USDA Natural Resources Conservation Service

Ecological site R103XY009MN
Calcareous Rim 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)

Relationship to Other Established Classifications:
Biophysical Setting (Landfire, 2009)-Central Tallgrass Prairie (4214210)

The reference state shares similarities to Minnesota Department of Natural Resources WPs54b Southern Wet Prairie

Ecological site concept

The Calcareous Rim Prairies ecological site is located on low-lying rims. Rims are plane or gently sloping linear segments or toeslope-like positions shaped as concentric rings surround ponded depressions. Soils are poorly drained, have an inherent water table, and are mollisols (dark surface layer) with a high calcium carbonate content.

Associated sites

R103XY001MN	**Loamy Wet Prairies** The Loamy Wet Prairies ecological site is located on inter-depressional linear slopes and slight depressions on till plains, moraines, and short-lived lakeplains. Soil parent materials are loamy till and lacustrine materials. The soil drainage class is poorly drained but the site does not flood or pond.

R103XY015MN	**Depressional Marsh** The Depressional Marsh ecological site is in concave small- to medium-sized depressions. This site is very poorly drained and ponded throughout the early part of the growing season in most years (i.e. seasonal wetlands). Vegetation includes cattails, bulrushes, sedges and other emergent wetland species.
R103XY016MN	**Organic Marsh** The Organic Marsh ecological site occurs in the centers of medium to large-sized depressions and is typically surrounded by mineral soils associated with the Depressional Marsh ecological site. Soils are very poorly drained and ponded with deep water throughout the growing season in most years (i.e. semi-permanent wetlands). Soils are developed from organic parent materials.
R103XY005MN	**Clayey Upland Prairies** Clayey Upland Prairies sites are located on uplands and are found on soils that are somewhat poorly drained to well drained, have a dark surface horizon (mollic epipedon), and have clayey textures. The reference plant community is warm-season tallgrass prairie.

Similar sites

R103XY008MN	**Clayey Wet Prairies** The Clayey Wet Prairies ecological site is located on soils that are poorly drained and have surface textures of clay, silty clay, silty clay loam, and clay loam. This site does not typically flood or pond, but the water table is usually at or near the surface during spring months.

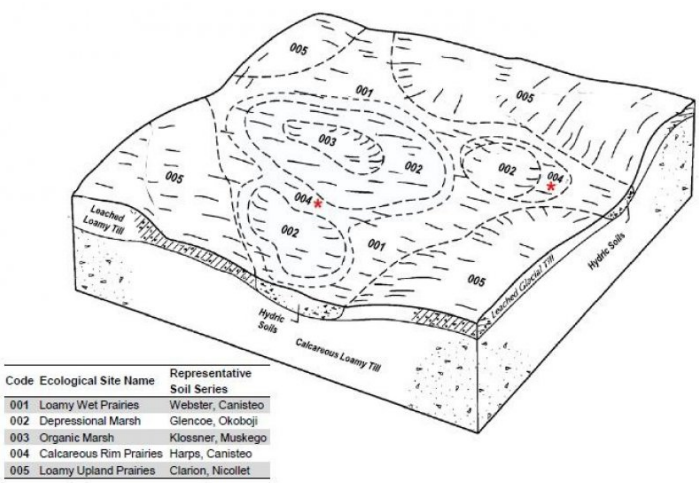
Table 1. Dominant plant species

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

Physiographic features

The Calcareous Rim Prairies ecological site is widely distributed throughout MLRA 103 except for the Big Woods ecoregion. The site is located on various till plains, ground moraines, lake plains, and outwash plains, but most prevalent in till-derived landscapes with frequent concavities on the surface of landforms. In all cases, the landscapes have poorly integrated drainage networks. The ecological site is typically part of broader semi-closed wetland basins and are hydrologically connected to adjacent ponded depressions. As a result, delineations of these areas are often of irregularly shape and surround multiple depressions of varying shapes and sizes.

This ecological site is defined by its hydrologic relationship with the surrounding uplands and depressional marshes. The term “rim” best describes the landscape position of this site. Rims are plane or gently sloping (0 to 2 percent slope) linear segments or toeslope-like positions above concave depressions. They can appear as an extension of the often-broader linear segments which abut the concave, ponded depressions. It is important to note that although the Calcareous Rims ecological site may be small in terms of acreage, they are virtually omnipresent in areas of MLRA 103 that have historic ponded depressions. As a result, they often occur as unmapped minor components, or may be overlooked altogether. Even where it is too small to be mapped, this site occurs as a narrow rim surrounding a ponded depression.



Code	Ecological Site Name	Representative Soil Series
001	Loamy Wet Prairies	Webster, Canisteo
002	Depressional Marsh	Glencoe, Okoboji
003	Organic Marsh	Klossner, Muskego
004	Calcareous Rim Prairies	Harps, Canisteo
005	Loamy Upland Prairies	Clarion, Nicollet

Figure 1. Block diagrams of the representative Calcareous Rim Prairies and associated ecological sites.

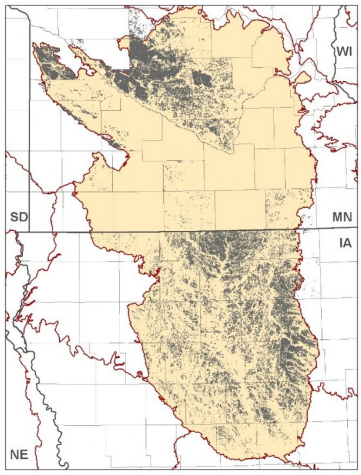


Figure 2. Distribution of the Calcareous Rim Prairies ecological site within MLRA 103. In many cases, the data set is not spatially consistent across political boundaries due to the method by which soils were mapped; e.g. due to county subsets.

Table 2. Representative physiographic features

Hillslope profile	(1) Footslope (2) Toeslope
Landforms	(1) Till plain (2) Ground moraine (3) Lake plain (4) Outwash plain
Runoff class	Negligible to low
Flooding frequency	None
Ponding frequency	None
Elevation	689–1,837 ft
Slope	0–2%
Water table depth	0–48 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 154 days, while the frost-free period is 130 days. The average mean annual precipitation total is 31 inches, which includes rainfall plus the water equivalent from snowfall.

Cold air drainage from above and the fact that wet soils are generally colder than dry soils make this site colder than adjacent, upslope areas. As a result, snow and frost remain longer in the spring, thus resulting in shorter growing seasons than the adjacent uplands.

Table 3. Representative climatic features

Frost-free period (characteristic range)	126-135 days
Freeze-free period (characteristic range)	148-161 days
Precipitation total (characteristic range)	28-33 in
Frost-free period (actual range)	123-136 days
Freeze-free period (actual range)	143-164 days
Precipitation total (actual range)	28-34 in
Frost-free period (average)	130 days
Freeze-free period (average)	154 days
Precipitation total (average)	31 in

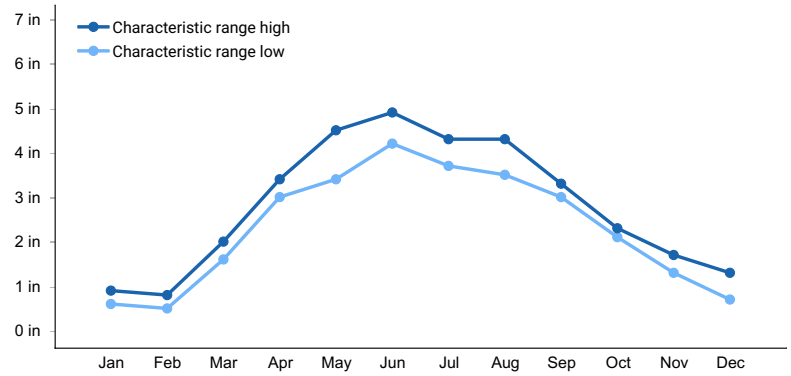


Figure 3. Monthly precipitation range

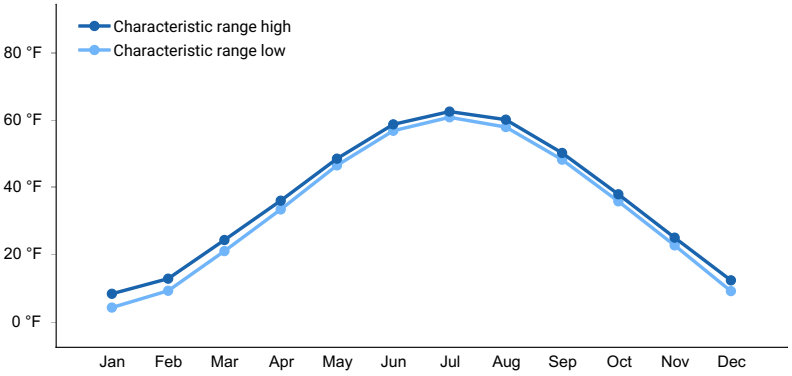


Figure 4. Monthly minimum temperature range

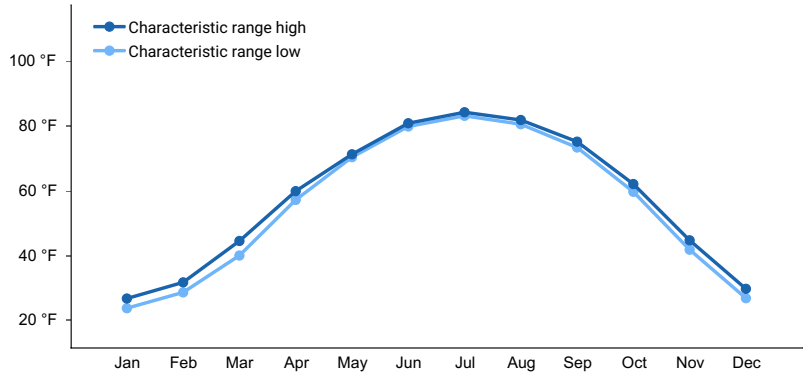


Figure 5. Monthly maximum temperature range

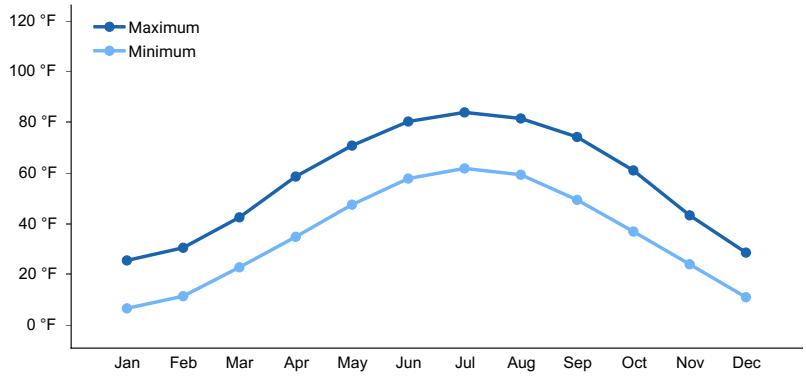


Figure 6. Monthly average minimum and maximum temperature

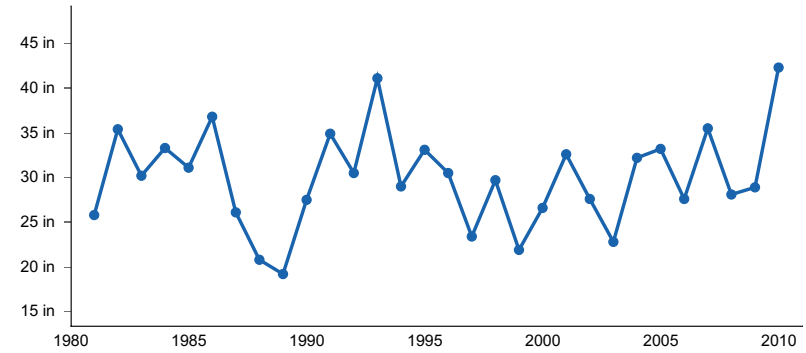


Figure 7. Annual precipitation pattern

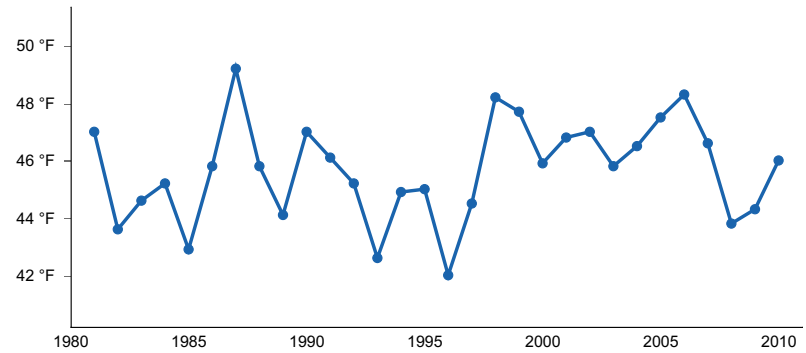


Figure 8. Annual average temperature pattern

Climate stations used

- (1) PERRY [USC00136566], Perry, IA
- (2) MARSHALL [USC00215204], Marshall, MN
- (3) WORTHINGTON 2 NNE [USC00219170], Worthington, MN

- (4) SPENCER 1 N [USC00137844], Spencer, IA
- (5) LAMBERTON SW EXP STN [USC00214546], Lamberton, MN
- (6) SPRINGFIELD 1 NW [USC00217907], Springfield, MN
- (7) POCAHONTAS [USC00136719], Pocahontas, IA
- (8) ROCKWELL CITY [USC00137161], Rockwell City, IA

Influencing water features

This ecological site functionally acts as discharge wetlands due to the hydrologic interaction with adjacent areas. With natural hydrology intact, the site receives water from four other sources: the regional groundwater table, direct precipitation, runoff from uplands, and recharge through base flow from adjacent upland areas.

In the spring months, the site can produce surface runoff. During the summer months these “rims of depressions” receive backwards discharge and draw water by capillary action from the nearby ponded depressions. Evapotranspiration of water in this way exceeds downward leaching in comparison to adjacent wetland and upland soils (Thompson and Bell, 2001).

Vigorously growing wet prairie vegetation enhances this lateral/upward water movement. Ultimately the water molecules evaporate or are transpired by plants, leaving calcium carbonate (CaCO3) accumulations behind in the soil. This phenomenon is apparent to an extreme extent on soils that have developed diagnostic calcic horizons (e.g., Harps or Corvuso series).

The soils of Calcareous Rim Prairies ecological site is classified as endosaturated. The water table is at or near the soil surface during the spring months and may drop to as low as four feet later in the growing season during dry periods. In the hydrogeomorphic (HGM) classification system, this site is considered a part of a Depressional complex, receiving discharge from associated upslope ecological sites (USDA-NRCS,2008; Gilbert et al., 2006). This site has a Saturated Cowardin Hydrologic Regime of Palustrine, Persistent Emergent Wetland. It also has a United States Army Corps of Engineers Wetland Plant Community of D; Fresh (wet) Meadows, Sedge Meadows, and Wet Prairies (Mineral Soils).

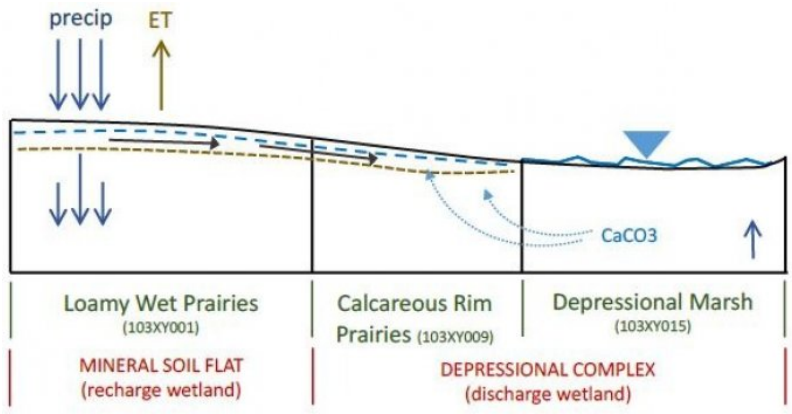


Figure 6. Hydrologic representation of a typical Des Moines Lobe (MLRA 103) wetland basin and associated Provisional Ecological Sites.

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

Soil features

These mineral soils are rich in organic matter and developed under prairie vegetation. Prairie soils typically have thick, nearly black, organic-rich mollic epipedons. The parent material for these soils includes till, outwash, and lacustrine deposits. The soil drainage class is poorly drained. The most common surface textures are silty clay loam, clay loam, and loam. Subsurface group is classified primarily as fine-loamy (with 18 to 35 percent clay) but also includes fine (with 35 to 60 percent clay) and coarse-loamy (with less than 18 percent clay). Soil order is Mollisol, with the most common taxonomic classes being Typic Calciaquolls or Typic Endoaquolls (with calcareous reaction class). Harps and Canisteo are the most extensive soil series for this ecological site.

