Ecological site R105XY018WI
Dry Mollic or Umbric Upland

Last updated: 2/23/2024
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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): 105X–Upper Mississippi River Bedrock Controlled Uplands and Valleys

The Northern Mississippi Valley Loess Hills area corresponds closely to the Western Coulees and Ridges and Southwest Savanna Ecological Landscapes. Some of the following brief overview is borrowed from the Wisconsin Department of Natural Resources Ecological Landscape publication (2015). Fifty-two percent of the Upper Mississippi River Bedrock Controlled Uplands and Valleys MLRA is in Wisconsin; Iowa, Minnesota, and Illinois contain the rest. This region is the only area in Wisconsin that has not been covered by glaciers within the past 2.4 million years. The Wisconsin portion of this MLRA is approximately 7.4 million acres (11,600 square miles). The landscape is characterized by dissected topography with deeply-incised, steep-walled valleys between bedrock controlled ridges. Though it's called the "Driftless Region", some glacial drift is found in the major river valleys of this region in the form of outwash, deposited by proglacial streams of glacial meltwater. Wisconsin's most recent glaciations also impacted the sediment of the area through the deposition of loess. After the glacier receded and before vegetation established, the bare surfaces of the glaciated areas were highly susceptible to wind erosion. As a result, a veneer of loess (wind-blown silt) was deposited over the entire region. The thickest deposits—nearly five meters—are on ridges near the Mississippi River and gradually thin moving eastward. The loess caps in Dane and Green counties are generally 0.5-1.5 meters deep. Much of the loess has eroded downslope and collected in floodplains. Bedrock is shallow throughout this MLRA and is a major influence on topography and hydrology. Most of the MLRA has bedrock within two meters, except in the deep river valleys that are filled with outwash and alluvium materials. Sandstone is the dominant bedrock type in MLRA 105, but the southernmost portion is dominated by dolomite. Military Ridge is an escarpment that straddles the boundary between sandstone and dolomite bedrock. The sandstone north of the ridge is weaker than the erosion-resistant dolomite south of the ridge. The sandstone is deeply cut and dissected into steep slopes and valleys. The dolomite-controlled ridges tend to be less dissected and broader with more gentle, south sloping topography. Geomorphic and fluvial processes formed these landscapes by way of sheet wash, soil creep, and flowage. These processes eroded the hillslopes, cut into bedrock, and transported the debris to streams, forming floodplains and terraces. Underfit streams are common in MLRA 105, especially in the southern portion. These streams currently occupy large river valleys—especially those of the Black, Chippewa, Mississippi, and Wisconsin Rivers—that were carved by proglacial meltwater streams carrying much larger quantities of water than what's present today. As the climate dried, waterflow decreased and the valleys filled with alluvial sediment. Narrow meanders were formed by the shrinking streams and are often dissimilar to the meanders of the larger valleys they occupy. Fluvial landforms – including terraces, oxbow lakes, sandbars, eroding bluffs, and large floodplain complexes – are found within these large valleys and are subject to varying flooding frequencies, intensities, and durations. Karst topography formed in this region from dissolution of carbonate bedrock by surface and groundwater. Dolomite and limestone are more easily affected by dissolution, but karst topography also formed in sandstone. Erosion by water (stream meanders, rain/runoff, and groundwater), wind, and frost weaken joints and bedding planes that can cause collapse. In addition, sandstone materials collapse into cavities in underlying dolomite or limestone. Historically, MLRA 105 was dominated by oak forests and oak openings making up more than 50% of the area. Prairies were significant and covered 32% of the area south of Military Ridge. Maple-basswood forests covered 19% of the area north of Military Ridge. Dominant tree species were white oak (Quercus alba), bur oak (Quercus macrocarpa), black oak (Quercus velutina), and sugar maple (Acer saccharum).

Classification relationships

Relationship to Established Framework and Classification Systems: Habitat Types of S. Wisconsin (Kotar, 1996): The sites in this ES likely key out to Pinus strobus/Vaccinium-Cornus racemose [PVCr] and Acer rubrum/Desmodium-Vaccinium [ArDe-V] if forested. Biophysical Settings (Landfire, 2014): This ES is largely mapped as North-Central Interior Sand and Gravel Tallgrass Prairie, Paleozoic Plateau Bluff and Talus Woodland, Managed Tree Plantation-Northern and Central Hardwood and Conifer Plantation Group, Eastern Cool Temperate Row Crop, Eastern Cool Temperate Close Grown Crop, and Eastern Cool Temperate Developed Ruderal Grassland WDNR Natural Communities (WDNR, 2015): This ES is best matches Dry Prairies as described by the Wisconsin DNR Hierarchical Framework Relationships: Major Land Resource Area (MLRA): Upper Mississippi River Bedrock Controlled Uplands and Valleys (105) USFS Subregions: Menominee Eroded Pre-Wisconsin Till (222La), Melrose Oak Forest and Savannah (222Lb), Mississippi-Wisconsin

