USDA Natural Resources Conservation Service

Ecological site F094DY008WI
Sandy Terraces And Plains

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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.

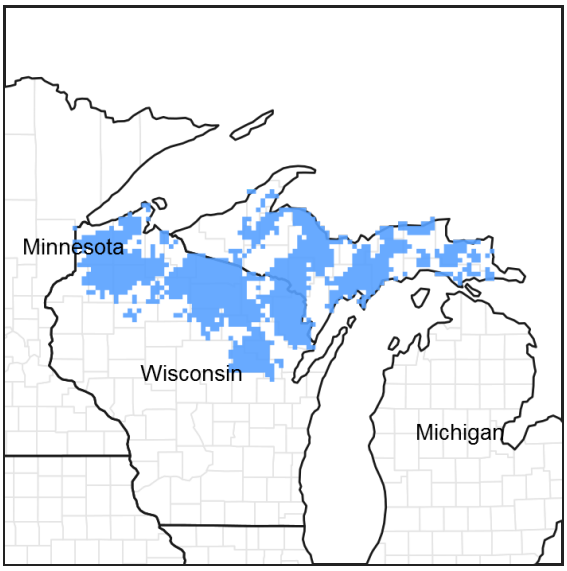

Figure 1. Mapped extent

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

MLRA 94D, the Northern Highland Sandy Drift, comprises 1.346 million acres of outwash plains, sandy moraines, wetlands and numerous water bodies (large lakes, small ponds, large rivers, small streams and flowages of all sizes). The Sandy Terraces and Plains ecological site comprises about 60,000 acres in MLRA 94D.

Classification relationships

The Sandy Terraces and Plains ecological sites correlate to the PArVAa habitat type developed by Kotar and Burger (2002); this habitat type is named after Pinus strobus (white pine)-Acer rubrum (red maple) /Vaccinium angustifolium (low-bush blueberry)-Aralia nudicaulis (wild sarsaparilla). 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-mesic moisture regime and is poor to medium in nutrients.

Ecological site concept

ATTENTION: This ecological site meets the NESH 2014 requirements for PROVISIONAL. A provisional ecological site is established after broad ecological site concepts are identified and an initial state-and-transition model is drafted. Following quality control and quality assurance reviews of the ecological site concepts, an identification number and name for the provisional ecological site are entered into ESIS. A provisional ecological site may include

literature reviews, land use history information, some soils data, legacy data, ocular estimates for canopy and/or species composition by weight, and even some line-point intercept information. A provisional ecological site does not meet the NESH 2014 standards for an Approved ESD, but does provide the conceptual framework of soil-site correlation for the development of the ESD. For more information about this ecological site, please contact your local NRCS office.

The Sandy Terraces and Plains ecological site is distinguished by flat terrain with less than 6% slopes and moderately well drained soils that support productively growing xerophytic species. The overstory species can tap into a water table at 3 to 6 feet during the spring months and the understory benefits from the cool shade of the closed canopy forest.

Table 1. Dominant plant species

Tree	(1) *Pinus strobus* (2) *Acer rubrum*
Shrub	(1) *Corylus cornuta* (2) *Vaccinium angustifolium*
Herbaceous	(1) *Maianthemum canadense* (2) *Eurybia macrophylla*

Physiographic features

This nearly level ecological site is located between the uplands and the wetlands. If the site is linear in shape, it is called a terrace, if irregular or ovoid, then it is a plain. Outwash fans are somewhat triangular; given that the sediment was derived from a narrow glaciofluvial channel, then fanned out with distance. Most notably, these flat, very porous landforms are groundwater flowthrough conduits; subsurface water flows from the upland watershed to the wetlands where the water surfaces.

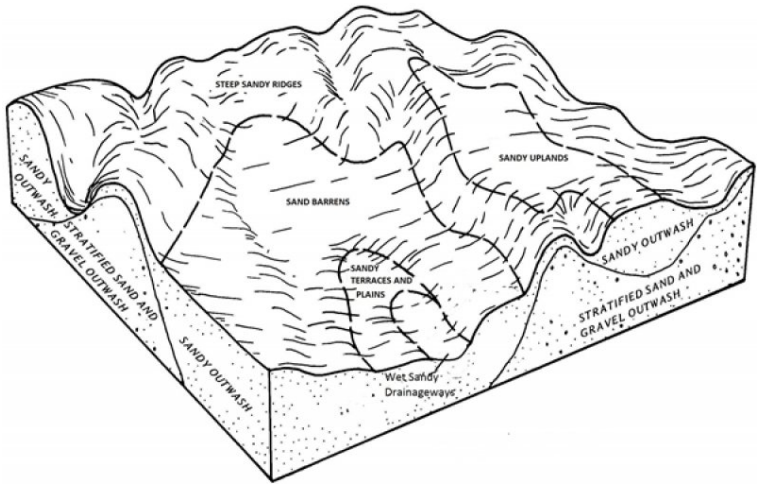

Figure 2. Sandy ecological sites on pitted outwash

Table 2. Representative physiographic features

Landforms	(1) Outwash plain (2) Outwash terrace (3) Outwash fan
Flooding frequency	None
Ponding frequency	None
Elevation	408–567 m
Slope	0–6%
Water table depth	102–203 cm
Aspect	Aspect is not a significant factor

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 of this site matches the average regional climatic data, as this is the site that deviates the least from the ambient conditions on a day-to-day basis.

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

The extra groundwater flowing through these sites makes a more productive site. The depth of groundwater flowthrough is dependent on the size of the subsurface watershed and the height of the hydraulic head, because the hydraulic conductivity of these sites is uniformly high. Thus, smaller ecological sites with the same size watershed and hydraulic head as Sandy Terraces and Plains would be a wetter site, and likely classify as Wet Sandy Drainageways.

Soil features

Sandy Terraces and Plains ecological sites have nearly level, moderately well drained sandy soils characterized by the Croswell series. The surface layer can either be loamy sand or sand with loamy sand more common. The subsoil and substratum to depth of 80 inches is mostly sand with some gravelly layers in places. The spodic horizon is well developed in these soils; spodic materials increase the water-holding and cation exchange capacities of the soil and thus the productivity of this site. In many of these horizons, iron and aluminum sesquioxides have cemented sand grains together to form a material called ortstein (iron stone). Also present is a seasonal high water that occurs between 40 and 80 inches deep during spring months in most years. The presence of the water table also increases the productivity of the site, even though the water table drops below 80 inches rapidly during the growing season, it may still be within the root zone of large trees.

Table 4. Representative soil features

Surface texture	(1) Loamy sand (2) Sand
Family particle size	(1) Sandy
Drainage class	Moderately well drained
Permeability class	Rapid to very rapid
Soil depth	203 cm
Surface fragment cover <=3"	2–10%
Surface fragment cover >3"	0–2%

Available water capacity (0-101.6cm)	5.08–10.16 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)	5.1–5.9
Subsurface fragment volume <=3" (Depth not specified)	5–20%
Subsurface fragment volume >3" (Depth not specified)	0–4%

Ecological dynamics

The Sandy Terraces and Plains ecological site has plant communities that are responding directly or indirectly to the seasonal high water table and subsequent groundwater flowthrough at 3 to 6 feet. The deeper-rooted forest canopy species, especially white pine, have a decided advantage because they are essentially sub-irrigated on this site. The root zone of the ground flora is mostly confined to the dry upper 2 feet, thus these are water stress-tolerant species such as wintergreen (*Gaultheria procumbens*) and trailing-arbutus (*Epigaea repens*). The success of the canopy species creates a favorable habitat for shade-tolerant species such large-leaf aster and wild sarsaparilla. As a result of the interaction of climate, vegetation and sandy parent materials, this nearly level, sub-irrigated site has soils that are strongly podzolized and exhibit clear Spodosol diagnostic horizons: O horizons at the surface, albic horizon and spodic horizons with humus accumulation in the upper part and iron cementation in the lower part. This site has the full expression of soil characteristics that supported the vast pinery of pre-European settlement times.

