Ecological site F093BY008MI
Fragic Loamy Uplands

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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.

MLRA notes

Major Land Resource Area (MLRA): 093B–Superior Stony and Rocky Loamy Plains and Hills

The Wisconsin portion of this MLRA is a mixture of high-relief moraines and flat till plains with interspersed glacial meltwater deposits. It is bordered on the north by glaciolacustrine deposits of Glacial Lake Duluth and on the south by extensive pitted and unpitted outwash plains. The approximate land area is just under 600,000 acres (935 sq miles). The Penokee-Gogebic Iron Range runs through the middle of the Wisconsin portion of this MLRA and into Michigian. The range is a hilly, bedrock-controlled moraine. The bedrock outcropping is composed of igneous and metamorphic materials and was created by inland folding and faulting of the ancient Superior continent when it collided with the Marshfield continent about 1.8 billion years ago (Dott & Attig, 2004). Volcanic and intrusive bedrock occurs in some places. This bedrock is overlain by a thin layer of glacial till deposited by the Chippewa Lobe. To the north of the range is a former spillway for Glacial Lake Ontonagon. The flowing meltwater cut deep channels into the morainal systems. Glaciofluvial landforms here include old beaches and dunes. South of the range, along the southern edge of this MLRA, are rolling collapsed end moraines, pushed to their extent by the Chippewa and Ontonagon Lobes. The landscape is dotted with abundant kettle lakes and swamps, especially in the eastern portion. Ice-walled lake plains and eskers are also found along these collapsed moraines. The climate is influenced by Lake Superior in areas near the lake, resulting in cooler summers, warmer winters, and greater precipitation – especially snowfall – compared to more inland locations. Historically, mixtures of eastern hemlock (Tsuga canadensis), sugar maple (Acer saccharum), yellow birch (Betula alleghaniensis), eastern white pine (Pinus strobus), and red pine (Pinus resinosa) covered the area. In wetter pockets (such as the swamps that dot the moraines to the south) white cedar (Thuja occidentalis), black spruce (Picea mariana), and tamarack (Larix laricina) were common (Finley, R., 1976).

Classification relationships

Relationship to Established Frameworks and Classification Systems: Habitat Types of N. Wisconsin (Kotar, 2002): Two sites key out to Acer saccharum – Tsuga canadensis/ Dryopteris spinulosa (ATD), two sites key to Acer saccharum – Tsuga canadensis/ Maianthemum canadense (ATM), and two sites key to Acer saccharum / Vaccinium angustifolium – Viburnum acerifolium (AVVb). Biophysical Setting (Landfire, 2014): This ES is mapped as Laurentian-Acadian Northern Pine(-Oak) Forest, Laurentian-Acadian Northern Hardwoods Forest – Hemlock, and Laurentian-Acadian Northern Hardwoods Forest; though, it is likely best represented by the latter. WDNR Natural Communities (WDNR (2015): This ES is most similar to the Northern Mesic Forest. Hierarchical Framework Relationships: Major Land Resource Area (MLRA): Superior Stoney and Rocky Loamy Plains and Hills, Eastern Part (93B) USFS Subregions: Winegar Moraines (212Jc) Small sections occur in the Gogebic-Penokee Iron Range (212Jb) subregion Wisconsin DNR Ecological Landscapes: North Central Forest

Ecological site concept

The Fragic Loamy Uplands ecological site is a dominant site in MLRA 93B, located on moraines, hills, and till plains. These sites are characterized by moderately deep to very deep, moderately well to well drained soils that formed in sandy and loam till, eolian, and glaciofluvial deposits, and residuum. Soils have a fragipan (a dense, reversibly-cemented layer) or fragic properties that perch water and restrict rooting depth. Precipitation and runoff from adjacent uplands are the primary sources of water. Soils range from ultra acid to moderately acid. Fragic Loamy Uplands differ from all other sites by the presence of a fragipan or fragic properties, which limit rooting depth and may cause windthrow. Other upland sites have sandy materials. Loamy materials have a higher pH and available water capacity than sandy materials, which may promote more vegetative growth.

Associated sites

F093BY004MI	**Wet Lowlands** Wet Lowlands occur on depressions and drainageways and form in loamy till or loamy alluvium underlain by dense sandy till or sandy and gravelly outwash. These sites are poorly drained and occur lower on the drainage sequence than Fragic Loamy Uplands.
F093BY005MI	**Moist Lowlands** Moist Lowlands occur on footslope positions across the landscape. They are not subject to flooding nor ponding. Soils form in till, lacustrine deposits, or outwash deposits and may be loamy to sandy. These sites are somewhat poorly drained and occur slightly lower on the drainage sequence than Fragic Loamy Uplands.

Similar sites

F093BY009MI	**Alfic Loamy Uplands** Alfic Loamy Uplands occur on upland sites in loamy glaciofluvial deposits where an argillic horizon is either forming or present. Like Fragic Loamy Uplands, they are moderately well to well drained. They lack a Fragic layer that restricts rooting depth and perches the water table. Generally, Alfic Loamy Uplands support species with a slightly higher nutrient status than Fragic Loamy Uplands.
F093BY010MI	**Loamy Uplands** Loamy Uplands occur on upland sites in loamy till, sometimes with a mantle of loess. These soils lack significant clay accumulation or a Fragic layer. Like Fragic Loamy Uplands, they are moderately well to well drained. Generally, Loamy Uplands support species with a slightly higher nutrient status than Fragic Loamy Uplands.

Table 1. Dominant plant species

Tree	(1) *Acer saccharum* (2) *Betula alleghaniensis*
Shrub	(1) *Acer saccharum*
Herbaceous	(1) *Maianthemum canadense* (2) *Aralia nudicaulis*

Physiographic features

These sites are found on moraines and till plains in backslope, shoulder, and summit positions. Slope ranges from 1 to 45 percent. These sites are subject to neither ponding nor flooding. Because of their fragic properties, most sites have a perched seasonally high water table (episaturation) within 12 inches. Surface runoff is low to very high.

Figure 1. Distribution of Fragic Loamy Uplands in the Superior Stoney and Rocky Loamy Plains and Hills, Eastern Part (93B).

Table 2. Representative physiographic features

Landforms	(1) End moraine (2) Ground moraine (3) Hill (4) Till plain
Runoff class	Low to very high
Flooding frequency	None
Ponding frequency	None
Elevation	200 – 300 m
Slope	0 – 80 %
Water table depth	30 – 200 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

The continental climate of the Superior Stoney and Rocky Loamy Plains and Hills, Eastern Part MLRA is characterized by long, cold winters and short, warm summers where precipitation exceeds evapotranspiration. Neither average annual precipitation nor average annual minimum and maximum temperatures vary greatly within this MLRA, though the climate of the northern tip is somewhat affected by Lake Superior and receives higher annual precipitation in the form of lake effect snow.

Table 3 Representative climatic features

Frost-free period (characteristic range)	90-120 days
Freeze-free period (characteristic range)	120-150 days
Precipitation total (characteristic range)	740-860 mm
Frost-free period (actual range)	80-120 days
Freeze-free period (actual range)	120-160 days
Precipitation total (actual range)	710-910 mm

Frost-free period (average)	100 days
Freeze-free period (average)	140 days
Precipitation total (average)	810 mm

- (1) MARQUETTE [USW00014838], Marquette, MI
- (2) HANCOCK HOUGHTON CO AP [USW00014858], Calumet, MI
- (3) MELLEN 4 NE [USC00475286], Mellen, WI
- (4) HURLEY [USC00473800], Ironwood, WI
- (5) DRUMMOND [USC00472240], Drummond, WI
- (6) WATTON [USC00208706], Watton, MI

Influencing water features

Water is received through precipitation and runoff from adjacent uplands. Water is lost from the site primarily through runoff, evapotranspiration, and groundwater recharge. Subsurface outflow may occur based on water perching on the fragipan.

Permeability of the soils is impermeable to very slow. The hydrologic soil group of these sites is C, D, or C/D.

Wetland description

Hydrologic Group: C, D, C/D
Hydrogeomorphic Wetland Classification: None
Cowardin Wetland Classification: None

Soil features

These sites are represented primarily by the Gogebic series, classified as an Alfic Oxyaquic Fragiorthod. Also representing these sites are the Schweitzer, Wakefield, and Michigamme series, classified as Alfic Fragiorthods, Alfic Oxyaquic Fragiorthods, and Fragic Haplorthods, respectively.

In these soils, a fragipan is either present or developing. This root-restrictive layer is usually found within 14 inches, and thickness ranges from 3 to 20 inches. These soils formed in loamy till, usually overlain by modified loamy or silty eolian deposits. Sometimes, the loamy till is underlain by sandy till or, rarely, igneous or metamorphic bedrock. These soils are often impermeable. When not impermeable, permeability is very slow. They are usually very deep and are moderately well to well drained. They do not meet hydric soil requirements.

Surface textures are fine sandy loam to silt loam and may contain up to 5 percent cobbles. Subsurface textures range from sand to silt loam. Subsurface fragments are nearly always present. Gravels constitute 6 to 22 percent of volume, while cobbles constitute 1 to 30 percent of volume. Soil pH ranges from ultra acid to moderately acid with values of 3.1 to 5.9. Carbonates are absent in these soils.

Surface Texture: Fine sandy loam, very fine sandy loam, loam, silt loam
Surface Texture Modifiers: Cobbly
Subsurface Texture: Sand, loamy sand, sandy loam, fine sandy loam, very fine sandy loam, loam, silt loam
Subsurface Texture Modifiers: Gravelly, cobbly, very cobbly

Table 4. Representative soil features

Parent material	(1) Eolian deposits (2) Residuum (3) Glaciofluvial deposits (4) Till

Surface texture	(1) Cobbly fine sandy loam (2) Very fine sandy loam (3) Loam (4) Silt loam
Drainage class	Moderately well drained to well drained
Permeability class	Very slow
Soil depth	80 – 200 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	0 – 10 %
Available water capacity (Depth not specified)	11.18 – 35.31 cm
Calcium carbonate equivalent (Depth not specified)	Not specified
Soil reaction (1:1 water) (Depth not specified)	3.1 – 5.9
Subsurface fragment volume <=3" (Depth not specified)	10 – 20 %
Subsurface fragment volume >3" (Depth not specified)	0 – 30 %

Ecological dynamics

Historically, mature forests on this ecological site were dominated by shade tolerant sugar maple and hemlock, often with an admixture of yellow birch (Wilde, 1933, Finley, 1976). This association was self-maintained with new cohorts of advance regeneration gaining canopy status through gaps formed by small-scale disturbances and natural mortality in the dominant canopy. Scattered large individuals of less shade tolerant white pine also were common component of mesic hardwood forests. These presumably became established following relatively rare disturbances that included fire (Schulte and Mladenoff, 2005).

Current stands on this Ecological Site represent the entire array of potential successional stages from pure aspen, or aspen-white birch, stands to sugar maple dominated mixed northern hardwoods stands. Succession to sugar maple dominance is evident everywhere that seed sources are present. However, hemlock regeneration is scarce. In old forests, hemlock finds optimal conditions for germination and seedling establishment on rotten logs, stumps and mounds that normally have warmer surfaces and better moisture retention than the forest floor (USDA, 1990). Most present forest communities lack these conditions.

While this ES may be similar to others (Loamy Uplands and Alfic Loamy Uplands) in its state and transition model, it should be noted that due to the fragipan or fragic properties of the subsoil there are likely to be more frequent blow downs and stunted trees on these sites due in both cases to root restrictions. In essence this ES will have lower productivity and frequently younger potentially stunted trees.

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 6. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 7. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 8. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 9. Community 2.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 10. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Inventory data references

Sites key primarily to mesic Kotar Habitat Types. STM designed based on ATM and ATD types. (Wisconsin Forest Habitat Type Classification System) Gogebic is the only soil represented in the sites collected for this ESD.

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Approval

Suzanne Mayne-Kinney, 9/27/2023

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	09/27/2023
Approved by	
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:**