Ecological site F094BY005MI
Wet Loamy Lowland

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Accessed: 05/13/2025

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): 094B–Michigan Eastern Upper Peninsula Sandy Glacial Deposits

he Michigan Eastern Upper Peninsula MLRA (94B) corresponds closely with the Northwestern Sands Ecological Landscape. Some of the following brief overview is borrowed from the Wisconsin Department of Natural Resources ecological landscape publication (2015).

The Michigan Eastern Upper Peninsula MLRA is in northeast Wisconsin on the border of the Upper Peninsula of Michigan, with a very small portion on the Lake Michigan coast disjoined from the rest of the MLRA. The Wisconsin portion of the MLRA is a bit shy of 1.1 million acres (1,668 square miles). This region, which was covered entirely by the Green Bay Lobe in Wisconsin's most recent glaciation, has a unique glacial landscape defined by intermingled loamy moraines and sandy heads-of-outwash. Extensive pitted outwash plains dominate the region, with significant glaciolacustrine sediments in the southeast portion of this region.

A prominent landform in this MLRA is the hummocky ridges of intermingled loamy moraines and sandy heads-of-outwash that protrude from extensive pitted outwash plains. These north-south trending, loamy morainal ridges were deposited as the Green Bay Lobe was stagnant—the rate of melting was relatively equal to the rate of advancement. This stagnation allowed the deposition of a ridge of sandy loam materials. Supraglacial till was deposited unevenly, and buried ice blocks melted and collapsed the surface to form hummocky topography on the moraines. The heads-of-outwash formed while the ice was melting and thinning rapidly. Large amounts of sand and gravel outwash materials, and some till and loamy debris-flow sediment, were deposited on top of the thin edge of ice. They, too, have hummocky topography resulting from the collapse of buried ice. The topographically similar appearances of the moraines and heads-of-outwash make them difficult to distinguish superficially, but they are formed in different-textured materials and the vegetation divergence is often evident. These moraines and heads-of-outwash mark the western extent of the Green Bay Lobe and are sometimes referred to as the Athelstane Moraines.

As the Green Bay Lobe receded, meltwaters carried sand and gravel outwash sediments to lower-lying areas. The outwash buried broken ice that melted, collapsed the surface, and created extensive pitted outwash plains that occur between the high elevation moraines and heads-of-outwash. More than 50% of this land region is covered in outwash sediments, and most of the outwash is pitted or collapsed.

The southeast portions of this MLRA are dominated by glacial lake sediments. Glacial Lake Oshkosh covered a portion of this MLRA when it was at its largest extent (1.4 million acres). The lake deposited silts and clays along the southeast portion of the inland section of this MLRA. Beach terraces, ridges, and dunes were also formed by the lake. In the Lake Michigan coastal section of this MLRA, Glacial Lake Nipissing deposited a level lake plain full of sandy lacustrine material that overlies dolomite and limestone bedrock. Glacial Lake Nipissing was a postglacial lake that occurred in the Lake Michigan Basin as the Lake Michigan Lobe was receding. Wetlands are abundant in this area of the MLRA. In the north section, Glacial Lake Dunbar formed when ice dams impounded glacial meltwater between the Athelstane Moraine and the Inner Athelstane Moraine. This glacial lake deposited small areas of level sandy lacustrine materials.

The northeast section of this MLRA is a till plain that formed in later advances of the Green Bay Lobe. Some pitted outwash is present, but the till plain is much more exposed here than elsewhere in the MLRA. The till deposited throughout 94B is primarily sandy, dolomitic till. The dolomite was scraped off the Niagara Escarpment as the Green Bay Lobe moved across it. In some areas, the carbonates are deeply leached.

