

Ecological site R058AY738MT Subirrigated 10-19

Last updated: 8/29/2024
Accessed: 12/22/2024

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): 058A–Northern Rolling High Plains, Northern Part

MLRA 058A, Northern Rolling High Plains (Northern Part), is an expansive and agriculturally and ecologically significant area encompassing 26 counties in southeast Montana (99 percent) and northeast Wyoming (1 percent). It stretches approximately 290 miles from east to west and 220 miles from north to south and comprises approximately 42,350 square miles (26,875,928 acres). The area is within the Missouri Plateau, Unglaciaded, Section of the Great Plains Province of the Interior Plains. It is an area of old plateaus and terraces that have been eroded. Slopes generally are gently rolling to steep, and wide belts of steeply sloping badlands border a few of the larger river valleys. In some areas flat-topped, steep-sided buttes rise sharply above the general level of the plains. Elevations generally range from 1,950 to 3,280 feet, increasing from east to west and from north to south.

Tertiary continental shale, siltstone, and sandstone of the Fort Union Formation underlie the eastern one-third to one-half of this area. Marine and continental sediments of the Cretaceous Montana Group underlie the rest of the MLRA, generally at the higher elevations. There are also younger Cretaceous sediments of the Livingston Group occurring between the higher elevation Montana Group sediments and the lower elevation Tertiary sediments. The dominant soil orders in MLRA 058A are Entisols and Inceptisols. The soils in the area dominantly have a frigid soil temperature regime, an ustic soil moisture regime, and mixed or smectitic mineralogy. They range from shallow to very deep and are generally well drained and clayey or loamy.

The area primarily supports native prairie vegetation characterized by a variety of cool-season and warm-season graminoids, forbs, and shrubs. In the western portion of the area, cool-season grasses such as western wheatgrass and bluebunch wheatgrass are dominant but, in the eastern portion of the area, warm-season grasses such as little bluestem and sideoats grama become dominant. Wyoming big sagebrush, silver sagebrush, and fringed sagewort are common shrub species throughout the area. Forested areas occur in rough hilly areas and river breaks, particularly in areas with higher precipitation. Common tree species are ponderosa pine and Rocky Mountain juniper with scattered pockets of Douglas fir.

More than 75 percent of this MLRA is native rangeland utilized for livestock production and more than 50 percent of the MLRA consists of privately-owned ranches. Approximately 15 percent of the MLRA is used as cropland. Other land uses including forestland, urban development, water, and other uses combine for less than 10 percent of the total land use.

Classification relationships

NRCS Soil Geography Hierarchy

- Land Resource Region: Western Great Plains
- Major Land Resource Area (MLRA): 058A Northern Rolling High Plains, Northern Part

National Hierarchical Framework of Ecological Units (Cleland et al., 1997; McNab et al., 2007)

- Domain: Dry

- Division: Temperate Steppe
- Province: Great Plains-Palouse Dry Steppe Province (331)
- Section: North Central Highlands (331K) and Powder River Basin (331G)

National Vegetation Classification Standard (Federal Geographic Data Committee, 2008)

- Class: Mesomorphic Shrub and Herb Vegetation Class (2)
- Subclass: Shrub and Herb Wetland Subclass (2.C)
- Formation: Temperate to Polar Freshwater Marsh, Wet Meadow and Shrubland Formation (2.C.4)
- Division: Salix interior / Juncus spp. - Eupatorium perfoliatum Wet Meadow and Shrubland Division (2.C.4.Nd)
- Macrogroup: Spartina pectinata - Typha spp. - Schoenoplectus spp. Great Plains Marsh, Wet Meadow, Shrubland and Playa Macrogroup (2.C.4.Nd.5)
- Group: Spartina pectinata - Calamagrostis stricta - Carex spp. Great Plains Wet Prairie, Wet Meadow and Seepage Fen Group (2.C.4.Nd.5.b)

EPA Ecoregions

- Level 1: Great Plains (9)
- Level 2: West-Central Semi-Arid Prairies (9.3)
- Level 3: Northwestern Great Plains (9.3.3)
- Level 4: Montana Central Grasslands (43n), River Breaks (43c), and Pine Scoria Hills (43p)

Ecological site concept

This ecological site occurs on alluvial fans, terraces, or stream terraces adjacent to floodplains of perennial or intermittent streams, near springs or seeps, or other areas that have a permanent water table 24 to 40 inches below the soil surface. The permanent water table has a major influence on plant community composition and production. This ecological site occurs at elevations ranging from 1,900 to 3,500 feet and on slopes ranging from 0 to 2 percent. This site occurs on all aspects, although aspect is not a significant factor. The soil textures are typically loam, silt loam or silty clay loam.

Associated sites

R058AY713MT	Saline Overflow 10-14 The Overflow ecological site is found adjacent to the Subirrigated ecological site, usually on higher terraces where groundwater is farther from the surface.
R058AY723MT	Wet Meadow 10-19 The Wet Meadow ecological site is found adjacent to the Subirrigated ecological site, usually in depressions or concave areas where flooding is very frequent and a water table is shallow and persistent.
R058AY729MT	Overflow 15-19 The Overflow ecological site is found adjacent to the Subirrigated ecological site, usually on higher terraces where groundwater is farther from the surface.

Similar sites

R058AY723MT	Wet Meadow 10-19 This site differs from the Subirrigated ecological site in that the depth to a water table is less than 24 inches.
R058AY713MT	Saline Overflow 10-14 This site differs from the Subirrigated ecological site in that it receives additional moisture primarily from surface water; whereas the Subirrigated ecological site receives it from groundwater. Depth to a water table is more than 40 inches.
R058AY729MT	Overflow 15-19 This site differs from the Subirrigated ecological site in that it receives additional moisture primarily from surface water; whereas the Subirrigated ecological site receives it from groundwater. Depth to a water table is more than 40 inches.
R058AY737MT	Saline Subirrigated 10-19 This site differs from the Subirrigated ecological site in that the soils contain accumulated salts in the upper 4 inches.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) <i>Calamagrostis</i> (2) <i>Spartina pectinata</i>

Physiographic features

This ecological site occurs on alluvial fans, stream terraces, and floodplains of perennial or intermittent streams, near springs or seeps, or other areas that have a permanent water table 24 to 40 inches below the soil surface. Slopes typically range from 0 to 2 percent. This site occurs on all aspects. Aspect is not a significant factor.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Stream terrace (3) Flood plain
Runoff class	Low
Flooding frequency	None to rare
Ponding frequency	None
Elevation	579–1,067 m
Slope	0–2%
Water table depth	61–102 cm
Aspect	Aspect is not a significant factor

Climatic features

MLRA 058A is a semi-arid region and is considered to have a continental climate characterized by cold winters, hot summers, low humidity, light rainfall, and much sunshine. The climate is the result of the MLRA's location in the geographic center of North America. Temperatures can be extreme. The average annual temperature is 41 to 49 degrees Fahrenheit. Summer daytime temperatures are typically quite warm, generally averaging in the lower to mid 80 degree range for July and August. Summertime temperatures will typically reach 100 degrees or more at some point during the summer and can reach 90 degrees during any month between May and September. Conversely, winter temperatures can be cold, averaging in the teens or less for December and January. There will typically be several days of below zero temperatures each winter. It is not uncommon for temperatures to reach 30 to 40 degrees below zero, or even colder, most any winter.

During an average year, 70 to 75 percent of the annual precipitation falls between April and September, which are the primary growing season months. Most of the rainfall occurs as frontal storms early in the growing season during the months of May and June. Some high-intensity, convective thunderstorms occur in July and August, and some rainfall occurs in autumn. Later summer precipitation is greater in the eastern portion of the MLRA, which effects plant community composition. Winter precipitation occurs as snow although snowfall is not heavy, averaging about 39 inches annually, and snow cover is typically 1 to 3 inches. Heavy snowfall occurs infrequently, usually late in the winter or early spring. The average annual precipitation ranges from 8 to 22 inches but is typically 11 to 17 inches throughout most of the area. Precipitation fluctuates widely from year to year and severe drought occurs 2 out of 10 years on average.

There are few natural barriers on the northern Great Plains and the winds move freely across the plains and account for rapid changes in temperature. Spring can be windy throughout the MLRA, with winds averaging over 10 mph about 15 percent of the time. Speeds of 50 mph or stronger can occasionally occur. During the winter months, the western half of the MLRA commonly experiences Chinook winds, which are strong west to southwest surface winds accompanied by abrupt increases in temperature. The Chinook winds are strongest on the western boundary of the MLRA near the Rocky Mountain foothills and decrease eastward. In addition to producing damaging winds,

prolonged Chinook episodes can result in drought or vegetation kills due to a reaction of plants to a “false spring” (Oard, 1993).

For local climate station information, refer to <https://wrcc.dri.edu/summary/Climsmemt.html>.

Table 3. Representative climatic features

Frost-free period (characteristic range)	70-150 days
Freeze-free period (characteristic range)	90-180 days
Precipitation total (characteristic range)	254-483 mm
Frost-free period (average)	121 days
Freeze-free period (average)	143 days
Precipitation total (average)	381 mm

