Ecological site F095XB003WI
Wet and Moist Sandy Lowland

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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): 095X–Eastern Wisconsin, Northern Illinois, and Upper Michigan Drift Plain

This MLRA is characterized by nearly level to rolling till plains, outwash plains, drumlin fields, and glacial lake plains. It is used to produce cash crops, feed grain, and livestock. It includes the shorelines of Lake Winnebago and Lake Michigan. This area is in Wisconsin (85 percent), Illinois (10 percent), and Michigan (5 percent). It makes up about 17,255 square miles (44,690 square kilometers). This area is in the Central Lowland province of the Interior Plains. Most of the area is in the Eastern Lake section. A narrow strip along the southwestern edge of the area is in the Wisconsin Driftless section. The southwestern quarter is in the Till Plains section. The nearly level to rolling till plains, glacial lake plains, and outwash plains are mixed with drumlin fields, ground moraines, end moraines, flood plains, lake terraces, beaches, dunes, swamps, and marshes. Most of the southern part of this area has belts of morainic hills and ridges and nearly level outwash terraces. Drumlins are prominent features in the central part of the area. Glaciokarst topography occurs in the east-central parts of the area influenced by underlying Niagara Dolomite. Lakes and streams are numerous, and streams generally form a dendritic drainage pattern. Elevation ranges from 530 to 1,580 feet (160 to 480 meters). Local relief is mainly 25 feet (8 meters), but the moraines, drumlins, and bedrock escarpments rise 80 to 330 feet (25 to 100 meters) above the adjacent valleys. The annual precipitation ranges from 28 to 37 inches (700 to 950 millimeters) with a mean of 33 inches (840 millimeters). The annual temperature ranges from 41 to 48 degrees F (5.1 to 9.2 degrees C) with a mean of 46 degrees F (7.7 degrees C). The freeze-free period ranges from 115 to 185 days with a mean of 155 days. It decreases in length from south to north and from the shore of Lake Michigan inland. Lake Michigan helps to moderate the climate of the area. This MLRA is mostly covered with glacial drift of Wisconsin age. Some of the higher areas are moraines that appear as arc-shaped ridges representing the retreat of the ice from south to north. Most of the bedrock in the area consists of Silurian, Ordovician, and Cambrian sandstone, limestone, and dolomite. Some igneous and metamorphic rocks underlie the northwestern edge of the area. Devonian limestone and shale occur at the far eastern edge in the Milwaukee area. The dominant soil orders in this MLRA are Alfisols, Entisols, Histosols, Mollisols, and Spodosols. The soils in the area dominantly have a mesic or frigid temperature regime, an aquic or udic moisture regime, and mixed mineralogy. They are very deep, excessively drained to very poorly drained, and sandy to clayey. Areas of Spodosols and soils with a frigid soil temperature regime occur in the northern part of the MLRA. The northern part of this MLRA supports natural stands of mixed northern hardwoods and pine. Sugar maple, oak, white ash, elm, yellow birch, white pine, red pine, and American beech are the principal species. Low-lying areas support both mixed hardwoods and conifers. Elm, soft maple, black ash, and northern white cedar are the major species. Brush and sedge meadows also occur in the low-lying areas. The southern part of this MLRA supports hardwoods and prairie vegetation. Uplands support natural stands of oak, sugar maple, and hickory, and natural prairie vegetation is characterized by little bluestem and big bluestem. Many of the prairies have scattered oak and hickory trees. Low-lying areas support sedge and grass meadows and mixed stands of hardwoods and conifers. Elm, ash, eastern cottonwood, soft maple, and white cedar are the major species in the low-lying areas. (USDA-NRCS, 2022)

LRU notes

The Southern Wisconsin and Northern Illinois Drift Plain LRU (Land Resource Unit) (95XB) corresponds closely to the Central Sand Hills and Southeast Glacial Plains Ecological Landscapes. Some of the following brief overview is borrowed from the Wisconsin Department of Natural Resources Ecological Landscape publication (2015). The Southern Wisconsin and Northern Illinois Drift Plain MLRA is found in southeast Wisconsin and extends into northern Illinois. The Wisconsin portion of this LRU is approximately 6.3 million acres (9,900 square miles). This LRU was entirely glaciated – mostly formed by the Green Bay and Lake Michigan Lobes of the Wisconsin Glaciation except the southern part, which was covered by an earlier glaciation. The landscape is dominated by till plains with drumlins, but also has large areas of outwash, pitted outwash, and glaciolacustrine deposits. The LRUcontains the Kettle Interlobate Moraine—the end moraine system formed where the Green Bay and Lake Michigan lobes met. The thickness of glacial deposits is typically less than 15 meters deep throughout the LRU, but the eastern portion can reach up to 60 meters thick. Nearly all the LRU is covered in a loess cap ranging from 1.2 meters (in the west) to 15 centimeters (in the east). The northwest portion of LRU 95XB is part of the Central Sand Hills Ecological Landscape. The area from Portage County south through Marquette is dominated by till plains covered in outwash. The Green Bay Lobe deposited the till and created a morainal system along the west margin. The Johnstown moraine is the terminal moraine, but

smaller, lateral moraines are also prominent on the landscape. As the glacier receded, meltwaters covered the intermorainal till plain with sand and gravel outwash sediments, sometimes covering blocks of ice. As the temperatures rose, the ice melted and collapsed the surface, creating an extensive area of pitted outwash. Till in this area is sandy and lacks dolomite found in other tills of this LRU. It may be hard to distinguish from the sandy outwash of the area. The rest of the northwest portion is dominated by till plains and glacial lake sediments. Glacial Lake Wisconsin covered a portion of this LRU, but the Lewiston Basin is the most significant glacial lake in this region. The Lewiston Basin formed when glacial meltwaters were impounded behind the Johnstown Moraine. Most of the lake drained after a catastrophic breach of an ice dam that supported it. The rest of this region is a till plain covered in a thin layer of loess. This till is a sandy loam with dolomite from the Niagara Escarpment. The till plain is covered with drumlins and bedrock-cored knolls and hills where the overlying till has been eroded. Wetlands are common in the low-lying outwash and the fine-textured lake sediments. The central portion of this LRU is dominated by a rolling till plain covered in drumlins. Terminal and recessional moraines show the extent of the Green Bay Lobe. The topography of the moraines is hummocky because the supraglacial till was deposited unevenly along the ice margin and the surface collapsed after buried ice melted. Glacial lakes formed on the ice margin from ice dams, bedrock ridges, and moraines. Glacial Lakes Scuppernong and Yahara were two significant lakes that deposited clay and silty clay in deep basins. Meltwater streams deposited outwash sediments over some areas of the till plain, creating pockets of outwash and pitted outwash. The till deposited here is gravelly, clayey, and silty sand with dolomite pebbles. The Kettle Interlobate Moraine is a unique and significant feature along the eastern border this LRU. The Kettle Moraine is a complex range of ridges and hills that formed by the end moraine systems where the Green Bay and Lake Michigan lobes met. The area ranges from 1 to 30 miles wide and landforms up to 300 feet in elevation. The area experienced massive volumes of meltwater from the two glacial lobes, which deposited primarily sand and gravel, but morainal till is also present. There are two distinct portions for the Kettle Moraine. The south potion formed as the lobes receded and deposited a series of level outwash fans between the lobes. Buried ice melted and parts of the fan collapsed to form kettles—round depressions on the surface that often fill with water to become lakes when the water table is near the surface. In the northern section, debris collected in the ice where the two lobes flowed together. As the glaciers receded, meltwaters deposited outwash materials on top of ice. As the ice melted, the surface collapsed and created a mixture of collapsed outwash and till materials. The till was in and beneath the buried ice. West of the Kettle Moraine lies a landscape dominated by till plains with drumlins and areas of outwash formed by the Lake Michigan Lobe. Braided proglacial streams deposited outwash and pitted outwash plains. A small extent of lake plains is present. Wetlands are abundant because of impeded drainage from the underlying till and lake sediments. The southern portion of this LRU is comprised of older glacial sediment deposited before the Wisconsin Glaciation. In the east lie broad, flat to rolling till plains. In the west, an eroded and dissected, hilly bedrock-controlled landscape is present; this area is similar in appearance to the Driftless region. Some low areas have outwash deposited by proglacial streams from Green Bay Lobe meltwater. In some areas in the west, dissolution of bedrock has created karst topography. There is a small extent of lake plain sediments. Historically, the vegetation in this LRU was dominated in the northwest by oak forest and opening with interspersed marsh and sedge wetlands. The southern portion was dominated by oak and mesic forests with abundant wetlands. Black oak (Quercus velutina), white oak (Quercus alba), and bur oak (Quercus macrocarpa) were significant tree species in all of the LRU. There were also many areas of prairie, maple-basswood upland forest, and small areas of tamarack (Larix laricina), northern white-cedar (Thuja occidentalis), and black spruce (Picea mariana) in the lowlands. Conifers were not significant in this LRU. Wetlands covered up to 17% of land area.

Classification relationships

Relationship to Established Framework and Classification Systems: Biophysical Settings (Landfire, 2014): This ES is largely mapped as North-Central Interior Dry Oak Forest and Woodland, Laurentian-Acadian Northern Pine Forest, Central Interior and Appalachian Swamp Forest, Central Interior and Appalachian Herbaceous Wetlands, Eastern Cool Temperate Developed Ruderal Grassland, and Eastern Cool Temperate Row Crop Habitat Types of N. & S. Wisconsin (Kotar, 2002, 1996): The sites of this ES keyed out to Pinus/Vaccinium-Gaultheria [PVG]. WDNR Natural Communities (WDNR, 2015): This ES is most similar to the White Pine-Red Maple Swamp and Southern Mesic Forest described by the WDNR. Hierarchical Framework Relationships: Major Land Resource Area (MLRA):095X–Eastern Wisconsin, Northern Illinois, and Upper Michigan Drift Plain USFS Subregions: Central Wisconsin Moraines and Outwash (222Kb), South Central Wisconsin Prairie and Savannah (222Kd) DNR Ecological Landscapes: Central Sand Hills

Ecological site concept

The Wet and Moist Sandy Lowlands ecological site primarily occurs in the north and east area of LRU95XB. These sites are represented by a variety of Aquolls and Aquic Udipsamments and Udolls. These soils were formed in very deep, sandy materials deposits by wind or flowing water and are present on floodplains, depressions, and drainageways on outwash plains and terraces. They may be underlain by finer-textured lacustrine deposits. Some have a mantle of loamy outwash or windblown materials. These soils sometimes have organic-enriched surfaces. Wet and Moist Sandy Lowlands are often subjected to periodic flooding and ponding. These soils are very poorly to somewhat poorly drained. The very poorly and poorly drained soils meet hydric soil requirements and are wetlands. Sites may receive water from a variety of sources including: groundwater discharge, precipitation, and runoff. Water leaves these sites through groundwater recharge and evapotranspiration primarily. Typical vegetation on these sites include Pinus strobus, Acer rubrum, Quercus spp., Prunus spp., Onoclea sensibilis, and Parthenocissus quinquefolia.

Associated sites

F095XB001WI	**Mucky Swamp** Mucky Swamp consist of deep, herbaceous organic materials. They are very poorly drained and remain saturated throughout the year. The occur in landscape depressions and occupy the lowest points on their drainage sequences.
F095XB009WI	**Sandy Upland** These sites consist of very deep, sandy outwash, till, or eolian deposits. Some are mantled with loamy outwash or alluvium. They are primarily found in the Central Sand Hills in the northwestern portion of the MLRA. They are moderately well to excessively drained. They occupy higher, drier positions on the landscape than Wet Sandy Lowlands. They share particle size class with Wet and Moist Sandy Lowland but have improved drainage.

Similar sites

F095XB002WI	**Wet Floodplain** These sites occur on floodplains and depressions and form in very deep, loamy or silty materials, primarily alluvial in origin. Most sites are subject to flooding events of varying frequency, duration, and intensity. They are very poorly to moderately well drained. Like Wet and Moist Sandy Lowland, they may sometimes host vegetation that is tolerant of inundation by water.
F095XB004WI	**Wet Loamy or Clayey Lowland** These sites occur on depressions within loamy glacial landscapes including till plains and lake plains. They form in very deep, loamy alluvium, till, outwash, or lacustrine materials. They are sometimes underlain by clayey lacustrine deposits or sandy outwash. They are very poorly to poorly drained. They are found on similar positions on the drainage sequence as Wet and Moist Sandy Lowland and have similar drainage capabilities but have finer particle size classes.

Table 1. Dominant plant species

Tree	(1) *Acer rubrum* (2) *Pinus strobus*
Shrub	(1) *Cornus racemosa* (2) *Prunus virginiana*
Herbaceous	(1) *Onoclea sensibilis* (2) *Parthenocissus quinquefolia*

Physiographic features

This site occurs in floodplains, depressions, and drainageways on outwash plains and stream terraces. Landform shape is concave or linear, and sites are in the footslope or toeslope position. Slope ranges from 0 to 3 percent.

Flooding and ponding are generally rare on these rapidly-permeable sites. Inundation by water may last from four hours to over a month. The soil has an apparent seasonally high water table (endosaturation) within 7 inches (18 cm) of the surface. Runoff is negligible to low.

Table 2. Representative physiographic features

Hillslope profile	(1) Toeslope (2) Footslope
Slope shape across	(1) Concave
Slope shape up-down	(1) Linear
Landforms	(1) Depression (2) Drainageway (3) Outwash plain (4) Stream terrace
Runoff class	Negligible to low
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	None to very rare
Ponding duration	Brief (2 to 7 days) to very long (more than 30 days)
Ponding frequency	Rare to occasional
Elevation	220 – 290 m
Slope	0 %
Ponding depth	0 – 30 cm
Water table depth	0 – 20 cm
Aspect	Aspect is not a significant factor

Climatic features

The continental climate of MLRA 95B is typical of southern Wisconsin – cold winters and warm summers. The MLRA spans over 2 degrees of latitude, or about 150 miles. The lowest latitudes have warmer summers, warmer winters, and high precipitation rates. The growing season decreases from south to north and from the shores of the thermal mass of Lake Michigan inland.

This site occurs on landscape depressions and may have a microclimate with shorter freeze-free and frost-free periods than what is represented by the weather station data.

Table 3 Representative climatic features

Frost-free period (characteristic range)	110-120 days
Freeze-free period (characteristic range)	140-150 days
Precipitation total (characteristic range)	860-890 mm
Frost-free period (actual range)	110-130 days
Freeze-free period (actual range)	140-150 days
Precipitation total (actual range)	860-910 mm
Frost-free period (average)	120 days
Freeze-free period (average)	140 days
Precipitation total (average)	890 mm

- (1) DALTON [USC00471970], Dalton, WI
- (2) MARKESAN [USC00475096], Markesan, WI
- (3) MONTELLO [USC00475581], Montello, WI
- (4) PORTAGE [USC00476718], Portage, WI
- (5) TOWN OF WESTFORD [USC00478540], Beaver Dam, WI

Influencing water features

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

Wetland description

Under the Cowardin System of Wetland Classification, or National Wetlands Inventory (NWI), the wetlands can be classified as:
1) Palustrine emergent, persistent, saturated, or
2) Palustrine, forested, broad-leaved deciduous, saturated

Under the Hydrogeomorphic Classification System (HGM), the wetlands can be classified as:
1) Depressional, herbaceous/organic, or
2) Depressional, forested/organic

Permeability of the soil is impermeable to moderately rapid. The hydrologic group of this site is A, A/D or C/D.

Hydrogeomorphic Wetland Classification: Depressional, forested/organic; Depressional, scrub-shrub/organic

Cowardin Wetland Classification: PEM1B, PFO1B

Soil features

The soils of this site are represented by the Morocco, Tedrow, Watseka, Granby and Maumee series. Morocco and Tedrow are classified as Aquic Udipsamments. Watseka is classified as an Aquic Hapludoll. Granby and Maumee are classified as Typic Endoaquolls. Some Granby soils are also classified as Typic Haplaquolls.

These soils form in very deep, sandy materials deposits by wind or flowing water. They may be underlain by finer-textured lacustrine deposits. Some have a mantle of loamy outwash or windblown materials. These soils sometimes have thick, organic-enriched surfaces.

These soils are slightly acid to moderately alkaline. Secondary carbonates are sometimes present and may occupy up to 10 percent volume. Small, rounded rock fragments usually occupy a limited volume of the substratum in outwash soils. These soils are very poorly to somewhat poorly drained. The very poorly and poorly drained soils meet hydric soil requirements.

Figure 7. Granby(variant) Soil Series sampled on 06/03/2020 in Marquette County, WI. Image courtesy of UWSP.

Table 4. Representative soil features

Parent material	(1) Outwash (2) Lacustrine deposits (3) Eolian deposits
Surface texture	(1) Sandy loam (2) Loamy sand
Drainage class	Very poorly drained to somewhat poorly drained
Permeability class	Moderately slow to moderately rapid
Soil depth	200 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-150.1cm)	4.29 – 7.09 cm
Soil reaction (1:1 water) (0-100.1cm)	5.8 – 7.9
Subsurface fragment volume <=3" (0-100.1cm)	0 – 10 %

Subsurface fragment volume >3" (Depth not specified)	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 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 the species that are fire-tolerant and intolerant of shade, are replaced by other species. Species such as white pine and red oak are still common on the landscape based of their tolerance to some shade; these species may 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.

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 (%)

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 of 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

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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	07/11/2026
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

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2. **Presence of water flow patterns:**

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3. **Number and height of erosional pedestals or terracettes:**

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

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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:**
