

Ecological site F094AA002MI

Snowy Loamy Till

Last updated: 9/10/2024

Accessed: 09/11/2026

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): 094A–Northern Michigan Sandy Highlands

This area is dominated by outwash plains and moraines. The terrain can be steep on the moraines and flat in the areas of outwash. Elevation ranges from 177 to 520 m (580 to 1705 ft). Local topographic relief averages 14 m and ranges up to 188 m (45 to 615 ft). This area is covered entirely by drift. Bedrock consisting of Devonian limestone and dolomite with interbedded shale, chert, and anhydrite stringers is at various depths below the surface because of the curvature of the Michigan basin. However, bedrock exposures completely absent, as the depth of glacial drift ranges from 60 to 300 m (200-1000 ft). The Au Sable, Manistee, Au Gres, and Pine Rivers are the major streams draining this MLRA, in both the Lake Michigan and Lake Huron watersheds. The Muskegon River has its headwaters in this area. About 70 percent of this area is forested, and about 15 percent is cropland or hayland. About one-third of the area is in small, privately owned holdings, and another one-third consists of national and State forests. The forests are used mainly for timber production and recreation. Dairy and beef operations are very important enterprises in the area. Forage and feed grains for dairy cattle and other livestock are the principal crops. Wheat, oats, corn, potatoes, and hay also are grown in the area. The Huron and Manistee National Forests, Hartwick Pines State Park, Camp Grayling (Department of Defense), Pigeon River Country State Forest are among the most notable conservation lands in the area. Reaches of the Au Sable and Pine Rivers are National Wild and Scenic Rivers. Summary of existing land use: Upland Forest (58%) Hardwood (41%) Conifer (15%) Swamps and Marshes (14%) Developed (11%) Agricultural (10%) Grassland (5%)

Classification relationships

According to the USFS (Bailey) system of ecoregions, the site is located mostly within 212Hc (Interlobate End and Ground Moraines), 212He (Kalkaska Sandy Moraines), and 212Hi (Wolverine Moraines) subsections. According to the EPA (Omernik) system of ecoregions, the site is located in western 50ac (Onaway Moraines), western 50ad (Vanderbilt Moraines), and 50af (Cadillac Hummocky Moraines) level IV ecoregions. This site roughly corresponds to AFOCa, in the Kotar system. This site corresponds to the Herb-Rich Moraines, ecological land type phases 45-47, in the USFS Ecological Land Type system.

Ecological site concept

The central concept of Snowy Loamy Till is uplands with a seasonal high watertable greater than 50 cm in depth (excessively drained to moderately well drained) loamy drift (till or lake plains) with soil textures loamy to clayey (upper 50 cm 70% sand). Site is in the heavy annual snowfall belt, mostly west of Houghton Lake where fire was rare. Vegetation trending towards mesophytic forest with a rich herb understory and a low fire frequency.

Associated sites

F094AA003MI	Snowy Loamy Depression
-------------	------------------------

Similar sites

F094AB015MI	Loamy Till
-------------	------------

Table 1. Dominant plant species

Tree	(1) <i>Fagus grandifolia</i> (2) <i>Acer saccharum</i>
Shrub	Not specified
Herbaceous	(1) <i>Caulophyllum thalictroides</i>

Physiographic features

Site occurs mostly on glacial till, but minor areas of fine lake plain deposits have similar properties. Landforms are gently to steeply sloping, and range from lower to upper slope positions.

Table 2. Representative physiographic features

Landforms	(1) Moraine (2) Till plain
Runoff class	Low to very high
Elevation	190 – 520 m
Water table depth	150 cm
Aspect	Aspect is not a significant factor

Climatic features

Mean annual temperatures are 5.8 to 7.4 °C (42 to 45 °F). The warmest six months average 14.2 to 15.9 °C (58 to 61 °F). Mean July temperatures range from 18.6 to 20.6 °C (65 to 69 °F). Mean January temperatures range from -8.3 to -5.7 °C (17 to 22 °F). The maximum monthly average daily highs are 24.9 to 27.5 °C (77 to 82 °F). The minimum monthly average daily lows are -13.2 to -10 °C (8 to 14 °F). Temperatures generally decrease with elevation and latitude. Mean annual precipitation ranges from 770 to 910 mm (30 to 36 in). Average 0 °C (32 °F) frost-free season ranges from 73 to 144 days. Average -2 °C (28 °F) freeze-free season is 106 to 172 days. Mean annual snowfall ranges from 1.5 to 4.1 m (60 to 160 in). Mean annual extreme minimum temperatures range from -33.3 to -23.1 °C (-28 to -10 °F), or hardiness zones 4a to 6a.

Table 3 Representative climatic features

Frost-free period (characteristic range)	90-110 days
Freeze-free period (characteristic range)	120-140 days
Precipitation total (characteristic range)	840-910 mm
Frost-free period (actual range)	90-120 days

Freeze-free period (actual range)	120-140 days
Precipitation total (actual range)	840-940 mm
Frost-free period (average)	100 days
Freeze-free period (average)	130 days
Precipitation total (average)	890 mm

- (1) BOYNE FALLS [USC00200925], Boyne City, MI
- (2) GAYLORD 9SSW [USC00203099], Gaylord, MI
- (3) BIG RAPIDS WTR WKS [USC00200779], Big Rapids, MI
- (4) GAYLORD [USC00203096], Gaylord, MI
- (5) LAKE CITY EXP FARM [USC00204502], Lake City, MI
- (6) CADILLAC [USW00014817], Cadillac, MI
- (7) KALKASKA [USC00204257], Kalkaska, MI

Influencing water features

Lower slope positions and finer substrates may have a seasonal high water table 50-100 cm in depth. Well drained upper slope positions are 100 cm or more from the water table.

Soil features

Soils are moderately well drained to well drained loams or clays. They are commonly classified Haplic Glossudalfs, Inceptic Hapludalfs, and Oxyaquic Glossudalfs, and commonly mapped as Emmet, Nester, and McBride series or components. The top 50 cm has a typical pH of 6.1 and is 60% sand and 0.5% organic matter. At depth, pH ranges up to 7.7, and texture averages 55% sand and 20% clay. Depth to impeded hydraulic conductivity or root restrictive layers averages 195 cm. Depth to carbonates averages 80 cm.

Table 4. Representative soil features

Parent material	(1) Till
Surface texture	(1) Loam
Drainage class	Well drained
Permeability class	Moderately slow to moderately rapid
Soil depth	200 cm
Surface fragment cover <=3"	0 – 10 %
Surface fragment cover >3"	0 – 10 %

Available water capacity (0-100.1cm)	10 – 20 cm
Soil reaction (1:1 water) (0-50cm)	5.5 – 10
Subsurface fragment volume <=3" (0-150.1cm)	0 – 40 %
Subsurface fragment volume >3" (0-150.1cm)	0 – 20 %

Ecological dynamics

Snowy Loamy Till tends to share the same ecological dynamics as Natureserve/Landfire system, Laurentian-Acadian Northern Hardwoods Forest. Stand replacing fires occurred every 1650-6500 years, while light surface fires were very rare. Overstory was dominated by late successional beech (*Fagus grandifolia*) and maple (*Acer* spp.). Understory was dominated by shade-tolerant and calcium and nitrogen dependent forbs such as blue cohosh (*Caulophyllum thalictroides*). Kotar community, AFOCa (*Acer saccharum*-*Fagus grandifolia*/*Osmorhiza claytonii*-*Caulophyllum thalictroides*), understory indicator species include: *Acer saccharum*, *Actaea pachypoda*, *Adiantum pedatum*, *Allium tricoccum*, *Arisaema triphyllum*, *Botrypus virginianus*, *Carex plantaginea*, *Caulophyllum thalictroides*, *Dryopteris carthusiana*, *Galium triflorum*, *Maianthemum canadense*, *Osmorhiza claytonii*, *Polygonatum pubescens*, and *Trillium grandiflorum* (Sugar Maple, White Baneberry, Maidenhair Fern, Ramps, Jack-in-the-pulpit, Rattlesnake Fern, Plantain-Leaf Sedge, Blue Cohosh, Spinulose Woodfern, Fragrant Bedstraw, Canada Mayflower, Hairy Sweet-cicely, Downy Solomon's-seal, and Great White Trillium).

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 (%)
-------	-------------	--------	-----------------	----------------------	------------------

Table 6. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
-------	-------------	--------	-----------------	----------------------	------------------

Table 7. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
-------	-------------	--------	-----------------	----------------------	------------------

Table 8. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
-------	-------------	--------	-----------------	----------------------	------------------

Table 9. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
-------	-------------	--------	-----------------	----------------------	------------------

Table 10. Community 2.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
-------	-------------	--------	-----------------	----------------------	------------------

Table 11. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
-------	-------------	--------	-----------------	----------------------	------------------

Table 12. Community 3.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
-------	-------------	--------	-----------------	----------------------	------------------

Other references

A PROVISIONAL ECOLOGICAL SITE is a conceptual grouping of soil map unit components within a major land resource area (MLRA) based on the similarities in response to management. A provisional ecological site is a first approximation based on a cursory literature review, personal experience, and limited field reconnaissance. As more adequate literature review, expert opinion, and intensive plot data are collected, the site concept is subject to shifting, broadening, narrowing, subdivision, or re-aggregation in definition. Likewise, the community dynamics will be more elaborate in content, and may also change in structure, upon reaching approved status.

Future work, as described in a project plan, to validate the information in this provisional ecological site description is needed. This will include field activities to collect low and medium intensity sampling, soil correlations, and analysis of that data. Annual field reviews should be done by soil scientists and vegetation specialists. A final field review, peer review, quality control, and quality assurance reviews of the ESD will be needed to produce the final document. Annual reviews of the project plan are to be conducted by the Ecological Site Technical Team.

Albert, D. A. et al., 1995. Vegetation circa 1800 of Michigan. Michigan's native landscape as interpreted from the General Land Office Surveys 1816-1856 (digital map), Lansing: Michigan Natural Features Inventory.

Baker, M.E. and Barnes, B.V., 1998. Landscape ecosystem diversity of river floodplains in northwestern Lower Michigan, USA. Canadian Journal of Forest Research, 28(9), pp.1405-1418.

Barnes, B. V. and Wagner, W. H., 2004. Michigan trees: a guide to the trees of the Great Lakes region. Ann Arbor (Michigan): University of Michigan Press.

Burger, T. L. and Kotar, J., 2003. A Guide to Forest Communities and Habitat Types of Michigan. Madison, Wisconsin: Department of Forest Ecology and Management, University of Wisconsin.

Cleland, D. T. et al., 1994. Field guide: Ecological classification and inventory system of the Huron-Manistee National Forests, s.l.: USDA Forest Service, North Central Forest Experiment Station.

Kost, M. A. et al., 2010. Natural Communities of Michigan: Classification and Description, Lansing, MI: Michigan Natural Features Inventory.

Landfire, 2017. Landfire Biophysical Settings Review Site. Accessed May, 2017 <http://www.landfirereview.org/descriptions.html>.

U.S. Department of the Interior, Geological Survey, 2011. LANDFIRE: LANDFIRE 1.1.0 Existing Vegetation Type layer. <http://landfire.cr.usgs.gov/viewer/>

USFS, Witness Tree data for northern Lower Michigan.

Contributors

Gregory J. Schmidt

Approval

Greg Schmidt, 9/10/2024

Acknowledgments

The following individuals made substantive comments regarding the development of the Provisional Ecological Sites: Randy Swaty, The Nature Conservancy; Trevor Hobbs, USFS; Richard A. Corner, USFS; Andy Henriksen, NRCS; Dan Zay, NRCS.

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	09/11/2026
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:
