Ecological site F096XA006MI
Snowy Rich Sandy Drift

Last updated: 10/03/2019
Accessed: 04/24/2024

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.

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): 096X–Northwestern Michigan Fruit Belt

This area is dominated by outwash plains and moraines. Lake plains, till plains, drumlins, and sand dunes are found locally across the area. The terrain is steep on stream carved moraines, ice contact ridges, and sand dunes, and flat on outwash plains and lake plains. Elevation ranges from 177 to 369 m (580 to 1210 ft). Local topographic relief averages 11 m (35 ft) in the south to 20 m (65 ft) in the north and ranges up to a maximum of 158 m (520 ft) at Empire Bluff (Sleeping Bear Dunes). Much of the area rises sharply from the lakeshore to the adjoining hilltops. The Manistee River is the longest river in this area. Its trout fishery is maintained by constant inflow of cool ground water from the porous sand dominated landscape. The Pine and Pere Marquette Rivers also occur in this MLRA. Surficial topography are formed of glacial deposits except for local areas with dune building near Lake Michigan. Most of the bedrock surface is at or below the elevation of Lake Michigan, and is exposed in only in limited extents near Charlevoix. The bedrock, all Paleozoic in age, is the Traverse Group and the Dundee Limestone. These Silurian-Devonian rocks are mostly limestone and dolomite with some interbedded shale, chert, and anhydrite stringers. The drumlin belts in the northern portion of the area is the most affected by the limestone nearer to the surface in terms of carbonates in the till.

About two-thirds of this area is in small, privately owned holdings, and one-third consists mostly of State forests. The forests are used mainly for timber production and recreation. The growth of orchard crops and other crops and dairy and beef operations are important enterprises in the area. Forage and feed grains for dairy and other livestock

are the principal crops. Asparagus, wheat, oats, corn, and hay are commonly grown in the area. Orchard products include sweet and tart cherries, apples, plums, and peaches. The Manistee National Forest and Sleeping Bear Dunes National Lakeshore are among the more notable conservation lands in the area. Nordhouse Dunes Wilderness Area is within the Manistee National Forest. Sections of the Pere Marquette, Pine, and Manistee Rivers, and Bear Creek have been designated as National Wild and Scenic Rivers.

Summary of existing land use:
Upland Forest (47%)
Hardwood (38%)
Conifer (7%)
Developed (16%)
Swamps and Marshes (12%)
Agricultural (10%)
Open Water (8%)
Grassland (6%)

Classification relationships

According to the USFS (Bailey) system of ecoregions, the site is located mostly within 212Hd (Grand Traverse Ground Moraine) and 212Hf (Grand Traverse Drumlin Fields) subsections. According to the EPA (Omernik) system of ecoregions, the site is located in 51m (Manistee-Leelanau Shore) and 51n (Platte River Outwash) 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 moderately 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 north of Manistee River, where fire was rare. Area with a more northern flora than sites further south. Vegetation trending towards mesophytic forest with a poor herb understory and a low fire frequency.

Table 1. Dominant plant species

Tree	(1) *Acer saccharum* (2) *Fagus grandifolia*
Shrub	Not specified
Herbaceous	(1) *Osmorhiza claytonii*

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 (3) Lake plain

Climatic features

Mean annual temperatures are 7.1 to 8.0 °C (45 to 46 °F). The warmest six months average 15.3 to 16.2 °C (60 to 61 °F). Mean July temperatures range from 19.8 to 20.7 °C (68 to 69 °F). Mean January temperatures range from -6.7 to -4.2 °C (20 to 24 °F). The maximum monthly average daily highs are 24.2 to 27.4 °C (76 to 81 °F). The minimum monthly average daily lows are -10.8 to -7.2 °C (13 to 19 °F). Mean annual precipitation ranges from 780