These soils were formed under saturated conditions that produced anaerobic conditions during at least part of the year. Thick, dark mollic epipedons tend to mask the typical redoximorphic features used to determine seasonal high-water table depths. Beneath the mollic epipedon, these soils have a depleted matrix with low chroma (2 or less) and high value (4 or more). The primary hydric soil indicators include: Depleted Below Dark Surface (A11), Thick Dark Surface (A12), and Redox Dark Surface (F6, option a; USDANRCS, 2010).

The soil series that make up this site are Canisteo, Colvin, Corvuso, Crowriver, Danube, Harcot, Harps, Harpster, Leen, Marysland, and Revere.

Table 4. Representative soil features

Parent material	(1) Till–shale (2) Outwash–limestone (3) Lacustrine deposits
Surface texture	(1) Clay loam (2) Silty clay loam (3) Loam
Drainage class	Poorly drained
Permeability class	Slow to moderately rapid
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0–1%
Available water capacity (0-60in)	8–12 in
Calcium carbonate equivalent (0-40in)	5–30%
Soil reaction (1:1 water) (0-40in)	7.8–8.4
Subsurface fragment volume <=3" (0-40in)	0–10%
Subsurface fragment volume >3" (0-40in)	0–1%

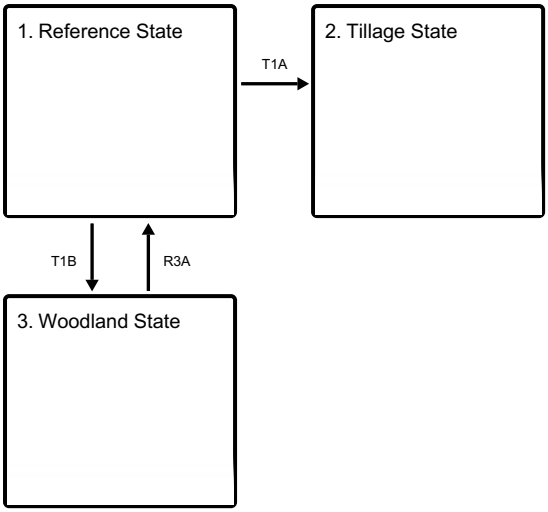
Ecological dynamics

The Calcareous Rim Prairie ecological site is characterized by three states: the Reference State, the Tillage State, and the Woodland State. The Reference State includes two communities. The High Diversity Prairie, is characterized by a fire return interval of 3 years or less and the Old Growth Prairie is characterized by a fire return interval of up to 5 years. Grazing can also be a trigger for change on this ecological site. The Tillage State includes the Row Crop Community and the Seeded Grassland Community. State 3 in this model describes a woodland on untilled soils dominated by boxelder, green ash, willow, and cottonwood.

Previously tilled sites may revert to a woodland through abandonment; however, this is a very small percentage of acreage in MRLA 103 and not currently a community within this state and transition model (STM).

State and transition model

Ecosystem states

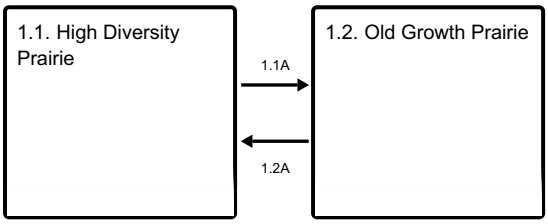


T1A - Transition to agriculture; tillage; seeding; continued management

T1B - Plant community succession

R3A - Restoration inputs

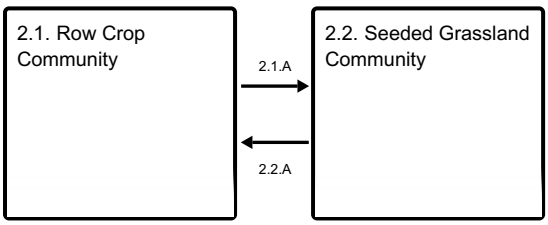
State 1 submodel, plant communities



1.1A - Fire return interval 3-5 years.

1.2A - Fire return interval less than 3 years

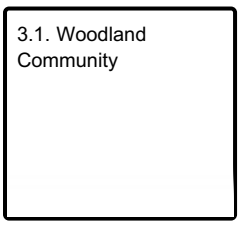
State 2 submodel, plant communities



2.1.A - Grass seeding; grassland management

2.2.A - Tillage; crop production

State 3 submodel, plant communities



State 1
Reference State

This site is characterized as a wet prairie, which include a diversity of grasses, sedges, and forbs tolerant of poorly

drained soils and calcareous conditions. Important species on this site include prairie cordgrass (*Spartina pectinata* Bosc ex Link), big bluestem (*Andropogon gerardii* Vitman) and Indiangrass (*Sorghastrum nutans* (L.) Nash). Sedges are an important component. Several species are possible including Bicknell's sedge (*Carex bicknellii* Britton), woolly sedge (*Carex pellita* Muhl. ex Willd.), and Buxbaum's sedge (*Carex buxbaumii* Whalen.). Tussock-forming species like Hayden's sedge (*Carex haydenii* Dewey) and upright sedge (*Carex stricta* Lam.) are also common. Orchids like the white lady's slipper (*Cypripedium candidum* Muhl. ex Willd.) is an important species that can reflect the high calcium carbonate content. Common forbs include prairie blazing star (*Liatris pycnostachya* Michx.), compassplant (*Silphium laciniatum* L.), fourflower yellow loosestrife (*Lysimachia quadriflora* Sims), and swamp milkweed (*Asclepias incarnata* L.). Shrubs, such as willows (Salix L.) and dogwoods (Cornus L.), increase with the absence of frequent fire. Today, high-quality, unplowed areas are extremely uncommon. Most remaining areas managed for tallgrass prairie were once tilled and utilized for agricultural production. It is therefore likely that hydrology has been altered and many of the historic native prairie species are extirpated even from these sites.

Resilience management. Prescribed fire and managed grazing are key resilience management practices. Prescribed fire is the controlled application of fire to modify vegetation structure and influence ecological processes. Prescribed grazing incorporates periods of grazing rest during the growing season which benefits tallgrass maintenance. Excessive grazing can quickly impact the vegetative composition and negatively impact soil stability.

Dominant plant species

- big bluestem (*Andropogon gerardii*), grass
- prairie cordgrass (*Spartina pectinata*), grass
- sedge (*Carex*), grass
- blazing star (*Liatris*), other herbaceous
- compassplant (*Silphium laciniatum*), other herbaceous
- fourflower yellow loosestrife (*Lysimachia quadriflora*), other herbaceous

Community 1.1
High Diversity Prairie

This plant community consists of native grasses and forbs that are tolerant of poorly drained soils and soils with a high calcium carbonate content. The vegetative composition of the reference state can be influenced by grazing or fire. Fire is an important trigger in maintaining a native grassland community. The communities described within this state and transition model are influenced primarily by a fire return intervals of less than 3 years. Fire reduces the extent of woody species and maintains the natural dominance and diversity of native grasses and forbs. Fire stimulates seed regeneration and reduces the amount of thatch. Common grasses include prairie cordgrass, big bluestem, and multiple species of sedges. Other wet-tolerant grass and herbaceous species will be present. The composition of forbs is often highly diverse. An orchid, the white lady's slipper (*Cypripedium candidum* Muhl. ex Willd.), is a species that reflects the high calcium carbonate content of this site. Wet prairie forbs are characteristic.

Resilience management. Prescribed fire and managed grazing are key resilience management practices. Prescribed fire is the controlled application of fire to modify vegetation structure and influence ecological processes. Prescribed grazing incorporates periods of grazing rest during the growing season which benefits tallgrass maintenance. Excessive grazing can quickly impact the vegetative composition and negatively impact soil stability.

Dominant plant species

- big bluestem (*Andropogon gerardii*), grass
- prairie cordgrass (*Spartina pectinata*), grass
- sedge (*Carex*), grass
- blazing star (*Liatris*), other herbaceous
- compassplant (*Silphium laciniatum*), other herbaceous
- fourflower yellow loosestrife (*Lysimachia quadriflora*), other herbaceous

Community 1.2
Old Growth Prairie

This plant community is characterized by a fire return interval of 3 to 5 years. Grass species are still dominant, but woody species have increased. Thatch is denser which can reduce seedling regeneration by shading and

obstruction.

Resilience management. Prescribed fire and grazing are resilience management practices. Although this community has a longer fire return interval than Community 1.1, it also relies on fire and grazing to maintain vegetation community structure.

