Ecological site F090BY013WI Sandy Upland

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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): 090B–Central Wisconsin Thin Loess Dissected Till Plain

The Wisconsin and Minnesota Thin Loess MLRA, Northern and Southern Parts (90A an 90B) correspond closely to the North Central Forest and the Forest Transition Ecological Landscapes, respectively. Some of the following brief overview is borrowed from the Wisconsin Department of Natural Resources ecological landscape publications (2015). The Wisconsin and Minnesota Thin Loess MLRA, Northern and Southern Parts (90A an 90B) is an extensive glacial landscape that comprised of over 11.1 million acres (17,370 sq mi) throughout central and northern Wisconsin – about 27% of the total land area in the state. This glacial landscape is comprised of a heterogenous mix of loess-capped ground moraines, end moraines with eskers and ice-walled lake plains, and pitted, unpitted, and collapsed outwash plains sometimes interspersed with drumlins from the Illinoian and Pre-Illinoian glaciations. The entire area has been glaciated and nearly all of it is underlain by dense glacial till that impedes drainage. An extensive morainal system – the Perkinstown end moraine – spans most of the width of northern Wisconsin and divides the Northern and Southern Parts of this large landscape. This moraine, which has been sliced by outwash in many places, marks the southernmost extent of the Wisconsin glaciation (Wisconsin's most recent glacial advance). North of the Perkinstown morainal system is a loess plain, with a loess mantle 6-24 inches thick. The northernmost edge of this landscape is an undulating till and outwash plain with materials deposited by the Chippewa Lobe. Drumlins are common in the northern and northeastern portions. The drumlins are oriented towards the southwest and formed during a glacial episode prior to the most recent glacial advance. Some are covered with glacial till. Pitted, unpitted, and collapsed outwash plains fill the spaces between drumlins. Detached from the major land mass to the northeast is the hummocky Hayward collapsed end moraines, where swamps, ice-walled lake plains, and eskers are common. Most of the MLRA to the south of the Perkinstown morainal system is an extensive ground moraine with some proglacial stream features including pitted outwash plains, terraces, and fans. A layer of loess 6-47 inches thick covers much of the area. Like the Northern Part, all areas of the Southern Part of this MLRA were glaciated, although the southcentral portion is a relatively older till plain with materials from the Illinoian and pre-Illinoian glaciations, not the most recent Wisconsin glaciation. The landforms in the southcentral portion are highly variable. Much of the area topography is controlled by underlying bedrock. Sandstone outcrops and pediments can be found here. Some of the most southern portions of the MLRA are mixed glacial deposits and residuum. The land surface of the southeastern portion was formed by many small glacial advances and retreats. Morainal ridges protrude through an erosional, pitted outwash-mantled surface. These parallel ridges run in a northeast to southwest orientation and are dissected by many steams. The continental climate of this MLRA is typical of northcentral Wisconsin, with cold winters and warm summers. The southern boundary of this MLRA straddles Wisconsin's Tension Zone, a zone of transition between Wisconsin's northern and southern ecological landscapes. Historically, the mesic forests were dominated by eastern hemlock (Tsuga canadensis), sugar maple (Acer saccharum), and yellow birch (Betula alleghaniensis).

Classification relationships

Major Land Resource Area (MLRA): Wisconsin and Minnesota Thin Loess and Till (Northern and Southern parts - 90A an 90B) USFS Subregions: Hayward Stagnation Moraines (212Xf), Glidden Loamy Drift Plain (212Xa), Mille Lacs Uplands (212Kb), Perkinstown End Moraine (212Xe), Rib Mountain Rolling Ridges (212Qd) Small sections occur in Rosemont Baldwin Plains and Moraines (222Md), Central-Northwest Wisconsin Loess Plains (212Xd), St. Croix Moraine (212Qa), Green Bay Lobe Stagnation Moraine (212Ta) Wisconsin DNR Ecological Landscapes: Northwest Lowlands, North Central Forest, Forest Transition, Western Prairie

Ecological site concept

The Moist Sandy Upland ecological site is most abundant on the northern border of MRLAs 90A and 90B, located on outwash and lake plains, end moraines, stream terraces, and valley trains. These sites are characterized by very deep, moderately well to well drained soils formed in sandy deposits including alluvium, outwash, and till. The sandy deposits may have underlying loamy alluvium till, or residuum. Precipitation and runoff from adjacent uplands are the primary sources of water. Soils range from extremely acid to neutral. Moist Sandy Upland is distinguished from other ecological sites based on the sandy materials and moderately well to well drainage. Other moderately well and well drained site have loamy or clayey materials. Sandy materials often have lower pH and available water capacity, and often lack carbonates found in loamy and clayey materials. These conditions can limit vegetative growth. The moderately well to well drained soils differentiate this site from other sandy sites.

Associated sites

F090BY001WI	**Poor Fen** Poor fen sites consist of deep herbaceous organic materials. Some sites have mineral soil contact. They are very poorly drained and remain saturated throughout the year. They are strongly to extremely acidic. These sites are permanently saturated wetlands. They are wetter and occur lower on the drainage sequence than Moist Sandy Upland.
F090BY005WI	**Wet Sandy Lowland** Wet Sandy Lowland sites consist of deep sandy deposits derived from a mixture of outwash, alluvium, and lacustrine sources. They form in seasonally ponded depressions and are saturated long enough for hydric conditions to occur. Some sites are wetlands. They are wetter and occur lower on the drainage sequence than Moist Sandy Upland.
F090BY009WI	**Moist Sandy Upland** Moist Sandy Lowland sites consist of deep, sandy deposits from outwash, alluvium, lacustrine, and till. They sandy deposits may have a loamy mantle or be underlain by loamy deposits. The finer materials can cause episaturation and allow the site to remain moist for some of the growing season. They are wetter and occur lower on the drainage sequence than Moist Sandy Upland.
F090BY019WI	**Dry Sandy Upland** Dry Sandy Upland sites consist of primarily sandy deposits of various origin. Loamy deposits are also present in many soils. They may have a seasonally high water table within two meters of the surface, though they do not remain saturated for sustained periods. They are much drier and occur higher on the drainage sequence than Moist Sandy Upland.

Similar sites

F090BY016WI	**Loamy Upland** Loamy Upland sites consist of deep loamy till, alluvium, residuum, lacustrine, or eolian deposits. Sandy deposits of these parent materials, plus outwash, may also be present. The depth to the seasonally high water table ranges from as high as the surface to as low as almost two meters below the surface. A few sites are on floodplains and upland drainageways, where very brief flooding is rare but possible. These sites share their position on the landscape and drainage class with Moist Sandy Upland but have finer textures.
F090BY019WI	**Dry Sandy Upland** Dry Sandy Upland sites consist of primarily sandy deposits of various origin. Loamy deposits are also present in many soils. They may have a seasonally high water table within two meters of the surface, though they do not remain saturated for sustained periods. They share particle size with Moist Sandy Upland but are drier. The two sites sometimes support similar vegetative communities.

Table 1. Dominant plant species

Tree	(1) *Pinus strobus* (2) *Acer rubrum*

Shrub	(1) *Corylus cornuta*
Herbaceous	(1) *Maianthemum canadense* (2) *Pyrola*

Physiographic features

These sites formed on lake plains, outwash plains, valley trains, moraines, and stream terraces. Slopes range from 0 to 55 percent.

These sites are not subject to ponding or flooding. Soils have a seasonally high water table at depths of 24 to 72 inches. The water table may drop below 80 inches during dry conditions. Runoff is negligible to high.

Table 2. Representative physiographic features

Hillslope profile	(1) Summit (2) Backslope (3) Shoulder
Slope shape across	(1) Convex
Slope shape up-down	(1) Linear
Landforms	(1) Outwash plain (2) Lake plain (3) Valley train (4) Stream terrace (5) Moraine
Runoff class	Negligible to high
Flooding frequency	None
Ponding frequency	None
Elevation	180 – 280 m
Slope	0 – 60 %
Water table depth	60 – 180 cm

Aspect	Aspect is not a significant factor

Climatic features

The climate of the expansive Wisconsin and Minnesota Thin Loess and Till Plain is highly variable. The eco-climatic zone (the “Tension Zone”) that runs southeast-northwest across the state splits the MLRA. In general, the MLRA has cold winters and warm summers with an adequate amount of precipitation. Near Lake Superior, precipitation and temperature tend to increase. The far western section of the MLRA, known as the western prairie ecological landscape by the Wisconsin DNR, has warmer temperatures compared to the rest of the MLRA because it falls below the eco-climatic zone. The soil moisture regime of MLRA is udic (humid climate). The soil temperature regime is frigid and cryic.

The average annual precipitation for this ecological site is 32 inches. The average annual snowfall is 57 inches. The annual average maximum and minimum temperatures are 52°F and 31°F, respectively.

Table 3 Representative climatic features

Frost-free period (characteristic range)	70-110 days
Freeze-free period (characteristic range)	110-140 days
Precipitation total (characteristic range)	740-810 mm
Frost-free period (actual range)	40-120 days
Freeze-free period (actual range)	90-150 days
Precipitation total (actual range)	690-890 mm
Frost-free period (average)	90 days
Freeze-free period (average)	120 days
Precipitation total (average)	790 mm

- (1) HOLCOMBE [USC00473698], Holcombe, WI
- (2) ROSHOLT 9 NNE [USC00477349], Wittenberg, WI
- (3) STAMBAUGH 2SSE [USC00207812], Iron River, MI
- (4) BIG FALLS HYDRO [USC00470773], Glen Flora, WI
- (5) COUDERAY 7 W [USC00471847], Stone Lake, WI
- (6) ISLE 12N [USC00214103], Isle, MN
- (7) MOOSE LAKE 1 SSE [USC00215598], Moose Lake, MN
- (8) MILACA [USC00215392], Milaca, MN

Influencing water features

Water is received through precipitation, runoff from adjacent uplands, and groundwater discharge. Water levels are greatly influenced by precipitation rates and runoff from upland sites. Water leaves the site primarily through runoff, evapotranspiration, and groundwater recharge.

Wetland description

Permeability of these sites range from very slow to rapid.
Hydrologic Group: A, B
Hydrogeomorphic Wetland Classification: None
Cowardin Wetland Classification: None

Soil features

These sites are represented by Chinwhisker, Croswell, Cublake, Dickman, Fremstadt, Gotham, Guenther, Keweenaw, Komro, Mahtomedi, Manitowish, Pence, Rousseau, Slimlake, Spoonerhill, Springstead, and Wurtsmith soil series. Some sites are represented by Udipsamments and Udorthents that are not classified to series. Chinwhisker is classified as a Lamellic Oxyaquic Haplorthod; Croswell, Cublake, Manitowich, and Springstead are Oxyaquic Haplorthods; Guenther and Keweenaw are Alfic Haplorthods; Fremstadt is an Arenic Hapludalf; Rousseau is an Entic Haplorthod; Komro is an Entic Hapludoll; Slimlake and Spoonerhill are Oxyaquic Dystrudepts; Wurtsmith is Oxyaquic Udipsamment; Gotham is a Psammentic Hapludalf; Pence is a Typic Haplorthod; Dickman is a Typic Hapludoll; Mahtomedi is a Typic Udipsamment.

These soils formed in various parent material including loamy or sandy alluvium, sandy outwash, sandy or loamy till, and loamy residuum. Soils are very deep and moderately well or well drained. They do not meet hydric requirements.

The surfaces of these sites are sandy loam, loam, loamy sand, and slightly to moderately decomposed plant material. Some sites have fine sands. Subsurface textures are sandy loam, silt loam, loamy sand, and sand. Many horizons have fine or very fine sand. Some horizons have gravelly and very gravelly modifiers. Soil pH ranges from extremely acid to neutral with values of 4.2 to 6.7. Carbonates are absent within 80 inches.

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Outwash (3) Till (4) Igneous and metamorphic rock (5) Residuum
Surface texture	(1) Loamy sand (2) Sandy loam (3) Loam
Drainage class	Moderately well drained to well drained
Permeability class	Very slow to rapid
Soil depth	200 – 250 cm
Surface fragment cover <=3"	0 – 10 %
Surface fragment cover >3"	0 – 10 %

Available water capacity (0-154.9cm)	3.71 – 6.81 cm
Calcium carbonate equivalent (0-100.1cm)	Not specified
Soil reaction (1:1 water) (0-100.1cm)	4.2 – 6.7
Subsurface fragment volume <=3" (Depth not specified)	0 – 30 %
Subsurface fragment volume >3" (Depth not specified)	0 – 10 %

Ecological dynamics

In pre-European settlement time wildfire was the main controlling factor of forest community dynamics. Following a severe, stand-replacing fire, any of the species present on the landscape could become established, depending on seed source availability and specific conditions of post-fire seedbed. The newly established young stands of any species were easily eliminated by recurring fires, but differences in fire-resisting properties among the species began to play a role in any species' survival success. Many pine and oak species were dominant in the region because of their fire-resistant properties and successful regeneration post-fire. With clear cutting and continued fire suppression, many of these species adapted to fire and intolerant of shade are replaced by other species. Species such as white pine and red oak are still common on the landscape based on their tolerance to some shade; these species to establish under a canopy, and in time, may become a component of the canopy. Red maple is sensitive to fire, but in its absence, it has the ability to dominate sites based on its shade tolerance and prolific seed production.

Today, these forests most commonly include stands of red oak, red maple, and aspen and birch. Various species can be found as associates including sugar maple, and in many areas, white pine is successfully reinvading the landscape. As long as fire is continually suppressed, maples and other mesic hardwoods will continue to dominate the canopy.

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

Plot and other supporting inventory data for site identification and community phases is located on a NRCS North Central Region shared and one drive folder. University Wisconsin-Stevens Point described soils, took photographs, and inventoried vegetation data at community phases within the reference state. The data sources include WI ESD Plot Data Collection Form - Tier 2, Releve Method, NASIS pedon description, NRCS SOI 036, photographs, and Kotar Habitat Types. Habitat Types of N. Wisconsin (Kotar, 2002): The sites of this ES keyed out to five habitat types: Acer saccharum/Hydrophyllum (AH); Acer saccharum-Tsuga/Maianthemum (ATM); Acer saccharum/Viburnum (AVb); Acer sachharum/Vaccinium-Viburnum (AVVb); Pinus-Acer rubrum/Vaccinium (PArV) Biophysical Settings (Landfire, 2014): This ES is largely mapped as Laurentian-Acadian Northern Hardwoods Forest, Boreal White Spruce-Fir Forest, Boreal White Spruce-Fir-Hardwood Forest, Boreal Hardwood Forest, and Eastern Cool Temperate Pasture and Hayland WDNR Natural Communities (WDNR, 2015):

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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	08/18/2026

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:**