to 880 mm (31 to 35 in). Prevailing winds pick up moisture from the Great Lakes in the form of lake effect rain and snow showers during fall and winter seasons, and in the form of fog during spring and summer. Thunderstorm intensity is reduced by temperature inversions over the lake during the spring and early summer when lake water is cools the air flowing over it. Average 0 °C (32 °F) frost-free season ranges from 108 to 161 days. Average -2 °C (28 °F) freeze-free season is 141 to 194 days increasing in length from north to south and decreasing in length from the lakeshore inward. Mean annual snowfall ranges from 2.1 to 3.4 m (60 to 130 in). Mean annual extreme minimum temperatures range from -29 to -18.9 °C (-20 to -2 °F), or hardiness zones 4b to 6b.

Table 3. Representative climatic features

Frost-free period (average)	122 days
Freeze-free period (average)	155 days
Precipitation total (average)	34 in

Climate stations used

- (1) FRANKFORT 2NE [USC00202984], Frankfort, MI
- (2) NW MICHIGAN RSCH FM [USC00206012], Suttons Bay, MI
- (3) NORTHPORT 2W [USC00206007], Northport, MI
- (4) TRAVERSE CITY CHERRY CPTL AP [USW00014850], Traverse City, MI
- (5) CHARLEVOIX [USC00201468], Charlevoix, MI
- (6) MAPLE CITY 1E [USC00205097], Cedar, MI
- (7) PETOSKEY [USC00206507], Petoskey, MI

Influencing water features

Lower slope positions and finer substrates may have a seasonal high water table 100-200 cm in depth. Well drained upper slope positions are 200 cm or more from the water table.

Soil features

Soils are well drained to excessively well drained sands. They are commonly classified Typic Haplorthods, Alfic Haplorthods, and Lamellic Haplorthods, and commonly mapped as Kaleva, Leelanau, and Kalkaska series or components. The top 50 cm has a typical pH of 5.4 and is 90% sand and 0.9% organic matter. At depth, pH ranges up to 6.4, 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.

