

Ecological site F090BY007WI

Wet Clayey 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): 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: Bayfield Sand Plains (212Ka), Rib Mountain Rolling Ridges (212Qd) Small sections occur in St. Croix Moraine (212Qa) and Mille Lacs Uplands (212Kb) Wisconsin DNR Ecological Landscapes: Northwest Sands, Forest Transition, Northwest Lowlands, North Central Forest

Ecological site concept

The Wet Clayey Lowland ecological site is uncommon in MLRA 90A and 90B, located in depressions and drainageways on lake plains and moraines. These sites are characterized by very deep, very poorly or poorly drained soils that formed primarily in clayey lacustrine, till, and residuum. Sites are subject to frequent ponding during the spring and fall. Soils remain saturated for long periods during the growing season and meet hydric soil requirements. Precipitation, runoff from adjacent uplands, and groundwater discharge are the primary sources of water. Soils range from very strongly acid to moderately alkaline. Wet Clayey Lowland is differentiated from other ecological sites by its deep clayey deposits and very poorly or poorly drained soils. Other very poorly or poorly drained sites have sandy

or loamy deposits. Clays often have higher pH and available water capacity than sandy and loamy sites, which can promote vegetative growth. The poor drainage of this site differs it from other clayey sites.

Associated sites

F090BY012WI	Moist Clayey Lowland Moist Clayey Lowland sites consist of deep clayey lacustrine deposits. The finer textures perch the water table. These soils remain moist - but not saturated - throughout much of the growing season. They are drier and occur higher on the drainage sequence than Wet Clayey Lowland.
F090BY017WI	Clayey Upland Clayey Upland consist of loamy to clayey residuum or lacustrine deposits overlain by loess or sandy outwash. Bedrock contact may occur within two meters of the surface. These sites have a seasonally high water table within one meter of the surface, though they are not saturated for sustained periods. They are drier and occur higher on the drainage sequence than Wet Clayey Lowland.

Similar sites

F090BY006WI	Wet Loamy Lowland Wet Loamy Lowland consist primarily of deep loamy deposits derived from a mixture of outwash, alluvium, loess, and lacustrine sources. Some sites may have bedrock contact within two meters of the surface. These sites are seasonally ponded depressions that remain saturated for sustained periods, allowing hydric conditions to occur. They occur in similar landscape positions and have similar drainage as Wet Clayey Lowland, though with coarser particle sizes. The vegetative communities they support are similar to those found on Wet Clayey Lowland.
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Table 1. Dominant plant species

Tree	(1) <i>Fraxinus nigra</i> (2) <i>Quercus bicolor</i>
Shrub	(1) <i>Fraxinus pennsylvanica</i>
Herbaceous	(1) <i>Oligoneuron</i> (2) <i>Carex</i>

Physiographic features

This site occurs in depressions and drainageways on lake plains and moraines. Slopes range from 0 to 2 percent.

Some sites are subject to occasional ponding throughout the year. The ponding duration ranges from brief (2 to 7 days) to long (7 to 30 days), with depths up to 6 inches above the soil surface. These sites do not flood. The soils have an apparent seasonally high water table (endosaturation) at the surface, but the water table may drop to 35 inches during dry conditions. Some sites have a perched seasonally high water table (episaturation). Runoff is negligible to very high.

Table 2. Representative physiographic features

Hillslope profile	(1) Toeslope (2) Footslope
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Slope shape across	(1) Concave
Slope shape up-down	(1) Linear
Landforms	(1) Depression (2) Drainageway (3) Lake plain (4) Moraine
Runoff class	Negligible to very high
Flooding frequency	None
Ponding duration	Brief (2 to 7 days) to long (7 to 30 days)
Ponding frequency	None to occasional
Elevation	180 – 340 m
Slope	0 %
Ponding depth	0 – 20 cm
Water table depth	0 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 29 inches. The annual average maximum and minimum temperatures are 53°F and 34°F, respectively.

Table 3 Representative climatic features

Frost-free period (characteristic range)	70-120 days
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Freeze-free period (characteristic range)	100-140 days
Precipitation total (characteristic range)	810-890 mm
Frost-free period (actual range)	40-120 days
Freeze-free period (actual range)	90-140 days
Precipitation total (actual range)	810-940 mm
Frost-free period (average)	90 days
Freeze-free period (average)	120 days
Precipitation total (average)	860 mm

- (1) LUCK [USC00474894], Luck, WI
- (2) AMERY [USC00470175], Amery, WI
- (3) COUDERAY 7 W [USC00471847], Stone Lake, WI

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 evapotranspiration and groundwater recharge. These sites are wetlands.

