USDA Natural Resources Conservation Service

Ecological site R103XY015MN
Depressional Marsh

Last updated: 10/04/2023
Accessed: 04/26/2024

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)

Relationship to Other Established Classifications:
The reference state shares similarities with Minnesota Department of Natural Resources MRp83 Prairie Mixed Cattail Marsh

Ecological site concept

The Depressional Marsh ecological site is extensive (>100,000 acres) in MLRA 103 and occurs in the central prairie region and the northeastern Big Woods ecoregion. Hydrologic interaction with adjacent sloping ground classifies this site as a recharge wetland. Landscape positions include slightly concave (depressional) to linear segments. Soils are very poorly drained, frequently ponded, and have a relatively high organic matter content in the surface and near surface horizons. Plant species dominance is influenced by water depth.

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 drainage class is poorly drained but the site does not flood or pond.
R103XY009MN	**Calcareous Rim Prairies** The Calcareous Rim Prairies ecological site is characterized by landscape position (rim), calcareous soils, low slope (0-2%), and poorly drained soils. This site is hydrologically connected to adjacent ponded depressions. This site does not pond.
R103XY005MN	**Clayey Upland Prairies** 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. Drainage class is somewhat poorly drained to well drained.
F103XY026MN	**Clayey Upland Forests** The Clayey Upland Forests ecological site is located on uplands. The soils are derived from clayey till and lacustrine (lake) materials, and drainage class ranges from somewhat poorly drained to well drained. The soils have a thin or moderately thick mollic (dark) surface.
R103XY003MN	**Sandy Upland Prairies** The Sandy Upland Prairies ecological site is located on uplands including outwash plains and valley trains along modern river valleys. Soils are formed from sandy and course loamy outwash and loamy-mantled outwash. Sites do not flood or pond. The reference state site concept is a mesic native prairie.
F103XY028MN	**Clayey Wet Forests** The Clayey Wet Forests ecological site occurs on clayey textured soils that have a seasonal depth to soil saturation of 0 to 30 cm. This site is located on concave or linear low-slope areas, but no flooding or ponding usually occurs.

Similar sites

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.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Typha latifolia* (2) *Bolboschoenus fluviatilis*

Physiographic features

The Depressional Marsh ecological site is predominantly located in the prairie region and Big Woods ecoregion of MLRA 103. This site is partially defined by the hydrologic relationship with adjacent uplands that surround the depressions. This site may be quite linear in shape; however, “depression” best describes the overall landform. The shallow, bowl-type topography, along with prairie fires during dry periods, kept the soil organic accumulation to a minimum.

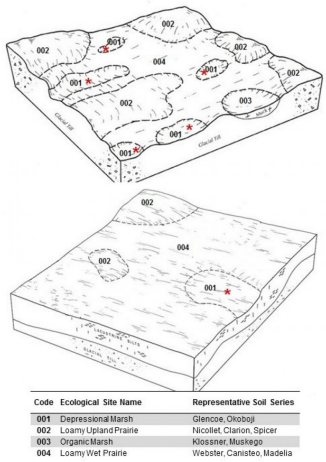


Figure 1. Block diagrams of the representative Depressional Marsh and associated ecological sites.

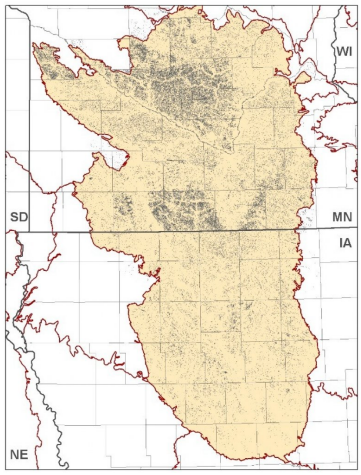


Figure 2. Distribution of the Depressional Marsh ecological site within MLRA 103. In many cases, the data set is not spatially consistent across political boundaries due to the method by which soils were mapped; e.g. due to county subsets.

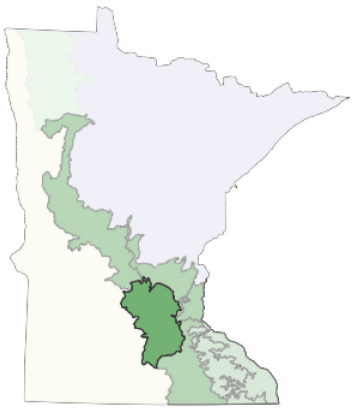


Figure 3. The Big Woods ecoregion shaded in dark green. (Minnesota Department of Natural Resources)

Table 2. Representative physiographic features

Landforms	(1) Till plain (2) Moraine (3) Lake plain (4) Outwash plain
Runoff class	Negligible to very low
Ponding duration	Brief (2 to 7 days) to very long (more than 30 days)

Ponding frequency	None to frequent
Elevation	689–1,837 ft
Slope	0–1%
Water table depth	0–36 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 157 days, while the frost-free period is 134 days. The average mean annual precipitation is 32 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)	130-136 days
Freeze-free period (characteristic range)	155-161 days
Precipitation total (characteristic range)	29-34 in
Frost-free period (actual range)	127-142 days
Freeze-free period (actual range)	150-161 days
Precipitation total (actual range)	28-36 in
Frost-free period (average)	134 days
Freeze-free period (average)	157 days
Precipitation total (average)	32 in

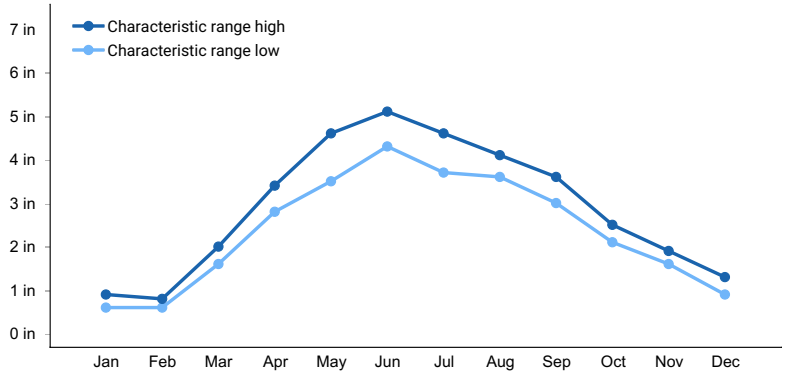


Figure 4. Monthly precipitation range

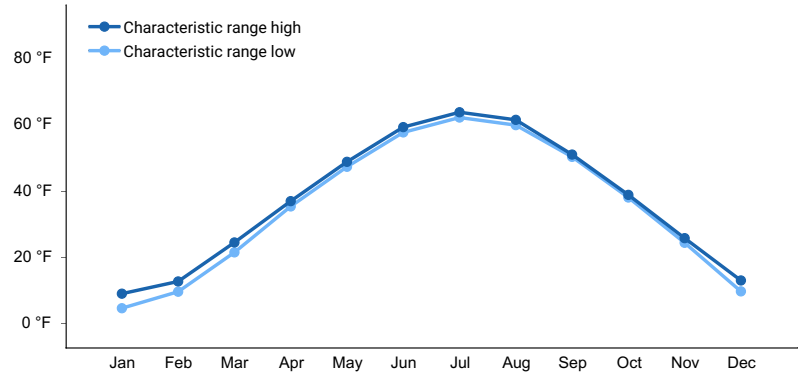


Figure 5. Monthly minimum temperature range

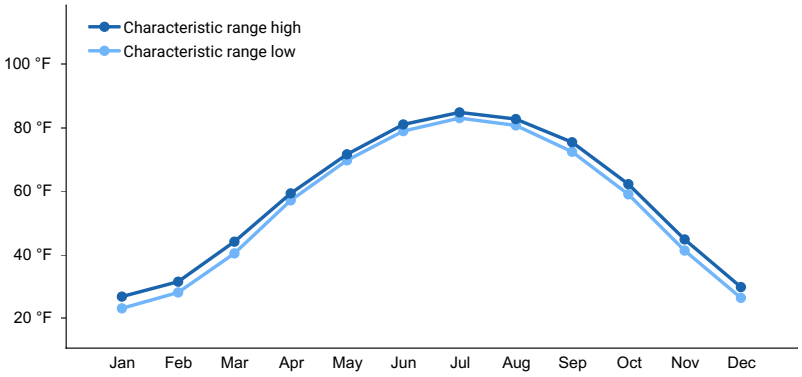


Figure 6. Monthly maximum temperature range

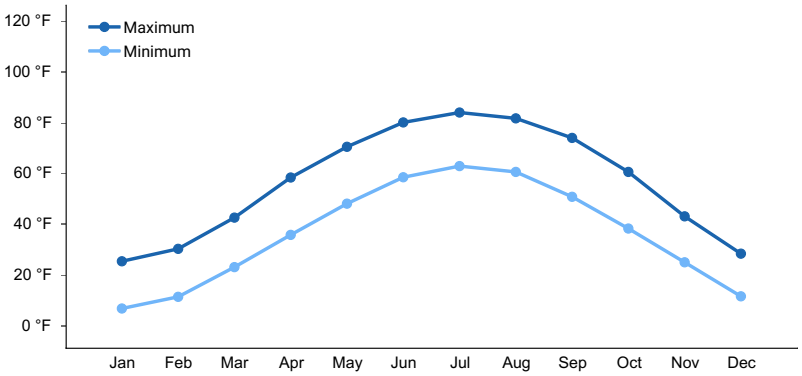


Figure 7. Monthly average minimum and maximum temperature

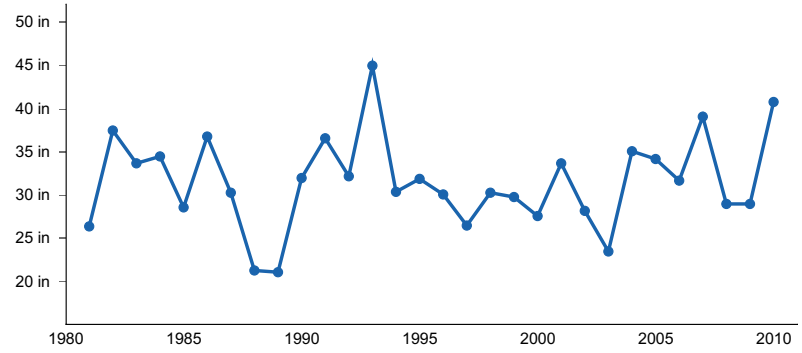


Figure 8. Annual precipitation pattern

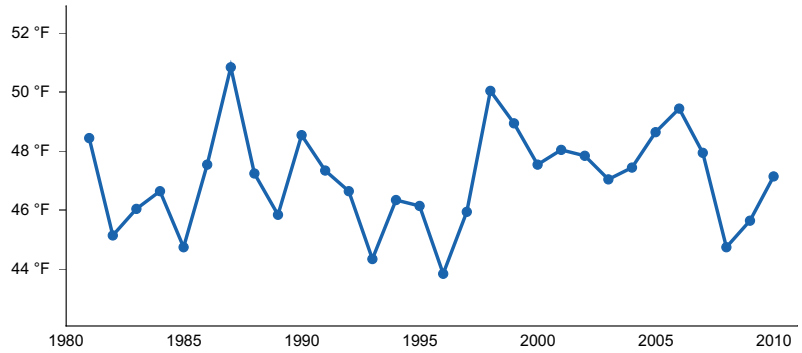


Figure 9. Annual average temperature pattern

Climate stations used

- (1) SPIRIT LAKE [USC00137859], Spirit Lake, IA
- (2) DASSEL [USC00212023], Dassel, MN
- (3) MARSHALL [USC00215204], Marshall, MN
- (4) OWATONNA [USC00216287], Owatonna, MN
- (5) LAKE PARK [USC00134561], Lake Park, IA
- (6) IOWA FALLS [USC00134142], Iowa Falls, IA
- (7) PERRY [USC00136566], Perry, IA

Influencing water features

The Depressional Marsh ecological site receives water from lateral subsurface flow or discharge, the regional groundwater table, direct precipitation, and runoff from uplands. Soils are classified as endosaturated and ponded during the spring. The water table may drop to as low as three feet 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 Cowardin Hydrologic Regime of Palustrine, Emergent Wetland Persistent (PEMC). It also has a United States Army Corps of Engineers Wetland Plant Community of G; Shallow Marshes.

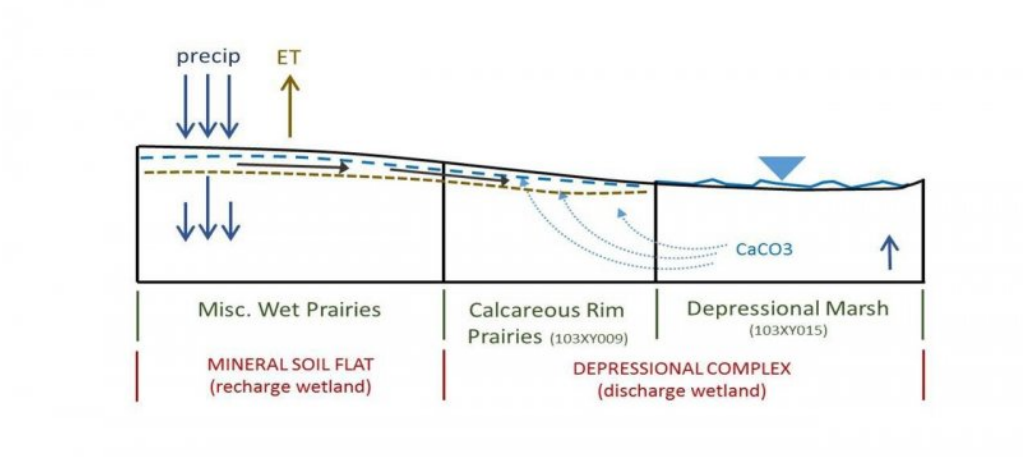


Figure 10. Hydrologic representation of a typical Des Moines Lobe (MLRA 103) Depressional Marsh and associated Ecological Sites.

Soil features

The soil series associated this ecological site are Glencoe,Okoboji, Biscay, Calcousta, Dassel, Granby, Hanska, Isanti, Knoke, Lanyon, Lundlake, Lura, Mayer, Oldham, Quam, Romnell, Shandep, Urness, Spicer, and Wacousta. These soils are relatively rich in organic matter and were developed under hydric vegetation and ponded conditions. They are mineral soils and can have a thin (<8 inches) histic cap. Glencoe and Okoboji are central to the site concept.

Soil drainage class is very poorly drained. The surface texture is variable at silty clay loam, clay loam, silt loam, silty clay, or mucky analogues of these textures. The subsurface group is classified primarily as fine-loamy (with 18 to 35% clay) and fine (greater than 35 % clay), but also includes coarse-loamy (with less than 18% clay), silty (less than 15% sand and 35% clay) and sandy (less than 15% clay and 30% silt). These soils were formed under saturated conditions that produced anaerobic conditions during much of the year. The anaerobic conditions inhibit decomposition of the organic matter which enriches the surface horizons. Since this site formed in ponded or intermittently ponded conditions in low areas, a certain amount of sediment tended to wash into the depressions. In some scenarios, these soils formed in lacustrine environments and tend to be finer. Most of the soils in this group are cumulic, which means they have mollic epipedons that are less than 24 inches thick.

Due to soil saturation, the variety of subsurface textures affect plant growth less than in other, upslope ecological sites. The high water table is a factor that overrides other soil properties (such as texture) in influencing the plant community composition.

Table 4. Representative soil features

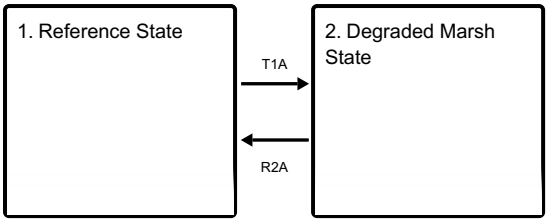
Parent material	(1) Glaciofluvial deposits (2) Slope alluvium (3) Till (4) Outwash (5) Lacustrine deposits
Surface texture	(1) Silty clay loam (2) Clay loam (3) Silt loam (4) Silty clay (5) Muck
Drainage class	Very poorly drained
Permeability class	Slow to rapid
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-60in)	5–13 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)	0–40%
Subsurface fragment volume >3" (0-40in)	0–5%

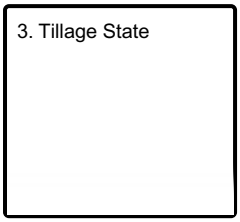
Ecological dynamics

The Depressional Marsh ecological site state and transition model (STM) has three states: the Reference State, the Degraded State, and the Tillage State. The Reference State describes a native, hydrophytic plant community with natural hydrology and no human disturbance triggers. State 2 is a Degraded Marsh State in which human disturbances have modified the plant community. Common triggers include cattle grazing, invasive species, absence of natural fire, and hydrological modifications. State 3 is the Tillage State which describes intensive agricultural production. These sites were primarily transitioned agriculture prior to current wetland protection regulations. This is the most common state in MLRA 103 for this site.

State and transition model

Ecosystem states

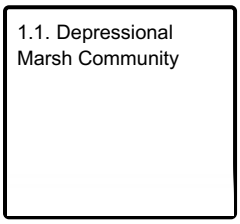




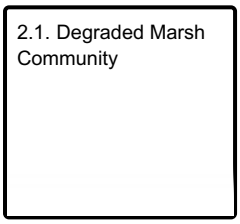
T1A - Disturbances change plant community

R2A - Management inputs to restore site

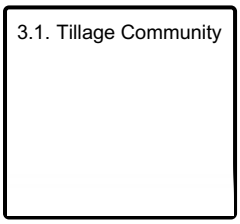
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Reference State

The Depressional Marsh ecological site is characterized by a native, hydrophytic plant community that was historically influenced by drought, fire, and grazing. Plant community structure and composition will vary on this site depending on hydrology. Dominant species include broadleaf cattail (*Typha latifolia*) and river bulrush (*Bolboschoenus fluviatilis*). Increases in water depth favor softstem bulrush (*Schoenoplectus tabernaemontani*) and giant bur-reed (*Sparganium eurycarpum*). Water knotweed (*Polygonum amphibium*) is common on muddy flats during drier periods. High-quality, natural reference sites are now uncommon in MLRA 103. Most sites have been transitioned to agricultural production. Of the sites that still remain, many have altered hydrology due to adjacent tile drainage and ditching.

Dominant plant species

- broadleaf cattail (*Typha latifolia*), grass
- river bulrush (*Bolboschoenus fluviatilis*), grass
- softstem bulrush (*Schoenoplectus tabernaemontani*), grass
- broadfruit bur-reed (*Sparganium eurycarpum*), grass
- water knotweed (*Polygonum amphibium*), other herbaceous

Community 1.1
Depressional Marsh Community

This site is characterized by natural hydrology, frequent ponding, very poorly drained soils, and native, hydrophytic vegetation. The composition of the plant community will depend on the depth and length of ponding.

