USDA Natural Resources Conservation Service

Ecological site R103XY007MN
Sandy Wet Prairies

Last updated: 10/04/2023
Accessed: 05/19/2024

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 WPs54b Southern Wet Prairie

Ecological site concept

The Sandy Wet Prairies ecological site occurs on poorly drained soils formed from sandy and gravelly outwash parent materials. There is no ponding; however, soils are endosaturated (i.e. have a seasonal high water table). This site is typically part of a broader semi-closed wetland basin and are commonly hydrologically connected to adjacent ponded depressions.

Associated sites

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.

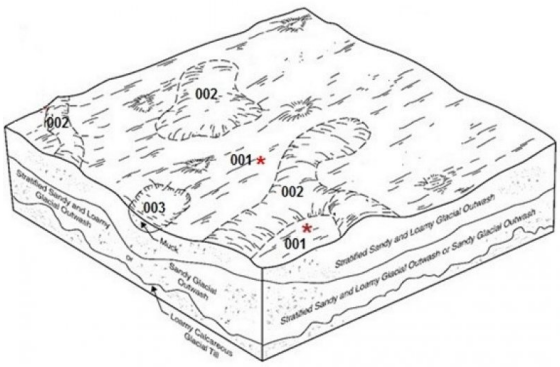
R103XY016MN	**Organic Marsh** The Organic Marsh ecological site occurs in the centers of medium to large-sized depressions and is typically surrounded by mineral soils associated with the Depressional Marsh ecological site. Soils are very poorly drained and ponded with deep water throughout the growing season in most years (i.e. semi-permanent wetlands). Soils are developed from organic parent materials.
R103XY019MN	**Sandy Upland Savannas** The Sandy Upland Savannas ecological site is located on soils that developed under a mix of grassland and scattered trees. Soil parent material is outwash or a loamy mantle over outwash. Drainage class is well to excessively drained.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Amorpha canescens*
Herbaceous	(1) *Spartina pectinata* (2) *Oligoneuron rigidum*

Physiographic features

The Sandy Wet Prairies ecological site is modest in acreage but widespread throughout MLRA 103. The site is on linear slopes of 2% or less. Landforms include valley trains, outwash plains, lake plains, and till plains. They also occur as isolated outwash deposits within broader till plain landscapes. The site is typically part of a broader semi-closed wetland basin and commonly is hydrologically connected to adjacent ponded depressions. The landscape position of this site is best described as "linear segment". The site is mostly defined as a level or nearly level surface or small area of land marked by little or no local relief. Low relief (0-2%) linear slopes interact with high water tables to make this site wetter than the adjacent upslope areas but drier than adjacent downslope depressional areas. However, subtle and uneven areas of swales or depressions may occur. The low slope gradient and linear to slightly concave slope shape are the most defining parameters. As a result these site do not typically pond, but the water table is usually at or near the soil surface during the spring months.



Code	Ecological Site Name	Representative Soil Series
001	Sandy Wet Prairie	Biscay, Darfur
002	Sandy Upland Prairie	Estherville, Dickinson
003	Organic Marsh	Klossner, Muskego

Figure 1. Block diagrams of the representative Sandy Wet Prairies and associated ecological sites.

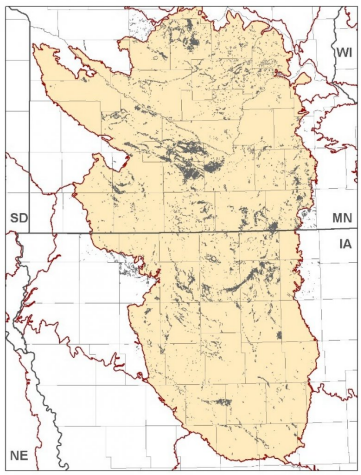


Figure 2. Distribution of the Sandy Wet Prairies ecological site within MLRA 103. In many cases, the data set is not spatially consistent across political boundaries due to the method by which soils were mapped; e.g. due to county subsets.

