Ecological site F090BY019WI
Dry Sandy Upland

Last updated: 11/16/2023
Accessed: 08/16/2026

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 heterogenous 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 steams. 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: Glidden Loamy Drift Plain (212Xa), Hayward Stagnation Moraines (212Xf), St. Croix Moraine (212Qa), Lincoln Formation Till Plain - Mixed Hardwoods (212Qb), Green Bay Lobe Stagnation Moraine (212Ta), Brule and Paint Rivers Drumlinized Ground Moraine (212Xc), Rosemont Baldwin Plains and Moraines (222Md), Rib Mountain Rolling Ridges (212Qd) Small sections occur in Central-Northwest Wisconsin Loess Plains (212Xd), Perkinstown End Moraine (212Xe), Mille Lacs Uplands (212Kb), Lincoln Formation Till Plain - Hemlock Hardwoods (212Qc), Bayfield Sand Plains (212Ka), Crystal Falls Till and Outwash (212Xq), Athelstane Sandy Outwash and Moraines (212Tc) Wisconsin DNR Ecological Landscapes: Western Prairie, Forest Transition, North Central Forest, Northwest Lowlands, Northwest Sands

Ecological site concept

The Dry Sandy Upland ecological site is scattered throughout the MLRAs 90A and 90B, located on primarily on outwash plains but may also be found on lake plains, eskers, kames, drumlins, hills, and stream terraces. These sites are characterized by very deep, somewhat excessively to excessively drained soils that formed primarily in sandy deposits including alluvium, outwash, till and eolian. Precipitation and runoff from adjacent uplands are the primary sources of water. Soils range from extremely acid to neutral. Dry Sandy Upland is distinguished from other ecological sites based on the deep sandy deposits and drainage. This site lacks the underlying bedrock found Dry Sandy Bedrock Upland.. Other somewhat excessively and excessively drained sites have loamy materials. Sandy materials often have lower pH and available water capacity, and often lack carbonates found in loamy materials. These conditions can limit vegetative growth. The somewhat excessive to excessive drainage differentiates this site from other sandy sites.

Associated sites

F090BY001WI	**Poor Fen** Poor Fen sites consist of deep herbaceous organic materials. Some sites have mineral soil contact. They are very poorly drained and remain saturated throughout the year. They are strongly to extremely acidic. These sites are permanently saturated wetlands. These sites are much wetter and occur lower on the drainage sequence than Dry Sandy Upland.
F090BY005WI	**Wet Sandy Lowland** Wet Sandy Lowland consist of deep sandy deposits derived from a mixture of outwash, alluvium, and lacustrine sources. They form in seasonally ponded depressions and are saturated long enough for hydric conditions to occur. Some sites are wetlands. These sites are much wetter and occur lower on the drainage sequence than Dry Sandy Upland.
F090BY009WI	**Moist Sandy Upland** Moist Sandy Lowland primarily consist of deep, sandy deposits from outwash, alluvium, lacustrine, and till. They sandy deposits may have a loamy mantle or be underlain by loamy deposits. The finer materials can cause episaturation and allow the site to remain moist for some of the growing season. These sites are wetter and occur lower on the drainage sequence than Dry Sandy Upland.
F090BY013WI	**Sandy Upland** Sandy Upland consist of deep sandy and loamy deposits of outwash, alluvium, till, and residuum. Soils are primarily sand and loamy sand and have a seasonally high water table within two meters, though they don't remain saturated for extended periods. These sites are somewhat wetter and occur lower on the drainage sequence than Dry Sandy Upland.

Similar sites

F090BY018WI	**Dry Sandy Bedrock Upland** Dry Sandy Bedrock Upland consist sandy alluvium or outwash, sometimes underlain by sandy residuum. Contact with igneous or sandstone bedrock typically occurs within one meter of the surface. These soils show no evidence of a seasonally high water table. They are found in similar landscape positions and share both drainage class and particle size with Dry Sandy Upland but have bedrock contact within two meters of the surface.
F090BY021WI	**Dry Loamy Upland** Dry Loamy Upland consist of deep sandy to loamy outwash, alluvium, or till. The water table is deeper than two meters year-round. They are found in similar landscape positions and share their drainage class with Dry Sandy Upland but have finer particle sizes.

