USDA Natural Resources Conservation Service

Ecological site F090AY001WI
Poor Fen

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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

Relationship to Established Framework and Classification Systems:
Wetland Forest Habitat Type Classification System for Northern Wisconsin (Kotar and Burger, 2017): All four visited sites in this ES keyed out to one habitat type: *Picea mariana* - *Larix laricina* [PmLLe]

Biophysical Settings (Landfire, 2014): Much of this site is mapped as Boreal Acidic Peatland Forest, Boreal Acidic Peatland Herbaceous, Boreal Acidic Peatland Shrubland, Central Interior and Appalachian Swamp Shrubland, and Laurentian-Acadian Alkaline Conifer-Hardwood Swamp Forest

WDNR Natural Communities (WDNR, 2015): This ES is most similar to the Black Spruce Swamp, Northern Wet Forest, and Northern Tamarack Swamp communities

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

USFS Subregions: St. Croix Moraine (212Qa), Hayward Stagnation Moraines (212Xf), Glidden Loamy Drift Plain (212Xa), Central-Northwest Wisconsin Loess Plains (212Xd), Perkinstown End Moraine (212Xe), Brule and Paint Rivers Drumlinized Ground Moraine (212Xc), Green Bay Lobe Stagnation Moraine (212Ta)

Small sections occur in Green Bay Lobe Stagnation Moraine (212Ta), Central Wisconsin Moraines and Outwash (222Kb), Bayfield Sand Plains (212Ka), Athelstane Sandy Outwash and Moraines (212Tc)

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

Ecological site concept

The Poor fen ecological site is scattered throughout MLRA 90A in drainageways and depressions on moraines, outwash, lake, and till plains. These sites are characterized by very deep, very poorly drained soils formed in thick organic deposits underlain by glacial till, glacial outwash, or alluvium. Sites are subject to frequent ponding in the spring and fall. Soils remain saturated during the growing season and meet hydric soils requirements. Water is primarily received form precipitation and runoff from adjacent uplands with little groundwater discharge and stream inflow. Soils range from extremely acid to strongly acid.

Poor fen sites have low pH that differentiates it from Organic ecological sites. The low pH is caused by limited interaction with groundwater that may be enriched with carbonates. In addition, the groundwater discharging into Poor fen sites is likely passing through surrounding parent materials that are acidic (i.e. outwash sand). Sites that are acid bogs have very little interaction with groundwater and receive most of their water from precipitation and runoff from adjacent uplands, both of which tend to be quite acidic. The low pH limits vegetative growth.

Associated 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. These sites occur slightly higher on the drainage sequence than Poor fen sites.
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 drier and occur higher on the drainage sequence than Poor fen sites.
F090AY013WI	**Sandy Upland** Sandy Upland consist of deep sandy and loamy deposits of outwash, alluvium, till, and residuum. Soils are primarily sand and loamy sand and have a seasonally high water table within 80 inches, though they don't remain saturated for extended periods. They are much drier and occur higher on the drainage sequence than Poor fen sites.
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 Poor fen sites.

Similar sites

F090AY002WI	**Mucky Swamp** Like Poor fen sites, Mucky Swamp sites consist of herbaceous organic materials, sometimes with mineral soil contact. They are also very poorly drained, permanently saturated wetlands. Organic Nonacid sites are more alkaline than Poor fen sites because they receive more stream and groundwater. Additionally, adjacent sites may have more calcareous parent materials than those adjacent to Poor fen sites. These differences are reflected in the vegetative communities, with Organic Nonacid having improved growing conditions over Poor fen.
F090AY003WI	**Sandy Floodplain** Sandy Floodplain sites are found exclusively on floodplains in sandy and sometimes silty alluvium. These sites are somewhat poorly to poorly drained and are subject to flooding. Some sites may be saturated for long enough for hydric conditions to occur. Unlike Poor fen sites, they receive most of their water from streamflow. They are much less acidic and slightly drier than Poor fen sites. Growing conditions are improved.
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. These sights occupy slightly higher landscape positions than Poor fen sites. The vegetative communities they support are slightly drier and more nutrient-demanding than those supported by Poor fen sites.

Table 1. Dominant plant species

Tree	(1) *Picea mariana* (2) *Larix laricina*
Shrub	(1) *Ledum groenlandicum*
Herbaceous	(1) *Sphagnum*

Physiographic features

This site occurs in drainageways and depressions on moraines, outwash, lake, and till plains. Landform shape is concave or linear, and sites are in the toeslope position. Slopes range from 0 to 2 percent.

These sites are subject to rare to frequent ponding throughout much the year. The ponding duration is brief to long with depths up to 6 inches above the surface. These sites do not flood. These soils have an apparent seasonally high water table (endosaturation) at the surface but the water table may drop during dry conditions. Runoff is

negligible.

Table 2. Representative physiographic features

Hillslope profile	(1) Toeslope
Slope shape across	(1) Concave
Slope shape up-down	(1) Linear
Landforms	(1) Drainageway (2) Depression (3) Outwash plain (4) Till plain (5) Lake plain
Runoff class	Very low
Flooding frequency	None
Ponding duration	Very brief (4 to 48 hours) to long (7 to 30 days)
Ponding frequency	Rare to frequent
Elevation	558–1,148 ft
Slope	0–2%
Ponding depth	0–6 in
Water table depth	0 in
Aspect	Aspect is not a significant factor

Climatic features

The climate of the expansive Wisconsin and Minnesota Thin Loess and Till Plain is highly variable. The eco-climatic zone (the “Tension Zone”) that runs southeast-northwest across the state splits the MLRA. In general, the MLRA has cold winters and warm summers with an adequate amount of precipitation. Near Lake Superior, precipitation and temperature tend to increase. The far western section of the MLRA, known as the western prairie ecological landscape by the Wisconsin DNR, has warmer temperatures compared to the rest of the MLRA because it falls below the eco-climatic zone. The soil moisture regime of MLRA is udic (humid climate). The soil temperature regime is frigid and cryic.

Table 3. Representative climatic features

Frost-free period (characteristic range)	90-115 days
Freeze-free period (characteristic range)	119-139 days
Precipitation total (characteristic range)	30-33 in
Frost-free period (actual range)	71-118 days
Freeze-free period (actual range)	105-150 days
Precipitation total (actual range)	29-34 in
Frost-free period (average)	97 days
Freeze-free period (average)	129 days
Precipitation total (average)	31 in

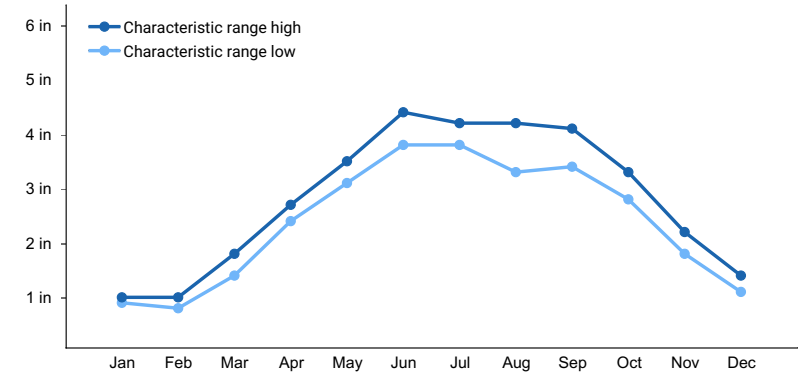


Figure 1. Monthly precipitation range

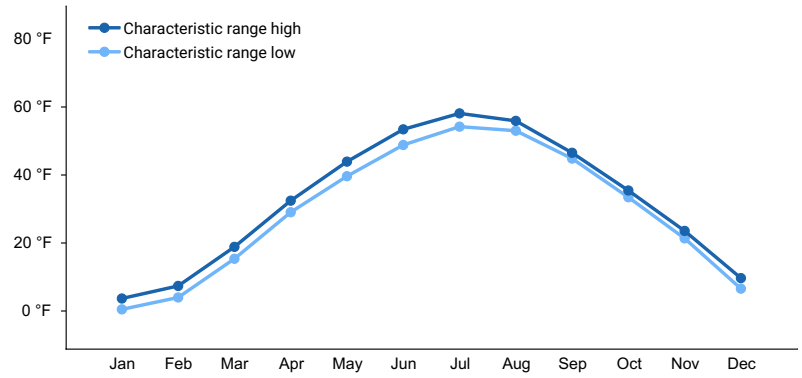


Figure 2. Monthly minimum temperature range

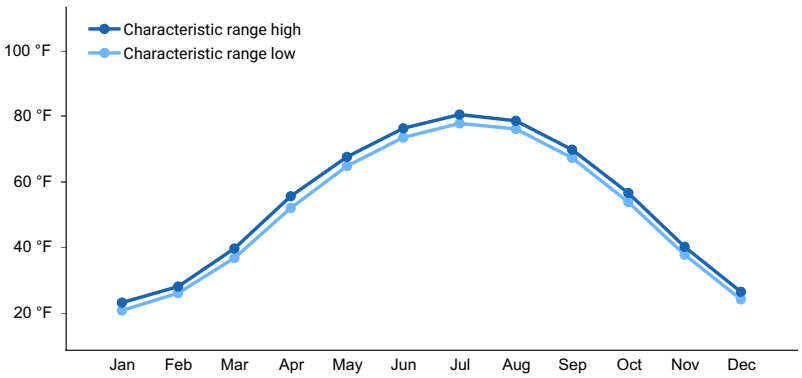


Figure 3. Monthly maximum temperature range

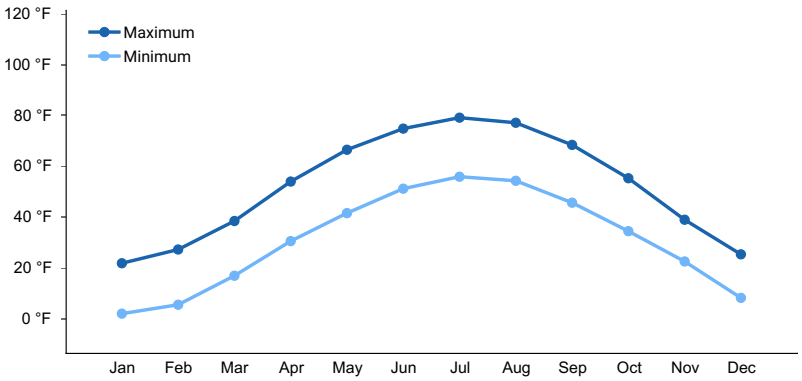


Figure 4. Monthly average minimum and maximum temperature

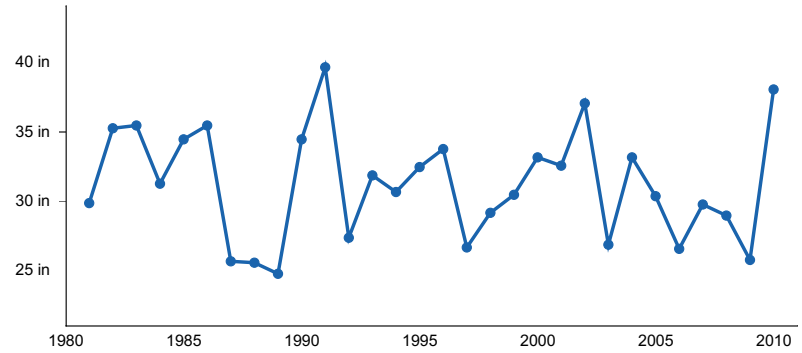


Figure 5. Annual precipitation pattern

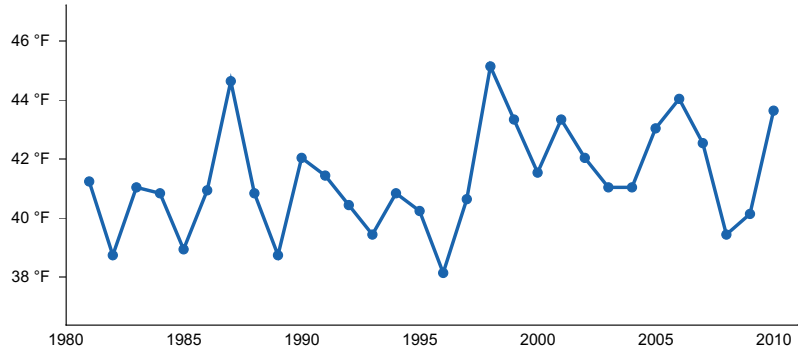


Figure 6. Annual average temperature pattern

Climate stations used

- (1) STAMBAUGH 2SSE [USC00207812], Iron River, MI
- (2) FLORENCE [USC00472826], Florence, WI
- (3) GOODMAN SANITARY DIST [USC00473174], Goodman, WI
- (4) LAONA 6 SW [USC00474582], Laona, WI
- (5) LAKEWOOD 3 NE [USC00474523], Lakewood, WI
- (6) ROSHOLT 9 NNE [USC00477349], Wittenberg, WI
- (7) WAUPACA [USC00478951], Waupaca, WI
- (8) JUMP RIVER 3E [USC00474080], Sheldon, WI
- (9) HOLCOMBE [USC00473698], Holcombe, WI
- (10) BIG FALLS HYDRO [USC00470773], Glen Flora, WI
- (11) WINTER [USC00479304], Ojibwa, WI
- (12) BUTTERNUT 3N [USC00471249], Butternut, WI
- (13) LUCK [USC00474894], Luck, WI
- (14) AMERY [USC00470175], Amery, WI
- (15) ISLE 12N [USC00214103], Isle, MN
- (16) SANDSTONE 6 W [USW00054932], Hinckley, MN
- (17) MILACA [USC00215392], Milaca, MN
- (18) CLOQUET [USC00211630], Cloquet, MN
- (19) AITKIN 2E [USC00210059], Aitkin, MN

Influencing water features

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

The hydrology of Poor fen sites significantly impacts their ecological development. Groundwater movement into these sites brings in water that is exposed to surrounding acidic parent materials, such as sand deposits. This interaction keeps the soils acidic, but less acidic than if it had no groundwater discharge on the site, as it is in the case of acid bogs.

