

# Ecological site R057XY008MN

## Shallow Gravelly Prairie

Last updated: 10/03/2023  
Accessed: 04/27/2024

---

### 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): 057X–Northern Minnesota Gray Drift

The Northern Minnesota Gray Drift (57) is located within the Northern Lakes Forest and Forage Region. This area is entirely in north-central Minnesota and makes up about 9,785 square miles (Figure 1). The entire area is covered by Wisconsin-age glacial drift. The glacial deposits are from four major ice lobes—Des Moines, Rainy, Superior, and Wadena. The landscape developed through a series of glaciations and the subsequent retreating and wasting of the ice sheets, which resulted in a complex pattern of moraines, outwash plains, drumlins, lake plains and drainages. Lakes, ponds and marshes are common. The thickness of the glacial till ranges from 90 to 185 meters. Some areas of these deposits are overlain by outwash or lacustrine sediments. Some depressional areas have an accumulation of organic matter. The organic deposits are more than 2.5 meters thick in some areas. Elevation ranges from 300 to 500 meters across the area. (USDA-NRCS 2006)

The dominant soil orders in this MLRA are Alfisols, Entisols, and Histisols, with some Mollisols in the westernmost part of the area. The soils in the area have a frigid soil temperature regime; aquic or udic soil moisture regime, and mixed mineralogy. Their natural drainage class is related to landscape position. In general, the Alfisols formed in till on moraines, Entisols formed in outwash on moraines and outwash plains, and Histisols formed in organic material over outwash or till on moraines or outwash plains. (USDA-NRCS 2006)

### Classification relationships

Major Land Resource Area (MLRA): Northern Minnesota Gray Drift (57) (USDA Handbook 296, 2006)

USFS Subregions: Northern Minnesota Drift & Lake Plain Section (212N); Chippewa Plains Subsection (212Na), Pine Moraines & Outwash Plains Subsections (212Nc), St. Louis Moraines Subsection (212Nb); Minnesota & NE Iowa Morainal Section (222M); Hardwood Hills Subsection (222Ma); Northern Superior Uplands Section (212L); Nashwauk Uplands Subsection (212Lc); Northern Minnesota & Ontario Peatlands Section (212M); Littlefork-Vermillion Uplands Subsection (212Ma) (Cleland et al. 2007).

US EPA Level IV Ecoregion: Itasca and St. Louis Moraines (50q); Chippewa Plains (50r); Nashwauk/Marcell Moraines and Uplands (50s); Alexandria Moraines and Detroit Lakes Outwash Plain (51j); McGrath Till Plain and Drumlins (51k); Wadena/Todd Drumlins and Osakis Till Plain (51l)(U.S. Environmental Protection Agency, 2013)

### Ecological site concept

Shallow Gravelly Prairie sites occur on all landscape positions on moraines and outwash plains. These sites exist on soils with gravelly and very gravelly textures within a depth of 50 centimeters. Soils are moderately well to excessively drained with rust and grey redoximorphic features and or depth to seasonal water table from 75 to greater than 150 centimeters. The central concept soil series is Arvilla, Clitheral, Osakis, Sandberg and Sioux but other series are included.

## Associated sites

R057XY011MN	<p><b>Sandy Outwash</b></p> <p>These sites occur on summit, shoulder and upper backslope hillslope positions on moraines and outwash plains. These sites typically exist on soils with coarse textured sandy and loamy textures of sand, coarse sand, loamy sand, loamy coarse sand, fine sand, loamy fine sand, sandy loam, fine sandy loam and loamy very fine sand within a depth of 50 centimeters.</p>
-------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

**Table 1. Dominant plant species**

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

## Physiographic features

Shallow Gravely Prairie sites occur on all landscape positions on moraines and outwash plains. The landscape developed through a series of glaciations and subsequent retreating and wasting of the ice sheets. A complex pattern of moraines, outwash plains, drumlins, lake plains, and drainages characterizes the area. The rest of the area is drained by the Mississippi River, southward into the Gulf of Mexico. The headwaters of the Mississippi River are in the northern part of the area. The Mississippi River and its tributaries drain most of the area.

**Table 2. Representative physiographic features**

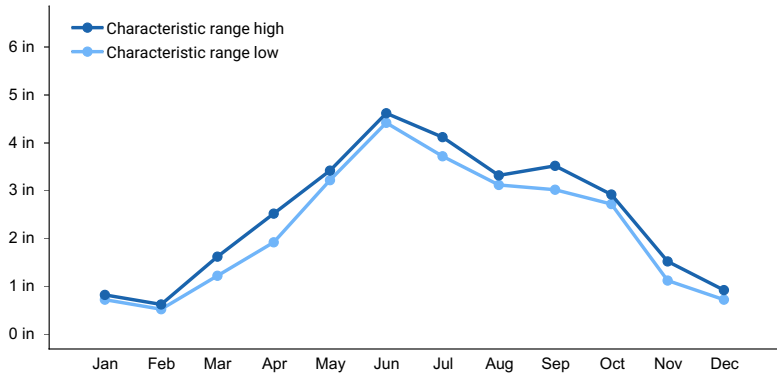
Landforms	(1) Moraine (2) Outwash plain (3) Hillslope
Runoff class	Negligible to low
Flooding frequency	None
Ponding frequency	None
Elevation	655–2,000 ft
Slope	0–25%
Aspect	Aspect is not a significant factor

## Climatic features

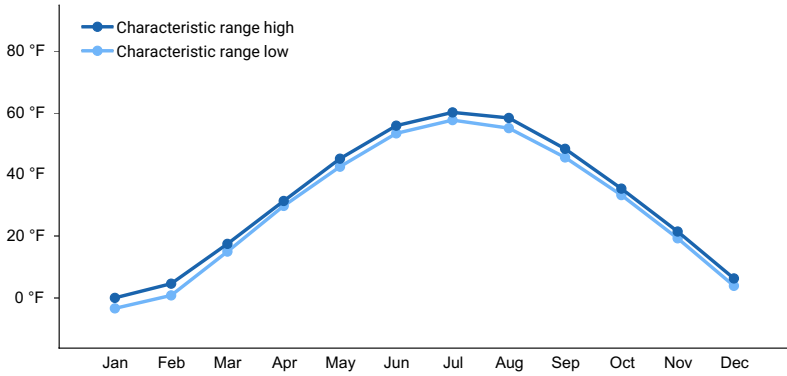
In general, MLRA 57 has cold winters and warm summers. About 65 percent of the annual precipitation falls as rain during the 5-month growing season (May through September), and an additional 18 percent falls as snow.

**Table 3. Representative climatic features**

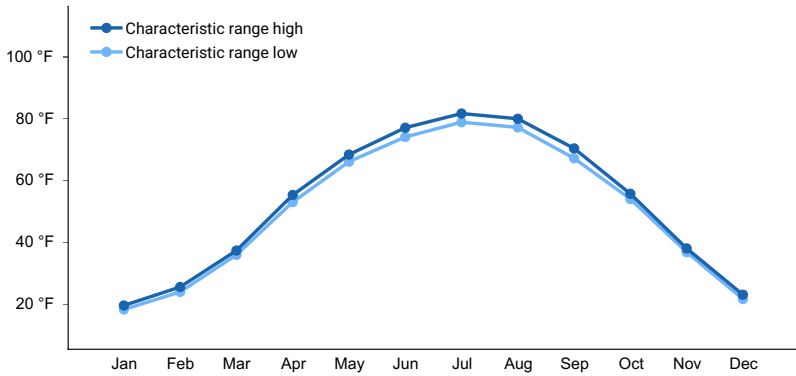
Frost-free period (characteristic range)	103-127 days
Freeze-free period (characteristic range)	128-143 days
Precipitation total (characteristic range)	26-29 in
Frost-free period (actual range)	96-131 days
Freeze-free period (actual range)	125-154 days
Precipitation total (actual range)	26-30 in
Frost-free period (average)	114 days
Freeze-free period (average)	138 days
Precipitation total (average)	28 in



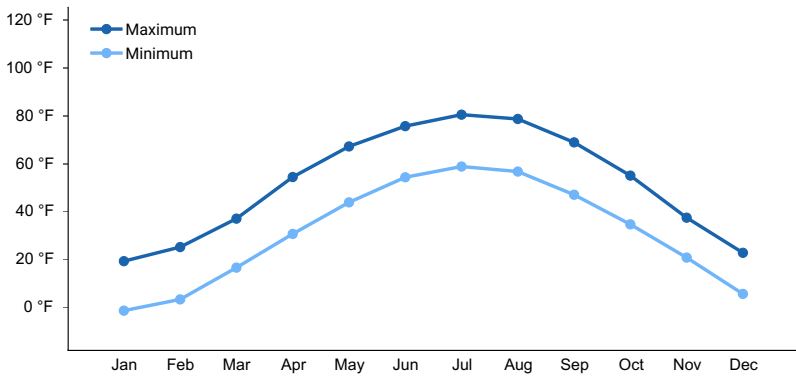
**Figure 1. Monthly precipitation range**



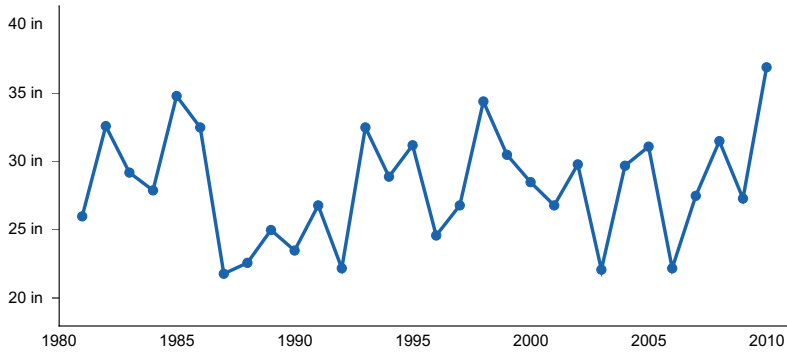
**Figure 2. Monthly minimum temperature range**



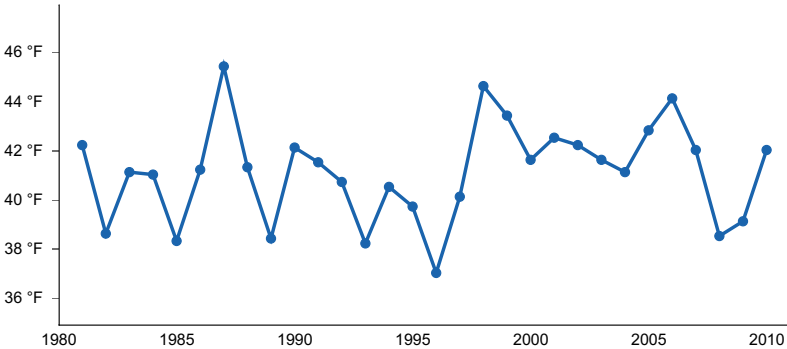
**Figure 3. Monthly maximum temperature range**



**Figure 4. Monthly average minimum and maximum temperature**



**Figure 5. Annual precipitation pattern**



**Figure 6. Annual average temperature pattern**

### Climate stations used

- (1) TAMARAC WILDLIFE REF [USC00218191], Rochert, MN
- (2) ITASCA UNIV OF MINN [USC00214106], Park Rapids, MN
- (3) NEW YORK MILLS [USC00215902], New York Mills, MN
- (4) DETROIT LAKES 1 NNE [USC00212142], Detroit Lakes, MN
- (5) GULL LAKE DAM [USC00213411], Brainerd, MN
- (6) LONG PRAIRIE [USC00214861], Long Prairie, MN
- (7) COLLEGEVILLE ST JOHN [USC00211691], Avon, MN
- (8) OTTERTAIL [USC00216276], Ottertail, MN
- (9) WADENA 3 S [USC00218579], Deer Creek, MN

### Influencing water features

The Shallow Gravelly Prairie ecological site can receive water from precipitation, subsurface flow, and runoff. The site primarily receives water from precipitation and provides recharge and runoff to adjacent downslope ecological sites. This site does not flood or pond.

### Wetland description

Not Applicable.

### Soil features

These sites exist on soils with gravelly and very gravelly textures within a depth of 50 centimeters. Soils are moderately well to excessively drained with rust and grey redoximorphic features and or depth to seasonal water table from 75 to greater than 150 centimeters. The central concept soil series is Arvilla, Clitheral, Osakis, Sandberg and Sioux but other series are included.

**Table 4. Representative soil features**

Parent material	(1) Alluvium (2) Outwash
Surface texture	(1) Gravelly coarse sandy loam (2) Gravelly sandy loam (3) Gravelly loam (4) Gravelly coarse sand
Drainage class	Moderately well drained to somewhat excessively drained
Permeability class	Moderately rapid to very rapid
Soil depth	80 in
Surface fragment cover <=3"	0–15%
Surface fragment cover >3"	0–15%
Available water capacity (0-60in)	2–4 in
Soil reaction (1:1 water) (0-40in)	5.1–8.4
Subsurface fragment volume <=3" (Depth not specified)	12–28%
Subsurface fragment volume >3" (Depth not specified)	0–18%

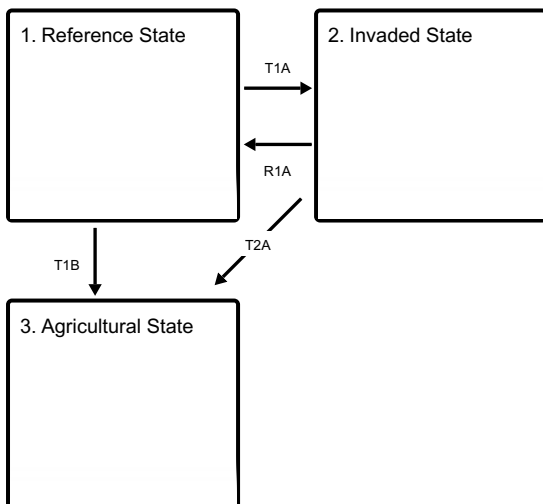
## Ecological dynamics

Shallow Gravelly Prairie sites are limited in extent in the southern region of MLRA 57, and typically occur on outwash plains and moraines. Soils have a substantial amount of gravel typically greater than 15 percent within a depth of 50 centimeters and are mollisols with dark organic-enriched upper horizons. These shallow gravelly prairie soils typically have thinner dark organic-enriched upper horizons with lower organic matter content than other soils of this prairie region. These sites are typically (moderately well) somewhat excessively to excessively drained, highly permeable, coarse textures sandy loams or loamy sand and are prone to severe growing-season moisture deficits.

Plant communities typical with Shallow Gravelly Prairies tend to be graminoid-dominated herbaceous communities of little bluestem, side-oats grama, plains muhly, and prairie dropseed. Less common species include needle-and-thread grass, silky aster, bastard toadflax, tall cinquefoil, and sage wormwood to mention a few. This site can also support sparsely treed communities with the same graminoid-dominated herbaceous species above.

## State and transition model

### Ecosystem states



**T1A** - Heavy grazing or high levels of ground litter accumulation due to irregular weather events allows invasive cool season grass species to invade and dominate this site.

**T1B** - Tillage and farming practices.

**R1A** - Extensive management inputs

**T2A** - Tillage and farming practices.

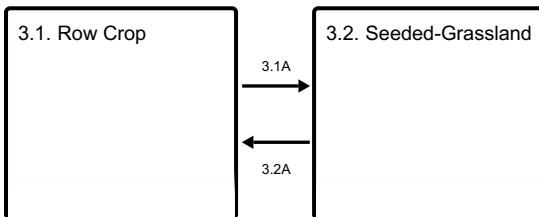
### State 1 submodel, plant communities

1.1. side oats grama -  
plains muhly - prairie  
dropseed

### State 2 submodel, plant communities

2.1. Smooth Brome -  
Little Bluestem -  
Kentucky Blue Grass

### State 3 submodel, plant communities



**3.1A** - Seeded grass species sowed.

**3.2A** - Tillage and seasonal row crop planting.

## State 1 Reference State

The Reference State represents the natural range of variability that dominated the dynamics of this ecological site (ES). This state was co-dominated by warm and cool season grasses in a mixed grass prairie ecosystem.

### Community 1.1 side oats grama - plains muhly - prairie dropseed

Midheight and shortgrass species are prominent. Graminoid-dominated, forb-rich herbaceous communities.

#### Dominant plant species

- sideoats grama (*Bouteloua curtipendula*), grass
- plains muhly (*Muhlenbergia cuspidata*), grass
- prairie dropseed (*Sporobolus heterolepis*), grass

## State 2 Invaded State

This state is dominated by invasive cool season grasses.

### Community 2.1

## **Smooth Brome - Little Bluestem - Kentucky Blue Grass**

Increased cool season grasses and invader species.

### **Dominant plant species**

- little bluestem (*Schizachyrium*), grass
- smooth brome (*Bromus inermis*), grass
- Kentucky bluegrass (*Poa pratensis*), grass

## **State 3**

### **Agricultural State**

This state is characterized by the production of annual crops using a variety of tillage and cropping systems along with management practices.

### **Community 3.1**

#### **Row Crop**

This plant community developed with the use of a variety of tillage systems and cropping systems for the production of annual crops.

### **Community 3.2**

#### **Seeded-Grassland**

Seeded back to a native grass species influenced site with evidence of human alteration apparent.

### **Pathway 3.1A**

#### **Community 3.1 to 3.2**

Seeded grass species sowed.

### **Pathway 3.2A**

#### **Community 3.2 to 3.1**

Tillage and seasonal row crop planting.

### **Transition T1A**

#### **State 1 to 2**

Heavy grazing or high levels of ground litter accumulation due to irregular weather events allows invasive cool season grass species to invade and dominate this site.

### **Transition T1B**

#### **State 1 to 3**

Tillage and farming practices.

### **Restoration pathway R1A**

#### **State 2 to 1**

This restoration pathway does not happen unless non-natives can be removed. usually this requires extensive management inputs like chemical and mechanic treatment.

### **Transition T2A**

#### **State 2 to 3**

Tillage and farming practices.

## **Additional community tables**

### **Inventory data references**

Information presented was derived from Minnesota Department of Natural Resources Field Guide to the Native Plant Communities of Minnesota, USDA-NRCS soil survey information, and USDA Plants Database.

Relationship to Other Established Classifications:

MN DNR Native Plant Community (MN DNR, 2003); the reference community of this Provisional Ecological Site is most similar to:

UPs13b Southern Dry Prairie (Dry Sand – Gravel Prairie)

UPs14b Southern Dry Savana (Dry sand – Gravel Oak Savanna)

### **Other references**

Cleland, D.T.; Freeouf, J.A.; Keys, J.E., Jr.; Nowacki, G.J.; Carpenter, C; McNab, W.H. 2007. Ecological Subregions: Sections and Subsections of the Conterminous United States.[1:3,500,000], Sloan, A.M., cartog. Gen. Tech. Report WO-76. Washington, DC: U.S. Department of Agriculture, Forest Service.

Eggers, Steve D. and Donald M. Reed. 1997. Wetland Plants and Plant Communities of Minnesota and Wisconsin. U.S. Army Corps of Engineers, St. Paul District. Minnesota Department of Natural Resources (2003).

Field Guide to the Native Plant Communities of Minnesota: The Laurentian Mixed Forest Province. Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program. MNDNR St. Paul, MN.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Official Soil Series Descriptions. Available online. Accessed March 2018.

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296.

USDA, NRCS. 2018. The PLANTS Database (<http://plants.usda.gov>, 27 March 2018). National Plant Data Team, Greensboro, NC 27401-4901 USA.

U.S. Environmental Protection Agency. 2013. Level III and IV ecoregions of the continental United States: Corvallis, Oregon, U.S. EPA, National Health and Environmental Effects Research Laboratory, map scale 1:3,000,000, <https://www.epa.gov/eco-research/level-iii-and-iv-ecoregions-continental-united-states>.

### **Contributors**

Kade Anderson, Ecological Site Specialist for North Central Region  
Patty Burns, Soil Scientist at Bemidji Soil Survey Office  
Stacey Clark, Former Regional Ecologist for Regions 10 & 11

### **Approval**

Suzanne Mayne-Kinney, 10/03/2023

### **Acknowledgments**

MLRA 57 technical team completed in 2022.

### **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	04/27/2024
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:**

---