River Ravines (222Lc) Wisconsin DNR Ecological Landscapes: Western Coulee and Ridges

Ecological site concept

The Dry Mollic or Umbric Upland site occupies approximately 129,000 acres across MLRA 105, or about 1.9% of total land area. It is found in upland positions on sandstone valleys and hills and sandy outwash terraces throughout the MLRA, especially the wide outwash plains along the Chippewa, Mississippi, and Wisconsin rivers. This site is characterized by somewhat excessively to excessively drained, sandy soils with deep, dark surfaces (mollic or umbric epipedons) resulting from long-term additions of organic materials, especially from fine, fibrous roots of grassy vegetation. Historically, these sites were prairies, though modern fire suppression has resulted in the encroachment by woody species. Today, many sites are forested.

Associated sites

F105XY002WI	**Wet Sandy Floodplain** These sites form in deep, sandy alluvium and outwash deposits in floodplains, especially those along the Chippewa, Black, and Wisconsin rivers. They support vegetation tolerant of seasonal flooding. They are sometimes saturated enough for hydric conditions to occur. They are found in floodplains adjacent to Dry Mollic or Umbric Upland.
F105XY006WI	**Moist Sandy Lowland** These sites form in sandy outwash deposits along major waterways. They are somewhat poorly drained. They are sometimes found adjacent to adjacent to Dry Mollic or Umbric Upland in lower landscape positions.
F105XY019WI	**Dry Upland** These sites form in sandy materials deposited by wind, water, gravity, or weathered from sandstone bedrock. They are well drained to excessively drained. They are often found adjacent to adjacent to Dry Mollic or Umbric Upland.

Similar sites

F105XY017WI	**Shallow Dry Upland** These sites form in sandy materials deposited by wind, water, gravity, or weathered from sandstone bedrock. They have bedrock contact within one meter of the soil surface. They are somewhat excessively to excessively drained. They are similar to Dry Mollic or Umbric Upland but have shallower surfaces (ochric rather than mollic or umbric epipedons).
F105XY019WI	**Dry Upland** These sites form in sandy materials deposited by wind, water, gravity, or weathered from sandstone bedrock. They are well drained to excessively drained. They are similar to Dry Mollic or Umbric Upland but have shallower surfaces (ochric rather than mollic or umbric epipedons).
R105XY011WI	**Mollic Loamy-Silty Upland** These sites form in loamy to silty materials, often silty loess and residuum. They have deep, dark surfaces. They are moderately well to somewhat excessively drained. They are similar to Dry Mollic or Umbric Upland but have slightly finer soil textures and are sometimes slightly wetter.

Table 1. Dominant plant species

Tree	Not specified

Shrub	Not specified
Herbaceous	(1) *Schizachyrium scoparium* (2) *Bouteloua curtipendula*

Physiographic features

These sites are found on ridges, hills, terraces, outwash plains, sand sheets, and valley trains in the summit, shoulder, or backslope position. Slope shape is convex to linear. Slopes range from 0 to 15 percent.

These sites are not subject to inundation by water. Evidence of a seasonally high water table is generally found below 44 inches (112 cm) from the soil surface, or not at all. Runoff potential is negligible to low.

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) Ridge (2) Hill (3) Terrace (4) Outwash plain (5) Sand sheet (6) Valley train
Runoff class	Negligible to low
Flooding frequency	None
Ponding frequency	None
Elevation	220 – 310 m
Slope	0 – 20 %

Water table depth	110 – 200 cm
Aspect	Aspect is not a significant factor

Climatic features

The climate of the Upper Mississippi River Bedrock Controlled Uplands and Valleys MLRA is typical of southern Wisconsin, with warmer winters, warmer summers, and higher precipitation rates than MLRA in northern Wisconsin. The MRA stretches over about 2.9 degrees of latitude, or nearly 200 miles, from its northern tip in Barron county to its southern Wisconsin extent on the border of Illinois. This results in considerable variation in climate throughout the MLRA. The growing season ranges from 117 to 181 growing degree days, with longer growing seasons in the southern portion.

The average annual precipitation for this ecological site is 34 inches. The average annual snowfall is 39 inches. The annual average maximum and minimum temperatures are 57°F and 35°F, respectively.

Table 3 Representative climatic features

Frost-free period (characteristic range)	120-130 days
Freeze-free period (characteristic range)	140-160 days
Precipitation total (characteristic range)	840-890 mm
Frost-free period (actual range)	110-140 days
Freeze-free period (actual range)	130-160 days
Precipitation total (actual range)	810-890 mm
Frost-free period (average)	120 days
Freeze-free period (average)	150 days
Precipitation total (average)	860 mm

- (1) MONDOVI [USC00475563], Mondovi, WI
- (2) PRAIRIE DU CHIEN [USC00476827], Prairie du Chien, WI
- (3) MAZOMANIE [USC00475189], Mazomanie, WI
- (4) MENOMONIE [USC00475335], Menomonie, WI
- (5) BOSCOBEL AP [USW00094994], Boscobel, WI
- (6) SPARTA [USC00477997], Sparta, WI
- (7) DURAND [USC00472279], Durand, WI
- (8) LONE ROCK TRI CO AP [USW00014921], Spring Green, WI
- (9) PRAIRIE DU SAC 2 N [USC00476838], Prairie du Sac, WI
- (10) DODGE [USC00472165], Arcadia, WI

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.

Permeability of the soils is moderately slow to rapid. The hydrologic soil group is A.

Wetland description

Not Applicable.

Soil features

This soil is represented by the Burkhardt, Dickinson, Finchford, Garne, Impact, Komro, and Sparta soil series, as well as a variant of the Sparta soil series. Entic Hapludolls account for 58% of the acreage of this site. The remaining acreage is equally split between Typic Hapludolls and Humic Psammentic Dystrudepts. As small amount of Oxyaquic Hapludolls belonging to this site can be found in northeast Iowa county in the outwash plains along the Wisconsin River.

These soils form in sandy to loamy outwash and alluvium deposits – sometimes reworked by wind – and in sandy residuum weathered from sandstone bedrock. Soils have thick surface horizons, dark from enrichment of organic matter (mollic or umbric epipedons). Bedrock contact within two meters in rare but is sometimes found in wind-blown deposits along the Chippewa River. Subsurface fragments smaller than 3 inches in diameter (gravel) may occupy up to 25% soil volume. Fragments may be mixed rocks deposited by flowing water or pieces of weathered sandstone bedrock. Soils are moderately well to excessively drained and do not meet hydric soil requirements.

Soils are strongly acid to neutral and they generally lack accumulations of secondary carbonates.

Figure 7. Finchford soil series sampled on 07/22/2020 in LaCrosse County, WI.

Table 4. Representative soil features

Parent material	(1) Eolian sands (2) Outwash (3) Residuum (4) Alluvium
Drainage class	Moderately well drained to excessively drained
Permeability class	Moderately slow to rapid
Soil depth	90 – 200 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-150.1cm)	3.73 – 6.02 cm

Soil reaction (1:1 water) (0-100.1cm)	5.5 – 6.9
Subsurface fragment volume <=3" (0-100.1cm)	0 – 30 %
Subsurface fragment volume >3" (0-100.1cm)	Not specified

Ecological dynamics

In pre-European settlement time wildfire was the main controlling factor of range and forest community dynamics. Some areas had been persistent in grasslands, but had the capacity to support both grassland and forest depending on the frequency and intensity of fire and the presence of large grazers. Shorter fire return intervals led to grasslands, intermediate fire return intervals to scrub, and long fire return intervals to forest. Any scrub or forest community was dependent on the presence of adjacent seed source. Many of the previous grasslands have been converted to agriculture or have reverted to forest following fire suppression.

Forest communities can be described thusly, 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. Several species of oak are common members of forest communities on this ecological site. Northern pin oak (Q. ellipsoidalis) and, to a lesser degree, black oak (Q. velutina), are intolerant of shade and do not reproduce from seed under existing canopies. However, following fire or clear cutting they respond by sprouting from stumps. In the absence of disturbance, they are replaced—through succession—by more shade-tolerant white pine, red maple (Acer rubrum), or white oak (Quercus alba).

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 damage, 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.
Some portions of this ES may support grassland or oak savanna and restoration/establishment efforts have had some success.

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 2.1 plant community composition

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

Table 7. Community 3.1 plant community composition

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

Table 8. Community 3.2 plant community composition

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

Table 9. Community 4.1 plant community composition

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

Table 10. Community 5.1 plant community composition

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

Inventory data references

Plot and other supporting inventory data for site identification and community phases is located on a NRCS North Central Region shared and one drive folder. University of Wisconsin-Stevens Point described soils, took photographs, and inventoried vegetation data at community phases within the reference state. The data sources include WI ESD Plot Data Collection Form - Tier 2, Releve Method, NASIS pedon description, NRCS SOI 036, photographs, and Kotar Habitat Types.

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Contributors

Jacob Prater, Associate Professor at University of Wisconsin Stevens Point
Bryant Scharenbroch, Assistant Professor at University of Wisconsin Stevens Point
John Kotar, Ecological Specialist Independent Contractor

Approval

Suzanne Mayne-Kinney, 2/23/2024

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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	09/08/2026
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:

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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:**