Dominant plant species

- leadplant (*Amorpha canescens*), shrub
- big bluestem (*Andropogon gerardii*), grass
- prairie cordgrass (*Spartina pectinata*), grass

Pathway 1.1A
Community 1.1 to 1.2

The frequency of fire is the primary factor affecting the transition from Community 1.1 and Community 1.2. Pathway 1.1A consists of a fire free period of 3 to 5 years. It allows for changes such as an increase in number of shrub species, an increase in abundance of dead plant material, and a reduced rate of regeneration. Secondary triggers, such as grazing and drought, also influence overall community composition.

Pathway 1.2A
Community 1.2 to 1.1

This pathway consists of a fire return interval of less than 3 years. Fire intolerant woody species are set back, and the amount of dead plant material that can slow new growth is reduced.

State 2
Tillage State

Tillage is the primary mechanism affecting the transition to this state. In this state, dynamic soil properties such as bulk density, structure, organic carbon content, and saturated hydraulic conductivity are altered by agricultural practices. Hydrological modifications (tiling and ditching) are commonly installed to improve drainage, so natural hydrology is altered. Most areas in this state will remain in use for crop production in the foreseeable future – primarily in an intensive corn and soybean rotation. 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 small percentage of this ecological sites have been seeded back to grass. Some previously tilled areas have been converted to warm-season grasslands as part of the NRCS Conservation Reserve Program (CRP). Species seeded will depend upon the hydrology of the site and landowners objectives. Native forbs are commonly included in seed mixes to benefit wildlife and pollinators. Although highly beneficial to wildlife, these sites generally lack the diversity of State 1. Cool-season grasses are also feasible. The most common cool-season grasses are non-native species, such as reed canarygrass and Kentucky bluegrass. Although cool-season grasslands are not as species rich or biologically diverse as warm-season grasslands, they still offer soil health benefits and benefits for grassland birds. Some tilled sites may revert to a woodland through abandonment; however, this is a small percentage of acres within MLRA 103 so is not currently given a community in this model.

Resilience management. Disturbance management and harvest management are resilience management practices. The maintenance of this state requires that the intensity, frequency, duration, and timing of agricultural practices (disturbances) be managed to control or modify vegetation structure.

Dominant plant species

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

Community 2.1
Row Crop Community

This plant community typically consists of intensively produced, traditional row crops. Tillage and intentional plant establishment (crop seeding) are the primary triggers for this community. A secondary trigger is substantial hydrological modifications (ditching and tiling), which are commonly installed to improve soil drainage. The most common crops are corn and soybeans on an annual rotation. Many crops, however, are feasible for these areas. Conservation tillage practices may be implemented to reduce the hazard of erosion while still maintaining a corn and soybean rotation. These practices can help protect the soil surface from erosion and allow water to infiltrate instead of running off. Examples include no-till or ridge-till, which leave residue on the surface of the field. Additional soil health benefits can be gained by adding alternative crops to fields that are already in conservation tillage. By diversifying the crop rotation, landowners take additional management steps to improve soil health and protect water quality.

Resilience management. Disturbance management and harvest management are resilience management practices. The maintenance of the desired vegetation community requires management of the intensity, frequency, duration, and timing of disturbances caused by agricultural practices.

Dominant plant species

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

Community 2.2
Seeded Grassland Community

This community is in areas that were previously tilled and used for agricultural production but have been transitioned to either warm-season or cool-season grasses. The primary trigger is the intentional establishment of a grassland community. Warm-season grasses are commonly planted through conservation programs, such as the NRCS Conservation Reserve Program (CRP). Species planted will depend upon the hydrology and landowner objectives. Commonly included are a mix of native forbs that benefit wildlife and pollinators. Numerous native grasses and forbs are suitable for this site. Seed mix selection depends on landowner objectives and site-specific characteristics. Grazing management may also be a trigger. Poor grazing management practices on can lead to soil erosion and invasion by cool-season grasses such as smooth brome (*Bromus inermis*) and Kentucky bluegrass (*Poa pratensis*). Resilience management practices include prescribed fire, invasive plant management, and a program of planned grazing that manages the intensity, frequency, and duration of grazing. Less common than warm-season species, but still feasible, are cool-season grass species such as reed canarygrass and Kentucky bluegrass. Many cool-season grasses can be planted, depending on the hydrology and landowner goals. Many of these areas are eventually transitioned to annual crop production.

Resilience management. Disturbance management and harvest management are resilience management practices. The maintenance of the desired vegetation structure requires management of the intensity, frequency, duration, and timing of disturbances caused by agricultural practices. Practices include seeding, controlling weeds and brush, and applying fertilizer. Prescribed fire is a resilience management practice on warm-season grasslands. The controlled application of fire modifies vegetation structure and influence ecological processes.

Dominant plant species

- prairie cordgrass (*Spartina pectinata*), grass
- big bluestem (*Andropogon gerardii*), grass

Pathway 2.1.A
Community 2.1 to 2.2

This pathway converts Community 2.1 (row crops) to Community 2.2 (seeded grassland). The primary mechanism of change is the seeding of desired grass species.

Conservation practices

Forage and Biomass Planting

Pathway 2.2.A
Community 2.2 to 2.1

This pathway converts seeded grassland to cropland. This is a common pathway throughout MLRA 103 as areas are placed in crop production. The mechanisms of change are tillage and intentional plant establishment (crop seeding). Resilience management practices include weed control (herbicide application), field cultivation, fertilizer application, and harvest management.

State 3
Woodland State

In the absence of a natural fire regime or grassland management, this site will transition to a Wooded State. Unmanaged grazing, altered hydrology, and invasive species may impact the site. Community composition will vary depending on the type and severity of disturbances. Dominant tree species often include eastern cottonwood, black willow, green ash, and boxelder. Reed canarygrass, Kentucky bluegrass, and smooth brome are often present. Few acres within MLRA 103 are in this State. Some remaining areas are conservation easements. Areas not in a conservation programs are likely to be jurisdictional wetlands, making it very unlikely they will be transitioned to the State 2 due to various wetland programs and laws, including the Swampbuster provision of the Food Security Act of 1985 (P.L. 99-198, as amended by P.L. 115-25) and the Minnesota Wetland Conservation Act (WCA) of 1991 (M.R. 8420.0100, as amended in 2009).

Dominant plant species

- eastern cottonwood (*Populus deltoides*), tree
- black willow (*Salix nigra*), tree
- green ash (*Fraxinus pennsylvanica*), tree
- boxelder (*Acer negundo*), tree
- dogwood (*Cornus*), shrub
- willow (*Salix*), shrub
- reed canarygrass (*Phalaris arundinacea*), grass
- Kentucky bluegrass (*Poa pratensis*), grass

Community 3.1
Woodland Community

This site is a woodland plant community usually consisting of various species of trees, shrubs, and often, non-native species. The composition and structure of this community will depend on the hydrology (natural or altered), previous and ongoing disturbances (tree removal, grazing), and available seed sources. Non-native shrub and herbaceous species are often present.

Dominant plant species

- eastern cottonwood (*Populus deltoides*), tree
- black willow (*Salix nigra*), tree
- green ash (*Fraxinus pennsylvanica*), tree
- boxelder (*Acer negundo*), tree
- dogwood (*Cornus*), shrub
- willow (*Salix*), shrub
- reed canarygrass (*Phalaris arundinacea*), grass
- Kentucky bluegrass (*Poa pratensis*), grass

Transition T1A
State 1 to 2

Transition T1A is the conversion of the reference state to agriculture. The triggers are tillage and intentional plant establishment (crop seeding). Hydrological modifications, such as ditching and tiling, are often also installed.

Constraints to recovery. Tillage and long-term intensive agricultural production generally preclude a return to State 1. Areas in row crop production may be placed in conservation programs and seeded with warm-season

grasses, but will not exhibit the natural species diversity or ecological resilience of State 1. Most acres converted to agriculture will stay as such for the foreseeable future.

Transition T1B
State 1 to 3

Plant community succession due to lack of natural fire and/or grazing. Brush and trees will increase and community structure will transition from a prairie to a woodland. Disturbances such as overgrazing and non-native vegetation may influence the plant community composition and structure.

Restoration pathway R3A
State 3 to 1

Sites that have not been tilled and still have natural hydrology may be feasible for restoration. Restoration activities will include woody species removal, weed/brush control, establishment of a native grassland community.

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.

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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	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:**

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:**

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6. **Extent of wind scoured, blowouts and/or depositional areas:**

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7. **Amount of litter movement (describe size and distance expected to travel):**

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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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:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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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:

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17. **Perennial plant reproductive capability:**
