USDA Natural Resources Conservation Service

Ecological site F094CY030MI
Cool Wet Loamy Depression

Last updated: 9/11/2024
Accessed: 05/14/2025

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 Cool Wet Loamy Depression is Site occurs on lowlands with seasonal water tables less than 25 cm deep (poorly drained to very poorly drained). Site occurs on loamy drift (till or lake plains) with soil textures loamy to clayey (upper 50 cm <70% sand). Site is in lower elevation northern portions of the MLRA where boreal conifer species are more frequent associates. Vegetation trending towards swamp forest with a calciphilic species composition.

Associated sites

F094CY029MI	**Cool Loamy Depression**

Similar sites

F094AB017MI	**Wet Loamy Depression**

Table 1. Dominant plant species

Tree	(1) *Thuja occidentalis* (2) *Abies balsamea*
Shrub	Not specified
Herbaceous	(1) *Acer pensylvanicum* (2) *Symplocarpus foetidus*

Physiographic features

Site occurs mostly on glacial till, but minor areas of fine lake plain deposits have similar properties. Landforms are gently sloping lower slope positions and depressions.

Table 2. Representative physiographic features

Landforms	(1) Moraine (2) Till plain (3) Depression
Runoff class	Low to high
Elevation	177–402 m
Water table depth	0–25 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)	101-119 days
Freeze-free period (characteristic range)	125-155 days
Precipitation total (characteristic range)	762 mm
Frost-free period (actual range)	83-132 days
Freeze-free period (actual range)	121-173 days
Precipitation total (actual range)	737-787 mm
Frost-free period (average)	108 days
Freeze-free period (average)	143 days
Precipitation total (average)	762 mm

Climate stations used

- (1) ONAWAY 4N [USC00206184], Onaway, MI
- (2) ROGERS CITY [USC00207094], Rogers City, MI
- (3) ALPENA CO RGNL AP [USW00094849], Alpena, MI
- (4) CHEBOYGAN [USC00201492], Cheboygan, MI
- (5) PELLSTON RGNL AP [USW00014841], Pellston, MI
- (6) ALPENA WWTP [USW00014814], Alpena, MI
- (7) CROSS VILLAGE 1E [USC00201896], Harbor Springs, MI

Influencing water features

Site has seasonal high water table within 0-25 cm of the surface. Some sites may have a perched water table or ponding due to the impermeability of finer textures.

Soil features

Soils are very poorly drained to poorly drained loams or clays. They are commonly classified Mollic Psammaquents, Typic Epiaquolls, and Mollic Endoaquepts, and commonly mapped as Roscommon, Hessel, and Tonkey series or components. The top 50 cm has a typical pH of 7.2 and is 50% sand and 3.4% organic matter. At depth, pH ranges up to 7.8, and texture averages 50% sand and 20% clay. Depth to impeded hydraulic conductivity or root restrictive layers averages 145 cm. Depth to carbonates averages 40 cm.

Table 4. Representative soil features

Parent material	(1) Till
Surface texture	(1) Loam
Drainage class	Moderately well drained to somewhat poorly drained
Permeability class	Moderately slow to moderately rapid
Soil depth	201 cm

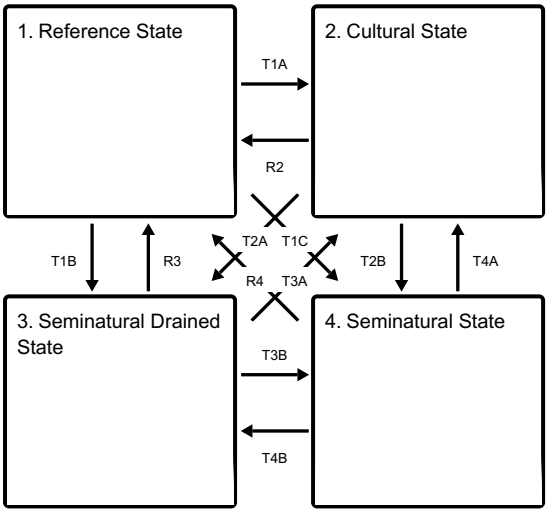
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0–1%
Available water capacity (0-100.1cm)	13–22 cm
Soil reaction (1:1 water) (0-50cm)	6.5–7.5
Subsurface fragment volume <=3" (0-150.1cm)	0–35%
Subsurface fragment volume >3" (0-150.1cm)	0–15%

