

Ecological site F090BY015WI

Loamy Upland with Carbonates

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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): 090B—Central Wisconsin Thin Loess Dissected Till Plain

The Wisconsin and Minnesota Thin Loess MLRA, Northern and Southern Parts (90A and 90B) correspond closely to the North Central Forest and the Forest Transition Ecological Landscapes, respectively. Some of the following brief overview is borrowed from the Wisconsin Department of Natural Resources ecological landscape publications (2015). The Wisconsin and Minnesota Thin Loess MLRA, Northern and Southern Parts (90A and 90B) is an extensive glacial landscape that comprised of over 11.1 million acres (17,370 sq mi) throughout central and northern Wisconsin – about 27% of the total land area in the state. This glacial landscape is comprised of a heterogeneous mix of loess-capped ground moraines, end moraines with eskers and ice-walled lake plains, and pitted, unpitted, and collapsed outwash plains sometimes interspersed with drumlins from the Illinoian and Pre-Illinoian glaciations. The entire area has been glaciated and nearly all of it is underlain by dense glacial till that impedes drainage. An extensive morainal system – the Perkinstown end moraine – spans most of the width of northern Wisconsin and divides the Northern and Southern Parts of this large landscape. This moraine, which has been sliced by outwash in many places, marks the southernmost extent of the Wisconsin glaciation (Wisconsin's most recent glacial advance). North of the Perkinstown morainal system is a loess plain, with a loess mantle 6-24 inches thick. The northernmost edge of this landscape is an undulating till and outwash plain with materials deposited by the Chippewa Lobe. Drumlins are common in the northern and northeastern portions. The drumlins are oriented towards the southwest and formed during a glacial episode prior to the most recent glacial advance. Some are covered with glacial till. Pitted, unpitted, and collapsed outwash plains fill the spaces between drumlins. Detached from the major land mass to the northeast is the hummocky Hayward collapsed end moraines, where swamps, ice-walled lake plains, and eskers are common. Most of the MLRA to the south of the Perkinstown morainal system is an extensive ground moraine with some proglacial stream features including pitted outwash plains, terraces, and fans. A layer of loess 6-47 inches thick covers much of the area. Like the Northern Part, all areas of the Southern Part of this MLRA were glaciated, although the southcentral portion is a relatively older till plain with materials from the Illinoian and pre-Illinoian glaciations, not the most recent Wisconsin glaciation. The landforms in the southcentral portion are highly variable. Much of the area topography is controlled by underlying bedrock. Sandstone outcrops and pediments can be found here. Some of the most southern portions of the MLRA are mixed glacial deposits and residuum. The land surface of the southeastern portion was formed by many small glacial advances and retreats. Morainal ridges protrude through an erosional, pitted outwash-mantled surface. These parallel ridges run in a northeast to southwest orientation and are dissected by many streams. The continental climate of this MLRA is typical of northcentral Wisconsin, with cold winters and warm summers. The southern boundary of this MLRA straddles Wisconsin's Tension Zone, a zone of transition between Wisconsin's northern and southern ecological landscapes. Historically, the mesic forests were dominated by eastern hemlock (*Tsuga canadensis*), sugar maple (*Acer saccharum*), and yellow birch (*Betula alleghaniensis*).

Classification relationships

Major Land Resource Area (MLRA): Wisconsin and Minnesota Thin Loess and Till (Northern and Southern Parts - 90A and 90B) USFS Subregions: Mille Lacs Uplands (212Kb), Rosemont Baldwin Plains and Moraines (222Md), Lincoln Formation Till Plain - Mixed Hardwoods (212Qb) Wisconsin DNR Ecological Landscape: Northwest Lowlands, Western Prairie, Forest Transition

Ecological site concept

The Loamy Upland with Carbonates ecological site is found on the western border of MLRAs 90A and 90B, located on till plains, moraines, lake plains, and sometimes outwash plains and stream terraces. These sites are characterized by very deep, moderately well to well drained soils that formed in loamy deposits including till colluvium, alluvium, loess, and residuum. Some sites may have a sandy mantle or underlying sandy outwash. Soils have carbonates present in soil profile. Precipitation and runoff are the primary source of water. Soils range from strongly acid to moderately alkaline. Loamy Upland with Carbonates is distinguished from other ecological sites by its deep loamy deposits with a strong presence of carbonates and moderately well and well drained soils. The carbonates raise or buffer pH, which can promote vegetative growth. Other moderately well or well drained sites have sandy or clayey deposits. Loams often

have higher pH and available water capacity than sands, but lower than clays. The moderately well to well drained soils of this site differentiates it from other loamy sites.

Associated sites

F090BY010WI	Moist Loamy Lowland with Carbonates Moist Loamy Lowland with Carbonates consists of deep loamy till, sometimes with a loess mantle. Carbonates are present in these soils. The finer textures allow the soil to stay moist - but not saturated - for sustained periods during the growing season. They are drier and occur lower on the drainage sequence than Loamy Upland with Carbonates.
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Similar sites

F090BY014WI	Loamy Bedrock Upland Loamy Bedrock Upland consist of loamy till, alluvium, or eolian deposits underlain by sandy to loamy residuum. Some sites may also contain sandy outwash or clayey pedisediment. Bedrock contact occurs within two meters of the surface. They have a seasonally high water table within one meter of the surface, though they don't remain saturated for extended periods of time. They occur on similar landscape positions and share both particle size and drainage class with Loamy Upland with Carbonates. They differ in that they have bedrock contact with two meters and often lack free carbonates.
F090BY016WI	Loamy Upland Loamy Upland consist of deep loamy till, alluvium, residuum, lacustrine, or eolian deposits. Sandy deposits of these parent materials, plus outwash, may also be present. The depth to the seasonally high water table ranges from as high as the surface to as low as almost two meters below the surface. A few sites are on floodplains and upland drainageways, where very brief flooding is rare but possible. They occur on similar landscape positions and share both particle size and drainage class with Loamy Upland with Carbonates, but they lack free carbonates within two meters.

Table 1. Dominant plant species

Tree	(1) <i>Acer saccharum</i> (2) <i>Fraxinus americana</i>
Shrub	(1) <i>Ribes missouriense</i>
Herbaceous	(1) <i>Amphicarpaea</i> (2) <i>Actaea rubra</i>

Physiographic features

These sites formed on outwash plains, lake plains, till plains, moraines, and stream terraces. Slopes range from 0 to 60 percent.

These sites are not subject to ponding or flooding. Some sites have seasonally high water table at depth of 18 to 80 inches, but the water table can drop below 80 inches during dry conditions. Surface runoff is very low to very high. This range of runoff is mostly caused by the wide range in slope.

Table 2. Representative physiographic features

Hillslope profile	(1) Summit (2) Shoulder (3) Backslope
Slope shape across	(1) Convex
Slope shape up-down	(1) Linear
Landforms	(1) Outwash plain (2) Lake plain (3) Till plain (4) Moraine (5) Stream terrace
Runoff class	Very low to very high
Flooding frequency	None
Ponding frequency	None
Elevation	180 – 350 m
Slope	0 – 60 %
Water table depth	50 – 200 cm
Aspect	Aspect is not a significant factor

Climatic features

The climate of the expansive Wisconsin and Minnesota Thin Loess and Till Plain is highly variable. The eco-climatic zone (the “Tension Zone”) that runs southeast-northwest across the state splits the MLRA. In general, the MLRA has cold winters and warm summers with an adequate amount of precipitation. Near Lake Superior, precipitation and temperature tend to increase. The far western section of the MLRA, known as the western prairie ecological landscape by the Wisconsin DNR, has warmer temperatures compared to the rest of the MLRA because it falls below the eco-climatic zone. The soil moisture regime of MLRA is udic (humid climate). The soil temperature regime is frigid and cryic.

The average annual precipitation for this ecological site is 31 inches. The average annual snowfall is 44 inches. The annual average maximum and minimum temperatures are 54°F and 34°F, respectively.

Table 3 Representative climatic features

Frost-free period (characteristic range)	90-110 days
Freeze-free period (characteristic range)	120-140 days
Precipitation total (characteristic range)	740-840 mm
Frost-free period (actual range)	50-120 days
Freeze-free period (actual range)	90-150 days
Precipitation total (actual range)	710-890 mm
Frost-free period (average)	90 days
Freeze-free period (average)	130 days
Precipitation total (average)	790 mm

- (1) HOLCOMBE [USC00473698], Holcombe, WI
- (2) ROSHOLT 9 NNE [USC00477349], Wittenberg, WI
- (3) STAMBAUGH 2SSE [USC00207812], Iron River, MI
- (4) BIG FALLS HYDRO [USC00470773], Glen Flora, WI
- (5) COUDERAY 7 W [USC00471847], Stone Lake, WI
- (6) ISLE 12N [USC00214103], Isle, MN
- (7) MOOSE LAKE 1 SSE [USC00215598], Moose Lake, MN
- (8) MILACA [USC00215392], Milaca, MN
- (9) WINTER [USC00479304], Ojibwa, WI
- (10) LAKEWOOD 3 NE [USC00474523], Lakewood, WI
- (11) MINONG 5 WSW [USC00475525], Minong, WI
- (12) AMERY [USC00470175], Amery, WI
- (13) BRUNO 7ENE [USC00211074], Bruno, MN

Influencing water features

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

Wetland description

Permeability of these sites is very slow to moderate.

Hydrologic Group: A, B, C, B/D

Hydrogeomorphic Wetland Classification: None

Cowardin Wetland Classification: None

Soil features

These sites are represented by the Annalake, Billett, Branstad, Churchtown, Cushing, Dakota, Huntsville, Kasson, Milaca, Vlasaty soil series. Annalake is classified as an Alfic Oxyaquic Haplorthod; Billett and Churchtown are Mollic Hapludalfs; Cushing is a Haplic

Glossudalf; Dakota is a Typic Argiudoll; Huntsville is a Cumulic Hapludoll; Kasson is a Mollic Oxyaquic Hapludalf; Branstad and Milaca are Oxyaquic Glossudalfs; Vlasaty is an Oxyaquic Hapludalf.

These sites formed in various parent materials including loamy till; loamy colluvium; loamy residuum; loamy or silty alluvium; loamy drift; loess; sandy eolian deposits; and sandy and gravelly outwash. Soils are moderately well or well drained. They do not meet hydric soil requirements.

The surface of these sites is sandy loam, silt loam, clay loam, loam, loamy sand, and highly decomposed plant material. Some sites have fine sands, and some have cobbly modifier. Subsurface textures consist of sandy loam, silt loam, clay loam, loam, silty clay, clay, loamy sand, and sand. Some soils have fine or very fine sand, and some have gravelly and cobbly modifiers. Soil pH ranges from strongly acid to moderately alkaline with values of 5.3 to 7.9. Carbonates can be present up to 10 percent beginning at 25 inches.

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Outwash (3) Till (4) Sandstone and shale (5) Residuum (6) Eolian deposits (7) Limestone, sandstone, and shale (8) Igneous and metamorphic rock
Surface texture	(1) Loamy sand (2) Sandy loam (3) Loam (4) Silt loam (5) Clay loam
Drainage class	Moderately well drained to well drained
Permeability class	Very slow to moderate
Soil depth	200 – 250 cm
Surface fragment cover ≤3"	0 – 10 %
Surface fragment cover >3"	Not specified
Available water capacity (0-154.9cm)	5.56 – 12.7 cm

Calcium carbonate equivalent (0-100.1cm)	0 – 10 %
Soil reaction (1:1 water) (0-100.1cm)	5.3 – 7.9
Subsurface fragment volume <=3" (Depth not specified)	0 – 20 %
Subsurface fragment volume >3" (Depth not specified)	0 – 20 %

Ecological dynamics

Historically, this site was dominated by mesic hardwoods in a landscape adapted to fire disturbance that allowed for a strong presence of oaks. 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 these species adapted to fire and intolerant of shade are replaced by other species. Species such as white pine and red oak are still common on the landscape based on their tolerance to some shade; these species to establish under a canopy, and in time, may become a component of the canopy. Mesic hardwoods are sensitive to fire, but in its absence, they have the ability to dominate sites based on their shade tolerance and prolific seed production.

Today, these forests most commonly include stands of sugar maple, red maple, and other mesic hardwoods. Some sites have a strong presence of red oak, and white pine is successfully reinvading the landscape in some areas. These sites have the conditions to support shade tolerant mesic hardwoods, but historically had significant wind throw and fire disturbance that allowed for a strong presence of oak species and white pine. As long as fire is continually suppressed, maples and other mesic hardwoods will continue to dominate the 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 (%)
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Table 6. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 7. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 8. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 9. Community 2.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 10. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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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, Relevé Method, NASIS pedon description, NRCS SOI 036, photographs, and Kotar Habitat Types. Habitat Types of N. & S. Wisconsin (Kotar, 2002 & 1996): The sites of this ES keyed out to four habitat types: *Acer saccharum*/*Caulophyllum*-*Circaea* (ACaCi); *Acer saccharum*/*Athyrium* (AAt); *Acer rubrum*/*Circaea* (ArCi) Biophysical Settings (Landfire, 2014): This ES is largely mapped as Laurentian-Acadian Northern Hardwoods Forest, Eastern Cool Temperate Pasture and Hayland, Eastern Cool Temperate Row Crop, and Eastern Cool Temperate Close Grown Crop WDNR Natural Communities (WDNR, 2015):

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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	08/20/2026
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):

10. Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:

11. Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):

12. Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):

Dominant:

Sub-dominant:

Other:

Additional:

13. Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):

14. Average percent litter cover (%) and depth (in):

15. Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):

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:

17. Perennial plant reproductive capability:
