USDA Natural Resources Conservation Service

Ecological site F094DY005WI
Sandy Uplands

Accessed: 04/29/2024

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.

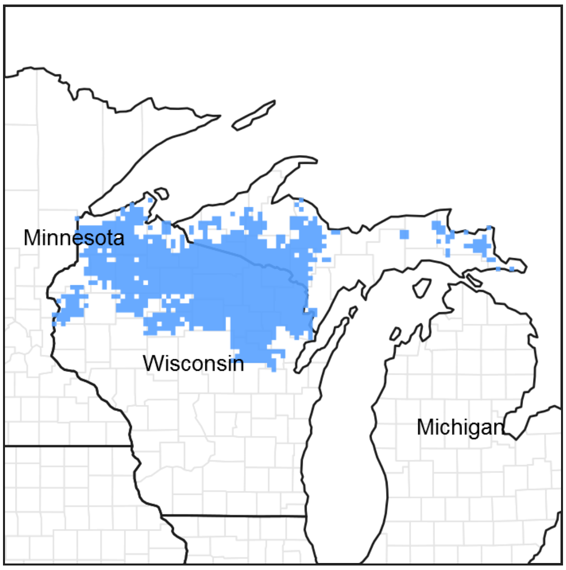


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 094D–Northern Highland Sandy Pitted Outwash

The Northern Highland Sandy Drift region (also referred to as MLRA 94D) lies mostly in northern Wisconsin with a few narrow outwash channels extending into the upper peninsula of Michigan. MLRA 94D encompasses 1.364 million acres and is surrounded by much larger, geologically different MLRAs. MLRA 94D is characterized mainly by sandy and gravelly soils formed in outwash sediments deposited by melt-water streams from late Wisconsin-Age glaciers, which receded from the area about 10,000 years before present (Attig 1985). The Sandy Uplands ecological site occupies about 300,000 acres in MLRA 94D.

Classification relationships

The Sandy Uplands ecological sites correlate to the PArV habitat type developed by Kotar et al (2002); this habitat type is named after Pinus strobus (white pine)-Acer rubrum (red maple)/Vaccinium angustifolium (low-bush blueberry). These species have very high constancy value relative to this site, i.e. they are present on a higher percentage of these sites than other species. This ecological site has a dry moisture regime and is poor in nutrients.

This ecological site is well described in the literature. This site correlates to the Northern Dry Forest after Curtis (1971), the PArV Habitat Type described by Kotar et al (2002) and the White Pine-Red Pine-Oak Forest Group of the National Vegetation Classification System.

Ecological site concept

The Sandy Uplands ecological site represents the dry northern forest, formerly dominated by large red and white pines, now a mix of hardwoods and conifers. This the most extensive ecological site in the MLRA and as such has the most variability in vegetation. This extensive old-growth pine forests that were found on this site were logged off in the late 1800's and early 1900's. Much of the cutover land was cleared for farming, mainly small-scale farms that supplied the local population. Most of these farms faded from scene because they couldn't be as productive as farms to the south. Many sites reverted to forest naturally, many were planted to red pine starting in the 1930's. The result is patchwork landscape of second- and third-growth forests, clearings of various sizes, modern agricultural land--some of which is irrigated, woodland home sites and hunting cabins. Some of the pine forests are attaining the stature of the former mature pine trees on the site, but the multi-layered old growth forest structure is rare.

Similar sites

F094DY006WI	**Steep Sandy Ridges** The transition to Steep Sandy Ridges from Sandy Uplands occurs gradually over several percent of slope gradient; 16 percent is less of a cutoff than an inflection point in an S-curve of ecological change (both floristically and environmentally).

Table 1. Dominant plant species

Tree	(1) *Pinus resinosa* (2) *Pinus strobus*
Shrub	(1) *Vaccinium angustifolium* (2) *Corylus americana*
Herbaceous	(1) *Gaultheria procumbens* (2) *Pteridium aquilinum*

Physiographic features

The Sandy Uplands ecological site is on gently undulating to rolling landforms. These landforms are composed of sandy and gravelly outwash deposits with some areas of sandy till distinguished by a higher stone and boulder content. Most of these landforms are low-relief due to mode of deposition from running water and the coarse texture of material has a low natural angle of repose.

Table 2. Representative physiographic features

Landforms	(1) Outwash plain (2) Moraine (3) Kame
Flooding frequency	None
Ponding frequency	None
Elevation	424–570 m
Slope	2–15%
Ponding depth	0 cm
Water table depth	203 cm

Climatic features

The climate is humid continental with very cold winters and warm summers. As is common across northern Wisconsin, two-thirds of the precipitation falls as rain during the relatively short growing season of late May to early September. Most of the rainfall is transpired by plants. Snow cover is likely in the months of November through April. Snow cover prevents deep frost penetration which promotes groundwater recharge. The microclimate for this ecological site is similar to the regional averages.

Table 3. Representative climatic features

Frost-free period (average)	109 days
Freeze-free period (average)	130 days
Precipitation total (average)	838 mm

Climate stations used

- (1) RHINELANDER [USC00477113], Rhinelander, WI
- (2) EAGLE RIVER [USC00472314], Eagle River, WI
- (3) MINOCQUA [USC00475516], Minocqua, WI
- (4) REST LAKE [USC00477092], Manitowish Waters, WI

Influencing water features

This ecological site is not directly related to surface water and wetlands. But the hydraulic conductivity of the soils on this site is very high, which means they offer potentially rapid recharge to aquifers and nearby wetlands and water bodies.

Soil features

The soils on this site are characterized by their high porosity and low water-holding capacity. There is a loamy sand surface layer that improves edaphic properties. The thickness of the loamy sand layer varies from 6 to 20 inches, typically it gets thinner as slope increases from 2% to 15%. Thinner loamy sand layers are subject to fine-scale patchiness due to soil mixing, mainly by tree wind throw. Soil components on this site include Vilas loamy sand, Sayner loamy sand, Keweenaw loamy sand, and Karlin loamy fine sand.

Table 4. Representative soil features

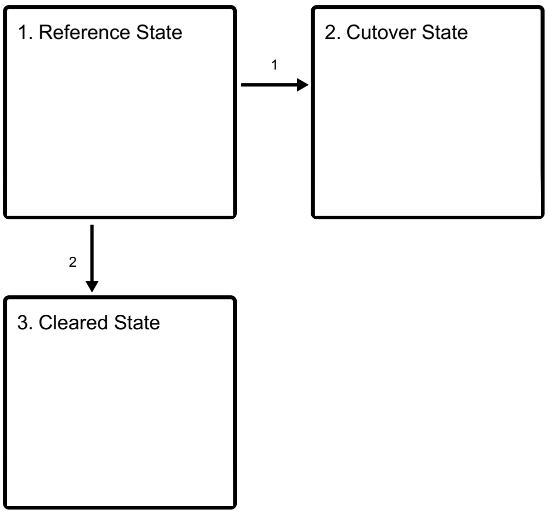
Surface texture	(1) Loamy sand
Family particle size	(1) Sandy
Drainage class	Somewhat excessively drained to excessively drained
Permeability class	Rapid to very rapid
Soil depth	203 cm
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0–2%
Available water capacity (0-101.6cm)	7.62–15.24 cm
Calcium carbonate equivalent (0-101.6cm)	0%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	5.1–6.1
Subsurface fragment volume <=3" (Depth not specified)	2–25%
Subsurface fragment volume >3" (Depth not specified)	0–10%