Historically, this MLRA was dominated by a mixture of northern hardwood forests, Jack pine-scrub oak barrens, and forested coniferous wetlands at 30%, 29%, and 20%, respectively. White pine (*Pinus strobus*) and red pine (Pinus resinosa) were dominant tree species and covered an estimated 15% of the area. Northern hardwood forests were dominated by eastern white pine, eastern hemlock (Tsuga canadensis), and American beech (Fagus grandifolia). The Jack pine-scrub oak barrens were dominant in the sandy portions of this MLRA. Forested coniferous wetlands were occupied by norther white-cedar (Thuja occidentalis), black spruce (Picea mariana), and tamarack (Larix laricina).

Classification relationships

Relationship to Established Framework and Classification Systems:

Habitat Types of N. Wisconsin (Kotar, 2002): Acer-Abies/Vaccinium-Coptis (ArAbVC), Tsuga/Maianthemum-Coptis (TMC), Acer/Hydrophyllum-Impatiens (AHI)

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

WDNR Natural Communities (WDNR, 2015): Northern Wet-Mesic Forest

Hierarchical Framework Relationships:

Major Land Resource Area (MLRA): Michigan Eastern Upper Peninsula MLRA (94B)
USFS Subregions: Athelstane Sandy Outwash and Moraines (212Tc)

Wisconsin DNR Ecological Landscapes: Northeast Sands

Ecological site concept

The Wet Loamy Lowland ecological site accounts for approximately 4,000 acres in MLRA 94B, or about 0.4% of total land area. It is the least extensive site in MLRA 94B. It is found in depressions and drainageways primarily on moraines, especially the Mountain, Athelstane, and Homestead Moraines along the western border of MLRA 94B. It can also be found in lake plains and loamy outwash plains.

This site is characterized by very deep, very poorly to poorly drained, loamy soils. Sites are subject to ponding in the spring and fall. Soils remain saturated for long periods during the growing season and meet hydric soil requirements. Precipitation, runoff from adjacent uplands, groundwater discharge, and stream inflow are the primary sources of water.

Associated sites

F094BY007MI	**Moist Loamy Lowland** Moist Loamy Lowland are found in lower landscape positions on moraines, lake plains, or outwash plains. They are somewhat poorly drained. They are found in higher, drier positions along the same drainage sequence as Wet Loamy Lowland.
F094BY009MI	**Loamy Upland** Loamy Upland are found in upland landscape positions on moraines, lake plains, and outwash plains. They are moderately well to somewhat excessively drained. They are found in higher, drier positions along the same drainage sequence as Wet Loamy Lowland.
F094BY010MI	**Clayey Upland** Clayey Upland are found in upland landscape positions on moraines, drumlins, and lake plains. They are moderately well to well drained. They are found in higher, drier positions along the same drainage sequence as Wet Loamy Lowland.

Similar sites

F094BY006MI	**Moist Sandy Lowland** Wet Sandy Lowland are wetland sites that occupy landscape depressions in sandy landscapes, often sandy pitted outwash plains. They are poorly drained. They are very similar to Wet Loamy Lowland except they have coarser textures and a lower nutrient status.
F094BY003MI	**Floodplain** These sites are found on floodplains adjacent to streams and rivers. They form in sandy to loamy alluvium deposits. They are seasonally flooded with flooding durations lasting up to a month. They are poorly to moderately well drained. They sometimes support vegetative communities similar to those supported by Wet Loamy Lowland.

Table 1. Dominant plant species

Tree	(1) *Acer rubrum* (2) *Abies balsamea*
Shrub	(1) *Alnus incana* (2) *Corylus cornuta*
Herbaceous	(1) *Osmunda claytoniana*

Physiographic features

This site is found on depressions and drainageway on moraines, lake plains, and outwash plains. It is most common on the morainal ridges found along the western border of this MLRA. Slopes range from 0 to 2 percent.

This site is subject to occasional to frequent ponding. Ponding duration may be brief (2 to 7 days) to very long (greater than 30 days). The soils have evidence of a seasonally-high water table at the surface, though the water table may drop in dry conditions. Some sites, especially those that formed in clayey glacial lake deposits, have a perched water table (episaturation). Runoff potential is low.

Table 2. Representative physiographic features

Hillslope profile	(1) Toeslope
Slope shape across	(1) Concave
Slope shape up-down	(1) Linear
Landforms	(1) Depression (2) Drainageway (3) Moraine (4) Lake plain (5) Outwash plain
Runoff class	Low
Flooding frequency	None
Ponding duration	Brief (2 to 7 days) to very long (more than 30 days)
Ponding frequency	Occasional to frequent
Elevation	209–287 m
Slope	0–2%
Ponding depth	0–30 cm
Aspect	Aspect is not a significant factor

Climatic features

The continental climate of the Michigan Eastern Upper Peninsula MLRA is typical of northern Wisconsin: cooler summers, colder winters, and shorter growing seasons. This site occurs on landscape depressions and may have a microclimate with shorter freeze-free and frost-free periods than what is represented by the weather station data.

Table 3. Representative climatic features

Frost-free period (characteristic range)	98-104 days
Freeze-free period (characteristic range)	125-132 days
Precipitation total (characteristic range)	787-813 mm
Frost-free period (actual range)	98-107 days
Freeze-free period (actual range)	122-133 days
Precipitation total (actual range)	762-813 mm
Frost-free period (average)	95 days
Freeze-free period (average)	120 days
Precipitation total (average)	787 mm

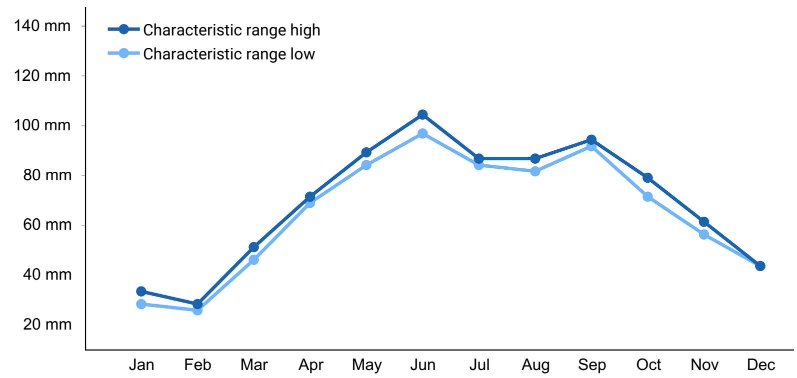


Figure 1. Monthly precipitation range

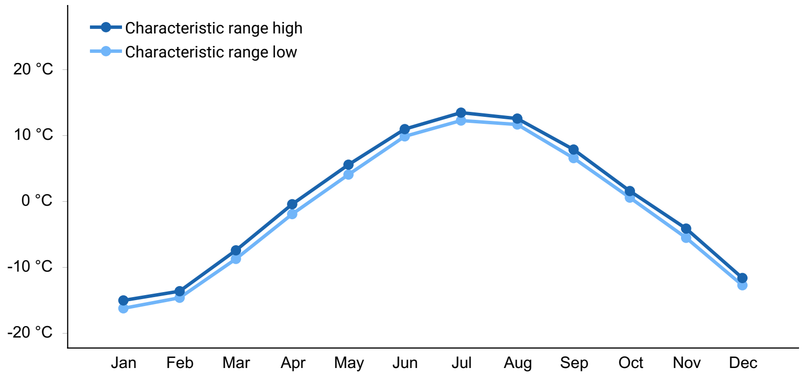


Figure 2. Monthly minimum temperature range

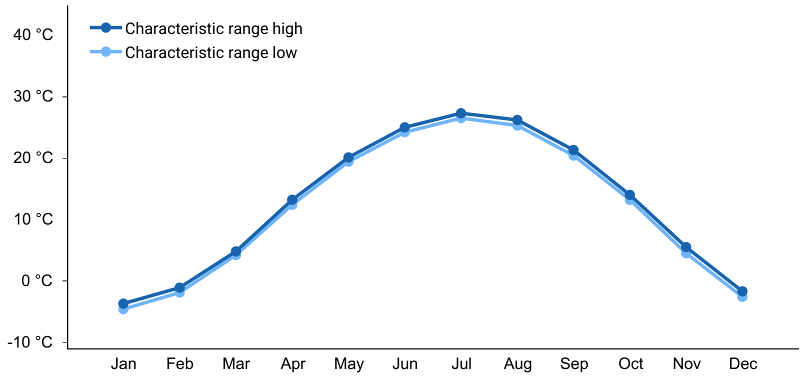


Figure 3. Monthly maximum temperature range

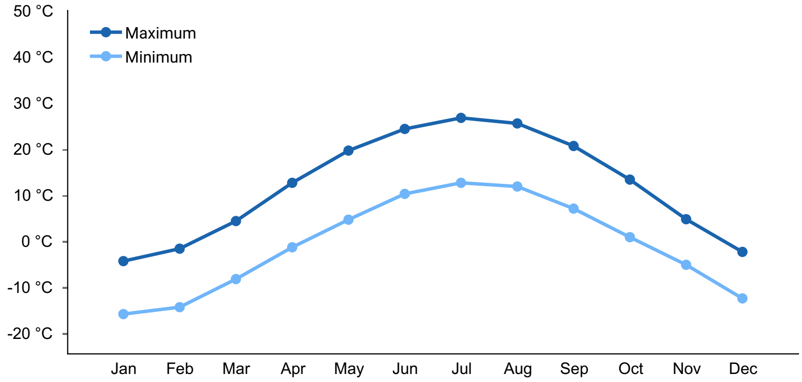


Figure 4. Monthly average minimum and maximum temperature

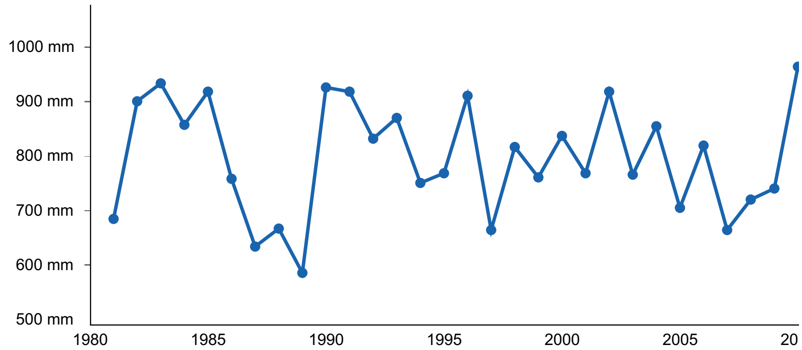


Figure 5. Annual precipitation pattern

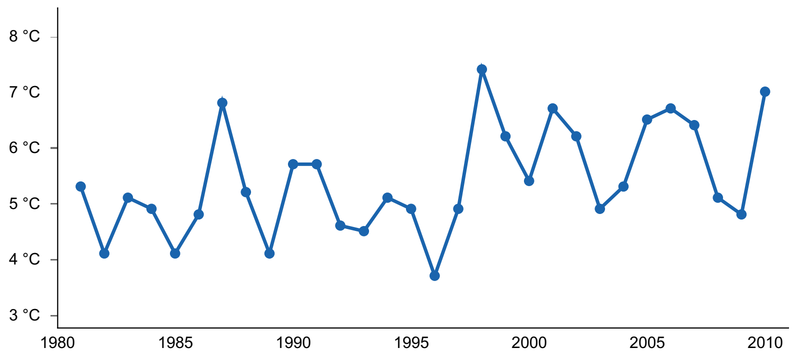


Figure 6. Annual average temperature pattern

Climate stations used

- (1) CRIVITZ HIGH FALLS [USC00471897], Crivitz, WI
- (2) LAKEWOOD 3 NE [USC00474523], Lakewood, WI
- (3) BREED 6 SSE [USC00471044], Suring, WI

Influencing water features

Water is received through precipitation, runoff from adjacent uplands, groundwater discharge, and less often, stream inflow. Water levels are greatly influenced by precipitation rates and runoff from upland sites. Water leaves the site primarily through evapotranspiration and groundwater recharge.

Wetland description

Under the Cowardin System of Wetland Classification, or National Wetlands Inventory (NWI), the wetlands can be classified as:
1) Palustrine, forested, broad-leaved deciduous, saturated, or
2) Palustrine, forested, needle-leaved evergreen, saturated, or
3) Palustrine, scrub/shrub, broad-leaved deciduous, saturated, or
4) Palustrine emergent, persistent, saturated

Under the Hydrogeomorphic Classification System (HGM), the wetlands can be classified as:
1) Depressional, acid, forested/organic, or
2) Depressional, acid, scrub-shrub/organic

Permeability of the soil is impermeable to moderately slow.
Hydrologic Group: D, B/D, C/D,
Hydrogeomorphic Wetland Classification: Depressional, forested/organic; Depressional, scrub-shrub/organic
Cowardin Wetland Classification: PFO1B, PFO4B, PSS1B, PEM1B

Soil features

The soils of this site are represented by the Bruce, Ensley, Minocqua, and Pickford soil series. Endoaquepts make up 43% of the acreage of this site. Epiaquents make up 25% The remaining acreage is made up of Epiaquepts and Haplaquepts.

These soils form in loamy to clayey deposits of till and lacustrine materials, sometimes underlain by sandy and gravelly outwash deposits. Sites lack bedrock contact within two meters. Soils are very poorly to poorly drained and meet hydric soil requirements.

The surfaces of these soils may be sand to silty clay loam, sometimes mucky. The subsurface may be sand to silty clay. Small fragments (gravels) may occupy up to 27 percent of the subsurface. Soils are strongly acid to moderately alkaline. Secondary carbonates may occupy up to 20 percent volume.

Figure 7. Bruce soil series photograph courtesy of UWSP taken on 7/1/2020 in Marinette County, WI.

Table 4. Representative soil features

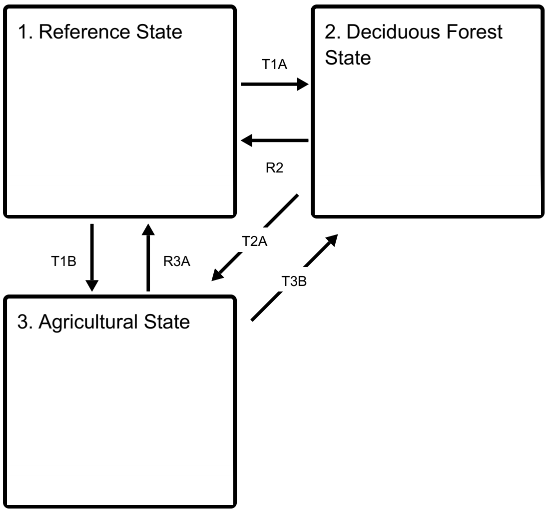
Parent material	(1) Outwash (2) Till (3) Lacustrine deposits
Surface texture	(1) Mucky sandy loam (2) Mucky loam (3) Mucky silt loam (4) Mucky silty clay loam
Drainage class	Very poorly drained to poorly drained
Permeability class	Very slow to moderately slow
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-152.4cm)	16.26–25.4 cm
Calcium carbonate equivalent (0-101.6cm)	0–20%
Soil reaction (1:1 water) (0-101.6cm)	5.1–8
Subsurface fragment volume <=3" (Depth not specified)	0–27%
Subsurface fragment volume >3" (Depth not specified)	0–2%

Ecological dynamics

In pre-European settlement time wildfire was the main controlling factor of forest community dynamics. Following a severe, stand-replacing fire, any of the species present on the landscape could become established, depending on seed source availability and specific conditions of post-fire seedbed. The newly established young stands of any species were easily eliminated by recurring fires, but differences in fire-resisting properties among the species began to play a role in any species' survival success. Many pine and oak species were dominant in the region because of their fire-resistant properties and successful regeneration post-fire. With clear cutting and continued fire suppression, many of these species adapted to fire and intolerant of shade, are replaced by other species. Species such as white pine and red oak are still common on the landscape based on their tolerance to some shade; these species to establish under a canopy, and in time, may become a component of the canopy. Red maple is sensitive to fire, but in its absence, it has the ability to dominate sites based on its shade tolerance and prolific seed production.

State and transition model

Ecosystem states



T1A - Stand replacing disturbance that includes fire.

T1B - Removal of forest cover and tilling for agricultural crop production.

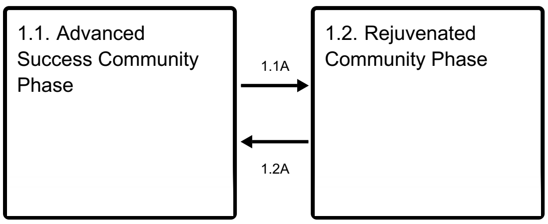
R2 - Deciduous forest community is slowly invaded by conifers.

T2A - Removal of forest cover and tilling for agricultural crop production.

R3A - Cessation of agricultural practices leads to natural reforestation, or site is replanted.

T3B - Cessation of agricultural practices leads to natural reforestation, or site is replanted.

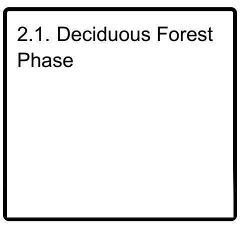
State 1 submodel, plant communities



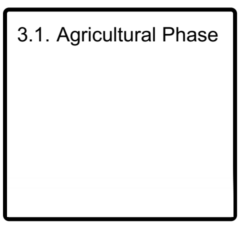
1.1A - Light to moderate intensity fires, blow-downs, ice storms.

1.2A - Disturbance-free period for 30+ years.

State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Reference State

Reference state is a forest community dominated by red maple (*Acer rubrum*) with groups of balsam fir (*Abies balsamea*). Depending on history of disturbance, two community phases can be distinguished largely by differences in dominance of tree species and community age structure.

Community 1.1
Advanced Success Community Phase

In the absence of major disturbance—particularly fire—these sites are dominated by a canopy of red maple and balsam fir. Sites may have a super-canopy of large white pine that might be able to maintain itself in few numbers through regeneration in gaps. White pine (*Pinus strobus*) has a moderate shade tolerance and grow to be much larger than red maple and balsam fir at maturity and typically live longer. The shrub layer is not well developed and dominated by red maple saplings and beaked hazelnut (*Corylus cornuta*). The ground layer is highly variable but often contains interrupted fern (*Osmunda claytoniana*) and various wet herbaceous plants (horsetail, goldthread, miterworts, black ash seedlings).

Dominant plant species

- red maple (*Acer rubrum*), tree
- balsam fir (*Abies balsamea*), tree
- gray alder (*Alnus incana*), shrub
- beaked hazelnut (*Corylus cornuta*), shrub
- interrupted fern (*Osmunda claytoniana*), other herbaceous

Community 1.2
Rejuvenated Community Phase

Figure 8. Photo courtesy of UWSP taken on 6/27/2020 in Oconto County, WI.

The canopy of the rejuvenated community is still dominated by original species, but the understory now also includes a well-established younger cohort and perhaps a few additional seedlings and saplings of less shade tolerant species. It is unable to compete with red maple and balsam fir to maintain a position in the canopy in advanced succession.

Dominant plant species

- red maple (*Acer rubrum*), tree
- balsam fir (*Abies balsamea*), tree
- beaked hazelnut (*Corylus cornuta*), shrub
- gray alder (*Alnus incana*), shrub

Pathway 1.1A
Community 1.1 to 1.2

Light intensity fires, crown breakage from ice and snow and small scale blow-downs create canopy openings, releasing advance regeneration and stimulating new seedling establishment. Some additional less shade tolerant species such as red oak may be able to enter the community.

Pathway 1.2A
Community 1.2 to 1.1

A long period without major canopy disturbance allows gradual replacement of oldest canopy trees by younger cohorts. Small scale disturbances may still occur periodically, but once second or third canopies are established there is minimal new regeneration taking place and the forest gradually returns to mature state.

State 2
Deciduous Forest State

Figure 9. Photo courtesy of UWSP taken on 7/1/2020 in Marinette County, WI.

Pure, or mixed, aspen – paper birch community replaces the reference state community. If seed source is present, red maple and young cohorts of balsam fir readily becomes member of this community.

Community 2.1
Deciduous Forest Phase

Figure 10. Photo courtesy of UWSP taken on 7/1/2020 in Marinette County, WI.

Pure, or mixed, aspen – paper birch community. Understory plants may be only weekly expressed when aspen and paper birch are closely growing and dominant. If seed source is present and canopy openings allow, red maple and young cohorts of balsam fir readily become member of this community. Depending on age within this phase the canopy varies from pure (young) to mixed (older) aspen – paper birch. Disturbance history and seed source will dictate whether aspen or birch dominate this phase.

Dominant plant species

- quaking aspen (*Populus tremuloides*), tree
- birch (*Betula*), tree
- red maple (*Acer rubrum*), tree
- balsam fir (*Abies balsamea*), tree
- beaked hazelnut (*Corylus cornuta*), shrub

State 3
Agricultural State

The Agricultural State consists of a post disturbance establishment of hay, crops, or pasture and a continuation of those practices for many years.

Community 3.1
Agricultural Phase

Continuous cultivation of the site in hay, crops, or pasture for many years.

Transition T1A
State 1 to 2

Reference State

Deciduous Forest State

Stand replacing disturbance that must include fire to create conditions for aspen and paper birch to colonize the site.

Transition T1B
State 1 to 3

Removal of forest cover by whatever means, followed by tilling for agricultural crop production. Establishment of agricultural crops, hay, or pasture following the disturbance.

Restoration pathway R2
State 2 to 1

Deciduous Forest State

Reference State

Deciduous forest community slowly ages out and is invaded by conifers, especially Balsam fir. Other species such as Red maple and Green or Black ash may begin to take hold as well as Aspen and Birch trees die and canopy openings develop.

Transition T2A
State 2 to 3

Removal of forest cover by whatever means, followed by tilling for agricultural crop production. Establishment of agricultural crops, hay, or pasture following the disturbance.

Restoration pathway R3A
State 3 to 1

Cessation of agricultural practices leads to natural reforestation, or site is replanted. Initial species is seed source dependent unless planted. Most likely initial species are Aspen and Red Maple.

Transition T3B
State 3 to 2

Cessation of agricultural practices leads to natural reforestation, or site is replanted. Initial species is seed source dependent unless planted. Most likely initial species are Aspen and Red Maple.

Additional community tables

Inventory data references

Plot and other supporting inventory data for site identification and community phases is located on a NRCS North Central Region shared and one drive folder. University Wisconsin-Stevens Point described soils, took photographs, and inventoried vegetation data at community phases within the reference state. The data sources include WI ESD Plot Data Collection Form - Tier 2, Releve Method, NASIS pedon description, NRCS SOI 036, photographs, and Kotar Habitat.
Habitat Types of N. Wisconsin (Kotar, 2002): Acer-Abies/Vaccinium-Coptis (ArAbVC), Tsuga/Maianthemum-Coptis (TMC), Acer/Hydrophyllum-Impatiens (AHI)
Biophysical Settings (Landfire, 2014): Laurentian-Acadian Alkaline Conifer-Hardwood Swamp
WDNR Natural Communities (WDNR, 2015): Northern Wet-Mesic Forest

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Contributors

Bryant Scharenbroch, Assistant Professor at University of Wisconsin Stevens Point
Jacob Prater, Associate Professor at University of Wisconsin Stevens Point
John Kotar, Ecological Specialist, independent contractor

Approval

Suzanne Mayne-Kinney, 11/16/2023

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NRCS contracted UWSP to write ecological sites in MLRA 94B, completed in 2021.

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	05/13/2025
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:**