Table 2. Representative physiographic features

Hillslope profile	(1) Toeslope
Landforms	(1) Outwash plain (2) Lake plain (3) Till plain (4) Valley train
Runoff class	Negligible to low
Elevation	183–610 m
Slope	0–2%
Water table depth	0–183 cm
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 is 157 days, while the frost-free period is 133 days. The average mean annual precipitation is 32.0 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)	129-137 days
Freeze-free period (characteristic range)	150-162 days
Precipitation total (characteristic range)	737-889 mm
Frost-free period (actual range)	126-138 days
Freeze-free period (actual range)	146-166 days
Precipitation total (actual range)	660-914 mm
Frost-free period (average)	133 days
Freeze-free period (average)	157 days
Precipitation total (average)	813 mm

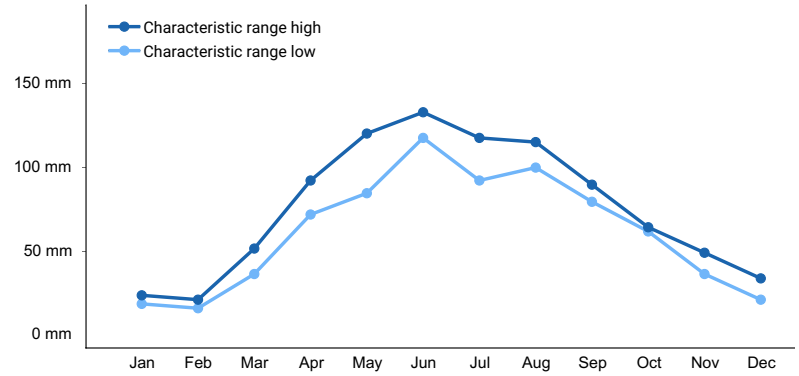


Figure 3. Monthly precipitation range

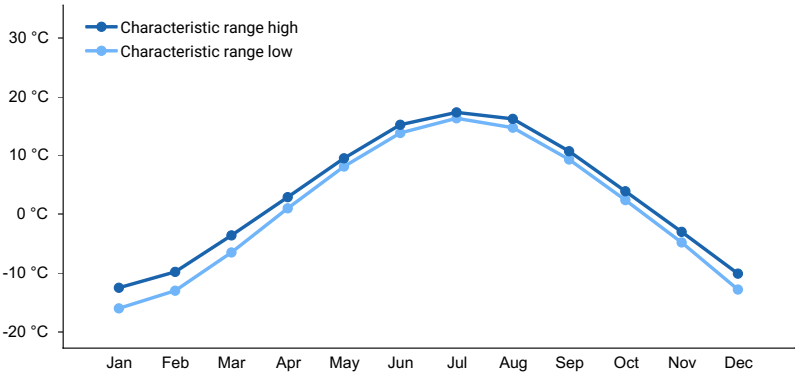


Figure 4. Monthly minimum temperature range

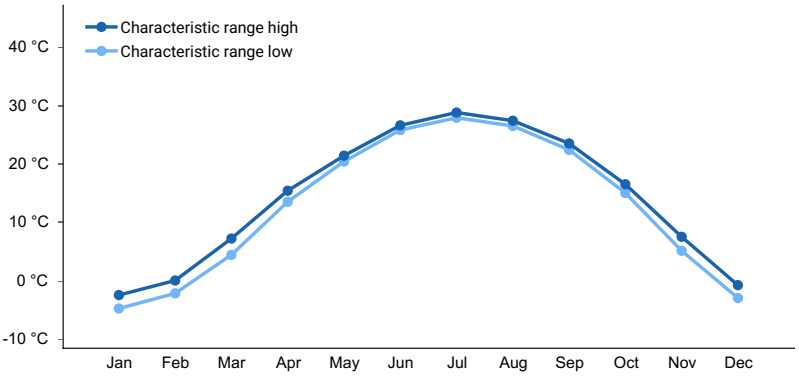


Figure 5. Monthly maximum temperature range

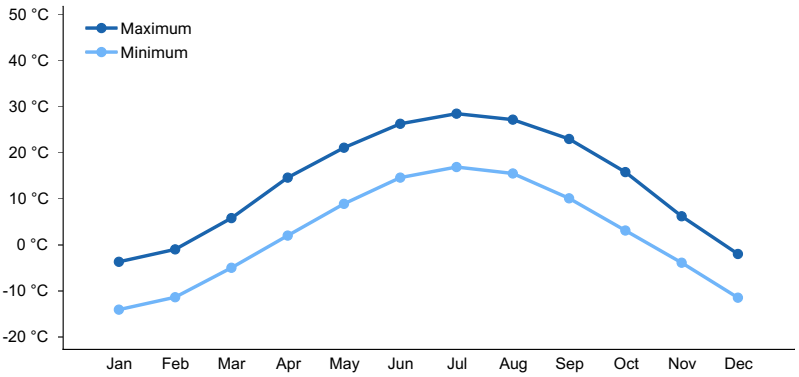


Figure 6. Monthly average minimum and maximum temperature

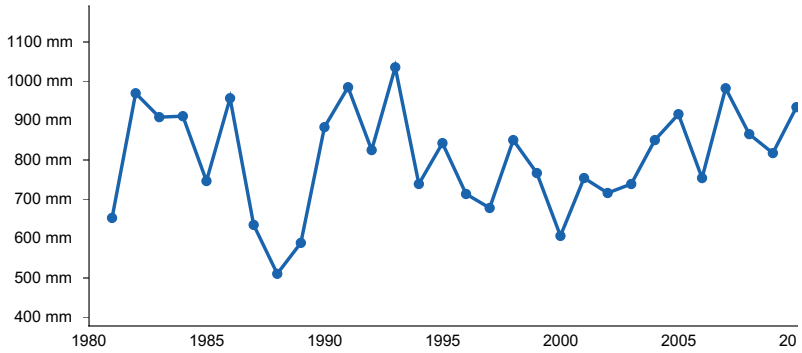


Figure 7. Annual precipitation pattern

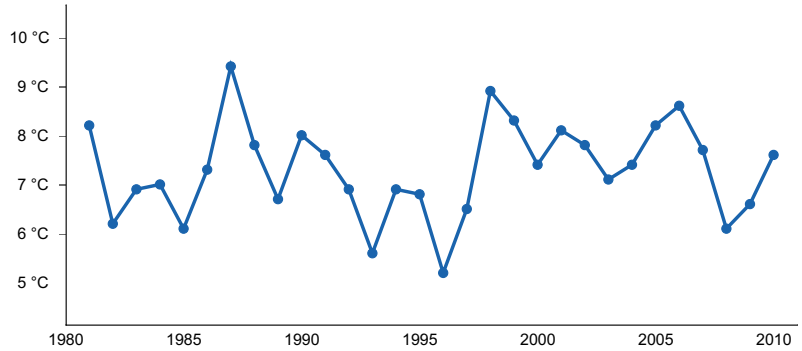


Figure 8. Annual average temperature pattern

Climate stations used

- (1) PERRY [USC00136566], Perry, IA
- (2) BUFFALO 2NE [USC00211107], Buffalo, MN
- (3) MADISON SEWAGE PLT [USC00214994], Madison, MN
- (4) WORTHINGTON 2 NNE [USC00219170], Worthington, MN
- (5) ALBERT LEA 3 SE [USC00210075], Albert Lea, MN
- (6) STORM LAKE 2 E [USC00137979], Storm Lake, IA
- (7) COLO [USC00131710], Colo, IA

Influencing water features

With natural hydrology intact, the Sandy Wet Prairies ecological site receives water from three sources: direct precipitation, runoff, and recharge through base flow from adjacent uplands. In the spring months, this site can produce surface runoff. Soils are classified as endosaturated as the water table is at or near the soil surface during the spring months. The water table will drop to as low as six feet during dry periods.

In the hydrogeomorphic (HGM) classification system, the Sandy Wet Prairies ecological site is considered a Recharge Mineral Soil Flat, producing recharge to groundwater and adjacent depressional wetlands (USDA-NRCS, 2008; Gilbert et al., 2006). This site has a Saturated Cowardin Hydrologic Regime of Palustrine; Persistent Emergent Wetlands. 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).

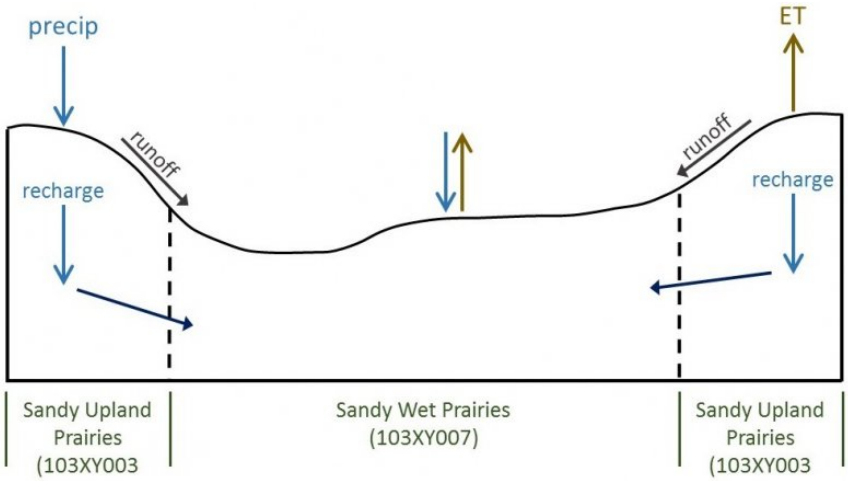


Figure 9. Representation of hydrological factors in a typical area of the Sandy Wet Prairies and associated ecological sites on the Des Moines Lobe (MLRA 103).

Soil features

Soil series include Belleville, Biscay, Darfur, Essexville, Fieldon, Granby, Hanska, Harcot, Lemond, Mayer, Regal, Shandep, Tadkee, and Talcot. These soils are rich in organic matter and were developed under prairie vegetation. Prairie soils by definition have thick, dark, organic-rich surface horizons. The central parent materials include outwash or glaciofluvial materials deposited by glacial meltwaters. Most soils have mantles of loamy drift above the outwash, which can range from 20 to 40 inches thick. Sandy lacustrine materials are also included within the site concept. Also included are soils having a mantle of outwash over till. The most common surface textures are loamy sand, loam, and silty clay loam. Most subsurface groups are classified as course-loamy or sandy (with greater than 60% clay). All soils are classified as Mollisols. The majority of these soils are further classified as Typic Endoaquolls, indicating an apparent water table. A number of these soils are considered calcareous.

Soils in this group were formed under saturated conditions that produced anaerobic conditions during at least part of the year. Thic, dark, surfaces tend to mask the typical redoximorphic features used to determine seasonal high water table depths. Beneath the mollic surface horizons, these soils have a depleted matrix (a chroma of 2 or less and a value of 4 or more). The primary hydric soil indicators include: Depleted Below Dark Surface (A11), Thick Dark Surface (A12), and Redox Dark Surface (USDA-NRCS, 2010).

Table 4. Representative soil features

Parent material	(1) Outwash–shale (2) Lacustrine deposits–limestone (3) Glaciofluvial deposits
Surface texture	(1) Sandy loam (2) Loam (3) Loamy sand
Family particle size	(1) Sandy
Drainage class	Poorly drained
Permeability class	Slow to very rapid
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0–2%
Available water capacity (0-152.4cm)	15.24–25.4 cm
Calcium carbonate equivalent (0-101.6cm)	0–30%

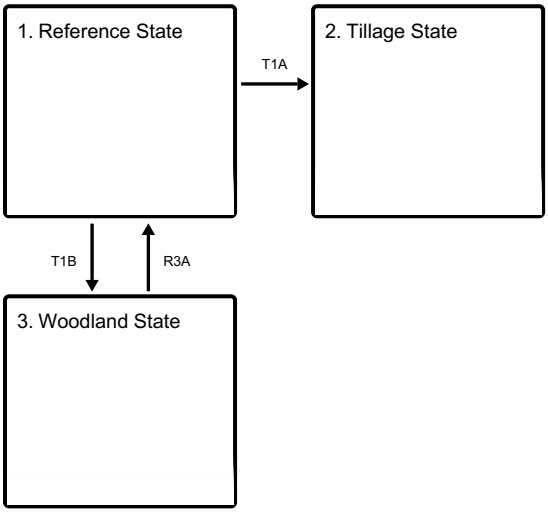
Soil reaction (1:1 water) (0-101.6cm)	6.1–8.4
Subsurface fragment volume <=3" (0-101.6cm)	0–45%
Subsurface fragment volume >3" (0-101.6cm)	0–6%

Ecological dynamics

The Sandy Wet Prairie ecological site is characterized by three states: the Reference State, the Tillage State, and the Woodland State. Two plant communities exist in the Reference State and are characterized by different fire return intervals. Fire and grazing are triggers for change on this ecological site. The Tillage State describes sites that have been tilled and generally have modified hydrology. Two communities make up the Tillage State: the Row Crop Community and the Seeded Grassland Community. The Woodland State is a disturbed wooded state. Disturbances may include lack of natural fire, unmanaged grazing, and non-native species.

State and transition model

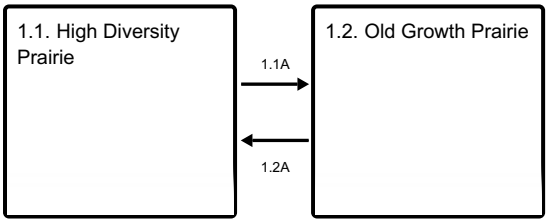
Ecosystem states



T1B - Lack of natural fire regime/grazing.

R3A - Restoration of untilled sites to native prairie

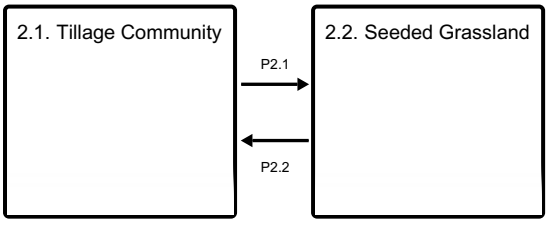
State 1 submodel, plant communities



1.1A - Fire-free period 3-5 years

1.2A - Fire-free period less than 3 years.

State 2 submodel, plant communities



P2.1 - Establishment of grasses

P2.2 - Tillage; seeding of row crops

State 3 submodel, plant communities

3.1. Woodland Community

State 1
Reference State

The Sandy Wet Prairies ecological site reference is a wet to wet-mesic prairie that includes a diversity of wet-tolerant grasses and forbs. Variation in water table allows both wetland and non-wetland species to thrive on this site. Grass species include prairie cordgrass, big bluestem, and Indiangrass. Sedges are an important component, especially in wetter areas. Several dozen species are possible. The most noteworthy species are Bicknell's sedge (*Carex bicknellii* Britton), woolly sedge (*Carex pellita* Muhl ex. Willd.), and Buxbaum's sedge (*Carex buxbaumii* Wahlen B.). Tussock-forming species like Hayden's sedge (*Carex haydenii* Dewey) and upright sedge (*Carex stricta* Lam.) may also be important in wet conditions. Common forbs include classic tallgrass prairie species like prairie blazing star (*Liatris pycnostachya* Michx.) and compassplant (*Silphium laciniatum* L.), as well as species typical of wetland conditions like four flower yellow loosestrife (*Lysimachia quadriflora* Sims) and swamp milkweed (*Asclepias incarnata* L.). Shrub cover was typically low and likely included leadplant (*Amorpha canescens* Pursh), willows (Salix L.) and dogwoods (Cornus L.), which quickly spread in the absence of frequent fire. Community phases within the reference state are generally dependent upon the impacts of fire or grazing. Fire is a trigger that occurs during dry periods and promotes continued herbaceous vegetation dominance and removes dense thatch. This promotes seedling regeneration. Fire removes plant litter, helps cycle nutrients, and allows light to reach the seedbed. Frequent fire maintains the community in a grassland state by keeping fire-sensitive woody species from gaining dominance. 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.

Dominant plant species

- prairie cordgrass (*Spartina pectinata*), grass
- big bluestem (*Andropogon gerardii*), grass
- Indiangrass (*Sorghastrum nutans*), grass
- sedge (*Carex*), grass
- stiff goldenrod (*Oligoneuron rigidum*), other herbaceous
- swamp milkweed (*Asclepias incarnata*), other herbaceous

Community 1.1
High Diversity Prairie

This plant community is composed of wet-tolerant native grasses along with a variety of native forbs. The vegetative composition is influenced by fire return intervals of less than 3 years. Frequent fire reduces fire-intolerant woody species and maintains the natural dominance and diversity of native grasses and forbs. Fire also stimulates seed regeneration and reduces the amount of thatch. Managed grazing may also be a trigger to maintain and promote a diverse grassland community. A diversity of native forbs are present on these sites.

Dominant plant species

- prairie cordgrass (*Spartina pectinata*), grass
- big bluestem (*Andropogon gerardii*), grass
- Indiangrass (*Sorghastrum nutans*), grass
- sedge (*Carex*), grass

- stiff goldenrod (*Oligoneuron rigidum*), other herbaceous
- swamp milkweed (*Asclepias incarnata*), other herbaceous

Community 1.2
Old Growth Prairie

This plant community is characterized by a fire return interval longer than three years which allows for an increase in woody species and thatch buildup. Thatch can reduce herbaceous plant regeneration through blockage and shading. Although this community has a longer fire return interval than Community 1.1, it also relies on fire and/or grazing to maintain vegetation community structure. Prescribed grazing management may also be used to manage community structure, plant health, regeneration, and vigor. By incorporating periods of rest and recovery during the growing season, landowners can insure that the palatable grasses and forbs are maintained as dominants within the community.

Resilience management. Prescribed fire and grazing are resilience management practices. Prescribed fire is the controlled application of fire to modify vegetation structure and influence ecological processes.

Dominant plant species

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

Pathway 1.1A
Community 1.1 to 1.2

An decrease in fire frequency will allow for an increase in woody vegetation within the community.

Pathway 1.2A
Community 1.2 to 1.1

An increase in fire frequency will reduce woody vegetation and thatch plus enhance regeneration of native grasses and forbs.

State 2
Tillage State

Soil tillage and hydrological modification (ditching, tiling) are the primary mechanisms transitioning this site to a Tillage State. Tillage alters dynamic soil properties such as bulk density, structure, organic carbon content, and saturated hydraulic conductivity. 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 soil health impacts of traditional agricultural practices. 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 the Sandy Wet Prairies ecological site have been seeded back to grasses. Under conservation programs. Native grasses and forbs benefit wildlife and pollinators; however, these sites generally lack the diversity of a reference state condition. Cool-season grasses are also feasible. Species selection will depend on the landowner's objectives and site specifics.

Dominant plant species

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

Community 2.1
Tillage Community

This plant community typically consists of traditional row crops. Tillage, drainage, 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.

Dominant plant species

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

Community 2.2
Seeded Grassland

Community 2.2. includes 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 under a NRCS conservation program. Seed mixes include native forbs that benefit wildlife and pollinators. Seed mix selection depends on existing hydrological conditions and landowner objectives. Landowners may choose to establish cool-season grass species. Multiple cool-season grasses can be planted, depending on management objectives. Many of these areas are eventually transitioned to annual crop production.

Resilience management. Resilience management practices include invasive plant management, woody species control, and a program of planned grazing.

Dominant plant species

- big bluestem (*Andropogon gerardii*), grass
- Indiangrass (*Sorghastrum nutans*), grass
- reed canarygrass (*Phalaris arundinacea*), grass
- Kentucky bluegrass (*Poa pratensis*), grass

Pathway P2.1
Community 2.1 to 2.2

Seeding of either warm season or cool season grass species is the mechanism of change from Community 2.1. to 2.2.

Conservation practices

Forage and Biomass Planting

Pathway P2.2
Community 2.2 to 2.1

Returning the area to row crop production is the mechanism of change from Community 2.2 to 2.1. Common management inputs include tillage, seeding, weed control, and fertilizing.

