Ecological site F105XY005WI
Wet Loamy-Clayey Lowland

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): Wetland Forest Habitat Types have not yet been developed for this area, but this would likely be a *Fraxinus nigra* [Fn] habitat type.

Biophysical Settings (Landfire, 2014): This ES is largely mapped as Central Interior and Appalachian Floodplain Forest, Eastern Cool Temperate Developed Ruderal Grassland, Eastern Cool Temperate Pasture and Hayland, and Eastern Cool Temperate Row Crop

WDNR Natural Communities (WDNR, 2015): This ES is most closely described as Southern Hardwood Swamp and Northern Hardwood Swamp 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), Point Prairie-Savannah (222Le)

Wisconsin DNR Ecological Landscapes: Western Coulee and Ridges, Southwest Savannah

Ecological site concept

The Wet Loamy-Clayey Lowlands ecological is accounts for approximately 28,000 acres of MLRA 105, or about 0.4% of the total land area. It is one of the least extensive sites in MLRA 105. It can be found in depressions, drainageways, and swales across a variety of landforms throughout the MLRA. Nearly half of the acreage of this site is found north of the Chippewa River amid valley trains and sandstone hills.

These sites are characterized by very deep, very poorly to poorly drained soils formed in clayey, loamy, and silty materials comprised of alluvium, residuum, and outwash. Some sites are subject to flooding and/or ponding.

Associated sites

F105XY001WI	**Mucky Swamp** These sites are permanently saturated wetlands that consist of deep, herbaceous organic materials. They are very poorly drained. They are often found adjacent to Wet Loamy-Clayey Lowlands in lower landscape positions.
F105XY008WI	**Moist Loamy-Clayey Lowland** These sites form in loamy and clayey materials. They are somewhat poorly drained. They are often found adjacent to Wet Loamy-Clayey Lowlands. They are often found adjacent to Wet Loamy-Clayey Lowlands in lower landscape positions.
F105XY012WI	**Shallow Loamy-Silty Upland** These sites form in loamy to silty materials, often silty loess and residuum. They have bedrock contact within one meter of the soil surface. They are moderately well to well drained. They are found adjacent to Wet Loamy-Clayey Lowlands in lower landscape positions.

Similar sites

F105XY004WI	**Wet Sandy Lowland** These sites form in depressions and drainageway in deep, sandy outwash deposits. They are very poorly or poorly drained and are saturated long enough for hydric conditions to occur. They are found in similar landscape positions as Wet Loamy-Clayey Lowlands but have coarser textures and a lower nutrient status.
F105XY003WI	**Wet Loamy-Clayey Floodplain** These sites form in deep, loamy alluvium deposits along floodplains, especially those along smaller tributaries to the Chippewa, Black, and Wisconsin rivers. They support vegetation tolerant of seasonal flooding. They are sometimes saturated enough for hydric conditions to occur. They may sometimes host vegetative communities similar to those supported by Wet Loamy-Clayey Lowlands.

Table 1. Dominant plant species

Tree	(1) *Fraxinus nigra* (2) *Acer saccharinum*
Shrub	Not specified
Herbaceous	(1) *Carex* (2) *Impatiens capensis*

Physiographic features

These sites are found in depressions, drainageways, and swales. Landform shape is generally concave or linear. Sites are in the footslope position. Slopes range from 0 to 12 percent. Elevation of the landform ranges from 705 to 1001 feet (215 to 205 meters) above sea level.

Some sites are subject to rare flooding or frequent ponding. The apparent seasonally high-water table is generally found between 0 to 6 inches (0 and 15 cm) from the soil surface. The water table may drop during dry conditions. Runoff potential is generally negligible but may be low on sites with steeper slopes.

Table 2. Representative physiographic features

Hillslope profile	(1) Footslope
Slope shape across	(1) Concave
Slope shape up-down	(1) Linear
Landforms	(1) Depression (2) Drainageway (3) Swale
Runoff class	Negligible to low
Flooding duration	Very brief (4 to 48 hours) to long (7 to 30 days)
Flooding frequency	None to rare
Ponding duration	Brief (2 to 7 days) to long (7 to 30 days)
Ponding frequency	None to frequent
Elevation	215–305 m
Slope	0–12%
Ponding depth	0–30 cm
Water table depth	0–15 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 MLRA 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.

Table 3. Representative climatic features

Frost-free period (characteristic range)	112-121 days
Freeze-free period (characteristic range)	131-151 days
Precipitation total (characteristic range)	813-914 mm
Frost-free period (actual range)	108-123 days
Freeze-free period (actual range)	125-159 days
Precipitation total (actual range)	787-965 mm
Frost-free period (average)	117 days
Freeze-free period (average)	144 days
Precipitation total (average)	864 mm

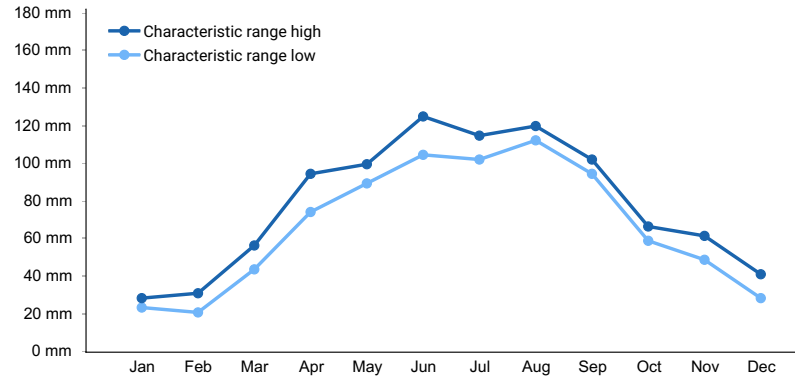


Figure 1. Monthly precipitation range

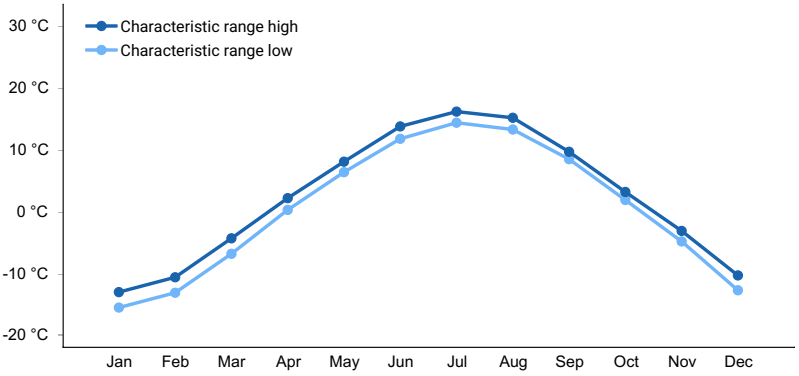


Figure 2. Monthly minimum temperature range

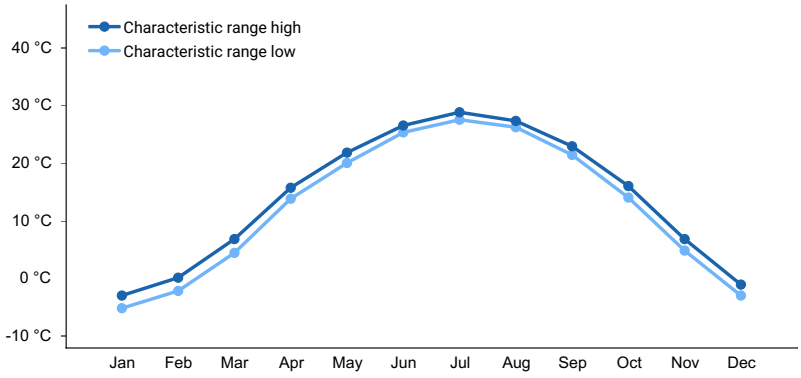


Figure 3. Monthly maximum temperature range

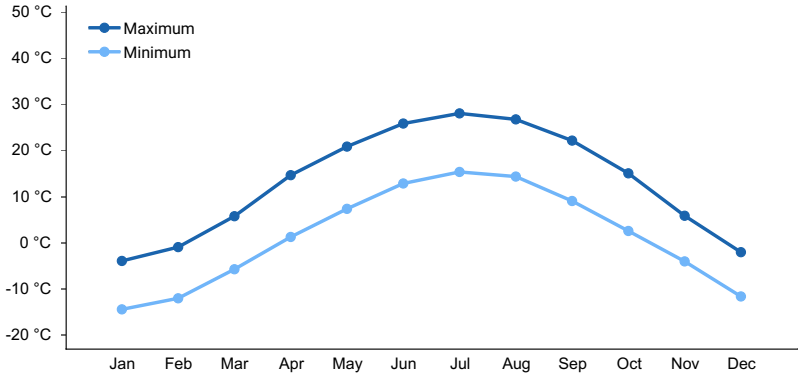


Figure 4. Monthly average minimum and maximum temperature

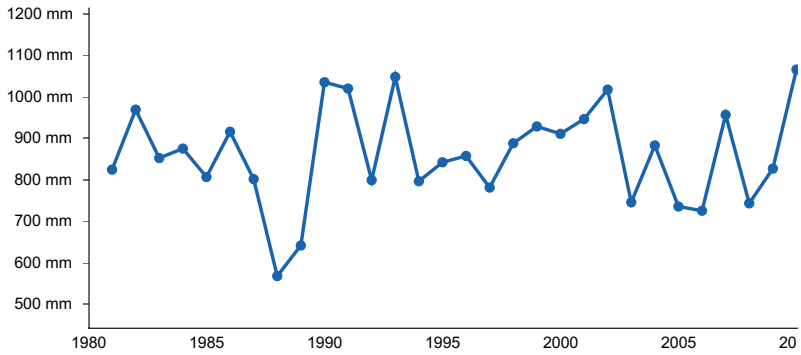


Figure 5. Annual precipitation pattern

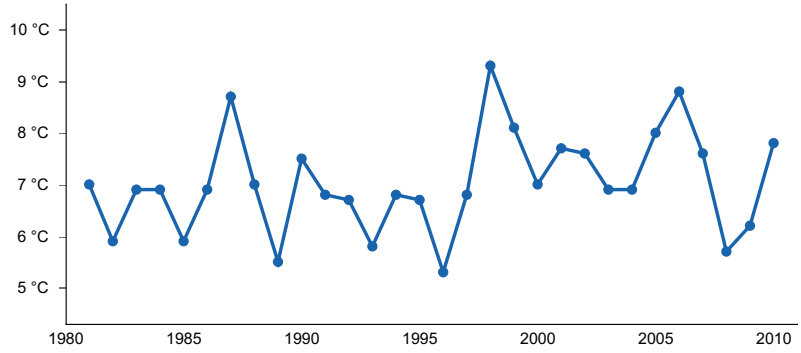


Figure 6. Annual average temperature pattern

Climate stations used

- (1) RIDGELAND 1 NNE [USC00477174], Dallas, WI
- (2) MONDOVI [USC00475563], Mondovi, WI
- (3) EAU CLAIRE RGNL AP [USW00014991], Eau Claire, WI

- (4) MENOMONIE [USC00475335], Menomonie, WI
- (5) AUGUSTA RS [USC00470382], Augusta, WI
- (6) PLATTEVILLE [USC00476646], Platteville, WI
- (7) DARLINGTON [USC00472001], Darlington, WI
- (8) DODGE [USC00472165], Arcadia, WI

Influencing water features

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

