USDA Natural Resources Conservation Service

Ecological site F094DY006WI
Steep Sandy Ridges

Accessed: 05/09/2024

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.

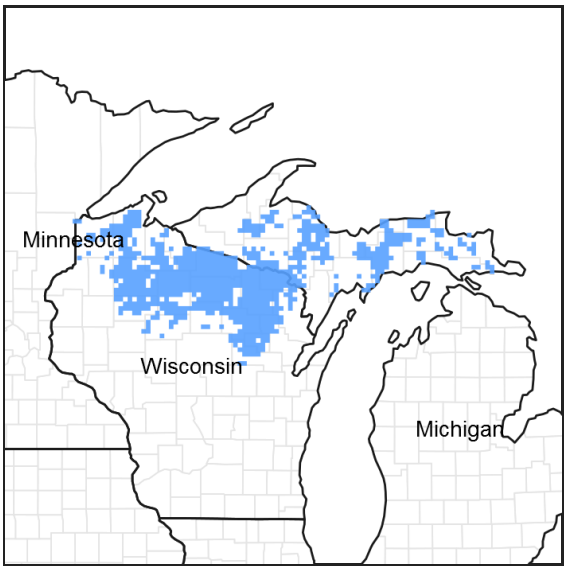


Figure 1. Mapped extent

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 Steep Sandy Ridges ecological site occupies about 75,000 acres in MLRA 94D.

Classification relationships

The Steep Sandy Ridges ecological sites correlates to a hybrid of two habitat types--PQE and PArV-- both developed by Kotar et al (2002); these habitat types are named after Pinus strobus (white pine)-Quercus spp. (oak species)/Gaultheria procumbens (wintergreen) and Pinus strobus (white pine)-Acer rubrum (red maple)/Vaccinium angustifolium (low-bush blueberry) respectively. 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.

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 modal concept of the Steep Sandy Ridges is that they occur on slopes of 16% or greater and this affects their soil-plant relationships, productivity and management. Steep Sandy Ridges ecological site differs markedly from Sandy Uplands in several important aspects, and most notably one: aspect. Most of these sites have a strong linear orientation, but some are curvilinear, which reduces the overall effect of aspect on the site. The effect in question is caused by the site's orientation relative to the sun. Given a south-southwest exposure and other factors equal a site is drier, due to the greater potential evapo-transpiration.

Table 1. Dominant plant species

Tree	(1) *Pinus resinosa* (2) *Quercus rubra*
Shrub	(1) *Diervilla lonicera* (2) *Vaccinium angustifolium*
Herbaceous	(1) *Maianthemum canadense* (2) *Gaultheria procumbens*

Physiographic features

The Steep Sandy Ridges ecological site is mainly a glaciofluvial stream deposit of well-rounded sand and gravel. There are several modes of deposition for these landforms. Quantity and velocity of the meltwater is crucial. As are the three main locations for these deposits to be laid down: 1) under glacial ice creating eskers, kames and crevasse fillings 2)on top of glacial ice which becomes collapsed outwash and 3) away from the glacial ice. The first two ice contact deposits are more likely to produce Steep Sandy Ridges after the ice melts and the land attains stability, while the third creates outwash plains which were once braided meltwater channels.

Table 2. Representative physiographic features

Landforms	(1) Esker (2) Crevasse filling (3) Collapsed outwash plain
Elevation	408–570 m
Slope	16–50%
Aspect	NE, SW

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.

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) REST LAKE [USC00477092], Manitowish Waters, WI
- (3) EAGLE RIVER [USC00472314], Eagle River, WI
- (4) MINOCQUA [USC00475516], Minocqua, 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. This site is steep, therefore the potential for runoff could be high, however infiltration is very rapid given the coarse textures and vegetative cover on this site and that makes runoff less of a factor. The lines of hydraulic equipotential beneath this site have a steep gradient as well.

Soil features

The soil components associated with this ecological site have a slope of 16% or greater and a loamy sand or coarser surface texture. They are members of Vilas, Sayner, Rubicon, Emmert, or Pelissier series. These soils are characterized by their very high hydraulic conductivity and their very low water-holding capacity. Vilas and Rubicon represent the sandy end of the spectrum while Sayner, Emmert and Pelissier are gravelly to extremely gravelly, which makes them sought after for road-building material.

