Ecological site F094BY007MI
Moist Loamy Lowland

Last updated: 11/16/2023
Accessed: 05/05/2024

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

The 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): Tsuga/Maianthemum-Coptis (TMC), Acer-Tsuga/Athyrium-Onoclea (ATAtOn)

Biophysical Settings (Landfire, 2014): Laurentian-Acadian Northern Hardwoods Forest, Laurentian-Acadian Alkaline Conifer-Hardwood Swamp, Laurentian-Acadian Sub-boreal Aspen-Birch Forest

WDNR Natural Communities (WDNR, 2015): Northern 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 Moist Loamy Lowland ecological site accounts for approximately 7,000 acres in MLRA 94B, or about 0.7% of total land area. It is the third-least extensive site in MLRA 94B. It is found in depressions and drainageways on moraines, lake plains, and outwash plains throughout the MLRA.

These sites are characterized by moderately deep to very deep, somewhat poorly drained, loamy soils. Precipitation, runoff from adjacent uplands, and groundwater discharge are the primary sources of water. Soils are very strongly acid to moderately alkaline. These sites can support vegetative communities with higher nutrient requirements than their Moist Sandy Lowland counterparts.

Associated sites

F094BY002MI	**Mucky Swamp** Mucky Swamp are wetland sites occupying landscape depression and drainageways. They form in deep, herbaceous organic deposits and are very poorly drained. They occupy the lowest, wettest positions along the same drainage sequence as Moist Loamy Lowland and are sometimes found directly adjacent to Moist Loamy Lowland.
F094BY005MI	**Wet Loamy Lowland** Wet Loamy Lowland are sites that occupy landscape depressions on moraines, lake plains, or outwash plains. They are very poorly to poorly drained. They occupy the lower, wetter positions along the same drainage sequence as Moist 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 occupy the higher, drier positions along the same drainage sequence as Moist Loamy Lowland and are often found directly adjacent to Moist 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 occupy the higher, drier positions along the same drainage sequence as Moist Loamy Lowland.

Similar sites

F094BY006MI	**Moist Sandy Lowland** Moist Sandy Lowland are found in lower landscape positions on outwash plains. They are somewhat poorly drained. They are very similar to Moist Sandy Lowland except have coarser textures and a lower nutrient status.

Table 1. Dominant plant species

Tree	(1) *Acer rubrum* (2) *Acer saccharum*
Shrub	(1) *Corylus cornuta* (2) *Ilex verticillata*
Herbaceous	(1) *Dryopteris* (2) *Anemone quinquefolia*

Physiographic features

This site is found on moraines, lake plains, outwash plains, and stream terraces in lower landscape positions throughout the MLRA. Slopes range from 0 to 4 percent.

This site is subject to neither flooding nor ponding. The soil has evidence of a seasonally-high water table within 12 inches (30 cm) of the surface, though the actual water table may be found at greater depths when conditions are dry. The water table may sometimes be perched (episaturated) on bedrock or dense, clayey layers. Runoff potential is generally low or medium but may be high where the soil surface is silty and the slope is relatively steep.

Table 2. Representative physiographic features

Hillslope profile	(1) Footslope
Slope shape across	(1) Concave
Slope shape up-down	(1) Linear
Landforms	(1) Depression (2) Drainageway (3) Outwash plain (4) Stream terrace (5) Moraine (6) Lake plain (7) Flat
Runoff class	Low to high
Flooding frequency	None
Ponding frequency	None
Elevation	659–837 ft
Slope	0–4%
Water table depth	5–12 in

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.

Table 3. Representative climatic features

Frost-free period (characteristic range)	102-110 days
Freeze-free period (characteristic range)	126-140 days
Precipitation total (characteristic range)	30-31 in
Frost-free period (actual range)	99-111 days
Freeze-free period (actual range)	122-143 days
Precipitation total (actual range)	30-32 in
Frost-free period (average)	100 days
Freeze-free period (average)	125 days
Precipitation total (average)	31 in

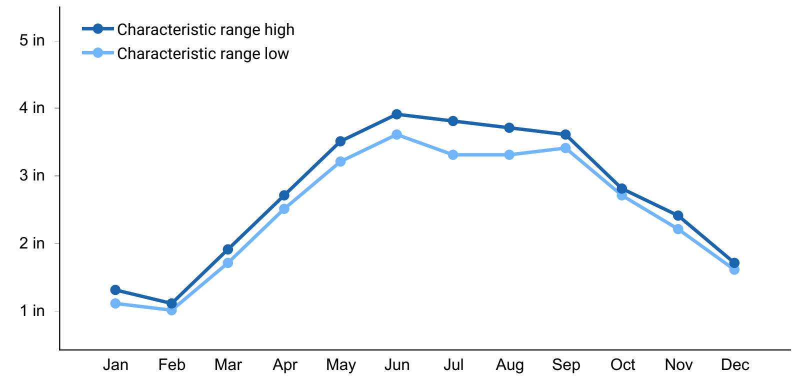


Figure 1. Monthly precipitation range

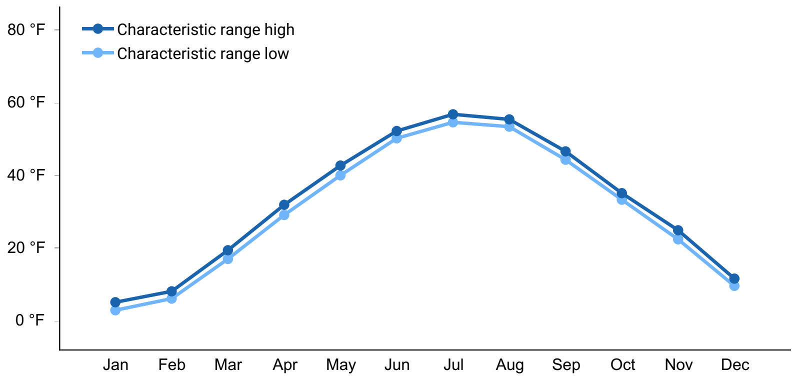


Figure 2. Monthly minimum temperature range

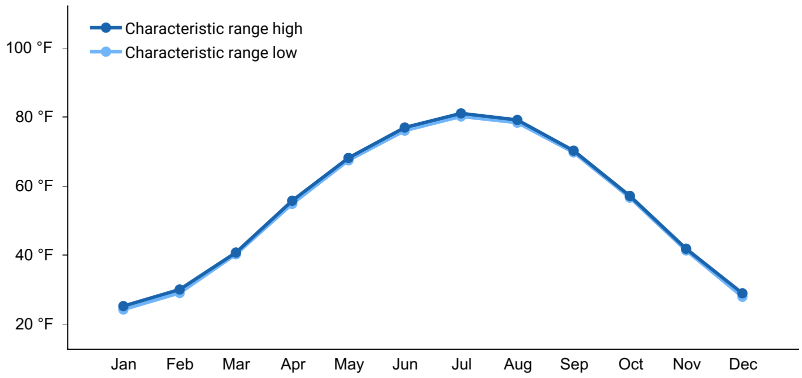


Figure 3. Monthly maximum temperature range

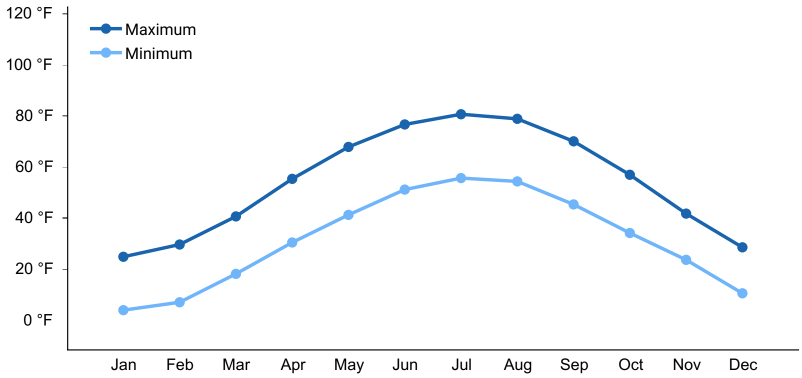


Figure 4. Monthly average minimum and maximum temperature

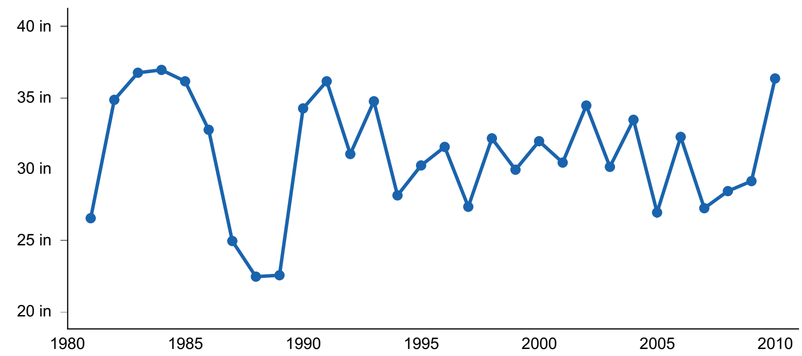


Figure 5. Annual precipitation pattern

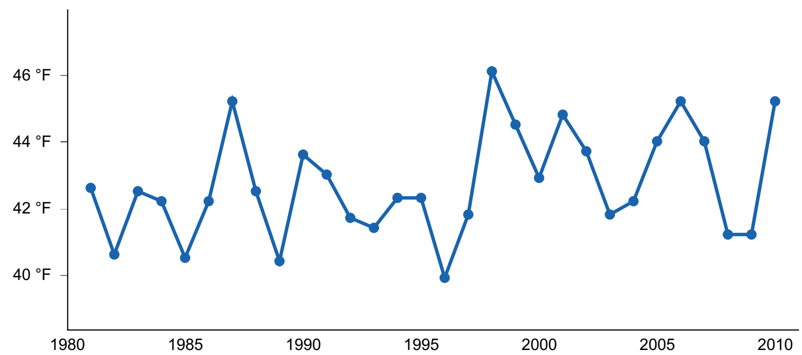


Figure 6. Annual average temperature pattern

Climate stations used

- (1) CRIVITZ HIGH FALLS [USC00471897], Crivitz, WI
- (2) BREED 6 SSE [USC00471044], Suring, WI
- (3) SURING [USC00478376], Suring, WI

Influencing water features

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

Wetland description

Permeability of these sites is impermeable to moderately slow.
Hydrologic Group: A/D, B/D, C/D
Hydrogeomorphic Wetland Classification: None
Cowardin Wetland Classification: None

Soil features

The soils of this site are represented by the Banat, Crossett, Gaastra, Lablatz, Peshtigo, Robago, Selkirk, Wayka, and Worcester soil series. Endoaquods make up 44% of the acreage of this site. Glossudalfs make up 26%. Endoaqualfs make up 20%. Epiaquods make up 9%.

These sites form in loamy outwash and till or silty and clayey lacustrine deposits. Some sites are underlain by sandy and gravelly outwash. Soils generally lack bedrock contact within two meters, though some sites in Menominee county have contact with granitic bedrock as high as 27in. Soils are somewhat poorly drained and do not meet hydric soil conditions.

The surfaces of these soils may be sandy loam to silt loam. The subsurface may be sand to clay. Small fragments (gravel) may occupy up to 24 percent volume of the substratum. Soils are very strongly acid to moderately alkaline. Accumulations of secondary carbonates may be found soils in northern Marinette county and may occupy up to 15 percent volume.

Figure 7. Banat Soil Series sample taken in Marinette County, WI on 06/19/2020. Courtesy of UWSP.

Table 4. Representative soil features

Parent material	(1) Till (2) Outwash (3) Lacustrine deposits
Surface texture	(1) Sandy loam (2) Loam (3) Silt loam
Drainage class	Somewhat poorly drained
Permeability class	Very slow to moderately slow
Soil depth	27–80 in

Surface fragment cover <=3"	0–8%
Surface fragment cover >3"	0–2%
Available water capacity (0-60in)	3.7–11.4 in
Soil reaction (1:1 water) (0-40in)	4.6–7.9
Subsurface fragment volume <=3" (Depth not specified)	2–24%
Subsurface fragment volume >3" (Depth not specified)	0–5%