Wetland description

Under the Cowardin System of Wetland Classification, or National Wetlands Inventory (NWI), the wetlands can be classified as:

- 1) Palustrine, forested, broad-leaved deciduous, saturated, or
- 2) Palustrine, scrub-shrub, broad-leaved deciduous, saturated, or
- 3) Palustrine emergent, persistent, saturated

Under the Hydrogeomorphic Classification System (HGM), the wetlands can be classified as:

- 1) Depressional, forested/sandy, or
- 2) Depressional, scrub-shrub/sandy

Permeability of the soils are impermeable to very slow.

Hydrologic Group: D, C/D

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

Cowardin Wetland Classification: PFO1B, PSS1B, PEM1B

Soil features

These sites are represented by Altdorf, Indus, and Wildwood soil series. Altdorf is classified as an Aerlic Glossaqualf, Indus is a Vertic Epiaqualf, and Wildwood is a Histic Humaquept.

These soils formed in various parent materials including silty alluvium, loamy or clayey residuum, loess, loamy or clayey till, and clayey lacustrine. Soils are very deep. Sites are very poorly or poorly drained and remain saturated for much of the growing season. They meet hydric soil requirements.

The surface of these sites is often muck, mucky silt loam, silt loam, or clay loam. Subsurface horizons include clay loam, silt loam, silty clay, and clay textures. Soil pH ranges from very strongly acid to moderately alkaline with values of 4.6 to 7.9. This range occurs because some sites have carbonates present beginning at 25 inches and can have up to 18 percent calcium carbonates. Fragments are typically absent, but subsurface fragments less than 3 inches can be present up to 3 percent in the profile.

Table 4. Representative soil features

Parent material	(1) Lacustrine deposits (2) Till (3) Organic material (4) Eolian deposits (5) Metamorphic rock
Surface texture	(1) Mucky silt loam (2) Mucky clay
Drainage class	Very poorly drained to poorly drained
Permeability class	Very slow
Soil depth	200 – 250 cm
Surface fragment cover ≤3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-154.9cm)	5.92 – 9.98 cm
Calcium carbonate equivalent (0-100.1cm)	0 – 20 %
Soil reaction (1:1 water) (0-100.1cm)	4.6 – 7.9
Subsurface fragment volume ≤3" (Depth not specified)	Not specified

Subsurface fragment volume >3" (Depth not specified)	Not specified
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Ecological dynamics

Because of the poorly drained soils, the historic fire disturbance has likely been less frequent and less severe than on the better drained sites. These forested wetlands are dominated by black ash (*Fraxinus nigra*) with other hardwood associates such as swamp white oak (*Quercus bicolor*) and slippery elm (*Ulmus rubra*). Trembling aspen (*Populus tremuloides*) is common on many sites, but cannot compete with other hardwoods that are more tolerant of shade and moisture. This community relies heavily on soil moisture and nutrient regimes. These sites can support more nutrient demanding species, and the plants must tolerate seasonal ponding. During the driest months, standing water drains, but soils remain saturated throughout the growing season. Tree species often rely on the pit-and-mound microtopography to remain above the oversaturated rooting zones to avoid prolonged anaerobic conditions. Pit-and-mound topography is caused by tree species that have shallow roots and tip from windthrow. Seasonal ponding prevents other shade-tolerant species such as sugar maple from becoming competitive on these sites.

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 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, Releve Method, NASIS pedon description, NRCS SOI 036, photographs, and Kotar Habitat Types. Wetland Forest Habitat Type Classification System for Northern Wisconsin (Kotar and Burger, 2017): The sites of this ES keyed out to two main habitat type (due to MLRA spanning several habitat type regions others are included here as likely in the PESD): *Fraxinus nigra*-*Acer rubrum*/Impatiens (FnArl); *Fraxinus nigra*-*Acer rubrum*/Impatiens-Ilex variant (FnArl-Ix); *Fraxinus nigra*/Onoclea (FnOn); *Fraxinus nigra*-*Abies balsamea*-*Acer rubrum*/Onoclea (FnAbArOn); *Abies balsamea*-*Fraxinus nigra*-*Thuja*/Ilex (AbFnThIx); *Acer rubrum*-*Fraxinus nigra*/Rubus hispidus (ArFnRh) Biophysical Settings (Landfire, 2014): This ES is largely mapped as Laurentian-Acadian Northern Hardwoods Forest, Eastern Cool Temperate Close Grown Crop, and Eastern Cool Temperate Pasture and Hayland WDNR Natural Communities (WDNR, 2015):

Other references

Cleland, D.T.; Avers, P.E.; McNab, W.H.; Jensen, M.E.; Bailey, R.G., King, T.; Russell, W.E. 1997. National Hierarchical Framework of Ecological Units. Published in, Boyce, M. S.; Haney, A., ed. 1997. Ecosystem Management Applications for Sustainable Forest and Wildlife Resources. Yale University Press, New Haven, CT. pp. 181-200.