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

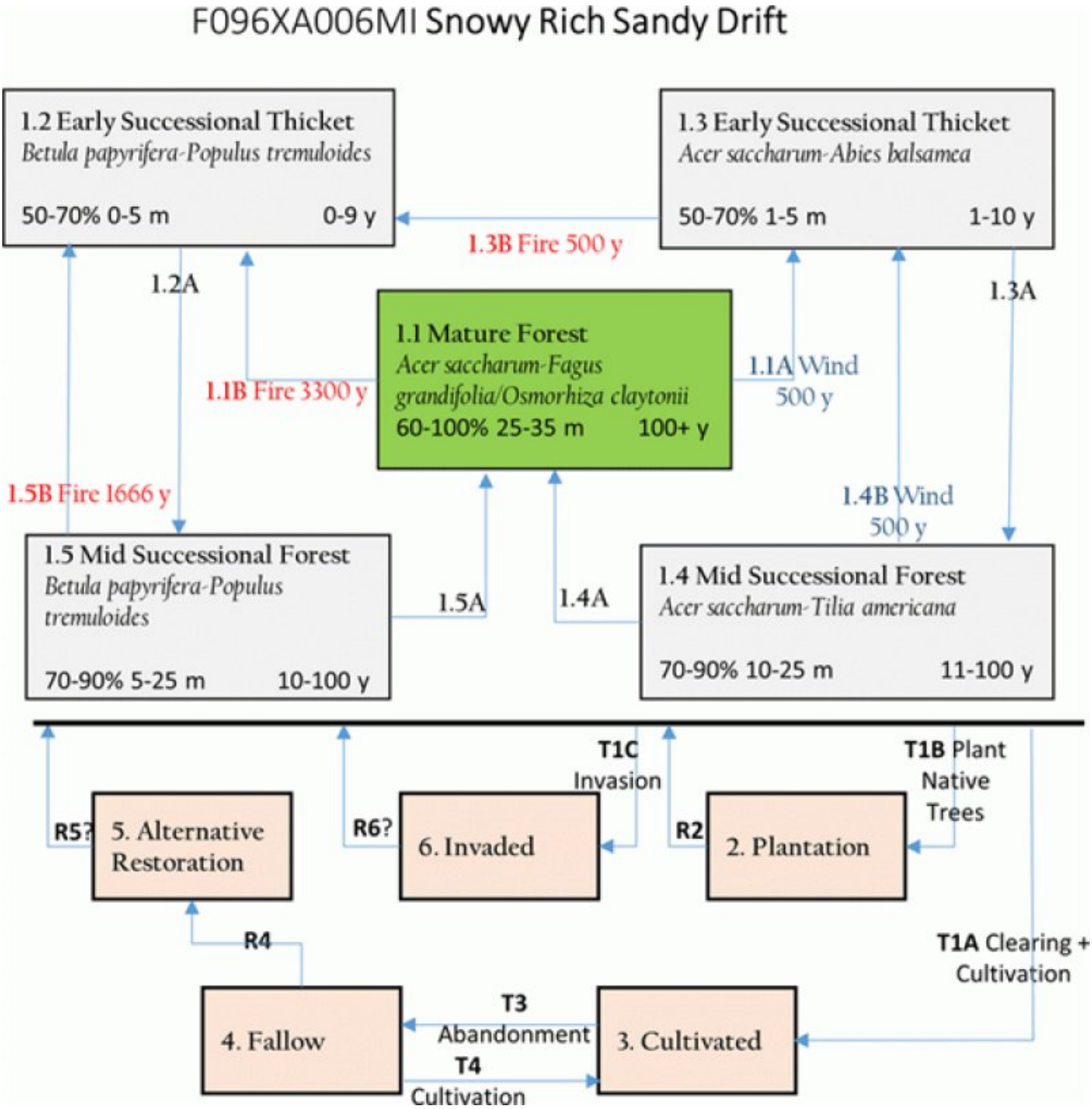
F096XA006MI Snowy Rich Sandy Drift
1.2 Early Successional Thicket
Betula papyrifera-Populus tremuloides
50-70% 0-5 m
0-9 y
1.3 Early Successional Thicket
Acer saccharum-Abies balsamea
50-70% 1-5 m
1-10 y
1.3B Fire 500 y
1.2A
1.3A
1.1 Mature Forest
Acer saccharum-Fagus grandifolia/Osmorhiza claytonii
60-100% 25-35 m
100+ y
1.1B Fire 3300 y
1.1A Wind 500 y
1.5B Fire 1666 y
1.4B Wind 500 y
1.5 Mid Successional Forest
Betula papyrifera-Populus tremuloides
70-90% 5-25 m
10-100 y
1.5A
1.4A
1.4 Mid Successional Forest
Acer saccharum-Tilia americana
70-90% 10-25 m
11-100 y
T1C Invasion
T1B Plant Native Trees
R5?
5. Alternative Restoration
R6?
6. Invaded
R2
2. Plantation
R4
T1A Clearing + Cultivation
4. Fallow
T3 Abandonment
T4 Cultivation
3. Cultivated

Figure 6. stm

Legend

1.1A	Excess wind every 500 years
1.1B	Replacement fire every 3300 years
1.2A	Succession
1.3A	Succession
1.3B	Replacement fire every 500 years
1.4A	Succession
1.4B	Excess wind every 500 years
1.5A	Succession
1.5B	Replacement fire every 1666 years
R2	Restoration
R4	Restoration
R5	Restoration?
R6	Restoration?
T1A	Clearing + cultivation of crops
T1B	Clearing + plant native trees in rows
T1C	Invasive species introduction
T3	Abandonment + invasive species
T4	Cultivation

Figure 7. legend

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
Forest Stand Improvement

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
Tree/Shrub Establishment

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
Grassed Waterway

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

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.

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Contributors

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Approval

Nels Barrett, 10/03/2019

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	
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:**