Wetland description

Under the Cowardin System of Wetland Classification, or National Wetlands Inventory (NWI), the wetlands can be classified as:
1) Palustrine, emergent, persistent, saturated, or
2) Palustrine, forested, broad-leaved deciduous, saturated, or
3) Palustrine, forested, needle-leaved evergreen, saturated

Under the Hydrogeomorphic Classification System (HGM), the wetlands can be classified as:
1) Depressional, emergents/loamy-clayey, or
2) Depressional, forested/loamy-clayey

Permeability of the soil is impermeable to moderately slow. The hydrological groups for this site are D, B/D, and C/D.

Soil features

This site is made up of the Calamine, Lows, Otter, Sable, Vancecreek, Wallkill, and Zwingle series. The Ettrick series also belongs to this site when flooded for short durations. Aquepts make up 58% of the acreage of this site. Aquolls make up 40%. The remaining acreage is made up of Aqualfs and Aquents.

These soils form in silty or loamy deposits of alluvium or loess and in loamy or clayey residuum weathered from shale. The sites are sometimes overlain by organic deposits or underlain by sandstone residuum. Silty alluvium sites are sometimes underlain by clayey lacustrine deposits or by sandy alluvium. Though residuum is present in some soils, bedrock contact is generally lacking within 6 feet (2 meters) of the surface in these sites. They are poorly to very poorly drained and meet hydric soil requirements.

These soils have loamy surface textures. Subsurface textures may be sandy to clayey. They are very strongly acid to slightly alkaline. They sometimes have subsurface fragments which may be composed of gravel deposited by flowing water or of fragments of weathered bedrock. Secondary carbonates may sometimes be found starting at 25 inches (64 cm) below the soil surface.

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Loess (3) Residuum (4) Outwash (5) Organic material
Surface texture	(1) Silt loam (2) Loam
Drainage class	Very poorly drained to poorly drained
Permeability class	Moderately slow
Soil depth	201 cm
Surface fragment cover <=3"	0–1%

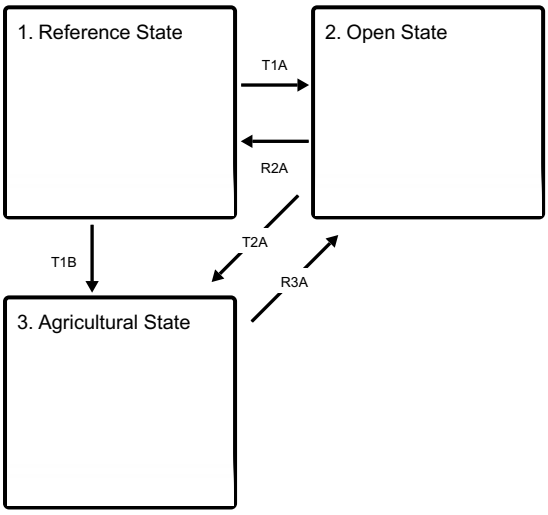
Surface fragment cover >3"	0%
Available water capacity (0-150.1cm)	7.09–19.3 cm
Calcium carbonate equivalent (0-100.1cm)	0–3%
Soil reaction (1:1 water) (0-100.1cm)	5–7.5
Subsurface fragment volume <=3" (0-100.1cm)	0–4%
Subsurface fragment volume >3" (Depth not specified)	0%

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 maples (Acer spp.) and Elm (Ulmus spp.). Various birch species are likely to be present in this ecological site as well. This community relies heavily on high soil moisture and nutrient regimes. These sites require plants that can 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

Ecosystem states



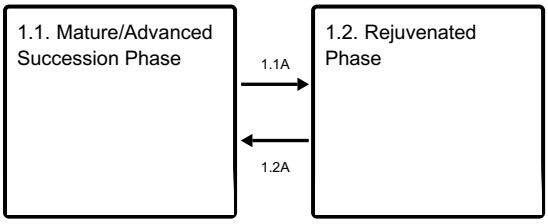
T1A - Stand replacing disturbance e.g., blow-down and fire, or clear-cutting followed by fire. Regeneration by natural seeding or planting.

R2A - Fire control, time, natural succession.

T2A - Grazing by livestock. Disruption of tree regeneration and ground vegetation.

R3A - Removal of livestock from stands.

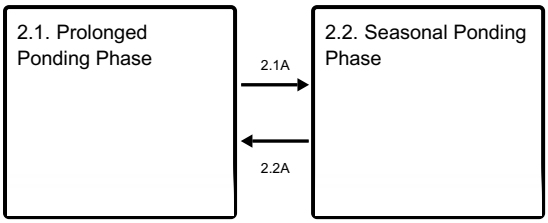
State 1 submodel, plant communities



1.1A - Major stand replacing disturbance e.g. blow-down or clear-cutting

1.2A - Time and natural succession.

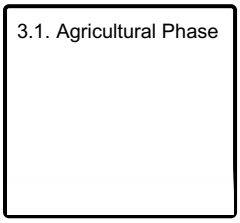
State 2 submodel, plant communities



2.1A - Decreased frequency and duration ponding events, encroachment of tree species such as aspen and black ash.

2.2A - Increased frequency and duration of ponding events.

State 3 submodel, plant communities



State 1
Reference State

Reference state is a forest community dominated by black ash. Depending on disturbance history, two community phases can be distinguished largely by differences in dominance of tree species and community age structure.

Community 1.1
Mature/Advanced Succession Phase

In absence of stand replacing disturbance (major blow-downs, clearcutting, or prolonged ponding event), this community is dominated by black ash in all layers of the forest from canopy to shrub layer. Black ash has a shallow and fibrous root system that to tolerate seasonal ponding of stagnant water. Long duration of ponding will cause black ash to diminish. Silver maple and slippery elm are common associates, both tolerant of high soil moisture, but not as tolerant as black ash. The forest floor cover, though sparse, is dominated by jewelweed (Impatiens spp.) and sedges (Carex, spp.).

Dominant plant species

- black ash (*Fraxinus nigra*), tree
- silver maple (*Acer saccharinum*), tree
- slippery elm (*Ulmus rubra*), tree
- sedge (*Carex*), grass
- jewelweed (*Impatiens capensis*), other herbaceous

Community 1.2
Rejuvenated Phase

The canopy of the rejuvenated community is still dominate by black ash, but swamp white oak, slippery elm, and birches have entered canopy and sub-canopy to fill in canopy gaps created by small-scale disturbances. Advanced regeneration black ash saplings may also gain considerable size. Some additional less shade tolerant species may be able to enter the community, such as Green ash (*Fraxinus pennsylvanica*).

Dominant plant species

- black ash (*Fraxinus nigra*), tree
- swamp white oak (*Quercus bicolor*), tree
- slippery elm (*Ulmus rubra*), tree
- birch (*Betula*), tree
- sedge (*Carex*), grass
- goldenrod (*Oligoneuron*), other herbaceous

Pathway 1.1A
Community 1.1 to 1.2

Natural mortality in the oldest age classes, sporadic small-scale blow-downs and ice storms, and prolonged ponding create canopy openings, releasing advance regeneration and stimulating new seedling establishment. Swamp white oak and elms may enter openings along with birches.

Pathway 1.2A
Community 1.2 to 1.1

Time and natural succession. Black ash tolerance to seasonal ponding and soil saturation continues its dominance as most competitive canopy species.

State 2
Open State

Open State consists of two main community phases. Phases are primarily driven by frequency and duration of ponding events that allow or deter establishment of woody, less tolerant species.

Community 2.1
Prolonged Ponding Phase

The Prolonged Ponding Phase is defined by the increased frequency and duration of ponding events. Communities are dominated by sedges and grasses that can tolerate constant saturation and long periods of standing, stagnant surface water.

Dominant plant species

- sedge (*Carex*), grass

Community 2.2
Seasonal Ponding Phase

The Seasonal Ponding Phase is defined by the presence of woody species, primarily trembling aspen and black ash with higher transpiration rates.

Dominant plant species

- quaking aspen (*Populus tremuloides*), tree
- black ash (*Fraxinus nigra*), tree
- silver maple (*Acer saccharinum*), tree
- sedge (*Carex*), grass
- goldenrod (*Oligoneuron*), other herbaceous

Pathway 2.1A
Community 2.1 to 2.2

Decreased frequency and duration of ponding events. Seasonal ponding where surface water usually drains by midsummer. Allows for establishment of less tolerant species.

Pathway 2.2A
Community 2.2 to 2.1

Increased frequency and duration of ponding events.

State 3
Agricultural State

The agricultural state in this ecological site is characterized as likely having artificial drainage and is composed of crops such as corn, soybeans, potatoes, and hay.

Community 3.1
Agricultural Phase

The agricultural state in this ecological site is characterized as likely having artificial drainage and is composed of crops such as corn, soybeans, potatoes, and hay. Agricultural production in these settings is likely to include practices such as tilling and fertilizing.

Transition T1A
State 1 to 2

Major stand-replacing disturbance, such as a blow-down or clear cutting. Removal of canopy causes water table to rise. Sites have more frequent and longer duration of ponding events.

Transition T1B
State 1 to 3

Elimination of forest cover and the application of agricultural practices, such as artificial drainage, tilling, and planting crops.

Restoration pathway R2A
State 2 to 1

Decreased frequency and duration of ponding events. Seasonal ponding where surface water drains by midsummer. Recruitment of tree species e.g. black ash on localized mounds or high points.

Transition T2A
State 2 to 3

Elimination of forest cover and the application of agricultural practices, such as artificial drainage, tilling, and planting crops.

Restoration pathway R3A
State 3 to 2

Cessation of agricultural practices and either planting or allowing natural seeding is required for this restoration pathway. Restoration might be accelerated with removal of artificial drainage and restoring hydrology, if applicable.

Additional community tables

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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Contributors

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Approval

Suzanne Mayne-Kinney, 2/23/2024

Acknowledgments

NRCS contracted UWSP to write ecological sites in MLRA 105. 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	05/18/2024
Approved by	Suzanne Mayne-Kinney
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:**