County Soil Surveys from St. Croix, Polk, Barron, Rusk, Chippewa, Clark, Marathon, Taylor, Price, Sawyer, Burnett, Washburn, Douglas, Bayfield, Ashland, Lincoln, Oneida, Langlade, Shawano, Menominee, Forest, Florence, Marinette, and Pierce Counties.

Curtis, J.T. 1959. Vegetation of Wisconsin: an ordination of plant communities. University of Wisconsin Press, Madison. 657 pp.

Davis, R.B. 2016. Bogs and Fens, A Guide to the Peatland Plants of Northeastern United States and Adjacent Canada. University Press of New England, Hanover and London. 296 pp.

Finley, R. 1976. Original vegetation of Wisconsin. Map compiled from U.S. General Land Office notes. U.S. Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.

Hvizdak, David. Personal knowledge and field experience.

Jahnke, J. and Gienccke, A. 2002. MLRA 92 Clay Till Field Investigations. Summary of field day investigations by Region 10 Soil Data Quality Specialists.

Kotar, J. 1986. Soil – Habitat Type relationships in Michigan and Wisconsin. *J. For. and Water Cons.* 41(5): 348-350.

Kotar, J., J.A. Kovach and G. Brand. 1999. Analysis of the 1996 Wisconsin Forest Statistics by Habitat Type. U.S.D.A. For. Serv. N.C. Res. Stn. Gen. Tech. Rept. NC-207.

Kotar, J., J. A. Kovach, and T. L. Burger. 2002. A Guide to Forest Communities and Habitat Types of Northern Wisconsin. Second edition. University of Wisconsin-Madison, Department of Forest Ecology and Management, Madison.

Kotar, J., and T. L. Burger. 2017. Wetland Forest Habitat Type Classification System for Northern Wisconsin: A Guide for Land Managers and landowners. Wisconsin Department of Natural Resources, PUB-FR-627 2017, Madison.

Martin, L. 1965. The physical geography of Wisconsin. Third edition. The University of Wisconsin Press, Madison.

McNab, W.H. and P.W. Avers. 1994. Ecological Subregions of the United States: Section Descriptions. USDA For. Serv. Pun. WO-WSA-5, Washington, D.C.

NatureServe. 2018. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. U.S.A. Data current as of 28 August 2018.

Radeloff, V.C., D.J. Mladenoff, H.S. He and M.S. Boyce. 1999. Forest landscape change in Northwestern Wisconsin Pine Barrens from pre-European settlement to the present. *Can. J. For. Res.* 29: 1649-1659.

Schulte, L.A., and D.J. Mladenoff. 2001. The original U.S. public land survey records: their use and limitations in reconstructing pre-European settlement vegetation. *Journal of Forestry* 99:5–10.

Schulte, L.A., and D.J. Mladenoff. 2005. Severe wind and fire regimes in northern forests: historical variability at the regional scale. *Ecology* 86(2):431–445.

Soil Survey Staff. Input based on personal experience. Tim Miland, Scott Eversoll, Ryan Bevernitz, and Jason Nemecek.

Stearns, F. W. 1949. Ninety years change in a northern hardwood forest in Wisconsin. *Ecology*, 30: 350-58.

United States Department of Agriculture, Forest Service. 1989. Proceedings – Land Classification Based on Vegetation: Applications for Management. Gen. Tech. Report INT-527.

United States Department of Agriculture, Forest Service. 1990. Silvics of North America, Vol. 1, Hardwoods. Agricultural Handbook 654, Washington, D.C.

United States Department of Agriculture, Forest Service. 1990. Silvics of North America, Vol. 2, Conifers. Agricultural Handbook 654, Washington, D.C.

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land Resource and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296.

United States Department of Agriculture, Natural Resources Conservation Service. 2008. Hydrogeomorphic Wetland Classification System: An Overview and Modification to Better Meet the Needs of the Natural Resources Conservation Service. Technical Note No. 190-8-76. Washington D.C.

Wilde, S.A. 1933. The relation of soil and forest vegetation of the Lake States Region. *Ecology* 14: 94-105.

Wilde, S.A. 1976. Woodlands of Wisconsin. University of Wisconsin Cooperative Extension, Pub. G2780, 150 pp.

Wisconsin Department of Natural Resources. 2015. The ecological landscapes of Wisconsin: An assessment of ecological resources and a guide to planning sustainable management. Wisconsin Department of Natural Resources, PUB-SS-1131 2015, Madison.

Contributors

Bryant Scharenbroch, Assistant Professor at University of Wisconsin Stevens Point

Jacob Prater, Associate Professor at University of Wisconsin Stevens Point

John Kotar, Ecological Specialist, independent contractor

Approval

Suzanne Mayne-Kinney, 11/16/2023

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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	08/16/2026
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:
