

## Ecological site F090BY012WI Moist Clayey Lowland

Last updated: 11/16/2023  
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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: Rib Mountain Rolling Ridges (212Qd)

Small sections occur in Mille Lacs Uplands (212Kb), Bayfield Sand Plains (212Ka), St. Croix Moraine (212Qa)

Wisconsin DNR Ecological Landscapes: Forest Transition, North Central Forest, Northwest Lowlands, Northwest Sands

## Ecological site concept

The Moist Clayey Lowland ecological site is found primarily in two small areas on the southern and west borders of MLRAs 90A and 90B, located on lake plains. These sites are characterized by very deep, somewhat poorly drained soils that formed in lacustrine deposits. Precipitation, runoff from adjacent upland, and groundwater discharge are the primary sources of water. Soils range from very strongly acid to moderately alkaline.

Moist Clayey Lowland is distinguished from other ecological sites based on its clayey texture and somewhat poor drainage. Other somewhat poorly drained sites have sandy or loamy deposits. The clayey materials often have higher pH and available water capacity than coarser materials. The somewhat poor drainage differentiates this site from other clayey sites.

## Associated sites

F090BY007WI	<p><b>Wet Clayey Lowland</b> Wet Clayey Lowland form in deep, loamy to clayey deposits derived from a mixture of alluvium, residuum, till, or lacustrine sources. These sites have a seasonally high water table at the surface, and some are subject to occasional ponding. Sustained saturation is enough for hydric conditions to occur. They are wetter and occur lower on the drainage sequence than Moist Clayey Lowland.</p>
F090BY017WI	<p><b>Clayey Upland</b> 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 Moist Clayey Lowland.</p>

## Similar sites

F090BY011WI	<p><b>Moist Loamy Lowland</b> Moist Loamy Lowland consist of deep sandy and loamy deposits derived from a mixture of alluvium, residuum, till, or lacustrine sources. The finer textures allow the soil to stay moist - but not saturated - for sustained periods during the growing season. They are found in similar landscape positions with the same drainage class as Moist Clayey Lowland, but with finer particle sizes.</p>
F090BY010WI	<p><b>Moist Loamy Lowland with Carbonates</b> Moist Loamy Lowland with Carbonates consists of deep loamy till, sometimes with a loess mantle. Carbonates are present in these soils. The finer textures allow the soil to stay moist - but not saturated - for sustained periods during the growing season. They are found in similar landscape positions with the same drainage class as Moist Clayey Lowland, but with finer particle sizes.</p>
F090BY008WI	<p><b>Moist Sandy Bedrock Upland</b> Moist Sandy Bedrock Upland sites consist of sandy to clayey alluvium, till, or eolian deposits over residuum weathered from bedrock. Bedrock contact occurs within two meters of the surface. Sites have seasonally high water table within a meter of the surface. Perching of the water table may occur as a result of bedrock contact. They are found in similar landscape positions with the same drainage class as Moist Clayey Lowland, often with finer particle sizes.</p>

**Table 1. Dominant plant species**

Tree	(1) <i>Acer rubrum</i> (2) <i>Acer saccharum</i>
Shrub	(1) <i>Ribes</i>
Herbaceous	(1) <i>Parthenocissus quinquefolia</i> (2) <i>Geranium maculatum</i>

## Physiographic features

This site occurs on lake plains. Slopes range from 0 to 3 percent.

These sites are not subject to ponding or flooding. Soils have a perched seasonally high water table (episaturation) at depths of 6 to 12 inches but can drop below 80 inches during dry conditions. Runoff is low medium.

**Table 2. Representative physiographic features**

Hillslope profile	(1) Summit (2) Backslope (3) Footslope (4) Shoulder
Slope shape across	(1) Concave (2) Convex
Slope shape up-down	(1) Linear
Landforms	(1) Lake plain
Runoff class	Low to medium
Flooding frequency	None
Ponding frequency	None
Elevation	215–260 m
Slope	0–3%
Water table depth	15–30 cm
Aspect	Aspect is not a significant factor

## Climatic features

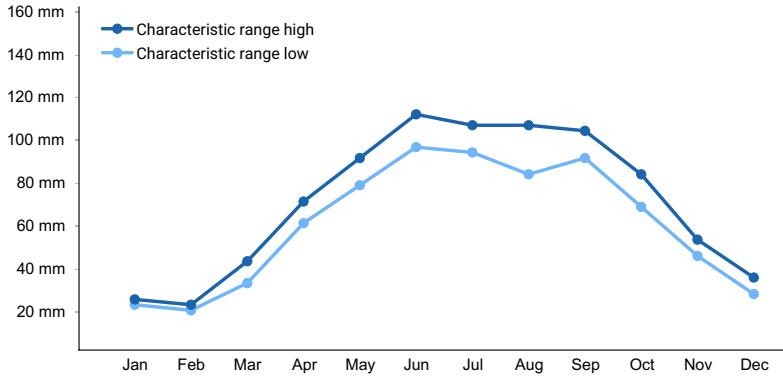
The climate of the expansive Wisconsin and Minnesota Thin Loess and Till Plain is highly variable. The eco-climatic zone (the “Tension Zone”) that runs southeast-northwest across the state splits the MLRA. In general, the MLRA has cold winters and warm summers with an adequate amount of precipitation. 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 31 inches. The average annual snowfall is 52 inches. The annual average maximum and minimum temperatures are 54°F and 34°F, respectively.

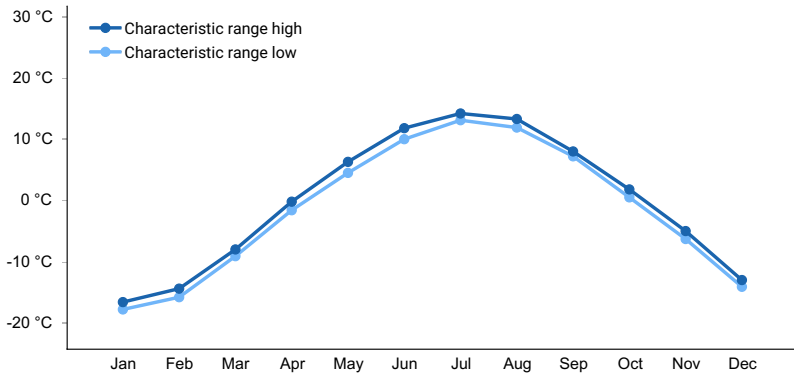
**Table 3. Representative climatic features**

Frost-free period (characteristic range)	84-108 days
Freeze-free period (characteristic range)	115-136 days
Precipitation total (characteristic range)	737-813 mm
Frost-free period (actual range)	42-116 days

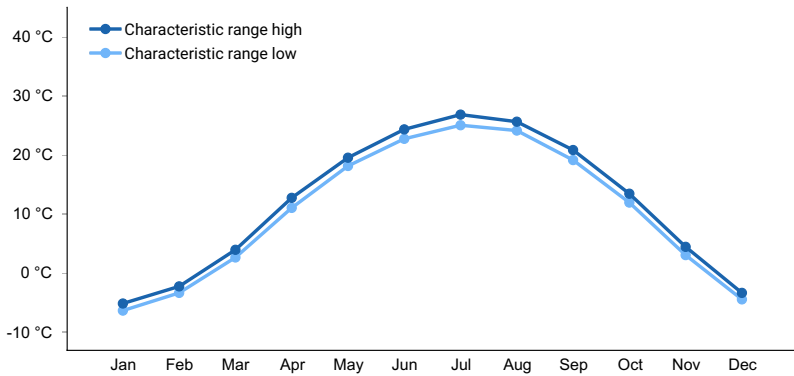
Freeze-free period (actual range)	87-145 days
Precipitation total (actual range)	711-889 mm
Frost-free period (average)	90 days
Freeze-free period (average)	123 days
Precipitation total (average)	787 mm



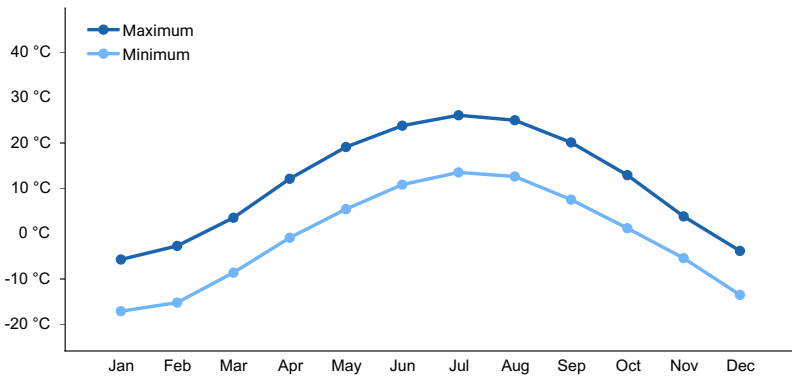
**Figure 1. Monthly precipitation range**



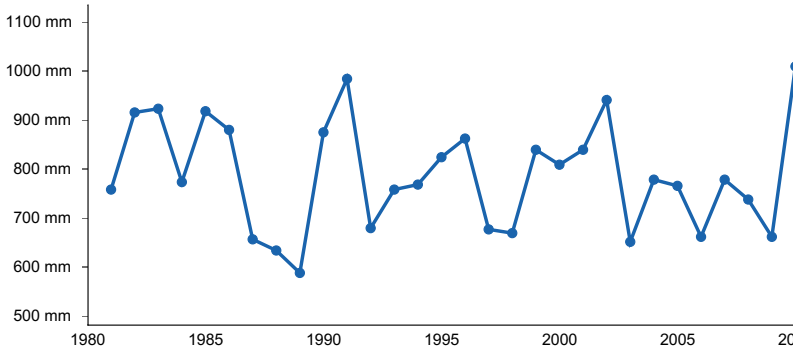
**Figure 2. Monthly minimum temperature range**



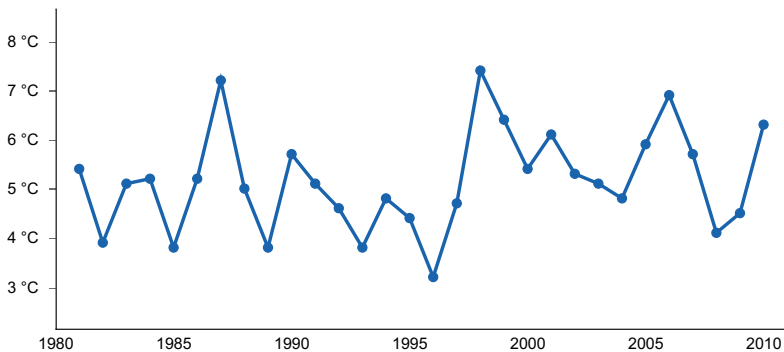
**Figure 3. Monthly maximum temperature range**



**Figure 4. Monthly average minimum and maximum temperature**



**Figure 5. Annual precipitation pattern**



**Figure 6. Annual average temperature pattern**

### Climate stations used

- (1) HOLCOMBE [USC00473698], Holcombe, WI
- (2) ROSHOLT 9 NNE [USC00477349], Wittenberg, WI
- (3) LAONA 6 SW [USC00474582], Laona, WI
- (4) STAMBAUGH 2SSE [USC00207812], Iron River, MI
- (5) PARK FALLS DNR HQ [USC00476398], Park Falls, WI
- (6) BIG FALLS HYDRO [USC00470773], Glen Flora, WI
- (7) COUDERAY 7 W [USC00471847], Stone Lake, WI
- (8) ISLE 12N [USC00214103], Isle, MN
- (9) MOOSE LAKE 1 SSE [USC00215598], Moose Lake, MN
- (10) MILACA [USC00215392], Milaca, MN

### Influencing water features

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

## Wetland description

Permeability of these sites is very low.

Hydrologic Group: D, C/D

Hydrogeomorphic Wetland Classification: None

Cowardin Wetland Classification: None

## Soil features

These sites are represented by the Alango and Siren soil series, classified as Chromic Vertic Epiaqualfs and Aquic Glossudalfs, respectively.

These soils formed in lacustrine deposits. Soils are very deep and somewhat poorly drained. They do not meet hydric requirements.

The surface textures of these sites is clay loam or loam. Subsurface textures include clay, sandy loam, and sandy clay loam. Soil pH ranges from very strongly acid to moderately alkaline with values of 4.8 to 8.3. Carbonates are present up to 25 percent beginning at 28 inches.

**Table 4. Representative soil features**

Parent material	(1) Lacustrine deposits
Surface texture	(1) Loam (2) Clay loam
Drainage class	Somewhat poorly drained
Permeability class	Very slow
Soil depth	203–254 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-154.9cm)	7.14–8.64 cm
Calcium carbonate equivalent (0-100.1cm)	0–25%
Soil reaction (1:1 water) (0-100.1cm)	4.8–8.3
Subsurface fragment volume <=3" (Depth not specified)	1–12%
Subsurface fragment volume >3" (Depth not specified)	0–1%

## Ecological dynamics

Mature forests on this ecological site were likely composed of a mixture of Sugar maple, Red maple, Basswood, Ashes, and Yellow birch. Several other associates including elms, oaks, and White birch may occur as well. White pine may be present in some stands as well. Shrub layers are usually poorly developed or altogether absent on this ES and may only contain gooseberries. Ground flora is likely to consist of ferns, jewelweed, hog peanut, wild geranium, virginia creeper, and sweet cicely.

While these sites at present are wetter than may be optimal for Sugar maple, once established in full succession canopy trees are likely to “dry” the site due to increased evapotranspiration allowing Sugar maple to become a dominant canopy member on these sites. The opposite condition of “swamping” has been noted on these sites, where heavy cutting on these sites leads to an elevated water table. Due to their connection to water table elevation, soil wetness, and evapotranspiration of a full canopy these sites have a variety of species mixtures at present. Additionally many soils in this ES may experience infrequent flooding that could affect species composition.

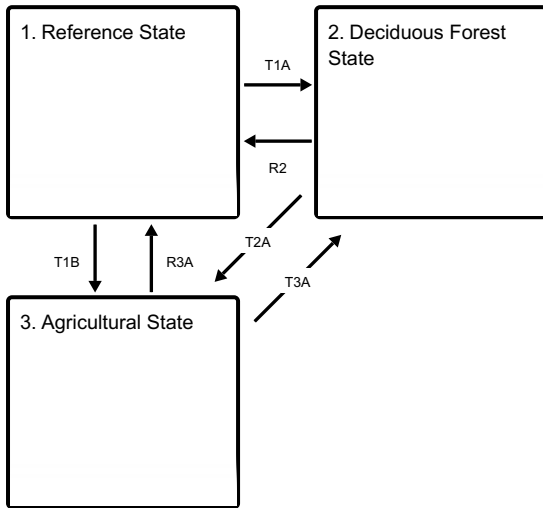
Greater soil wetness may tilt this site towards species such as Black ash rather than Sugar maple.

Current stands on this Ecological Site can represent a broad array of species composition and all potential successional stages, however, the Advanced Successional stage of the Reference State is uncommon and instead the Deciduous Forest State (Aspen – Red maple) is likely to be the most common state that one finds.

While this ES is similar to Moist Loamy Lowland it is distinctly more nutrient rich and often wetter leading to an increased abundance of Black ash. Due to increased wetness from the fine textured soils of this ES there is often decreased productivity in spite of the richness of the soils in this ES.

## State and transition model

### Ecosystem states



**T1A** - Stand replacing disturbance that includes fire.

**T1B** - Removal of forest cover and tilling for agricultural crop production.

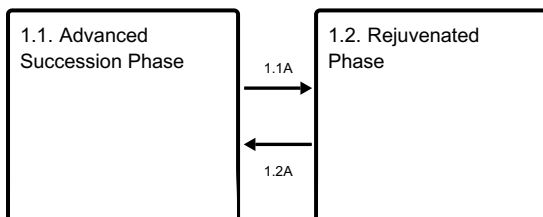
**R2** - Deciduous forest community is slowly invaded by conifers.

**T2A** - Removal of forest cover and tilling for agricultural crop production.

**R3A** - Cessation of agricultural practices leads to natural reforestation, or site is replanted.

**T3A** - Cessation of agricultural practices leads to natural reforestation, or site is replanted.

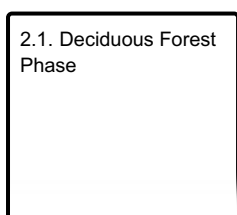
### State 1 submodel, plant communities



**1.1A** - Blow-downs and ice storms leaving canopy openings.

**1.2A** - Disturbance-free period for 30+ years.

### State 2 submodel, plant communities



## State 3 submodel, plant communities

3.1. Agricultural Phase

## State 1 Reference State

The reference plant community is categorized as mesic to wet-mesic forest community dominated by mixed deciduous species, primarily Sugar maple, Red maple, Basswood, Ashes, and Yellow birch. Several other associates including elms, oaks, and White birch may occur as well. White pine may be present in some stands as well. Shrub layers are usually poorly developed or altogether absent on this ES and may only contain gooseberries. Ground flora is likely to consist of ferns, jewelweed, hog peanut, wild geranium, virginia creeper, and sweet cicely. Although forest communities can vary greatly in terms of species composition and stand structure, depending on type, degree, and frequency of disturbance, two common phases predominate:

### Community 1.1 Advanced Succession Phase

In the absence of major, stand-replacing disturbance this community is dominated by sugar maple, red maple, basswood, ashes, and yellow birch. The tree sapling and shrub layer in this community is not well developed due to dense shade created by multi-story tree canopy. Commonly the shrub layer may contain only gooseberries. The herb layer is likely to consist of ferns (lady fern, interrupted fern, maidenhair fern, and sensitive fern), jewelweed, hog peanut, wild geranium, virginia creeper, and sweet cicely.

#### Dominant plant species

- sugar maple (*Acer saccharum*), tree
- red maple (*Acer rubrum*), tree
- black ash (*Fraxinus nigra*), tree
- currant (*Ribes*), shrub
- Virginia creeper (*Parthenocissus quinquefolia*), other herbaceous
- geranium (*Geranium*), other herbaceous

### Community 1.2 Rejuvenated Phase

Disturbances described in Pathway 1.1A lead to increased species and structural diversity of the forest community. Depending on seed source, red oak and red maple regenerate in the canopy openings and in time join sugar maple and hemlock in the dominant canopy. Basswood is also commonly present. The relative density of the shrub and herb layers also increases during this stage. Species composition remains relatively unchanged, but abundance changes can be significant. Particularly beaked hazelnut can form dense thickets. Many other herb species that were present with very low abundance in the advanced-succession community typically form much larger population clusters as there is more light penetrating the canopy.

#### Dominant plant species

- red maple (*Acer rubrum*), tree
- sugar maple (*Acer saccharum*), tree
- black ash (*Fraxinus nigra*), tree
- basswood (*Tilia*), tree
- currant (*Ribes*), shrub
- Virginia creeper (*Parthenocissus quinquefolia*), other herbaceous
- geranium (*Geranium*), 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—create openings for entry of red maple, ashes, elms, and basswood.

## **Pathway 1.2A**

### **Community 1.2 to 1.1**

In the absence of canopy reducing disturbances natural succession leads to community dominance by the most shade-tolerant species resulting in return to community phase 1.1. The longer the time without disturbance the more likely that Sugar maple will dominate.

## **State 2**

### **Deciduous Forest State**

Post disturbance pioneer community of aspen and red maple with mixtures of other species from available seed sources (ashes, elms, white birch) are common in this state. This state can have broad variation depending on what seed sources are available as these sites readily supply water and nutrients in quantities that many species can thrive with. Depending on age and tree species composition the shrub and herb layer in this state can vary considerably. Namely with the dominance of aspen there is likely to be very little in the shrub layer.

## **Community 2.1**

### **Deciduous Forest Phase**

A pure aspen, sometimes with paper birch, community replaces the reference state community. If seed source is present, red maple and readily becomes a member of this community. Early in this phase the shrub and herb layer may be minimal with the presence of an aspen thicket. Other trees likely to be present as long as the seed source is present include ashes and elms.

#### **Dominant plant species**

- quaking aspen (*Populus tremuloides*), tree
- red maple (*Acer rubrum*), tree
- Canadian gooseberry (*Ribes oxycanthoides*), shrub
- sedge (*Carex*), grass
- Virginia creeper (*Parthenocissus quinquefolia*), other herbaceous

## **State 3**

### **Agricultural State**

Indefinite period of applying agricultural practices. Cropping systems vary on these sites and likely include tillage, row crops, hay or pasture, and specialty crops. Agricultural development of these sites could include drainage.

## **Community 3.1**

### **Agricultural Phase**

Indefinite period of applying agricultural practices. Crops likely include alfalfa, corn, soybeans, and hay or pasture. It is possible that some areas are or have been in ginseng production as well. Agricultural drainage may be a component of the practices used on these sites.

## **Transition T1A**

### **State 1 to 2**

Major stand-replacing disturbance. In pre-European settlement time, the event was most often a severe blow down, only very occasionally followed by fires on these sites due to wetness. Such blow downs have been estimated to occur in this part of Wisconsin every 300 to 400 years (Schulte and Mladenoff, 2005), but may have occurred more often on wet sites such as those in this ES. In post settlement virtually every acre has been logged either by clear

cutting or successive cuts targeting species marketable at that time. These disturbances created the environment suitable for natural regeneration of many shade-intolerant species and for commercial planting. The history of cutting has lead many of these sites to be “swamped” as well leading to less Sugar maple in the Deciduous Forest State.

### **Transition T1B**

#### **State 1 to 3**

Removal of forest cover, tilling and application of other agricultural techniques to grow agricultural crops.

### **Restoration pathway R2**

#### **State 2 to 1**

Deciduous forest community is slowly invaded by conifers.

### **Transition T2A**

#### **State 2 to 3**

Removal of forest cover, tilling and application of other agricultural techniques to grow agricultural crops.

### **Restoration pathway R3A**

#### **State 3 to 1**

Abandonment of agricultural practices and allowing natural vegetation to colonize the site or apply artificial afforestation. The time required for forest community to reach the reference state conditions may exceed 100 years. This direct restoration pathway is likely slow and uncommon unless there has been drainage and adjacent seed sources exist.

### **Transition T3A**

#### **State 3 to 2**

Abandonment of agricultural practices and allowing natural vegetation to colonize the site or apply artificial afforestation. The site can return much more quickly to the Deciduous Forest State as compared to the Reference State.

## **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 Wisconsin-Stevens Point described soils, took photographs, and inventoried vegetation data at community phases within the reference state. The data sources include WI ESD Plot Data Collection Form - Tier 2, Releve Method, NASIS pedon description, NRCS SOI 036, photographs, and Kotar Habitat Types.

Habitat Types of N. Wisconsin (Kotar, 2002): The sites of this ES keyed out to one habitat type: *Acer saccharum/Sanguinaria-Impatiens* (ASal)

Biophysical Settings (Landfire, 2014): This ES is largely mapped as Laurentian-Acadian Northern Hardwoods Forest, Eastern Cool Temperate Row Crop, Eastern Cool Temperate Close Grown Crop, and Eastern Cool Temperate Pasture and Hayland

WDNR Natural Communities (WDNR, 2015):

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## Approval

Suzanne Mayne-Kinney, 11/16/2023

## Acknowledgments

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

## Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	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:**

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2. **Presence of water flow patterns:**

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3. **Number and height of erosional pedestals or terracettes:**

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

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5. **Number of gullies and erosion associated with gullies:**

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6. **Extent of wind scoured, blowouts and/or depositional areas:**

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7. **Amount of litter movement (describe size and distance expected to travel):**

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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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:**

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