USDA Natural Resources Conservation Service

Ecological site R057XY013MN
Loamy Overflow

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 2.5meters 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 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 Overflow sites are limited in extent in the southern region of MLRA 57, and typically occur on low relief moraines, lake plains and outwash plain in uplands swales and lower backslope and foot slope positions. Soils textures can vary widely in texture and are mollisols with dark organic-enriched upper horizons.

Associated sites

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.
R057XY011MN	**Sandy Outwash** 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.

Similar sites

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.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Amorpha canescens* (2) *Rosa arkansana*
Herbaceous	(1) *Andropogon gerardii* (2) *Sporobolus heterolepis*

Physiographic features

Loamy Overflow sites are limited in extent in the southern region of MLRA 57, and typically occur on low relief moraines, lake plains and outwash plain in uplands swales and lower backslope and foot slope positions.

Table 2. Representative physiographic features

Hillslope profile	(1) Backslope (2) Footslope
Landforms	(1) Lake plain (2) Outwash plain (3) Moraine
Runoff class	Negligible to low
Flooding frequency	None
Ponding frequency	None
Elevation	850–1,525 ft
Slope	0–3%
Water table depth	25–35 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)	104-121 days
Freeze-free period (characteristic range)	130-148 days
Precipitation total (characteristic range)	26-30 in
Frost-free period (actual range)	96-130 days
Freeze-free period (actual range)	127-156 days
Precipitation total (actual range)	26-30 in
Frost-free period (average)	113 days
Freeze-free period (average)	140 days
Precipitation total (average)	28 in

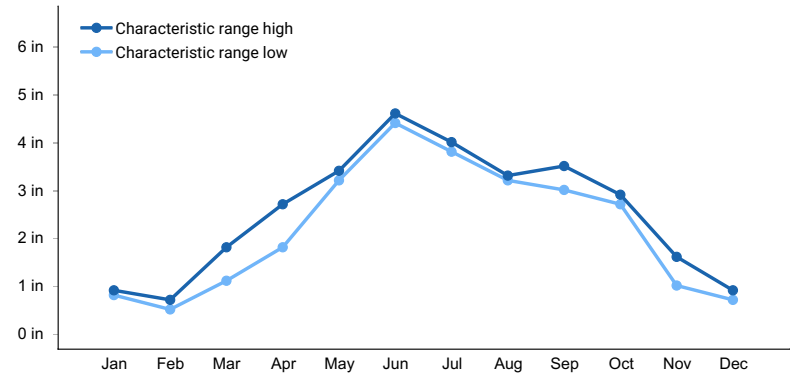


Figure 1. Monthly precipitation range

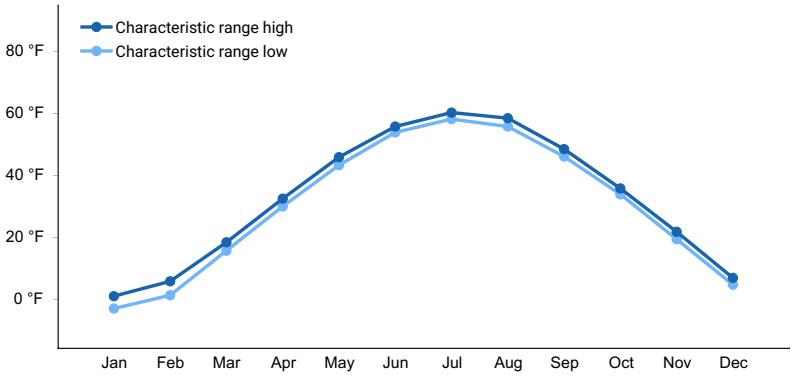


Figure 2. Monthly minimum temperature range

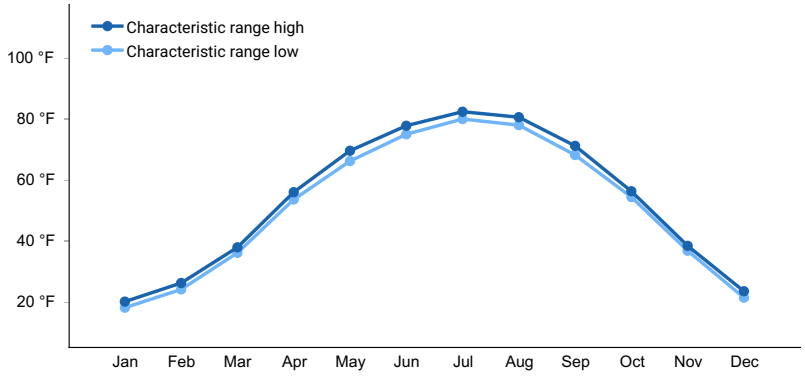


Figure 3. Monthly maximum temperature range

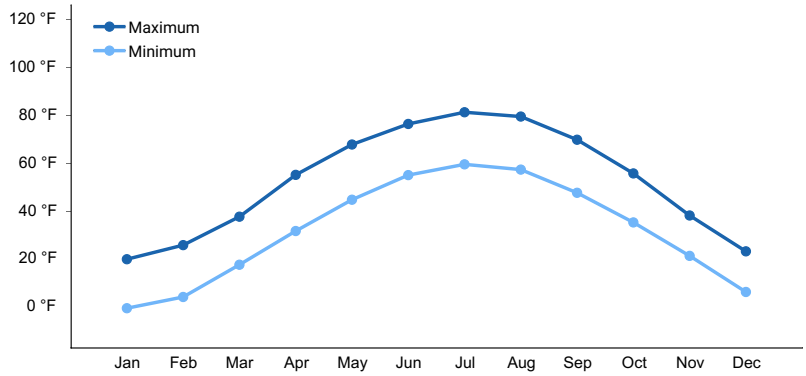


Figure 4. Monthly average minimum and maximum temperature

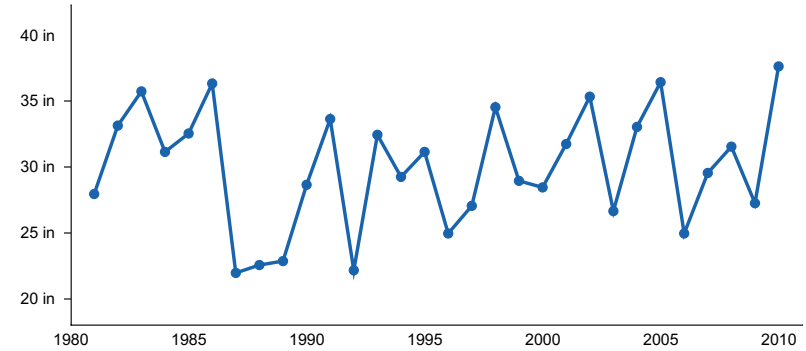


Figure 5. Annual precipitation pattern

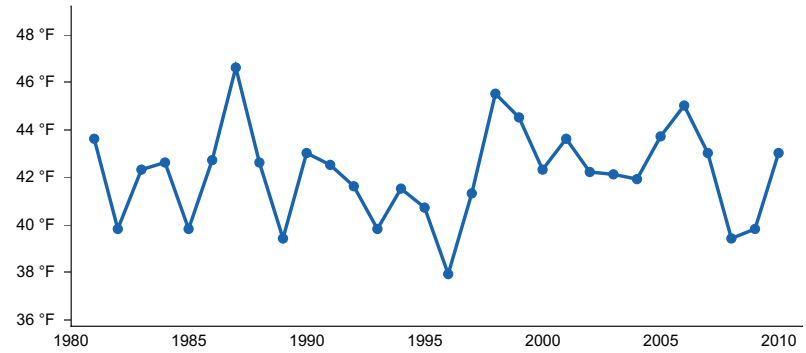


Figure 6. Annual average temperature pattern

Climate stations used

- (1) TAMARAC WILDLIFE REF [USC00218191], Rochert, MN
- (2) DETROIT LAKES 1 NNE [USC00212142], Detroit Lakes, MN
- (3) NEW YORK MILLS [USC00215902], New York Mills, MN
- (4) LONG PRAIRIE [USC00214861], Long Prairie, MN
- (5) COLLEGEVILLE ST JOHN [USC00211691], Avon, MN

Influencing water features

Depth to an apparent seasonal high water table is as high as 25 to 35 inches at some time from April through July in most years.

Wetland description

Not Applicable.

Soil features

Soils textures can vary widely in texture and are mollisols with dark organic-enriched upper horizons. These sites are typically moderately well drained soils with depth to gray and or rust colored redoximorphic features or depth to due to seasonal high water table . The central concept soil series is Radium and Reiner, but other series are included.

Table 4. Representative soil features

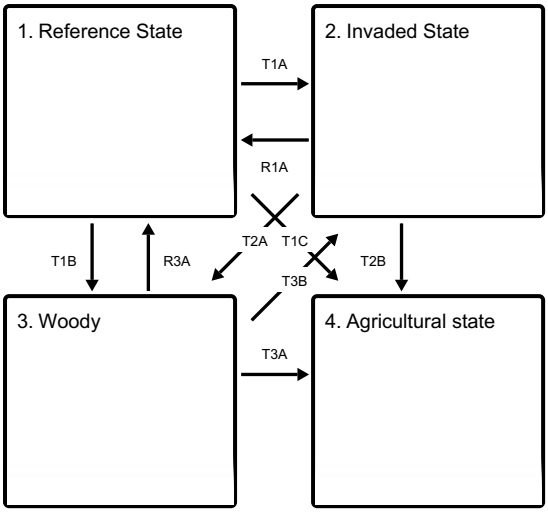
Parent material	(1) Outwash (2) Till (3) Glaciolacustrine deposits
Surface texture	(1) Fine sandy loam (2) Loamy sand (3) Sandy loam (4) Loam
Drainage class	Moderately well drained to well drained
Permeability class	Moderate to rapid
Depth to restrictive layer	72 in
Soil depth	80 in
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0–2%
Available water capacity (0-60in)	2–7 in
Calcium carbonate equivalent (0-40in)	0–25%
Soil reaction (1:1 water) (0-40in)	6.1–8.4
Subsurface fragment volume <=3" (0-40in)	0–9%
Subsurface fragment volume >3" (0-40in)	0–2%