Ecological dynamics

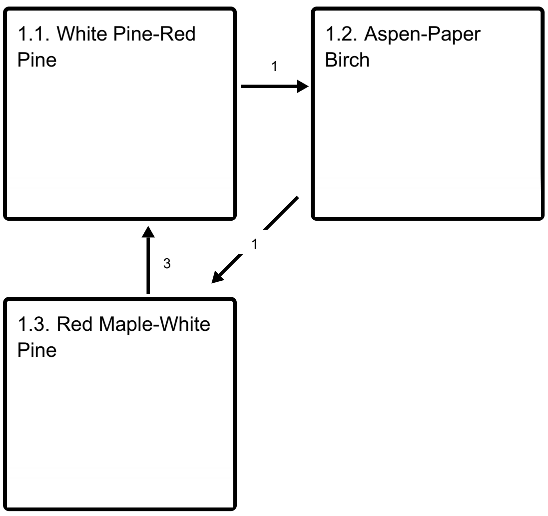
The vast tracts of 200 to 300 year-old pine forests are gone, replaced by second-growth and sometimes third-growth mixed forests of hardwoods and conifers, and an array of disturbance affected non-forested sites. Forest fragmentation has completely changed the plant and animal ecology of these sites. A number of large animal species were extirpated, although some notable re-introductions have occurred by both natural and man-made means (e.g. pine marten, fisher, wolf, and moose). Plant and animal species adapted to old-growth forests have declined, and forest-edge species have increased. On the other hand, a number of native pioneer, open grown or early successional species have benefitted from forest fragmentation. However, numerous invasive exotic species have also gained a foothold, and that threatens some native species and the ecosystem services they provide.

State and transition model

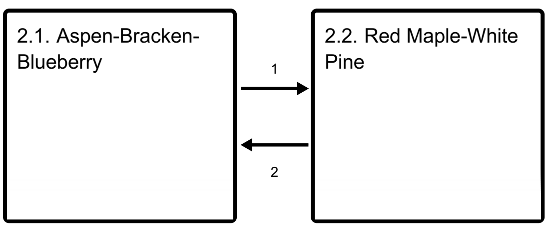
Ecosystem states



State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities

3.1. Converted phase

3.2. Red Pine Plantation

State 1
Reference State

The reference state has largely been replaced by the cutover state. There are only few acres here and there that were untouched during the logging era (1870 to 1920).

Community 1.1
White Pine-Red Pine

Old-growth pine forests were once the most common community phase, now they are the rarest. But there are remnants in isolated spots and some areas superficially resemble this phase.

Community 1.2
Aspen-Paper Birch

This phase occurred in patches in which the pine overstory was removed by a major disturbance factor. This phase indicates that sunlight is reaching the ground stimulating the germination of aspen and paper birch.

Community 1.3
Red Maple-White Pine

As disturbed areas matured, the plant community transformed to contain more shade-tolerant species.

Pathway 1
Community 1.1 to 1.2

The life span of old-growth was such that they persisted through gap replacement for hundreds of years. But a windstorm and subsequent fires could reset the succession back to a starting point. Pioneer species such as aspen and birch will fill the gap within a few years.

Pathway 1
Community 1.2 to 1.3

Decades of disturbance-free stability would lead to the mid-seral stage.

Pathway 3
Community 1.3 to 1.1

As the decades pass, large pine trees form a super-canopy leading to a multi-layered old growth forest.

State 2
Cutover State

The Cutover State is the most common. The logging era and subsequent forest management and land development has touched nearly every acre. Not to say this state can't resemble the reference state after many years have past but it's does have the old stumps for decades and coarse woody debris, downed logs and snags that function as den trees are probably missing from this state.

Community 2.1
Aspen-Bracken-Blueberry

This initial post-logging community phase took root when land use stabilized. Post-logging stump fields were either cleared for agriculture or part of large slash fueled wildfires or forest regeneration began almost immediately. The burned areas grow up to large berry patches until forest tree seedling appear and gradually overtop the ground layer. Farming was hit or miss in this climate and soil region. Old field succession is very common even to this day; many pastures and old hayfields face encroachment from woody vegetation unless actively managed.

Community 2.2
Red Maple-White Pine

These moderately shade tolerant species succeed the aspen dominated early forest. The presence or absence of seed trees is critical to the development of this forest cover type. It's likely that advance regeneration will eventually produce seed trees. Modern forestry practices make this part of the plan and spare seed trees from logging.

Pathway 1
Community 2.1 to 2.2

The life span of aspen is shorter on dry, nutrient-poor sites. As these stands break up they are replaced by the shade-tolerant maple that persists in the understory until release. Maples are such prolific seed producers they are the most common follow-up to the pioneer species. Pine regeneration is more problematic unless there are sufficient seed trees in the vicinity. White pine is more shade-tolerant than red pine, it is more to have advance regeneration i.e persist in the understory until release.

Pathway 2
Community 2.2 to 2.1

A clear cut logging operation or large natural disturbance (like a tornado) can set this phase back to the early seral stage of aspen and other sun-loving plants.

State 3
Cleared State

Community 3.1
Converted phase

Community 3.2
Red Pine Plantation

Transition 1
State 1 to 2

Transition 2
State 1 to 3

Additional community tables

Other references

Attig JW. 1985 Pleistocene geology of Vilas County, Wisconsin. Wis. Geol. and Nat. Hist. Surv. Information Circular 50. 38 pp.

Black MR., Judziewicz EJ. 2009. Wildflowers of Wisconsin and the Great Lakes Region: a comprehensive field guide. 2nd ed. Univ. Wisc. Press 275pp. Curtis JT. 1971. The Vegetation of Wisconsin: an ordination of plant communities. Univ. Wisc. Press. 657 pp.

ECOMAP. 1993. National hierarchical framework of ecological units. USDA Forest Service, Washington, D.C.

Epstein E, Smith W, Dobberpuhl J, Galvin A. 1999. Biotic inventory and analysis of the Northern Highland-American

Legion State Forest. Bureau of Endangered Resources, Wisconsin Department of Natural Resources. 263pp.
Faber-Langedoen D, editor. 2001. Plant communities of the Midwest: Classification in an ecological context. Association for Biodiversity Information, Arlington, VA. 61 pp. + appendix (705 pp.).
Grime JP. 1981. Plant Strategies and vegetation Processes. J Wiley and Sons. 222pp.
Kent M, Coker P. 1992. Vegetation Description and Analysis: A Practical Approach. CRC Press, Boca Raton, FL. 363pp.
Kotar J, Kovach JA, Burger TL. 2002. A Guide to Forest Communities and Habitat Types of Northern Wisconsin. 2nd ed. University of Wisconsin-Madison, Dept. of Forest Ecology and Management.
Kozlowski TT, Pallardy SG. 2002. Acclimation and adaptive responses of woody plants to environmental stresses. The Botanical Review 68(2): 270-334.
Mitchell SJ. 2013. Wind as a natural disturbance in forests; a synthesis. Forestry 86:147-157.
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.
Pielou EC. 1991. After the Ice Age: the return of life to glaciated North America. Univ. Chicago Press, Chicago, IL. 366 pp.
Wisconsin Department of Natural Resources (DNR). 2014. The ecological landscapes of Wisconsin: an assessment of ecological resources and a guide to planning sustainable management. Chapter 14, Northern Highland Ecological Landscape. Wisconsin Department of Natural Resources, PUB-SS-1131P 2014, Madison. 84 pp.
Wisconsin Initiative on Climate Change Impacts (WICCI) 2011. Wisconsin's Changing Climate: Impacts and Adaptations. Nelson Institute for Environmental Studies, University of Wisconsin-Madison & the Wisconsin Department of Natural Resources, Madison, Wisconsin.
Zobel RW. 1992. Soil environment constraints to root growth. Adv. Soil Science 19:27-51.

Contributors

Mark Krupinski

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	
Approved by	
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:**