USDA Natural Resources Conservation Service

Ecological site R057XY014MN
Linear Meadow

Last updated: 10/03/2023
Accessed: 05/11/2025

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 2.5meters 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 Histosols, 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 Histosols 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

Linear Meadow sites are limited in extent in the southern region of MLRA 57, and typically occur on moraines, lake plains and outwash plain in lower footslope and toeslope hillslope positions, bottomlands, and linear upland drainageways. Soils can vary widely in texture and are mostly mollisols with dark organic-enriched upper horizons. These sites are typically poorly and very poorly drained soils with depth to gray and or rust colored redoximorphic features or depth to seasonal high water-table ranges from 0 to 25 centimeters. These sites often support a prairie ecosystem consisting of mix grass species adapted to seasonal high water tables.

Associated sites

R057XY013MN	**Loamy Overflow** 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. Soils are well to excessively well drained with rust and grey redoximorphic features and or depth to seasonal water table from 100 to greater than 150 centimeters. The central concept soil series is Arvilla, Dorest, Sverdrup and Verndale but other series are included.
R057XY010MN	**Loamy Prairie** These sites occur on summit, shoulder and upper backslope hillslope positions on moraines and outwash plains. These sites typically exist on soils with loamy and clayey textures of loam, silt loam, silty clay loam, clay loam, sandy clay loam, very fine sandy loam, clay, silty clay and silty clay loam within a depth of 50 centimeters. Soils are well drained with rust and grey redoximorphic features and or depth to seasonal water table from 100 to greater than 150 centimeters. The central concept soil series is Almora and Lizzie but other series are included.

Similar sites

R057XY013MN	**Loamy Overflow** 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. Soils are well to excessively well drained with rust and grey redoximorphic features and or depth to seasonal water table from 100 to greater than 150 centimeters. The central concept soil series is Arvilla, Dorest, Sverdrup and Verndale but other series are included.

Table 1. Dominant plant species

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

Physiographic features

Linear Meadow sites typically occur on moraines, lake plains and outwash plain in lower footslope and toeslope hillslope positions, bottomlands, and linear upland drainageways.

Table 2. Representative physiographic features

Hillslope profile	(1) Footslope (2) Toeslope
Landforms	(1) Lake plain (2) Moraine (3) Outwash plain
Runoff class	Very low to low
Flooding frequency	None to occasional
Ponding frequency	None to frequent
Elevation	600–2,350 ft
Slope	0–2%
Water table depth	0–6 in
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)	110-121 days
Freeze-free period (characteristic range)	135-151 days
Precipitation total (characteristic range)	26-30 in
Frost-free period (actual range)	110-130 days
Freeze-free period (actual range)	128-157 days
Precipitation total (actual range)	26-30 in
Frost-free period (average)	117 days
Freeze-free period (average)	143 days
Precipitation total (average)	28 in

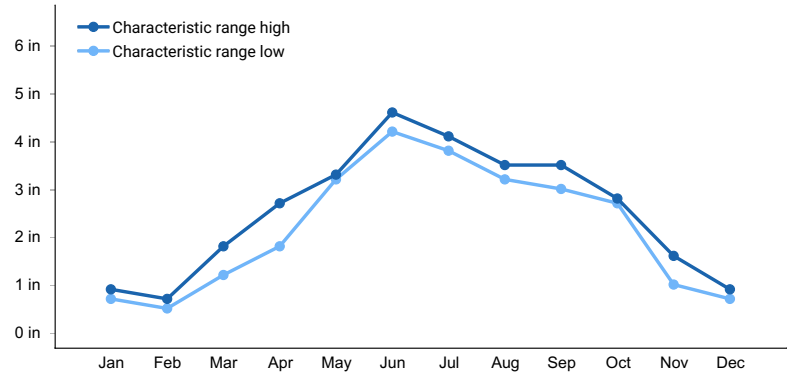


Figure 1. Monthly precipitation range

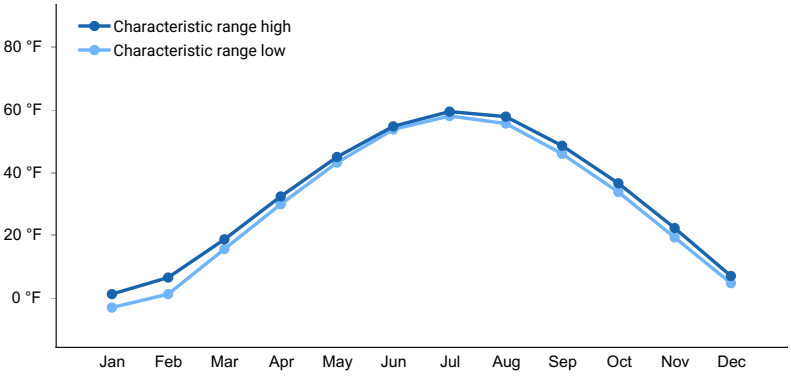


Figure 2. Monthly minimum temperature range

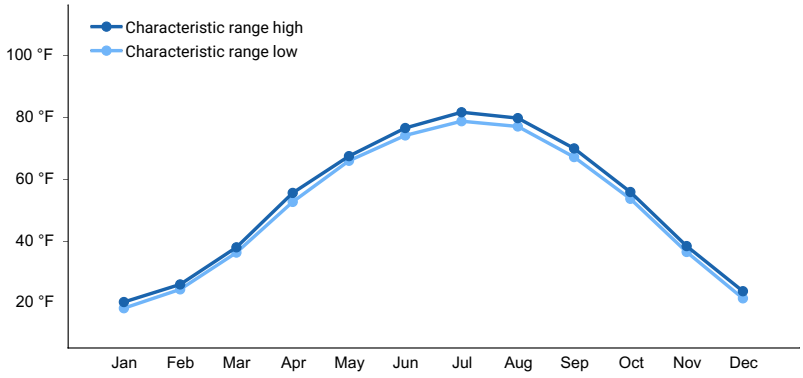


Figure 3. Monthly maximum temperature range

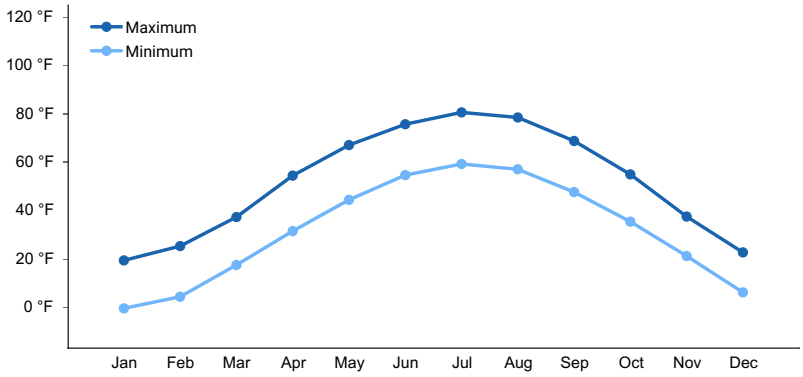


Figure 4. Monthly average minimum and maximum temperature

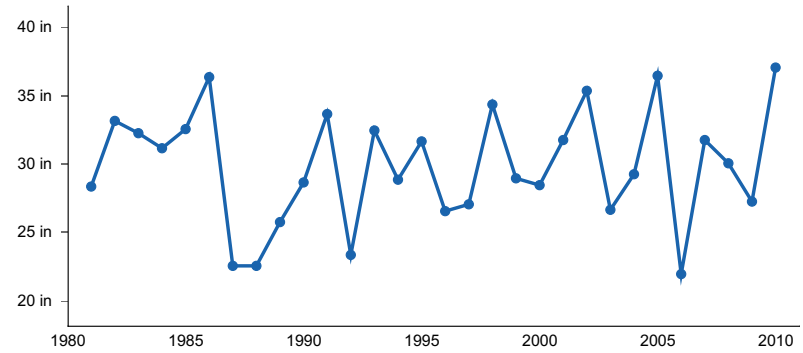


Figure 5. Annual precipitation pattern

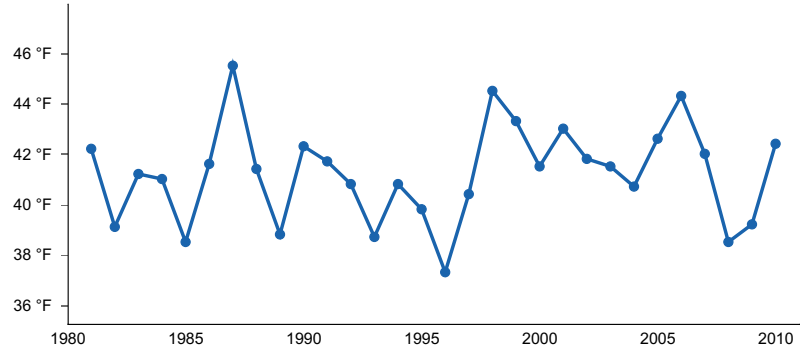


Figure 6. Annual average temperature pattern

Climate stations used

- (1) LONG PRAIRIE [USC00214861], Long Prairie, MN
- (2) COLLEGEVILLE ST JOHN [USC00211691], Avon, MN
- (3) NEW YORK MILLS [USC00215902], New York Mills, MN

- (4) TAMARAC WILDLIFE REF [USC00218191], Rochert, MN
- (5) WALKER AH GWAH CHING [USC00218618], Walker, MN

Influencing water features

Runoff from adjacent higher landscape position sites contributes to seasonal high water tables which range from 0 to 25 centimeters.

Wetland description

Not Applicable.

Soil features

Soils can vary widely in texture and are mollisols with dark organic-enriched upper horizons. These sites are typically poorly and very poorly drained soils with depth to gray and or rust colored redoximorphic features or depth to seasonal high watertable ranges from 0 to 25 centimeters. Some soil series included in this site are Bluffton, Runeberg, Blomford, and Fordum.

Table 4. Representative soil features

Parent material	(1) Till (2) Alluvium (3) Glaciolacustrine deposits (4) Outwash (5) Lagoonal deposits
Surface texture	(1) Loam (2) Sandy loam (3) Silt loam (4) Clay loam
Drainage class	Very poorly drained to poorly drained
Permeability class	Moderately slow to moderately rapid
Depth to restrictive layer	72 in
Soil depth	80 in
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0–2%
Available water capacity (0-40in)	3–8 in
Calcium carbonate equivalent (0-40in)	0–45%
Soil reaction (1:1 water) (0-40in)	5.1–8.4
Subsurface fragment volume <=3" (0-40in)	2–14%
Subsurface fragment volume >3" (0-40in)	0–5%

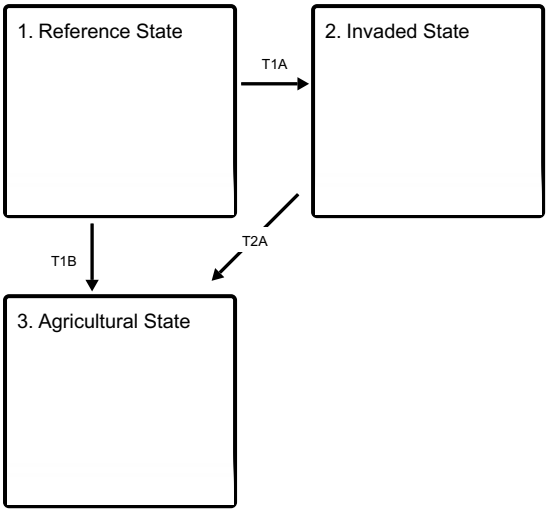
Ecological dynamics

Linear meadow sites consist of a meadow community of mixed grasses and sedges that are influenced by seasonally high water tables. During wet weather cycles, community 1.1 can become more marsh like and creates a sedge dominated community with willow and dogwood. It is possible to go back to the reference community with prolonged draught from community 1.2. State 2 consists of an invaded state where invasive grasses such as smooth brome and reed canarygrass have taken hold due to lack of grazing, overgrazing, or long periods of no fire. It is expected there is a woody state, consisting of heavier shrub and tree populations that occur on this site as well,

but it is not documented well enough to be included at this time. Some of these sites may be turned into agricultural land.

State and transition model

Ecosystem states

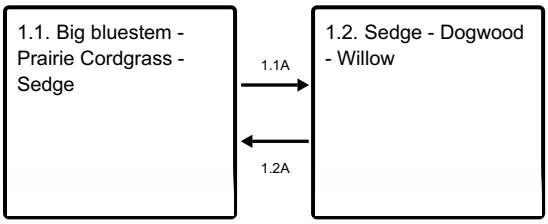


T1A - Introduction of non-native species coupled with heavy grazing pressure and extended periods without wildfire.

T1B - Tillage and farming practices

T2A - Tillage and farming practices

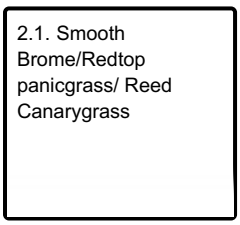
State 1 submodel, plant communities



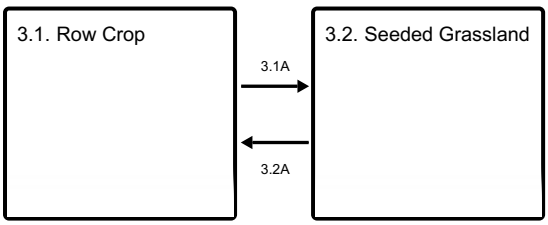
1.1A - Increased water on the site from frequent storm events and excess runoff from adjacent landscapes.

1.2A - Decreased water available on the site due to draught.

State 2 submodel, plant communities



State 3 submodel, plant communities



3.1A - Seeding.

3.2A - Tillage or other agricultural method.

State 1
Reference State

The reference state on this site consists of a mix grass prairie ecosystem adapted to seasonally high water tables.

Community 1.1
Big bluestem - Prairie Cordgrass - Sedge

Meadow consisting of grasses and sedges tolerant of seasonally high water tables.

Dominant plant species

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

Community 1.2
Sedge - Dogwood - Willow

Increased water on this site results in a wetter plant community consisting of sedges, along with dogwood and/or willow.

Dominant plant species

- pussy willow (*Salix discolor*), tree
- dogwood (*Cornus*), tree
- pussy willow (*Salix discolor*), shrub
- woolly sedge (*Carex pellita*), grass

Pathway 1.1A
Community 1.1 to 1.2

Increased water on the site from frequent storm events and excess runoff from adjacent landscapes.

Pathway 1.2A
Community 1.2 to 1.1

Decreased water available on the site due to draught.

State 2
Invaded State

This state consists of native and invasive grasses tolerant of seasonally high water tables.

Dominant plant species

- smooth brome (*Bromus inermis*), grass
- redtop panicgrass (*Panicum rigidulum*), grass
- reed canarygrass (*Phalaris arundinacea*), grass

Community 2.1
Smooth Brome/Redtop panicgrass/ Reed Canarygrass

Dominant plant species

- smooth brome (*Bromus inermis*), grass
- redtop panicgrass (*Panicum rigidulum*), grass
- reed canarygrass (*Phalaris arundinacea*), grass

State 3
Agricultural State

Indefinite time frame where agricultural practices are applied.

Community 3.1
Row Crop

Production of annual crops such as corn and soybean.

Community 3.2
Seeded Grassland

Seeded grassland with native or desired species mix.

Pathway 3.1A
Community 3.1 to 3.2

Seeding by machine or other agricultural method.

Pathway 3.2A
Community 3.2 to 3.1

Tillage or other pre-planting method for annual crop production.

Transition T1A
State 1 to 2

The introduction of non-native species coupled with the absence of wildfire, heavy grazing pressure, and drought. These changes result high levels of litter accumulation and a shift in dominant functional group.

Transition T1B
State 1 to 3

Removal of native vegetation followed by extensive soil disturbance and the introduction of perennial forage species and annual crops.

Transition T2A
State 2 to 3

Removal of native vegetation followed by extensive soil disturbance and the introduction of perennial forage species and annual crops.

Additional community tables

Inventory data references

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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.

Other references

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:
WPs54b Southern Wet Prairie

Contributors

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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	10/03/2023
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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2. **Presence of water flow patterns:**

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3. **Number and height of erosional pedestals or terracettes:**

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

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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:**
