Ecological site R097XA024MI
Great Lakes Marsh

Last updated: 1/16/2024
Accessed: 04/25/2024

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): 097X–Southwestern Michigan Fruit and Vegetable Crop Belt

Physiography consists of sandy lake plains and dunes along the western side adjacent to Lake Michigan, and moderately sloping fine-loamy moraine from the Lake Michigan lobe of the Wisconsin Ice Sheet.

Vegetation is mostly mesophytic forests of central and northern hardwood and conifer species with prairie and oak savanna to the south. Compared to inland locations, cold sensitive hardwood species extend further north due to milder winters, and conifers extend further south due to cooler summers, heavier snowfall, and sandier soils. Lake effect snow and delayed spring warm up dampen the fire frequency relative to similar inland sites, except along the south side of Lake Michigan. The northern extent is defined by a major floristic boundary where several central hardwoods species drop out. The southern boundary is defined by fine-loamy moraines with predominantly prairie vegetation.

The ecological site inference area for MLRA 97 is subdivided along a floristic/climatic break roughly from New Buffalo, Michigan to Portage, Indiana. This corresponds to the heaviest lake effect snow belt (>160 cm) south and east of this line and is associated lower historic fire frequencies. The snow belt portion “A”, has more frequent conifer and beech, while the less snowy portion “B” has more prairie and savanna elements. Although differing in precise boundary location, both USFS and EPA ecoregions support a climatic/floristic break at the next higher rank in their respective hierarchies.

Classification relationships

Among the USFS ecoregional framework (Cleland et al., 2007), most of MLRA 97 is represented by the Humid Temperate Domain (200), Hot Continental Division (220), Midwest Broadleaf Forest Province (222), South Central Great Lakes Section (222J), subsections 222Ja and 222Jb. MLRA 97 was recently extended northward to be more consistent with the limits of the USFS ecoregions subsections 222Ja and 222Jb, because it is more consistent with vegetation patterns and species distributions. A former portion of MLRA 97 that extended westward from the southern end of Lake Michigan (including most of the city of Chicago) was recently removed from the MLRA due to its predominantly non-sandy deposits and reduced lake effect climate, and would have overlapped USFS ecoregion 222K.

Among the EPA ecoregional framework (Omernik and Griffith, 2014), most of MLRA 97 falls within Eastern Temperate Forests (Level I: 8), Mixed Wood Plains (Level II: 8.1), Southern Michigan/Northern Indiana Drift Plains (Level III: 56), and Level IV: 56d and 56f. Ecoregion 56f continues north beyond MLRA 97. Former portions of MLRA 97 that encompassed the city of Chicago included Level III ecoregion 54, Central Corn Belt Plains, before the last revision of MRLA boundaries.

Ecological site concept

The central concept of the Great Lakes Marsh is any poorly/very poorly drain soils which fringe lakes, bays, and

river mouths affected by the daily, seasonal, and decadal variations of Lake Michigan water levels. Frequently mapped as floodplain soils or as miscellaneous areas like "marshes".

Associated sites

F097XA027MI	**Wet Floodplain**
F097XB049IN	**Chicago Wet Floodplain**

Similar sites

F097XA027MI	**Wet Floodplain**
F097XB049IN	**Chicago Wet Floodplain**

Table 1. Dominant plant species

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

Physiographic features

River mouths along the Great Lakes.

Table 2. Representative physiographic features

Landforms	(1) Estuary
Runoff class	Negligible to low
Flooding duration	Very brief (4 to 48 hours) to very long (more than 30 days)
Flooding frequency	Occasional to very frequent
Elevation	577–581 ft
Water table depth	0 in
Aspect	Aspect is not a significant factor

Climatic features

The southeastern Lake Michigan lake plain and adjacent lake influenced moraines have a humid warm continental climate with cold winters and warm summers. About half to two thirds of the precipitation is distributed during the warmer half of the year with a significant portion of the precipitation occurring as heavy downpours during thunderstorms. Thunderstorm activity is enhanced inland by lake breeze fronts, while it is diminished near the lakeshore by the stabilizing effect of the cooler lake waters. Occasionally, thunderstorm microbursts cause localized high winds which open single tree gaps in forest canopies, or more rarely, tornados and derechos (severe straight-line winds) open larger gaps. Fall storms bring more frequent strong winds, but with impacts moderated by the lack of leaves (wind resistance) in the canopy. During July, average precipitation lags potential evapotranspiration, resulting in droughty conditions in the upper soil horizons of upland sites. During dry years, this droughty period is extended into August and September, resulting in dry fuels and potential for wildfire over oak and pine dominated areas.

Winter precipitation is enhanced by lake effect snows, with 1.6 to 2.4 m (40-95 inches) falling annually within the snow belt. Peak snowfall occurs at intermediate distances from the lake where topography enhances uplift. The combination of heavier winter snowfall, lake-delayed spring warm up, and frequent wetlands all contribute to relatively lower fire frequencies relative to inland locations with similarly droughty soils. The area falls within USDA Hardiness zones 6a and 6b and has delayed spring warm up until after the last killing frosts, allowing for a wide range of fruit crops to be grown.

Table 3. Representative climatic features

Frost-free period (characteristic range)	123-149 days
Freeze-free period (characteristic range)	156-197 days
Precipitation total (characteristic range)	34-38 in
Frost-free period (actual range)	118-177 days
Freeze-free period (actual range)	151-202 days
Precipitation total (actual range)	33-39 in
Frost-free period (average)	142 days
Freeze-free period (average)	177 days
Precipitation total (average)	36 in

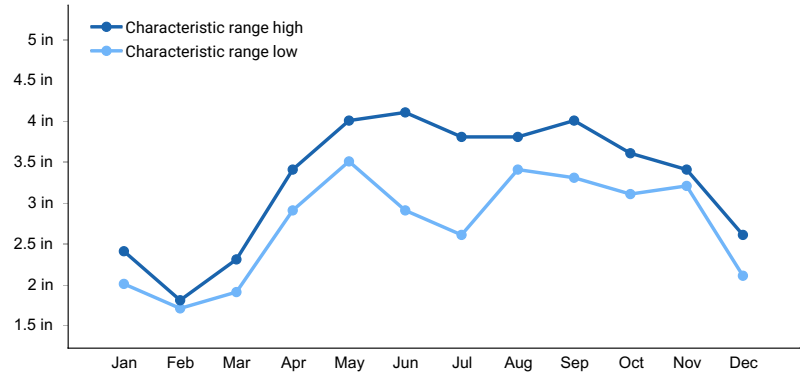


Figure 1. Monthly precipitation range

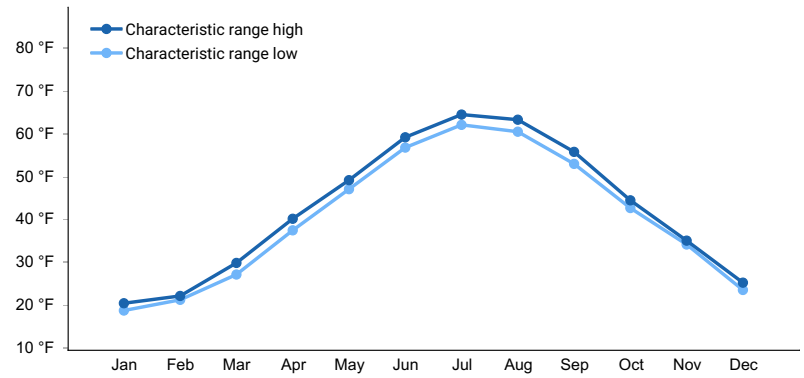


Figure 2. Monthly minimum temperature range

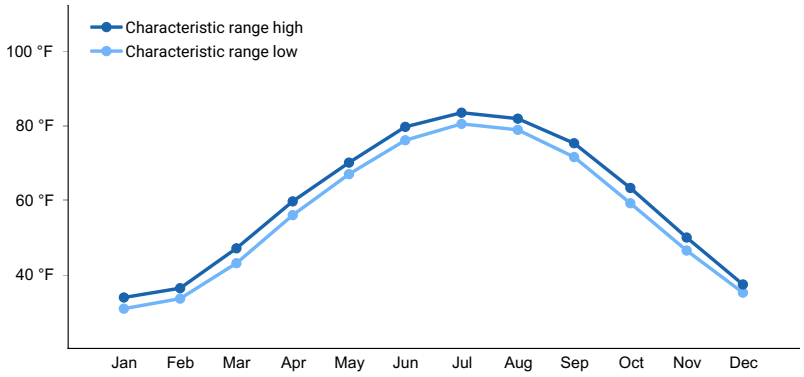


Figure 3. Monthly maximum temperature range

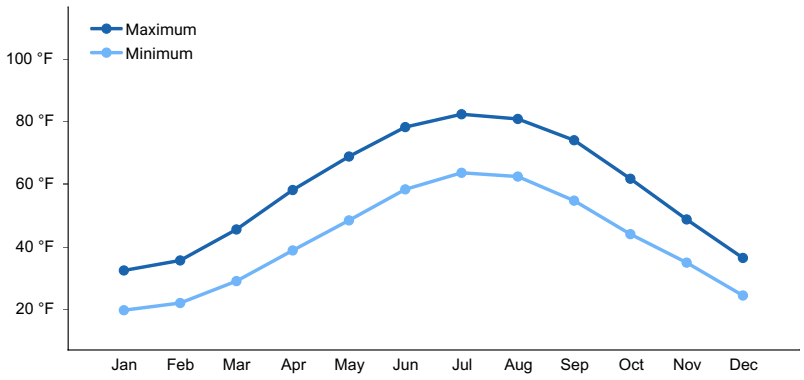


Figure 4. Monthly average minimum and maximum temperature

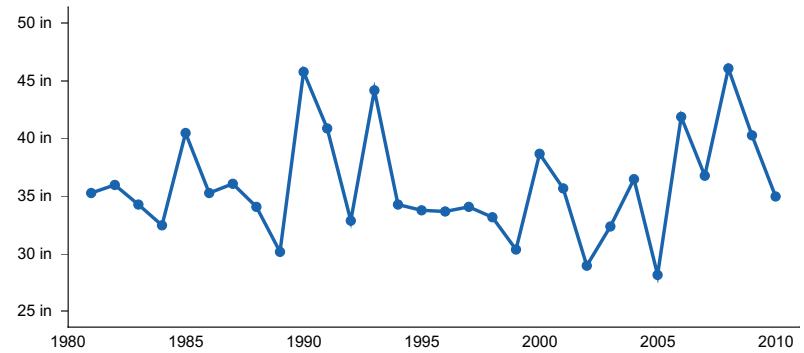


Figure 5. Annual precipitation pattern

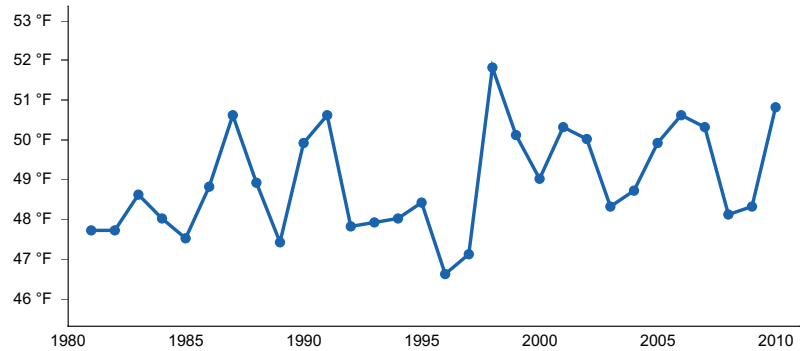


Figure 6. Annual average temperature pattern

Climate stations used

- (1) HOLLAND WTP [USC00203858], Holland, MI
- (2) GRAND HAVEN FIRE DEPT [USC00203290], Grand Haven, MI
- (3) INDIANA DUNES NATL LKS [USC00124244], Chesterton, IN
- (4) MUSKEGON CO AP [USW00014840], Muskegon, MI
- (5) CHICAGO UNIV [USW00014892], Chicago, IL
- (6) BENTON HARBOR AP [USW00094871], Benton Harbor, MI

Influencing water features

Generally permanently flooded, but water level fluctuating with river flooding, storm surges, and decadal climatic variations in lake level.

Soil features

Soils are very poorly drained to subaqueous organics, sands, or loams in river mouths. They are commonly classified as Typic Haplosaprists and Typic Medisaprists, and commonly mapped as Houghton series.