Ecological dynamics

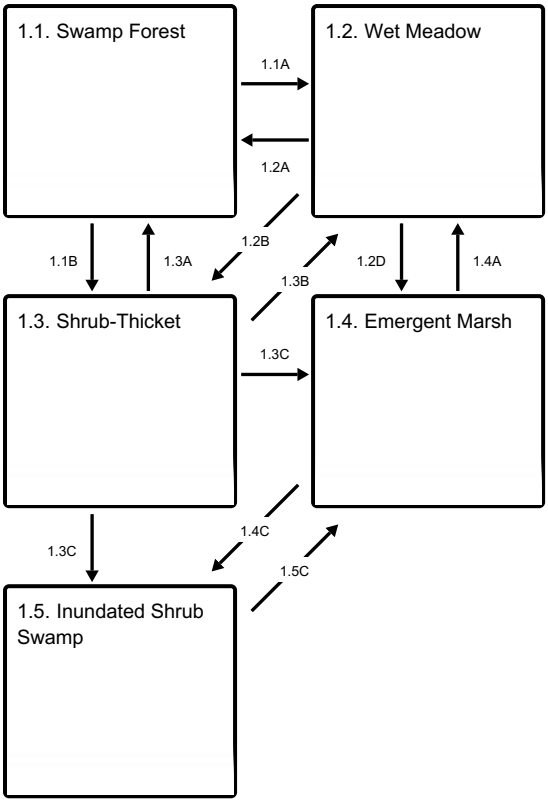
Cool Wet Loamy Depression tends to share the same ecological dynamics as Natureserve/Landfire system, Boreal White Spruce-Fir-Hardwood Forest or Laurentian-Acadian Northern Hardwoods Forest. Stand replacing fires occurred every 500-2000 years, while light surface fires were very rare. Overstory was dominated by nutrient loving late successional whitecedar (*Thuja occidentalis*) and balsam fir (*Abies balsamea*). Drought intolerant understory tree, striped maple (*Acer pensylvanicum*), is frequent, especially in cooler foggy areas near the lakeshore. Wet soil conditions supports wetland herb understory of skunk cabbage (*Symplocarpus foetidus*).

State and transition model

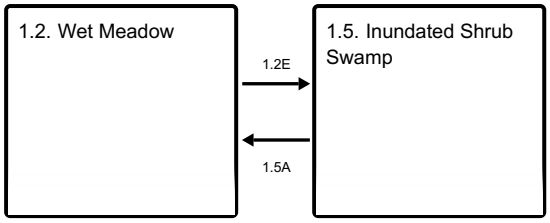
Ecosystem states



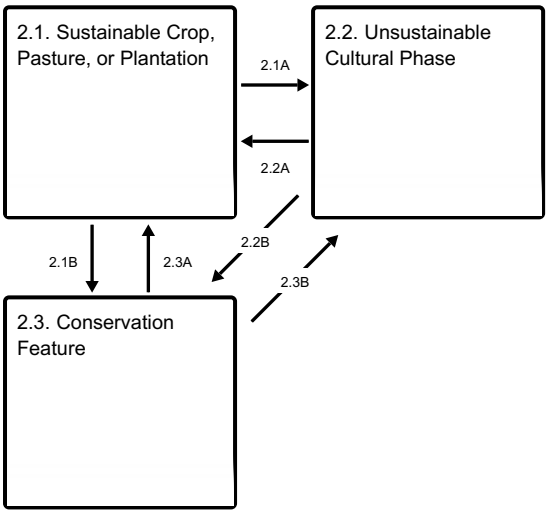
State 1 submodel, plant communities



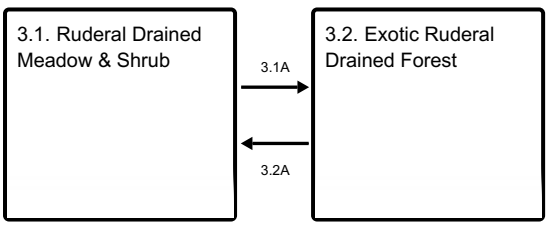
Communities 2 and 5 (additional pathways)



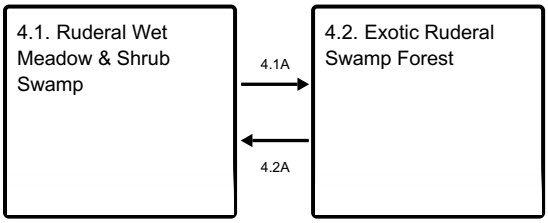
State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 submodel, plant communities



State 1
Reference State

Dominant plant species

- arborvitae (*Thuja occidentalis*), tree
- balsam fir (*Abies balsamea*), tree
- striped maple (*Acer pensylvanicum*), tree
- skunk cabbage (*Symplocarpus foetidus*), 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

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

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

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

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

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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:**

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:**
