Ecological site F093BY006MI
Alfic Sandy Uplands

Last updated: 9/27/2023
Accessed: 08/25/2026

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): Four of the five sites in teis ES key to the Acer saccharum – Tsuga canadensis/ Maianthemum canadense (ATM) habitat type, and one outlier site keys to Pinus strobus – Acer rubrum / Vaccinium angustifolium – Aralia nudicaulis (PArVAa). Biophysical Setting (Landfire, 2014): This ES is mapped as Boreal White Spruce-Fir-Hardwood Forest – Inland, Laurentian-Acadian Pine-Hemlock-Hardwood Forest, and Laurentian-Acadian Northern Hardwoods Forest – Hemlock; 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 Alfic Sandy Uplands ecological site is an uncommon site in MLRA 93B, located on moraines, lake plains, and outwash plains. These sites are characterized by very deep, well to somewhat excessively drained soils that formed in sandy till and sandy outwash. These soils have a layer of significant clay accumulation (i.e. an argillic horizon, sometimes composed of lamellae) that helps perch and retain water in the soil profile. Precipitation and runoff from adjacent uplands are the primary sources of water. Soils range from very strongly acid to slightly acid. The characteristic clay accumulation found in Alfic Sandy Uplands differentiates it from Sandy Uplands. This boost in available water capacity provided by the clay layer allows Alfic Sandy Uplands to support a wide range of vegetative species. Other upland sites have loamy materials. Sandy materials often have a lower pH and available water capacity than loamy materials, which may limit 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 Alfic Sandy 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 Alfic Sandy Uplands.
F093BY011MI	**Dry Uplands** Dry Uplands are found in the sandiest, most permeable soils on the driest landscape positions. They are very deep and excessively drained. These sites occur slightly higher on the drainage sequence than Alfic Sandy Uplands.

Similar sites

F093BY009MI	**Alfic Loamy Uplands** Alfic Loamy Uplands occur on upland sites in loamy glaciofluvial deposits. They are moderately well to well drained. They occur on similar landscape positions and drainage sequence positions as Alfic Sandy Uplands. In both sites, an argillic horizon is either present or forming. Alfic Loamy Uplands have finer textures.
F093BY007MI	**Sandy Uplands** Like Alfic Sandy Uplands, Sandy Uplands occur on upland sites in deep sandy outwash deposits, sometimes with a thin loamy mantle of alluvium or loess. Unlike Alfic Sandy Uplands, argillic horizons are neither present nor forming in these soils. These soils are moderately well to somewhat excessively drained.
F093BY011MI	**Dry Uplands** Dry Uplands are found in the sandiest, most permeable soils on the driest landscape positions. They are very deep and excessively drained. These soils lack a horizon of significant clay accumulation. The amount of water stored by these soils is lower than that of Alfic Sandy Uplands. The vegetative community reflects these differences with slightly drier and less nutrient-demanding species present.

Table 1. Dominant plant species

Tree	(1) *Acer saccharum* (2) *Betula alleghaniensis*
Shrub	(1) *Acer saccharum*
Herbaceous	(1) *Dryopteris carthusiana* (2) *Trientalis borealis*

Physiographic features

These sites occur on moraines, lake plains, and outwash plains in backslope, shoulder, and summit positions. Slope ranges from 0 to 45 percent. These sites are subject to neither flooding not ponding. These sites lack evidence of a seasonally high water table within 80 inches. Surface runoff ranges from very low to high and is largely affected by slope and landscape position.

Hillslope Positions: Summit, backslope, shoulder
Slope Shapes: Convex, linear

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

Table 2. Representative physiographic features

Landforms	(1) Disintegration moraine (2) End moraine (3) Ground moraine (4) Lava plain (5) Outwash plain
Runoff class	Very low to high
Flooding frequency	None
Ponding frequency	None
Elevation	200 – 250 m
Slope	0 – 50 %
Water table depth	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)	100-120 days
Freeze-free period (characteristic range)	130-150 days
Precipitation total (characteristic range)	760-890 mm

Frost-free period (actual range)	100-120 days
Freeze-free period (actual range)	120-160 days
Precipitation total (actual range)	740-910 mm
Frost-free period (average)	110 days
Freeze-free period (average)	140 days
Precipitation total (average)	840 mm

- (1) MELLEN 4 NE [USC00475286], Mellen, WI
- (2) WATTON [USC00208706], Watton, MI
- (3) MARQUETTE [USW00014838], Marquette, MI
- (4) TWIN LAKES [USC00208345], Toivola, 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.
Permeability of the soils is slow to rapid. The hydrologic soil group of these sites is A or C.

Hydrologic Group: A, C
Hydrogeomorphic Wetland Classification: None
Cowardin Wetland Classification: None

Soil features

These sites are represented by the Keweenaw, Menominee, and Lindquist series. Keweenaw and Menominee are classified as Alfic Haplorthods. Lindquist is classified as Lameillc Haplorthods.

In these soils, an argillic horizon is either present or developing, and may be in the form of lamellae with a combined thickness of 6 inches or greater. These soils form in deep sandy drift deposits. They are well to somewhat excessively drained. They do not meet hydric soil requirements.

Surface is either loamy sand or sandy loam. Surface textures are generally sand to sandy loam or the fine or very fine analogues of these textures. Soils formed in relatively finer materials may see clay loam textures in their argillic horizons. Gravels and cobbles may constitute up to 7 percent of surface volume. Subsurface gravel is usually present and may constitute 7 to 13 percent of volume. Soil pH ranges from very strongly acid to slightly acid with values of 4.6 to 6.5. Calcium carbonate equivalency is generally zero, but may be up to 15 percent beginning at 23 inches.

Table 4. Representative soil features

Parent material	(1) Till (2) Outwash

Surface texture	(1) Gravelly sand (2) Fine sand (3) Loamy sand (4) Very fine sand (5) Fine sandy loam (6) Loam (7) Very fine sandy loam (8) Clay loam
Drainage class	Well drained to excessively drained
Permeability class	Slow to rapid
Soil depth	200 cm
Surface fragment cover <=3"	0 – 10 %
Surface fragment cover >3"	0 – 10 %
Available water capacity (Depth not specified)	14.48 – 18.8 cm
Calcium carbonate equivalent (Depth not specified)	0 – 20 %
Soil reaction (1:1 water) (Depth not specified)	4.6 – 6.5
Subsurface fragment volume <=3" (Depth not specified)	10 %
Subsurface fragment volume >3" (Depth not specified)	Not specified

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.

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

All sites collected that key to the ATM Kotar Habitat Type are well represented by this type. All these sites were represented by Keweenaw soil series. One site collected keys to PArVAa, but does not represent this ESD well.

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Approval

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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:

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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:**
