

Ecological site R103XY006MN

Bedrock Controlled 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

Major Land Resource Area (MLRA): Central Iowa and Minnesota Till Prairies (103) (USDA Handbook 296, 2006) USFS Subregions: North Central Glaciated Plains Section (251B); Upper Minnesota River-Des Moines Lobe (251BA) and Southern Des Moines Lobe (251Be) Subsections (Cleland et al. 2007) The reference state shares similarities to Minnesota Department of Natural Resources UPs13 Southern Dry Prairie International Vegetation Classification Hierarchy Class: 2. Shrub & Herb Vegetation Subclass: 2.B. Temperate & Boreal Grassland & Shrubland Formation: 2.B.2. Temperate Grassland & Shrubland Division: 2.B.2.Nb. Central North American Grassland & Shrubland Macrogroup: M054. Central Lowlands Tallgrass Prairie Central Tallgrass Prairie NatureServe Element Code: CES205.683

Ecological site concept

The Bedrock Controlled Upland Prairies ecological site is characterized by very shallow (10"), shallow (10-20"), or moderately deep (20-40") soils that are influenced by bedrock and have a low available water capacity (1-7"). This site typically occurs within larger river valleys that have been scoured to the bedrock by glacial meltwaters, such as the Minnesota and Des Moines Rivers. Soils are mostly Mollisols that developed under prairie vegetation. These soils have a dark (black) mollic epipedon that is above the subsurface horizons and/or bedrock.

Associated sites

F103XY032MN	Loamy Floodplains The Loamy Floodplains ecological site is located on medium textured alluvium throughout MRLA 103. Soils textures include loam, silt loam, sandy loam and fine sandy loam. Some areas within this ecological site will exhibit long-term flooding (7-30 days).
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F103XY031MN	Sandy Floodplains The Sandy Floodplains ecological site is located on sandy-textured Mollisol soils in floodplains and drainageways throughout MLRA 103. Soils drainage class ranges from moderately well drained to excessively drained. Brief flooding may occur on areas within this ecological site.
R103XY010MN	Bedrock Controlled Wet Prairies The Bedrock Controlled Wet Prairies ecological is characterized by poorly drained soils whose parent materials are loamy slope alluvium or alluvial/glaciofluvial deposits overlying carbonaceous bedrock. This site is associated with river valleys. Soils range in depth from 10

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Amorpha canescens</i>
Herbaceous	(1) <i>Schizachyrium scoparium</i> (2) <i>Bouteloua curtipendula</i>

Physiographic features

The Bedrock Controlled Upland Prairies ecological site typically situated near larger rivers, especially in the Minnesota and Des Moines river valleys in Minnesota and Iowa, respectively. Glacial meltwaters scoured these broad valleys, leaving areas of bedrock occurring as strath terraces above the floodplain. The terms “linear” or “sloping” best describes the physiographic character of this site. Bedrock substratum and slope are the most defining parameters.

Figure 1. Block diagrams of the representative Bedrock Controlled Upland Prairies and associated ecological sites.

Figure 2. Distribution of the Bedrock Controlled 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
Landforms	(1) Strath terrace
Runoff class	Low to very high
Elevation	210 – 560 m
Slope	0 – 80 %

Water table depth	30 – 100 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 ecological site is 154 days, while the frost-free period is 132 days. The average mean annual precipitation average is 30 inches, which includes rainfall plus the water equivalent from snowfall.

Table 3 Representative climatic features

Frost-free period (characteristic range)	130-140 days
Freeze-free period (characteristic range)	150-160 days
Precipitation total (characteristic range)	690-860 mm
Frost-free period (actual range)	130-140 days
Freeze-free period (actual range)	150-160 days
Precipitation total (actual range)	660-860 mm
Frost-free period (average)	130 days
Freeze-free period (average)	150 days
Precipitation total (average)	760 mm

- (1) GRANITE FALLS [USC00213311], Granite Falls, MN
- (2) MANKATO [USC00215073], Mankato, MN
- (3) OLIVIA 3E [USC00216152], Bird Island, MN
- (4) LAKEFIELD 2NE [USC00214453], Lakefield, MN
- (5) ALBERT LEA 3 SE [USC00210075], Albert Lea, MN
- (6) PERRY [USC00136566], Perry, IA

Influencing water features

With natural hydrology intact, this ecological site may receive water from direct precipitation, runoff from higher sites, and recharge through base flow from adjacent sites. In the spring months, this site can produce surface runoff. The soils are typically classified as endosaturated. Drainage class ranging from somewhat poorly drained to somewhat excessively drained. The water table can be near the soil surface during the spring months, especially in the somewhat poorly drained soils, but will drop as low as the depth to the underlying bedrock during dry periods.

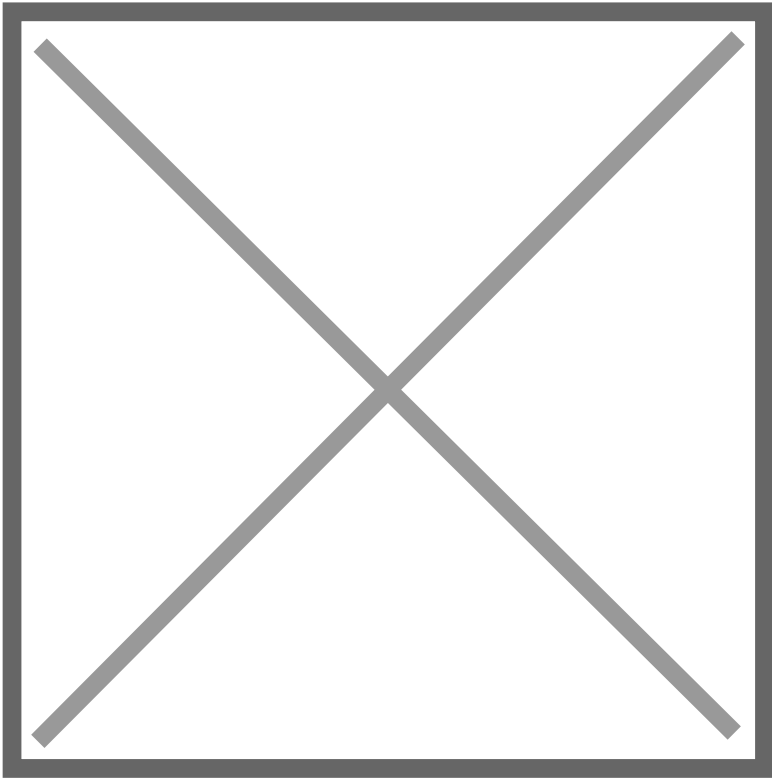


Figure 9. Representation of hydrological factors in a typical area of the Bedrock Controlled Upland Prairie and associated ecological sites on the Des Moines Lobe (MLRA 103).

Soil features

This ecological site is typically on mineral soils that developed under prairie vegetation. These prairie soils have a thick, nearly black, organic rich mollic epipedon. The parent materials include loamy slope alluvium and alluvial glaciofluvial deposits overlying carbonaceous bedrock (i.e., limestone or dolomite), usually in close association with river valleys. Soil drainage class varies from somewhat poorly to somewhat excessively drained. Common surface textures are loam, clay loam, silt loam, silty clay loam, and fine sandy loam. The subsurface textural group is typically classified as coarse loamy, fine loamy, or fine. Most soils are Mollisols with the majority of the components classified as Typic Hapludolls or Lithisc Hapludolls. A minority are classified as Aquic Hapludolls or Oxyaquic Dystrudepts. The central concept soils are Copaston, Rockton, and Ridgeport.

Soil series include Bechyn, Germantown, Copaston, Gosport, Emeline, Ridgeport, Jacwin, Kensett, and Rockton.

Table 4. Representative soil features

Parent material	(1) Till (2) Glaciofluvial deposits (3) Slope alluvium
Surface texture	(1) Loam (2) Clay loam (3) Silt loam (4) Silty clay loam (5) Fine sandy loam

Family particle size	(1) Fine-loamy (2) Coarse-loamy (3) Fine
Drainage class	Somewhat poorly drained to somewhat excessively drained
Permeability class	Rapid to very rapid
Soil depth	10 – 100 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-152.4cm)	2.54 – 17.78 cm
Calcium carbonate equivalent (0-101.6cm)	0 – 30 %
Soil reaction (1:1 water) (0-101.6cm)	3.5 – 8.4
Subsurface fragment volume <=3" (0-101.6cm)	0 – 20 %
Subsurface fragment volume >3" (0-101.6cm)	0 – 10 %

Ecological dynamics

The Bedrock Controlled Upland Prairies ecological site is characterized by two states: the Reference State and the Agricultural State. Some areas within this ecological site are utilized for cropland; however, many areas preclude tillage due to shallow soils and/or slope. Two plant communities exist in the Reference State are characterized by different fire return intervals. The mechanism of change between communities is fire frequency. Grazing can also be a trigger for change.

Two communities make up the Agricultural State: the Row Crop Community (mostly moderately deep soils on lower sloping sites) and the Seeded Grassland Community. Shallow soils (Bechyn, Emeline, and Copaston) are generally utilized for pasture or have reverted to a ruderal woodland. Moderately deep soils (Germantown, Gosport, Ridgeport, Jacwin, Kensett, and Rockton) on lower sloping sites are often utilized for row crops or pasture.

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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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	09/01/2026
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:
