USDA Natural Resources Conservation Service

Ecological site F092XY006WI
Wet Sandy Lowlands

Last updated: 4/09/2020
Accessed: 05/11/2025

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): 092X–Superior Lake Plain

The Wisconsin portion of the Superior Lake Plain (MLRA 92) corresponds very closely to the Superior Coastal Plain Ecological Landscape published by Wisconsin Department of Natural Resources (WDNR 2015). The following brief overview of this MLRA is borrowed from that publication.

The Superior Coastal Plain is bordered on the north by Lake Superior and on the south by the Northwest Sands, Northwest Lowlands, and North Central Forest Ecological Landscapes. The total land area is approximately 1.2 million acres, which mostly consists of privately-owned forestland. The climate is strongly influenced by Lake Superior, resulting in cooler summers, warmer winters, and greater precipitation compared to more inland locations. The most extensive landform in this ecological landscape is a nearly level plain of lacustrine clays that slopes gently northward toward Lake Superior. The coastal plain is cut by deeply incised stream drainages and interrupted by the comparatively rugged Bayfield Peninsula.

During the Late Wisconsin glacial period, this area was covered with the advancing and retreating lobes of Superior and Chippewa. The landscape was rippled with moraines, but they were subdued by deposition of lacustrine materials. As the glaciers receded, glacial lakes riddled the landscape—most notably, Glacial Lake Duluth. The glacier receded eastward, exposing the western Lake Superior Basin. The ice covered the eastern basin, blocking the outlet of the lake, and continued to recede and contribute meltwaters that filled the glacial lake. The deep, red clays were deposited during this period of glacial lakes. The meltwaters from the glacier also contained sands which were deposited along the edge of the glacial lakes as beach deposits. Deep, narrow valleys have since been carved by rivers and streams flowing north into Lake Superior.

Historically, the Superior Coastal Plain was almost entirely forested. Various mixtures of eastern white pine (Pinus strobus), white spruce (Picea glauca), balsam fir (Abies balsamea), white birch (Betula papyrifera), balsam poplar (Populus balsamifera), quaking aspen (Populus tremuloides), and northern white-cedar (Thuja occidentalis) occurred on the fine-textured glacio-lacustrine deposits bordering much of the Lake Superior coast. Sandy soils, sometimes interlayered with clays, occur in some places. Such areas supported forests dominated by eastern white pine and red pine (Pinus resinosa). Eastern white pine was strongly dominant in some areas, according to mid-19th century notes left by surveyors of the federal General Land Office (Finley, R. 1976). Dry-mesic to wet-mesic northern hardwoods or hemlock-hardwood forests were prevalent on the glacial tills of the Bayfield Peninsula. Large peatlands occurred along the Lake Superior shoreline, associated with drowned river mouths.

Classification relationships

Habitat Types of N. Wisconsin (Kotar, 2002): All forested sites in this ES key out to Fraxinus nigra – Abies balsamea / Impatiens capensis [FnAbI].

Biophysical Setting (Landfire, 2014): This is ES is mapped as Eastern Boreal Floodplain, Boreal Acidic Peatland System, and Laurentian – Acadian Sub-boreal Mesic Balsam Fir-Spruce Forest. The ES is not well represented by

any of these, but most similar to Eastern Boreal Floodplain.

WDNR Natural Communities (WDNR, 2015): This ES is most similar to Mesic Floodplain Terrace.

USFS Subregions: Superior-Ashland Clay Plain Subsection (212Ya); May contain small areas of Ewen Dissected Lake Plain Subsection (212Jo), Winegar Moraines Subsection (212Jc), Gogebic-Penokee Iron Range Subsection (212Jb), and NorthShore Highlands Subsection (212Lb)*

Major Land Resource Area (MLRA): Superior Lake Plain (92)

Ecological site concept

Wet Sandy Lowlands mainly occurs on the Bayfield peninsula, but is scattered throughout MLRA 92. These sites are associated predominantly with rolling moraines. Typically occurs as scattered low-lying areas along slope bottoms and drainage ways and on lake and swamp borders. The representative soil is the Kinross series. Kinross is a poorly to very poorly drained sandy soil. The soil has a seasonally high water table and often experiences ponding in spring and fall. The water table is high in these soils but may drop to greater than 100cm during droughts. The primary water sources are precipitation, runoff from adjacent uplands, and groundwater, and stream inflow. The soil meets hydric classification. Based on its coarse texture and lack of carbonates, Wet Sandy Lowlands is strongly to extremely acid.

Typical vegetation is mixed hardwoods and conifers, including black ash, American elm, northern white cedar, black cherry, and balsam fir. Ground flora includes ferns, marsh marigold, grasses, and sedges. Sites can sometimes express as open wet marshes or tag/speckled alder thickets depending on ponding duration.This ES is the one most likely to include white cedar and thus the habitat type ThAbFnIx may occur sporadically in this ES. However, heavy deer browse has reduced regeneration of white cedar dramatically throughout much of northern Wisconsin.

Associated sites

F092XY010WI	**Moist Sandy Lowlands** Moist Sandy Lowlands have a sandy mantle overlying finer glaciofluvial materials. The finer materials can cause episaturation in spring and fall, allowing the site to remain moist for some of the growing season, but does not remain saturated, nor does it have hydric conditions. This site is often adjacent to Wet Sandy Lowlands. It is a step higher in the drainage sequence.
F092XY013WI	**Sandy Uplands** These sites are formed primarily in sandy outwash or beach deposits, and some are underlain by finer glaciofluvial material. Sites are moderately well to well drained, but sites with underlying finer materials may have extended saturation in spring and fall. Sites range from strongly acid to neutral and may contain carbonates. This site is often at the top of the drainage sequence that contain Wet Sandy Lowlands.
F092XY003WI	**Peaty Shore Fens** These sites are composed of deep, permanently saturated, partially decomposed herbaceous organic material. They are fens on active shore complexes of Lake Superior and are influenced by water levels and wave action. The depth of organic materials is greater than 200cm, and lack lithic contact. Sites are slightly acidic. These sites can be found below Wet Sandy Lowlands in the drainage sequence, but not always. In some instances, Wet Sandy Lowlands is the end of the drainage sequence.

Similar sites

F092XY007WI	**Wet Loamy or Clayey Lowlands** These sites are poorly to very poorly drained soils that formed in mainly clayey deposits. Some sites may have a sandy or loamy mantle overlying a clayey deposit. Soils remain saturated throughout the year and frequently experience ponding and flooding in the spring and fall. Water table rarely drops below 30cm in drought conditions. Most sites have apparent carbonates, and pH ranges from strongly acid to moderately alkaline. HGM criteria: recharge, Depressional. These sites are found on a similar landform, but are finer textured and found in a different drainage sequence than Wet Sandy Lowlands.
F092XY002WI	**Mucky Swamps** The soils are different, but the vegetation is similar to Wet Sandy Lowlands.

Table 1. Dominant plant species

Tree	(1) *Fraxinus nigra* (2) *Abies balsamea*
Shrub	Not specified
Herbaceous	(1) *Impatiens capensis*

Physiographic features

This site occurs in swamps, closed depressions, open depressions, and stream terraces located on outwash plains and lake plains. Landform shape is concave to linear. Elevation of the landforms range from 185 to 330 meters above sea level. Slopes are 0 to 2 percent.

Table 2. Representative physiographic features

Landforms	(1) Lake plain > Swamp (2) Outwash plain > Stream terrace (3) Lake plain > Closed depression (4) Lake plain > Open depression
Runoff class	Negligible
Ponding duration	Brief (2 to 7 days) to long (7 to 30 days)
Ponding frequency	None to frequent
Elevation	607–1,083 ft
Slope	0–1%
Ponding depth	0–6 in
Water table depth	0–12 in
Aspect	Aspect is not a significant factor

Climatic features

Wet Sandy Lowlands PESD is mostly distributed across the Bayfield peninsula and scattered on the Apostle Islands. The annual average precipitation ranges from 29-32 inches, with a range of 72-103 inches of annual snowfall (PRISM, 1981-2010). The annual average minimum temperatures range from 29-32oF, and the maximum temperatures range from 49-51oF (PRISM, 1981-2010). The length of the freeze-free period ranges from 173 to 194 days, with an average of 184 days (Table 2). The length of the frost-free period ranges from 143 to 166 days, with an average of 156 days (Table 2). This PESD is located in low depressions, so likely has a cooler and wetter microclimate compared to its adjacent PESDs. The data from the weather stations and PRISM are unlikely to capture the precise microclimate data of this PESD based on its physiographic features.

Table 3. Representative climatic features

Frost-free period (characteristic range)	113-114 days
Freeze-free period (characteristic range)	137-138 days
Precipitation total (characteristic range)	32-33 in
Frost-free period (actual range)	113-114 days
Freeze-free period (actual range)	137-138 days
Precipitation total (actual range)	32-33 in
Frost-free period (average)	114 days
Freeze-free period (average)	138 days
Precipitation total (average)	33 in

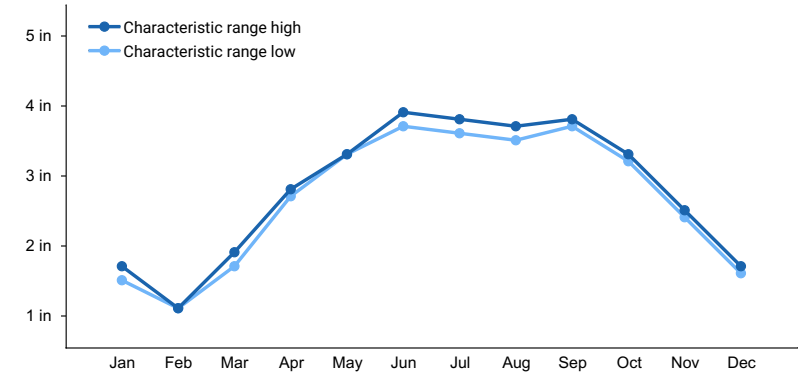


Figure 1. Monthly precipitation range

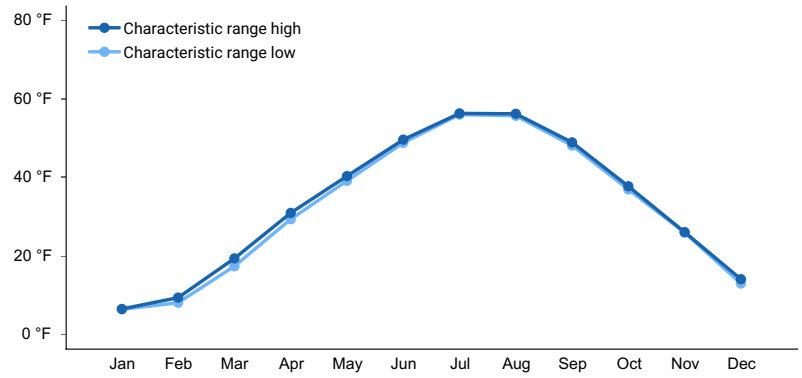


Figure 2. Monthly minimum temperature range

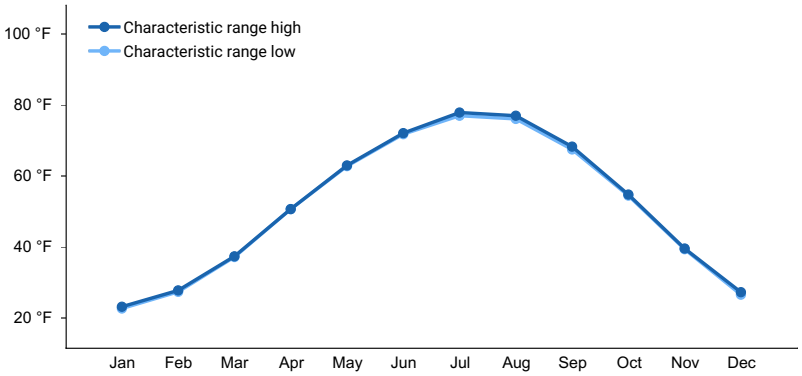


Figure 3. Monthly maximum temperature range

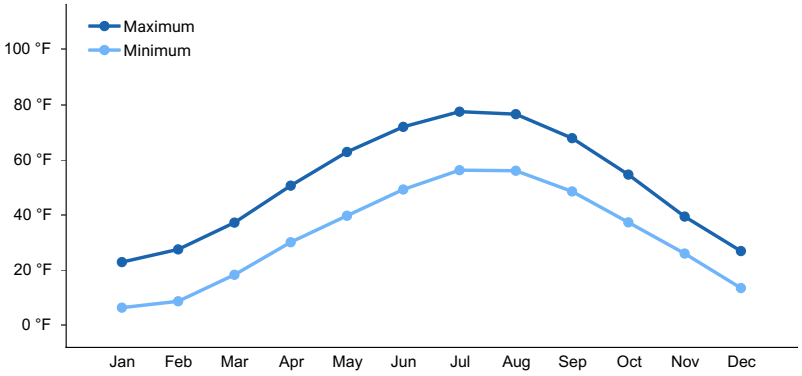


Figure 4. Monthly average minimum and maximum temperature

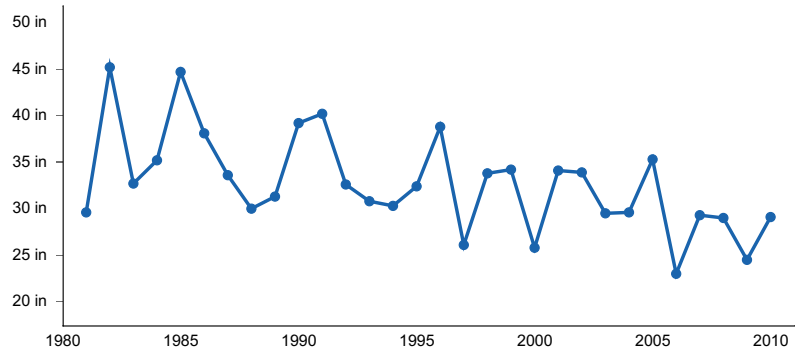


Figure 5. Annual precipitation pattern

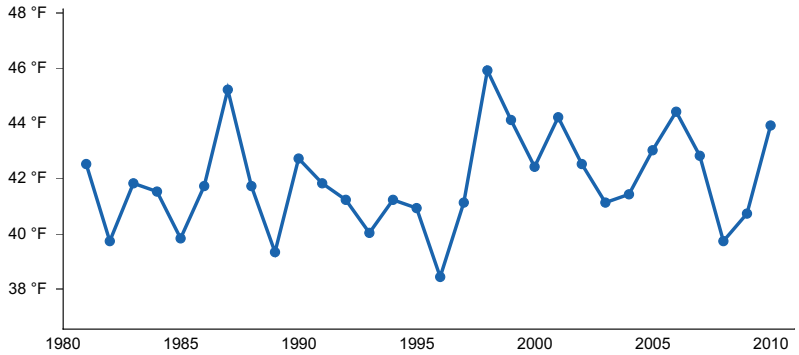


Figure 6. Annual average temperature pattern

Climate stations used

- (1) BAYFIELD 6 N [USC00470603], Bayfield, WI
- (2) MADELINE ISLAND [USC00474953], La Pointe, WI

Influencing water features

Water is received through precipitation, runoff from adjacent uplands, ground water discharge, and stream inflow. Water is discharged from the site primarily through evapotranspiration, stream outflow, and ground water recharge. These sites are wetlands.

Permeability of the soil ranges from moderate to rapid. Runoff is negligible. The hydrologic group of this site is A/D.

These sites may be subject to frequent ponding during spring and fall for long periods with water depths up to 15 cm above the surface. Enough water will percolate into the soil resulting in an apparent seasonal high water table (endosaturation) that is generally at a depth of 0 to 30 cm throughout the year, but will range to 122 cm under dry conditions. Water that percolates in the soil is generally lost through plant uptake and evapotranspiration. There is a high potential for significant ground water recharge.

