Ecological site F094DY005WI
Sandy Uplands

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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): 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	420 – 570 m
Slope	0 – 20 %
Ponding depth	0 cm
Water table depth	200 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)	110 days
Freeze-free period (average)	130 days
Precipitation total (average)	840 mm

- (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	200 cm
Surface fragment cover <=3"	0 – 10 %
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	7.62 – 15.24 cm
Calcium carbonate equivalent (0-101.6cm)	Not specified
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	Not specified

Soil reaction (1:1 water) (0-101.6cm)	5.1 – 6.1
Subsurface fragment volume <=3" (Depth not specified)	0 – 30 %
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

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 6. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 7. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 8. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 9. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 10. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 11. Community 3.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

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

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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	
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:**

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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):**

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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:**