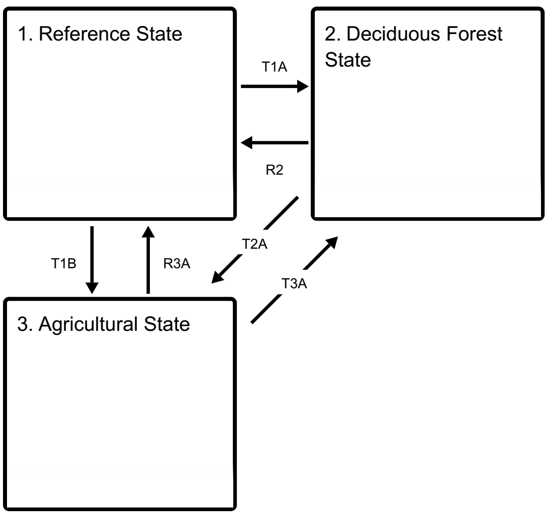
Ecological dynamics

Historically, mature forests on this ecological site were dominated by shade tolerant sugar maple and hemlock, often with an admixture of yellow birch (Wilde, 1933, Finley, 1976). This association was self-maintained with new cohorts of advance regeneration gaining canopy status through gaps formed by small-scale disturbances and natural mortality in the dominant canopy. Scattered large individuals of less shade tolerant white pine also were a common component of mesic hardwood forests. These presumably became established following relatively rare disturbances that included fire (Schulte and Mladenoff, 2005). It is now uncommon to find large stands containing hemlock.

Current stands on this Ecological Site represent the entire array of potential successional stages from pure aspen, or aspen-white birch, stands to sugar maple dominated mixed northern hardwoods stands. Succession to sugar maple dominance is evident everywhere that seed sources are present. However, hemlock regeneration is scarce. In old forests, hemlock finds optimal conditions for germination and seedling establishment on rotten logs, stumps and mounds that normally have warmer surfaces and better moisture retention than the forest floor (USDA, 1990). Most present forest communities lack these conditions.

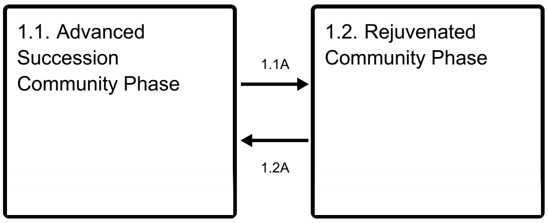
State and transition model

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.
T3A - Cessation of agricultural practices leads to natural reforestation, or site is replanted.

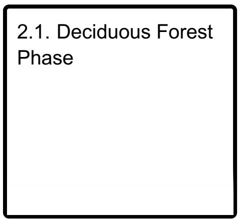
State 1 submodel, plant communities



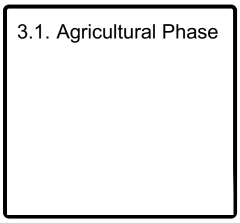
1.1A - Light to moderate intensity fires, blow-downs, ice storms.

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

State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Reference State

The reference plant community is categorized as mesic forest community dominated by mixed deciduous species, primarily red maple (*Acer rubrum*) and sugar maple (*Acer saccharum*), and sporadic occurrence of several conifer species. Although forest communities can vary greatly in terms of species composition and stand structure, depending on type, degree, and frequency of disturbance, two common phases predominate:

Community 1.1
Advanced Succession Community Phase

In the absence of major, stand-replacing disturbance this community is dominated by sugar maple, yellow birch (*Betula alleghaniensis*) and eastern hemlock (*Tsuga canadensis*. This was the most common condition in pre-European settlement forests, but no longer predominates. Though not dominant community members Basswood and Ash may be present and White pine could be present as a super canopy in some instances. The tree sapling and shrub layer in this community is not well developed due to dense shade created by multi-story tree canopy. Sugar maple saplings dominate the shrub layer, but other shrubs including hazelnuts (Corylus spp.) are common with low coverage. It is important to note that in most current mature stands, hemlock is significantly under-represented compared to historic conditions. Apparently, this lack of hemlocks is due to seed source elimination during the early logging era and herbivory by currently high white tail deer populations.

Dominant plant species

- sugar maple (*Acer saccharum*), tree
- red maple (*Acer rubrum*), tree
- hemlock (*Tsuga*), tree
- yellow birch (*Betula alleghaniensis*), tree
- beaked hazelnut (*Corylus cornuta*), shrub
- common winterberry (*Ilex verticillata*), shrub
- woodfern (*Dryopteris*), other herbaceous
- wood anemone (*Anemone quinquefolia*), other herbaceous
- horsetail (*Equisetum*), other herbaceous

Community 1.2
Rejuvenated Community Phase

Figure 8. Photo courtesy of UWSP taken on 06/19/2020 in Marinette County, WI.

Disturbances described in Pathway 1.1A lead to increased species and structural diversity of the forest community. Depending on seed source, red oak and red maple regenerate in the canopy openings and in time join sugar maple and hemlock in the dominant canopy (at this time hemlock is uncommon or absent in this phase). Basswood is also commonly present along with Green ash. The relative density of the shrub and herb layers also increases during this stage. Species composition remains relatively unchanged, but abundance changes can be significant. Particularly hazelnut can form dense thickets. Winterberry may be present in the shrub layer as well. Many other herb species that were present with very low abundance in the advanced-succession community typically form much larger population clusters as there is more light penetrating the canopy.

Dominant plant species

- red maple (*Acer rubrum*), tree
- sugar maple (*Acer saccharum*), tree
- green ash (*Fraxinus pennsylvanica*), tree
- basswood (*Tilia*), tree
- hazelnut (*Corylus*), shrub
- common winterberry (*Ilex verticillata*), shrub
- woodfern (*Dryopteris*), other herbaceous
- wood anemone (*Anemone quinquefolia*), other herbaceous

Pathway 1.1A
Community 1.1 to 1.2

Natural mortality in the oldest age classes—sporadic small-scale blow-downs and ice storms—create openings for entry of mid-tolerant species such as red oak and red maple.

Pathway 1.2A
Community 1.2 to 1.1

In the absence of canopy reducing disturbances natural succession leads to community dominance by the most shade-tolerant species resulting in return to community phase 1.1.

State 2
Deciduous Forest State

Post disturbance pioneer community of aspen and paper birch with mixtures of other species from available seed sources. This state can have broad variation depending on what seed sources are available as these sites readily supply water and nutrients in quantities that many species can thrive with.

Community 2.1
Deciduous Forest Phase

Figure 9. Photo courtesy of UWSP taken on 06/18/2020 in Marinette County, WI.

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

Dominant plant species

- quaking aspen (*Populus tremuloides*), tree
- European white birch (*Betula pendula*), tree
- red maple (*Acer rubrum*), tree
- blackberry (*Rubus*), shrub

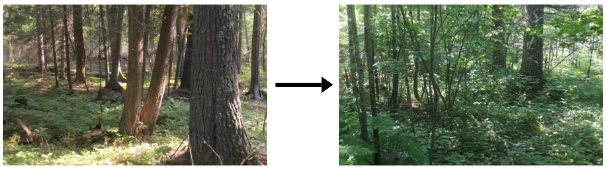
State 3
Agricultural State

Indefinite period of applying agricultural practices. Cropping systems vary on these sites and likely include tillage, row crops, hay or pasture, and specialty crops.

Community 3.1
Agricultural Phase

Indefinite period of applying agricultural practices. Crops likely include alfalfa, corn, soybeans, and hay or pasture. It is possible that some areas are or have been in ginseng production as well.

Transition T1A
State 1 to 2



Reference State **Deciduous Forest State**

Major stand-replacing disturbance. In pre-European settlement time, the event was most often a severe blow down, sometimes followed by fires. Such blow downs have been estimated to occur in this part of Wisconsin every 300 to 400 years (Schulte and Mladenoff, 2005). In post settlement virtually every acre has been logged either by clear cutting or successive cuts targeting species marketable at that time. Post logging slash fires also have been a significant factor in most areas. These disturbances created the environment suitable for natural regeneration of many shade-intolerant species and for commercial planting.

Transition T1B
State 1 to 3

Removal of forest cover, tilling and application of other agricultural techniques to grow agricultural crops.

Restoration pathway R2
State 2 to 1

Deciduous Forest State **Reference State**

Invasion of conifers in the deciduous forest.

Transition T2A
State 2 to 3

Removal of forest cover, tilling and application of other agricultural techniques to grow agricultural crops.

Restoration pathway R3A
State 3 to 1

Abandonment of agricultural practices and allowing natural vegetation to colonize the site or apply artificial afforestation. The time required for forest community to reach the reference state conditions may exceed 100 years.

Transition T3A
State 3 to 2

Abandonment of agricultural practices and allowing natural vegetation to colonize the site or apply artificial afforestation. The site can return much more quickly to the Deciduous Forest State as compared to the Reference State.

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): Tsuga/Maianthemum-Coptis (TMC), Acer-Tsuga/Athyrium-Onoclea

(ATAtOn)
Biophysical Settings (Landfire, 2014): Laurentian-Acadian Northern Hardwoods Forest, Laurentian-Acadian Alkaline Conifer-Hardwood Swamp, Laurentian-Acadian Sub-boreal Aspen-Birch Forest
WDNR Natural Communities (WDNR, 2015): Northern Mesic Forest

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Approval

Suzanne Mayne-Kinney, 11/16/2023

Acknowledgments

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	05/05/2024
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:**
