

Ecological site F093AY012MN

Sandy Upland Forest

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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): 093A–Superior and Rainy Stony and Rocky Till Plains and Moraines

The Superior Stony and Rocky Loamy Plains and Hills, Western Part is located and completely contained in northeastern Minnesota. This area has both the highest and lowest elevations in the state, as well as some of the state's most rugged topography (Ojakangas and Matsch, 1982). The MLRA was glaciated by numerous advances of the Superior, Rainy, and Des Moines glacial lobes during the Wisconsin glaciation as well as pre-Wisconsin glacial periods. The geomorphic surfaces in this MLRA are geologically very young (i.e., 10,000 to 20,000 years) and dominated by drumlin fields, moraines, small lake plains, outwash plains, and bedrock-controlled uplands (USDA-NRCS, 2022). There are thousands of lakes scattered throughout the region that were created by these glacial events. Most of these lakes are bedrock-controlled in comparison to adjacent glaciated regions where glacial drift deposits are much thicker and the lakes occur in depressions atop the glacial drift (Ojakangas and Matsch, 1982). In contrast to adjacent MLRAs, the depth to the predominantly crystalline or sandstone bedrock in MLRA 93A is relatively shallow because the most recent glacial events were more erosional than depositional (Ojakangas and Matsch, 1982).

Classification relationships

Major Land Resource Area (MLRA): Superior Stony and Rocky Loamy Plains and Hills, Western Part (93A) USFS Subregions: Northern Superior Uplands Section (212L); North Shore Highlands Subsection (212Lb) Relationship to Other Established Classifications: FDn32 - Northern Poor Dry-Mesic Mixed Woodland, Fire-Dependent Forest/Woodland System, Northern Floristic Regions, Minnesota Department of Natural Resource

Ecological site concept

This site is a dry to dry-mesic pine-hardwood woodland on sandy and loamy soils. Historically, fire was a common disturbance on this site. Soils are moderately well drained to well drained. Tree species include jack pine, red pine, white pine, spruce, and mixed hardwoods.

Associated sites

F093AY010MN	Moist Sandy Forest Moist Sandy Forest. This site occurs on sandy soils on outwash plains. Soils are somewhat poorly drained to moderately well drained and have a seasonal wet layer depth of 4-18 inches.
F093AY011MN	Dry Sandy Upland Forest The Dry Sandy Upland Forest occurs on course-textured soils that are well drained to excessively drained. Soils have a low available water capacity (2-4 inches). Usually a stonier surface texture comparatively and drier. Less common to find northern pin oak on this site.

Similar sites

F093AY011MN	Dry Sandy Upland Forest The Dry Sandy Upland Forest occurs on course textured soils that are well drained to excessively drained. Soils have a low available water capacity (2-4 inches). Usually a stonier surface texture comparatively and drier.
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Table 1. Dominant plant species

Tree	(1) <i>Pinus banksiana</i> (2) <i>Quercus</i>
Shrub	(1) <i>Amelanchier</i> (2) <i>Vaccinium angustifolium</i>
Herbaceous	(1) <i>Maianthemum canadense</i> (2) <i>Cornus canadensis</i>

Physiographic features

This site is often located on outwash plains, moraines, and upland slopes. No flooding or ponding occurs. The seasonal high water table ranges from 30 - 42 inches (76 - 107centimeters).

Table 2. Representative physiographic features

Landforms	(1) Outwash plain (2) Flat (3) Esker
Runoff class	Low to high
Flooding frequency	None
Ponding frequency	None
Elevation	310 – 530 m
Slope	0 – 40 %
Water table depth	80 – 110 cm
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation is 26-32 inches (66 to 81 centimeters). Measurable climatic variation (due to the lake effect) near some of Lake Superior may alter temperature and precipitation (Hillman & Nielsen, 2023). About 65 percent of the precipitation falls as rain

during the growing season (May through September) and about 21 percent falls as snow. The freeze-free period averages about 130 days and ranges from 97 to 150 days (USDA-NRCS, 2022).

Table 3 Representative climatic features

Frost-free period (characteristic range)	90-110 days
Freeze-free period (characteristic range)	120-140 days
Precipitation total (characteristic range)	660-810 mm
Frost-free period (actual range)	40-110 days
Freeze-free period (actual range)	100-150 days
Precipitation total (actual range)	660-810 mm
Frost-free period (average)	90 days
Freeze-free period (average)	130 days
Precipitation total (average)	740 mm

- (1) GRAND PORTAGE [USC00213296], Grand Portage, MN
- (2) WOLF RIDGE ELC [USC00219134], Finland, MN
- (3) DULUTH [USW00014913], Duluth, MN
- (4) ELY 25E [USC00212555], Ely, MN
- (5) KETTLE FALLS [USC00214306], Voyageurs Natl Park, MN
- (6) BRIMSON 2S [USC00210989], Brimson, MN
- (7) KABETO GAMA [USC00214191], Orr, MN

Influencing water features

This site is not influenced by riparian or wetland features.

Wetland description

N/A

Soil features

Representative soil series include Friendship, Grytal, Lavell, Oysterlake, Pequaywan, Slimlake, and Wurtsmith. These soils are coarse textured Entisols and Inceptisols. Parent materials include eolian sand, loamy drift, sandy outwash, and glaciofluvial deposits. Soil drainage is moderately well drained to well drained. Due to a loamy mantel on the Aldenlake and Cloquet soil series the hydrology is altered and those series are included in the Sandy Upland Forest site.

Table 4. Representative soil features

Parent material	(1) Eolian deposits (2) Drift (3) Glaciofluvial deposits (4) Outwash
Surface texture	(1) Sandy loam (2) Fine sandy loam (3) Loam (4) Loamy sand
Drainage class	Moderately well drained to well drained
Permeability class	Moderately rapid to rapid
Depth to restrictive layer	200 cm
Soil depth	200 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	0 – 10 %
Available water capacity (0-152.4cm)	5.08 – 15.24 cm
Calcium carbonate equivalent (0-101.6cm)	Not specified
Sodium adsorption ratio (Depth not specified)	Not specified
Soil reaction (1:1 water) (0-101.6cm)	4.5 – 6.5

Subsurface fragment volume <=3" (Depth not specified)	0 – 50 %
Subsurface fragment volume >3" (Depth not specified)	0 – 70 %

Ecological dynamics

This site is a dry to dry-mesic conifer dominated woodland. Soils are sandy or loamy and have a low available water capacity. This site was historically was influenced by drought and reoccurring fire events. Numerous successional communities may occur on this site. Immediately following a disturbance event, the early successional community consists of red pine, white pine, balsam fir and quaking aspen. As the community matures in the absence of major disturbances, the canopy becomes co-dominated by red pine, jack pine, spruce, and oak. The rotation of all fires combined is estimated to be approximately 100 years, understory fire occurrence may have been more often pre-colonization and depending on fire regime (MN DNR, 2005).

Jack pine (*Pinus banksiana*) occurs over a broad range of glacially scoured bedrock and outwash sand plains, with cover ranging from sparse to dense, depending on habitat features. On sand plain habitats, the combination of physiognomy, floristics, and disturbance factors can be used to further distinguish the denser forests with blueberries (*Vaccinium* spp.) and feathermoss (*Pleurozium schreberi*) from more open stands, maintained by a 25 to 50 year fire rotation, where oaks (*Quercus* spp.), little bluestem (*Schizachyrium scoparium*), and other prairie forbs may be common. Herbivores respond positively to the understory plants after fire has cycled through the stands. This provides ideal browsing to moose and deer (Faber-Langendoen 2001). Young woodlands recovering from fire, are dominated by jack pine mixed with quaking aspen and paper birch. Followed by a transition period marked by a gradual decline in jack pine and quaking aspen. Red pine and paper birch are most abundant during this transition period. Spruce, balsam fir, and white pine invade and increase in abundance. At 95+ years mature woodlands form characterized by mixed canopies dominated by spruce with some paper birch, balsam fir, white pine, and old jack pine. Black spruce is the spruce species most associated with this community, but white spruce is also present (MN DNR 2005, MN DNR 2022).

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 (%)
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Table 6. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 7. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 8. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 9. Community 2.2 plant community composition

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

No field plots were established for this project. A review of the scientific literature and professional experience were used to approximate the plant communities for this provisional ecological site. Information for the state-and-transition model was obtained from the same sources. All community phases are considered provisional based on these plots and the sources identified in ecological site description. Future field verification will refine the plant communities described in this project.

References

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Contributors

Anita Arends, Former ESI Specialist, Springfield IL
Mike Rokus, SSOL, Duluth, MN
Kade Anderson, NRCS Ecologist, Duluth, MN

Approval

Suzanne Mayne-Kinney, 9/06/2024

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	09/06/2024

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:
