

## Ecological site F094AA005MI Snowy Rich Sandy Drift

Last updated: 11/25/2024  
Accessed: 05/12/2025

### 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.

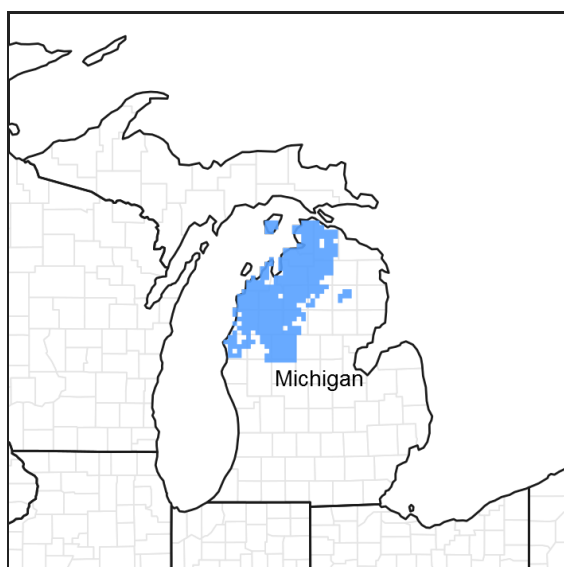


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

### 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 AFO, in the Kotar system. This site corresponds to the Herb-Poor Moraines, ecological land type phases 40-43, in the USFS Ecological Land Type system.

Ecological site concept

The central concept of Snowy Rich Sandy Drift is uplands with a seasonal high watertable greater than 100 cm in depth (excessively drained to well drained) and a dark brown spodic (Bhs) horizon present in soil profile. Site occurs on sandy drift (outwash, ice contact, or lake plains) where soil textures are sand or loamy sand (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 poor herb understory and a low fire frequency.

Associated sites

F094AA006MI	Snowy Sandy Drift
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Similar sites

F094AB018MI	Rich Sandy Drift
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Table 1. Dominant plant species

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

Physiographic features

Site occurs on coarse textured ice contact, glacial till, outwash, and lake plain deposits. Landforms are gently to steeply sloping.

Table 2. Representative physiographic features

Landforms	(1) Kame (2) Moraine
Runoff class	Negligible to medium
Elevation	189–518 m
Water table depth	150 cm
Aspect	Aspect is not a significant factor

## Climatic features

The warmest six months average 14.2 to 15.9 °C (58 to 61 °F). Temperatures generally decrease with elevation and latitude. 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)	92-109 days
Freeze-free period (characteristic range)	124-139 days
Precipitation total (characteristic range)	838-914 mm
Frost-free period (actual range)	87-119 days
Freeze-free period (actual range)	122-142 days
Precipitation total (actual range)	813-940 mm
Frost-free period (average)	100 days
Freeze-free period (average)	130 days
Precipitation total (average)	864 mm

## Climate stations used

- (1) GAYLORD 9SSW [USC00203099], Gaylord, MI
- (2) CADILLAC [USW00014817], Cadillac, MI
- (3) EAST JORDAN [USC00202381], East Jordan, MI
- (4) BOYNE FALLS [USC00200925], Boyne City, MI
- (5) GAYLORD [USC00203096], Gaylord, MI
- (6) BIG RAPIDS WTR WKS [USC00200779], Big Rapids, MI
- (7) LAKE CITY EXP FARM [USC00204502], Lake City, MI

## Influencing water features

Seasonal water table is deeper than 100 cm.

## Soil features

Soils are well drained to excessively well drained sands. They are commonly classified Typic Haplorthods, Lamellic Haplorthods, and Alfic Haplorthods, and commonly mapped as Kalkaska, Leelanau, and Islandlake series or components. The top 50 cm has a typical pH of 5.4 and is 90% sand and 1.1% organic matter. At depth, pH ranges up to 6.5, and texture averages 90% sand and 5% clay. Depth to impeded hydraulic conductivity or root restrictive layers averages >200 cm. Depth to carbonates averages >200 cm.