Dominant plant species

- broadleaf cattail (*Typha latifolia*), grass
- river bulrush (*Bolboschoenus fluviatilis*), grass
- softstem bulrush (*Schoenoplectus tabernaemontani*), grass
- broadfruit bur-reed (*Sparganium eurycarpum*), grass
- water knotweed (*Polygonum amphibium*), other herbaceous

State 2
Degraded Marsh State

The Degraded Marsh State is characterized by one or more disturbance triggers. These disturbances could be hydrology alterations, non-native plants species, cattle grazing, or long-term fire suppression which allows for an increase woody plant species. Common species include common reed (*Phragmites australis*), narrowleaf cattail (*Typha angustifolia*), hybrid cattail (*Typha ×glauca*), reed canarygrass (*Phalaris arundinacea*), and various shrubs and tree saplings. Plant community composition will be influenced by the type, severity, and duration of disturbances as well as the depth of ponding. Some areas in State 2 may be in a conservation easement. Areas not in a conservation program are assumed to be jurisdictional wetlands, making it very unlikely they will be transitioned to agriculture 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

- common reed (*Phragmites australis*), grass
- narrowleaf cattail (*Typha angustifolia*), grass
- hybrid cattail (*Typha ×glauca*), grass
- reed canarygrass (*Phalaris arundinacea*), grass

Community 2.1
Degraded Marsh Community

The Degraded Marsh Community is characterized by various disturbances such as altered hydrology, non-native invasive plants, cattle grazing, and an increase in woody species due to an absence of fire. A variety of invasive woody plants and grasses can become dominant on this site. Typical species include hybrid cattail, reed canarygrass, common reed, and various woody plants. Plant community composition will be influenced by disturbances and the duration and depth of ponding.

Dominant plant species

- common reed (*Phragmites australis*), grass
- narrowleaf cattail (*Typha angustifolia*), grass
- hybrid cattail (*Typha ×glauca*), grass
- reed canarygrass (*Phalaris arundinacea*), grass

State 3

Tillage State

Tillage and drainage are the primary mechanisms for transitioning to this state. Most of these sites were transitioned to agriculture prior to current wetland protection legislation. Soil tillage affects dynamic soil properties such as bulk density, structure, organic carbon content, and saturated hydraulic conductivity. Hydrological modifications (tiling and ditching) may be installed to improve drainage, so natural hydrology is also altered. Most areas in this state will remain in crop production in the foreseeable future – primarily in an intensive corn and soybean rotation. Conservation 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 erosion, and protect water quality. Some areas may be seeded to grass or have reverted to a scrubby woodland. However, this is a small percentage of acres within the MLRA, so these communities are not currently included in the state and transition model.

Resilience management. The mechanisms of change are tillage, drainage, and intentional plant establishment (crop seeding). Resilience management practices include weed control (herbicide application), field cultivation, fertilizer application, and harvest management.

Dominant plant species

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

Community 3.1
Tillage Community

This plant community typically consists of intensively produced, traditional row crops. Tillage, tiling/ditching, and intentional plant establishment (planting crops) are the primary triggers for this community. The most common crops are corn and soybeans on an annual rotation.

Resilience management. Resilience management practices include weed control (herbicide application), field cultivation, fertilizer application, and harvest management.

Dominant plant species

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

Transition T1A
State 1 to 2

Disturbances such as hydrological changes, cattle grazing, invasive species, and absence of a natural fire regime will alter the State 1 plant community composition and structure.

Restoration pathway R2A
State 2 to 1

Restoration activities may include the eliminate of invasive plant species, establishment of desired native species, and protection of the site from disturbances such as cattle grazing. Complete restoration is only possible if the natural hydrology still exists.

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	04/26/2024
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:**

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:**