Wetland description

Under the Cowardin System of Wetland Classification, or National Wetlands Inventory (NWI), the wetlands can be classified as (PFO4B, PSS1B):
1) Palustrine, forested, needle-leaved evergreen, saturated, or
2) Palustrine, scrub-shrub, broad-leaved deciduous, saturated.

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

Soil features

The soils of this site are represented by the Kinross and Deford soil series. Kinross is classified as an Typic Endoaquod while Deford is a Typic Psammaquent.

This ecological site is characterized by very deep, poorly and very poorly drained soils formed in sandy outwash. These soils formed under saturated conditions throughout most of the year and meet the criteria for hydric soils.

The average gravel content within the soil can be as much as 2 percent, while the average content of cobbles and stones is 0 percent. Soil reaction (pH) in the upper 100 cm ranges from extremely acid to strongly acid. Carbonates are absent within 200 cm.

Table 4. Representative soil features

Parent material	(1) Outwash
Surface texture	(1) Sand
Drainage class	Poorly drained to very poorly drained
Permeability class	Moderate to rapid
Soil depth	80 in
Available water capacity (0-60in)	5.12 in
Soil reaction (1:1 water) (0-40in)	4.3–5.5
Subsurface fragment volume <=3" (0-40in)	0–2%

Ecological dynamics

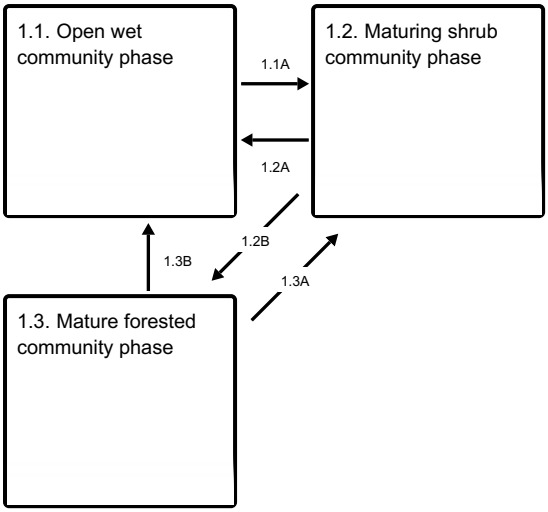
This ES can be characterized as a hydroperiod influenced ecosystem with vegetation ranging from northern wet meadow to northern shrub thicket to Black ash/Balsam fir forest. As flooding is less frequent and of shorter duration the site will tend towards Black ash – Balsam fir forest. Phases that are ponded/flooded more frequently or for longer durations may be dominated by shrubs (Tag and Speckled alder) or sedges if flooding/ponding is very prolonged. These sites are very similar to Mucky Swamps and Wet Floodplains, but are more likely to be in phase 1.3 where Mucky Swamps might tend towards 1.1 and 1.2. A further difference is the operability for logging. This ES might allow logging in winter while in Muck Swamps it is quite unlikely. This difference in operability could be important for restoration after an emerald ash borer infestation.

State and transition model

Ecosystem states

1. Reference State

State 1 submodel, plant communities



1.1A - Ponding frequency and duration decreases

1.2A - Ponding frequency and duration increases

1.2B - Very infrequent flooding

1.3B - Ponding frequency and duration increases dramatically

1.3A - Ponding frequency and duration increases moderately

State 1
Reference State

Reference State is a continuum of hydroperiod influenced vegetation where flooding frequency and duration drive vegetation communities. There are three distinct phases, each being stable within a window of hydroperiod variation. Sites on or near floodplains are most likely to be in phases 1.1 and 1.2 while sites farther from streams are more likely to be in phase 1.3. The higher the frequency and more prolonged the wetness the more likely the site will be a northern wet meadow 1.1 (dominantly sedges with sporadic willows and steeplebush). As wetness frequency and duration decreases the site will become a northern shrub thicket 1.2 and speckled alder (and tag alder) will appear and begin to dominate the vegetation. If a site has very low frequency flooding/ponding that is of short duration a Black ash/Balsam fir forest will likely form 1.3. This forested state can be described by the Kotar Wetland Forest Habitat Type Black ash-Balsam fir/Spotted Touch-me-not [FnAbI]. In some cases this forest will also include White cedar an associate, but deer browsing has limited the regeneration of this species in this MLRA.

Community 1.1
Open wet community phase

With frequent flooding and long durations of inundation this ES will exhibit as a northern wet meadow. The vegetation will be dominated by sedges and grasses with sporadic willows and steeplebush present. Willows can be quite extensive in these sites at times. As long as the hydroperiod is consistent this is a stable state. This phase may also include some isolated large shrubs or trees that persist from a previous phase with a different hydroperiod.

Community 1.2
Maturing shrub community phase

With moderate frequency of flooding with out very long durations of inundation a shrub thicket will form on these sites. The composition of the shrubs on these sites is often dominated by Tag and/or Speckled alder but willow may occur as well. As long as the hydroperiod is consistent this is a stable state.

Community 1.3
Mature forested community phase

In the absence of frequent long duration flooding a wet forest community composed of Black ash and Balsam fir will dominate these sites. Common associates may include Red maple, American elm, and White cedar. White cedar is

more common on these sites than on the similar phase in “Mucky Swamps”. Reproduction of Black ash is often very successful in these stands. A shrub layer may be present in this community phase as well. The shrub layer is often composed of Tag alder and Winterberry. Understory plant communities may be composed of many different species including sedges, grasses, and ferns. Dwarf raspberry and Touch-me-not are commonly present and skunk cabbage may be present if there is moving water (small streams). As long as flooding frequency and duration remain low this is a stable state.

Pathway 1.1A
Community 1.1 to 1.2

This transition represents a decrease in hydroperiod where flooding frequency and duration decrease enough for Tag alder and Speckled alder to establish in what was previously open sedges with Steeplebush, and a few isolated Willows.

Pathway 1.2A
Community 1.2 to 1.1

This transition represents an increase in the hydroperiod where flooding frequency and duration increase enough for Sedges to out compete Tag alder and Speckled alder. This could be done as a restoration effort if hydroperiod is controllable or the stream channel is made narrower causing increased frequency of flooding.

Pathway 1.2B
Community 1.2 to 1.3

This transition represents a decrease in hydroperiod where flooding frequency and duration decrease enough for Black ash and Balsam fir to establish and out compete Tag alder and Speckled alder. This ecosystem is stable with very infrequent and/or short duration flooding. Understory species will shift to Impatiens spp., sedges, and sometimes skunk cabbage. Sites where there is little deer browse may include White cedar as an associate.

Pathway 1.3B
Community 1.3 to 1.1

This transition represents a dramatic increase in the hydroperiod where flooding frequency and duration increase enough for Sedges to out compete Black ash and Balsam fir. This could be done as a restoration effort if hydroperiod is controllable or the stream channel is made narrower causing increased frequency of flooding.

Pathway 1.3A
Community 1.3 to 1.2

This transition represents an increase in the hydroperiod where flooding frequency and duration increase enough for Tag alder and Speckled alder to outcompete Black ash and Balsam fir.

Additional community tables

Other references

Cleland, D.T.; Avers, P.E.; McNab, W.H.; Jensen, M.E.; Bailey, R.G., King, T.; Russell, W.E. 1997. National Hierarchical Framework of Ecological Units. Published in, Boyce, M. S.; Haney, A., ed. 1997. Ecosystem Management Applications for Sustainable Forest and Wildlife Resources. Yale University Press, New Haven, CT. pp. 181-200.

County Soil Surveys from Douglas, Bayfield, and Ashland Counties.

Curtis, J.T. 1959. Vegetation of Wisconsin: an ordination of plant communities. University of Wisconsin Press, Madison. 657 pp.

Davis, R.B. 2016. Bogs and Fens, A Guide to the Peatland Plants of Northeastern United States and Adjacent Canada. University Press of New England, Hanover and London. 296 pp.

Finley, R. 1976. Original vegetation of Wisconsin. Map compiled from U.S. General Land Office notes. U.S. Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.