**Table 4. Representative soil features**

Parent material	(1) Outwash
Surface texture	(1) Sand
Drainage class	Well drained to excessively drained
Permeability class	Moderately rapid to rapid
Soil depth	201 cm
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0–1%
Available water capacity (0-100.1cm)	3.99–10.01 cm

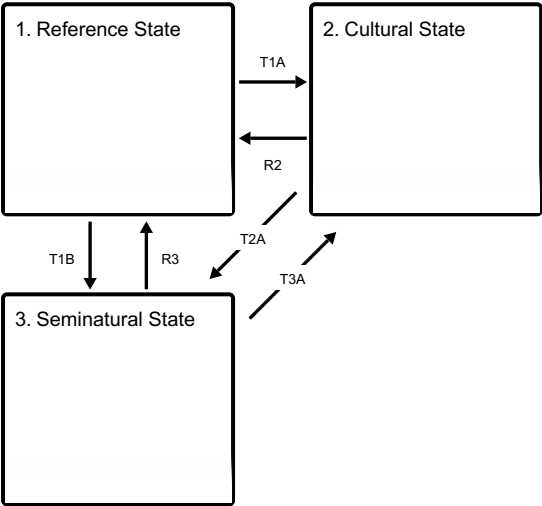
Soil reaction (1:1 water) (0-50cm)	3.5–6
Subsurface fragment volume <=3" (0-150.1cm)	0–10%
Subsurface fragment volume >3" (0-150.1cm)	0–5%

Ecological dynamics

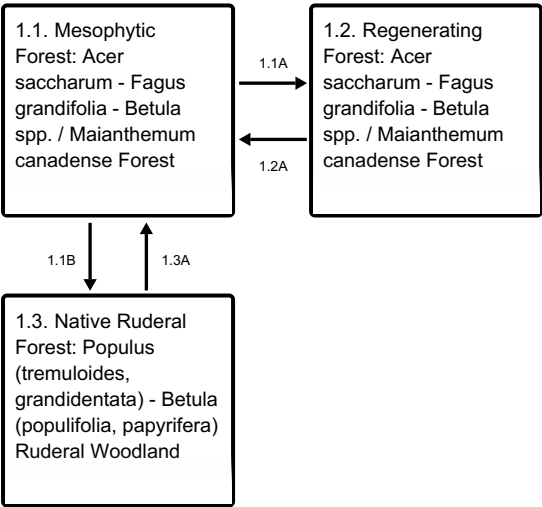
Snowy Rich Sandy Drift tends to share the same ecological dynamics as Natureserve/Landfire system, Laurentian-Acadian Northern Hardwoods Forest. Stand replacing fires occurred every 1650-6500 years, while light surface fires were very rare. Overstory was dominated by late successional beech (*Fagus grandifolia*) and maple (*Acer* spp.). Understory is composed of shade tolerant, high nitrogen dependent, but acid tolerant forbs such as sweet cicely (*Osmorhiza claytonii*). Kotar community, AFO (*Acer saccharum*-*Fagus grandifolia*/*Osmorhiza claytonii*), understory indicator species include: *Acer saccharum*, *Actaea pachypoda*, *Botrypus virginianus*, *Dryopteris carthusiana*, *Eurybia macrophylla*, *Galium triflorum*, *Maianthemum canadense*, *Osmorhiza claytonii*, *Polygonatum pubescens*, and *Trillium grandiflorum* (Sugar Maple, White Baneberry, Rattlesnake Fern, Spinulose Woodfern, Big-leaved Aster, Fragrant Bedstraw, Canada Mayflower, Hairy Sweet-cicely, Downy Solomon's-seal, and Great White Trillium).

State and transition model

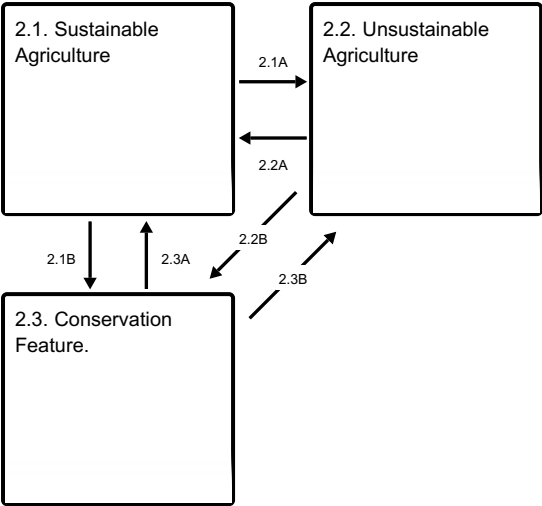
Ecosystem states



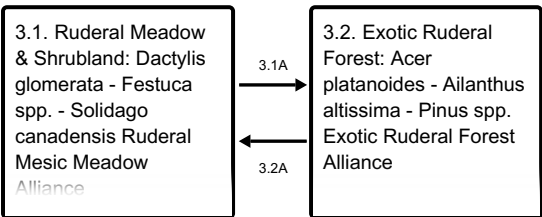
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1  
Reference State

**Community 1.1**  
**Mesophytic Forest: Acer saccharum - Fagus grandifolia - Betula spp. / Maianthemum canadense Forest**