State 3
Woodland State

The absence of a natural disturbances, such as fire, can revert areas to the Wooded State. These sites often have other disturbances such as unmanaged grazing, altered hydrology, and invasive species. Community composition and characteristics will vary depending on seed sources and the type, severity, and length of disturbances. Tree species often include eastern cottonwood, black willow, green ash, and boxelder. Shrubs include dogwood and willow. State 3 may be a conservation easement. Areas not in a conservation program are assumed to be jurisdictional wetlands, making it unlikely they will be transitioned to 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
- redosier dogwood (*Cornus sericea*), shrub
- black willow (*Salix nigra*), shrub
- reed canarygrass (*Phalaris arundinacea*), grass
- Kentucky bluegrass (*Poa pratensis*), grass

Community 3.1
Woodland Community

This site is a woodland community consisting of various species of trees, shrubs, and often, non-native species. Common trees include eastern cottonwood, black willow, boxelder, and green ash. Open areas may be dominated by reed canarygrass and other cool-season, non-native grasses. Plant community composition will be determined by past disturbances, seed sources, and current disturbances.

Dominant plant species

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

Transition T1A
State 1 to 2

Reference site is transitioned to agricultural uses. Multiple management inputs are possible depending on site characteristics and landowner objectives. Common inputs include ditching, tiling, tillage and seeding of desired crop or grass species.

Transition T1B
State 1 to 3

Plant community succession via the lack of natural fire and/or grazing. Brush and trees will increase and plant community structure will begin to move from a prairie to a woodland.

Restoration pathway R3A
State 3 to 1

Sites that have not been tilled and still have natural hydrologic functions may be feasible to restore back to a reference community. Soil structure is intact, hydrology is natural, and remnant plant communities may still exist on site.

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

Cleland, D.T., J.A. Freeouf, J.E. Keys, G.J. Nowacki, C. Carpenter, and W.H. McNab. 2007. Ecological Subregions: Sections and Subsections of the Conterminous United States. USDA Forest Service, General Technical Report WO-76. Washington, DC.

Cowardin, L. M., V. Carter, F. C. Golet, and E.T. LaRoe. 1979 (revised 2013). Classification of Wetlands and Deepwater Habitats of the United States. FWS/OBS-79/31, U.S. Department of Interior-Fish and Wildlife Service, Washington, D.C.

Gilbert, M.C., P.M. Whited, E.J. Clairain, Jr., and D.R. Smith. 2006. A Regional Guidebook for Applying the Hydrogeomorphic Approach to Assessing Wetland Functions of Prairie Potholes. ERDC/EL TR-06-5, U.S. Army Corps of Engineers, Vicksburg, MS.

Gleason, H.A. 1913. The Relation of Forest Distribution and Prairie Fires in the Middle West. Torreya 13:8, 173-181.

Gleason, R. A., N. H. Euliss Jr., D. E. Hubbard, and W. G. Duffy. 2004. Invertebrate Egg Banks of Restored, Natural, and Drained Wetlands in the Prairie Pothole Region of the United States. Wetlands 24:3, 562-572.

H.R. 2100 – 99th Congress: Food Security Act of 1985, Pub. L. No. 99-198, Stat 1504, Sec. 1221-1223.

Landfire. 2009. Biophysical Setting 4214210 Central Tallgrass Prairie. In: Landfire National Vegetation Dynamics Models. USDA For. Serv. and U.S. Department of Interior. Washington, DC.

USDA-NRCS. 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean and the Pacific Basin. United States Department of Agriculture Handbook 296.

Minnesota Department of Natural Resources. 2005. Field Guide to the Native Plant Communities of Minnesota: the Prairie Parkland and Tallgrass Aspen Parklands Provinces. Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program. St. Paul, Minnesota.

Minnesota Rules, part 8420.0100, subpart 1, item A-D (2009).

Ojakangas, R.W. and C.L. Matsch. 1982. Minnesota’s Geology. University of Minnesota Press. Minneapolis, MN.

Shaw, S.P and C.G. Fredine. 1956. Wetlands of the United States. U.S. Fish Wildl. Serv., Circ. 39.

USDA-NRCS. 2010. Field Indicators of Hydric Soils in the United States, A Guide for Identifying and Delineating Hydric Soils, Version 7.0. Washington, DC.

USDA-NRCS. 2008. Hydrogeomorphic Wetland Classification System: An Overview and Modification to Better Meet the Needs of the Natural Resources Conservation Service. Technical Note No. 190–8–76. Washington D.C.

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	05/19/2024
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:**