Table 1. Dominant plant species

Tree	(1) *Pinus strobus* (2) *Quercus rubra*
Shrub	(1) *Corylus cornuta* (2) *Prunus serotina*
Herbaceous	(1) *Eurybia macrophylla* (2) *Pteridium*

Physiographic features

These sites formed on outwash plains, lake plains, eskers, kames, drumlins, hills, and stream terraces. Slopes range from 0 to 55 percent. Sites are positioned on summit, shoulder backslope positions.

These sites are not subject to ponding or flooding. Sites have a seasonally high water table at depths of 40 to 80 inches. The water table can drop below 80 inches during dry conditions. Surface runoff ranges from negligible to high. The range in surface runoff is caused by the wide range in slope percent across the sites.

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) Esker (4) Kame (5) Drumlin (6) Hill (7) Stream (8) Terrace
Runoff class	Negligible to high
Flooding frequency	None

Ponding frequency	None
Elevation	170 – 310 m
Slope	0 – 60 %
Water table depth	100 – 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 32 inches. The average annual snowfall is 53 inches. The annual average maximum and minimum temperatures are 53°F and 32°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)	40-120 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) MILACA [USC00215392], Milaca, MN
- (8) LAKEWOOD 3 NE [USC00474523], Lakewood, WI
- (9) MINONG 5 WSW [USC00475525], Minong, WI
- (10) AMERY [USC00470175], Amery, WI
- (11) 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 slow to rapid.
Hydrologic Group: A, B, A/D
Hydrogeomorphic Wetland Classification: None
Cowardin Wetland Classification: None

Soil features

These sites are represented by the Burkhardt, Cress, Cromwell, Drammen, Duelm Variant, Elderon, Emmert, Graycalm, Hubbard, Karlin, Lilah, Lindquist, Mahtomedi, Menahga, Moberg, Nymore, Omega, Pelissier, Pence, Plainfield, Rosholt, Sayner, Udorthents, and Vilas soil series. Burkhardt is classified as a Typic Hapludoll; Duelm variant is an Aquic Hapludoll; Karlin, Plissier, Rubicon, Sayner, and Vilas are classified as Entic Haplorthods; Hubbard is an Entic Hapludoll; Cress is a Humic Dystrudept; Lindquist is Lamellic Haplorthod; Drammen is a Lamellic Hapludalf; Graycalm is a Lamellic Udipsamment; Lilah is a Psammentic Hapludalf; Cromwell, Elderon, and Moberg are Typic Dystrudepts; Omega and Pence are Typic Haplorthods; Mahtomedi, Menahga, Nymore, Plainfield, and Rosholt are Typic Udipsamments; Emmert is a Typic Udorthent.

These soils formed in various parent materials including sandy or loamy alluvium; sandy, loamy, and gravelly outwash; sandy, loamy, gravelly, and cobbly drift; loamy till; and eolian sand. Soils are very deep, and somewhat excessively or excessively drained. They do not meet hydric soil requirements.

Surface texture is sandy loam, silt loam, loamy sand, sand, and slightly to highly decomposed plant material. Some surface horizons have a fine sand or gravelly modifier. Subsurface textures are sandy loam, silt loam, loamy sand, and sand. Some horizons have fine sand, gravelly, very gravelly, extremely gravelly, very cobbly, or extremely cobbly modifiers. Soil pH ranges from very strongly acid to slightly acid with values of 4.6 to 6.9. Carbonates may be present up to 8 percent beginning at 17 inches.

