Ecological site F090AY006WI
Wet Loamy Lowland

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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: Mille Lacs Uplands (212Kb), Glidden Loamy Drift Plain (212Xa), Lincoln Formation Till Plain - Hemlock Hardwoods (212Qc), Lincoln Formation Till Plain - Mixed Hardwoods (212Qb), Perkinstown End Moraine (212Xe), Rib Mountain Rolling Ridges (212Qd), Brule and Paint Rivers Drumlinized Ground Moraine (212Xc), St. Croix Moraine (212Qa), Rosemont Baldwin Plains and Moraines (222Md), Central-Northwest Wisconsin Loess Plains (212Xd)

Small sections occur in Hayward Stagnation Moraines (212Xf), Green Bay Lobe Stagnation Moraine (212Ta)

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

Ecological site concept

The Wet Loamy Lowland ecological site is scattered throughout MLRA 90A in depressions and drainageways on outwash, lake, and till plains, moraines, and stream terraces. These sites are characterized by very deep, very poorly or poorly drained soils that formed primarily in loamy deposits including lacustrine, till, alluvium, and residuum. Some sites have mantles or underlying sandy or clayey material. Sites are subject to frequent ponding or occasional flooding during the spring and fall. Soils remain saturated for long periods during the growing season and meet hydric soil requirements. Precipitation, runoff from adjacent uplands, groundwater discharge, and stream inflow are the primary sources of water. Soils range from extremely acid to moderately alkaline.

Wet Loamy Lowland is differentiated from other ecological sites by its deep loamy deposits and very poorly or poorly drained soils. Other very poorly or poorly drained sites have sandy or clayey deposits. pH and available water capacity are often higher in loamy sites than sandy sites and often lower in loamy sites than clayey sites.

Associated sites

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 wetter and occur lower on the drainage sequence than Wet Loamy Lowland.
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 somewhat drier and occur higher on the drainage sequence than Wet Loamy Lowland.

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 much drier and occur higher on the drainage sequence than Wet Loamy Lowland.
F090AY021WI	**Dry Loamy Upland** Dry Loamy Upland consist of deep sandy to loamy outwash, alluvium, or till. The water table is deeper than two meters year-round. They are much drier and occur higher on the drainage sequence than Wet Loamy Lowland.

Similar sites

F090AY004WI	**Loamy Floodplain** Loamy Floodplain are found exclusively on floodplains in loamy alluvium, sometimes underlain by sandy alluvium. Soils are very poorly to moderately well drained and are subject to flooding. Some sites may be saturated for long enough for hydric conditions to occur. They share particle size and sometimes drainage capability with Wet Loamy Lowlands, though their landforms are different. The vegetative communities are similar between the two sites.
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 found in similar landforms with similar drainage as Wet Loamy Lowlands, though their particle sizes are coarser. Wet Sandy Lowlands supports vegetative communities with lower nutrient requirements.
F090AY007WI	**Wet Clayey Lowlands** Wet Clayey Lowlands form in deep, loamy to clayey deposits derived from a mixture of alluvium, residuum, till, or lacustrine sources. These sites have a seasonally high water table at the surface, and some are subject to occasional ponding. Sustained saturation is enough for hydric conditions to occur. They are found in similar landforms with similar drainage as Wet Loamy Lowlands, though their particle sizes are finer. The vegetative communities are similar between the two sites.
F090AY014WI	**Loamy Bedrock Upland** Loamy Bedrock Upland sites consist of sandy to clayey alluvium, till, or eolian deposits over residuum weathered from bedrock. Bedrock contact occurs within two meters of the surface. Sites have seasonally high water table within a meter of the surface. Perching of the water table may occur as a result of bedrock contact. They are somewhat drier but with similar particle sizes as Wet Loamy Lowlands. The two sites support similar vegetative communities.

Table 1. Dominant plant species

Tree	(1) *Acer rubrum* (2) *Abies balsamea*
Shrub	(1) *Corylus*
Herbaceous	(1) *Onoclea* (2) *Carex*

Physiographic features

This site occurs in depressions and drainageways on outwash, lake, and till plains, moraines, and stream terraces. Slopes range from 0 to 4 percent. Sites are in footslope and toeslope positions.

Some sites are subject to frequent ponding. The ponding duration is brief (2 to 7 days) to long (7 to 30 days), with depths up to 12 inches above the soil surface. Some sites are subject to occasional flooding with durations of brief to long. These soils have seasonally high water table at a depth of 0 to 12 inches, but the water table may drop below 80 inches during dry conditions. Runoff is negligible to low.

Table 2. Representative physiographic features

Hillslope profile	(1) Toeslope (2) Footslope
Slope shape across	(1) Linear
Slope shape up-down	(1) Concave
Landforms	(1) Depression (2) Drainageway (3) Outwash plain (4) Lake plain (5) Till plain (6) Moraine (7) Stream terrace
Runoff class	Negligible to low
Flooding duration	Brief (2 to 7 days) to long (7 to 30 days)
Flooding frequency	None to occasional
Ponding duration	Brief (2 to 7 days) to long (7 to 30 days)
Ponding frequency	None to frequent
Elevation	150–275 m
Slope	0–4%
Ponding depth	0–30 cm
Water table depth	0–15 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.

Table 3. Representative climatic features

Frost-free period (characteristic range)	84-108 days
Freeze-free period (characteristic range)	115-136 days
Precipitation total (characteristic range)	737-813 mm
Frost-free period (actual range)	42-116 days
Freeze-free period (actual range)	87-145 days
Precipitation total (actual range)	711-889 mm
Frost-free period (average)	90 days
Freeze-free period (average)	123 days
Precipitation total (average)	787 mm

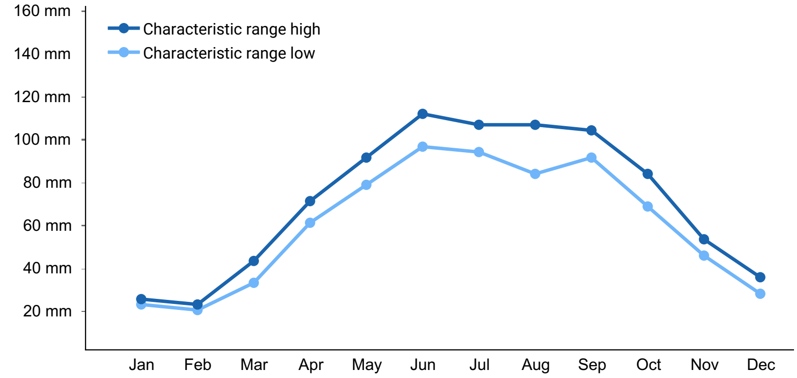


Figure 1. Monthly precipitation range

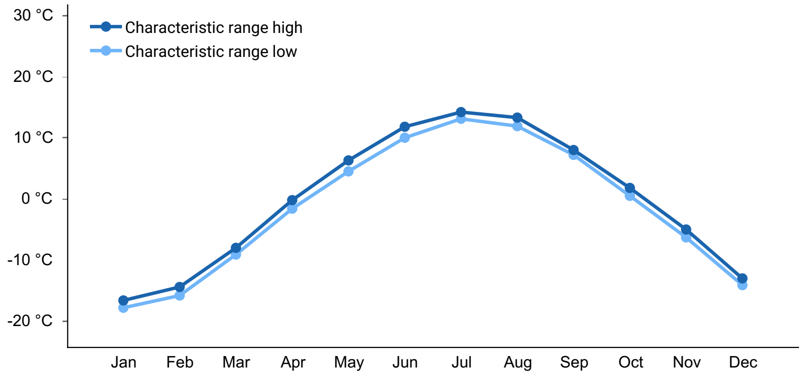


Figure 2. Monthly minimum temperature range

