USDA Natural Resources Conservation Service

Ecological site F099XY010MI Great Lakes Marsh

Last updated: 1/25/2024
Accessed: 05/14/2024

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.

MLRA notes

Major Land Resource Area (MLRA): 099X–Erie-Huron Lake Plain

This area is in the Eastern Lake Section of the Central Lowland Province of the Interior Plains (USDA-NRCS, 2022). It is a nearly level glacial lake plain with a few scattered ridges of sand that represent past shorelines and moraines. The Saginaw, Clinton, and Huron Rivers empty into the Great Lakes in the part of the area in Michigan. The southern half of this area is covered with glacial deposits of till, lake sediments, and outwash from the Wisconsin and older glacial periods. The area also has some low moraines. Mississippian- to Silurian-age shale, limestone, and dolomite rocks are at or near the surface close to Lake Erie and Lake Huron. Sandstone comes near the surface in the Thumb area east of Saginaw Bay, and a sandstone headland exists on a short stretch of Lake Huron shoreline. An extensive swamp in proximity the Maumee River prevented overland travel prior to its drainage by early settlers. Remnant marshes are near the Lake Erie shore.

The dominant soils in this MLRA are Alfisols, Inceptisols, Mollisols, and Spodosols. The soils in the area dominantly have a mesic soil temperature regime, an aquic soil moisture regime, and mixed or illitic mineralogy. Most soils in MLRA 99 are very deep, generally somewhat poorly drained to very poorly drained, and loamy or clayey. Epiaqualfs (Blount, Hoytville, Nappanee, and Shebeon series) and Glossudalfs (Capac series) formed in till (some of which is dense) on till plains, moraines, and lake plains. Epiaquepts formed in loamy till on till plains and moraines (Kilmanagh series) and in lacustrine deposits on lake plains (Lenawee and Paulding series). Endoaquepts formed in lacustrine deposits on lake plains (Latty and Toledo series) and in loamy till on moraines (Parkhill series). Endoaquolls formed in outwash deposits on outwash plains and lake plains, in drainageways (Granby series), and in loamy till on till plains and moraines (Tappan series). Endoaquods (Pipestone series) formed in outwash deposits on outwash plains, lake plains, and beach ridges. Epiaquods (Wixom series) formed in sandy sediments over till or lacustrine deposits on till plains, outwash plains, and lake plains.

Broad flat areas of somewhat poorly drained soils support Landfire (2017) systems: North-Central Interior Beech-Maple Forest, with wetter patches of North-Central Interior Wet Flatwoods, and Central Interior and Appalachian Swamp. Sandy beach ridges and thin sand flats have Landfire (2017) systems: North-Central Interior Dry-Mesic Oak Forest and Woodland and Great Lakes Wet-Mesic Lakeplain Prairie. Central Interior and Appalachian Floodplain Systems occur adjacent to rivers that flow through the area. To the north, oak systems decline in coverage. Thin sandy flats in the north have Laurentian-Acadian Pine-Hemlock-Hardwood Forest. The north and south are best separated as ecological inference areas due to floristic and dominant vegetation contrasts which also correspond to generally lower summer and winter temperatures northward. This north-south break is approximated by the drainage divide between the Lake Huron and Lake Erie/Lake St. Clair basins.

Nearly three-fourths of this MLRA is in farms. About three-fifths of the area is cropland. The rest of the farmland is mostly in small farm woodlots, but some of the farmland is used for permanent pasture or other purposes. Cash crops are important. Corn, winter wheat, soybeans, and hay are the major crops. Sugar beets and canning crops also are important. Some fruit and truck crops are grown on the coarse textured soils. Dairying is an important enterprise on some farms near the larger cities. Almost one-fifth of the area is used for urban development. Shiawassee National Wildlife Refuge, Cedar Point National Wildlife Refuge, Oak Openings Preserve Metropark

(Ohio) are among the more notable conservation lands.

