USDA Natural Resources Conservation Service

Ecological site F105XY004WI
Wet Sandy Lowland

Last updated: 2/23/2024
Accessed: 05/04/2024

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): No Wetland Forest Habitat Types exist for this region yet. However, it is likely that a *Fraxinus nigra* [Fn] habitat type would best describe this forest.

Biophysical Settings (Landfire, 2014): This ES is largely mapped as North-Central Interior Maple-Basswood Forest, Central Interior and Appalachian Swamp Forest, Laurentian Oak Barrens, Eastern Cool Temperate Pasture and Hayland, and Eastern Cool Temperate Row Crop

WDNR Natural Communities (WDNR, 2015): This ES is best described as a Northern or Southern 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)

Wisconsin DNR Ecological Landscapes: Western Coulee and Ridges

Ecological site concept

The Wet Sandy Lowlands ecological site accounts for approximately 10,000 acres in MLRA 105, or about 0.15% of total land area. It is one of the least-extensive ecological sites in MLRA 105. It is found in depressions and drainageways in the sandy valley trains in Dunn, Chippewa, and Pepin counties. Some sites are also found in sandy outwash plains along the Baraboo and Wisconsin River in Iowa and Sauk counties. These sites are characterized by very deep, very poorly to poorly drained soils comprised of sandy outwash deposits. They are subject to frequent 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 sometimes found adjacent to Wet Sandy Lowlands.
F105XY009WI	**Sandy Upland** These sites form in deep sandy materials deposits by water and wind. They are moderately well to somewhat excessively drained. They are sometimes found adjacent to Wet Sandy Lowlands.
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 Wet Sandy Lowlands on higher positions along the drainage sequence.

Similar sites

F105XY005WI	**Wet Loamy-Clayey Lowland** These sites form in depressions, drainageways, and swales in deep loamy alluvium deposits or in clayey residuum. They are very poorly or poorly drained and are saturated long enough for hydric conditions to occur. They form in similar landscape positions as Wet Sandy Lowlands but have finer textures and higher nutrient statuses.

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.

Table 1. Dominant plant species

Tree	(1) *Fraxinus nigra* (2) *Quercus bicolor*
Shrub	Not specified
Herbaceous	(1) *Carex* (2) *Oligoneuron*

Physiographic features

These sites are found in sandy depressions and drainageways on sandy valley trains. Slope shape is linear. Slopes range from 0 to 2 percent. Elevation of the landform ranges from 705 to 902 feet (215 to 275 meters) above sea level.

These sites are subject to frequent ponding. Ponding duration may be brief to long (2 to 30 days) with depths up to 12 inches above the soil surface. These sites generally do not flood. The apparent seasonally high-water table is generally found at the soil surface, though it may drop during dry conditions. Runoff potential is negligible.

Table 2. Representative physiographic features

Hillslope profile	(1) Toeslope
Slope shape across	(1) Linear
Landforms	(1) Depression (2) Drainageway
Runoff class	Negligible
Flooding frequency	None
Ponding duration	Brief (2 to 7 days) to long (7 to 30 days)
Ponding frequency	Frequent
Elevation	705–902 ft
Slope	0–2%
Ponding depth	0–12 in
Water table depth	0 in
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)	114-121 days
Freeze-free period (characteristic range)	134-147 days
Precipitation total (characteristic range)	32-34 in

Frost-free period (actual range)	112-123 days
Freeze-free period (actual range)	131-150 days
Precipitation total (actual range)	31-34 in
Frost-free period (average)	118 days
Freeze-free period (average)	141 days
Precipitation total (average)	33 in

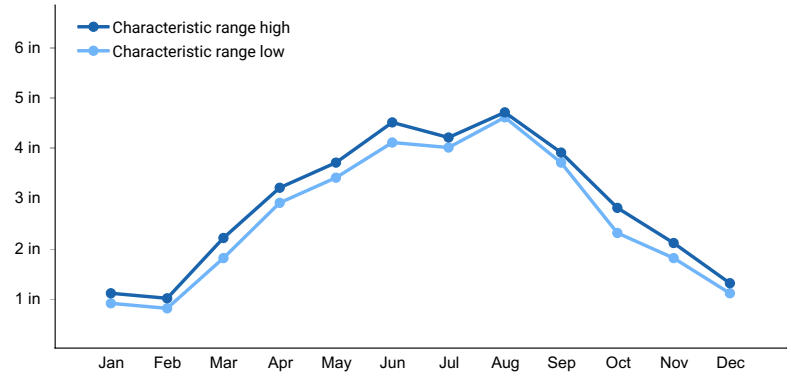


Figure 1. Monthly precipitation range

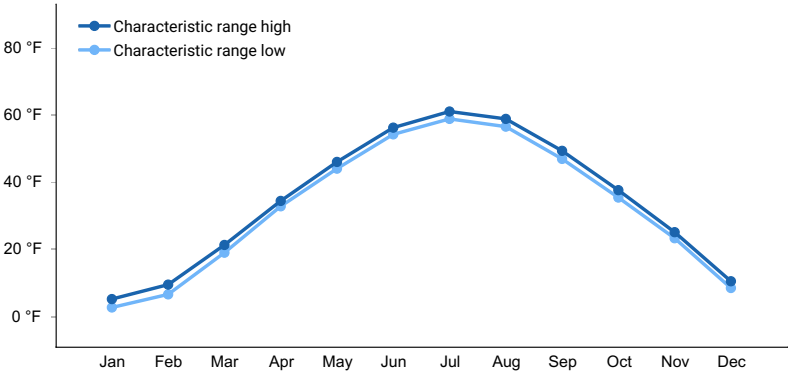


Figure 2. Monthly minimum temperature range

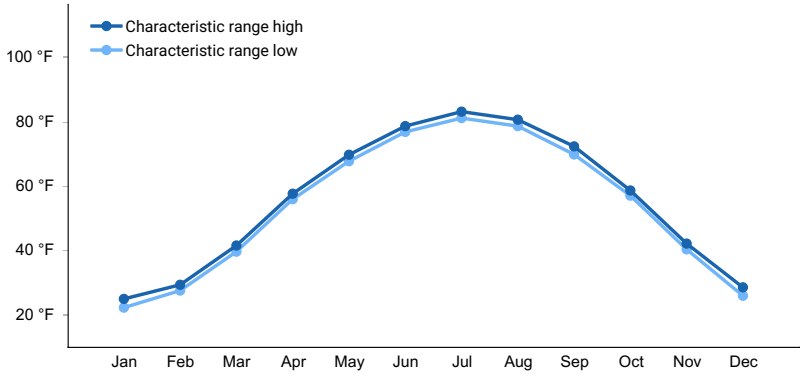


Figure 3. Monthly maximum temperature range

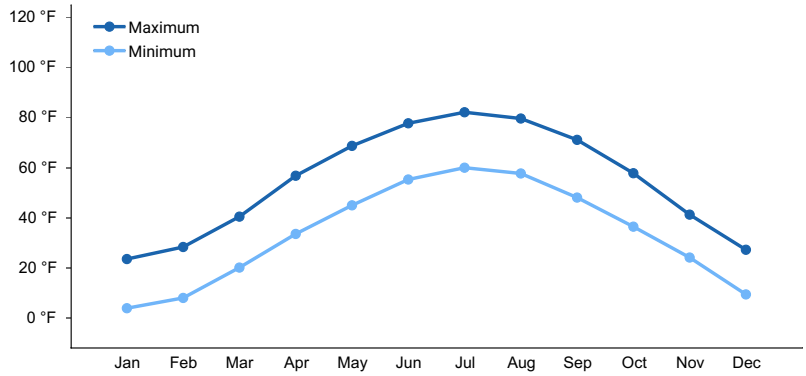


Figure 4. Monthly average minimum and maximum temperature

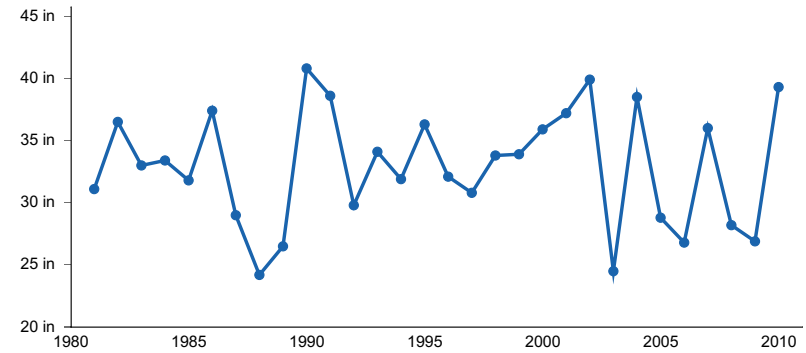


Figure 5. Annual precipitation pattern

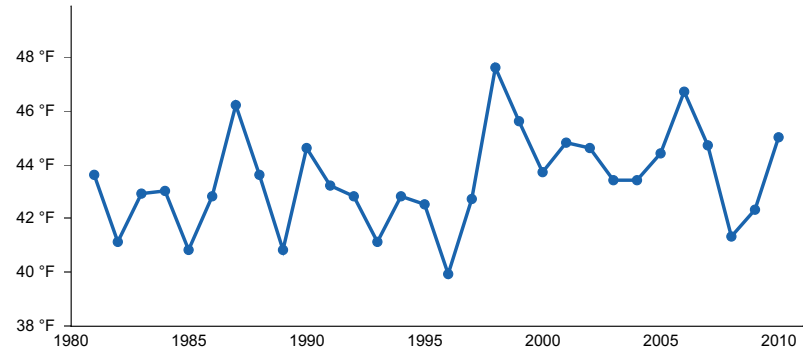


Figure 6. Annual average temperature pattern

Climate stations used

- (1) RIDGELAND 1 NNE [USC00477174], Dallas, WI
- (2) EAU CLAIRE RGNL AP [USW00014991], Eau Claire, WI
- (3) DURAND [USC00472279], Durand, WI

Influencing water features

Influencing Water Features
Water is received primarily through precipitation, runoff from adjacent uplands, 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.