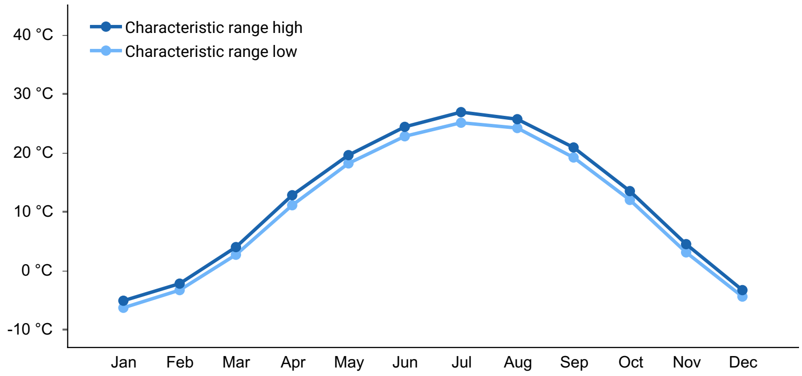


Figure 3. Monthly maximum temperature range

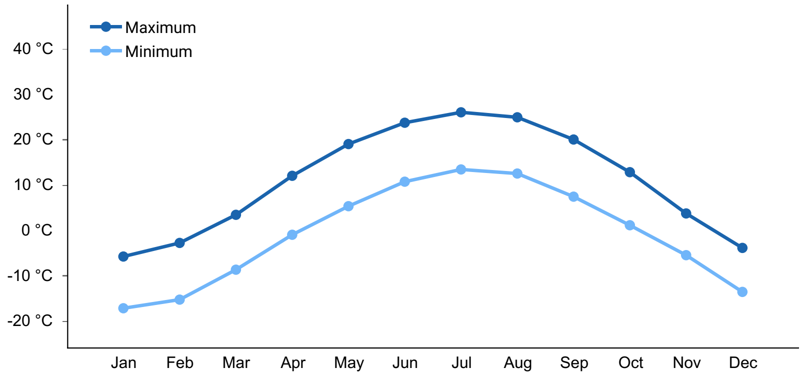


Figure 4. Monthly average minimum and maximum temperature

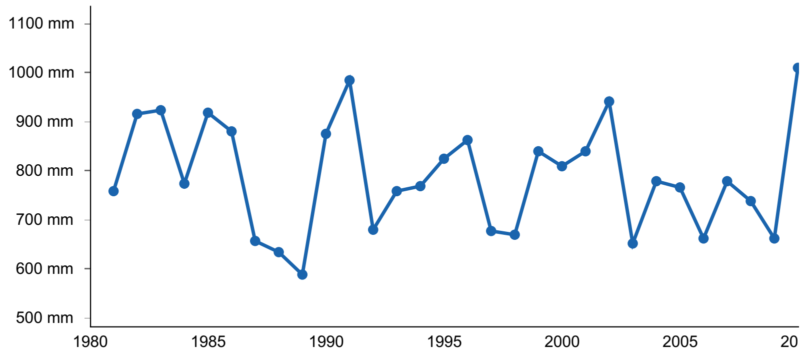


Figure 5. Annual precipitation pattern

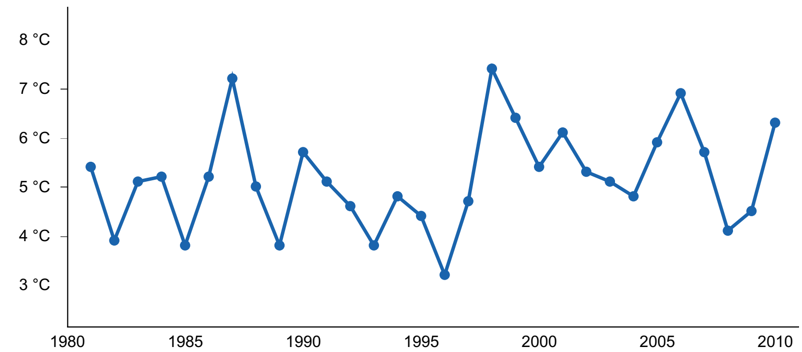


Figure 6. Annual average temperature pattern

Climate stations used

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

Influencing water features

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

Wetland description

Under the Cowardin System of Wetland Classification, or National Wetlands Inventory (NWI), the wetlands can be classified as:
1) Palustrine, forested, broad-leaved deciduous, saturated, or
2) Palustrine, forested, needle-leaved evergreen, saturated, or
3) Palustrine, scrub/shrub, broad-leaved deciduous, saturated, or
4) Palustrine emergent, persistent, saturated

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

Permeability of the soil is impermeable to moderately slow.
Hydrologic Group: D, B/D, C/D
Hydrogeomorphic Wetland Classification: Depressional, forested/organic; Depressional, scrub-shrub/organic
Cowardin Wetland Classification: PFO1B, PFO4B, PSS1B, PEM1B

Soil features

These sites are represented by the Annriver, Barronett, Bjorkland, Bluffton, Cable, Capitola, Clyde, Dancy, Fenander, Giese, Glenflora, Lows, Mann, Marshan, Nokasippi, Rib, Roscommon Variant, Sherry, Warman Variant, and Wozny soil series. Some sites are also represented by Aquents, Aquepts, and Fluvaquents that have not been classified to series. Annriver and Rib are classified as Mollic Endoaqualfs; Lows and Roscommon Variant are Mollic Endoaquepts; Auburndale, Barronett, and Marshfield are Mollic Epiaqualfs; Warman Variant is a Mollic Epiaquept; Cebana and Glenflora are Mollic Glossaqualfs; Roscommon is a Mollic Psammaquent; Capitola is an Aeric Epiaqualf; Pleine is a Histic Humaquept; Elmlake is a Humaqueptic Epiaquent; Veedum and Vesper are Humic Epiaquepts; Minoqua is a Typic Endoaquept; Bluffton, Clyde, and Marshan are Typic Endoaquolls; Bjorkland and Wozny are Typic Epiaqualfs; Cable is a Typic Epiaquept; Mann is a Typic Epiaquoll; Dancy is a Typic Glossaqualf; Giese is a Typic Humaquept; Sherry is a Udollic Endoaqualf; Fenander and Nokasippi are Udollic Epiaqualfs.

These soils formed in various parent materials including outwash, lacustrine deposits, loess, till, alluvium, and residuum. Most soils are very deep, but some sites have bedrock contact as high as 36 inches. These soils are very poorly or poorly drained and remain saturated for much of the growing season. They meet hydric soil requirements.

The surface horizon of these sites is muck, peat, silt loam, sandy loam, fine sandy loam, loam, and loamy coarse sand. Some sites have a very cobbly modifier at the surface. Subsurface horizons have silt loam, clay loam, sandy clay loam, silty clay loam, sandy loam, loam, loamy sand, mucky sand, sand, and clay textures. Some horizons have fine, very fine or coarse sands. Some sites have gravelly and cobbly modifiers on subsurface horizons. Soil pH is extremely acid to moderately alkaline with a range of 4.2 to 7.9. Carbonates may be present up to 18 percent within a depth range for 26 to 80+ inches

Figure 7. Capitola soil series photograph courtesy of UWSP taken on 7/12/2019 in Forest County, WI.

Table 4. Representative soil features

Parent material	(1) Lacustrine deposits (2) Eolian deposits (3) Outwash (4) Till (5) Alluvium (6) Granite (7) Sandstone and shale
Surface texture	(1) Peaty, mucky loamy sand (2) Peaty, mucky sandy loam (3) Peaty, mucky silt loam

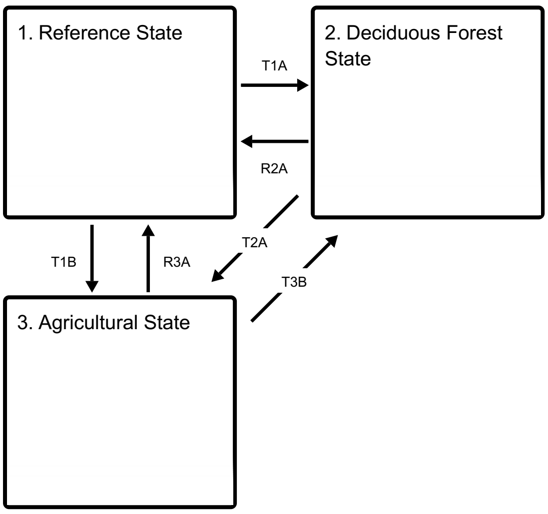
Drainage class	Very poorly drained to poorly drained
Permeability class	Very slow to moderately slow
Soil depth	91–249 cm
Surface fragment cover <=3"	0–7%
Surface fragment cover >3"	0–20%
Available water capacity (0-154.9cm)	2.08–12.83 cm
Calcium carbonate equivalent (0-100.1cm)	0–18%
Soil reaction (1:1 water) (0-100.1cm)	4.2–7.9
Subsurface fragment volume <=3" (Depth not specified)	0–46%
Subsurface fragment volume >3" (Depth not specified)	0–35%

Ecological dynamics

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.

State and transition model

Ecosystem states



T1A - Stand replacing disturbance that includes fire.

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

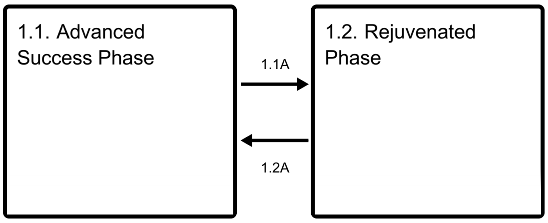
R2A - Deciduous forest community is slowly invaded by conifers.

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

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

T3B - Cessation of agricultural practices leads to natural reforestation, or site is replanted.

State 1 submodel, plant communities



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

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

State 1
Reference State

Reference state is a forest community dominated by red maple (*Acer rubrum*) with groups of balsam fir (*Abies balsamea*). 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 Phase

Figure 8. Photo courtesy of UWSP taken on 7/15/2019 in Forest County, WI.

In the absence of major disturbance—particularly fire—these sites are dominated by a canopy of red maple and balsam fir. Sites may have a super-canopy of large white pine that might be able to maintain itself in few numbers through regeneration in gaps. White pine (*Pinus strobus*) has a moderate shade tolerance and grow to be much larger than red maple and balsam fir at maturity and typically live longer. The shrub layer is not well developed and dominated by red maple sapling and tag alder (*Alnus incana*). The ground layer is covered by cinnamon fern (Osmunda cinamomea), bunchberry (*Cornus canadensis*), Canada mayflower (*Maianthemum canadense*), and blueberry (Vaccinium, spp.) are common.

Dominant plant species

- red maple (*Acer rubrum*), tree
- balsam fir (*Abies balsamea*), tree
- beaked hazelnut (*Corylus cornuta*), shrub
- sedge (*Carex*), grass
- sensitive fern (*Onoclea*), other herbaceous

Community 1.2
Rejuvenated Phase

Figure 9. Photo courtesy of UWSP taken on 7/12/2019 in Forest County, WI.

The canopy of the rejuvenated community is still dominated by original species, but the understory now also includes a well-established younger cohort and perhaps a few additional seedlings and saplings of less shade tolerant species. Black spruce (*Picea mariana*) may occur sporadically on sites, but is unable to compete with red maple and balsam fir with the lack of fire or other disturbance.

Dominant plant species

- red maple (*Acer rubrum*), tree
- balsam fir (*Abies balsamea*), tree
- green ash (*Fraxinus pennsylvanica*), tree
- beaked hazelnut (*Corylus cornuta*), shrub
- chokecherry (*Prunus virginiana*), shrub
- sedge (*Carex*), grass
- sensitive fern (*Onoclea*), other herbaceous

Pathway 1.1A
Community 1.1 to 1.2

 → 

Advanced Success Phase **Rejuvenated Phase**

Light intensity fires, crown breakage from ice and snow and small scale blow-downs create canopy openings, releasing advanced regeneration and stimulating new seedling establishment. Some additional less shade tolerant species such as red oak may be able to enter the community.

Pathway 1.2A
Community 1.2 to 1.1

 → 

Rejuvenated Phase **Advanced Success Phase**

A long period without major canopy disturbance allows gradual replacement of oldest canopy trees by younger cohorts. 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
Deciduous Forest State

Figure 10. Photo courtesy of UWSP taken on 7/18/2019 in Price County, WI.

Pure, or mixed, aspen – paper birch community replaces the reference state community. If seed source is present, red maple and young cohorts of balsam fir readily becomes member of this community.

Dominant plant species

- quaking aspen (*Populus tremuloides*), tree
- birch (*Betula*), tree
- red maple (*Acer rubrum*), tree
- balsam fir (*Abies balsamea*), shrub
- beaked hazelnut (*Corylus cornuta*), shrub
- sedge (*Carex*), grass
- sensitive fern (*Onoclea*), other herbaceous

State 3
Agricultural State

Hay or cultivated crops.

Transition T1A
State 1 to 2

Stand replacing disturbance that must include fire to create conditions for aspen and paper birch to colonize the site.

Transition T1B
State 1 to 3

Removal of forest cover and tilling for agricultural crop production.

Restoration pathway R2A
State 2 to 1

Conifers slowly increase in abundance in the deciduous forest community.

Transition T2A
State 2 to 3

Removal of forest cover and tilling for agricultural crop production.

Restoration pathway R3A
State 3 to 1

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

Transition T3B
State 3 to 2

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

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.

Forest Habitat Type Classification System for Northern Wisconsin (Kotar and Burger, 2017): The sites of this ES keyed out to three habitat types: *Abies balsamea*-Fraxinus nigra-Thuja/Ilex (AbFnThIx); *Abies balsamea*- Fraxinus nigra -Thuja-Arisaema (AbFnThAs); Fraxinus nigra-*Acer rubrum*/Impatiens (FnArI)

Biophysical Settings (Landfire, 2014): This ES is largely mapped as Laurentian-Acadian Northern Hardwoods Forest, North-Central Interior Maple-Basswood Forest, Laurentian-Acadian Alkaline Conifer-Hardwood Swamp Forest, Laurentian-Acadian Herbaceous Wetlands, and Boreal White Spruce-Fir Forest

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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	05/17/2024
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

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

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

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

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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:**