Ecological dynamics

State 1 represents the natural range of variability that dominated the dynamics of this ecological site (ES). This state was dominated by warm-season grasses. In pre-European times, the primary disturbance mechanisms for this site in the reference condition included periods of below and/or above average precipitation, periodic fire, and herbivory by insects and large ungulates. Timing of fires and herbivory coupled with weather events dictated the dynamics that occurred within the natural range of variability. In some locations, this site likely received relatively heavy grazing pressure. Tall warm-season grasses would have declined and shorter warm-season grasses would have increased.

State and transition model

Ecosystem states



T1A - Heavy grazing, high levels of ground litter accumulation, or introduction of invasive species.

T1B - Lack of fire for more than 5 years.

T1C - Tillage or other agricultural practices.

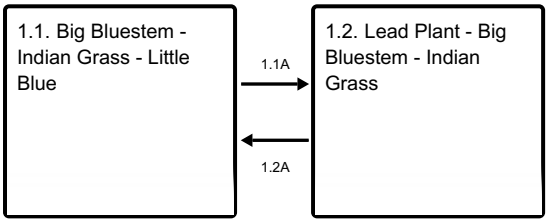
R1A - Managed grazing plans

T2A - Lack of fire for more than 5 years.

T2B - Tillage and farming practices.

T3A - Lands have been cleared and cultivated.

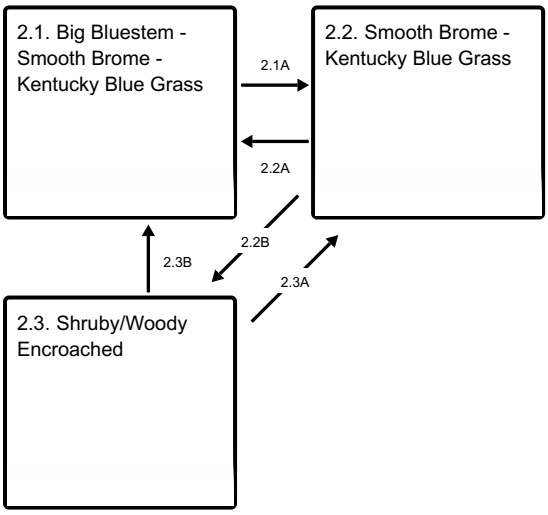
State 1 submodel, plant communities



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.

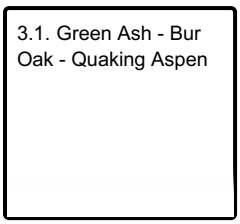
2.2A - Timed grazing and fire

2.2B - Lack of disturbance

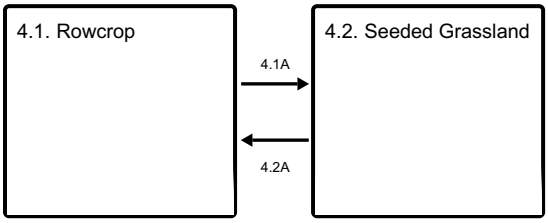
2.3B - Intensive prescribed burning

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.

Community 1.1
Big Bluestem - Indian Grass - Little Blue

Dominant plant species

- big bluestem (*Andropogon gerardii*), grass
- Indiangrass (*Sorghastrum*), grass
- little bluestem (*Schizachyrium*), 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. From this state, a shift can occur to an agricultural state or a return to the reference state.

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
Woody

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

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

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

The introduction of non-native, cool-season, perennial grasses that can not be removed from the system. 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

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. Nutrient cycling, energy capture and hydrologic function have been spatially and temporally truncated by the dominance of trees.

Transition T1C
State 1 to 4

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

Restoration pathway R1A
State 2 to 1

Managed grazing plans remove invasive species and allow native grasses to regain dominance on the site.

Transition T2A
State 2 to 3

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. Nutrient cycling, energy capture and hydrologic function have been spatially and temporally truncated by the dominance of trees.

Transition T2B
State 2 to 4

Lands have been cleared and cultivated. These management actions represent a discrete event that truncates energy, nutrient, water cycling dynamics reducing ecological resilience. 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.

Transition T3B
State 3 to 2

Fire returns to this site but is coupled with heavy grazing soon after allowing a return to the invaded state rather than the reference state.

Transition T3A
State 3 to 4

Lands have been cleared and cultivated.

Additional community tables

Inventory data 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:
UPs23 Southern Mesic Prairie (***wetter end of this NCP***)
UPs24 Southern Mesic Savanna (***wetter end of the NPC***)

Other references

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Contributors

Ezra Hoffman, Ecological Site Specialist for North Central Region
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:

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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:**