Hvizdak, David. Personal knowledge and field experience.

Jahnke, J. and Gienccke, A. 2002. MLRA 92 Clay Till Field Investigations. Summary of field day investigations by Region 10 Soil Data Quality Specialists.

NatureServe. 2018. International Ecological Classification Satandard: Terrestrial Ecological Classifications. NautreServe Centreal Databases. Arlington, VA. U.S.A. Data current as of 28 August 2018.

Kotar, J. 1986. Soil – Habitat Type relationships in Michigan and Wisconsin. J. For. and Water Cons. 41(5): 348-350.

Kotar, J., J.A. Kovach and G. Brand. 1999. Analysis of the 1996 Wisconsin Forest Statistics by Habitat Type. U.S.D.A. For. Serv. N.C. Res. Stn. Gen. Tech. Rept. NC-207.

Kotar, J., J. A. Kovach, and T. L. Burger. 2002. A Guide to Forest Communities and Habitat Types of Northern Wisconsin. Second edition. University of Wisconsin-Madison, Department of Forest Ecology and Management, Madison.

Kotar, J., and T. L. Burger. 2017. Wetland Forest Habitat Type Classification System for Northern Wisconsin: A Guide for Land Managers and landowners. Wisconsin Department of Natural Resources, PUB-FR-627 2017, Madison.

Martin, L. 1965. The physical geography of Wisconsin. Third edition. The University of Wisconsin Press, Madison.

McNab, W.H. and P.W. Avers. 1994. Ecological Subregions of the United States: Section Descriptions. USDA For. Serv. Pun. WO-WSA-5, Washington, D.C.

Radeloff, V.C., D.J. Mladenoff, H.S. He and M.S. Boyce. 1999. Forest landscape change in Northwestern Wisconsin Pine Barrens from pre-European settlement to the present. Can. J. For. Res. 29: 1649-1659.

Schulte, L.A., and D.J. Mladenoff. 2001. The original U.S. public land sur¬vey records: their use and limitations in reconstructing pre-European settlement vegetation. Journal of Forestry 99:5–10.

Schulte, L.A., and D.J. Mladenoff. 2005. Severe wind and fire regimes in northern forests: historical variability at the regional scale. Ecology 86(2):431–445.

Soil Survey Staff. Input based on personal experience. Tim Miland, Scott Eversoll, Ryan Bevernitz, and Jason Nemecek.

Stearns, F. W. 1949. Ninety years change in a northern hardwood forest in Wisconsin. Ecology, 30: 350-58.

United States Department of Agriculture, Forest Service. 1989. Proceedings – Land Classification Based on Vegetation: Applications for Management. Gen. Tech. Report INT-527.

United States Department of Agriculture, Forest Service. 1990. Silvics of North America, Vol. 1, Hardwoods. Agricultural Handbook 654, Washington, D.C.

United States Department of Agriculture, Forest Service. 1990. Silvics of North America, Vol. 2, Conifers. Agricultural Handbook 654, Washington, D.C.

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land Resource and Major Land Resource Areas of the United Sates, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296.

United States Department of Agriculture, Natural Resources Conservation Service. 2008. Hydrogeomorphic Wetland Classification System: An Overview and Modification to Better Meet the Needs of the Natural Resources Conservation Service. Technical Note No. 190-8-76. Washington D.C.

Wilde, S.A. 1933. The relation of soil and forest vegetation of the Lake States Region. Ecology 14: 94-105.

Wilde, S.A. 1976. Woodlands of Wisconsin. University of Wisconsin Cooperative Extension, Pub. G2780, 150 pp.

Wisconsin Department of Natural Resources. 2015. The ecological landscapes of Wisconsin: An assessment of ecological resources and a guide to planning sustainable management. Wisconsin Department of Natural Resources, PUB-SS-1131 2015, Madison.

Approval

Chris Tecklenburg, 4/09/2020

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	05/11/2025
Approved by	Chris Tecklenburg
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:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

14. **Average percent litter cover (%) and depth (in):**

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

17. **Perennial plant reproductive capability:**