USDA Natural Resources Conservation Service

Ecological site F088XY009MN
Floodplain Terrace 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).

Classification relationships

Relationship to Established Framework and Classification Systems:

Habitat Types of N. Wisconsin (Kotar, 2002): Acer-Tsuga/Dryopteris-Hydrophyllum (ATDH), Acer-Tsuga/Athyrium-Onoclea (ATAtOn)

Biophysical Settings (Landfire, 2014): Laurentian-Acadian Floodplain Forest, Laurentian-Acadian Alkaline Conifer-Hardwood Swamp

Hierarchical Framework Relationships:

MLRA 88- Northern Minnesota Glacial Lake
Basins(USDA Agricultural Handbook 296, 2022)

USFS / MN DNR Sub-regions: 212Mb Agassiz Lowlands, 212Ma Littlefork Vermillion, 212nd Tamarack Lowlands , and 212Nb St Luis Moraines (Cleland et al, 2007)

Ecological site concept

The Floodplain Terrace Forest ecological site accounts for approximately 13,000 acres in MLRA 88. Sites are located on floodplain terraces throughout the MLRA. These sites are characterized by very deep, somewhat poorly drained soils that form in sandy to loamy alluvium. Sites are subject to flooding in spring and fall. Soils remain saturated for long duration during growing season and some sites meet hydric soil requirements. Stream inflow, precipitation, runoff from adjacent uplands, and groundwater discharge are the primary sources of water. Soils range from slightly acid to neutral. Vegetation supported by these sites must be tolerant of frequent floods. Damage

to vegetation may also occur due to winter ice jams evident by scaring on trees.

Associated 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.
F088XY008MN	**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.

Similar sites

F088XY006MN	**Floodplain Forest Wet** These sites are present on occasionally or annually flooded sites on flats and floodplains of streams and rivers. Soils consist of stratified alluvium which vary widely from silty clay to fine sandy loam soils on the occasionally flooded river terraces to coarser textured alluvium on the active floodplain sites.

Table 1. Dominant plant species

Tree	(1) *Acer saccharum* (2) *Acer rubrum*
Shrub	Not specified
Herbaceous	(1) *Onoclea sensibilis* (2) *Maianthemum canadense*

Physiographic features

Floodplain Terrace Forest sites occur primarily on gently sloping stream terrace landforms, but also occurs on flood plains, rises, and flats. These sites are prone to occasional, brief to long-duration flooding, and commonly have a water table within 30 inches of the soil surface.

Table 2. Representative physiographic features

Slope shape across	(1) Linear
Slope shape up-down	(1) Linear
Landforms	(1) Stream terrace (2) Flood plain (3) Rise (4) Flat
Runoff class	Negligible to high
Flooding duration	Brief (2 to 7 days) to long (7 to 30 days)
Flooding frequency	Rare to frequent
Ponding frequency	None
Elevation	299–491 m
Slope	0–3%
Ponding depth	0 cm
Water table depth	30–76 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 109 days, with the mean freeze-free period ranging from 116 to 136 days.

Table 3. Representative climatic features

Frost-free period (characteristic range)	82-109 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)	95 days
Freeze-free period (average)	128 days
Precipitation total (average)	660 mm

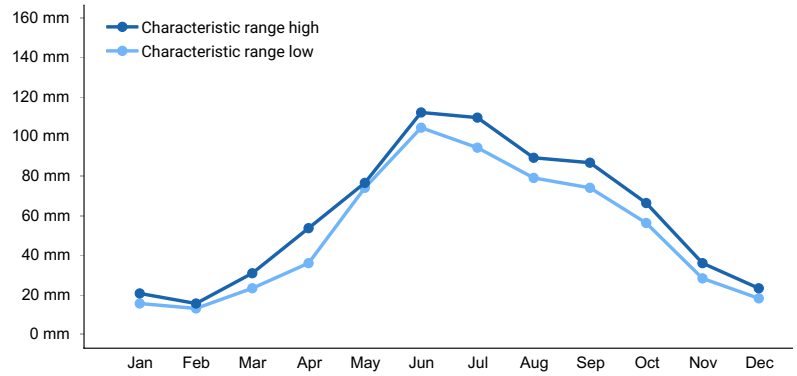


Figure 1. Monthly precipitation range

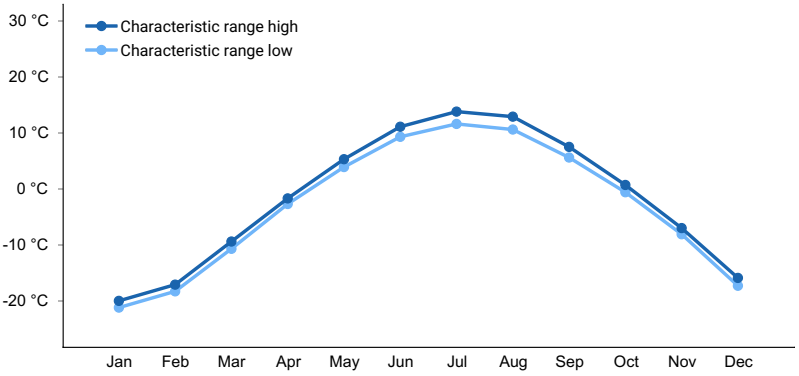


Figure 2. Monthly minimum temperature range

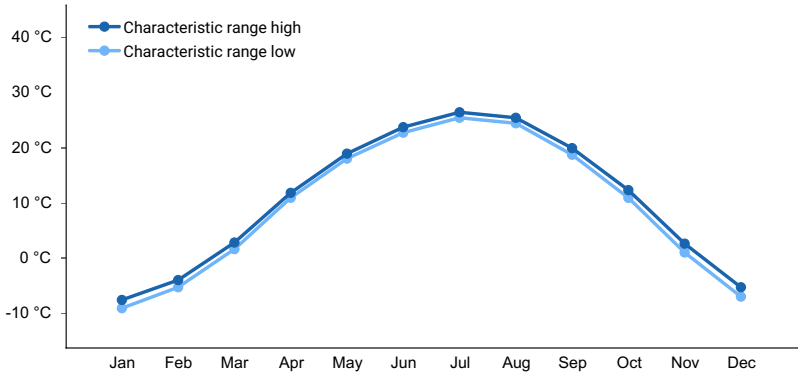


Figure 3. Monthly maximum temperature range

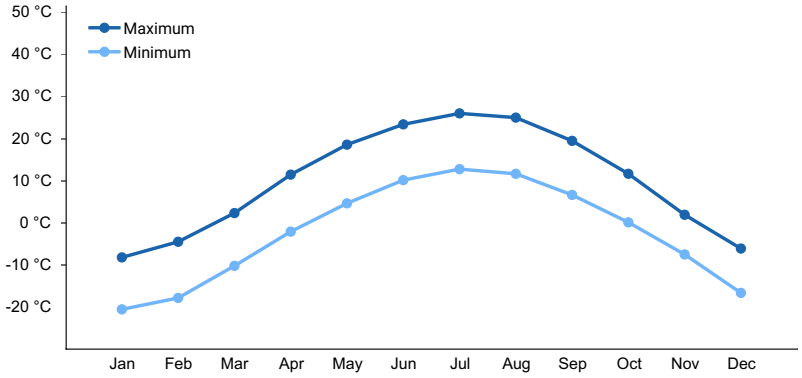


Figure 4. Monthly average minimum and maximum temperature

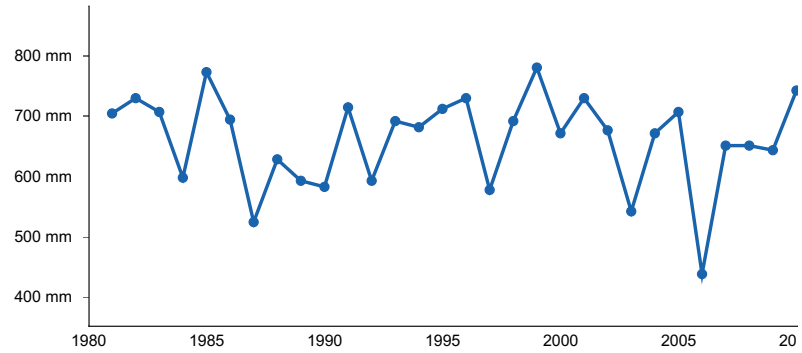


Figure 5. Annual precipitation pattern

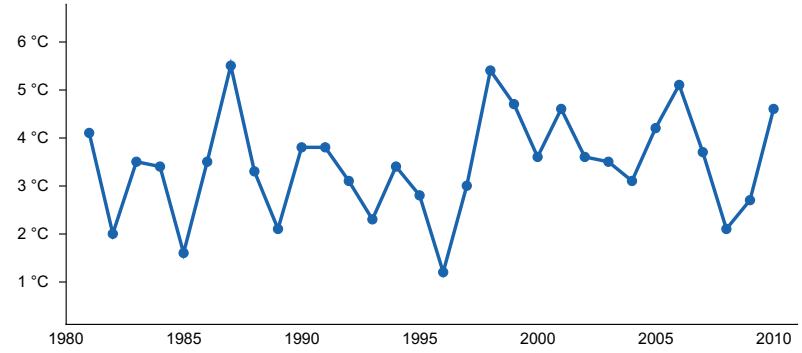


Figure 6. Annual average temperature pattern

Climate stations used

- (1) WARROAD [USC00218679], Warroad, MN
- (2) BAUDETTE INTL AP [USW00094961], Baudette, MN
- (3) RED LAKE INDIAN AGCY [USC00216795], Ponemah, MN

- (4) WASKISH 4NE [USC00218700], Big Falls, MN
- (5) BIG FALLS [USC00210746], Big Falls, MN
- (6) LITTLEFORK 10 SW [USC00214809], Big Falls, MN
- (7) INTL FALLS INTL AP [USW00014918], International Falls, MN
- (8) POKEGAMA DAM [USC00216612], Cohasset, MN
- (9) SANDY LAKE DAM LIBBY [USC00217460], McGregor, MN
- (10) FLOODWOOD 3 NE [USC00212842], Floodwood, MN
- (11) HIBBING CHISHOLM HIBBING AP [USW00094931], Hibbing, MN
- (12) EVELETH WWTP [USC00212645], Eveleth, MN

Influencing water features

This site is subject to occasional flooding and a relatively high water table. Soils are also somewhat poorly drained.

Soil features

Soils in this site range in texture from loamy fine sands to clay loams over alluvium and till parent materials. Soils are deep, somewhat poorly drained, and generally free of sub-surface fragments.

Soils in the Floodplain Terrace Forest fall within the Alfisol, Entisol, and Mollisol orders. These soils can be further classified as Aquic Hapludolfs, Oxyaquic Glossudalfs, Aquic Udifluvents, Aquic Udipsamments, and Hapludolls. Soil series within the Floodplain Terrace Forest include Lindford, Littlefork, Winterfield, and Wega.

Table 4. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Loamy fine sand (2) Silt loam (3) Silty clay loam (4) Clay loam
Drainage class	Somewhat poorly drained
Permeability class	Moderately slow to rapid
Depth to restrictive layer	0 cm
Soil depth	152–203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	10.41–20.57 cm
Soil reaction (1:1 water) (0-25.4cm)	5.6–7.8
Subsurface fragment volume <=3" (0-203.2cm)	0%
Subsurface fragment volume >3" (0-203.2cm)	0%

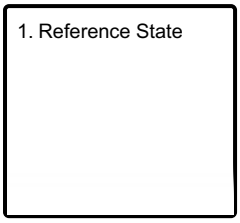
Ecological dynamics

Because floodplain sites are subject to seasonal, yearly and long-term variation in hydrological conditions, it is not possible to speak of any directional, community-driven plant succession, as is typical of more environmentally-stable upland plant communities. Instead, individual hydrologic events create conditions temporarily favorable to a given species, or groups of species, and unfavorable to other species or groups. Species differ greatly in their ability to tolerate frequency of flooding. Silver maple (*Acer saccharinum*) is best adapted species to colonize freshly deposited sediment. It is a prolific seed producer and germinates immediately upon maturing, without the need of undergoing a cold period. Once established, seedlings, as well as mature trees, tolerate repeated flooding and prolonged ponding. Black ash (*Fraxinus nigra*) is well adapted to growing in saturated conditions, allowing it to grow

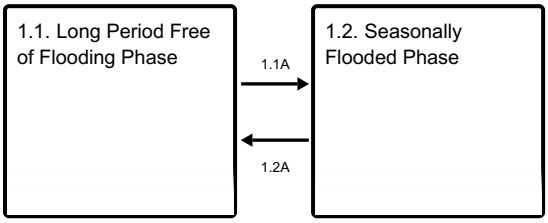
commonly in seasonally flooded habitats. Other species that may become established in periods without major flooding include sugar maple (*Acer saccharum*) red maple (*Acer rubrum*), Balsam fir (Abies, balsamia), white oak (*Quercus alba*), swamp white oak (*Q. bicolor*), and white ash (*Fraxinus americana*).

