Ecological site F090AY013WI
Sandy 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: Hayward Stagnation Moraines (212Xf), Glidden Loamy Drift Plain (212Xa), Mille Lacs Uplands (212Kb), Perkinstown End Moraine (212Xe), Rib Mountain Rolling Ridges (212Qd)

Small sections occur in Rosemont Baldwin Plains and Moraines (222Md), Central-Northwest Wisconsin Loess Plains (212Xd), St. Croix Moraine (212Qa), Green Bay Lobe Stagnation Moraine (212Ta)

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

Ecological site concept

The Sandy Upland ecological site is most abundant on the northern border of MRLA 90A, located on outwash and lake plains, end moraines, stream terraces, and valley trains. These sites are characterized by very deep, moderately well to well drained soils formed in sandy deposits including alluvium, outwash, and till. The sandy deposits may have underlying loamy alluvium till, or residuum. Precipitation and runoff from adjacent uplands are the primary sources of water. Soils range from extremely acid to neutral.

Sandy Upland is distinguished from other ecological sites based on the sandy materials and moderately well to well drainage. Other moderately well and well drained site have loamy or clayey materials. Sandy materials often have lower pH and available water capacity, and often lack carbonates found in loamy and clayey materials. These conditions can limit vegetative growth.

Associated sites

F090AY001WI	**Poor Fen** Poor fen sites consist of deep herbaceous organic materials. Some sites have mineral soil contact. They are very poorly drained and remain saturated throughout the year. They are strongly to extremely acidic. These sites are permanently saturated wetlands. They are wetter and occur lower on the drainage sequence than Sandy Upland.
F090AY005WI	**Wet Sandy Lowland** Wet Sandy Lowland consist of deep sandy deposits derived from a mixture of outwash, alluvium, and lacustrine sources. They form in seasonally ponded depressions and are saturated long enough for hydric conditions to occur. Some sites are wetlands. They are wetter and occur lower on the drainage sequence than Sandy Upland.

F090AY009WI	**Moist Sandy Upland** Moist Sandy Lowland primarily consist of deep, sandy deposits from outwash, alluvium, lacustrine, and till. They sandy deposits may have a loamy mantle or be underlain by loamy deposits. The finer materials can cause episaturation and allow the site to remain moist for some of the growing season. They are wetter and occur lower on the drainage sequence than Sandy Upland.
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 much drier and occur higher on the drainage sequence than Sandy Upland.

Similar 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. These sites share their position on the landscape and drainage class with Sandy Upland but have finer textures.
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 share particle size with Sandy Upland but are drier. The two sites sometimes support similar vegetative communities.

Table 1. Dominant plant species

Tree	(1) *Pinus strobus* (2) *Acer rubrum*
Shrub	(1) *Corylus cornuta*
Herbaceous	(1) *Maianthemum canadense* (2) *Pyrola*

Physiographic features

These sites formed on lake plains, outwash plains, valley trains, moraines, and stream terraces. Slopes range from 0 to 55 percent.

These sites are not subject to ponding or flooding. Soils have a seasonally high water table at depths of 24 to 72 inches. The water table may drop below 80 inches during dry conditions. Runoff is negligible to high.

Table 2. Representative physiographic features

Hillslope profile	(1) Summit (2) Backslope (3) Shoulder
Slope shape across	(1) Convex
Slope shape up-down	(1) Linear
Landforms	(1) Outwash plain (2) Lake plain (3) Valley train (4) Stream terrace (5) Moraine
Runoff class	Negligible to high
Flooding frequency	None
Ponding frequency	None
Elevation	180–275 m
Slope	0–55%
Water table depth	61–183 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 32 inches. The average annual snowfall is 57 inches. The annual average maximum and minimum temperatures are 52°F and 31°F, respectively.

Table 3. Representative climatic features

Frost-free period (characteristic range)	69-107 days
Freeze-free period (characteristic range)	106-137 days
Precipitation total (characteristic range)	737-813 mm

Frost-free period (actual range)	40-116 days
Freeze-free period (actual range)	86-146 days
Precipitation total (actual range)	686-889 mm
Frost-free period (average)	87 days
Freeze-free period (average)	122 days
Precipitation total (average)	787 mm

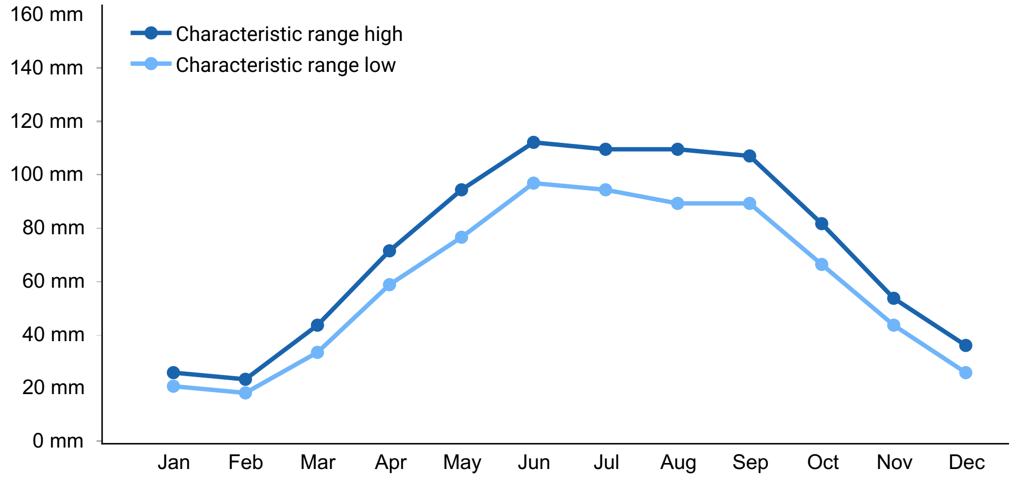


Figure 1. Monthly precipitation range

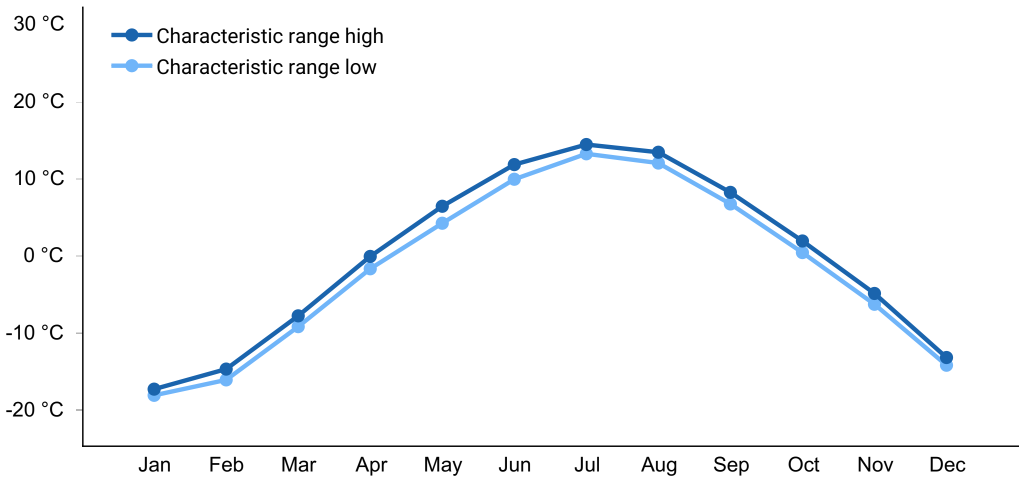


Figure 2. Monthly minimum temperature range

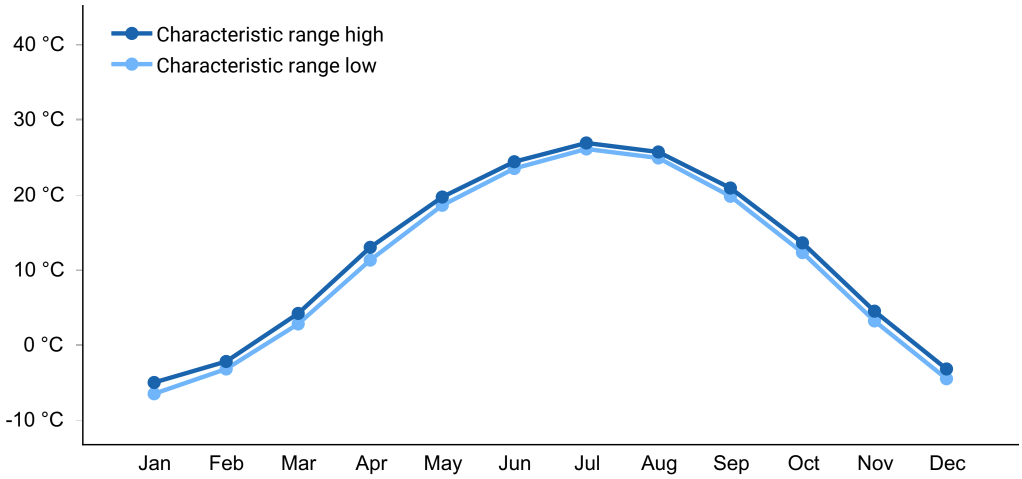


Figure 3. Monthly maximum temperature range

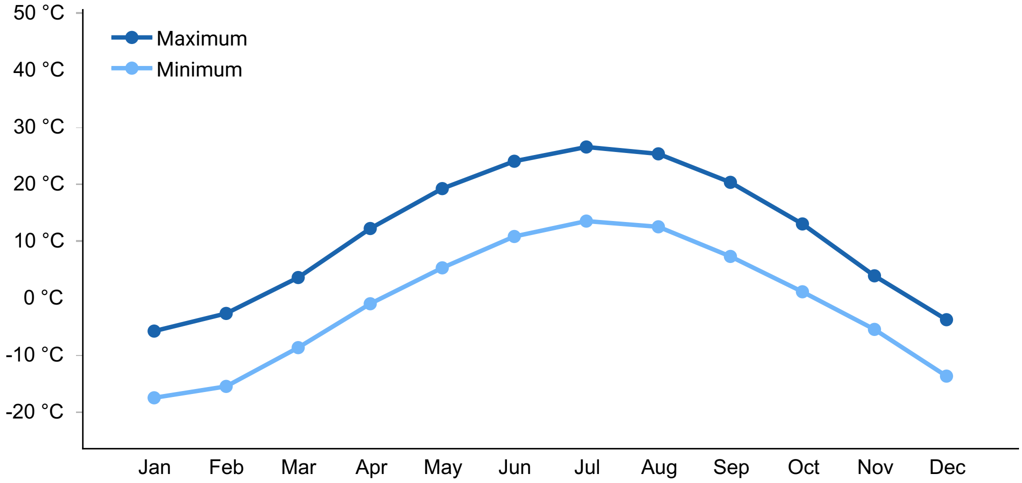


Figure 4. Monthly average minimum and maximum temperature

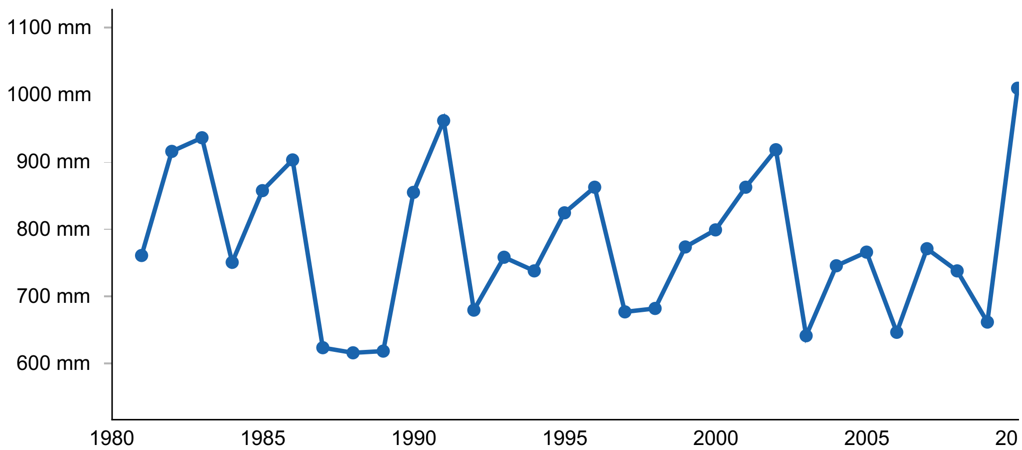


Figure 5. Annual precipitation pattern

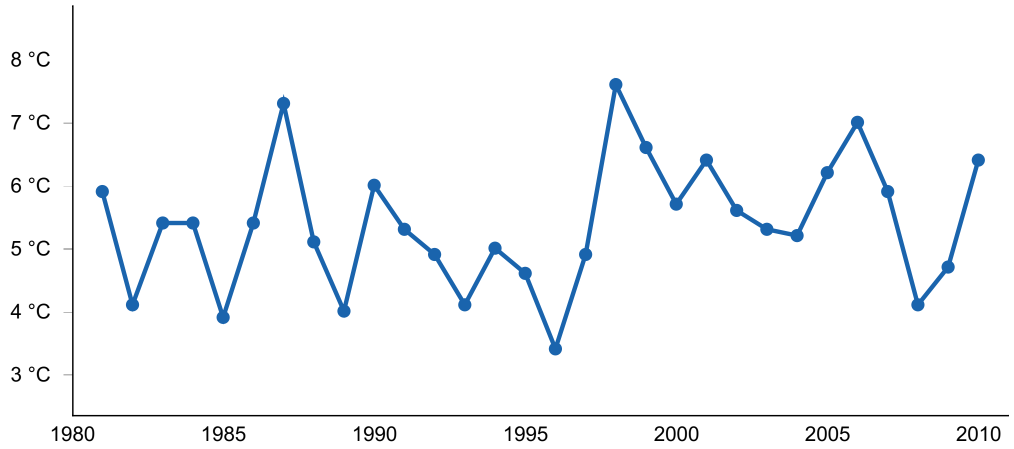


Figure 6. Annual average temperature pattern

Climate stations used

- (1) HOLCOMBE [USC00473698], Holcombe, WI
- (2) ROSHOLT 9 NNE [USC00477349], Wittenberg, WI
- (3) STAMBAUGH 2SSE [USC00207812], Iron River, MI
- (4) BIG FALLS HYDRO [USC00470773], Glen Flora, WI
- (5) COUDERAY 7 W [USC00471847], Stone Lake, WI
- (6) ISLE 12N [USC00214103], Isle, MN
- (7) MOOSE LAKE 1 SSE [USC00215598], Moose Lake, MN
- (8) 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 range from very slow to rapid.
Hydrologic Group: A, B
Hydrogeomorphic Wetland Classification: None
Cowardin Wetland Classification: None

Soil features

These sites are represented by Chinwhisker, Croswell, Cublake, Dickman, Fremstadt, Gotham, Guenther, Keweenaw, Komro, Mahtomedi, Manitowish, Pence, Rousseau, Slimlake, Spoonerhill, Springstead, and Wurtsmith soil series. Some sites are represented by Udipsamments and Udorthents that are not classified to series. Chinwhisker is classified as a Lamellic Oxyaquic Haplorthod; Croswell, Cublake, Manitowich, and

Springstead are Oxyaquic Haplorthods; Guenther and Keweenaw are Alfic Haplorthods; Fremstadt is an Arenic Hapludalf; Rousseau is an Entic Haplorthod; Komro is an Entic Hapludoll; Slimlake and Spoonerhill are Oxyaquic Dystrudepts; Wurtsmith is Oxyaquic Udipsamment; Gotham is a Psammentic Hapludalf; Pence is a Typic Haplorthod; Dickman is a Typic Hapludoll; Mahtomedi is a Typic Udipsamment.

These soils formed in various parent material including loamy or sandy alluvium, sandy outwash, sandy or loamy till, and loamy residuum. Soils are very deep and moderately well or well drained. They do not meet hydric requirements.

The surfaces of these sites are sandy loam, loam, loamy sand, and slightly to moderately decomposed plant material. Some sites have fine sands. Subsurface textures are sandy loam, silt loam, loamy sand, and sand. Many horizons have fine or very fine sand. Some horizons have gravelly and very gravelly modifiers. Soil pH ranges from extremely acid to neutral with values of 4.2 to 6.7. Carbonates are absent within 80 inches.

Figure 7. Pence soil series photograph courtesy of UWSP taken on 7/11/2019 in Sawyer County, WI.

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Outwash (3) Till (4) Igneous and metamorphic rock (5) Residuum
Surface texture	(1) Loamy sand (2) Sandy loam (3) Loam
Drainage class	Moderately well drained to well drained

Permeability class	Very slow to rapid
Soil depth	201–249 cm
Surface fragment cover <=3"	0–8%
Surface fragment cover >3"	0–7%
Available water capacity (0-154.9cm)	3.71–6.81 cm
Calcium carbonate equivalent (0-100.1cm)	0%
Soil reaction (1:1 water) (0-100.1cm)	4.2–6.7
Subsurface fragment volume <=3" (Depth not specified)	0–31%
Subsurface fragment volume >3" (Depth not specified)	0–6%

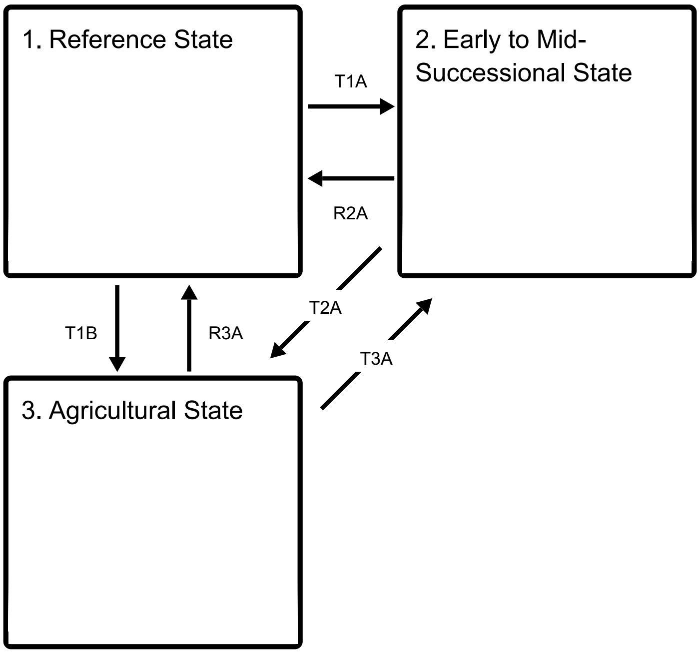
Ecological dynamics

Historically, this site was dominated by white and red pine in a landscape adapted to fire disturbance. 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. Red maple is sensitive to fire, but in its absence, it has the ability to dominate sites based on its shade tolerance and prolific seed production.

Today, these forests most commonly include stands of red oak, red maple, and aspen and birch. Various species can be found as associates including sugar maple, and in many areas, white pine is successfully reinvading the landscape. As long as fire is continually suppressed, maples and other mesic hardwoods will continue to dominate the canopy.

State and transition model

Ecosystem states



T1A - Clear cutting or stand-replacing fire.

T1B - Removal of forest vegetation and tilling.

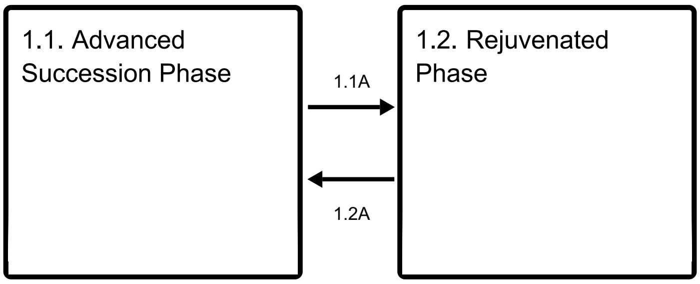
R2A - Disturbance-free period 70+ years.

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

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

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

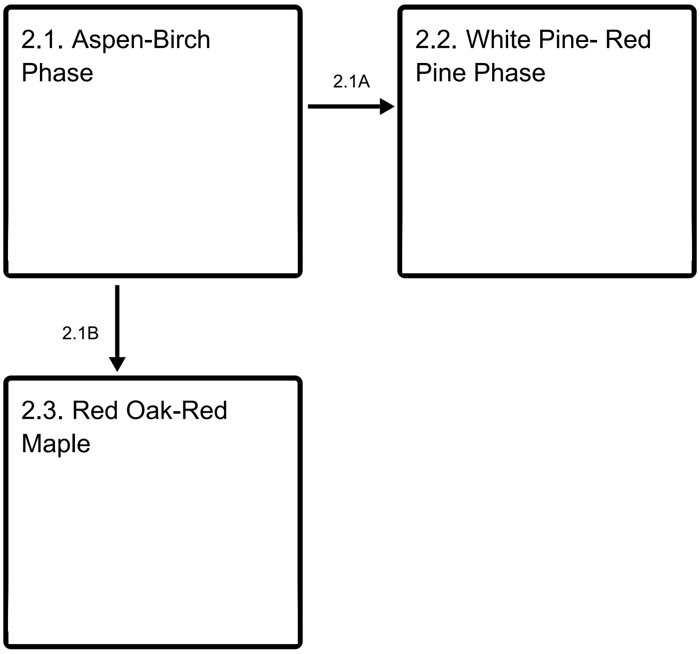
State 1 submodel, plant communities



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

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

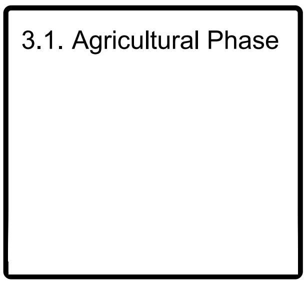
State 2 submodel, plant communities



2.1A - Immigration and establishment of red pine/white pine. Might include small, frequent fire disturbance.

2.1B - Immigration and establishment of red oak and red maple.

State 3 submodel, plant communities



State 1
Reference State

Reference state is a forest community dominated by Red maple (*Acer rubrum*) and 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 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

- red maple (*Acer rubrum*), tree
- sugar maple (*Acer saccharum*), tree
- beaked hazelnut (*Corylus cornuta*), shrub
- wild sarsaparilla (*Aralia nudicaulis*), other herbaceous
- Canada mayflower (*Maianthemum canadense*), other herbaceous

Community 1.2
Rejuvenated Phase

Figure 8. Photo courtesy of UWSP taken on 7/11/2019 in Sawyer County, WI.

This community is often dominated by red oak and red maple. Associates likely include sugar maple invading the site, and white pine and red pine (*Pinus resinosa*) if they were established after a previous disturbance. The shrub and ground layers are similar to the advanced succession phase, but may include the establishment of new seedlings.

Dominant plant species

- northern red oak (*Quercus rubra*), tree
- red maple (*Acer rubrum*), tree
- sugar maple (*Acer saccharum*), tree
- beaked hazelnut (*Corylus cornuta*), shrub
- wild sarsaparilla (*Aralia nudicaulis*), other herbaceous
- Canada mayflower (*Maianthemum canadense*), 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, releasing advance regeneration and stimulating new seedling establishment. Some additional less shade tolerant species such as red oak and white pine may be able to enter the community.

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 with red and sugar maple. 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

These two species have a very narrow window of environmental and ecological conditions for successful establishment. The 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 Pine- Red Pine Phase

This community phase occurs by invading and succeeding a pioneer aspen-birch community. Seed source of red and white pine is required, and some fire disturbance can increase chances of establishment. A continued fire regime will allow the growth of the pines while removing or slowing the growth of shade tolerant species in the understory. If fire disturbance does not occur, a sub-canopy of shade tolerant species such as red maple may establish and eventually become part of the canopy.

Dominant plant species

- eastern white pine (*Pinus strobus*), tree
- red pine (*Pinus resinosa*), tree

Community 2.3
Red Oak-Red Maple

Figure 9. Photo courtesy of UWSP taken on 7/14/2019 in Oneida County, WI.

This community phase occurs by invading and succeeding a pioneer aspen-birch community. Stand structure consists of dominant 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 beaked hazelnut (*Corylus cornuta*), typically reaches its best development in this community phase.

Dominant plant species

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

Pathway 2.1A
Community 2.1 to 2.2

Time and the immigration, establishment, and growth of white and red pine seedlings. This pathway most likely includes small, but frequent fire disturbance that favors the shade intolerant, and fire adapted red pine, and moderately tolerant white pine.

Pathway 2.1B
Community 2.1 to 2.3

Time and the immigration, establishment, and growth of the moderately shade tolerant red oak and red maple seedlings.

State 3
Agricultural State

Indefinite period of applying agricultural practices. Agricultural practices are likely to include planted row crops, but some hay or pasture is possible

Community 3.1
Agricultural Phase

This community phase consists of planted row crops and possibly some hay or pasture in some locations.

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

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

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 moderately shade tolerant red maple and red oak and a sub-canopy of shade tolerant sugar maple, returning the community to Reference State.

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.

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 five habitat types: *Acer saccharum*/Hydrophyllum (AH); *Acer saccharum*-Tsuga/Maianthemum (ATM); *Acer saccharum*/Viburnum (AVb); Acer sachharum/Vaccinium-Viburnum (AVVb); Pinus-*Acer rubrum*/Vaccinium (PArV)

Biophysical Settings (Landfire, 2014): This ES is largely mapped as Laurentian-Acadian

Northern Hardwoods Forest, Boreal White Spruce-Fir Forest, Boreal White Spruce-Fir-Hardwood Forest, Boreal Hardwood Forest, and Eastern Cool Temperate Pasture and Hayland

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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	05/20/2025
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):

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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:**
