USDA Natural Resources Conservation Service

Ecological site R103XY022MN
Loamy Wet Savannas

Last updated: 10/04/2023
Accessed: 05/05/2024

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.

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)

Ecological site concept

The Loamy Wet Savannas ecological site occurs on poorly drained loamy soils that developed under a savanna plant community (scattered trees and native grasses). The seasonal high depth to saturation is between 0-30 cm. No flooding or ponding occurs on this site.

Associated sites

R103XY016MN	**Organic Marsh** The Organic Marsh ecological site is characterized by very poorly drained organic soils, a high water table, frequent ponding, and hydrophytic vegetation.
R103XY020MN	**Loamy Upland Savannas** The Loamy Upland Savannas ecological site is characterized by a savanna plant community. Soils are derived from medium-textured till and lacustrine materials. Drainage class ranges from well to somewhat poorly drained.

Similar sites

R103XY023MN	**Clayey Wet Savannas** The Clayey Wet Savannas ecological site occurs on poorly drained, silty-textured soils located in depressions, on low gradient linear slopes, or on toeslopes. This site has a seasonal high water table at or very near the surface.

Table 1. Dominant plant species

Tree	(1) *Populus tremuloides*
Shrub	Not specified
Herbaceous	(1) *Andropogon gerardii* (2) *Spartina pectinata*

Physiographic features

The Loamy Wet Savannas ecological site occurs adjacent to the Big Woods ecoregion in northeastern MLRA 103. This site occurs on ground, end, and lateral moraines. Landform positions include drainageways, footslopes, toeslopes, depressions, and low gradient linear segments. The positions are linear to slightly concave both vertically and horizontally.

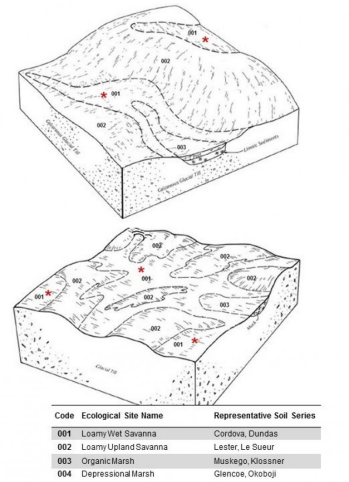


Figure 1. Block diagrams of the representative Loamy Wet Savannas and associated ecological sites.

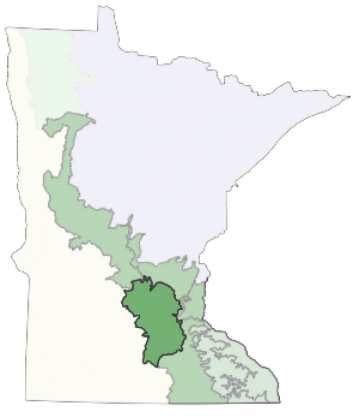


Figure 2. The Big Woods ecoregion in dark green. (Minnesota Department of Natural Resources)

Table 2. Representative physiographic features

Hillslope profile	(1) Footslope (2) Toeslope

Landforms	(1) Ground moraine (2) Lateral moraine (3) End moraine
Runoff class	Negligible to low
Elevation	669–1,601 ft
Slope	0–3%
Water table depth	0–47 in
Aspect	Aspect is not a significant factor

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 153 days, while the frost-free period is 133 days. The average mean annual precipitation is 30 inches, which includes rainfall plus the water equivalent from snowfall. Cold air drainage and the fact that wet soils are colder than dry soils make this ecological site slightly colder than adjacent sloping landforms.

Table 3. Representative climatic features

Frost-free period (characteristic range)	133 days
Freeze-free period (characteristic range)	153 days
Precipitation total (characteristic range)	30 in
Frost-free period (actual range)	133 days
Freeze-free period (actual range)	153 days
Precipitation total (actual range)	30 in
Frost-free period (average)	133 days
Freeze-free period (average)	153 days
Precipitation total (average)	30 in

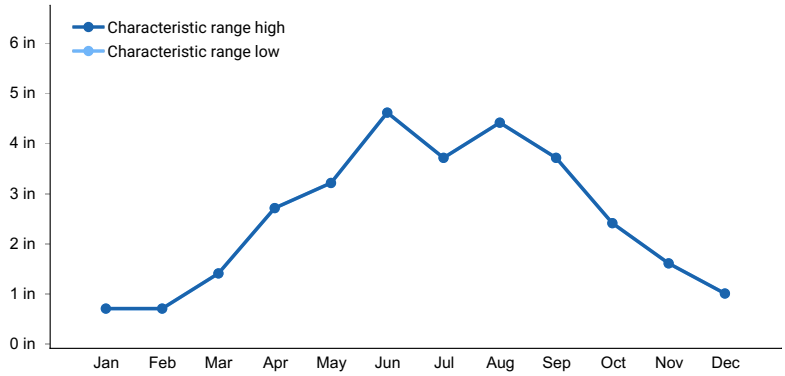


Figure 3. Monthly precipitation range

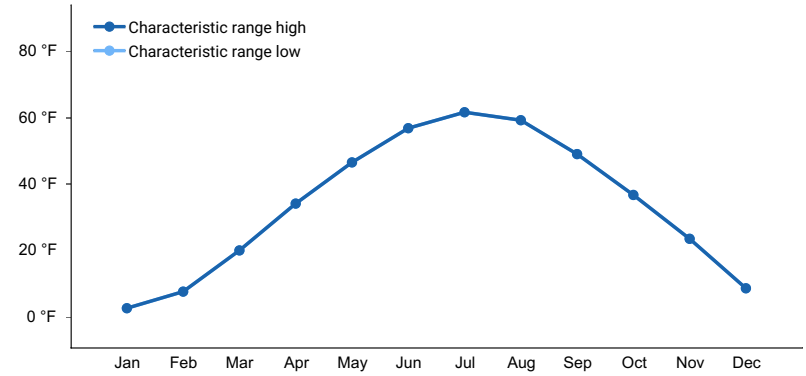


Figure 4. Monthly minimum temperature range

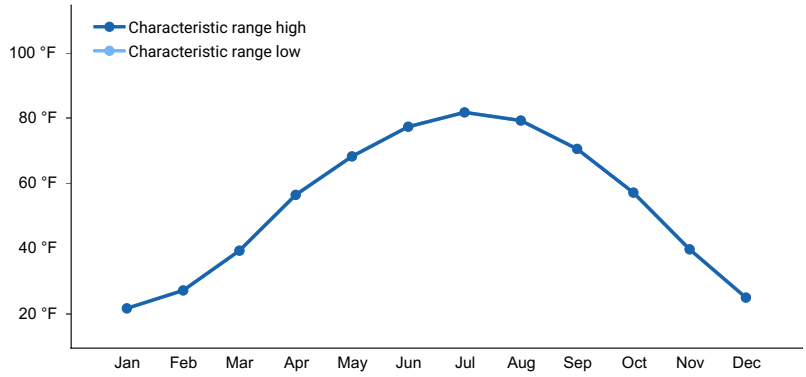


Figure 5. Monthly maximum temperature range

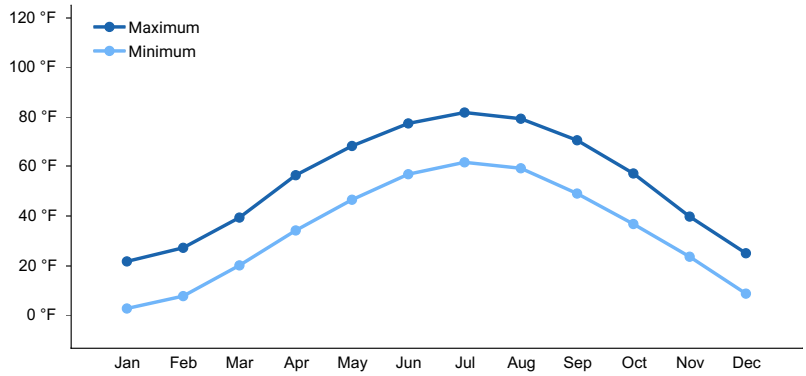


Figure 6. Monthly average minimum and maximum temperature

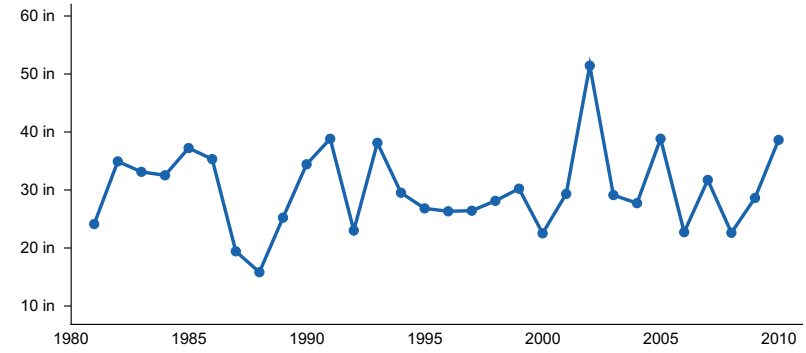


Figure 7. Annual precipitation pattern

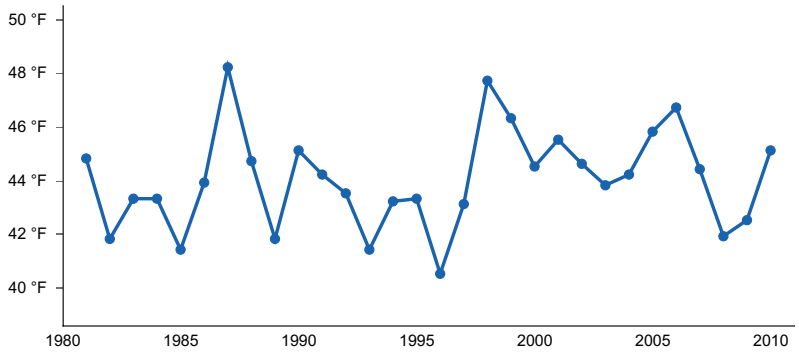


Figure 8. Annual average temperature pattern

Climate stations used

- (1) BUFFALO 2NE [USC00211107], Buffalo, MN
- (2) OWATONNA [USC00216287], Owatonna, MN
- (3) FARIBAULT [USC00212721], Faribault, MN
- (4) WASECA EXP STN [USC00218692], Waseca, MN
- (5) WELLS [USC00218808], Wells, MN

Influencing water features

The Loamy Wet Savannas ecological site receives water via precipitation, lateral subsurface flow, and runoff. Since some of these components have little for contributing area, direct precipitation may be the only water source that they receive. Spring is the wettest time of the year in the region.

Soils associated with this site are classified as endosaturated and are groundwater recharge areas. Soil saturation on this site is at or very near the soil surface during the spring months but may drop to as low as four or more feet later in the growing season during dry periods.

In the hydrogeomorphic (HGM) classification system, the Loamy Wet Savannas site is considered Mineral Flat wetlands, producing recharge to adjacent ecological sites (USDA-NRCS, 2008; Gilbert et al., 2006). This site also has a Cowardin Hydrologic classification of Palustrine Emergent Wetland and is a United States Army Corps of Engineers Wetland Plant Community of B; Fresh (wet) Meadows.

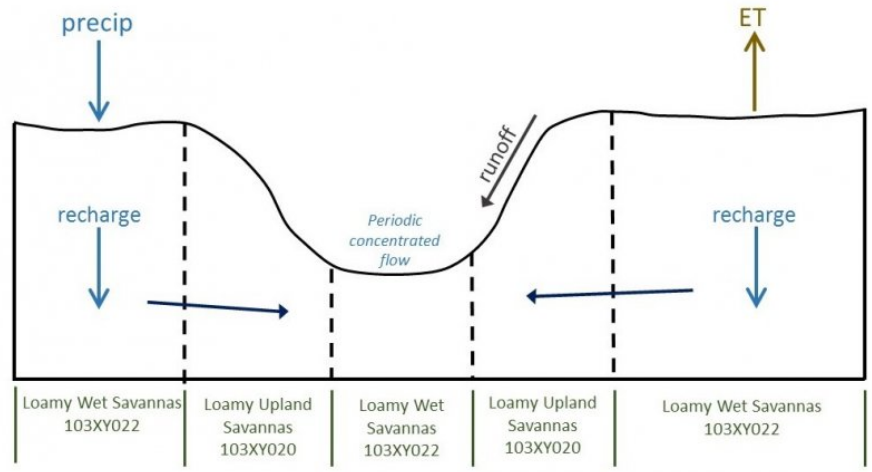


Figure 9. Representation of hydrological factors in a typical area of the Loamy Wet Savannas and associated ecological sites on the Des Moines Lobe (MLRA 103).

Soil features

The soils associated with the Loamy Wet Savannas developed under scattered trees and grasslands. They are classified as Typic Argiaquolls or Mollic Endoaqualfs and are often located in slight depressions which accumulated

slope alluvium. As a result, dark epipedons (at times thicker than many prairie soils) formed in these savanna areas. Also, clay particles were illuviated from albic 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).

These soils formed under saturated conditions that produced anaerobic conditions during at least part of the year. Organic matter tends to mask the redoximorphic features that are used to determine seasonal high depth to saturation. The primary hydric soil indicator is Thick Dark Surface (A12; USDA-NRCS, 2010).

The dominant soil series correlated to this ecological site are Cordova and Dundas. The parent material is loamy glacial till, and the soils are very deep (>60 inches to bedrock). The drainage class is poorly drained, and the seasonal high water table is at or very near the surface. The epipedon textures include clay loam, loam, silty clay loam, or silt loam. The soil family particle size class is fine loamy. Coarse fragments are between 0 and 12 percent by volume. One concept (Udolpho) has outwash that underlies the loamy till and can have up to 40 percent coarse fragments. Soil pH classes are strongly acid to moderately alkaline throughout the series control section. The soil series associated with this site are Cordova, Dundas, and Udolpho.

Table 4. Representative soil features

Parent material	(1) Till (2) Glaciofluvial deposits (3) Outwash
Surface texture	(1) Clay loam (2) Silty clay loam (3) Loam (4) Silt loam
Drainage class	Poorly drained
Permeability class	Slow to rapid
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-60in)	8–11.1 in
Calcium carbonate equivalent (0-40in)	0–30%
Soil reaction (1:1 water) (0-40in)	5.1–8.4
Subsurface fragment volume <=3" (0-40in)	0–12%
Subsurface fragment volume >3" (0-40in)	0–3%

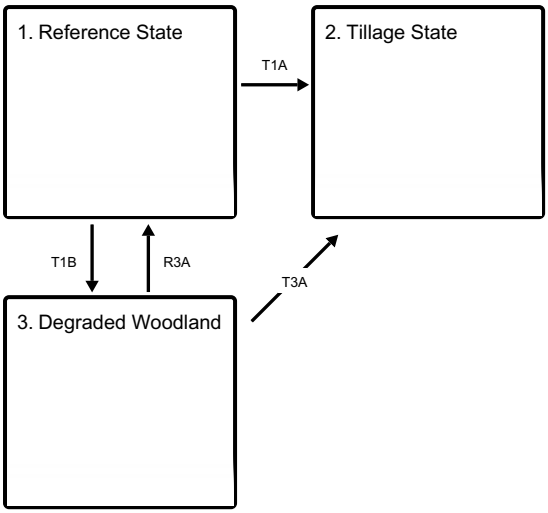
Ecological dynamics

The Loamy Wet Savanna ecological site is primarily located in areas adjacent to the Big Woods region of Minnesota and areas adjacent to rivers and streams, which partially protected the site from fire. Natural fire disturbance was suppressed on this site but not eliminated resulting in a savanna landscape.

The state and transition model (STM) consists of three states: Reference State, Tillage State, and the Degraded Woodland State. The Reference State describes a site with native grasses and scattered hardwoods. State 2 is the Tillage State which describes land transitioned to agricultural production. This is the most common state in MLRA 103 for this site. A few areas in this State have been reseeded to native warm season or cool-season grasses. State 3 is a Degraded Woodland State in which disturbances have modified the plant community composition and structure. Lack of natural fire, unmanaged grazing, and invasive species are common triggers transitioning a site to State 3.

State and transition model

Ecosystem states



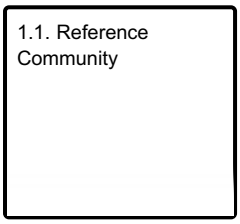
T1A - Tillage, drainage, planting

T1B - Absence of natural fire regime, increase in woody vegetation, and invasion of non-native species

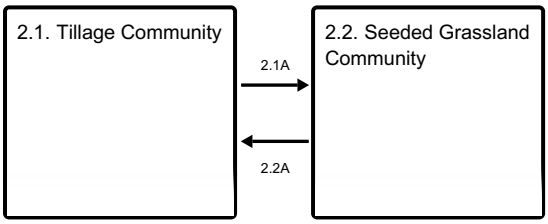
R3A - Restoration activities

T3A - Tillage, drainage, planting of crop species

State 1 submodel, plant communities



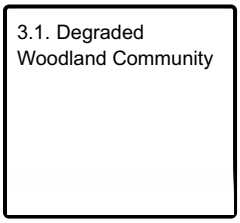
State 2 submodel, plant communities



2.1A - Establishment of grasses

2.2A - Transition to row crop agriculture

State 3 submodel, plant communities



State 1
Reference State

The Loamy Wet Savannas reference state is a savanna community on poorly drained, loamy soils, that exhibits a diversity of native grasses, forbs, and scattered hardwoods. Plant community structure and composition within the

reference state are variable and dependent upon the impacts of drought, grazing, fire events, and human disturbances. Fire was historically present on these sites but to a much lesser degree than the prairie ecological sites. This reduced occurrence of fire resulted in a plant community that included woody shrubs and scattered trees. A secondary trigger for maintenance or conversion of this ecological site is grazing. Intensive grazing can reduce the extent of highly palatable species thereby allowing the growth of less desirable plants to increase. Depending upon fire frequency, periods of drought, and/or grazing intensity, a mosaic of plant community composition may be present on this site. Characteristic vegetation in the reference savanna state includes scattered aspen, basswood, and maple in a native grassland of big bluestem and prairie cordgrass. Other native prairie grasses and forbs will be present in reference plant community. High-quality, untilled areas of the Loamy Wet Savannas ecological site are uncommon in MLRA 103 as most sites have been transitioned to agricultural production.

Dominant plant species

- quaking aspen (*Populus tremuloides*), tree
- big bluestem (*Andropogon gerardii*), grass
- prairie cordgrass (*Spartina pectinata*), grass

Community 1.1
Reference Community

The Loamy Wet Savannas ecological site is characterized by a diversity of native grasses and forbs with scattered hardwood trees. Common tree species include aspen, basswood, and maple. Dominant grasses include big bluestem and prairie cordgrass. The vegetative composition is influenced primarily by drought, grazing and fire. Variations within the plant community structure and composition will occur on these sites depending on the disturbance regime.

Dominant plant species

- quaking aspen (*Populus tremuloides*), tree
- big bluestem (*Andropogon gerardii*), grass
- prairie cordgrass (*Spartina pectinata*), grass

State 2
Tillage State

Soil tillage is the primary mechanism to transition a site to the Tillage State. Hydrological modifications, such as ditching and tiling, are often present. Most areas in this state will remain in use for crop production in the foreseeable future. Tillage alters the dynamic soil properties such as bulk density, structure, organic carbon content, and saturated hydraulic conductivity. Certain practices can mitigate the impacts of traditional agricultural practices on soil health. Conservation tillage minimizes soil disturbance and can improve soil structure and overall soil health. Corn or soybean plantings and a cover crop rotation can build soil structure, improve infiltration rates, reduce runoff and erosion, and protect water quality. A few areas within this ecological site have been seeded back to grass. Some previously tilled areas have been converted to warm-season grasslands through NRCS conservation programs. Native forbs are commonly included in seed mixes to benefit wildlife and pollinators. Cool-season grasses are also feasible . Species selection will depend on the landowner’s objectives and site specifics. Although cool-season grasslands are not as biologically diverse as warm-season grasslands, they still offer various soil health and wildlife benefits.

Dominant plant species

- corn (*Zea mays*), grass
- soybean (*Glycine max*), other herbaceous

Community 2.1
Tillage Community

The Tillage Community typically consists of intensively produced, traditional row crops. Tillage and intentional plant establishment (crop seeding) are the primary triggers for this community. The most common crops are corn and soybeans on an annual rotation. Ditching and tiling is often installed to improve drainage.

Dominant plant species

- corn (*Zea mays*), grass
- soybean (*Glycine max*), other herbaceous

Community 2.2
Seeded Grassland Community

The primary mechanism of change to this community is the seeding of desired grass species. Commercial vegetative seed mixes commonly include a variety of native grasses plus forbs to enhance wildlife habitat and to benefit native pollinators. This pathway may be triggered in conjunction with a NRCS conservation program. A few areas within this ecological site may be seeded to cool-season grasses. Numerous species may be planted depending on the landowner's objectives and management.

Resilience management. Multiple resilience management practices may be needed after establishment of warm-season grasses. Examples include prescribed fire, brush management, and herbaceous weed treatment. Resilience management practices for cool-season grass sites include planned grazing, invasive plant management and appropriate disturbance/harvest management.

Dominant plant species

- big bluestem (*Andropogon gerardii*), grass
- Indiangrass (*Sorghastrum nutans*), grass

Pathway 2.1A
Community 2.1 to 2.2

The mechanism of change is the seeding of grass species. Warm season or cool season grasses may be planted depending on the landowner's objectives. Warm season grasses may be established as part of a conservation program.

Conservation practices

Forage and Biomass Planting

Pathway 2.2A
Community 2.2 to 2.1

The site is transitioned back to cropland through tillage and seeding.

State 3
Degraded Woodland

This state is characterized by a disturbed and degraded woodland condition. Characteristics include the dominance of trees (no longer a true savanna community) and the presence of invasive plant species. Mixed hardwoods are present and include aspen. Invasive, non-native species such as Kentucky bluegrass and common buckthorn, are in the understory. As the tree and shrub density increases, the ground layer plant diversity transitions to more shade-tolerant species.

Dominant plant species

- quaking aspen (*Populus tremuloides*), tree
- Kentucky bluegrass (*Poa pratensis*), grass
- common buckthorn (*Rhamnus cathartica*), grass

Community 3.1
Degraded Woodland Community

This plant community exhibits an increase in hardwood trees and invasive species. Due to the increasing shade

levels, ground flora is transitioning to more shade-tolerant species. The community is no longer a savanna but a woodland.

Dominant plant species

- quaking aspen (*Populus tremuloides*), tree
- Kentucky bluegrass (*Poa pratensis*), grass
- common buckthorn (*Rhamnus cathartica*), grass

Transition T1A
State 1 to 2

The site is transitioned to agricultural production through tillage, hydrological alterations, and seeding of desired crops.

Transition T1B
State 1 to 3

Transition mechanisms include absence of a natural fire regime, invasion of non-native plant species and a continual increase in woody species. Native plant diversity will decrease as the community transitions from a open savanna to a closed, shaded woodland.

Restoration pathway R3A
State 3 to 1

Restoration of the site to include non-native vegetation control, woody vegetation removal, introduction of prescribed fire, establishment of desired native species. Natural hydrology is necessary for a full restoration of this site.

Transition T3A
State 3 to 2

Site is transitioned to agricultural production via tillage, hydrological alterations, and seeding of desired crops.

Additional community tables

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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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

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	05/05/2024
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

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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:**