Ecological site F091XY012WI
Loamy Upland

Last updated: 9/27/2023
Accessed: 05/12/2025

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): 091X–Wisconsin and Minnesota Sandy Outwash

The Wisconsin and Minnesota Sandy Outwash MLRA is the most extensive glacial outwash system in the northern half of Wisconsin. The total land area of the Wisconsin portion is just under 1.4 million acres (2,170 sq miles). The northern half is a former spillway for Glacial Lake Duluth. The flowing meltwater from the draining lake has left behind thick deposits of drift and carved a terraced river valley now occupied by the St. Croix and Bois Brule Rivers.

The northeastern section – the Bayfield hills – is a collapsed outwash plain where drift deposits are thick. Lacustrine materials from Glacial Lake Duluth line the northeastern tip. Moving southwest, the landscape transitions into a large pitted outwash plain. This is an area of extensive kettle holes, and, where the underlying till is less permeable, kettle lakes with some interspersed morainic hills and ridges. The glacial drift deposits are thinner in the southwestern section, although there is still no documented surface bedrock within this MLRA.

The St. Croix and Bois Brule rivers share a channel that lines much of the northwestern border of this MLRA. In some places, the underlying reddish-brown sandy loam till of the Copper Falls Formation is exposed along cut riverbanks, though most of it is covered by a mantle of outwash. Glacial lakes deposited pockets of fine-textured lacustrine materials, most of which were washed away or buried by glacial outwash and meltwater flowing through the channel. East of the channel, some of the silty and clayey lakebed deposits are found near the surface, where they impede drainage and contribute to the formation of extensive wetlands.

Historically, the area supported extensive jack pine (Pinus banksiana), scrub, and oak forests and barrens. The northern portion also supported stands of red pine (Pinus resinosa) and eastern white pine (*Pinus strobus*) as well. Marsh and sedge meadow, wet prairies, and lowland shrubs dominated the extensive wetland complexes in the southern tip of this MLRA (Finley, R., 1976).

Classification relationships

Relationship to Established Framework and Classification Systems:
Biophysical Settings (Landfire, 2014): This ES is largely mapped as Laurentian-Acadian Northern Hardwoods Forest, Boreal Aspen-Birch Forest, and Eastern Cool Temperate Row Crop

Habitat Types of N. Wisconsin (Kotar, 2002): The sites of this ES keyed out to two habitat types: *Pinus strobus-Acer rubrum*/Vaccinium-Amphicarpa (PArVAm); *Acer saccharum*/Athyrium (AAt)

WDNR Natural Communities (WDNR, 2015): This ES is most similar to the Northern Mesic Forest community.

Hierarchical Framework Relationships:
Major Land Resource Area (MLRA): Wisconsin and Minnesota Sandy Outwash (91X)

USFS Subregions: Mille Lacs Uplands (212Kb)

Small sections occur in the Bayfield Sand Plains (212Ka) subregion

Wisconsin DNR Ecological Landscapes: Northwest Lowlands, Northwest Sands

Ecological site concept

The Loamy Uplands ecological site is found most commonly on the northwest border of MLRA 91X near the St. Croix River on outwash, lake, and till plains, moraines, stream terraces, hillslopes, and river valleys. These sites are characterized by moderately deep to very deep, moderately well to well drained soils formed in loamy deposits. Some sites have a sandy mantle or are underlain by sandy outwash. Precipitation and runoff are the primary sources of water. Soils range from very strongly acid to slightly alkaline.

Historically, this Ecological Site was occupied by forest communities dominated by various mixtures of pine and oak species. Specific mixtures were largely dependent on frequency and severity of disturbances, particularly fire and subsequent seed-bed conditions and availability of seed sources. White pine (*Pinus strobus*) was the most persistent species in forest communities due to its biological and ecological characteristics of great longevity, resistance of old trees to fire damage and moderate tolerance to shade by seedlings and saplings. Red oak (*Quercus rubra*) and white oak (*Q. alba*) were often present as associate species. Virtually all stands on this Ecological Site were harvested during the late 19th and early 20th centuries and post-logging fires were almost universal. Today's forests are dominated by any mixture of, aspen, red oak, white oak, red maple (*Acer rubrum*) and white pine. Red pine (Pinus resinosa) plantations also are common. In some stands there is sporadic occurrence of species typical of mesic communities, such as ironwood (*Ostrya virginiana*), basswood (*Tilia americana*), ashes (Fraxinus spp.) and sugar maple (*Acer saccharum*), indicating that this ES represents a transition on the soil moisture/nutrient gradient from Dry to Dry-Mesic Forest Habitat Types.

Loamy Uplands differ from sandy and clayey uplands based on its loamy textures. Loamy textures have a higher pH and available water capacity than sandy materials, but lower than clay materials. The moderately well and well drainage differs Loamy Uplands from other loamy sites.

Associated sites

F091XY005WI	**Wet Sandy and Loamy Lowland** These sites occur on depressions and drainageways on outwash plains and lake plains. They primarily form in sandy outwash are subject to some flooding. Soils are very deep and poorly or very poorly drained. They are saturated for much of the year. They are much wetter and occur lower on the drainage sequence than Lamy Uplands.
F091XY007WI	**Moist Sandy and Loamy Lowland** These soils formed in sandy outwash, sandy lacustrine deposits, sandy eolian deposits, or loess that is sometimes underlain by sandy or loamy till. Soils are very deep and somewhat poorly drained. They are wetter and occur lower on the drainage sequence than Loamy Uplands.

Similar sites

F091XY004WI	**Terrace** These sites occur on stream and strath terraces. They are defined by their landforms, not by particle size class or drainage class. These sites were once floodplains but are no longer subject to frequent flooding. Terrace sites with loamy particle size classes and good drainage will support vegetative communities similar to those of Loamy Uplands.
F091XY011WI	**Sandy Upland** These soils formed primarily in sandy outwash or sandy eolian deposits, but some sites formed in sandy lacustrine or loamy alluvium underlain by sandy outwash. They occupy similar landscape positions as Loamy Uplands and are also moderately well to somewhat excessively drained. Sandy Uplands have coarser particle size classes. This difference is reflected in the vegetative communities, with Loamy Uplands supporting communities with higher nutrient requirements.
F091XY013WI	**Clayey Upland** These sites form in clayey lacustrine deposits, often with a sandy or loamy mantle. They occupy similar landscape positions as Loamy Uplands and are also moderately well to somewhat excessively drained. Clayey Uplands have finer particle size classes. The two sites can support similar vegetative communities.

Table 1. Dominant plant species

Tree	(1) *Quercus rubra* (2) *Acer rubrum*
Shrub	(1) *Corylus*
Herbaceous	(1) *Eurybia macrophylla* (2) *Amphicarpaea bracteata*

Physiographic features

These sites formed on outwash, lake, and till plains, moraines, and stream terraces. Slopes range from 0 to 45 percent. Sites are on summit, shoulder, and backslope positions.

These sites are not subject to ponding or flooding. Some sites have a perched seasonally high water table (episaturation), while the others have an apparent water table (endosaturation). The depth to seasonally high water tables for these sites ranges from 24 to 42 inches but the water table can drop to greater than 60 inches during dry conditions. Runoff ranges from negligible to high.

Table 2. Representative physiographic features

Hillslope profile	(1) Summit (2) Shoulder (3) Shoulder
Slope shape up-down	(1) Convex
Slope shape across	(1) Linear
Landforms	(1) Outwash plain (2) Lake plain (3) Till plain (4) Moraine (5) Stream terrace
Runoff class	Negligible to high
Flooding frequency	None
Ponding frequency	None
Elevation	200–610 m
Slope	0–45%
Water table depth	61–107 cm

Climatic features

The continental climate of the Wisconsin and Minnesota Sandy Outwash MLRA is typical of northern Wisconsin – colder winters and warmer summers. In general, the northern latitudes have cooler summers, colder winters, lower precipitation, and shorter growing seasons than the south; however, neither average annual precipitation nor average annual minimum and maximum temperatures vary greatly within this MLRA. The climate of the northernmost tip is somewhat affected by Lake Superior and receives higher annual precipitation in the form of lake effect snow.

The average annual precipitation for this site is 31 inches. The average annual snowfall is 51 inches. The average annual maximum and minimum temperatures are 53°F and 32°F, respectively.

Table 3. Representative climatic features

Frost-free period (characteristic range)	88-114 days
Freeze-free period (characteristic range)	118-138 days
Precipitation total (characteristic range)	737-813 mm

Frost-free period (actual range)	78-118 days
Freeze-free period (actual range)	107-141 days
Precipitation total (actual range)	737-813 mm
Frost-free period (average)	101 days
Freeze-free period (average)	127 days
Precipitation total (average)	787 mm

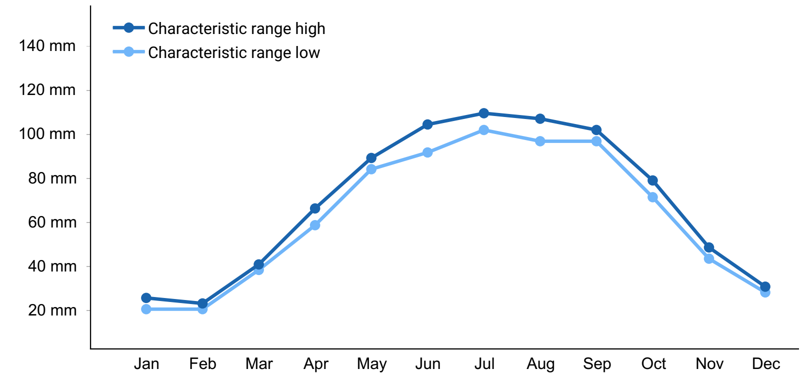


Figure 1. Monthly precipitation range

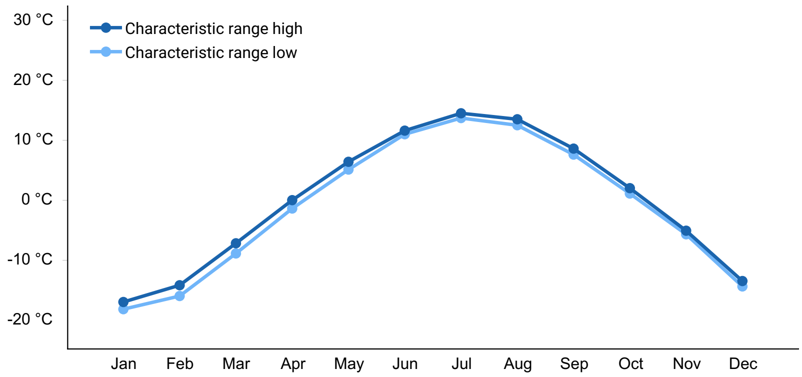


Figure 2. Monthly minimum temperature range

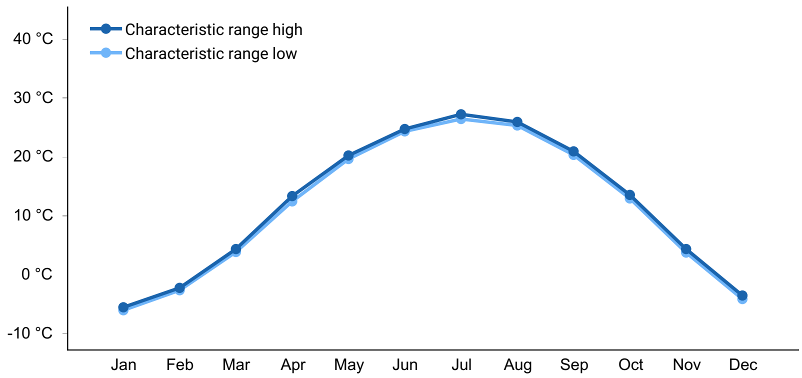


Figure 3. Monthly maximum temperature range

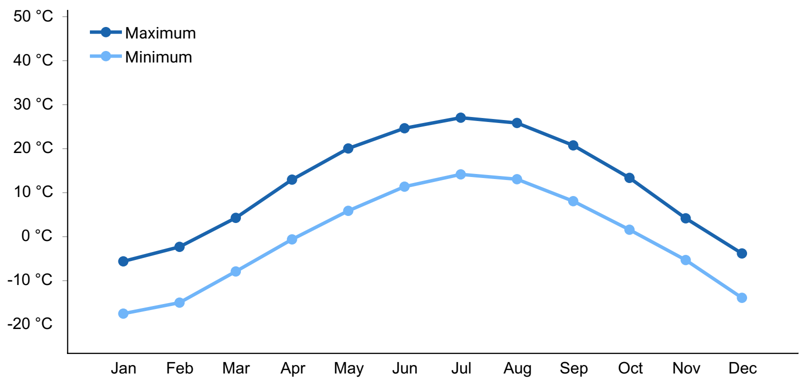


Figure 4. Monthly average minimum and maximum temperature

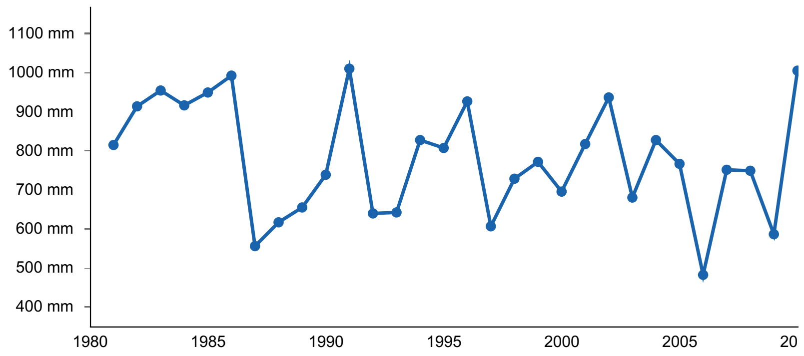


Figure 5. Annual precipitation pattern

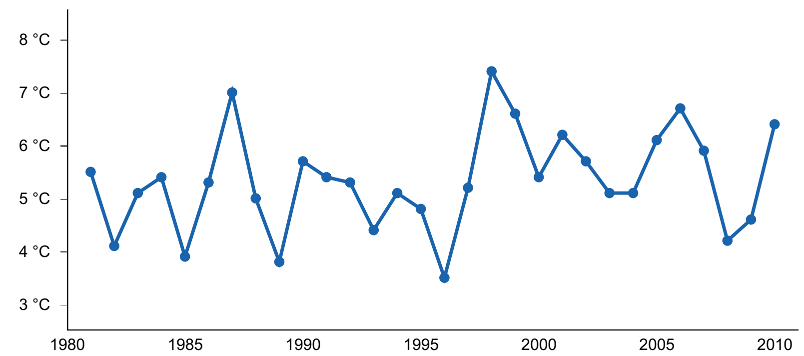


Figure 6. Annual average temperature pattern

Climate stations used

- (1) DANBURY [USC00471978], Danbury, WI
- (2) MINONG 5 WSW [USC00475525], Minong, WI
- (3) GORDON [USC00473186], Gordon, WI
- (4) GRANTSBURG [USW00014995], Grantsburg, WI

Influencing water features

Water is received primarily through precipitation, runoff from adjacent uplands, and groundwater discharge. Water is discharged from the site primarily through runoff, evapotranspiration, and groundwater recharge.

Permeability of these sites is impermeable to moderately slow.
Hydrologic group is A, B, or C.

Wetland description

Hydrogeomorphic Wetland Classification: None
Cowardin Wetland Classification: None

Soil features

These sites are represented by the Aftad, Amery, Braham, Branstad, Chetek, Crystal Lake, Cutaway, Haugen, Haustrup, Lundeen, Milaca, Padus, Pierz, Pomroy, Rosholt, and Scott Lake soil series. Aftad, Branstad, Crystal Lake, Milaca, and Scott Lake series are all classified as Oxyaquic Glossudalfs; Amery and Rosholt are Haplic Glossudalfs; Braham is an Arenic Hapludalf; Chetek is an Inceptic Hapludalf; Cutaway is an Oxyaquic Hapludalf; Haugen is an Oxyaquic Palueudalf; Haustrup is a Humic Lithic Dystrudept; Lundeen is a Humic Dystrudept; Padus is an Alfic Haplorthod; Pierz is a Typic Argiudoll; and Pomroy is an Arenic Oxyaquic Hapludalf.

These soils formed in loamy lacustrine, loamy alluvium, loamy till, sandy outwash, sandy eolian, or loess deposits. Some sites have underlying lacustrine deposits, till, or basalt bedrock. Soil depth ranges from 16 to over 80 inches. Drainage class is moderately well to well drained. Soils do not meet hydric soil requirements.

Surface textures of these sites are primarily loamy sand, sandy loam, and silt loams. Some have fine and very fine modifiers. Subsurface textures include loam, sandy loam, silt loam, clay loam, sandy clay loam, and loamy sand. Some have fine or gravelly modifiers. Soil pH ranges from very extremely acid to slightly alkaline with values of 4.4 to 7.6. Carbonates are mostly absent, but can be present up to 1 percent beginning at 35 inches.

Figure 7. Pomroy Soil Series sampled on 07/23/2019 in Burnett County, WI.

Table 4. Representative soil features

Parent material	(1) Outwash (2) Eolian sands (3) Loess (4) Lacustrine deposits (5) Alluvium (6) Glaciofluvial deposits (7) Basalt
Surface texture	(1) Loamy sand (2) Sandy loam (3) Silt loam
Drainage class	Moderately well drained to well drained
Permeability class	Very slow to moderately slow
Soil depth	41–203 cm
Surface fragment cover <=3"	0–8%
Surface fragment cover >3"	0–2%
Available water capacity (0-152.4cm)	3.43–12.27 cm

Calcium carbonate equivalent (0-101.6cm)	0–1%
Soil reaction (1:1 water) (0-101.6cm)	4.4–7.6
Subsurface fragment volume <=3" (0-101.6cm)	0–27%
Subsurface fragment volume >3" (0-101.6cm)	0–7%

Ecological dynamics

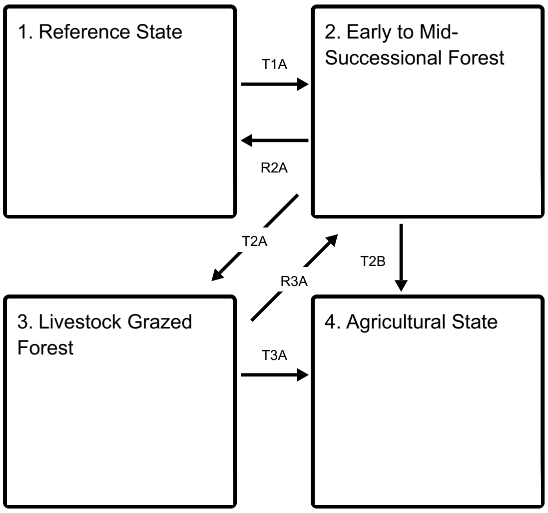
Perhaps the most important ecological characteristic of this Ecological Site, in terms of influence on forest community dynamics, is its limited capacity to support the high to moderate soil moisture and nutrient requiring species such as sugar maple (*Acer saccharum*), basswood (*Tilia americana*) and white ash (Fraxinus Americana). These are the shade-tolerant species, commonly known as the northern hardwoods, that typically dominate the more productive sites throughout northern Wisconsin. Although some of these species do occur sporadically on this Ecological Site, their regeneration capacity and growth rates are sub-optimal, thus limiting their attainment of canopy dominance.

In pre-European settlement time wild fire was the main controlling factor of forest community dynamics. Following a severe, stand-replacing fire, any of the naturally occurring species could become established, depending on the seed source 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 a given species' survival success. White pine is best adapted for long-term success on this Ecological Site. Although vulnerable to damage or elimination by fire in early growth stages, it eventually develops thick fire-resistant bark which helps to extend its longevity, in some cases for up to four centuries or more. These survival properties assure the species' relatively continuous seed source in the region as a whole. White pine is also moderately shade-tolerant in early life which means that it can become established in some pioneer communities, such as aspen – white birch stands, or in poorly stocked oak and red maple dominated communities. Red pine had in the past been a common associate of white pine stands. It shares some of the fire-resisting properties of white pine, but it lacks shade-tolerance and does not become established in the understory. For this reason, it has not maintained its presence in current stands and its seed source has been greatly reduced throughout its natural range following the unset of fire suppression. Red and white oak (*Quercus rubra* and *Q. alba*) have been common members of white pine-dominated stands and upon removal of white pine during early logging era, became the dominant tree component in most stands. Red oak's shade tolerance is only moderate, about equal to that of white pine and both species typically regenerate in large canopy openings. White oak is somewhat more tolerant and regenerates more readily in stands with full stocking. The oaks also have an advantage with the ability to sprout from sumps and damaged seedlings and saplings, while pines do not reproduce vegetatively.

In his reconstruction of pre-European settlement vegetation of Wisconsin, Finley (1976) did not identify red maple (*Acer rubrum*) as a prominent component of pine forests, but the species is a common member of current communities. Absence of fire since the end of the original logging era is probably the main reason. Red maple is extremely sensitive to fire, but is a prolific and early seed producer. Stems of 2-4 inches in diameter can produce large amounts of seed (USDA Forest Service, 1990). It is sufficiently shade-tolerant to become established in the understories of most communities on sandy soils. On this Ecological Site it behaves similarly to white pine, but because of its much smaller stature at maturity, it does not compete with white pine in the upper canopy.

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 - Time, natural succession by white pine and red maple.

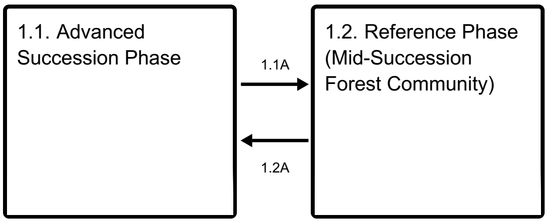
T2A - Grazing by livestock. Disruption of tree regeneration and ground vegetation.

T2B - Removal of natural vegetation, plowing, fertilizing, irrigating, planting agricultural crops.

R3A - Removal of livestock from stands.

T3A - Removal of natural vegetation, plowing, fertilizing, irrigating, planting agricultural crops.

State 1 submodel, plant communities



1.1A - Light to moderate intensity fires, reducing or eliminating advance tree regeneration.

1.2A - White pine and red oak regeneration re-establishes.

State 2 submodel, plant communities

2.1A - Red pine seed into the successional communities of mixed oak

2.1B - Repetitive clearcutting and burning of earlier stands

2.2A - Disturbance e.g., blow-down and fire, or clear-cutting followed by fire. Regeneration by natural seeding or planting.

2.3A - Time without disturbance, natural succession

State 1
Reference State

In the long-term absence of stand replacing disturbance, tree species composition of forest communities on this ecological site fluctuates among white pine (*Pinus strobus*), red pine (P. Resinosa), red oak (*Quercus rubra*) and red maple (*Acer rubrum*). This fluctuation is due to many factors. There is a differential response to a range of common, but not stand-replacing disturbances, such as light fire, snow and ice brakeage and natural mortality in the canopy. There are differences in regeneration requirements among the species and in seedling tolerance of understory conditions. While the resulting community species composition and structure can be viewed as a continuum, two distinct community phases can be described as representing the opposite ends of a continuum.

Dominant plant species

- eastern white pine (*Pinus strobus*), tree
- red pine (*Pinus resinosa*), tree
- northern red oak (*Quercus rubra*), tree

Community 1.1
Advanced Succession Phase

In long-term absence of stand-replacing natural disturbance, or harvesting, forest communities on this ES typically develop into white pine dominated stands with varying admixtures of red oak, white oak and red maple. The shrub layer may be thick or sparse and typically includes hazelnut (*Corylus cornuta* and *C. americana*) as well as saplings of red maple and, more rarely, ironwood (*Ostrya virginiana*). The herb layer is most often dominated by bracken fern (*Pteridium aquilinum*), large leaf aster (*Eurybia macrophylla*) and hog peanut (Amphicarpa bracteata). This Community Phase is rare on today's landscape and for this reason is not designated as the Reference Community Phase.

Community 1.2
Reference Phase (Mid-Succession Forest Community)

Next to the ubiquitous aspen stands, red maple is the most common tree species on this ES. It is commonly associated with red and/or white oaks, which became the dominant components of stands, following the removal of white pine in the early logging era and subsequent selection harvesting practices, often considered as high-grading. White pine reproduction is common if seed sources are present. Understory species composition is similar to that describe in Community Phase 1.1, but individual species' abundance varies greatly depending on the frequency and intensity of disturbance. In general, bracken fern and large-leaf aster comprise dominant cover and hog peanut is well represented. This community phase was chosen as reference state because it is compositionally closest to late successional community and commonly occurs on the landscape today.

Pathway 1.1A
Community 1.1 to 1.2

Periodic moderate intensity fires, eliminating or reducing advance regeneration, but leaving at least the oldest and fire-resistant pines and oaks.

Pathway 1.2A
Community 1.2 to 1.1

Canopy species re-establish regeneration layer.

State 2
Early to Mid-Successional Forest

Community 2.1
Red Oak-White Oak Phase

Figure 8. Image courtesy of UWSP taken on 07/23/2019 in Burnett County, WI.

Most oak dominated communities originated following heavy disturbance such as blow-downs, logging and fire. Reproduction from seed is sporadic and dependent on many factors, such as seed dispersal by animals, seed predation by insects and seedbed conditions. Ability to sprout from stumps and damaged, or destroyed, above-ground portions of seedlings and saplings, is a significant factor in the maintenance of oak communities. Red maple is more shade-tolerant than are oaks and white pine and tends to be the primary succeeding species in oak communities, but white pine regeneration also is common in larger canopy gaps wherever seed sources exist. Understory species composition is similar to that describe in Community Phase 1.1, but individual species' abundance varies greatly depending on the frequency and intensity of disturbance. In general, bracken fern and large-leaf aster comprise dominant cover and hog peanut is well represented.

Dominant plant species

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

Community 2.2
Red Pine Plantation

Almost all red pine stands on the landscape today are plantations. Red pine has been by far the most successful species for nursery production and planting, ever since the first attempts of reforestation, following the end of the logging era in the early 20th century. For almost half a century it was promoted as a species of choice on all landscapes with no consideration of ecological appropriateness of the site for the species. This approach naturally led to the existence of a range of excellent to failed plantations. Plantations on this Ecological Site turned out to be successful, if competing vegetation was controlled during the plantation establishment phase. Many plantations continue to be managed as even-aged red pine forests by clearcutting and planting, or by other silvicultural techniques. If left unmanaged, these plantation typically succeed to either red maple or white pine, or a mixture of the two.

Dominant plant species

- red pine (*Pinus resinosa*), tree

Community 2.3
Aspen Phase

Figure 9. Image courtesy of UWSP taken on 06/25/2019 in Burnett County, WI.

Aspen became established on this Ecological Site almost exclusively following clearcutting and burning of eariler stands of pine and oak. Both, the trembling aspen (*Populus tremuloides*) and big-tooth aspen (*P. grandidentata*) play a role. These stands are being perpetuated through clear cutting. If left unmanaged, they most commonly succeed to red maple and/or white pine. Red or white oak admixtures may occur if scattered individuals of these species existed in the cut-over aspen stand.

Dominant plant species

- quaking aspen (*Populus tremuloides*), tree
- bigtooth aspen (*Populus grandidentata*), tree

Pathway 2.1A
Community 2.1 to 2.2

Red pine seed into the successional communities of mixed oak, leading to the development of Red Pine Plantation.

Pathway 2.1B
Community 2.1 to 2.3

Red Oak-White Oak Phase **Aspen Phase**

Aspen becomes established following repetitive clearcutting and burning of early stages of pine and oak. These stands are being perpetuated through clear cutting.

Pathway 2.2A
Community 2.2 to 2.1

Disturbance e.g., blow-down and fire, or clear-cutting followed by fire. Regeneration by natural seeding or planting.

Pathway 2.3A
Community 2.3 to 2.1

Aspen Phase

Red Oak-White Oak Phase

Elimination of repetitive clearcutting and burning of stands. Lack of disturbance over time will cause this transition.

State 3
Livestock Grazed Forest

Livestock grazed forests are more often referred to as woodlands rather than forests because this long-term land use significantly changes some soil characteristics and nature of vegetative community. Species composition is altered by selective browsing and grazing as well as by distribution of seeds and other propagules by grazing animals. In addition, soil compaction differentially affects germination and establishment of plant species, including trees.

State 4
Agricultural State

Production of agricultural crops, most often oats or hay. Routine usage of tillage, fertilizer, and other field practices.

Transition T1A
State 1 to 2

Stand-replacing disturbance, such as blow-down, or ice storm, followed by fire, or clear-cut logging, followed by natural regeneration or site preparation and planting.

Restoration pathway R2A
State 2 to 1

Red maple and white pine seed into the successional communities of mixed oak, red pine or aspen leading to the development of Reference State communities.

Transition T2A
State 2 to 3

Prolonged grazing by livestock

Transition T2B
State 2 to 4

Elimination of forest cover and introduction of tilling, fertilizing an/or irrigation.

Restoration pathway R3A
State 3 to 2

Removal of livestock, natural succession. Results may be sped up by planting and initial outcomes will be heavily influenced by seed source and adjacent plant communities.

Transition T3A
State 3 to 4

Elimination of forest cover and introduction of tilling, fertilizing an/or irrigation.

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.

Other references

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Approval

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NRCS contracted UWSP to write ecological sites for MLRA 91. 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	09/27/2023
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):

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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):**

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:**