State and transition model

Ecosystem states



State 1 submodel, plant communities



1.1A - Major flooding event depositing new sediment.

1.2A - Long period without major flooding.

State 1
Reference State

Because of the dynamic nature of hydrological events affecting this Ecological Site, many different plant communities can be found at any given time. We chose two distinct community phases to represent the Reference state: 1, a long period free of extended flooding community phase and 2, frequently flooded community phase.

Dominant plant species

- sugar maple (*Acer saccharum*), tree
- red maple (*Acer rubrum*), tree
- balsam fir (*Abies balsamea*), tree
- white oak (*Quercus alba*), tree
- swamp white oak (*Quercus bicolor*), tree
- white ash (*Fraxinus americana*), tree
- American basswood (*Tilia americana*), tree
- sensitive fern (*Onoclea sensibilis*), other herbaceous
- Canada mayflower (*Maianthemum canadense*), other herbaceous
- early meadow-rue (*Thalictrum dioicum*), other herbaceous
- bedstraw (*Galium*), other herbaceous

Community 1.1
Long Period Free of Flooding Phase

Periods of several decades, or longer, without prolonged flooding allow for the development of forest communities closely resembling the upland mesic or wet-mesic communities. Such forests are characterized by strong presence, or dominance of any of the following species: white and swamp white oak, white ash, and other mesic hardwoods like red and sugar maple (*Acer saccharum*), and basswood (TIlia americana). Some of these mesic hardwoods are sensitive to saturated soils and are quickly eliminated by extended major flooding events. Characteristic understory plants Sensitive fern (*Onoclea sensibilis*), Canada mayflower (Mainathemum canadense), bedstraws (Gallium, spp.), and meadow rue (*Thalictrum dioicum*). Small scale canopy disturbances may occur, e.g., snow/ice breakage and individual tree mortality, increase light on forest floor and stimulate regeneration of canopy species. Through

this process the relative importance of different species varies, but the basic mesic community is perpetuated.

Resilience management. The long period free of flooding phase is driven by lack of flooding for decades or longer.

Dominant plant species

- sugar maple (*Acer saccharum*), tree
- red maple (*Acer rubrum*), tree
- balsam fir (*Abies balsamea*), tree
- white oak (*Quercus alba*), tree
- swamp white oak (*Quercus bicolor*), tree
- white ash (*Fraxinus americana*), tree
- American basswood (*Tilia americana*), tree
- sensitive fern (*Onoclea*), other herbaceous
- Canada mayflower (*Maianthemum canadense*), other herbaceous
- early meadow-rue (*Thalictrum dioicum*), other herbaceous
- bedstraw (*Galium*), other herbaceous
- riverbank grape (*Vitis riparia*), other herbaceous

Community 1.2
Seasonally Flooded Phase

Silver maple is a well-adapted species to frequently flooded conditions. On such sites it typically occurs in pure stands, or with only sporadic association of other species that become established on micro-sites with less frequent, or shorter duration ponding. Such associates are black ash, red maple, swamp white oak, elms (Ulmus spp.) and occasionally yellow birch. Understory vegetation is sparse, consisting mostly of grasses, sedges, and ferns. Seasonal flooding with fresh sediment deposition may occur.

Resilience management. The seasonally flooded phase is driven by frequently flooded conditions.

Dominant plant species

- silver maple (*Acer saccharinum*), tree
- sedge (*Carex*), grass
- sensitive fern (*Onoclea*), other herbaceous

Pathway 1.1A
Community 1.1 to 1.2

Major flooding event deposits new sediment that causes mortality of some of the canopy trees and provides germination and seedling establishment conditions for some species, most frequently silver maple.

Pathway 1.2A
Community 1.2 to 1.1

Long periods, usually decades, without major flooding. Woody encroachment from less water tolerant species allows for the development of forest communities closely resembling the upland mesic or wet-mesic communities.

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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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:**
