Ecological site F090AY021WI
Dry Loamy Upland

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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): 090A–Wisconsin and Minnesota Thin Loess and Till

MLRA 90A is part of the recently glaciated till and outwash plains of central Minnesota and northern Wisconsin. The area was covered with loamy alluvium or loess after glaciation. It is in Wisconsin (56 percent), Minnesota (40 percent), and Michigan (4 percent). It makes up about 21,967 square miles (56,901 square kilometers).

This MLRA has distinct boundaries to the north where it borders tills of a dissimilar origin on the less morainic landscapes of MLRAs 88, 92, and 93A. The boundary to the west is where the MLRA transitions to the calcareous tills of the Des Moines Lobe, in MLRA 57. To the south, MLRA 90A borders MLRA 90B, which has older soils and better-defined drainage patterns, and MLRA 91, which has the distinct lower landscape relief of an outwash channel.

The part of this area in Minnesota is mostly in the Western Lake section of the Central Lowland province of the Interior Plains. Nearly all the parts in Wisconsin and Michigan are in the Superior Upland province of the Laurentian Upland. Four distinct lobes of the Laurentide Ice Sheet (Rainy, Superior, Chippewa, and Green Bay) played major roles in shaping the landscape in this area. The landscape is characterized by gently undulating to rolling, loess-mantled till plains, drumlin fields, and end moraines mixed with outwash plains associated with major glacial drainageways, swamps, bogs, and fens. In some areas lake plains and ice-walled lakes are significant. Steeper areas occur mostly as valley side slopes along flood plains and as escarpments along the margins of lakes.

Lakes, ponds, and marshes are common throughout the area, and streams generally have a dendritic pattern. The major rivers in this area are the Chippewa, St. Croix, Mississippi, and Wisconsin Rivers. Elevation ranges from 1,100 to 1,950 feet (335 to 595 meters). Local relief is mainly less than 10 feet to 20 feet (3 to 6 meters), but some major valleys and hills are 200 feet (60 meters) above the adjacent lowland.

Precambrian-age bedrock underlies most of the glacial deposits in this MLRA. The bedrock is a complex of folded and faulted igneous and metamorphic rocks. The bedrock terrain has been modified by glaciation and is covered in most areas by Pleistocene deposits and windblown silts. The glacial deposits form an almost continuous cover in most areas. The drift is several hundred feet thick in many areas. Loess covered the area shortly after the glacial ice melted.

Ground water is abundant in deep glacial deposits in most of this area. It also occurs in sedimentary and volcanic rock in the western part of the area. It is scarce where the layer of drift is thin. The water meets the domestic, agricultural, municipal, industrial, rural, and irrigation needs of the area. The content of dissolved solids in the ground water from all the various aquifers in this area is low, and the water generally is moderately hard or hard. The level of total dissolved solids in some of the water can be much higher because of a high content of limestone in some of the glacial deposits. Most of this area obtains ground water from unconsolidated glacial sand and gravel deposits on or very near the surface. Some wells tap the Cambrian sandstone in the southwestern part of the area, in Wisconsin.

In northwest Wisconsin (Ashland and Bayfield Counties) where there are no glacial deposits and in much of the part of this area in Minnesota, ground water from sedimentary and volcanic rock aquifers is used. This water is of very good quality; however, many soils have very porous layers that are poor filters of domestic waste and agricultural chemicals, so there is a risk of contamination from development and agriculture. Minor water concerns are hardness and, in some areas, high concentrations of iron. Yields of water from the glacial deposits vary.

The dominant soil orders are Alfisols, Entisols, Histosols, and Spodosols. The soils in the area have a frigid temperature regime, a udic or aquic moisture regime, and mixed mineralogy.

This area has a significant acreage of public and private forestland used to support the paper and lumber industry Sap collection from sugar maple and syrup production are important forestry enterprises. Agricultural enterprises include row crops, dairy farms, and beef operations. Crops include corn, soybeans, oats, wheat, and alfalfa. Tourism, recreation, and wildlife management are important. Hunting, fishing, snowmobiling, hiking, and skiing are popular activities because of the area's abundance of water, the many acres of national and county forests, and public hunting grounds. (United States Department of Agriculture, Natural Resources Conservation Service, 2022)

Classification relationships

Major Land Resource Area (MLRA 90A): Wisconsin and Minnesota Thin Loess and Till

USFS Subregions: Lincoln Formation Till Plain - Mixed Hardwoods (212Qb), St. Croix Moraine (212Qa), Rib Mountain Rolling Ridges (212Qd), Green Bay Lobe Stagnation Moraine (212Ta), Central-Northwest Wisconsin Loess Plains (212Xd)

Small sections occur in Rosemont Baldwin Plains and Moraines (222Md), Perkinstown End Moraine (212Xe), Hayward Stagnation Moraines (212Xf)

Wisconsin DNR Ecological Landscapes: North Central Forest, Forest Transition, Western Prairie

Ecological site concept

The Dry Loamy Upland ecological site is scattered across MLRA 90A, located on outwash plains, stream terraces, kames, and hills. These sites are characterized by very deep, somewhat excessively and excessively drained soils that formed in loamy deposits including outwash, alluvium, and drift. Some sites may have a sandy mantle or underlying sandy or deposits. Precipitation and runoff are the primary water sources. Soils range from very strongly acid to neutral.

Dry Loamy Upland is distinguished from other ecological sites by its deep loamy deposits and somewhat excessively and excessively drained soils. Other somewhat excessively and excessively drained sites have sandy deposits. The loamy material often has a higher pH and available water capacity than sandy material.

Associated sites

F090AY016WI	**Loamy Upland** Loamy Upland consist of deep loamy till, alluvium, residuum, lacustrine, or eolian deposits. Sandy deposits of these parent materials, plus outwash, may also be present. The depth to the seasonally high water table ranges from as high as the surface to as low as almost two meters below the surface. A few sites are on floodplains and upland drainageways, where very brief flooding is rare but possible. They are wetter and occur lower on the drainage sequence than Dry Loamy Upland.
F090AY002WI	**Mucky Swamp** Mucky Swamp sites consist of deep, highly decomposed herbaceous organic materials. Some sites have mineral soil contact. They are very poorly drained and are neutral to slightly acid. These sites are permanently saturated wetlands. They are much wetter and occur lower on the drainage sequence than Dry Loamy Upland.

F090AY006WI	**Wet Loamy Lowland** Wet Loamy Lowland consist primarily of deep loamy deposits derived from a mixture of outwash, alluvium, loess, and lacustrine sources. Some sites may have bedrock contact within two meters of the surface. These sites are seasonally ponded depressions that remain saturated for sustained periods, allowing hydric conditions to occur. They are much wetter and occur lower on the drainage sequence than Dry Loamy Upland.
F090AY011WI	**Moist Loamy Lowland** 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 wetter and occur lower on the drainage sequence than Dry Loamy Upland.

Similar sites

F090AY020WI	**Dry Loamy Bedrock Upland** Dry Loamy Bedrock Upland consist of silty loess, sometimes underlain by loamy till. Basalt or quartzite bedrock typically occurs within one meter of the surface. These soils show no evidence of a seasonally high water table. They are found in similar landscape positions and share both drainage class and particle size with Dry Loamy Upland but have bedrock contact within two meters of the surface.
F090AY019WI	**Dry Sandy Upland** Dry Sandy Uplands consist of primarily sandy deposits of various origin. Loamy deposits are also present in many soils. They may have a seasonally high water table within two meters of the surface, though they do not remain saturated for sustained periods. They are found in similar landscape positions and share their drainage class with Dry Loamy Upland but have coarser particle sizes.

Table 1. Dominant plant species

Tree	(1) *Acer saccharum* (2) *Fraxinus americana*
Shrub	(1) *Corylus* (2) *Rubus*
Herbaceous	(1) *Oligoneuron* (2) *Eurybia macrophylla*

Physiographic features

These sites formed on outwash plains, stream terraces, kames, and hills. Slopes range from 0 to 40 percent. Sites are on summit, shoulder, and backslope positions.

These sites are not subject to ponding or flooding. The water table is below 80 inches year-round because of the excessive drainage. Surface runoff ranges from negligible to very high. This range in runoff is caused by the wide range of slopes across sites.

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) Outwash plain (2) Stream terrace (3) Kame (4) Hill
Runoff class	Very low to very high
Flooding frequency	None

Ponding frequency	None
Elevation	705–853 ft
Slope	0–40%
Water table depth	80–100 in
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 32 inches. The average annual snowfall is 49 inches. The annual average maximum and minimum temperatures are 53°F and 33°F, respectively.

Table 3. Representative climatic features

Frost-free period (characteristic range)	95-114 days
Freeze-free period (characteristic range)	129-140 days
Precipitation total (characteristic range)	29-33 in
Frost-free period (actual range)	59-117 days
Freeze-free period (actual range)	102-147 days
Precipitation total (actual range)	27-35 in
Frost-free period (average)	97 days
Freeze-free period (average)	131 days
Precipitation total (average)	31 in

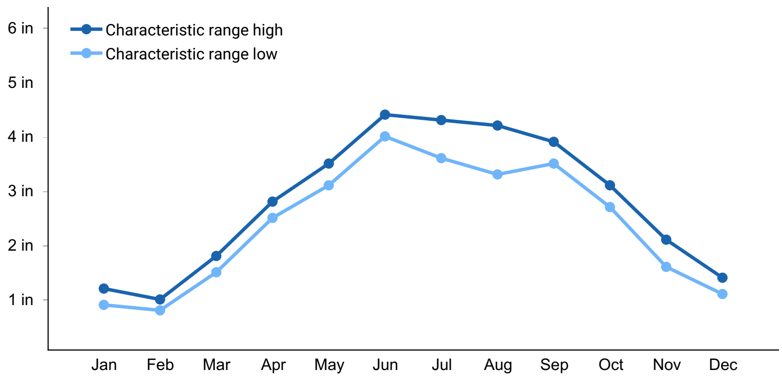


Figure 1. Monthly precipitation range

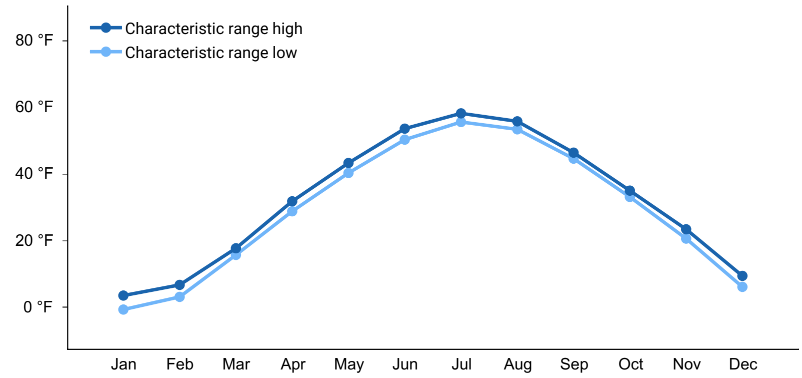


Figure 2. Monthly minimum temperature range

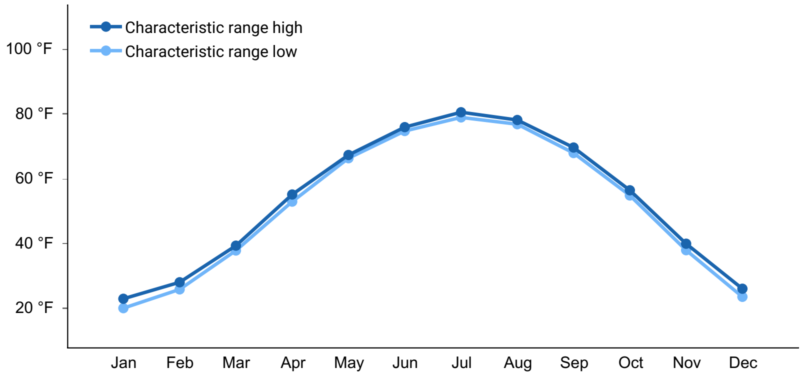


Figure 3. Monthly maximum temperature range

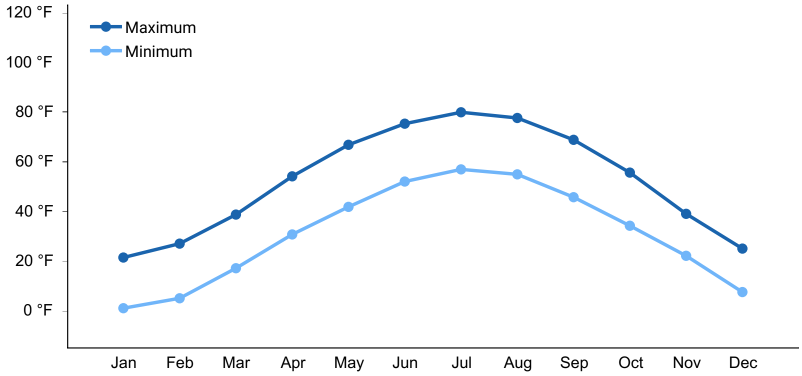


Figure 4. Monthly average minimum and maximum temperature

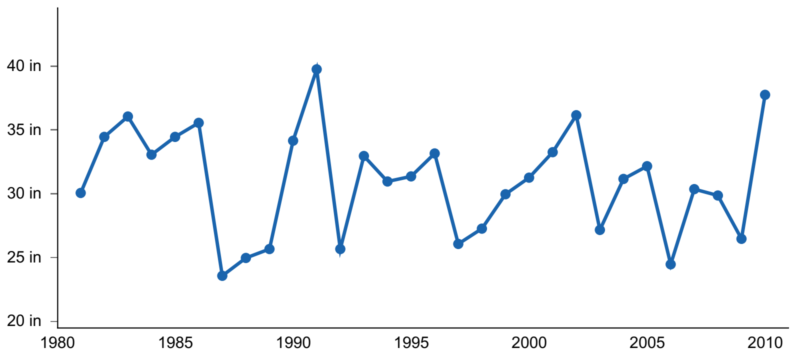


Figure 5. Annual precipitation pattern

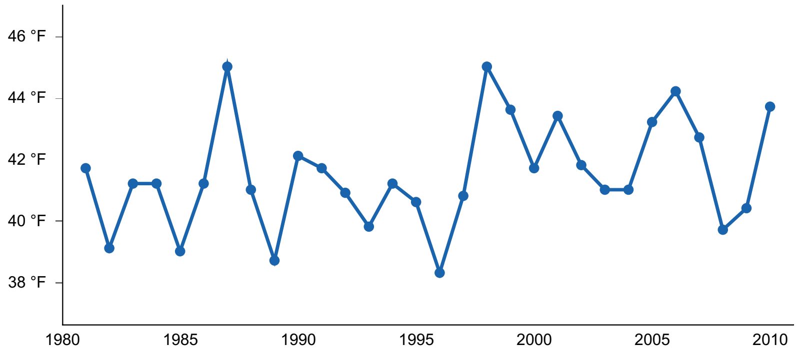


Figure 6. Annual average temperature pattern

Climate stations used

- (1) HOLCOMBE [USC00473698], Holcombe, WI
- (2) ROSHOLT 9 NNE [USC00477349], Wittenberg, WI
- (3) COUDERAY 7 W [USC00471847], Stone Lake, WI
- (4) MILACA [USC00215392], Milaca, MN
- (5) MINONG 5 WSW [USC00475525], Minong, WI
- (6) AMERY [USC00470175], Amery, WI
- (7) BRUNO 7ENE [USC00211074], Bruno, MN
- (8) AITKIN 2E [USC00210059], Aitkin, MN
- (9) LAKEWOOD 3 NE [USC00474523], Lakewood, WI
- (10) ISLE 12N [USC00214103], Isle, 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 moderately slow to moderate.
Hydrologic Group: A, B
Hydrogeomorphic Wetland Classification: None
Cowardin Wetland Classification: None

Soil features

These sites are represented by the Chetek and Richford soil series, classified as an Inceptic Hapludalfs and Arenic Hapludalfs, respectively.

These sites formed in sandy, loamy, or gravelly outwash, loamy alluvium, or loamy drift. Soils are very deep and somewhat excessively to excessively drained. They do not meet hydric soil requirements.

Surface textures of these sites are loamy sand, sandy loam, coarse sandy loam, and moderately decomposed plant material. Subsurface textures include sandy loam, coarse sandy loam, loamy sand, coarse sand, and sand. Some horizons have gravelly or very gravelly modifiers. Soil pH ranges from very strongly acid to neutral with values of 4.8 to 6.7. Carbonates are absent within 80 inches.

Figure 7. Chetek soil series photograph courtesy of UWSP taken on 7/10/2019 in St. Croix County, WI.

Table 4. Representative soil features

Parent material	(1) Outwash (2) Alluvium (3) Drift
Surface texture	(1) Loamy sand (2) Sandy loam
Family particle size	(1) Coarse-loamy
Drainage class	Somewhat excessively drained to excessively drained
Permeability class	Moderately slow to moderate
Soil depth	79–98 in
Surface fragment cover <=3"	0–7%
Surface fragment cover >3"	0–5%
Available water capacity (0-61in)	1.22–2.16 in
Calcium carbonate equivalent (0-39.4in)	0%
Soil reaction (1:1 water) (0-39.4in)	4.8–6.7
Subsurface fragment volume <=3" (Depth not specified)	13–28%
Subsurface fragment volume >3" (Depth not specified)	0–5%

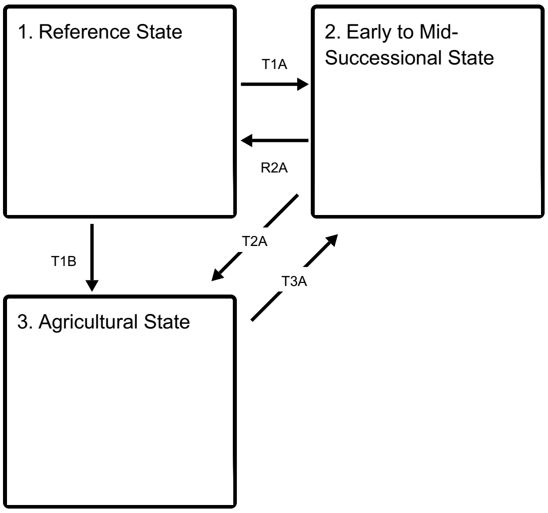
Ecological dynamics

Historically, this site was dominated by oak species in a landscape adapted to fire disturbance, thought mesic hardwoods were present in pockets. In pre-European settlement time wildfire 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. Many pine and oak species were dominant in the region because of their fire-resistant properties and successful regeneration post-fire. With clear cutting and continued fire suppression, many of these species adapted to fire and intolerant of shade are replaced by other species. Species such as white pine and red oak are still common on the landscape based on their tolerance to some shade; these species to establish under a canopy, and in time, may become a component of the canopy. Mesic hardwoods are sensitive to fire, but in its absence, the have the ability to dominate sites based on their shade tolerance and prolific seed production.

Today, these forests most commonly include stands of sugar maple, and other mesic hardwoods. Some sites have a strong presence of red and white oak. These sites have the conditions to support shade tolerant mesic hardwoods, but these sites have dry soil moisture regime. Red and white oak can compete with the mesic hardwoods based on their ability to grow in drier soils. Historically, these sites had significant wind throw and fire disturbance that allowed for a strong presence of oak species. As long as fire is continually suppressed, maples and other mesic hardwoods will continue to dominate the canopy with oak as an associate. With some management or fire disturbance, oaks will dominate these sites.

State and transition model

Ecosystem states



T1A - Clear cutting or stand-replacing fire.

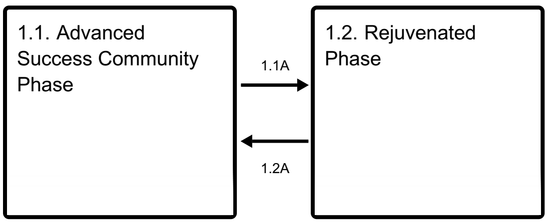
T1B - Removal of forest vegetation and tilling.

R2A - Disturbance-free period 70+ years.

T2A - Removal of forest vegetation and tilling.

T3A - Stopping of agricultural practices and allowing to natural revegetation, or site is replanted.

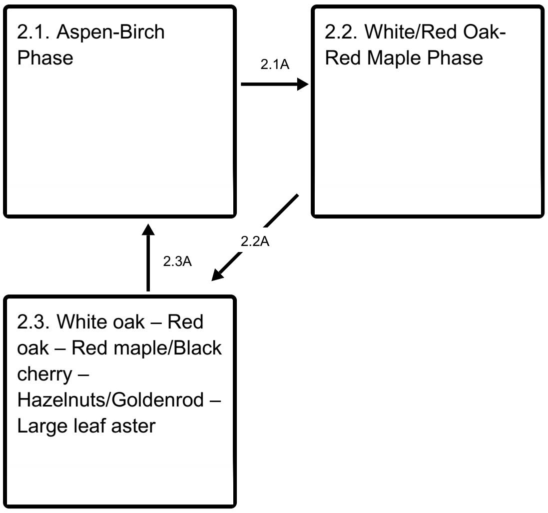
State 1 submodel, plant communities



1.1A - Light to moderate intensity fires, blow-downs, snow-ice breakage.

1.2A - Disturbance-free period 30+ years

State 2 submodel, plant communities

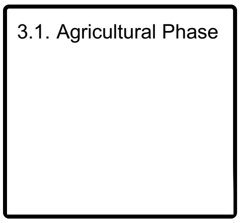


2.1A - Red oak and red maple regenerating under aspen -- paper birch canopy

2.2A - Time and natural succession.

2.3A - Major stand replacing disturbance e.g. blow-down and fire, or clear-cutting, followed by fire.

State 3 submodel, plant communities



State 1
Reference State

Reference state is a forest community dominated by sugar maple (*Acer saccharum*). Depending on history of disturbance, two community phases can be distinguished largely by differences in dominance of tree species and community age structure.

Community 1.1
Advanced Success Community Phase

Figure 8. Photo courtesy of UWSP taken on 8/1/2019 in Winnebago County, WI.

In the absence of any major disturbance, specifically fire, this community is dominated by sugar maple. Common associates include moderately shade tolerant white ash (*Fraxinus americana*), basswood (*Tilia americana*), red oak (*Quercus rubra*) and white oak (*Q. alba*). Some sites may be dominated by white and/or red oak but is unlikely without any disturbance. The shrub layer is often dominated by hazelnuts (Corylus, spp.) and blackberries (Rubus, spp.). The ground layer is dominated by large leaf aster (*Eurybia macrophylla*) and goldenrod (Solidago, spp.), with false Solomon's seal (Maianthemum racemose), Pyrola, spp., Virginia creeper (*Parthenocissus quinquefolia*), and bedstraw (Gallium, spp.) also common.

Dominant plant species

- sugar maple (*Acer saccharum*), tree
- white ash (*Fraxinus americana*), tree
- northern red oak (*Quercus rubra*), tree
- hazelnut (*Corylus*), shrub
- blackberry (*Rubus*), shrub
- goldenrod (*Oligoneuron*), other herbaceous
- bigleaf aster (*Eurybia macrophylla*), other herbaceous

Community 1.2
Rejuvenated Phase

This community is dominated by a mixture of hardwoods including white oak, red oak and red maple (Acer rurbrum). Lacking disturbance, a sub canopy of tolerant hardwoods including sugar maple and white ash may develop. The shrub and ground layers are similar to the advanced succession phase, but may include the establishment of new seedlings.

Dominant plant species

- white oak (*Quercus alba*), tree

- northern red oak (*Quercus rubra*), tree
- red maple (*Acer rubrum*), tree
- sugar maple (*Acer saccharum*), tree
- hazelnut (*Corylus*), shrub
- blackberry (*Rubus*), shrub
- goldenrod (*Oligoneuron*), other herbaceous
- bigleaf aster (*Eurybia macrophylla*), other herbaceous

Pathway 1.1A
Community 1.1 to 1.2

Light intensity fires, crown breakage from ice and snow and small scale blow-downs create canopy openings, allowing gap regeneration of less shade tolerant species such as white oak and red oak. These species may join the canopy composition.

Pathway 1.2A
Community 1.2 to 1.1

A long period without major canopy disturbance allows gradual replacement of oldest canopy trees by younger cohorts. Lacking a major disturbance, the canopy will likely be replaced primarily with sugar maple and other tolerant mesic hardwoods. Small scale disturbances may still occur periodically, but once second or third canopies are established there is minimal new regeneration taking place and the forest gradually returns to mature state.

State 2
Early to Mid-Successional State

Following disturbances described in Transition T1A a wide range of forest community phases may come into temporary existence, the three most common ones are described here.

Community 2.1
Aspen-Birch Phase

Figure 9. Photo courtesy of UWSP taken on 7/10/2019 in St. Croix County, WI.

These two species have a very narrow window of environmental and ecological conditions for successful establishment. Main requirements are exposed mineral soil and elimination, most effectively by fire, of on-site seed sources of potential competing vegetation. In addition, adequate soil moisture must be available for initial seedling development. Once seedlings are firmly established, height growth of both species is relatively rapid and able to outgrow most competitive species. Paper birch seedlings and saplings tolerate partial shade and often become members of mixed species communities. This is not true for aspen which requires continuous full-sun exposure for survival. Aspen stands are initially very dense due to sprouting from extensive lateral roots, but rapid natural thinning ensues as stems compete for available light.

Dominant plant species

- quaking aspen (*Populus tremuloides*), tree
- paper birch (*Betula papyrifera*), tree

Community 2.2
White/Red Oak- Red Maple Phase

Figure 10. Photo courtesy of UWSP taken on 7/22/2019 in Rusk County, WI.

This community phase occurs by invading and succeeding a pioneer aspen-birch community. Stand structure consists of dominant white and red oak and red maple in combination with a modest, or strong presence of mature, or decaying, aspen and/or paper birch. The shrub layer, dominated by hazelnuts (Corylus, spp.), typically reaches its best development in this community phase.

Dominant plant species

- northern red oak (*Quercus rubra*), tree
- red maple (*Acer rubrum*), tree
- white oak (*Quercus alba*), tree

Community 2.3
White oak – Red oak – Red maple/Black cherry – Hazelnuts/Goldenrod – Large leaf aster

Stand structure consists of dominant white and red oak and red maple in combination with a modest, or strong presence of mature, or decaying, aspen and/or paper birch. The shrub layer typically reaches its best development in this community phase. Depending on seed source, sugar maple has become established and a young cohort exists in the subcanopy.

Dominant plant species

- white oak (*Quercus alba*), tree
- northern red oak (*Quercus rubra*), tree
- red maple (*Acer rubrum*), tree
- black cherry (*Prunus serotina*), shrub
- hazelnut (*Corylus*), shrub
- goldenrod (*Oligoneuron*), other herbaceous
- bigleaf aster (*Eurybia macrophylla*), other herbaceous

Pathway 2.1A
Community 2.1 to 2.2

Aspen-Birch Phase

White/Red Oak- Red Maple Phase

Time and the immigration, establishment, and growth of red oak and red maple seedlings. These moderately shade tolerant species seed in beneath the aspen and birch and eventually outcompete these intolerant species.

Pathway 2.2A

Community 2.2 to 2.3

Time and natural succession. Red oak and red maple have succeeded the aspen-birch community. Depending on seed source, sugar maple begins growth and establishment in the understory.

Pathway 2.3A
Community 2.3 to 2.1

Clear cutting or stand-replacing fire that allows for the reinvasion of the aspen—birch community.

State 3
Agricultural State

Indefinite period of applying agricultural practices. Primary crops include row crops, hay, and pasture.

Community 3.1
Agricultural Phase

The agricultural phase consists of planted row crops, hay, or pasture.

Transition T1A
State 1 to 2

Clear cutting with initial control of competing vegetation, or stand-replacing fire, prepare the site for occupancy by shade intolerant species. This may occur through natural regeneration or by planting.

Transition T1B
State 1 to 3

Clearing of land and application of tillage and other agricultural practices to establish crops, hay, or pasture.

Restoration pathway R2A
State 2 to 1

A period of some 70-100 years without major stand disturbance, especially fire, leads to decreased presence, through natural mortality, of early successional species and the dominance of shade tolerant sugar maple with less tolerant associates of red oak and white ash, returning the community to Reference State.

Transition T2A
State 2 to 3

Clearing of land and application of tillage and other agricultural practices to establish crops, hay, or pasture.

Transition T3A
State 3 to 2

Abandonment of agricultural practices and allowing natural vegetation to colonize the site or apply artificial afforestation.

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. & S. Wisconsin (Kotar, 2002 & 1996): The sites of this ES keyed out to five habitat types: *Acer saccharum*/Caulophyllum-Circaea (ACaCi); *Acer saccharum*/Hydrophyllum (AH); Acer rubrum/Circaea (ArCi); Pinus-Acer rubrum/Vaccinium (PArV); Pinus-Acer rubrum/Vaccinium-Hamamelis (PArVHa)

Biophysical Settings (Landfire, 2014): This ES is largely mapped as Eastern Cool Temperate Row Crop, Eastern Cool Temperate Close Grown Crop, Eastern Cool Temperate Pasture and Hayland, Developed-Low Intensity, and Developed-Medium Intensity

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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	05/11/2025
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):**

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:**