USDA Natural Resources Conservation Service

# Ecological site F097XA031MI
# Acidic Peaty Depression

Last updated: 1/16/2024
Accessed: 04/26/2024

## 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): 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 Acidic Peaty Depression is a organic soils (typically peat) of low pHs (usually <4.5). Generally associated with closed depressions with minimal groundwater or runoff influence on mineral and nutrient levels. Vegetation tends toward a short list of high fidelity acidophiles like Sphagnum spp, and various Ericaceae.

## Associated sites

| | |
|---|---|
| F097XA023MI | **Wet Loamy Depression** |

## Similar sites

| | |
|---|---|
| F097XA030MI | **Mucky Depression** |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | (1) *Acer rubrum*<br>(2) *Nyssa sylvatica* |
| Shrub | (1) *Chamaedaphne calyculata*<br>(2) *Vaccinium corymbosum* |
| Herbaceous | (1) *Sphagnum* |

## Physiographic features

Organic deposits dominated by rainwater inputs, such as depressions with without significant groundwater inputs.

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Depression |
| Runoff class | Negligible to low |
| Ponding duration | Very brief (4 to 48 hours) to long (7 to 30 days) |
| Ponding frequency | Rare to occasional |
| Elevation | 581–1,017 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.

Just over half 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) | 123-143 days |
| Freeze-free period (characteristic range) | 149-188 days |
| Precipitation total (characteristic range) | 34-39 in |
| Frost-free period (actual range) | 119-149 days |
| Freeze-free period (actual range) | 141-195 days |
| Precipitation total (actual range) | 33-41 in |
| Frost-free period (average) | 132 days |
| Freeze-free period (average) | 165 days |
| Precipitation total (average) | 37 in |

## Climate stations used

- (1) BLOOMINGDALE [USC00200864], Bloomingdale, MI
- (2) MUSKEGON CO AP [USW00014840], Muskegon, MI
- (3) HOLLAND WTP [USC00203858], Holland, MI
- (4) GRAND RAPIDS [USW00094860], Grand Rapids, MI
- (5) ALLEGAN 5NE [USC00200128], Allegan, MI
- (6) EAU CLAIRE 4 NE [USC00202445], Dowagiac, MI
- (7) GRAND HAVEN FIRE DEPT [USC00203290], Grand Haven, MI

## Influencing water features

Semi-permanently saturated.

## Soil features

Soils are very poorly drained organics with low pH. They are commonly classified as Typic Medihemists and Terric Haplosaprists, and commonly mapped as Napoleon and Palms series.

**Table 4. Representative soil features**

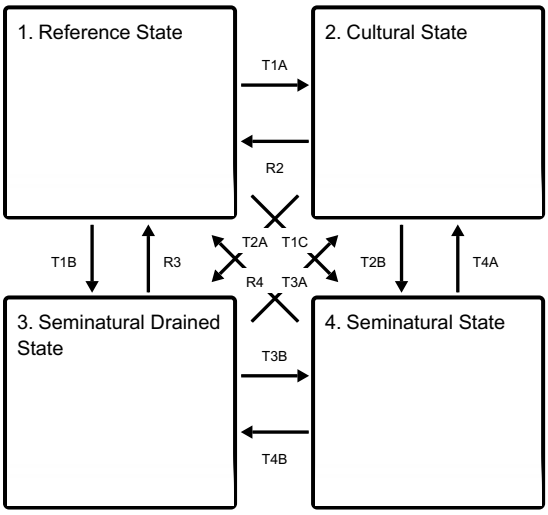
| | |
|---|---|
| Parent material | (1) Organic material |
| Surface texture | (1) Peat<br>(2) Mucky peat<br>(3) Muck |
| Drainage class | Very poorly drained |
| Permeability class | Moderately slow to moderately rapid |
| Soil depth | 79 in |
| Surface fragment cover <=3" | 0% |
| Surface fragment cover >3" | 0% |
| Available water capacity (0-39.4in) | 13.78–21.65 in |
| Soil reaction (1:1 water) (0-19.7in) | 3.5–5.5 |
| Subsurface fragment volume <=3" (0-59.1in) | 0% |
| Subsurface fragment volume >3" (0-59.1in) | 0% |

## Ecological dynamics

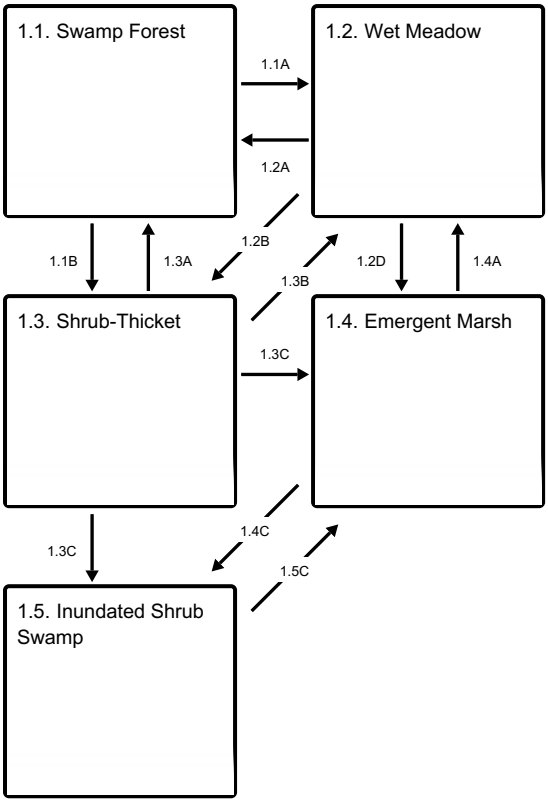
Fire was infrequent, allowing succession to fire sensitive species. Windthrow a frequent disturbance due to shallow rooting in wet soils. Wet anoxic soils favor facultative and obligate wetland species. The acidic low nutrient status of the substrate favors red maple and black gum, insectivorous plants, and ericads. The floating mat of peat moss tends to maintain saturated conditions, wherein species intolerant of long term flooding are able to persist. Site is differentiated from relict black spruce swamps inland and northward.

## State and transition model

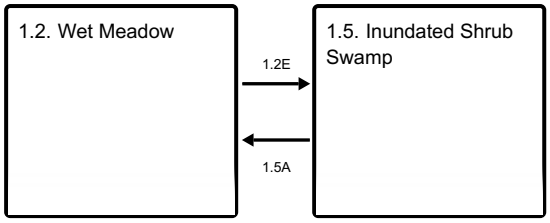
**Ecosystem states**



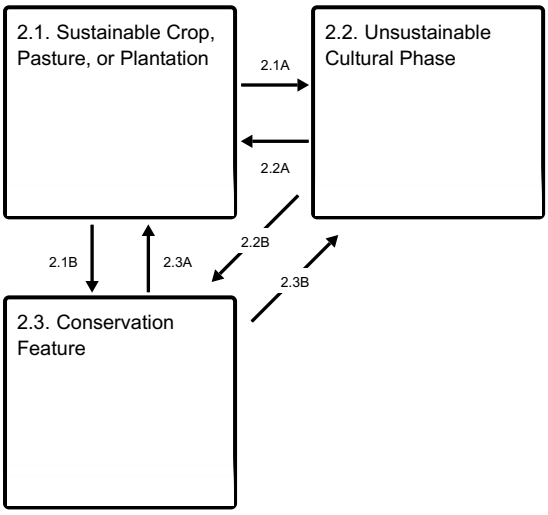
**State 1 submodel, plant communities**



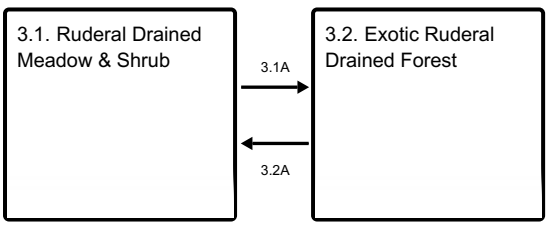

**Communities 2 and 5 (additional pathways)**



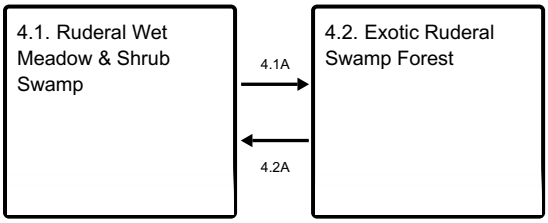

**State 2 submodel, plant communities**




**State 3 submodel, plant communities**




**State 4 submodel, plant communities**



## State 1
## Reference State

The Reference State consists of bog forests and bogs.

**Dominant plant species**

- red maple (*Acer rubrum*), tree
- blackgum (*Nyssa sylvatica*), tree
- leatherleaf (*Chamaedaphne calyculata*), shrub
- highbush blueberry (*Vaccinium corymbosum*), shrub
- sphagnum (*Sphagnum*), other herbaceous

### Community 1.1
### Swamp Forest

### Community 1.2
### Wet Meadow

### Community 1.3
### Shrub-Thicket

### Community 1.4
### Emergent Marsh

### Community 1.5
### Inundated Shrub Swamp

### Pathway 1.1A
### Community 1.1 to 1.2

Temporary prolonged inundation.

### Pathway 1.1B
### Community 1.1 to 1.3

Clearcut/Blowdown.

**Conservation practices**

| |
|---|
| Early Successional Habitat Development/Management |
| Forest Stand Improvement |

### Pathway 1.2A
### Community 1.2 to 1.1

Succession.

**Conservation practices**

| |
|---|
| Tree/Shrub Site Preparation |
| Tree/Shrub Establishment |

### Pathway 1.2B
### Community 1.2 to 1.3

Succession.

**Conservation practices**

| |
|---|
| Tree/Shrub Site Preparation |
| Tree/Shrub Establishment |

### Pathway 1.2D
### Community 1.2 to 1.4

Permanent inundation.

### Pathway 1.2E
### Community 1.2 to 1.5

Shrub establishment; permanent inundation.

**Conservation practices**

| |
|---|
| Tree/Shrub Establishment |

### Pathway 1.3A
### Community 1.3 to 1.1

Succession.

**Conservation practices**

| |
|---|
| Tree/Shrub Site Preparation |
| Tree/Shrub Establishment |

### Pathway 1.3B
### Community 1.3 to 1.2

Temporary prolonged inundation.

### Pathway 1.3C
### Community 1.3 to 1.4

Permanent inundation.

### Pathway 1.3C
### Community 1.3 to 1.5

Permanent inundation.

### Pathway 1.4A
### Community 1.4 to 1.2

Drop water table.

### Pathway 1.4C
### Community 1.4 to 1.5

Temporary drop water table; shrub establishment.

### Pathway 1.5A
### Community 1.5 to 1.2

Drop water table; shrub mortality.

**Conservation practices**

| |
|---|
| Brush Management |

### Pathway 1.5C
### Community 1.5 to 1.4

Temporary drought; shrub mortality.

## State 2
## Cultural State

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

### Community 2.1
### Sustainable Crop, Pasture, or Plantation

### Community 2.2
### Unsustainable Cultural Phase

### 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

Revert to unsustainable cultural practices.

### 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

Implement sustainable cultural practices.

**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

Implement sustainable cultural practices.

**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 cultural practices.

## State 3
## Seminatural Drained State

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

### Community 3.1
### Ruderal Drained Meadow & Shrub

### Community 3.2
### Exotic Ruderal Drained Forest

### Pathway 3.1A
### Community 3.1 to 3.2

Succession

### Pathway 3.2A
### Community 3.2 to 3.1

Blowdown/clearcut.

**Conservation practices**

| |
|---|
| Early Successional Habitat Development/Management |

| |
|---|
| Forest Stand Improvement |

### State 4
### Seminatural State

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

### Community 4.1
### Ruderal Wet Meadow & Shrub Swamp

### Community 4.2
### Exotic Ruderal Swamp Forest

### Pathway 4.1A
### Community 4.1 to 4.2

Succession.

### Pathway 4.2A
### Community 4.2 to 4.1

Blowdown/clearcut.

**Conservation practices**

| |
|---|
| Early Successional Habitat Development/Management |
| Forest Stand Improvement |

### Transition T1A
### State 1 to 2

Drain; clear vegetation; cultivate domesticated species.

### Transition T1B
### State 1 to 3

Drain; clear vegetation, invasive species introduced.

### Transition T1C
### State 1 to 4

Clear vegetation, invasive species introduced.

### Restoration pathway R2
### State 2 to 1

Restore hydrology; remove domesticated species; restore native species.

**Conservation practices**

| |
|---|
| Brush Management |
| Restoration and Management of Rare and Declining Habitats |
| Wetland Wildlife Habitat Management |
| Wetland Restoration |

| |
|---|
| Herbaceous Weed Control |

### Transition T2A
### State 2 to 3

Abandon, succession.

### Transition T2B
### State 2 to 4

Restore hydrology; abandon; succession.

**Conservation practices**

| |
|---|
| Wetland Restoration |

### Restoration pathway R3
### State 3 to 1

Restore hydrology; control invasive species; restore native species

**Conservation practices**

| |
|---|
| Brush Management |
| Restoration and Management of Rare and Declining Habitats |
| Wetland Wildlife Habitat Management |
| Wetland Restoration |
| Herbaceous Weed Control |

### Transition T3A
### State 3 to 2

Clear vegetation; cultivate domesticated species.

### Transition T3B
### State 3 to 4

Restore hydrology.

**Conservation practices**

| |
|---|
| Wetland Restoration |

### Restoration pathway R4
### State 4 to 1

Control invasive species; restore native species.

**Conservation practices**

| |
|---|
| Brush Management |
| Restoration and Management of Rare and Declining Habitats |
| Wetland Wildlife Habitat Management |
| Herbaceous Weed Control |

### Transition T4A
### State 4 to 2

Drain; clear vegetation; cultivate domesticated species.

### Transition T4B
### State 4 to 3

Drain.

## 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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layer. http://landfire.cr.usgs.gov/viewer/

## Contributors

Greg J. Schmidt

## 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 | 04/26/2024 |
| 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):**

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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:

---

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:**

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