Wetland description

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

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

Permeability of the soil is very slow to moderately slow.
Hydrologic Group: A/D, B/D, C/D
Hydrogeomorphic Wetland Classification: Depressional acidic forested/organic; Depressional acidic scrub-shrub/organic
Cowardin Wetland Classification: PFO4B, PSS4B, PSS3B, PEM1B

Soil features

The soils of this site are represented by the Beseman, Cathro, Daisybay, Dawson, Greenwood, and Loxley soil series. Besemen, Cathro, and Dawson are classified as Terric Haplosaprists; Daisybay is a Terric Haplohemist, Greenwood is a Typic Haplohemist, and Loxley is a Typic Haplosaprist.

These soils are formed in deep, highly decomposed organic material primarily of herbaceous origin. The organic material may be underlain by loamy till, sandy outwash, glacial drift, or loamy alluvium. The thickness of organic deposits ranges from 31 to 60 inches. These sites are very poorly drained and remain saturated throughout the year. They meet hydric soil requirements.

The surface horizon of these soils is muck, peat, or mucky peat. The subsurface horizons are highly decomposed muck—sapric materials. Underlying the muck is mineral soil with loam, sandy loam, silt loam, clay, and sand textures. Soil pH is extremely acid to strongly acidic with a range of 4.0 to 5.4. Surface horizons are absent of fragments, and subsurface fragments less than three inches may exist in the mineral soil material, up to 19 percent volume. Sites are often absent of carbonates, but may have up to 2 percent within 35 inches.

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

Table 4. Representative soil features

Parent material	(1) Organic material (2) Till (3) Outwash (4) Alluvium
Surface texture	(1) Mucky, peaty
Drainage class	Very poorly drained
Permeability class	Very slow to moderately slow
Soil depth	80–100 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (Depth not specified)	15–30.7 in
Calcium carbonate equivalent (Depth not specified)	0–2%
Soil reaction (1:1 water) (Depth not specified)	4–5.4
Subsurface fragment volume <=3" (Depth not specified)	0–19%
Subsurface fragment volume >3" (Depth not specified)	0–1%

Ecological dynamics

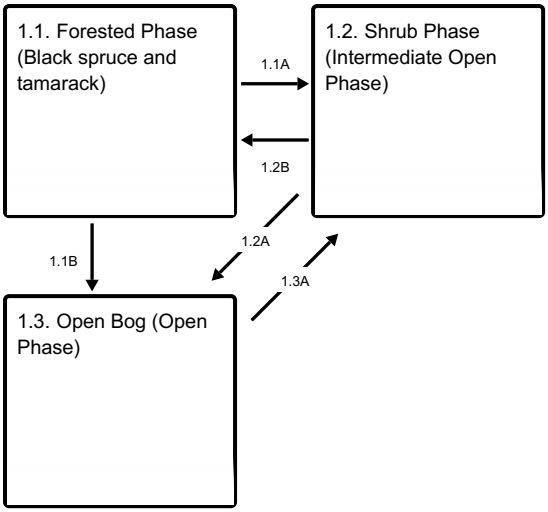
Vegetative communities on this ecological site develop over very long and slow processes. These sites are part of the acid peatlands of northern Wisconsin. Communities range from open bogs to black spruce swamps. These sites developed in wet depressions that allowed organic matter to build over time. These communities are distinct from other wetland communities by the dominance and total carpeting of Sphagnum moss and its effects on the hydrology, pH, and nutrient availability of the site. As Sphagnum moss dominates these sites, it develops thick layers that raise the surface and effectively isolates vegetation from groundwater interaction. Precipitation and runoff become the primary sources of water, which causes sites to become very acidic and poor in nutrients. These sites remain saturated throughout the year based on the moss' ability to retain water. Vegetation on these sites is limited by species that can tolerate saturation, high acidity, and low nutrient availability. Changes to the hydrology can cause severe changes. Drainage near the site that lowers the water table can allow for invasion of woody shrubs.

State and transition model

Ecosystem states

1. Reference State

State 1 submodel, plant communities



State 1
Reference State

This community phase is best described as a poor fen. Sites in this ES are almost universally in the reference state owing to its wetness and low overall productivity. Due to wetness and low productivity this ES has almost exclusively been overlooked for logging and land use conversion or changes. This ES usually has a complete or near complete sphagnum ground cover with some woody low shrubs present, including leatherleaf, Labrador tea, and Bog Rosemary. Sedges and Blue bead lily may also be present in this ES. The dominant tree species in this ES are Black spruce and Tamarack. Other trees may be present but are unlikely to be successfully regenerating. Sporadic trees may include White pine, red maple, and others depending on seed dispersal by squirrels and other animals. Black spruce and tamarack present on these sites are likely to be stunted or partially stunted depending on available nutrient status and location within the site. If the site is very old it may have characteristics of (or be) a true bog. In this case most of the trees will be gone and the sphagnum will be the most dominant plant with the previously mentioned low woody shrubs still being present. The reference state includes three community phases that are part of the mosaic of northern acid peatlands. We chose three distinct community phases to represent the Reference state: 1, a forested phase, 2, shrub phase, and 3, open bog phase. Other communities may exist within this ecological site if they lack similar hydrology. In addition, many sites may exhibit characteristics of multiple community phases. These community phases are not necessarily linear success but may develop in that fashion. While not always present this ES may at times contain some uncommon plants such as pitcher plants, sundews, and lady slippers.

Dominant plant species

- black spruce (*Picea mariana*), tree
- tamarack (*Larix laricina*), tree
- bog Labrador tea (*Ledum groenlandicum*), shrub
- bog rosemary (*Andromeda polifolia*), shrub
- leatherleaf (*Chamaedaphne calyculata*), shrub
- sedge (*Carex*), grass
- bluebead (*Clintonia*), other herbaceous
- sphagnum (*Sphagnum*), other herbaceous

Community 1.1
Forested Phase (Black spruce and tamarack)

Figure 8. Photo courtesy of UWSP taken on 7/12/2019 in Forest County, WI.

This community phase consists forest communities tolerant of seasonal, brief ponding. Vegetation must also be tolerant of acidic soils. The presence of moisture and low pH cause these communities to be slow-growing and canopy trees may be stunted. Such forests are characterized by strong presence, or dominance of black spruce (*Picea mariana*), with tamarack (*Larix laricina*) as a common associate. Other tree species may be present on sites including red maple (*Acer rubrum*), white pine (Pinus storbus), and balsam fir (*Abies balsamea*), but these species will not persist because of the lack of nutrients and high acidity. The shrub layer may be well developed in some communities and often include Labrador tea (*Ledum groenlandicum*) and leatherleaf (*Chamaedaphne calyculata*). Characteristic understory plants include a total covering of Sphagnum moss, blueberries (Vaccinium, spp.), and sedges (Carex, spp.). If the site is very old (has persisted in this phase for a very long time) it may have characteristics of (or be) a true bog. In this case most of the trees will be gone or very stunted and the sphagnum will be the most dominant plant with the previously mentioned low woody shrubs still being present. This condition is distinct from the “Open Bog Phase” 1.3 hydrologically. Since this condition represents the conditions of a true bog (only precipitation as the water source). It is unlikely that there are very many of these Poor Fens that have reached this condition in this MLRA.

Dominant plant species

- black spruce (*Picea mariana*), tree
- tamarack (*Larix laricina*), tree
- bog Labrador tea (*Ledum groenlandicum*), shrub
- leatherleaf (*Chamaedaphne calyculata*), shrub
- blueberry (*Vaccinium*), shrub
- sedge (*Carex*), grass
- sphagnum (*Sphagnum*), other herbaceous

Community 1.2
Shrub Phase (Intermediate Open Phase)

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

This community phase is dominated by Labrador tea and leatherleaf, two species tolerant of extended ponding. The understory is dominated by Sphagnum and sedges. Sphagnum moss is developing thick layers and isolating site from groundwater.

Dominant plant species

- bog Labrador tea (*Ledum groenlandicum*), shrub
- leatherleaf (*Chamaedaphne calyculata*), shrub
- sedge (*Carex*), grass
- sphagnum (*Sphagnum*), other herbaceous

Community 1.3
Open Bog (Open Phase)

This community is dominated by Sphagnum moss and sedges with a few very tolerant associates. These sites often have standing water throughout the growing season.

Dominant plant species

- sedge (*Carex*), grass
- sphagnum (*Sphagnum*), other herbaceous

Pathway 1.1A
Community 1.1 to 1.2

Forested Phase (Black spruce and tamarack)

Shrub Phase (Intermediate Open Phase)

Mortality of canopy species from blow-downs, ice storms, or an increase in ponding frequency and duration. Lack of tree species may be increase ponding duration with the loss of transpiration. Increased connection to nutrient-rich groundwater.

Pathway 1.1B
Community 1.1 to 1.3

Ponding frequency and duration increases dramatically.

Pathway 1.2B
Community 1.2 to 1.1

Shrub Phase (Intermediate Open Phase)

Forested Phase (Black spruce and tamarack)

Decrease in ponding frequency and duration. Sphagnum moss continues to grow and build up thicker layers, causing surface to be isolated from groundwater. Establishment of black spruce and tamarack.

Pathway 1.2A
Community 1.2 to 1.3

Increase in ponding frequency and duration. Mortality of some woody species intolerant to increased ponding. Increased connection to nutrient-rich groundwater.

Pathway 1.3A
Community 1.3 to 1.2

Decrease in ponding frequency and duration. Sphagnum moss continues to grow and build up thick layers, beginning to isolate surface from groundwater. Labrador tea and leatherleaf establishment.

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.

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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	04/27/2024
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):**

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):**

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:**
