Ecological site F089XY019WI
Loamy-Clayey Bedrock Upland Forest

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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): 089X–Wisconsin Central Sands

The Wisconsin Central Sands (MLRA 89) corresponds closely to Central Sand Plains Ecological Landscape published by the Wisconsin Department of Natural Resources (WDNR, 2015). Much of the following brief overview of this MLRA is borrowed from that publication. The Wisconsin Central Sands MLRA is entirely in Wisconsin. The total land area is 2,187,100 acres (3,420 square miles, 8858 square kilometers). It is bordered to the east by Johnstown-Hancock end moraines, which were pushed to their extent by the west side of the Green Bay Lobe (Clayton & Attig, 1999). It is bordered to the southwest by highly eroded, unglaciated valleys and ridges. The dominant feature of this MLRA is the remarkably flat, sandy plain, composed of lacustrine deposits and outwash sand, that was once the main basin of Glacial Lake Wisconsin. It also features extensive pine and oak barrens and wetland complexes. Glacial Lake Wisconsin was fed primarily by glacial meltwater from the north and east. The lake deposited silt overlain by tens of meters of sand (Clayton & Attig, 1989). The silty layers are closer to the surface in some areas, where they impede drainage and contribute to the formation of extensive wetland complexes. It is believed that Glacial Lake Wisconsin drained within several days after a breach in the ice dam that supported it. The catastrophic flood that followed flowed to the south and carved the scattered buttes and mesas protruding from the sandy plain in the southern portion of this MLRA. Before vegetation established after glacial recession, strong winds formed aeolian sand dunes that now support xeric pine and oak stands within the Wisconsin Central Sands. The surface of the northwestern portion is mostly undulating. The sandy surface sediment was mostly deposited by meltwater during the Wisconsin glaciation. Gentle hills are a result of underlying bedrock topography. Valleys and floodplains are formed by stream action. The underlying bedrock controls the water table elevation and contributes to the formation of numerous wetlands. Historically, the Wisconsin Central Sands were dominated by large wetland complexes, sand prairies, and oak forests, savannas, and barrens. Some pine and hemlock forests were found in the northwest portion. The Wisconsin Central Sands was subject to frequent fires, leading to today's need for prescribed burns to maintain a representation of fire-dependent communities.

Classification relationships

Major Land Resource Area (MLRA): Wisconsin Central Sands (89) USFS Subregions: Neillsville Sandstone Plateau (222Rb) and Lincoln Formation Till Plain - Mixed Hardwoods (212Qb) Small sections occur in the Central Wisconsin Sand Plain (222Ra) Subregions Relationship to Established Framework and Classification Systems: Habitat Types of N. & S. Wisconsin (Kotar, 2002 & 1996): The sites of this ES keyed out to three habitat types: Pinus-Acer rubrum/Vaccinium-Hamamelis (PArVHa); Pinus/Vaccinium-Gaultheria (PVG); Pinus/Vaccinium-Rubus hispidus (PVRh) Biophysical Settings (Landfire, 2014): This ES is largely mapped as North-Central Interior Dry Oak Forest and Woodland, Eastern Cool Temperate Pasture and Hayland, Laurentian-Acadian Northern Hardwoods Forest, and Eastern Cool Temperate Close Grown Crop. WDNR Natural Communities (WDNR, 2015): This ES is most similar to the Mixed Hardwood Forest, Northern Dry-Mesic Forest, and Central Sands Pine-Oak Forest communities.

Ecological site concept

Loamy Bedrock Uplands formed on pediments, hillslopes, upland hills, and ridges, primarily in the northern portion of MLRA 89 where loamy materials were deposits during the Wisconsin glaciation and the bedrock is relatively shallow. This region has bedrock influence that is absent in most of the MLRA. These sites are characterized by shallow to moderately deep, well drained soils that formed primarily in loamy alluvium over loamy residuum weathered from the underlying interbedded sandstone and shale. Some sites have sandy residuum over sandstone underlying the loamy alluvium, and others may have other loamy materials, such as loess or silty alluvium. Precipitation and runoff from adjacent uplands are the primary sources of water, but groundwater discharge can be a significant contribution. Soils range from very strongly acid to slightly acid. Current plant community is a dry-mesic forest dominated by varying mixtures of red oak (Quercus rubra), white oak (Q. alba) and red maple (Acer rubrum) with sporadic presence of white pine (Pinus strobus). Aspen-Paper birch (P. tremuloides – B. papyrifera) stands and red pine plantations also occur. Loamy Bedrock Uplands differs from other sites based on moderate depth to bedrock, drainage, and loamy textures. Loamy Uplands have soils that are greater than 80

inches (200 cm) in depth. The bedrock both perches water and restricts root growth, which can cause trees to tip. Other well drained sites have sandy textures. Loamy textures tend to have higher pH and available water capacity than sand. The well-draining soil sets this site apart from other loamy sites.

Associated sites

F089XY004WI	**Loamy-Clayey Floodplain Forest** Loamy Floodplains are found exclusively on floodplains in loamy alluvium underlain by sandy alluvium. Soils are somewhat poorly to poorly drained and are subject to flooding. These sites occur primarily along tributaries to the Yellow River in central Wood County and along the Lemonweir River. They may be adjacent to Loamy Bedrock Uplands.
F089XY008WI	**Wet Loamy-Clayey Lowland Forest** Wet Loamy Lowlands form in a loamy or silty mantle 10 to 40 inches (25 to 100 cm) thick overlying sandy residuum weathered from sandstone and shale. Bedrock contact may occur as high at 26 inches (66 cm). These soils are poorly drained, remain saturated for much the growing season, and are sometimes subject to ponding. They are exclusive to the northern third of the Wisconsin Central Sands MLRA, which was covered in loamy glacial deposits prior to the most recent glacial advance. They occur lower on the drainage sequence and are wetter than Loamy Bedrock Uplands.

Similar sites

F089XY020WI	**Loamy-Clayey Upland Forest** Loamy Uplands consist of sandy deposits underlain by clayey lacustrine deposits or of loamy alluvium underlain by sandy outwash. They are moderately well to somewhat excessively drained. Because of they lack bedrock contact within 80 inches (200 cm), these sites sometimes have a much deeper water table and can hold more water. They may support vegetative communities with higher nutrient requirements than those of Loamy Bedrock Uplands.
F089XY016WI	**Sandy Nutrient Limited Bedrock Upland Forest** Dry Sandy Bedrock Uplands form in sandy deposits derived from a mixture of outwash, alluvium, and residuum. Contact with interbedded sandstone and shale bedrock occurs within 40 inches (100 cm) of the surface. These soils are moderately well to excessively drained. Because Loamy Bedrock Uplands sometimes have a mantle of sandy alluvium, the vegetative communities they support may sometimes be similar to those of Loamy Bedrock Uplands.

Table 1. Dominant plant species

Tree	(1) *Pinus strobus* (2) *Quercus alba*
Shrub	(1) *Corylus* (2) *Prunus serotina*
Herbaceous	(1) *Pteridium aquilinum* (2) *Maianthemum canadense*

Physiographic features

These sites formed on pediments, hillslopes, and upland hills and ridges. Slopes range from 1 to 33 percent. Sites are positioned on summits, shoulders, backslopes, and toeslopes. Elevation ranges from 689 to 1,411 feet (210 to 430) meters above sea level. These sites are not subject to ponding or flooding. Most sites have a seasonally high water table at depths of 24 to 80+ inches (61 to 200+ cm).

The water table may drop to greater than 80 inches (200 cm) during dry conditions. Surface runoff ranges from medium to very high.

Figure 1. Distribution of Loamy Bedrock Uplands in the Wisconsin Central Sands MLRA (89).

Table 2. Representative physiographic features

Slope shape across	(1) Linear
Slope shape up-down	(1) Convex
Hillslope profile	(1) Summit (2) Shoulder (3) Backslope (4) Toeslope
Landforms	(1) Pediment (2) Hillslope (3) Hill
Runoff class	Medium to very high
Flooding frequency	None
Ponding frequency	None
Elevation	210 – 430 m
Slope	0 – 30 %
Water table depth	60 – 200 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

The continental climate of the Wisconsin Central Sands is typical of the southern half of the state – cold winters and warm summers. Precipitation is well-distributed throughout the year with a slight peak in the summer months. Snowfall covers the ground from late fall to early spring. The soil moisture regime of MLRA 89 is udic (humid climate). The soil temperature regime is mostly frigid, with a small portion of mesic in the southern tip. Neither precipitation nor temperature vary greatly across this MLRA. More so than latitude, local topography seems to be an important predictor of growing season length, with fewer growing degree days in lower-lying areas.

Table 3 Representative climatic features

Frost-free period (characteristic range)	80-120 days
Freeze-free period (characteristic range)	110-140 days
Precipitation total (characteristic range)	810-860 mm
Frost-free period (actual range)	70-120 days
Freeze-free period (actual range)	100-140 days
Precipitation total (actual range)	790-860 mm
Frost-free period (average)	100 days
Freeze-free period (average)	120 days
Precipitation total (average)	840 mm

- (1) HATFIELD [USC00473471], Merrillan, WI
- (2) WISCONSIN RAPIDS [USC00479335], Wisconsin Rapids, WI
- (3) PRENTICE #2 [USC00476859], Marshfield, WI
- (4) WISCONSIN DELLS [USC00479319], Wisconsin Dells, WI

Influencing water features

Water is received primarily from precipitation, runoff from adjacent uplands, and groundwater discharge. Water leaves the site primarily through runoff, evapotranspiration, and groundwater recharge. Subsurface outflow may occur where the sandstone bedrock perches the water table. Permeability of these sites is moderate in the loamy mantle, but slow to impermeable in the bedrock. Hydrologic group is B, C, or D.

Soil features

These sites are represented by the Elevasil, Hiles, Humbird, and Norgo soil series. Elevasil is classified as an Ultic Hapludalf; Hiles is an Oxyaquic Glossudalf; Humbird is an Oxyaquic Ultic Haplorthod; and Norgo is a Lithic Hapludalf.

These soils formed in loamy materials underlain by sandstone or interbedded sandstone and shale bedrock, sometimes with residuum. Loamy materials are alluvium, pedisediment, or loess, and the residuum is weathered from underlying sandstone or interbedded sandstone and shale. Soil depth ranges from 12 to 40 inches (30 to 99 cm) to bedrock. Soils are moderately well to well drained. Sites do not meet hydric soil requirements.

Surface textures of these sites are sandy loam and silt loam. Subsurface textures include sand, loamy sand, sandy loam, loam, silt loam, and clay loam. Soil pH ranges from very strongly acid to slightly acid with values of 4.50 to 6.10. Surface fragments are absent. Subsurface fragments less than 3 inches can be present up to 14 percent volume. Subsurface fragments greater than 3 inches can be present up to 5 percent volume. Carbonates are absent.

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Residuum (3) Pedisediment (4) Loess
Surface texture	(1) Sandy loam (2) Silt loam
Drainage class	Moderately well drained to well drained
Permeability class	Very slow to moderately slow
Soil depth	30 – 100 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-152.4cm)	4.22 – 13.31 cm
Calcium carbonate equivalent (0-101.6cm)	Not specified
Soil reaction (1:1 water) (0-101.6cm)	4.5 – 6.1
Subsurface fragment volume <=3" (0-198.1cm)	0 – 10 %
Subsurface fragment volume >3" (0-198.1cm)	0 – 10 %

Ecological dynamics

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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 2.4 plant community composition

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

Table 11. Community 3.1 plant community composition

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

Table 12. Community 4.1 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.

Other references

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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:**