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, scrub-shrub, broad-leaved deciduous, saturated, or

3) Palustrine, forested, broad-leaved deciduous, saturated, or
4) Palustrine, forested, needle-leaved evergreen, saturated

Under the Hydrogeomorphic Classification System (HGM), the wetlands can be classified as:
1) Depressional, emergents/sandy, or
2) Depressional, scrub-shrub/sandy, or
3) Depressional, forested/sandy

Permeability of the soil is slow to moderately rapid. The hydrologic group for this site is A/D.

Soil features

This site is represented by the Dillon and Newson soil series. A variant of the Granby series is also included in this site. Humaqueptic Psammaquents make up 92% of these sites. The remaining sites are Typic Endoaquolls.

These sites form in sandy outwash. They generally lack bedrock contact within two meters. They are poorly to very poorly drained and meet hydric soil requirements. The surfaces of these sites are sandy to silty and sometimes mucky. The substratum is generally sand or loamy sand. Clay loam or clay substratum is sometimes found deeper than 79 inches (150 cm) below the soil surface. Small amounts of subsurface fragments are sometimes present. These soils are extremely acid to slightly alkaline and generally lack secondary carbonates.

Table 4. Representative soil features

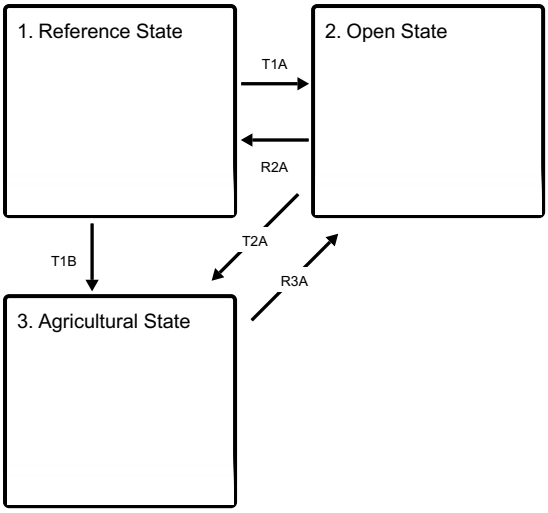
Parent material	(1) Outwash (2) Not specified
Surface texture	(1) Loamy sand (2) Highly decomposed plant material
Drainage class	Very poorly drained to poorly drained
Permeability class	Slow to moderately rapid
Soil depth	79 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-59.1in)	1.85–2.33 in
Soil reaction (1:1 water) (0-39.4in)	4–7.5
Subsurface fragment volume <=3" (0-39.4in)	0–2%
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 other hardwood associates such as various oaks (Quercus spp.) and Elm (Ulmus spp.). Various birch species are likely to be present in this ecological site as well. This community relies heavily on 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



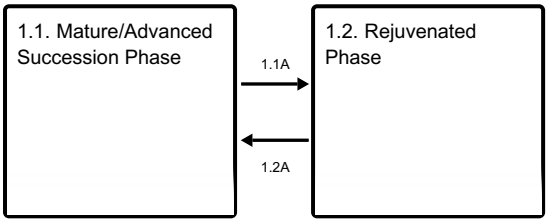
T1A - Stand replacing disturbance e.g., blow-down and fire, or clear-cutting followed by fire. Regeneration by natural seeding or planting.

R2A - Fire control, time, natural succession.

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

R3A - Removal of livestock from stands.

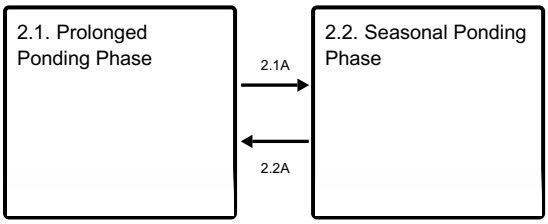
State 1 submodel, plant communities



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

1.2A - Time and natural succession.

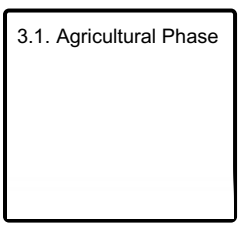
State 2 submodel, plant communities



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 with swamp white oak as a primary associate and

including elms and birches on most sites. 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. Swamp white oak and slippery elm are common associates, both tolerant of high soil moisture, but not as tolerant as black ash. The forest floor cover is dominated by goldenrod (Solidago, spp.) and sedges (Carex, spp.).

Dominant plant species

- black ash (*Fraxinus nigra*), tree
- swamp white oak (*Quercus bicolor*), tree
- sedge (*Carex*), grass
- goldenrod (*Oligoneuron*), 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
- 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

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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	05/04/2024
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:

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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:**
