Ecological site F095XB006WI
Shallow 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): 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 Maple-Basswood Forest, North-Central Interior Dry Oak Forest and Woodland, North-Central Interior Dry-Mesic Oak Forest and Woodland, Eastern Cool Temperate Row Crop, Eastern Cool Temperate Close Grown Crop, Eastern Cool Temperate Pasture and Hayland, and Developed-Low Intensity Habitat Types of N. & S. Wisconsin (Kotar, 2002, 1996): The sites of this ES keyed out to Acer saccharum-Tilia-Fraxinus/Viburnum [ATiFrVb] and Acer saccharum-Tilia-Fraxinus/Circaea quadrisulcata [ATiFrCi]. WDNR Natural Communities (WDNR, 2015): This ES is most similar to the 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: South Central Wisconsin Prairie and Savannah (222Kd), Southern Green Bay Lobe (222Ke), Geneva-Darien Moraines and Till Plains (222Kf), Rock River Old Drift Country (222Kh), Kickapoo-Wisconsin River Ravines (222Ld) DNR Ecological Landscapes: Southeast Glacial Plains

Ecological site concept

The Shallow Upland ecological site occurs throughout LRU 95XB, but has a concentration in the southwestern portion. Most of these have bedrock contact within one meter of the surface though some are slightly deeper. They form in diverse materials including loamy to clayey till, sandy outwash, alluvium, eolian deposits, and sandy to clayey residuum. Many have a loess mantle. Some form entirely in loess. All are underlain by bedrock, which may be comprised of sandstone, dolomite, limestone, or quartzite. Soils are strongly acid to moderately alkaline and may contain carbonates where they overly dolomite and limestone. These sites receive water primarily through precipitation, runoff from adjacent uplands, and groundwater discharge. The water levels are strongly influenced by precipitation and runoff from surrounding uplands. Typical vegetation includes Acer saccharum, Fraxinus americana, and Carya ovata. Common ground cover may include Hydrophyllum virginiana. These sites differ from the other upland ecological sites because they are underlain by bedrock. These restricted soil depth is likely to limit total productivity (and growth rate) and maximum size of tree species present.

Associated sites

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.
F095XB005WI	**Moist Loamy or Clayey Lowland** These sites consist of very deep, loamy or clayey materials deposited by flowing water, glacial ice, or ancient glacial lakes. Some sites are overlain or underlain by sandy outwash. They are somewhat poorly drained.
F095XB007WI	**Loamy Upland with Carbonates** Shallow bedrock is found in isolated spots on a diverse array of glacial landforms found through this MLRA. Because of this diversity, Shallow Bedrock sites are found adjacent to nearly all the upland Ecological Sites (listed in “Similar Ecological Sites” below) found in this MLRA.

Similar sites

F095XB007WI	**Loamy Upland with Carbonates** These sites consist of very deep, loamy materials deposited by flowing water, glacial ice, or ancient glacial lakes. Many are underlain by clayey lacustrine materials or sandy outwash. They have secondary carbonates, generally occupying at least 10% by volume, within the upper 40 inches (100 cm). They are moderately well to somewhat excessively drained. They may be characteristically similar to some sandy Shallow Uplands sites, except for their lack of bedrock contact within 6.5 feet (two meters).
F095XB008WI	**Clayey Upland with Carbonates** These sites consist of very deep, clayey till or lacustrine deposits, sometimes mantled with sandy outwash. Secondary carbonates usually occupy at least 10% volume in the upper 40 inches (100 cm). They are moderately well to well drained. They may be characteristically similar to some sandy Shallow Uplands sites, except for their lack of bedrock contact within two meters and slightly impeded drainage.
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 may be characteristically similar to some sandy Shallow Uplands sites, except for their lack of bedrock contact within two meters.
F095XB010WI	**Loamy and Clayey Upland** These sites consist of very deep, sandy to clayey deposits of till, outwash, alluvium, colluvium, and lacustrine materials. They are moderately well to somewhat excessively drained.

Table 1. Dominant plant species

Tree	(1) *Acer saccharum* (2) *Fraxinus americana*
Shrub	Not specified

Herbaceous	(1) *Hydrophyllum virginianum*

Physiographic features

This site occurs on moraines, till plains, outwash plains, bluffs, escarpments, and monadnocks. It's scattered throughout the MLRA but is particularly common to the southwestern section (Green and Rock counties) where much of the area has bedrock within 150 meters. Landform shape is concave to convex. Site are generally in upland positions. Slope ranges from 0 to 45 percent.

These sites are subject to neither flooding nor ponding. Depth to water table varies and may be as shallow at 20 inches (51 centimeters) from the surface. Runoff is highest in soils with steep soils and silt loam surfaces.

Table 2. Representative physiographic features

Hillslope profile	(1) Summit (2) Shoulder (3) Backslope (4) Footslope
Slope shape across	(1) Concave (2) Convex
Slope shape up-down	(1) Linear
Landforms	(1) Moraine (2) Till plain (3) Outwash plain (4) Bluff (5) Escarpment (6) Monadnock
Runoff class	High to very high
Elevation	180 – 310 m
Slope	0 – 50 %
Water table depth	50 – 200 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.

The average annual precipitation for this site is 35 inches. The average annual snowfall is 39 inches. The average annual maximum and minimum temperatures are 57oF and 36oF, respectively.

Table 3 Representative climatic features

Frost-free period (characteristic range)	130-140 days
Freeze-free period (characteristic range)	160-170 days
Precipitation total (characteristic range)	890-910 mm
Frost-free period (actual range)	120-140 days
Freeze-free period (actual range)	140-170 days
Precipitation total (actual range)	890-910 mm
Frost-free period (average)	130 days
Freeze-free period (average)	160 days
Precipitation total (average)	890 mm

- (1) AFTON [USC00470045], Janesville, WI
- (2) ROCKFORD GTR ROCKFORD AP [USW00094822], Rockford, IL
- (3) FREEPORT WASTE WTP [USC00113262], Freeport, IL
- (4) MONTELLO [USC00475581], Montello, WI
- (5) MCHENRY-WG STRATTON LD [USC00115493], McHenry, IL

Influencing water features

Water is received through precipitation and runoff from adjacent uplands. Water is lost from the site primarily through runoff, evapotranspiration, and groundwater recharge. Subsurface outflow may occur because of water perched on shallow bedrock.
Permeability of the soils is impermeable to moderately rapid. The hydrologic soil group of these sites is A, B, C, D.

Wetland description

Hydrogeomorphic Wetland Classification: None
Cowardin Wetland Classification: None

Soil features

The soils of this site are represented by the Ashdale, Baraboo, Channahon, Dodgeville, Eleva, Elkmound, Hixton, Hochheim, Knowles, Military, Northfield, Ripon, Ritchey, Rockton, Sogn, Sylvester, Urne, Whalan, Winneshiek, and series. These soils are classified as Argiudolls, Hapludolls, Quartzipsamments, Dystrudepts, and Eutrudepts.

These soils are shallow to deep, with most having bedrock contact within one meter of the surface. They form in diverse materials including loamy to clayey till, sandy outwash, alluvium, eolian deposits, and sandy to clayey residuum. Many have a loess mantle. Some form entirely in loess. All are underlain by bedrock, which may be comprised of sandstone, dolomite, limestone, or quartzite.

These soils are strongly acid to moderately alkaline. Presence of secondary carbonates varies; when present, they generally occupy 10 percent volume or less. Rock fragments are generally present. They consist of dislodged fragments of the underlying bedrock, pieces of limestone and dolomite plucked from the bedrock by glacial ice and mixed in with the mineral glacial deposits, or rounded, mixed rocks deposited by flowing water. These sites are moderately well to excessively drained. They do not meet hydric soil requirements.

Figure 7. Northfield(variant) Soil Series sampled on 06/17/2020 in Calumet County, Wisconsin. Image courtesy of UWSP.

Table 4. Representative soil features

Parent material	(1) Till (2) Outwash (3) Alluvium (4) Eolian deposits (5) Residuum (6) Colluvium (7) Loess
Surface texture	(1) Sand (2) Loamy sand (3) Sandy loam (4) Loam (5) Silt loam
Drainage class	Moderately well drained to excessively drained
Permeability class	Moderately rapid
Soil depth	30 – 150 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified

Available water capacity (0-150.1cm)	1.93 – 8.99 cm
Calcium carbonate equivalent (0-100.1cm)	0 – 50 %
Soil reaction (1:1 water) (0-100.1cm)	5.1 – 8.1
Subsurface fragment volume <=3" (0-100.1cm)	0 – 20 %
Subsurface fragment volume >3" (0-100.1cm)	0 – 60 %

Ecological dynamics

Historically, mature forests on this ecological site were dominated by shade tolerant sugar maple and White ash, often with an admixture of Basswood and a few Red oaks. This association was self-maintained with new cohorts of advance regeneration gaining canopy status through gaps formed by small-scale disturbances and natural mortality in the dominant canopy.

Small scale canopy disturbances are likely common in the ES as the is shallow bedrock leading to lower stability of large trees due to shallow rooting. This will lead to trees tipping in wind storms and periodic openings in the canopy occurring more frequently than similar ESs without shallow bedrock. Additionally, due to soils being shallower, trees are likely to be smaller and shorter than on other similarly vegetated ES's.

Current stands on this Ecological Site represent the entire array of potential successional stages from pure aspen, or aspen-white birch, stands to sugar maple dominated mixed northern hardwoods stands. Succession to sugar maple dominance is evident everywhere that seed sources are present. In many cases the mesic hardwoods (Sugar maple and White ash) may be absent due to lack of seed source. In those cases a mixed oak stand may predominate and be stable ecologically.

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 (%)

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.

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	08/19/2026
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):**

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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:**