State and transition model

Ecosystem states

1. Reference State

2. Cutover State

3. Disturbed/Invaded State

4. Converted State

State 1 submodel, plant communities

1.1. Quaking Aspen-Balsam Fir Phase

1.2. White Pine-Red Maple Phase

State 2 submodel, plant communities

2.1. Aspen-Bracken-Blueberry Phase

2.2. Red Maple-White Pine Phase

State 3 submodel, plant communities

3.1. Weeds-Worms Phase

3.1. Weeds-Worms Phase

State 4 submodel, plant communities

4.1. Farmland Phase

4.2. Pine Plantation Phase

4.3. Developed Phase

State 1
Reference State

The Reference State for this site has two phases: one for early successional, post-disturbance communities and another for later successional, edaphic climax communities. These phases represent endpoints on the successional continuum, but this site seems to have fewer naturally occurring intergrade phases on the continuum than other sites. The transition from early phase to late phase proceeds rapidly due in part to the short life span of quaking aspen and balsam fir compared to white pine and red maple.

Community 1.1
Quaking Aspen-Balsam Fir Phase

This phase lasts for about fifty years, at that point the aspen-fir stand starts to break-up. Then advance regeneration of white pine and shade tolerant hardwoods will take over the site. The shrub layer, consisting of hazel, native honeysuckles, viburnums and dogwood species is typically well developed on this phase.

Community 1.2
White Pine-Red Maple Phase

This phase is very long lasting and was the dominant pre-logging era cover type on this site and is now largely absent. It had the old growth characteristics of multi-layered canopy, a well-developed ground flora and a great deal of woody debris in various states of decomposition on the ground.

State 2

Cutover State

The Cutover State has largely replaced the Reference State. The Cutover Sate has two main phases; intergrade phases can occur depending on the how and when logging was conducted. Recent logging will regenerate to the Aspen-Bracken-Blueberry Phase and logging sites older than fifty years have enough time to produce a community that resembles the pre-logging condition minus some of the old-growth pine trees.

Community 2.1
Aspen-Bracken-Blueberry Phase

Community 2.2
Red Maple-White Pine Phase

State 3
Disturbed/Invaded State

The Disturbed/Invaded State is occurring with increasing frequency on this site. This state has two main phases, earthworm invaded and weed invaded. Earthworm invaded sites may or may not have invasive weeds but weed invaded sites are likely to have worms as well.

Community 3.1
Weeds-Worms Phase

This phase is becoming increasingly common. Earthworms are not native to the glaciated northern part of the country. Native earthworms have been spreading north at a very slow rate for thousands of years and still have not reached this far north. However non-native earthworms have been introduced by human activities and have changed the soils and concomitantly the vegetation on many of these sites. Worms ingest the organic duff layer on forest soils, and transform it into a mineral soil horizon that is warmer, lacks porosity and is more erodible. These changes also affect the plant communities, and some species are favored, some are not. Native wildflowers such as twisted-stalk and bellflower are reduced while trillium and jack-in-the-pulpit increase.

Community 3.2
Weeds-Worms Phase

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State 4
Converted State

The Converted State is common on this site because of the ease of development of the nearly level, sandy soils.

Community 4.1
Farmland Phase

A small amount of this site remains in agricultural production. Potatoes are a common crop on this phase. Hobby farms fields, pasture land, and old fields that were once in production are also represented by this phase. Abandoned farmland is recolonized by weeds and then native pioneer species.

Community 4.2
Pine Plantation Phase

More land is in Pine Plantation Phase than the other phases on this site. These nearly level, moderately well drained sites were readily cleared and easier to plant than any other site. Red pine and white pine are both productive on this site. Older pine plantations begin to resemble natural stands, if thinned at proper intervals. Thinning maximizes their productivity.

Community 4.3
Developed Phase

This phase is on the increase due to the ease of constructing roads, trails and building sites on nearly level, sandy soils. The seasonal high water table between 3 and 6 feet may be a complication for some uses such as dwellings with basements.

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

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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:**

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):

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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:**
