Ecological site F089XY006WI
Wet Sandy 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: Central Wisconsin Sand Plain (222Ra) Small sections occur in the Neillsville Sandstone Plateau (222Rb), Central Wisconsin Moraines and Outwash (222Kb), and Lincoln Formation Till Plain - Mixed Hardwoods (212Qb) subregions Habitat Types of S. Wisconsin (Kotar, 1996) and Wetland Forest Habitat Type Classification System for Northern Wisconsin (Kotar and Burger, 2017): The sites of this ES keyed out to four habitat types: Pinus/Vaccinium-Gaultheria (PVG); Pinus/Euphorbia (PEu); Pinus/Vaccinium-Rubus hispidus (PVRh); Pinus-Acer/Gaylussacia (PArGy). The latter is a wetland habitat type 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 Sand and Gravel Tallgrass Prairie, North-Central Interior Maple-Basswood Forest, Laurentian-Acadian Northern Hardwoods Forest, Eastern Cool Temperate Pasture and Hayland, and Eastern Cool Temperate Row Crop. WDNR Natural Communities (WDNR, 2015): This ES is most similar to the White pine-Red maple Swamp and Northern Hardwood Swamp communities.

Ecological site concept

The Wet Sandy Outwash Lowlands ecological site is widespread on the eastern portion of MLRA 89, which is dominated by an expansive sand plain created from the deposition of sandy outwash and sandy lacustrine materials by glacial meltwaters and Glacial Lake Wisconsin, respectively. These sites are characterized by poorly or very poorly drained, very deep soils, most of which formed in these sandy outwash and lacustrine materials. Some sites along the Lemonweir River were formed in sandy alluvium over clayey lacustrine deposits. Sites are subject to frequent ponding during the growing season. Precipitation and runoff from adjacent uplands are the primary water sources, but groundwater discharge and stream inflow can also be significant contributors. Soils range from extremely acid to slightly neutral. Wet Sandy Outwash Lowlands site is differentiated from others by its deep sandy deposits and poorly drained soils. Unlike those of Poorly Drained Siliceous Sands, the sands of these soils are not siliceous (i.e.. weathered from silica-rich sandstone) but were deposited by rushing proglacial meltwater. Sites with outwash sand tend to be more productive than the siliceous sands, and

differences in vegetation is observed. Lack of bedrock contact within 78.7 inches (200 cm) differentiates this site from Poorly Drained Sandy over Bedrock. The poor drainage of this site differs it from other sandy sites.

Associated sites

F089XY002WI	**Organic Swamps** Mucky Swamps 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 occur lower on the drainage sequence than Wet Sandy Outwash Lowlands and will stay saturated for long in the year.
F089XY011WI	**Moist Sandy Lowland Forest** Moist Sandy Outwash Uplands consist of deep sandy deposits derived from a mixture of outwash, alluvium, and lacustrine sources. They are somewhat poorly drained and are subject to neither flooding nor ponding. The occur higher in the drainage sequence than Wet Sandy Outwash Lowlands.
F089XY017WI	**Sandy Upland Forest** Sandy Outwash Uplands primarily consist of deep sandy outwash deposits. Soils are somewhat excessively to excessively drained and are primarily found east of the Yellow River. They occur much higher on the drainage sequence than Wet Sandy Outwash Lowlands.

Similar sites

F089XY007WI	**Wet Sandy Nutrient Limited Lowland Forest** Wet Siliceous Sand Lowlands consist of deep sandy deposits sourced primarily from the weathering of sandstone high in silica. The weathered sand was deposited by rivers or glacial lakes. They are very poorly to poorly drained and remain saturated from much of the growing season. Some are subject to ponding. These sites are primarily found in the western half of the Wisconsin Central Sands MLRA. The vegetative communities found on these sites are very similar to those found on Wet Sandy Outwash Lowlands.
F089XY003WI	**Sandy Floodplain Forest** Sandy Floodplains sites are found exclusively on floodplains in sandy alluvium. Most sites are somewhat poorly to poorly drained and are subject to flooding. These sites occur primarily along the Wisconsin, Lemonweir, Yellow, and Black Rivers and some of their tributaries. With similar textures and drainage classes, Sandy Floodplains and Wet Sandy Outwash Lowlands host similar vegetative communities.
F089XY005WI	**Wet Sandy Bedrock Lowlands** Wet Sandy Bedrock Lowlands consist of sandy alluvium underlain by loamy residuum. Bedrock occurs within 39.3 inches (100 cm) and perches the water table. Soils are poorly drained and subject to ponding. These sites are found in the northwestern portion of the Wisconsin Central Sands MLRA where the depth to bedrock is shallow. The vegetative communities found on these sites are very similar to those found on Wet Sandy Outwash Lowlands.

Table 1. Dominant plant species

Tree	(1) *Pinus strobus*

Shrub	(1) *Acer rubrum*
Herbaceous	(1) *Pteridium aquilinum* (2) *Vaccinium*

Physiographic features

This site occurs in depressions, drainageways, and flats in outwash plains, lake plains, lake basins, lake terraces, stream terraces, valley trains, and glacial drainageways. Slopes range from 0 to 2 percent. Elevation ranges from 590 to 1952 feet (180 to 595 meters) above sea level.

These sites are subject to frequent ponding throughout the year. The ponding duration ranges from brief (2 to 7 days) to long (7 to 30 days), with depths up to 11.8 inches (30 cm) above the soil surface. These sites do not flood. The soils have a seasonally high water table at the soil surface, but the water table may drop to 59 inches (150 cm) during dry conditions. Runoff is negligible to very low.

Table 2. Representative physiographic features

Hillslope profile	(1) Toeslope
Landforms	(1) Outwash plain > Depression (2) Alluvial plain > Drainageway (3) Alluvial plain > Flat
Runoff class	Negligible to very low
Flooding frequency	None
Ponding duration	Brief (2 to 7 days) to long (7 to 30 days)
Ponding frequency	Frequent
Elevation	60 – 180 m
Slope	0 %
Ponding depth	0 – 80 cm
Water table depth	0 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 44 inches. The annual average maximum and minimum temperatures are 56°F and 34°F, respectively.

Table 3 Representative climatic features

Frost-free period (characteristic range)	110-130 days
Freeze-free period (characteristic range)	140-150 days
Precipitation total (characteristic range)	840-860 mm
Frost-free period (actual range)	100-130 days
Freeze-free period (actual range)	130-150 days
Precipitation total (actual range)	810-860 mm
Frost-free period (average)	120 days
Freeze-free period (average)	140 days
Precipitation total (average)	840 mm

- (1) FRIENDSHIP [USC00472973], Adams, WI
- (2) MAUSTON 1 SE [USC00475178], Mauston, WI
- (3) NECEDAH [USC00475786], Necedah, WI
- (4) STEVENS POINT [USC00478171], Stevens Point, WI
- (5) HANCOCK EXP FARM [USC00473405], Hancock, WI
- (6) 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.

Wetland description

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, acid, forested/organic, or
2) Depressional, forested/sandy, or
3) Depressional, acid, scrub-shrub/organic, or
4) Depressional, scrub-shrub/sandy

Permeability of the soils are impermeable to slow. The hydrologic group of these sites is A/D.

Hydrologic Group: A/D
Hydrogeomorphic Wetland Classification: Depressional acidic forested/organic; Depressional forested/sandy; Depressional acidic scrub-shrub/organic; Depressional scrub-shrub/sandy
Cowardin Wetland Classification: PFO1B, PFO4B, PEM1B

Soil features

These sites are represented by Newson, Roscommon, and Wautoma soil series. Newson is classified as a Humaqueptic Psammaquent, Roscommon is a Mollic Psammaquent, and Wautoma is a Mollic Epiaquent. 82% of the acreage of this site is classified as a Psammaquent.

These sites formed in sandy outwash, alluvium, or lacustrine deposits, sometimes underlain by clayey lacustrine deposits. Soil depth is greater than 78.7 inches (200 cm). Soils are very poorly or poorly drained and remain saturated for much of the growing season. They meet hydric soil requirements.

The surface of these sites is often mucky sand or sandy. Subsurface horizons vary. Most sites are sandy throughout the profile, but some sites have clayey lacustrine deposits in the lower profile. Soil pH ranges in horizons from extremely acid to moderately alkaline with values of 4.0 to 7.9. This range occurs because some sites have carbonates present beginning at 9 inches (23 cm) and can have 18 percent calcium carbonates. Fragments are typically absent, but subsurface fragments less than 3 inches can be present up to 7 percent in the profile.

Table 4. Representative soil features

Parent material	(1) Outwash (2) Alluvium (3) Lacustrine deposits
Surface texture	(1) Muck (2) Loamy sand
Drainage class	Very poorly drained to poorly drained
Permeability class	Very slow to slow
Soil depth	200 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified

Available water capacity (0-152.4cm)	11.94 – 19.71 cm
Calcium carbonate equivalent (0-101.6cm)	0 – 20 %
Soil reaction (1:1 water) (0-101.6cm)	0 – 7.9
Subsurface fragment volume <=3" (0-101.6cm)	0 – 10 %
Subsurface fragment volume >3" (0-101.6cm)	Not specified

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 among the species in ability to respond to fire disturbance 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. 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 and red maple (Acer rubrum). Red oak (Q. rubra) is somewhat less shade-tolerant than the preceding species, but 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 3.1 plant community composition

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

Table 11. 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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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:**