Table 4. Representative soil features

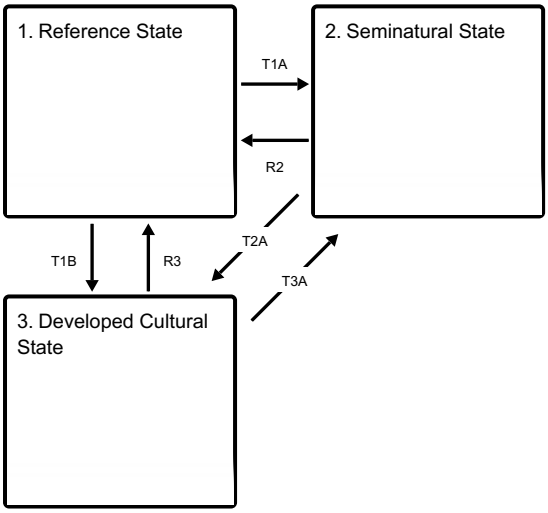
Parent material	(1) Alluvium (2) Lacustrine deposits
Surface texture	(1) Silt (2) Sand (3) Muck
Drainage class	Subaqueous to poorly drained
Permeability class	Slow to moderately rapid
Soil depth	79 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-39.4in)	1.97–9.84 in
Sodium adsorption ratio (0-19.7in)	6–7
Subsurface fragment volume <=3" (0-59.1in)	0%
Subsurface fragment volume >3" (0-59.1in)	0%

Ecological dynamics

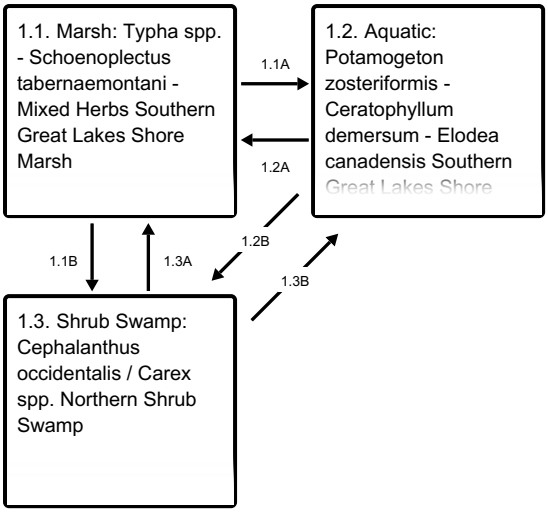
Fire was infrequent, allowing succession to fire sensitive species. Wet anoxic soils favor facultative and obligate wetland species. The long term flooding precluded establishment of trees. Fertility likely varies by watershed and degree of river versus lake water influence. Vegetation dominated by bulrushes and cattails.

State and transition model

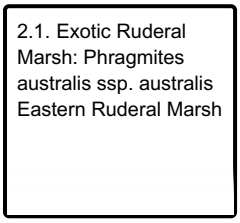
Ecosystem states



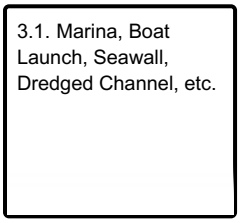
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Reference State

The Reference State consists of emergent and submergent marshes.

Dominant plant species

- broadleaf cattail (*Typha latifolia*), grass
- softstem bulrush (*Schoenoplectus tabernaemontani*), grass
- flatstem pondweed (*Potamogeton zosteriformis*), other herbaceous
- coon's tail (*Ceratophyllum demersum*), other herbaceous
- Canadian waterweed (*Elodea canadensis*), other herbaceous

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
Seminatural State

[Alternative States to be developed; refer to component communities.]

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

State 3
Developed Cultural State

[Alternative States to be developed; refer to component communities.]

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

Site Development and Testing Plan
Future work is needed, as described in a future project plan, to validate the information presented in this provisional ecological site description. Future work includes field sampling, data collection and analysis by qualified vegetation ecologists and soil scientists. As warranted, annual reviews of the project plan can be conducted by the Ecological Site Technical Team. A final field review, peer review, quality control, and quality assurance reviews of the ESD are necessary to approve a final document.

Other references

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Contributors

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Approval

Nels Barrett, 1/16/2024

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	04/25/2024
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:**

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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):**

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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):**

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:**