Summary of existing land use (South):
Upland Forest (7%)
Hardwood (6%)
Agricultural (60%)
Developed (28%)

Summary of existing land use (North):
Upland Forest (14%)
Hardwood (13%)
Agricultural (58%)
Developed (13%)
Swamps and Marshes (13%)

Classification relationships

The USFS ecoregion classification (Cleland et al., 2007) for the majority of MLRA 99 is the Humid Temperate, Hot Continental Division, Midwest Broadleaf Forest Province 222, Lake Whittlesey Glaciolacustrine Plain Section 222U. The ecoregion subsection composition is 222Ud (Sandusky Lake Plain) and 222Ue (Saginaw Clay Lake and Till Plain) in the north near Lake Huron and Saginaw Bay. In the south near Lake Erie, the area is composed of subsections 222Ua (Maumee Lake Plain), 222Ub (Paulding Plains), and 222Uc (Marblehead Drift/Limestone Plain). A mix of interlobate deposits extends into MLRA 99 as subsection 222Jf (Lum Interlobate Moraine) of South Central Great Lakes Section 222J. Sandy deposits extend south from adjacent MLRA are part the Warm Continental Division, Laurentian Mixed Forest Province 212, Northern Lower Peninsula Section 212H, subsection 212Hh (Gladwin Silty Lake Plain).

The Saginaw Bay and Lake Huron lake plains is coextensive with EPA ecoregion 57e (Saginaw Lake Plain) (Omernik and Griffith, 2014). The majority of the Lake Erie or Maumee Lake Plain includes EPA ecoregion 57a (Maumee Lake Plain), extending east to include 57d (Marblehead Drift/Limestone Plain). Large inclusions of sand are delineated as ecoregion 57b (Oak Openings). A significant area of higher clay is designated as 57c (Paulding Plains).

Ecological site concept

The central concept of Great Lakes Marsh is marshes located at river mouths and shallow bays of the Great Lakes, subject to storm surge and annual and decadal fluctuation in water levels.

Associated sites

F099XY001MI	**Coastal Dune Complex**
F099XY009MI	**Wet Floodplain**

Similar sites

F099XY009MI	**Wet Floodplain**
F139XY010OH	**Great Lakes Marsh**

Table 1. Dominant plant species

Tree	(1) *Typha latifolia* (2) *Schoenoplectus tabernaemontani*
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

Site occurs at the mouths of rivers draining into a large lake.

Table 2. Representative physiographic features

Landforms	(1) Estuary
Runoff class	Negligible
Flooding duration	Long (7 to 30 days) to very long (more than 30 days)
Flooding frequency	Very frequent
Elevation	173–176 m
Water table depth	0 cm
Aspect	Aspect is not a significant factor

Climatic features

This ecological site experiences a humid continental climate with mild summers and cold winters. Precipitation is moderately well distributed through the year with higher amounts during the growing season than the winter.

Temperature extremes are moderated in immediate proximity to the Great Lakes, but this moderation has minimal effect inland due to prevailing winds blowing mainly offshore. Mean annual extreme minimum temperatures range from -26.6 to -18.8 °C (-16 to -2 °F), which falls within hardiness zones 5a to 6a (USDA, 2009). In general, temperatures are cooler northward, though local city heat island effects may interrupt this pattern.

The lack of significant topographic relief and general downwind direction to the Great Lakes likely contribute to this MLRA having lower annual precipitation and snowfall compared to the MLRA to the west. Mean annual snowfall ranges from 0.7 to 1.5 m (25 to 55 in). In general, snowfall is highest northward.

Table 3. Representative climatic features

Frost-free period (characteristic range)	134-157 days
Freeze-free period (characteristic range)	179-190 days
Precipitation total (characteristic range)	813-838 mm
Frost-free period (actual range)	131-171 days
Freeze-free period (actual range)	168-200 days
Precipitation total (actual range)	813-864 mm
Frost-free period (average)	148 days
Freeze-free period (average)	185 days
Precipitation total (average)	838 mm

