Ecological site F089XY008WI
Wet Loamy-Clayey Lowland 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 the area.

Classification relationships

Major Land Resource Area (MLRA): Wisconsin Central Sands (89) USFS Subregions: Neillsville Sandstone Plateau (222Rb) Small sections occur in the Lincoln Formation Till Plain - Mixed Hardwoods (212Qb) and Central Wisconsin Sand Plain (222Ra) subregions Relationship to Established Framework and Classification Systems: Habitat Types of N. & S. Wisconsin (Kotar, 2002 & 1996) and Wetland Forest Habitat Type Classification System for Northern Wisconsin (Kotar and Burger, 2017): The sites of this ES keyed out to seven habitat types: Acer-Quercus/Viburnum, Geranium variant (AQVb-Gr); Acer saccharum-Tsuga/Athyrium-Onoclea (ATAtOn); Pinus/Vaccinium-Gaultheria (PVG); Pinus/Vaccinium-Rubus hispidus (PVRh); Pinus-Acer/Gaylussacia (PArGy); Ace rubrum-Fraxinus nigra/Rubus hispidus (ArFnRh). The latter two habitat types are wetland habitat types for Northern Wisconsin used in lieu of Southern Wisconsin wetland habitat types. Biophysical Settings (Landfire, 2014): This ES is largely mapped as North-Central Interior Maple-Basswood Forest and Laurentian-Acadian Northern Hardwoods Forest. WDNR Natural Communities (WDNR, 2015): This ES is most similar to the Northern Hardwood Swamp, Southern Hardwood Swamp, and White pine-Red maple Swamp.

Ecological site concept

The Wet Loamy Lowlands ecological site is widespread in the northern portion of MLRA 89, where loamy glacial till was deposited during the Wisconsin glaciation. These sites are characterized by very deep, somewhat poorly drained soils that formed in silty alluvium and loamy residuum weathered from interbedded sandstone and shale. Sites are subject to frequent, brief flooding during the growing season. Precipitation, runoff from adjacent uplands, and groundwater discharge are the primary sources of water. Soils range from very strongly acid to strongly acid. Some sites may be wetlands. Historically, this Ecological Site was dominated by a variety of plant communities, apparently reflecting differences in historic fire regime. Prairie, Pine Barrens, Oak Barrens, Oak Savanna and mixed Pine - Oak forests were all represented (Finley, 1976). Following European settlement most of the area was cleared of forest vegetation and converted to farming, although scattered woodlots remained. Current woodlots typically consist of mixed oak, primarily white oak (Q. alba) and Red oak (Q. rubra), white pine (Pinus strobus) and red maple (Acer rubrum). Also common are mixed stands of trembling

aspen (Populus tremuloides) and paper birch (Betula papyrifera). There also are considerable areas of planted red pine (P. resinosa). Wet Loamy Lowlands differs from other sites primarily by its drainage and loamy textures. Other poorly drained sites have sandy or clayey textures. Loamy textures often have higher pH and available water capacity than sandy textures, which offer improved growing conditions for this site. Loamy and clayey sites are often similar in soil features, but clayey soils tend to hold more water and for longer periods than loamy soils. The poor drainage differentiates this site from other loamy sites.

Associated sites

F089XY002WI	**Organic Swamps** Mucky Swamps sites consist of herbaceous organic materials sometimes underlain by sandy to loamy mineral soil. They are very poorly drained and remain saturated throughout much of the year. These sites are wetlands. They may occur lower on the drainage sequence than Wet Loamy Lowlands.
F089XY019WI	**Loamy-Clayey Bedrock Upland Forest** Loamy Bedrock Uplands form in loamy alluvium or loess overlain by interbedded sandstone and shale. Bedrock contact occurs within 40 inches (99 cm) of the surface. Soils are moderately well or well drained. These sites are primarily found in the northern portion of the Wisconsin Central Sands MLRA which was covered in loamy glacial deposits prior to the most recent glacial advance and where depth of bedrock is shallow. They occur higher on the drainage sequence and have a much deeper water table than Wet Loamy Lowlands.

Similar 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. These sites support vegetative communities similar to those found in Wet Loamy Lowlands.
F089XY009WI	**Wet Clayey Lowlands** Wet Clayey Lowlands form in deep clayey lacustrine deposits overlain by a silty mantle. These soils are poorly drained, remain saturated for much of the growing season, and are sometimes subject to ponding. They hold more water than Wet Loamy Lowlands. These sites are found in the southwestern portion of the Wisconsin Central Sands MLRA. The vegetative communities found on these sites is similar to those found on Wet Loamy Lowlands.
F089XY013WI	**Moist Loamy-Clayey Bedrock Upland Forest** Moist Loamy Bedrock Uplands form in loamy alluvium or loess underlain by loamy or clayey residuum weathered from interbedded sandstone and shale. Bedrock is found within 48 inches (122 cm) of the surface. These soils are somewhat poorly drained and are subject to neither flooding nor ponding. These sites are found in northern portion of the Wisconsin Central Sands MLRA where depth to bedrock is shallow.

Table 1. Dominant plant species

Tree	(1) *Pinus strobus* (2) *Quercus alba*
Shrub	(1) *Acer rubrum*

Herbaceous	(1) *Amelanchier* (2) *Pteridium aquilinum*

Physiographic features

This site occurs in depressions and drainageways on pediments. Slopes range from 0 to 2 percent. Elevation ranges from 705 to 1,394 feet (215 to 425) meters above sea level.

Some sites are subject to occasional to frequent ponding throughout the year. The ponding duration is brief (2 to 7 days), with depth up to 12 inches (30 cm) above the soil surface. Some sites do not pond. These sites do not flood. The soils have a seasonally high water table at a depth of 0 to 4 inches (0 to 10 cm), but the water table may drop to 60 inches (50 cm) during dry conditions. Runoff is negligible to low.

Figure 1. Distribution of Wet Loamy Lowlands in the Wisconsin Central Sands MLRA (89).

Table 2. Representative physiographic features

Geomorphic position, flats	(1) Dip
Slope shape across	(1) Linear
Slope shape up-down	(1) Concave
Landforms	(1) Pediment
Runoff class	Negligible to low
Flooding frequency	None
Ponding duration	Brief (2 to 7 days)
Ponding frequency	Occasional to frequent
Elevation	220 – 430 m
Slope	0 %
Ponding depth	0 – 30 cm
Water table depth	0 – 10 cm
Aspect	Aspect is not a significant factor

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.

This site sometimes occurs on landscape depressions, where the local topography is expected to influence growing season length. In landscape depressions, the freeze-free and frost-free periods may be shorter than what is represented here.

The average annual precipitation for this ecological site is 33 inches. The average annual snowfall is 43 inches. The annual average maximum and minimum temperatures are 56°F and 33°F, respectively. This site is exclusive to the northern portion of the latitudinal gradient of this MLRA. The frost-free period of this site is 21 days shorter than the MLRA average (135 days, base 32°F).

Table 3 Representative climatic features

Frost-free period (characteristic range)	80-110 days
Freeze-free period (characteristic range)	100-130 days
Precipitation total (characteristic range)	810-840 mm
Frost-free period (actual range)	80-120 days
Freeze-free period (actual range)	100-140 days
Precipitation total (actual range)	810-840 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

Influencing water features

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

Under the Cowardin System of Wetland Classification, or National Wetlands Inventory (NWI), the wetlands can be classified as:

1) Palustrine, forested, broad-leaved deciduous, saturated, or
2) Palustrine, forested, needle-leaved evergreen, saturated, or
3) Palustrine emergent, persistent, saturated

Under the Hydrogeomorphic Classification System (HGM), the wetlands can be classified as:

1) Depressional, forested/silty, or
2) Depressional, scrub-shrub/silty

Permeability of the soils range from rapid to very slow. Surface permeability is moderate or moderately slow but can be rapid to very slow in the subsurface based on textures with the varying parent materials. The hydrologic soil group of these sites is C/D.

Soil features

These sites are represented by the Veedum and Vesper soil series, both of which are classified as Humic Epiaquepts.

The Veedum series has bedrock within 26 inches (66 cm), but can range from 20 to 40 inches (50 to 100 cm). Vesper series does not have bedrock within 80 inches (200 cm). The silty mantle on these sites ranges from 10 to 28 inches (25 to 70 cm). In the Veedum series, the water table is perched on the bedrock. The NRCS writes that this soil series does not fit either definition of episaturation or endosaturation but expanded the definition of episaturation to include soils with a water table perched on top of bedrock, like Veedum. These soils are poorly drained and remain saturated for much of the growing season. They meet hydric soil requirements.

The surface of these sites is muck or silty loam. Subsurface horizons range from sand to clay loams based on parent material. Mineral soil has bedrock contact with interbedded sandstone and shale. Soil pH is very strongly acid to strongly acid in the profile with a range of 4.60 to 5.50. Surface fragments are absent. Subsurface fragments less than 3 inches can be present up to 7 percent by volume, and fragments greater than 3 inches can be present up to 6 percent. Sites are absent of carbonates within 80 inches (200 cm).

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Residuum (3) Loess
Surface texture	(1) Silt loam
Drainage class	Poorly drained to very poorly drained
Permeability class	Very slow to slow
Soil depth	50 − 200 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-152.4cm)	15.19 − 21.59 cm
Calcium carbonate equivalent (0-101.6cm)	Not specified

Soil reaction (1:1 water) (0-101.6cm)	4.6 – 5.5
Subsurface fragment volume <=3" (0-203.2cm)	0 – 10 %
Subsurface fragment volume >3" (0-203.2cm)	0 – 10 %

Ecological dynamics

Perhaps the most important ecological characteristic of this Ecological Site, in terms of its influence on forest community dynamics, is its lack of capacity to support the high to moderate soil moisture and nutrient requiring species such as sugar maple, basswood and white ash, the shade-tolerant species, that typically dominate the more productive sites throughout Wisconsin.

In pre-European settlement time wild fire 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. White pine is best adapted for long-term success on this Ecological Site. Although vulnerable to damage or elimination by fire in early life it eventually develops thick fire-resistant bark which helps to extend its longevity, in some cases for up to four centuries or more. These survival properties assure the species' relatively continuous seed source in the region as a whole. White pine is also moderately shade-tolerant in early life which means that it can become established in some pioneer communities, such as aspen – white birch stands, or in poorly stocked oak and red maple dominated communities. Red pine had in the past been a common associate of white pine stands. It shares some of the fire-resisting properties of white pine, but it lacks shade-tolerance and does not become established in the understory. For this reason, it has not maintained its presence in current stands and its seed source has been greatly reduced throughout its natural range following the unset of fire suppression. Several species of oak are common members of forest communities on this ecological site. Northern pin oak (Q. ellipsoidalis) and, to a lesser degree, black oak (Q. velutina), are intolerant of shade and do not reproduce from seed under existing canopies. However, following fire or clear cutting they respond by sprouting from stumps. In the absence of disturbance they are replaced, through succession, by more shade-tolerant white pine, red maple (Acer rubrum), or white oak (Q. alba). Red oak (Q. rubra) is somewhat less shade-tolerant than the preceding species, and reproduces sporadically in larger canopy gaps and following a major stand disturbance.

Although red maple has not been identified by Finley (1976) as an important component of pre-settlement pine or oak forests, it is a prominent member in current stands. Absence of fire since the original logging era is probably the main reason. Red maple is extremely sensitive to fire damage, but is a prolific and early seed producer. Stems of 2-4 inches in diameter can produce large amounts of seed (USDA For. Serv. 1990). It is sufficiently shade-tolerant to become established in the understories of most communities on sandy soils. On this Ecological Site it behaves similarly to white pine, but because of its much smaller size at maturity, it does not compete with white pine in the upper 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 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.

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Contributors

Jacob Prater, Associate Professor at University of Wisconsin Stevens Point
ohn Kotar, Ecological Specialist, independent contract
Bryant Scharenbroch, Assistant Professor at University of Wisconsin Stevens Point
Joel Gebhard, University of Wisconsin Stevens Point
Shelly Stein, University of Wisconsin Stevens Point

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:**

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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:**