Table 4. Representative soil features

Surface texture	(1) Gravelly loamy sand (2) Very gravelly sand
Family particle size	(1) Sandy
Drainage class	Excessively drained
Permeability class	Rapid to very rapid
Soil depth	203 cm
Surface fragment cover <=3"	0–20%
Surface fragment cover >3"	0–10%
Available water capacity (0-101.6cm)	5.08–7.62 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)	5–40%
Subsurface fragment volume >3" (Depth not specified)	0–10%

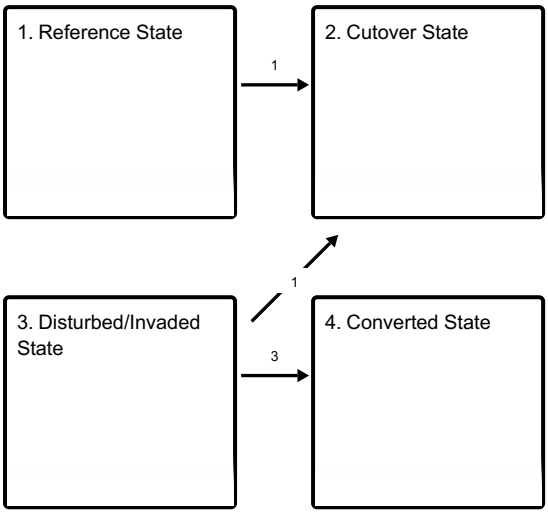
Ecological dynamics

The Steep Sandy Ridges ecological site contains a number smaller sites. The aspect of steeper slopes determines the microclimate variation. South facing slopes are warmer and drier, thus much more drought-prone than north-

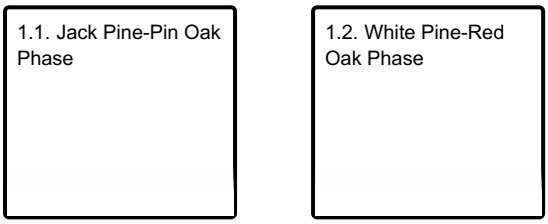
facing slopes, west-facing slopes, with afternoon sun, are slightly warmer and drier than eastern exposure. The drier slopes are likely to be less productive. Also, upper slopes are drier than their lower counterparts. The lower side slopes, while still steep, seem to be more productive, probably because they more sheltered. The summit areas (ridgetops) of Steep Sandy Ridges are less sloping but they are more exposed to wind, with it's drying effect and higher potential for damage to trees. The white pines on ridgetops often show pronounced flagging, that is, more branches on the downwind side of the tree. So while this site is distinctive in it's own right due to steepness, it can broken down into small components that are have different productivity classes and disturbance regimes.

State and transition model

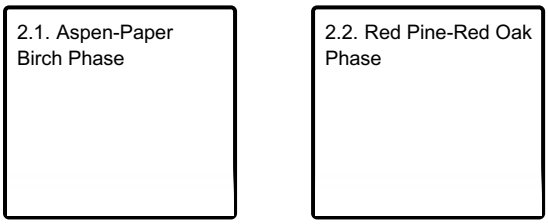
Ecosystem states



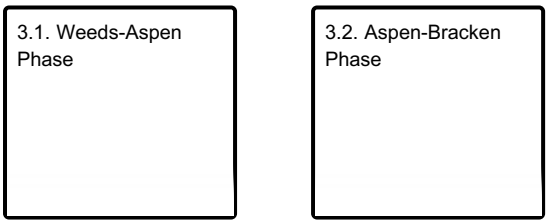
State 1 submodel, plant communities



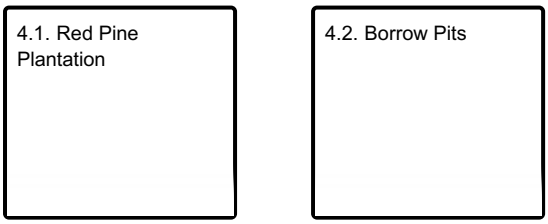
State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 submodel, plant communities



State 1
Reference State

The Reference State of Steep Sandy Ridges has two phases--the Jack Pine-Pin Oak Phase and the White Pine-Red Oak Phase--plus these phase tended to intergrade because they occurred simultaneously on different parts of the site but often in close proximity. In addition, the Jack Pine-Pin Oak Phase was succeeded by the White Pine-Red Oak Phase because the latter species are longer-lived and more shade tolerant. Moreover, jack pine and pin oak stands are regenerated by fire and this site has areas that are more or less protected from by their physiography, portions of the have natural fire breaks such as the lower slopes of the leeward side of the ridge. The Reference State exists as mere remnants of its former extent.

Community 1.1
Jack Pine-Pin Oak Phase

This phase can represent both early and late successional stages (the so-called edaphic climax) on this site; this is due to highly pronounced microsite variability. Small patches on this site can resemble Sand Barrens ecological sites, other patches are more mesic. The driest parts of this site occur on unprotected south to southwest facing slopes and also have little to no silt, clay, or humus in the topsoil. Several dozen feet away, soil and slope conditions are likely to be different and the plants respond accordingly. Small areas of barren conditions are not the dominant condition, but they do reduce overall site productivity and probably the species richness of the site as well.

Community 1.2
White Pine-Red Oak Phase

The dominant species in this phase are also tolerant of dry conditions, but they are have a broader range of adaptation and are more competitive on somewhat better sites than jack pine or pin oak. However, they are not as fire adapted as aforementioned species, but they have evolved with fire and fire plays a part in the ecology of these species. In general, white pine and red oak occur on and are thus indicative of the more productive areas of this site.

State 2
Cutover State

The Cutover State is by far the most common condition on this site. The pre-logging era vegetation on this site was mostly mature pine and oak forest. Both types of trees were in demand at the time. Pines were the most commonly logged species because of their usefulness as light-weight, moderate-strength building lumber, oaks were second in demand as sawlogs. This resulted in extensive clear-cuts that are now, one hundred years later, starting to resemble the former condition on some of these sites.

Community 2.1
Aspen-Paper Birch Phase

Following the clear-cut, aspen was the most abundant tree, paper birch was second. Of the two aspen species, bigtooth aspen is the most adapted to this site because of its lower nutrient and moisture requirements. This does not preclude quaking aspen clones from establishing on this site, but the stems self-prune at a higher rate and mature trees are more prone to fungal infection and are thus shorter-lived. Birch trees have been known to form pure stands on this site in the absence of viable competition. Both of these species give way over time to the more shade tolerant and longer-lived oaks and pines. However, jack pine is seldom present in second growth forests given its fire-dependent characteristics.

Community 2.2
Red Pine-Red Oak Phase

This phase is the modern-day edaphic climax for this site. Red pines supplant white pines because red pine seed has become more abundant than white pine seed and this species is well-adapted to dry sites. Red oak is also hardy, somewhat shade tolerant, and red oak acorns are widely dispersed by wildlife.

State 3
Disturbed/Invaded State

The Disturbed/Invaded State is less common on this ecological site than on other closely related sites, but given the prominent landforms on which this site is located, disturbance is readily identified. The disturbance is largely man-made, such as logging activities or accelerated erosion on bare soil; natural disturbances include drought, fire, wind damage, insect herbivory, and disease outbreaks. Insect herbivory spreads disease, but herbivory alone can extirpate some species. These disturbances open the canopy, expose the forest floor to sunlight and increase the risk of soil erosion. While these sites are prone to disturbances, many invasive species do not thrive here due to steep, thin soils; but that also slows recovery of the forest canopy. The main effect of disturbance is lower site productivity; a longer recovery time from disturbance is a property inherent to this site.

Community 3.1
Weeds-Aspen Phase

Native pioneer species found on this site include bracken fern, raspberry, blackberry, sweet fern, Canada goldenrod, staghorn sumac, quaking aspen, bigtooth aspen, and pin cherry. Lichens and mosses are important in establishing soil conditions favorable to the growth of those higher plants. Non-native weedy species that become serious pests include spotted knapweed, Canada thistle, burdock, and ragweed; weeds of lesser concern include common mullein, yellow and orange hawkweeds, dandelion, brome grass, birdsfoot trefoil, bindweed, tansy, plantain, sheep sorrel, bladder campion, sweet clover, horseweed, redtop and quackgrass.

Community 3.2
Aspen-Bracken Phase

As the canopy gradually closes, with mainly bigtooth or quaking aspen, weeds are shaded out. Although some weeds like spotted knapweed are pernicious and produce toxins that inhibit the growth of other plants, most are susceptible to being out-competed. Bracken fern is the common understory plant at this stage; bracken also has allelopathic properties (i.e. toxic to other plants). This phase seems to persist for long time. Although aspen trees are not lived, aspen clones are persistent and they will re-sprout in sunlit areas.

State 4
Converted State

The Converted State is common on most upland ecological sites, less so on this one because steepness limits alternatives. However, this site is an excellent source of sand and gravel, and is often preferred because of the ease of access. Landforms such as eskers are especially utilized. Plantations are less common on this site because of difficulties in preparing and planting steep ground, however these sites are often included in larger plantations.

Community 4.1
Red Pine Plantation

Red pine is planted because it is highly productive, even on marginal sites. Also red pine is highly uniform in its genetic characteristics which ultimately produces a uniform stands of trees. Many of these plantations are reaching maturity. Older plantations that have been well-managed through thinning resemble natural stands in terms of structure and species richness.

Community 4.2
Borrow Pits

This site has limitations for development due to steepness but is used commonly for borrow pits, roads and trails (especially on the summit) and cut and fill areas. Borrow pits, when active, are miscellaneous (non-soil) areas that lack vegetation. However, when inactive, they re-vegetate, albeit at highly variable rates. Some areas will produce a pioneer/weed species community in the first growing season, other areas will remain barren for years to come because the exposed sediments hold zero available water, heat up too much and lack any primary plant nutrients. Eventually the extreme conditions are softened by accumulation of organic matter transported to the site by wind, water, and wildlife.

Transition 1
State 1 to 2

Most of these sites were part of the great cutover of the logging era (1870-1920). It would very difficult to find a Steep Sandy Ridges ecological site that was left untouched by loggers

Restoration pathway 1
State 3 to 2

Canopy closure can reduce the weed problem. There no known methods to eliminate earthworms, if they could be eliminated, they could readily re-infest a site.

Transition 3
State 3 to 4

A disturbed area is a prime candidate for conversion to another land use if the opportunity arises. On Steep Sandy Ridges sites, agriculture is less desirable, but borrow pits are common. It is easier to excavate ridges than flat areas. Tree planting, however, is not easier.

Additional community tables

Other references

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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:**

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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:**