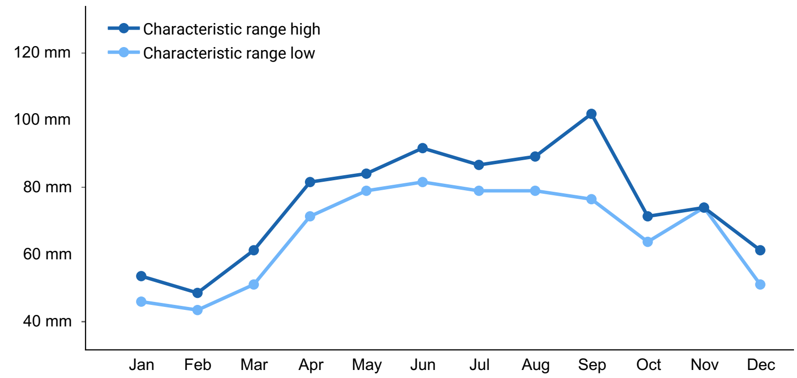


Figure 1. Monthly precipitation range

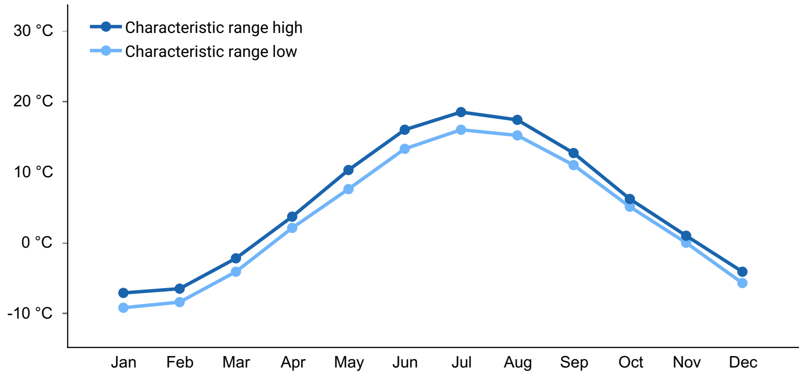


Figure 2. Monthly minimum temperature range

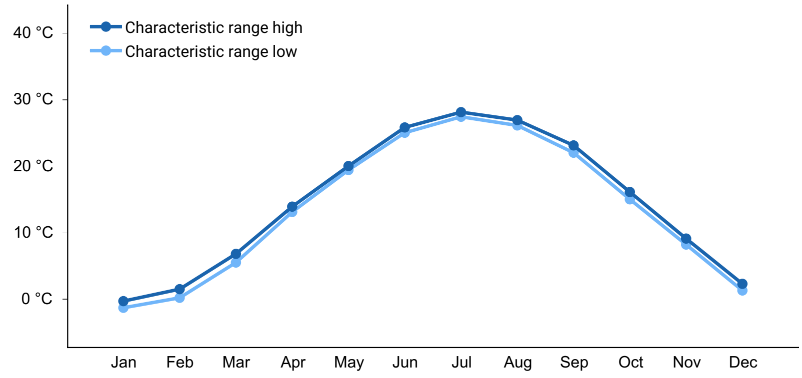


Figure 3. Monthly maximum temperature range

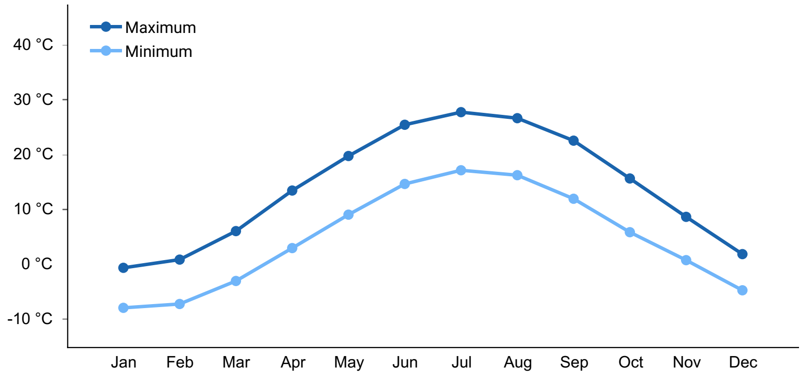


Figure 4. Monthly average minimum and maximum temperature

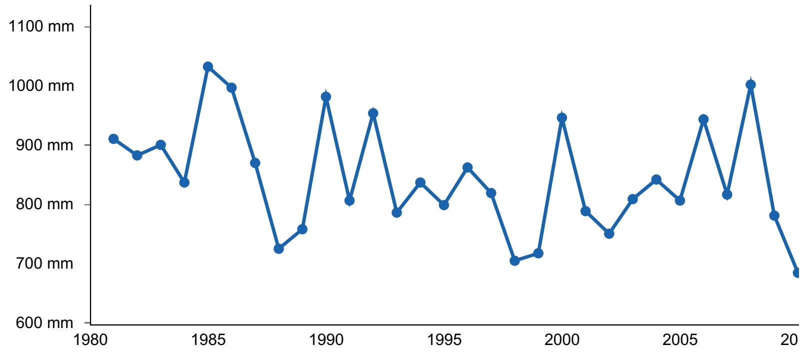


Figure 5. Annual precipitation pattern

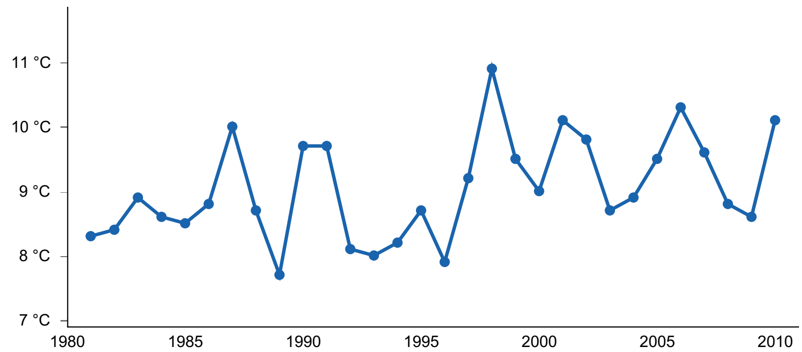


Figure 6. Annual average temperature pattern

Climate stations used

- (1) MONROE [USC00205558], Monroe, MI
- (2) SANDUSKY [USW00014846], Sandusky, OH
- (3) BAD AXE [USC00200417], Bad Axe, MI
- (4) ESSEXVILLE [USC00202631], Bay City, MI
- (5) MT CLEMENS ANG BASE [USW00014804], Harrison Township, 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 poorly drained to subaqueous muck, sand, and loam. They are not commonly classified, and are commonly mapped as water components or conflated with other wet soils.

Table 4. Representative soil features

Parent material	(1) Estuarine deposits
Surface texture	(1) Silt (2) Sand (3) Muck
Drainage class	Very poorly drained to subaqueous
Permeability class	Moderately slow to moderately rapid
Soil depth	201 cm
Surface fragment cover <=3"	0–1%
Surface fragment cover >3"	0%

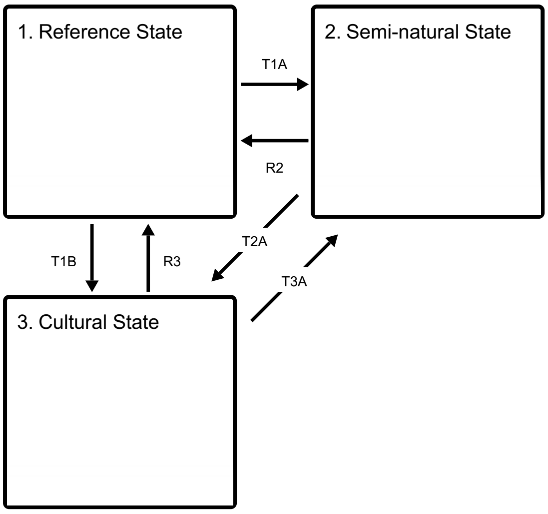
Available water capacity (0-100.1cm)	3.99–54.99 cm
Soil reaction (1:1 water) (0-50cm)	6–7
Subsurface fragment volume <=3" (0-150.1cm)	0–35%
Subsurface fragment volume >3" (0-150.1cm)	0–15%

Ecological dynamics

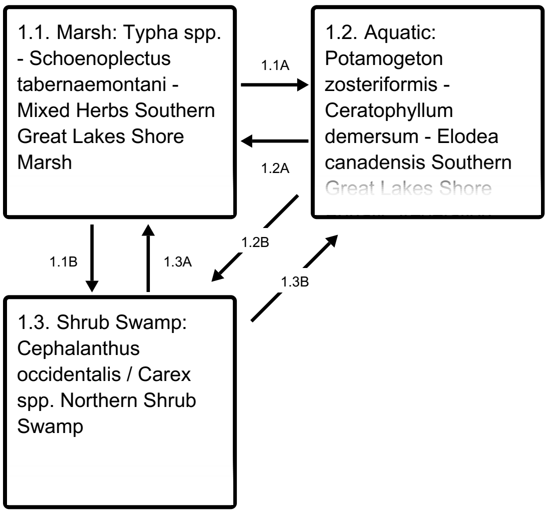
Great Lakes Marsh tends to share the same ecological dynamics as Natureserve/Landfire systems, Great Lakes Freshwater Estuary or Delta or Northern Great Lakes Coastal Marsh (Landfire, 2017). Site is subject to prolonged periods of deep inundation, rendering fire a rare event. Astronomical tides are insignificant (about 2 cm daily), but atmospheric disturbances (i.e. storm surge) may raise or lower water levels by 0.25-1 m (NOAA, 2019a). After a storm passes, water levels recover gradually after oscillating (seiches) with a period of up to half a day depending on direction of the original disturbance relative the axis of the lake. 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. Species of sedges (Cyperaceae) and rushes (Juncaceae) and cattails (Typhaceae) dominate the emergent marshes.

State and transition model

Ecosystem states



State 1 submodel, plant communities



State 2 submodel, plant communities

2.1. Exotic Ruderal Marsh: Phragmites australis ssp. australis Eastern Ruderal Marsh

State 3 submodel, plant communities

3.1. Marina, Boat Launch, Seawall, Dredged Channel, etc.

State 1
Reference State

The Reference State consists of plant-community-types in settings where natural ecological processes are operating that are unmanaged or only minimally-managed by land-use conditioning, e.g., ranging from old-growth plant community-types (sometimes construed as mature, or pre-settlement vegetation) to inherent transitional ruderal plant community-type phases.

Dominant plant species

- broadleaf cattail (*Typha latifolia*), grass
- softstem bulrush (*Schoenoplectus tabernaemontani*), grass

Community 1.1
Marsh: Typha spp. - Schoenoplectus tabernaemontani - Mixed Herbs Southern Great Lakes Shore Marsh

Community 1.2
Aquatic: Potamogeton zosteriformis - Ceratophyllum demersum - Elodea canadensis Southern Great Lakes Shore Aquatic Vegetation

Community 1.3
Shrub Swamp: Cephalanthus occidentalis / Carex spp. Northern Shrub Swamp

Pathway 1.1A
Community 1.1 to 1.2

Lake level rises; emergent herbaceous plant mortality.

Pathway 1.1B
Community 1.1 to 1.3

Lake level drop; shrubs established.

Pathway 1.2A
Community 1.2 to 1.1

Lake level drop; emergents established.

Pathway 1.2B

Community 1.2 to 1.3

Lake level drop; shrubs established.

Pathway 1.3A
Community 1.3 to 1.1

Lake level rise; shrub mortality; emergent herbaceous established.

Pathway 1.3B
Community 1.3 to 1.2

Lake level rises; shrub mortality.

State 2
Semi-natural State

The Semi-natural State consists of plant community-types in settings where natural ecological processes are primarily still operating but with some land-use conditioning in the past or present, e.g., varieties of managed sites with replacement plant community-types such as results of harvests or planting, or settings that possess a significant artifact of land management e.g., predominately invasive plants.

Community 2.1
Exotic Ruderal Marsh: Phragmites australis ssp. australis Eastern Ruderal Marsh

State 3
Cultural State

The Cultural State includes settings where natural ecological processes are absent or eclipsed by significant land-use conditioning and the conversion/transformation of plant cover is considered as Cultivated/Pasture/Plantation.

Community 3.1
Marina, Boat Launch, Seawall, Dredged Channel, etc.

Transition T1A
State 1 to 2

Filling or dredging.

Transition T1B
State 1 to 3

Invasive species established.

Restoration pathway R2
State 2 to 1

Conservation practices

Restoration and Management of Rare and Declining Habitats
Wetland Wildlife Habitat Management
Wetland Restoration

Transition T2A
State 2 to 3

Abandoned; invasive species established.

Restoration pathway R3
State 3 to 1

Remove invasive species; reestablish native plants.

Conservation practices

Restoration and Management of Rare and Declining Habitats
Wetland Wildlife Habitat Management
Wetland Restoration
Wetland Enhancement
Herbaceous Weed Control

Transition T3A
State 3 to 2

Filling or dredging.

Additional community tables

Inventory data references

Future work, as described in a future 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

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Contributors

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Approval

Nels Barrett, 1/25/2024

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	01/25/2024
Approved by	Nels Barrett
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:**