transition the site to community 1.3.

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

Time and natural plant community succession will transition the community to a mature, established wood over 75 years of age.

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

A severe disturbance, such as a major fire event, will transition the community back to an earlier successional stage.

## State 2
## Logged State

Removal of canopy species for timber harvest creates an open canopy and a highly disturbed understory. Shrubs will dominate post logging. A very dense shrub layer can impede tree regeneration. Heavy machinery are a common seed source for non-native species

**Dominant plant species**

- serviceberry (*Amelanchier*), shrub
- prickly rose (*Rosa acicularis*), shrub
- smooth rose (*Rosa blanda*), shrub
- beaked hazelnut (*Corylus cornuta*), shrub
- prairie willow (*Salix humilis*), shrub
- blueberry (*Vaccinium*), shrub
- poverty oatgrass (*Danthonia spicata*), grass
- ricegrass (*Oryzopsis*), grass

## Community 2.1
## Logged community

With the canopy removed, the initial post-logging community will be dominated by shrubs.

**Dominant plant species**

- beaked hazelnut (*Corylus cornuta*), shrub
- serviceberry (*Amelanchier*), shrub
- blueberry (*Vaccinium*), shrub
- prairie willow (*Salix humilis*), shrub
- poverty oatgrass (*Danthonia spicata*), grass
- ricegrass (*Oryzopsis*), grass

## Community 2.2
## Invaded Community

This community is identified by the presence of non-native plant species. Heavy machinery and soil disturbance provide an opportunity for invasives to become established. The invasive species on site will depend on the seed source.

**Dominant plant species**

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

## Pathway 2.1A
## Community 2.1 to 2.2

Invasive species are introduced to the site and become established.

## Pathway 2.2A
## Community 2.2 to 2.1

Management inputs will be required to eradicate non-native plant species.

## Transition T1A
## State 1 to 2

This transition represents the removal of canopy species and severe understory disturbance.

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

Restoration inputs, such as timber stand management activities, can transition the Logged State back to State 1.

## 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 | 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):**

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:**