

Ecological site F094BY010MI

Clayey Upland

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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): Acer/Viburnum (AVb), Acer-Fagus/Viburnum (AFVb) Biophysical Settings (Landfire, 2014): Laurentian-Acadian Northern Hardwoods Forest, 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 Clayey Upland ecological site accounts for approximately 21,000 acres in MLRA 94B, or about 2% of total land area. It is found on clayey moraines and lake plains, mostly in the far northern and southern portions of this MLRA (Florence, Menominee, and Oconto counties). This site is characterized by moderately well to well drained, clayey soils. Precipitation, runoff from adjacent uplands, and groundwater discharge and the primary sources of water. Soils are very strongly acid to moderately alkaline.

Associated sites

F094BY002MI	Mucky Swamp Mucky Swamp occupy 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 Clayey Upland.
F094BY005MI	Wet Loamy Lowland Wet Loamy Lowland are wetland 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 Clayey Upland.
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 occupy the lower, wetter positions along the same drainage sequence as Clayey Upland.

Similar sites

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 very similar to Clayey Upland except have coarser soil textures and improved drainage.
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Table 1. Dominant plant species

Tree	(1) <i>Acer saccharum</i> (2) <i>Acer rubrum</i>
Shrub	(1) <i>Corylus cornuta</i> (2) <i>Hamamelis</i>
Herbaceous	(1) <i>Viburnum acerifolium</i> (2) <i>Maianthemum canadense</i>

Physiographic features

This site is found on moraines, drumlins, and lake plains. It is common to the Homestead Moraines in southeastern Florence county and to the Hayes Moraines in western Oconto county. Slopes range from 0 to 35 percent.

These sites are subject to neither flooding nor ponding. When perched (episaturated), the seasonally-high water table may be found as high as 12 inches (30 cm) from the soil surface. Runoff potential ranges from high to very high.

Table 2. Representative physiographic features

Hillslope profile	(1) Summit (2) Shoulder (3) Backslope
Slope shape across	(1) Linear
Slope shape up-down	(1) Convex
Landforms	(1) Moraine (2) Drumlin (3) Lake plain
Runoff class	High to very high
Flooding frequency	None
Ponding frequency	None
Elevation	190 – 260 m
Slope	0 – 40 %
Water table depth	30 – 200 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.

Table 3 Representative climatic features

Frost-free period (characteristic range)	100-110 days
Freeze-free period (characteristic range)	130-140 days
Precipitation total (characteristic range)	760-810 mm

Frost-free period (actual range)	100-110 days
Freeze-free period (actual range)	120-140 days
Precipitation total (actual range)	760-810 mm
Frost-free period (average)	100 days
Freeze-free period (average)	130 days
Precipitation total (average)	790 mm

- (1) CRIVITZ HIGH FALLS [USC00471897], Crivitz, WI
- (2) SURING [USC00478376], Suring, WI
- (3) PESHTIGO [USC00476510], Peshtigo, 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: B, C, C/D

Hydrogeomorphic Wetland Classification: None

Cowardin Wetland Classification: None

Soil features

The soils of this site are represented by the Ellwood, Hibbing, Keshena, Onaway, Ossineke, Pecore, and Tilleda soil series, and by a variant of the Tilleda soil series. Glossudalfs make up most of the acreage of this site.

These sites form in loamy to clayey till deposits. They are sometimes underlain by sandy outwash or clayey lacustrine materials. They typically lack bedrock contact within 6.5 feet (two meters) of the soil surface. They are moderately well to well drained and do not meet hydric soil requirements.

The surfaces of these soils may be sandy loam to silt loam. Subsurface textures range from sand to clay. Small fragments (gravel) may occupy up to 20 percent volume of the substratum. Soils are very strongly acid to moderately alkaline. Accumulations of secondary carbonates are common. They may occupy up to 20 percent volume and be found as high as 64 cm from the surface.

Figure 7. Tilleda Soil Series sample taken in Oconto County, WI on 06/27/2020. 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	Moderately well drained to well drained
Permeability class	Very slow to moderately slow
Soil depth	200 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-152.4cm)	14.99 – 24.38 cm
Calcium carbonate equivalent (0-101.6cm)	0 – 20 %
Soil reaction (1:1 water) (0-101.6cm)	4.8 – 7.9
Subsurface fragment volume <=3" (Depth not specified)	10 – 20 %
Subsurface fragment volume >3" (Depth not specified)	Not specified

Ecological dynamics

Historically, this site was dominated by mesic hardwoods in a landscape adapted to fire disturbance that allowed for a strong presence of oaks. 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. Mesic hardwoods are sensitive to fire, but in its absence, they have the ability to dominate sites based on their shade tolerance and prolific seed production.

Today, these forests most commonly include stands of sugar maple although red oak, and other mesic hardwoods may be present as well. Some sites have a strong presence of red oak, and white pine is successfully reinvading the landscape in some areas. These sites have the conditions to support shade tolerant mesic hardwoods, but historically had significant wind throw and fire disturbance that allowed for a strong presence of oak species and white pine. As long as fire is continually suppressed, maples and other mesic hardwoods will continue to dominate the canopy.

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 6. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 7. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 8. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 9. Community 2.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 10. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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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 Types. Habitat Types of N. Wisconsin (Kotar, 2002): Acer/Viburnum (AVb), Acer-Fagus/Viburnum (AFVb) Biophysical Settings (Landfire, 2014): Laurentian-Acadian Northern Hardwoods Forest, Laurentian-Acadian Sub-boreal Aspen-Birch Forest WDNR Natural Communities (WDNR, 2015): Northern Mesic Forest

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Approval

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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	08/28/2026
Approved by	
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:
