USDA Natural Resources Conservation Service

# Ecological site R057XY010MN
# Loamy Prairie

Last updated: 10/03/2023
Accessed: 05/07/2024

## 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 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

Loamy Prairie sites are limited in extent in the southern region of MLRA 57, and typically occur on moraines on summits, shoulders and backslope hillslope postions. Soils textures are typically loamy but can vary from fine sandy loam to silt loam and are mollisols with dark organic-enriched upper horizons.

## Associated sites

| | |
|---|---|
| F057XY015MN | **Wet Mixed Forest**<br>These sites occur on summit, shoulder and backslope hillslope positions on short convex slopes greater than 12 percent on moraines. Parent material is variable and consists of a wide range of soil textures. |
| R057XY013MN | **Loamy Overflow**<br>These sites occur on lower backslope and footslope hillslope positions, and upland swales. They are generally low relief with linear slopes from 0 to 3 percent on moraines, lake plains and outwash plains. |

## Similar sites

| | |
|---|---|
| R057XY013MN | **Loamy Overflow**<br>These sites occur on lower backslope and footslope hillslope positions, and upland swales. They are generally low relief with linear slopes from 0 to 3 percent on moraines, lake plains and outwash plains. Parent material is variable and consists of a wide range of soil textures. |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | Not specified |
| Shrub | Not specified |
| Herbaceous | (1) *Andropogon gerardii*<br>(2) *Hesperostipa spartea* |

## Physiographic features

Loamy Prairie sites are limited in extent in the southern region of MLRA 57, and typically occur on moraines on summits, shoulders and backslope hillslope positions. These sites are mostly well drained.

**Table 2. Representative physiographic features**

| | |
|---|---|
| Hillslope profile | (1) Footslope<br>(2) Backslope |
| Landforms | (1) Moraine |
| Runoff class | Negligible to low |
| Flooding frequency | None |
| Ponding frequency | None |
| Elevation | 900–2,000 ft |
| Slope | 0–15% |
| 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) | 111-112 days |
| Freeze-free period (characteristic range) | 129-138 days |
| Precipitation total (characteristic range) | 26-29 in |
| Frost-free period (actual range) | 110-113 days |
| Freeze-free period (actual range) | 127-140 days |
| Precipitation total (actual range) | 26-30 in |
| Frost-free period (average) | 112 days |

| | |
|---|---|
| Freeze-free period (average) | 134 days |
| Precipitation total (average) | 28 in |

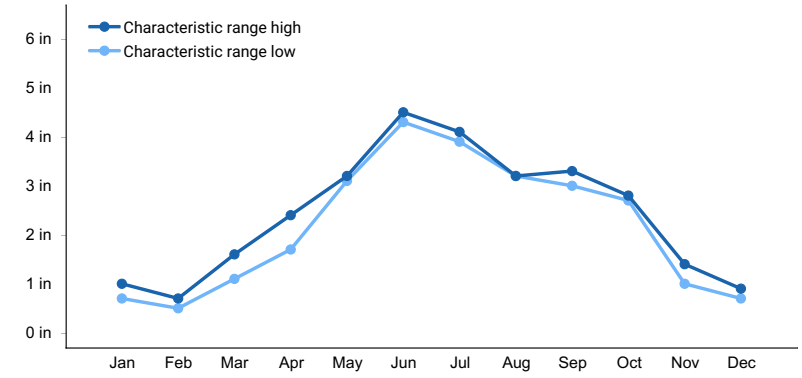



**Figure 1. Monthly precipitation range**

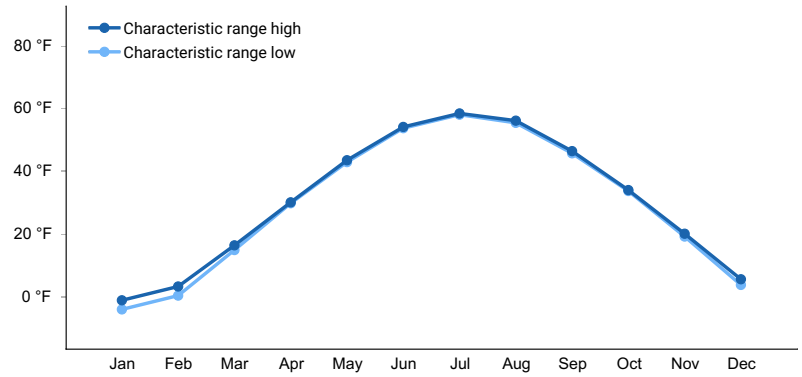



**Figure 2. Monthly minimum temperature range**

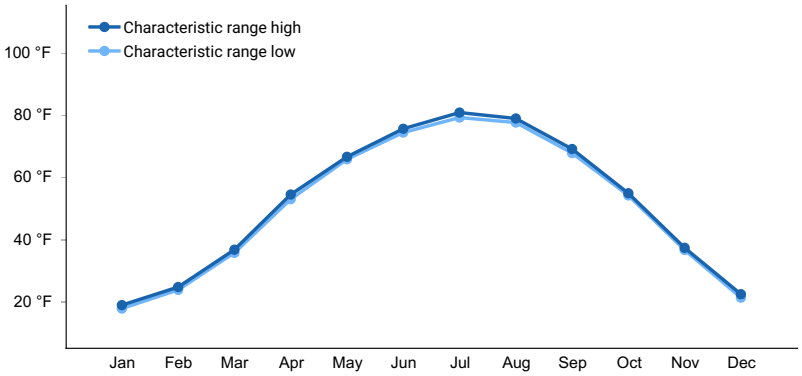



**Figure 3. Monthly maximum temperature range**

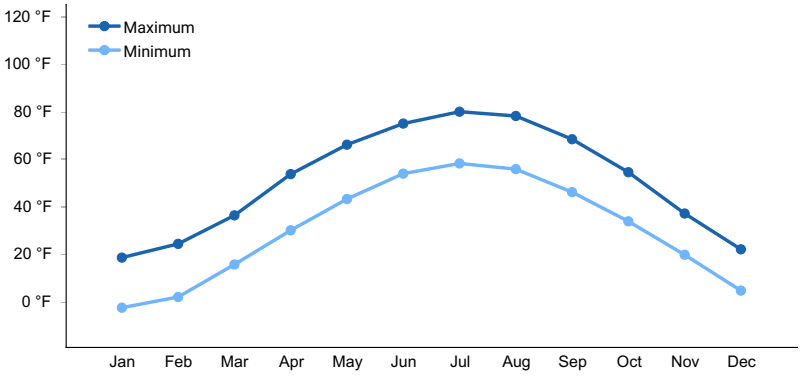



**Figure 4. Monthly average minimum and maximum temperature**

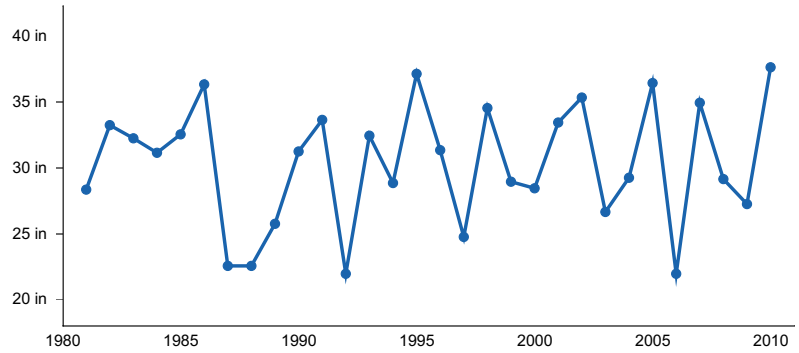



**Figure 5. Annual precipitation pattern**

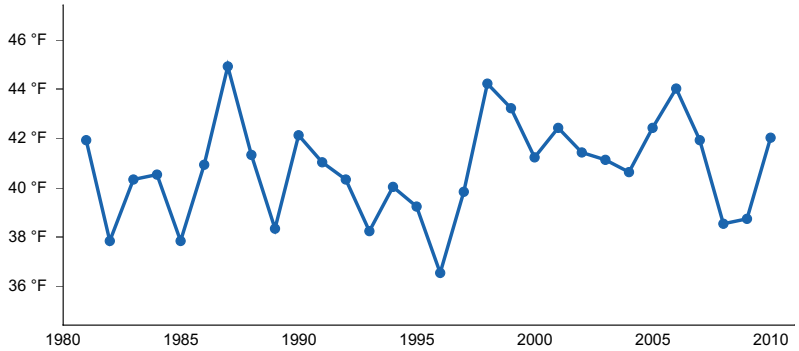



**Figure 6. Annual average temperature pattern**

## Climate stations used

- (1) TAMARAC WILDLIFE REF [USC00218191], Rochert, MN
- (2) NEW YORK MILLS [USC00215902], New York Mills, MN
- (3) LONG PRAIRIE [USC00214861], Long Prairie, MN

## Influencing water features

No influencing water features.

## Wetland description

Not Applicable.

## Soil features

Soil textures can vary from medium to fine textured and are mollisols with dark organic-enriched upper horizons. These sites are typically well drained soils with depth to gray and or rust colored redoximorphic features or depth to seasonal high water-table ranging from 100 to more than 150 centimeters. Soils in the Loamy Prairie ecological site include the Almora and Lizzie soil series among others.

**Table 4. Representative soil features**

| | |
|---|---|
| Parent material | (1) Till |
| Surface texture | (1) Loam<br>(2) Sandy loam<br>(3) Silt loam |
| Drainage class | Well drained |
| Permeability class | Moderate |
| Soil depth | 80 in |

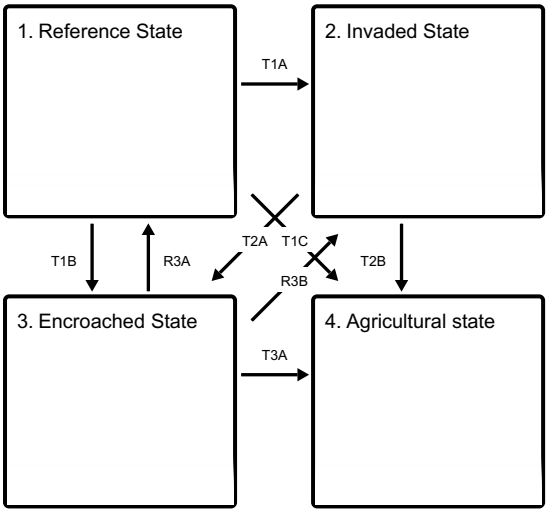
| | |
|---|---|
| Surface fragment cover <=3" | 1–7% |
| Surface fragment cover >3" | 0–2% |
| Available water capacity (0-60in) | 3.7–8.7 in |
| Soil reaction (1:1 water) (0-40in) | 5.6–7.3 |
| Subsurface fragment volume <=3" (0-40in) | 1–18% |
| Subsurface fragment volume >3" (0-40in) | 0–2% |

## Ecological dynamics

Plant communities typical with Loamy Prairies tend to be on the dry end of the southern mesic prairie community class. Graminoid cover consists of little bluestem, porcupine grass and side-oats grama. Forb cover consists of rough blazing star, Missouri and gray goldenrods and bird’s foot coreopsis. The low shrub wolfberry is commonly found in these areas, along with leadplant, prairie rose and sage wormwood. This site can also support sparsely treed communities with the same graminoid-dominated herbaceous species above. These southern mesic savanna sites consist typically of bur oak, but northern pin oak is also present. With fire suppression, trees other than oaks can become established, especially green ash, quaking aspen and basswood.

## State and transition model

**Ecosystem states**




**T1A** - Introduction of invasive cool season grasses

**T1B** - Lack of fire for more than 5 years.

**T1C** - Tillage or other agricultural practices.

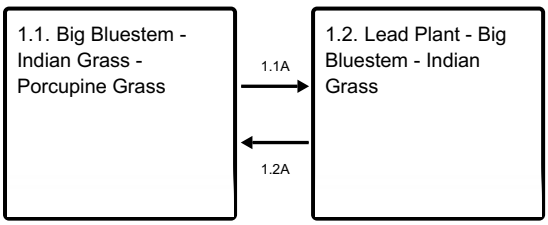
**T2A** - Lack of fire for more than 5 years.

**T2B** - Tillage and farming practices.

**R3B** - Fire or thinning treatments are applied to this site, killing off shrub overstory, along with prolonged heavy grazing and possible drought.

**T3A** - Tillage or other agricultural production methods.

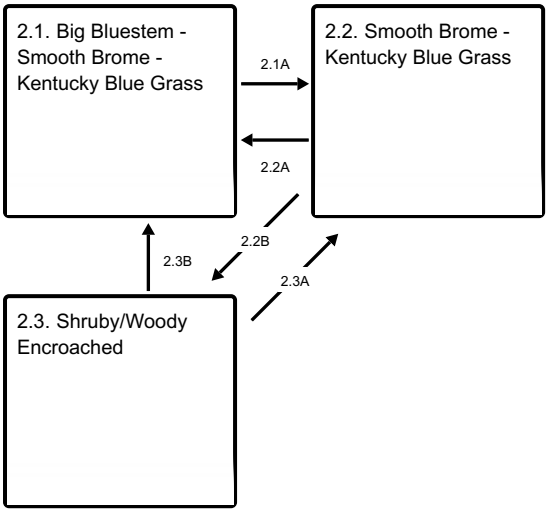
**State 1 submodel, plant communities**



**1.1A** - Lack of fire greater than five years, drought, and grazing.

**1.2A** - Increased fire return interval, less than 5 years.

**State 2 submodel, plant communities**




**2.1A** - Lack of disturbance, over grazing, buildup of heavy litter layer.

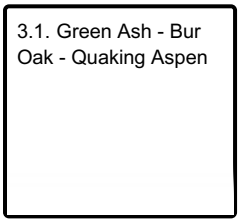
**2.2A** - Timed grazing and fire

**2.2B** - Lack of disturbance

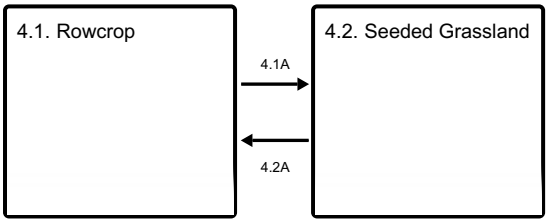
**2.3B** - Intensive prescribed burning

**2.3A** - Intensive prescribed burning

**State 3 submodel, plant communities**




**State 4 submodel, plant communities**




**4.1A** - Seeded grass species sowed.

**4.2A** - Tillage and seasonal row crop planting.

## State 1
## Reference State

The reference state is considered to be representative of the native range of variability under pre Euro-settlement conditions. Community phase changes in this state are primarily driven by a fire return interval less than 5 years, periodic drought cycles, and light to moderate grazing pressure. This state was co-dominated by warm and cool season grasses.

### Dominant plant species

- big bluestem (*Andropogon gerardii*), grass

- Indiangrass (*Sorghastrum*), grass
- porcupinegrass (*Hesperostipa spartea*), grass
- leadplant (*Amorpha canescens*), other herbaceous

### Community 1.1
### Big Bluestem - Indian Grass - Porcupine Grass

**Dominant plant species**

- big bluestem (*Andropogon gerardii*), grass
- Indiangrass (*Sorghastrum*), grass
- porcupinegrass (*Hesperostipa spartea*), grass

### Community 1.2
### Lead Plant - Big Bluestem - Indian Grass

**Dominant plant species**

- leadplant (*Amorpha canescens*), grass
- big bluestem (*Andropogon gerardii*), grass
- Indiangrass (*Sorghastrum*), grass

### Pathway 1.1A
### Community 1.1 to 1.2

Lack of fire greater than five years, drought, and heavy grazing.

### Pathway 1.2A
### Community 1.2 to 1.1

Increased fire return interval, less than 5 years; return to more frequent grazing.

### State 2
### Invaded State

This state is dominated by cool season invasive grasses resulting from heavy grazing and high ground litter accumulation. Some native species are still present.

### Community 2.1
### Big Bluestem - Smooth Brome - Kentucky Blue Grass

**Dominant plant species**

- big bluestem (*Andropogon gerardii*), grass
- smooth brome (*Bromus inermis*), grass
- Kentucky bluegrass (*Poa pratensis*), grass

### Community 2.2
### Smooth Brome - Kentucky Blue Grass

This community phase is dominated by Kentucky bluegrass , smooth brome, or other introduced cool-season grasses. Big bluestem is severely reduced and is suffering in terms of vigor and reproductive capacity.

### Community 2.3
### Shruby/Woody Encroached

Invasive shrubs and woody species dominate this site after encroaching on prairie communities.

**Dominant plant species**

- western snowberry (*Symphoricarpos occidentalis*), shrub
- smooth sumac (*Rhus glabra*), shrub

### Pathway 2.1A
### Community 2.1 to 2.2

Lack of disturbance, over grazing, buildup of heavy litter layer.

### Pathway 2.2A
### Community 2.2 to 2.1

Timed grazing and fire

### Pathway 2.2B
### Community 2.2 to 2.3

Lack of disturbance

### Pathway 2.3B
### Community 2.3 to 2.1

Intensive prescribed burning

### Pathway 2.3A
### Community 2.3 to 2.2

Intensive prescribed burning

## State 3
## Encroached State

The encroached state is characterized by increased cover of native woody species due to the absence of wildfire. Ecological processes such as energy distribution, nutrient cycling, and soil moisture recharge are being controlled by trees. Herbaceous species in the understory experience reduced productivity and reproductive capacity due to shading.

### Community 3.1
### Green Ash - Bur Oak - Quaking Aspen

**Dominant plant species**

- green ash (*Fraxinus pennsylvanica*), tree
- bur oak (*Quercus macrocarpa*), tree
- quaking aspen (*Populus tremuloides*), tree

## State 4
## Agricultural state

Indefinite use for agriculture including tillage and crop production.

### Community 4.1
### Rowcrop

Planted row crops such as corn and soybean.

### Community 4.2
### Seeded Grassland

This community phase is characterized by the seeding of or reestablishment of long-lived, perennial grasses both native and non-native following previous cultivation or tillage. Functional groups and visual aspect of the vegetation may be similar to the reference state, however ecological function is different. Tillage and cultivation negatively impacts soil structure and organic matter leading to lower rates of infiltration and increased runoff.

### Pathway 4.1A
### Community 4.1 to 4.2

Seeded grass species sowed.

### Pathway 4.2A
### Community 4.2 to 4.1

Tillage and seasonal row crop planting.

### Transition T1A
### State 1 to 2

Triggers: the introduction of non-native, cool-season, perennial grasses that can not be removed from the system. Slow variables: prolong periods of heavy grazing pressure reduce vigor and reproductive capacity of native species allowing non-natives to establish. This process can be exacerbated by the absence of wildfire that allows for the accumulation of litter that favors non-native, cool-season, grasses.

### Transition T1B
### State 1 to 3

Slow variables: Lengthened fire return intervals (greater than 5 years) allow native woody species in encroach and being to dominant the ecological processes. As canopy cover increases herbaceous perennial understory is reduced in both vigor and reproductive capacity. Heavy grazing pressure may exacerbate the impacts of woody species encroachment Thresholds: Nutrient cycling, energy capture and hydrologic function have been spatially and temporally truncated by the dominance of trees.

### Transition T1C
### State 1 to 4

Triggers: Lands have been cleared and cultivated. These management actions represent a discrete event that truncates energy, nutrient, water cycling dynamics reducing ecological resilience. Thresholds: Once the site is cultivated, soil properties such as structure and organic matter are permanently altered.

### Transition T2A
### State 2 to 3

Slow variables: Lengthened fire return intervals (greater than 5 years) allow native woody species in encroach and being to dominant the ecological processes. As canopy cover increases herbaceous perennial understory is reduced in both vigor and reproductive capacity. Heavy grazing pressure may exacerbate the impacts of woody species encroachment Thresholds: Nutrient cycling, energy capture and hydrologic function have been spatially and temporally truncated by the dominance of trees.

### Transition T2B
### State 2 to 4

Triggers: Lands have been cleared and cultivated. These management actions represent a discrete event that truncates energy, nutrient, water cycling dynamics reducing ecological resilience. Thresholds: Once the site is cultivated, soil properties such as structure and organic matter are permanently altered.

### Restoration pathway R3A
### State 3 to 1

The encroached state will not return to the reference state without significant management actions. To restore this community to reference-like conditions requires the continued use of prescribed burning (fire return interval of ~5years is required to maintain the reference state). Management may also initially require herbicide and mechanical brush control. Additional considerations include deferment from grazing and the health and vigor of remnant native grass species in the understory.

**Context dependence.** Fire return interval less than 5 years, plus herbicide or thinning of shrubs.

### Restoration pathway R3B
### State 3 to 2

Triggers: Widespread fire, or multiple fires, severe enough to kill overstory of woody species Slow variables: prolonged heavy grazing, may also be coupled with drought and the introduction of non-native species. Thresholds: hydrologic cycling, nutrient cycling, energy capture are controlled by herbaceous species

### Transition T3A
### State 3 to 4

Triggers: Lands have been cleared and cultivated. These management actions represent a discrete event that truncates energy, nutrient, water cycling dynamics reducing ecological resilience. Thresholds: Once the site is cultivated, soil properties such as structure and organic matter are permanently altered.

## 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:
UPs23 Southern Mesic Prairie (***Drier end of this NCP***)

## 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.

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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

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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 | 05/07/2024 |
| Approved by | Suzanne Mayne-Kinney |
| Approval date | |
| Composition (Indicators 10 and 12) based on | Annual Production |

## Indicators

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

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

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

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

5. **Number of gullies and erosion associated with gullies:**

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

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

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

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

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

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

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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

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

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

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if**

**their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

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17. **Perennial plant reproductive capability:**

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