**Community 1.2**  
**Regenerating Forest: Acer saccharum - Fagus grandifolia - Betula spp. / Maianthemum canadense Forest**

**Community 1.3**  
**Native Ruderal Forest: Populus (tremuloides, grandidentata) - Betula (populifolia, papyrifera) Ruderal Woodland**

**Pathway 1.1A**  
**Community 1.1 to 1.2**

Blowdown/clearcut

**Conservation practices**

Forest Stand Improvement

**Pathway 1.1B**  
**Community 1.1 to 1.3**

Blowdown/clearcut

**Conservation practices**

Early Successional Habitat Development/Management

**Pathway 1.2A**  
**Community 1.2 to 1.1**

Succession

**Pathway 1.3A**  
**Community 1.3 to 1.1**

Succession

**Conservation practices**

Tree/Shrub Site Preparation
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Tree/Shrub Establishment
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**State 2**  
**Cultural State**

**Community 2.1**  
**Sustainable Agriculture**

**Community 2.2**  
**Unsustainable Agriculture**

**Community 2.3**  
**Conservation Feature.**

Can be a grassed waterway, conservation reserve, a small patch pollinator garden, or other land taken out of its primary cultural production to mitigate or reduce impacts of adjacent land use, and is not by itself a permanent restoration of a complete native biological community and associated ecosystem services.

**Pathway 2.1A**  
**Community 2.1 to 2.2**

Apply unsustainable farming techniques.

**Pathway 2.1B**  
**Community 2.1 to 2.3**

Establish conservation feature.

**Conservation practices**

Conservation Cover
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Grassed Waterway
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**Pathway 2.2A**  
**Community 2.2 to 2.1**

Apply sustainable farming techniques.

**Conservation practices**

Conservation Crop Rotation
Cover Crop
Nutrient Management
Integrated Pest Management (IPM)

## **Pathway 2.2B**

### **Community 2.2 to 2.3**

Establish conservation feature.

#### **Conservation practices**

Conservation Cover
Grassed Waterway

## **Pathway 2.3A**

### **Community 2.3 to 2.1**

Revert to sustainable agriculture.

#### **Conservation practices**

Conservation Crop Rotation
Cover Crop
Nutrient Management
Integrated Pest Management (IPM)

## **Pathway 2.3B**

### **Community 2.3 to 2.2**

Revert to unsustainable agriculture.

## **State 3**

### **Seminatural State**

**Community 3.1**  
**Ruderal Meadow & Shrubland: *Dactylis glomerata* - *Festuca* spp. - *Solidago canadensis***  
**Ruderal Mesic Meadow Alliance**

**Community 3.2**  
**Exotic Ruderal Forest: *Acer platanoides* - *Ailanthus altissima* - *Pinus* spp. Exotic Ruderal Forest Alliance**

## **Pathway 3.1A**

### **Community 3.1 to 3.2**

Succession

## **Pathway 3.2A**

### **Community 3.2 to 3.1**

Blowdown/clearcut

## **Transition T1A**

### **State 1 to 2**

Clear vegetation; cultivate domesticated species

## **Transition T1B**

### **State 1 to 3**

Clear vegetation, invasive species introduced

## **Restoration pathway R2**

### **State 2 to 1**

Remove domesticated species; restore native species

#### **Conservation practices**

Brush Management
Tree/Shrub Site Preparation
Tree/Shrub Establishment
Restoration and Management of Rare and Declining Habitats
Upland Wildlife Habitat Management
Herbaceous Weed Control

## **Transition T2A**

### **State 2 to 3**

Abandoned, succession

## **Restoration pathway R3**

### **State 3 to 1**

Control invasive species; restore native species

#### **Conservation practices**

Brush Management
Tree/Shrub Site Preparation
Tree/Shrub Establishment
Restoration and Management of Rare and Declining Habitats
Upland Wildlife Habitat Management
Herbaceous Weed Control

## **Transition T3A**

### **State 3 to 2**

Clear vegetation; cultivate domesticated species

## **Additional community tables**

### **Inventory data references**

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.

## **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.

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## **Contributors**

Gregory J. Schmidt

# Approval

Greg Schmidt, 11/25/2024

## 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	11/25/2024
Approved by	Greg Schmidt
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

## Indicators

1. **Number and extent of rills:**  

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2. **Presence of water flow patterns:**  

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3. **Number and height of erosional pedestals or terracettes:**  

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**  

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5. **Number of gullies and erosion associated with gullies:**  

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6. **Extent of wind scoured, blowouts and/or depositional areas:**  

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7. **Amount of litter movement (describe size and distance expected to travel):**  

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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:**
-