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Eolian deposits (3) Till (4) Outwash

Surface texture	(1) Loamy sand (2) Sandy loam (3) Loam (4) Silt loam (5) Sand
Drainage class	Somewhat excessively drained to excessively drained
Permeability class	Slow to rapid
Soil depth	200 – 250 cm
Surface fragment cover <=3"	0 – 10 %
Surface fragment cover >3"	0 – 10 %
Available water capacity (0-152.4cm)	1.19 – 6.27 cm
Calcium carbonate equivalent (0-101.6cm)	0 – 10 %
Soil reaction (1:1 water) (0-101.6cm)	4.6 – 6.9
Subsurface fragment volume <=3" (Depth not specified)	0 – 50 %
Subsurface fragment volume >3" (Depth not specified)	0 – 30 %

Ecological dynamics

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

In pre-European settlement time wild fire was the main controlling factor of forest community dynamics. Following a severe, stand-replacing fire, any of the species present on the landscape could become established, depending on seed source availability and specific conditions of post-fire seedbed. The newly established young stands of any species were easily eliminated by recurring fires, but differences in fire-resisting properties among the species began to play a role in any species' survival success. White pine is best adapted for long-term success on this Ecological Site. Although vulnerable to damage or elimination by fire in early life it eventually develops thick fire-resistant bark which helps to extend its longevity, in some cases for up to four centuries or more. These survival properties assure the species' relatively continuous seed source in the region as a whole. White pine is also moderately shade-tolerant in early life which means that it can become established in some pioneer communities, such as aspen – white birch stands, or in poorly stocked oak and red maple dominated communities. Red pine had in the past been a common associate of white pine stands. It shares some of the fire-resisting properties of white pine, but it lacks shade-tolerance and does not become established in the understory. For this reason, it has not maintained its presence in current stands and its seed source has been greatly reduced throughout its natural range following the unset of fire suppression.

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

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

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

Table 6. Community 1.2 plant community composition

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

Table 7. Community 2.1 plant community composition

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

Table 8. Community 2.2 plant community composition

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

Table 9. Community 2.3 plant community composition

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

Table 10. Community 2.4 plant community composition

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

Table 11. Community 3.1 plant community composition

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

Table 12. Community 4.1 plant community composition

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

Inventory data references

Plot and other supporting inventory data for site identification and community phases is located on a NRCS North Central Region shared and one drive folder. University Wisconsin-Stevens Point described soils, took photographs, and inventoried vegetation data at community phases within the reference state. The data sources include WI ESD Plot Data Collection Form - Tier 2, Releve Method, NASIS pedon description, NRCS SOI 036, photographs, and Kotar Habitat Types. Habitat Types of N. Wisconsin (Kotar, 2002): The sites of this ES keyed out to eight habitat types: Acer saccharum/Athyrium (AAt); Acer saccharum/Vaccinium-Desmodium (AVDe); Acer saccharum-Tsuga/Dryopteris (ATD); Acer saccharum-Tsuga/Maianthemum (ATM); Acer saccharum/Viburnum, Vaccinium variant (AVb-V); Pinus-Acer rubrum/Vaccinium-Aralia (PArVHa); Pinus-Acer rubrum/Vaccinium-Amphicarpa (PArVAm); Pinus-Acer rubrum/Vaccinium-Hamamelis (PArVHa) Biophysical Settings (Landfire, 2014): This ES is largely mapped as Laurentian-Acadian Northern Hardwoods Forest, Laurentian-Acadian Northern Oak Forest, Boreal White Spruce-Fir Forest, Boreal White Spruce-Fir-Hardwood Forest, Boreal Hardwood Forest, Eastern Cool Temperate Row Crop, Managed Tree Plantation-Northern and Central Hardwood and Conifer Plantation

Group, Eastern Cool Temperate Urban Shrubland, Developed-Low Intensity, and Developed-Medium Intensity WDNR Natural Communities (WDNR, 2015):

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Approval

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Acknowledgments

NRCS contracted UWSP to write ecological sites in MLRA 90B, completed in 2021.

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	08/16/2026
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:**