USDA Natural Resources Conservation Service

Ecological site R094CY001MI
Cobble Shore And Fen Complex

Last updated: 9/11/2024
Accessed: 05/20/2025

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.

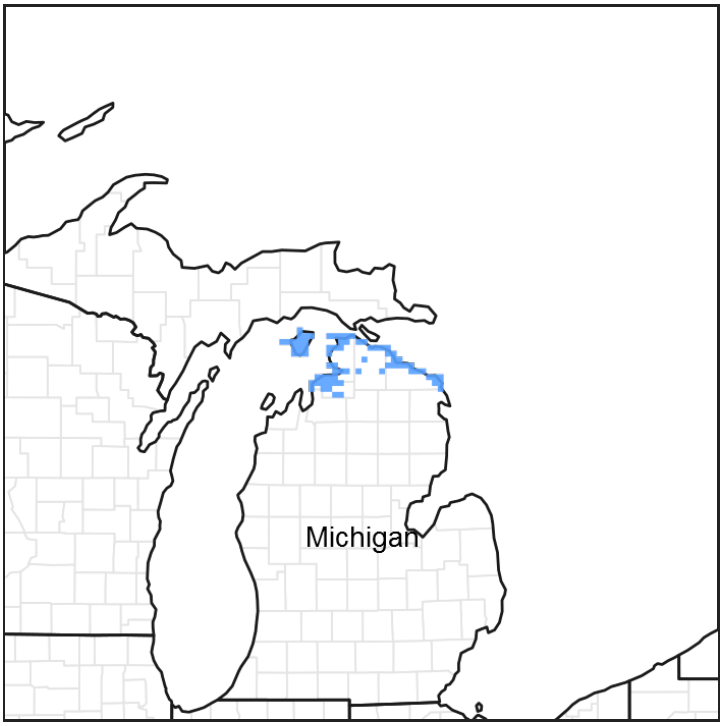


Figure 1. Mapped extent

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): 094C–Northern Michigan Limestone Lake Plains

This area is dominated by lake plains, some of which are till-floored plains. Drumlins, moraines, and outwash plains occur throughout the area. The terrain includes flat outwash

and lake plains and steep slopes in areas of moraines. Elevation ranges from 177 to 300 m (580 to 985 ft). Local topographic relief averages 7 m and ranges up to 79 m (25 to 260 ft). The Cheboygan, Ocqueoc, and Thunder Bay Rivers are the major streams in the area. This area is covered with thin to thick glacial deposits. Bedrock is generally at shallow depths and is evident throughout the area. It consists of Devonian limestone and dolomite with interbedded shale, chert, and anhydrite stringers. Karst features are very common in the area.

About two-thirds of this MLRA is in small, privately owned holdings, and the other third consists of State forestland. The forests are used mainly for timber production and recreation. Dairy and beef operations are very important enterprises in the area. Forage and feed grain crops for dairy cattle and other livestock are the principal crops. Wheat, oats, corn, potatoes, and hay also are grown. Wilderness State Park Natural Area, Negwegon State Park, Atlanta State Forest, and Beaver Island State Wildlife Research Area are among the more notable conservation lands in the area.

Summary of existing land use:
Upland Forest (40%)
Hardwood (24%)
Conifer (14%)
Swamps and Marshes (32%)
Developed (10%)
Agricultural (8%)
Open Water (6%)

Classification relationships

According to the USFS (Bailey) system of ecoregions, the site is located mostly within 212Hj (Presque Isle Lake and Till Plains) and 212Hl (Valders Red Till and Sandy Lake Plain) subsections. According to the EPA (Omernik) system of ecoregions, the site is located in 50ab (Cheboygan Lake Plain) and eastern 50ac (Onaway Moraines) level IV ecoregions. This site concept is outside the range of the USFS Ecological Land Type classification and the Kotar system.

Ecological site concept

The central concept of Cobble Shore and Fen Complex is cobble, limestone and sandy beaches and swales adjacent to open Great Lakes subject to occasional strong winds and large surf and ice scour. Vegetation ranges from meadow to fen and marsh.

Associated sites

F094CY028MI	**Cool Loamy Till**
F094CY028MI	**Cool Loamy Till**

Similar sites

R096XY001MI	**Coastal Dune Complex**

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Hypericum kalmianum*
Herbaceous	(1) *Clinopodium arkansanum* (2) *Iris lacustris*

Physiographic features

Site is formed of sand, gravel, and cobble, eroded and re-deposited by shoreline processes (waves and littoral currents).

Table 2. Representative physiographic features

Landforms	(1) Beach (2) Shoreline
Runoff class	Negligible to low
Flooding duration	Extremely brief (0.1 to 4 hours) to very long (more than 30 days)
Flooding frequency	Very rare to very frequent
Elevation	176–177 m
Water table depth	0–150 cm
Aspect	Aspect is not a significant factor

Climatic features

Mean annual temperatures are 6.0 to 7.1 °C (43 to 45 °F). The warmest six months average 14.6 to 15.4 °C (58 to 60 °F). Mean July temperatures range from 19.1 to 20.2 °C (66 to 68 °F). Mean January temperatures range from -7.9 to -5.9 °C (18 to 21 °F). The maximum monthly average daily highs are 24.1 to 27.3 °C (75 to 81 °F). The minimum monthly average daily lows are -13.3 to -9.4 °C (8 to 15 °F). Mean annual precipitation ranges from 720 to 810 mm (28 to 32 in). The western one-third of the area is wetter than the eastern two-thirds. The precipitation occurs as both rain during the growing season and snow in winter. Average 0 °C (32 °F) frost-free season ranges from 100 to 161 days. Average -2 °C (28 °F) freeze-free season is 137 to 188 days. Mean annual snowfall ranges from 1.6 to 2.9 m (60 to 110 in). Mean annual extreme minimum temperatures range from -31.6 to -23 °C (-25 to -9 °F), or hardiness zones 4b to 6a.

Table 3. Representative climatic features

Frost-free period (characteristic range)	107-127 days
Freeze-free period (characteristic range)	135-166 days
Precipitation total (characteristic range)	762 mm
Frost-free period (actual range)	102-134 days
Freeze-free period (actual range)	124-176 days
Precipitation total (actual range)	762-787 mm
Frost-free period (average)	117 days
Freeze-free period (average)	151 days
Precipitation total (average)	762 mm

Climate stations used

- (1) ROGERS CITY [USC00207094], Rogers City, MI
- (2) ALPENA WWTP [USW00014814], Alpena, MI
- (3) CROSS VILLAGE 1E [USC00201896], Harbor Springs, MI
- (4) CHEBOYGAN [USC00201492], Cheboygan, MI

Influencing water features

Surface waters of the Great Lakes have the greatest influence on this site, though groundwater seeps may occur inland. See ecological dynamics for details on water level variability.

Soil features

Soils are very poorly drained to well drained sands, gravels, cobbles, mucks, or exposed bedrock. They are commonly classified Spodic Udipsamments, and commonly mapped as Deer Park, Lake beaches, and Stony lake beaches series or components. The top 50 cm has a typical pH of 5.8 and is 95% sand and 0.3% organic matter. At depth, pH ranges up to 5.8, and texture averages 95% 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) Lacustrine deposits (2) Residuum–limestone and dolomite

Surface texture	(1) Very cobbly sand (2) Very cobbly (3) Very channery sand (4) Sand (5) Very gravelly sand
Drainage class	Well drained to poorly drained
Permeability class	Moderately rapid to rapid
Soil depth	0–201 cm
Surface fragment cover <=3"	1–95%
Surface fragment cover >3"	1–95%
Available water capacity (0-100.1cm)	2.01–10.01 cm
Soil reaction (1:1 water) (0-50cm)	7–8
Subsurface fragment volume <=3" (0-150.1cm)	5–35%
Subsurface fragment volume >3" (0-150.1cm)	5–15%

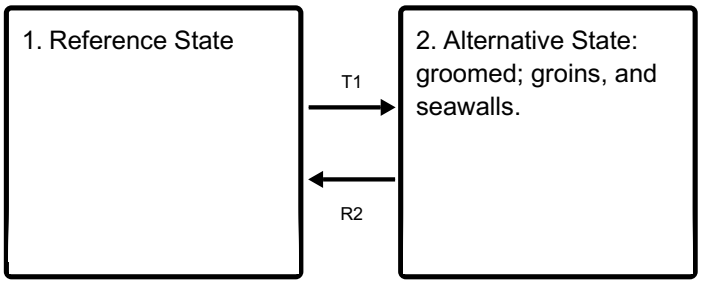
Ecological dynamics

Cobble Shore and Fen Complex tends to share the same ecological dynamics as Natureserve/Landfire system, Great Lakes Alkaline Rocky Shore and Cliff. Due to discontinuous fuels and water barriers, stand replacing fires rarely occurred, while light to moderate intensity fires occurred every 250-1050 years. Sites are in relatively sheltered coastline and often winds are offshore, resulting in mostly calm conditions throughout the year. The shallow waters tend to break up the limited wave activity and allow for emergent vegetation to develop in some areas. Seas are calm for 89% of the late spring and summer along even the most exposed shoreline with waves less than 0.5 m (periods <3 s). Calm periods are regularly interrupted by storms with waves of 0.5-1 m (periods 5-6 s). From fall through early spring, exposed shorelines are subject to wave action for 35% of the time, with average wave heights greater than 0.5 m (period >4 s). Peak storm waves in fall through early spring are typically 1-2 m (periods 5-6 s). The fairly short period local wind waves do not have the same run-up as waves produced along areas with larger upwind fetches. More important, however, is ice scour. Sheltered, shallower, and more northern lakeshores tend to have large ice shelves, which upon breakup, are occasionally blown inland. Moving ice may scrape the lake bottom nearshore, the its large momentum may plow into the shoreline, reducing vegetation cover for large distances inland. During low water years, more beach is exposed (>1000 m). Swales support open pools surrounded by marshy vegetation. The height of the water table of the swales is largely controlled by average lake levels. Water levels rise and fall on annual cycles of about a 30 cm, peaking in summer. Average water levels vary more than 1 m over periods of 20

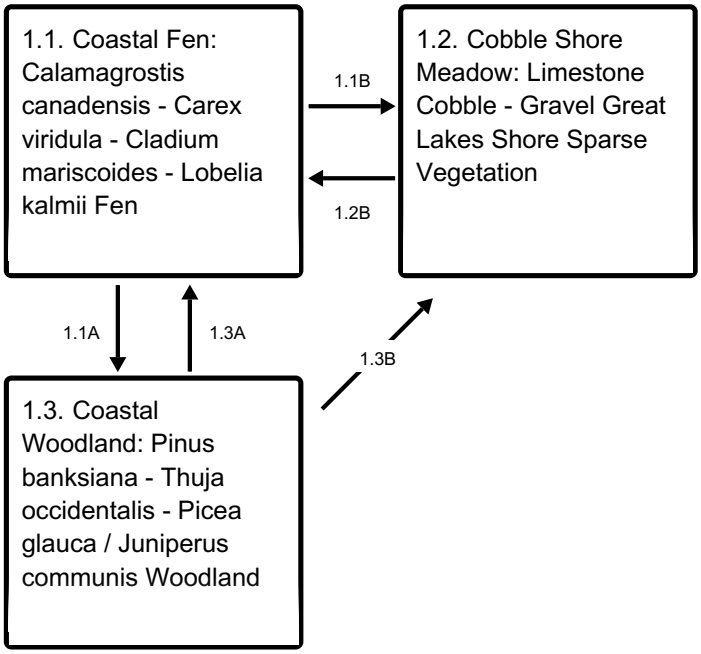
years or more due to trends in basin wide precipitation and evaporation. Maximum range within the last century has been about 2 m. The limestone near the surface supports calcium-loving shrubs like Kalm's St. John's wort (*Hypericum kalmianum*) and shrubby cinquefoil (*Dasiphora fruticosa*), and forbs like limestone calamint (*Clinopodium arkansanum*) and Great Lakes endemic, dwarf lake iris (*Iris lacustris*).

State and transition model

Ecosystem states



State 1 submodel, plant communities



State 1
Reference State

Dominant plant species

- Kalm's St. Johnswort (*Hypericum kalmianum*), shrub
- limestone calamint (*Clinopodium arkansanum*), other herbaceous
- dwarf lake iris (*Iris lacustris*), other herbaceous

Community 1.1
Coastal Fen: Calamagrostis canadensis - Carex viridula - Cladium mariscoides - Lobelia kalmii Fen

Community 1.2
Cobble Shore Meadow: Limestone Cobble - Gravel Great Lakes Shore Sparse Vegetation

Community 1.3
Coastal Woodland: Pinus banksiana - Thuja occidentalis - Picea glauca / Juniperus communis Woodland

Pathway 1.1B
Community 1.1 to 1.2

Rising lake level.

Pathway 1.1A
Community 1.1 to 1.3

Succession.

Pathway 1.2B
Community 1.2 to 1.1

Falling lake level.

Pathway 1.3A
Community 1.3 to 1.1

Storm wave action or wind driven winter ice.

Pathway 1.3B
Community 1.3 to 1.2

Rising lake level with tree mortality.

State 2
Alternative State: groomed; groins, and seawalls.

The natural flow of sand along shore is interrupted by groins and seawalls, dunes are kept smoothed out by bulldozers, or dredged sand is used to replenish an eroding beach.

Transition T1
State 1 to 2

Dune leveling or construction of shoreline structure which stop the flow of sand.

Restoration pathway R2
State 2 to 1

Dunegrass reestablishment, plus foredune redevelopment. Invasive species may need to be treated or removed.

Conservation practices

Brush Management
Tree/Shrub Establishment
Restoration and Management of Rare and Declining Habitats
Upland Wildlife Habitat Management
Early Successional Habitat Development/Management
Herbaceous Weed Control

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

Gregory J. Schmidt

Approval

Greg Schmidt, 9/11/2024

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	10/30/2023
Approved by	Greg Schmidt
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:**

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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):**

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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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:**
