

Ecological site F103XY026MN

Clayey Upland Forests

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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): 103X–Central Iowa and Minnesota Till Prairies

MLRA 103 is in Minnesota (56 percent) and Iowa (44 percent) and consists of approximately 18 million acres. It is in the Western Lake Section of the Central Lowland Province of the Interior Plains in an area known as the "Des Moines Lobe" of the Wisconsin-age ice sheet. The MLRA is mostly on a young, nearly level to gently rolling, glaciated till plain that has moraines and glacial lake plains in some areas. The plain is covered with glacial till, outwash, and glacial lake deposits. Recent alluvium consisting of clay, silt, sand, and gravel fill the bottoms of most of the major river valleys. Paleozoic bedrock sediments, primarily shale and limestone, underlie the glacial deposits in most of the area. The annual precipitation increases from northwest to southeast. Most of the rainfall occurs as high-intensity, convective thunderstorms during the summer. Two-thirds or more of the precipitation falls during the freeze-free period. Snowfall is common in winter. Ground water supplies are adequate for the domestic, livestock, municipal, and industrial needs. Nearly all of this area is farmland, and about four-fifths is cropland.

Classification relationships

U.S. Department of Agriculture (USDA) Land Resource Regions and Major Land Resource Areas (USDA NRCS, 2006) Major Land Resource Area (MLRA): Central Iowa and Minnesota Till Prairies (103) U.S. Forest Service (USFS) National Hierarchical Framework of Ecological Units (Cleland et al.,2007) Section: North central Glaciated Plains (251B) Subsections: Upper Minnesota River-Des Moines Lobe (251BA) and Southern Des Moines Lobe (251Be) International Vegetation Classification Hierarchy (NatureServe) Class: 1 Forest & Woodland Subclass: 1.B Temperate & Boreal Forest & Woodland Formation: 1.B.2 Cool Temperate Forest & Woodland Division: 1.B.2.Na Eastern North American Forest & Woodland The reference state is similar to Minnesota Department of Natural Resources MHs39 Southern Mesic Maple-Basswood Forest

Ecological site concept

The Clayey Upland Forests ecological site is located on uplands with soils with thin epipedons, fine textures, and argillic subsurface horizons. Surface textures include clay loam, silty clay loam, and silt loam. These soils were formed predominantly under forest vegetation and are classified as Alfisols. This ecological site does not pond or flood.

Associated sites

F103XY028MN	Clayey Wet Forests The Clayey Wet Forests ecological site occurred on poorly drained soils derived from clayey till and lacustrine materials. These soils developed under forest vegetation. The site is located on ridges, slight concavities, and linear areas.
R103XY015MN	Depressional Marsh The Depressional Marsh ecological site is in concave depressions downslope from the Sandy Upland Forests site. The soils are very poorly drained and often ponded during the early growing season. Water-tolerant vegetation such as cattails, bulrushes, and sedges are dominant.

Table 1. Dominant plant species

Tree	(1) <i>Acer saccharum</i> (2) <i>Tilia americana</i>
Shrub	(1) <i>Ostrya virginiana</i> (2) <i>Prunus virginiana</i>
Herbaceous	(1) <i>Viola pubescens</i>

Physiographic features

The Clayey Upland Forests ecological site occurs primarily on ground, end, and lateral moraines and lake plains. The most common landform position include backslopes, summits, and shoulders that are linear to slightly convex both vertically and horizontally. This site is generally found in an area known as the Big Woods ecoregion in Minnesota.

Figure 1. Block diagram of the representative Clayey Upland Forests and associated ecological sites.

Figure 2. A map of Minnesota with the Big Woods ecoregion shaded in dark green. (Minnesota Department of Natural Resources)

Figure 3. Distribution of the Clayey Upland Forests ecological site within MLRA 103. In many cases, the data set is not spatially consistent across political boundaries due to the method by which soils were mapped; e.g. due to county subsets.

Table 2. Representative physiographic features

Hillslope profile	(1) Backslope (2) Summit (3) Shoulder
Landforms	(1) Ground moraine (2) End moraine (3) Lateral moraine (4) Lake plain
Runoff class	Medium to very high
Elevation	210 – 560 m
Slope	0 – 40 %
Water table depth	30 – 200 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

The soil temperature regime of MLRA 103 is classified as “mesic” (i.e., mean annual soil temperature between 46 and 59°F). The average freeze-free period of this site is 152 days, while the average frost-free period is 127 days. The average mean annual precipitation is 31 inches, which includes rainfall plus the water equivalent from snowfall. Cold air drainage, a lower water table, and the fact that dry soils are generally warmer than wet soils make this site warmer than adjacent, downslope areas.

Table 3 Representative climatic features

Frost-free period (characteristic range)	120-130 days
Freeze-free period (characteristic range)	150-160 days
Precipitation total (characteristic range)	790-810 mm
Frost-free period (actual range)	120-130 days
Freeze-free period (actual range)	140-160 days
Precipitation total (actual range)	760-810 mm
Frost-free period (average)	130 days
Freeze-free period (average)	150 days
Precipitation total (average)	790 mm

- (1) CHANHASSEN WSFO [USC00211448], Chanhassen, MN
- (2) AMBOY [USC00210157], Amboy, MN
- (3) BUFFALO 2NE [USC00211107], Buffalo, MN
- (4) FARIBAULT [USC00212721], Faribault, MN

Influencing water features

The Clayey Upland Forests ecological site receives water from precipitation, lateral subsurface flow, and to a lesser extent from runoff. On some areas, direct precipitation may be the only water source. Spring is the wettest time of the year. Soils are classified as endosaturated. The depth to saturation for the central concept soil components is between 30 and 50cm during the spring months and may drop to as low as six or more feet (200cm) later in the growing season during dry periods.

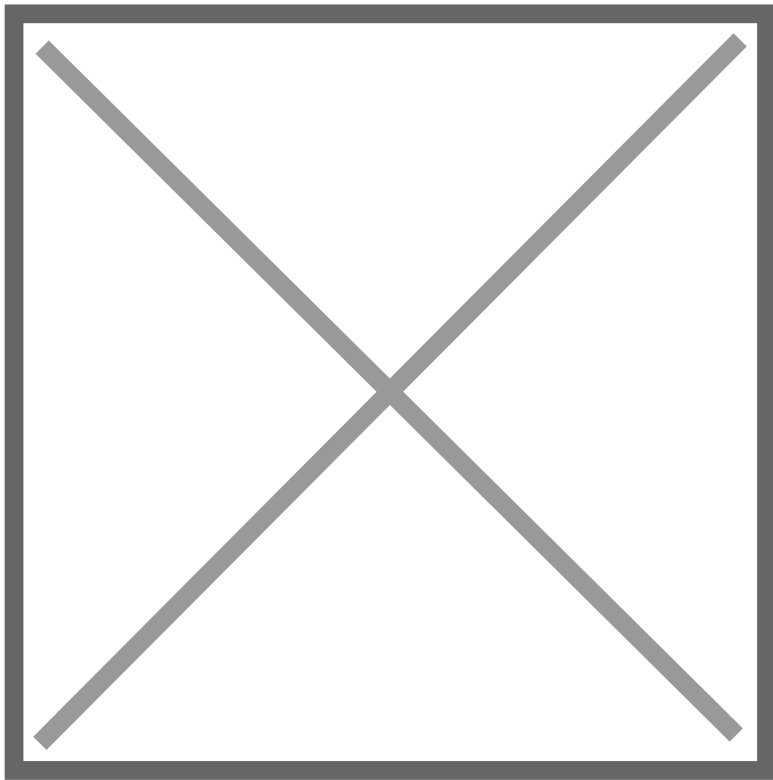


Figure 10. Hydrologic representation of a typical Des Moines Lobe (MLRA 103) Clayey Upland Forest and associated Provisional Ecological Sites.

Soil features

The soils associated with this site are classified as Vertic Hapludalfs or Epiqualfs. These soils developed predominantly under deciduous forest vegetation. Clay particles were illuviated from horizons higher in the profile and accumulated deeper. Argillic horizons form readily in Des Moines Lobe materials after leaching of all carbonates from the upper portion of the soil takes place (Grimm, 1984).

The soil series associated with this site are Kilkenney, Lerdal, and Shields soils. The soil parent material is fine glacial till, lacustrine deposits, or fine lacustrine deposits over loamy glacial till. Soils are deep (>60 inches to bedrock) and the drainage classes range from somewhat poorly drained to moderately well drained. The seasonal high depth to saturation stays below 30 cm from the surface. Typical soil surface textures include clay loam, silty clay loam, loam, and silt loam. The soil family particle size class is fine. Coarse fragments content is 0 to 15 percent by volume, and soil pH class is very strongly acid to moderately alkaline throughout the series control section.

Table 4. Representative soil features

Parent material	(1) Till (2) Lacustrine deposits
Surface texture	(1) Clay loam (2) Silty clay loam (3) Loam (4) Silt loam
Drainage class	Somewhat excessively drained to moderately well drained
Permeability class	Very slow to rapid

Soil depth	200 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-152.4cm)	21.59 – 26.67 cm
Calcium carbonate equivalent (0-101.6cm)	0 – 30 %
Soil reaction (1:1 water) (0-101.6cm)	4.5 – 8.4
Subsurface fragment volume <=3" (0-101.6cm)	0 – 20 %
Subsurface fragment volume >3" (0-101.6cm)	Not specified

Ecological dynamics

The Clayey Upland Forests ecological site is generally confined to the eastern and northern parts of MLRA 103 which includes the Big Woods ecoregion. Wildfires were historically suppressed in this region due to the topography and density of waterbodies. This ecological site currently has three states in the model: the Reference State, the Tillage State, and the Disturbed Forest State.

The Reference State is a mature, deciduous forest with multiple co-dominant canopy species including sugar maple and basswood. This is a relatively stable community in the absence of large-scale natural or anthropological disturbance. Small-gap disturbances occur and result in a series of successional communities. Early successional communities include quaking aspen, sugar maple, and American elm. Mid successional communities are often dominated by sugar maple and American elm. This ecological site can be affected by multiple natural triggers (disturbance processes) including wildfire, drought, insects, and windstorms.

The Tillage State is characterized by tillage and agricultural crop production. The two communities under this state are the Row Crop Community and the Seeded Grassland Community. Management inputs include preparing the site, seeding, fertilizing, controlling weeds and brush, and harvesting. This state is appropriate for lower slopes only.

The Disturbed Forest State is a wooded site that has undergone plant community changes due to human disturbances. Triggers include tree removal, invasive plants, and unmanaged grazing. These sites are dominated by various hardwoods along with invasive species, and do not have the ecological stability or native plant diversity of a reference state. The most common triggers are timber harvest or clearing the site for agricultural production (lower slopes only). Once a reference state has been transitioned to a tillage field, the reversibility class is irreversible.

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 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 7. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 8. Community 3.1 plant community composition

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

No field plots were available for this site. 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.

Other references

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Grimm, E.C., 1984. Fire and Other Factors Controlling the Big Woods Vegetation of Minnesota in the Mid-Nineteenth Century. Ecological Monographs, Vol. 54, No. 3, pp. 291-311.

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Approval

Suzanne Mayne-Kinney, 10/04/2023

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	08/26/2026
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:
