

Ecological site R103XY005MN

Clayey Upland Prairies

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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 Class: 2. Shrub and Herb Vegetation Subclass: 2.B. Temperate and Boreal Grassland and Shrubland Formation: 2.B.2. Temperate Grassland and Shrubland Division: 2.B.2.NB. Central North American Grassland and Shrubland The reference state is similar to Minnesota Department of Natural Resources UPs23 Southern Mesic Prairie

Ecological site concept

The Clayey Upland Prairies ecological site is located on uplands, including lakeplains, ground moraines, and till plains. Soils in this ecological site have a dark surface layer (mollic epipedon) and clayey textures. This site is not subject to flooding or ponding.

Associated sites

R103XY008MN	Clayey Wet Prairies The Clayey Wet Prairies ecological site is located on uplands. The soils have a clayey texture and are poorly drained. Wet prairie species, such as prairie cordgrass and wooly sedge, are common. This site is lower on the landscape than the Upland Clayey Prairies site.
R103XY015MN	Depressional Marsh The Depressional Marsh ecological site is located in concave, small to medium-sized depressions downslope from the Clayey Upland Prairies site. The soils are wet and commonly exhibit ponding in the early part of the growing season. Plants on these sites are tolerant of wet soils and standing water and include bulrushes, sedges, and cattails.

R103XY016MN	Organic Marsh The Organic Marsh ecological site is downslope from the Clayey Upland Prairie site and includes interspersed emergent and floating wetland plants surrounded by open water. Soils are very poorly drained and are ponded throughout most growing seasons.
R103XY009MN	Calcareous Rim Prairies The Calcareous Rim Prairies ecological site is located on saturated soils and appears similar to other wet prairie sites. The soils, however, are chemically classified as calcareous. This calcareous site is located on a variety of landscapes on rims surrounding ponded depressions.

Similar sites

R103XY004MN	Loamy Upland Prairies The Loamy Upland Prairies ecological site is located on uplands. These soils formed in loamy till and therefore have a loamy texture. This site commonly occurs on sloping areas and is characterized by a surface layer that is dark (a mollic epipedon) and has a surface texture of silt loam or silty clay loam.
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Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Amorpha canescens</i>
Herbaceous	(1) <i>Andropogon gerardii</i> (2) <i>Panicum virgatum</i>

Physiographic features

The Clayey Upland Prairies ecological site is throughout MLRA 103 on uplands, including lake plains, ground moraines, and till plains. The soils are primarily on backslopes but may also be on summits and shoulders. The positions are linear to convex, both vertically and horizontally.

Figure 1. Block diagrams of representative Clayey Upland Prairies and associated ecological sites.

Figure 2. Distribution of the Clayey Upland Prairies 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
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Landforms	(1) Lake plain (2) Ground moraine (3) Till plain
Runoff class	Low 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 “mesic” (i.e., mean annual soil temperature between 46 and 59°F). The average mean annual precipitation is 32 inches. The average frost free period is 130 days and the average freeze free period is 154 days. This site is warmer than adjacent downslope areas because of cold air drainage. Snow and frost melt sooner in the spring on warmer soils, thus resulting in a longer growing season than in adjacent depressions.

Table 3 Representative climatic features

Frost-free period (characteristic range)	120-140 days
Freeze-free period (characteristic range)	150-160 days
Precipitation total (characteristic range)	760-910 mm
Frost-free period (actual range)	110-150 days
Freeze-free period (actual range)	140-170 days
Precipitation total (actual range)	740-910 mm
Frost-free period (average)	130 days
Freeze-free period (average)	150 days
Precipitation total (average)	810 mm

- (1) WEBSTER CITY [USC00138806], Webster City, IA
- (2) JORDAN 1SSW [USC00214176], Jordan, MN
- (3) BUFFALO 2NE [USC00211107], Buffalo, MN
- (4) HUTCHINSON 1 N [USC00213962], Hutchinson, MN
- (5) DES MOINES WSFO-JOHNSTON [USC00132209], Johnston, IA

Influencing water features

The Clayey Upland Prairies ecological site can receive subsurface flow and runoff from higher adjacent sloping ground, but it primarily receives water directly from precipitation. It provides recharge and runoff to adjacent downslope ecological sites. Spring is the wettest time of the year for this site. The soils are classified as endosaturated (i.e., the water table comes from below) and they are not subject to flooding or ponding. The water table is typically at a depth of 12 to 80 inches.

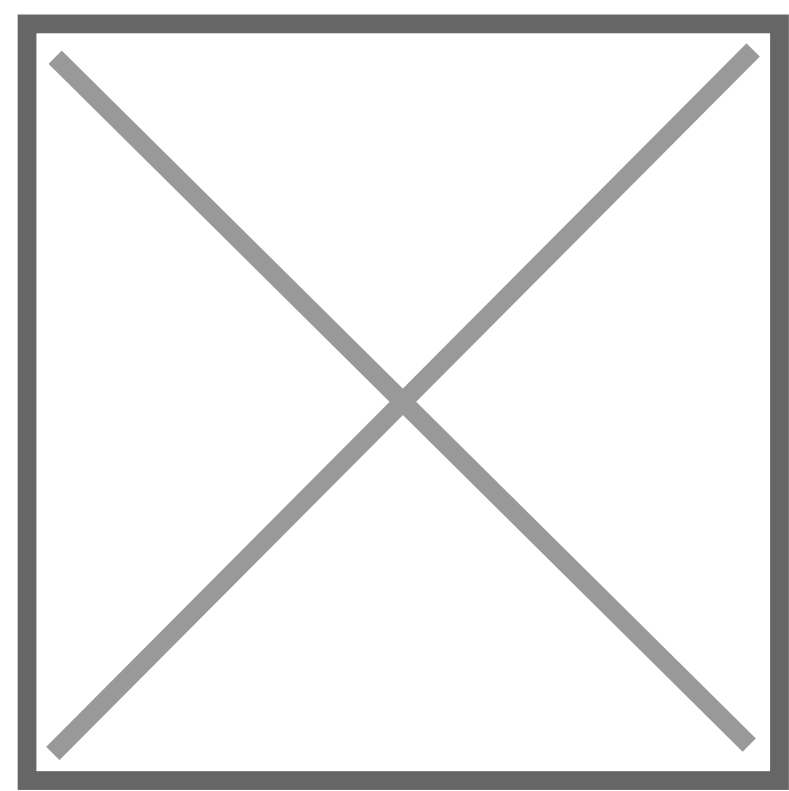


Figure 9. Representation of hydrological factors in a typical area of Clayey Upland Prairies and associated ecological sites on the Des Moines Lobe (MLRA 103).

Soil features

The Clayey Upland Prairies ecological site is on Guckeen, Kamrar, Strout, Kandiyohi, Ocheda, Sinai, Vinje, and Wilmonton soils.

The soils are lacustrine (relating to or associated with lakes) in origin and are composed of mineral soil material that is commonly stratified (formed in layers) due to the nature and environment in which it was deposited. Drainage ranges from somewhat poorly drained to well drained. Vinje, Bode, and Kamrar soils are well drained. Collinwood, Arkton, Strout, Guckeen, Sinai, and Kamrar soils are moderately well drained. Kandiyohi and Wilmonton soils are somewhat poorly drained.

Table 4. Representative soil features

Parent material	(1) Lacustrine deposits (2) Till
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Surface texture	(1) Clay (2) Silty clay (3) Silty clay loam (4) Clay loam
Family particle size	(1) Fine (2) Fine-loamy (3) Fine-silty
Drainage class	Somewhat poorly drained to well drained
Permeability class	Very slow to moderately rapid
Depth to restrictive layer	200 cm
Soil depth	150 – 200 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-152.4cm)	17.78 – 30.48 cm
Calcium carbonate equivalent (0-101.6cm)	0 – 30 %
Soil reaction (1:1 water) (0-101.6cm)	5.6 – 8.4
Subsurface fragment volume <=3" (0-101.6cm)	0 – 20 %
Subsurface fragment volume >3" (0-101.6cm)	0 – 10 %

Ecological dynamics

The Clayey Upland Prairies ecological site is characterized by two states: the Reference State (tallgrass prairie) and the Tillage State.

Two plant communities exist in the Reference State are characterized by different fire return intervals. The first community is the High Diversity Prairie, which is characterized by a fire return interval of 3 years or less. The second community is the Old Growth Prairie, which is characterized by a longer fire return interval of up to 5 years. The mechanism of change between communities is fire frequency and the resulting effects fire has on the plant community.

Two communities make up the Tillage State: the Row Crop Community and the Seeded Grassland Community. The Tillage State describes sites that have been tilled and either are currently used for intensive row crop production or were previously tilled and are currently seeded to a grassland plant community. Transition mechanisms between these communities are traditional agriculture practices such as preparing the site, planting desired species, applying herbicide (weed control), applying fertilizer, and harvesting.

Most areas of the Clayey Upland Prairies ecological site are used for row crop production, specifically a corn-soybean rotation.

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 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 8. 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 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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Ojakangas, R.W., and C.L. Matsch. 1982. Minnesota's geology. University of Minnesota Press. Minneapolis, MN.

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Contributors

Clayton Johnson (Clayton.Johnson@usda.gov), Soil Survey Office Leader, USDA-NRCS, Albert Lea, MN
Myles Elsen (Myles.Elsen@usda.gov), Soil Scientist, USDA-NRCS, Albert Lea, MN
Anita Arends (anita.arends@usda.gov), USDA-NRCS, Springfield, IL

Approval

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	08/22/2026
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:
