USDA Natural Resources
Conservation Service

Ecological site F097XA010MI
Sandy Slopes

Last updated: 1/16/2024
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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 Sand Hills is sands (>70% sands >50 cm deep) on open slopes >15%. There is a tendency for xerophytic vegetation of oak and pine due to the low available water holding capacity and low nutrient status. Northeastern aspects trend toward mesophytic vegetation, whereas there is a potential for small hill prairies on southwestern aspects. Areas sloping toward drainages are more decidedly mesophytic and are treated as the Loamy Ravine ESD. Hilly areas near Lake Michigan are affected by fog and lake spray and are treated as the Backdune ESD.

Associated sites

F097XA004MI	**Dry Sandy Lake Plain**
F097XA025MI	**Moist Floodplain**

Similar sites

F097XA002MI	**Backdune**
F097XA017MI	**Loamy Slopes**

Table 1. Dominant plant species

Tree	(1) *Quercus velutina*
Shrub	(1) *Hamamelis virginiana*
Herbaceous	Not specified

Physiographic features

Inland sand dunes and ice contact terrain, and sometimes the edge of ravines.

Table 2. Representative physiographic features

Landforms	(1) Dune (2) Kame
Runoff class	Very low to medium
Elevation	177–310 m
Slope	15–100%
Water table depth	99 cm

Aspect	W, NW, N, NE, E, SE, S, SW

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)	123-145 days
Freeze-free period (characteristic range)	147-194 days
Precipitation total (characteristic range)	864-1,016 mm
Frost-free period (actual range)	119-149 days
Freeze-free period (actual range)	141-196 days
Precipitation total (actual range)	838-1,041 mm
Frost-free period (average)	132 days
Freeze-free period (average)	165 days
Precipitation total (average)	940 mm

Climate stations used

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

Influencing water features

None

Soil features

Soils are excessively drained to moderately well drained sands on >15% slopes. They are commonly classified as Typic Udipsamments, Argic Udipsamments, and Typic Hapludalfs, and commonly mapped as Plainfield, Chelsea,

and Coloma series.

Table 4. Representative soil features

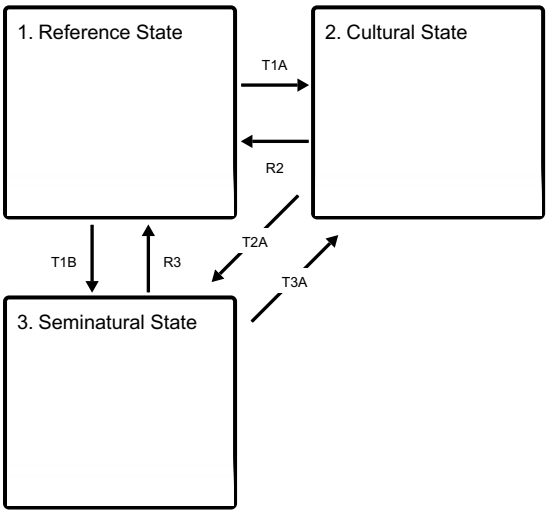
Parent material	(1) Eolian deposits (2) Glaciolacustrine deposits
Surface texture	(1) Sand
Drainage class	Well drained to excessively drained
Permeability class	Moderately rapid to rapid
Soil depth	201 cm
Surface fragment cover <=3"	0–1%
Surface fragment cover >3"	0%
Available water capacity (0-100.1cm)	3.99–10.01 cm
Soil reaction (1:1 water) (0-50cm)	4.5–6
Subsurface fragment volume <=3" (0-150.1cm)	0–10%
Subsurface fragment volume >3" (0-150.1cm)	0–5%

Ecological dynamics

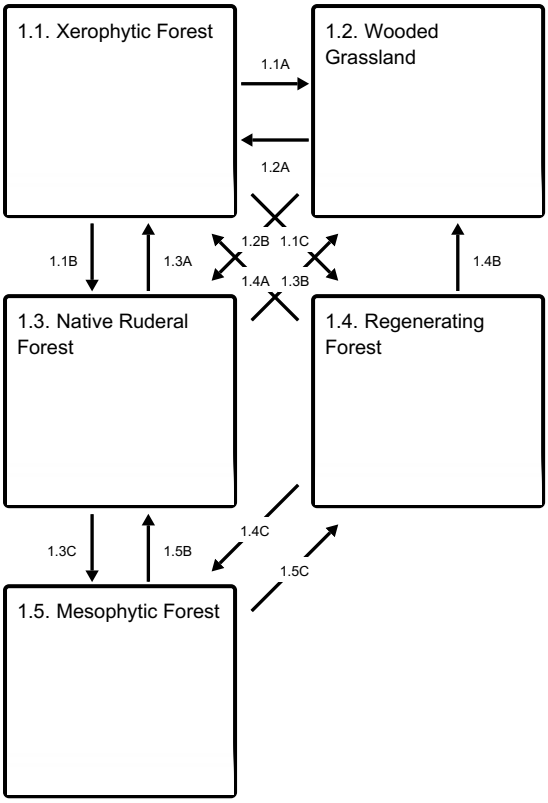
Fire was locally important adjacent to other fire prone ecological sites. Low to medium fertility favors oak and pine, but lack of fire and establishment of maple species gradually improves soil fertility, allowing for the establishment of a wider array of mesophytic species. Southwest exposures may remain persistently xeric with oak and pine.

State and transition model

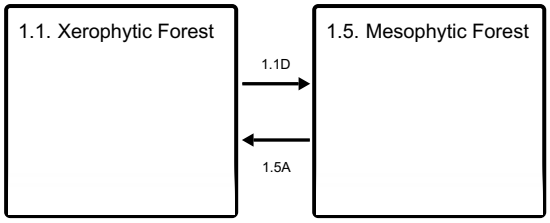
Ecosystem states



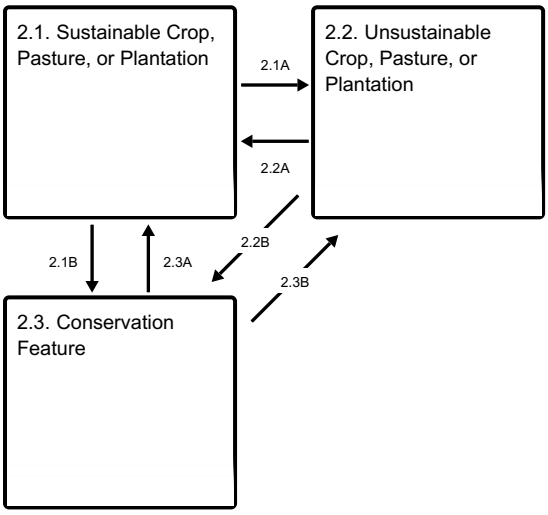
State 1 submodel, plant communities



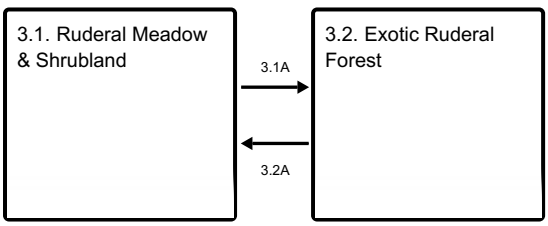
Communities 1 and 5 (additional pathways)



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Reference State

The Reference State consists of forests, open woodland, and associated successional phases.

Dominant plant species

- black oak (*Quercus velutina*), tree
- American witchhazel (*Hamamelis virginiana*), tree

Community 1.1
Xerophytic Forest

Community 1.2
Wooded Grassland

Community 1.3
Native Ruderal Forest

Community 1.4
Regenerating Forest

Community 1.5
Mesophytic Forest

Pathway 1.1A
Community 1.1 to 1.2

Blowdown; increased fire/drought.

Conservation practices

Prescribed Burning
Early Successional Habitat Development/Management
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 1.1C
Community 1.1 to 1.4

Blowdown/clearcut

Conservation practices

Forest Stand Improvement

Pathway 1.1D
Community 1.1 to 1.5

Succession; decreased fire/drought

Pathway 1.2A
Community 1.2 to 1.1

Succession

Pathway 1.2B
Community 1.2 to 1.3

Decreased fire/drought; succession

Pathway 1.3A
Community 1.3 to 1.1

Succession

Pathway 1.3B
Community 1.3 to 1.2

Blowdown; increased fire/drought.

Pathway 1.3C
Community 1.3 to 1.5

Succession; decreased fire/drought.

Pathway 1.4A
Community 1.4 to 1.1

Succession.

Pathway 1.4B
Community 1.4 to 1.2

Blowdown; increased fire/drought.

Pathway 1.4C
Community 1.4 to 1.5

Succession; decreased fire/drought.

Pathway 1.5A
Community 1.5 to 1.1

Increased fire/drought with mortality.

Conservation practices

Prescribed Burning
Forest Stand Improvement

Pathway 1.5B
Community 1.5 to 1.3

Blowdown/clearcut.

Conservation practices

Early Successional Habitat Development/Management
Forest Stand Improvement

Pathway 1.5C

Community 1.5 to 1.4

Blowdown/clearcut

Conservation practices

Forest Stand Improvement

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 Crop, Pasture, or Plantation

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 Cover
Conservation Crop Rotation
Nutrient Management
Integrated Pest Management (IPM)

Pathway 2.3B
Community 2.3 to 2.2

Revert to unsustainable cultural practices.

State 3
Seminatural State

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

Community 3.1
Ruderal Meadow & Shrubland

Community 3.2
Exotic Ruderal Forest

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

Restoration pathway T3A
State 3 to 2

Clear vegetation; cultivate domesticated species

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	01/16/2024
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:

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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:**