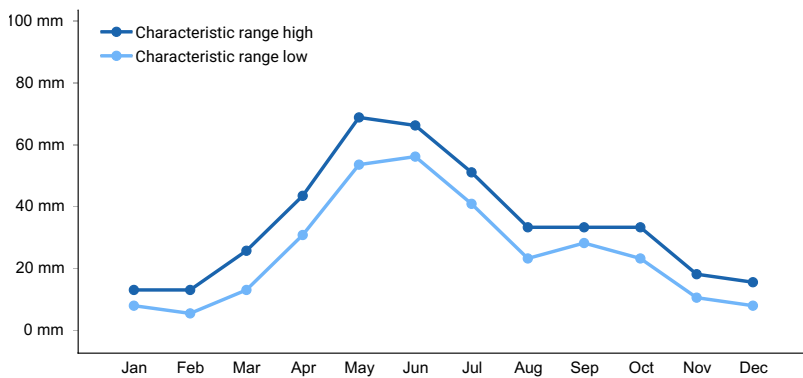


Figure 1. Monthly precipitation range

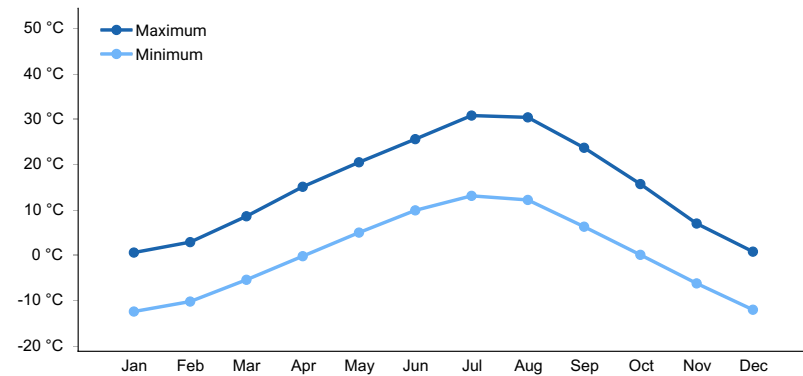


Figure 2. Monthly average minimum and maximum temperature

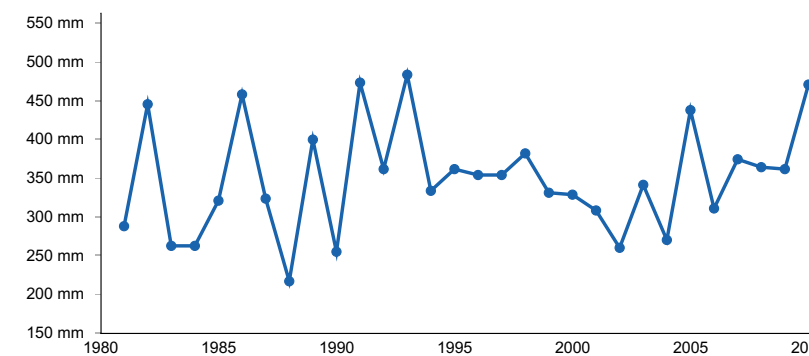


Figure 3. Annual precipitation pattern

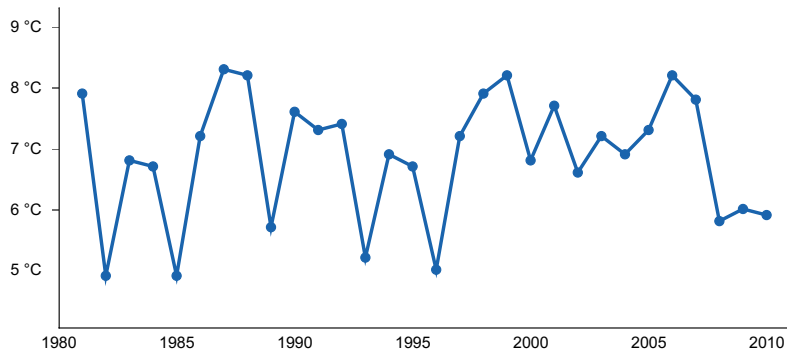


Figure 4. Annual average temperature pattern

Climate stations used

- (1) RAPELJE [USC00246862], Rapelje, MT
- (2) HYSHAM 25 SSE [USC00244364], Bighorn, MT
- (3) BRANDENBERG [USC00241084], Rosebud, MT
- (4) TERRY 21 NNW [USC00248169], Terry, MT
- (5) BLOOMFIELD 5 NNE [USC00240923], Bloomfield, MT
- (6) GLENDIVE [USC00243581], Glendive, MT
- (7) POWDERVILLE 8 NNE [USC00246691], Volborg, MT
- (8) JORDAN 23 ENE [USC00244530], Jordan, MT
- (9) FT PECK PWR PLT [USC00243176], Fort Peck, MT
- (10) CIRCLE [USC00241758], Circle, MT
- (11) BROCKWAY 3 WSW [USC00241169], Brockway, MT
- (12) MILES CITY F WILEY FLD [USW00024037], Miles City, MT
- (13) MIZPAH 4 NNW [USC00245754], Ismay, MT
- (14) SAND CREEK [USC00247342], Roy, MT
- (15) ROCK SPRINGS [USC00247136], Angela, MT
- (16) COHAGEN [USC00241875], Cohagen, MT
- (17) WINIFRED [USC00249033], Hilger, MT
- (18) COLUMBUS [USC00241938], Columbus, MT
- (19) WYOLA 1 SW [USC00249175], Wyola, MT
- (20) EKALAKA [USC00242689], Ekalaka, MT
- (21) MELSTONE [USC00245596], Musselshell, MT
- (22) YELLOWTAIL DAM [USC00249240], Lodge Grass, MT

Influencing water features

This is a floodplain or drainageway site that receives additional moisture from groundwater and occasionally stream overflow. When on floodplains, the site may be flooded for brief durations during major flood events. A seasonal groundwater table is present between 24 and 40 inches below the soil surface, particularly during spring.

Wetland description

Palustrine Emergent (Cowardin et al., 1979)

Soil features

Soils for this ecological site are typically very deep (greater than 60 inches to bedrock), somewhat poorly drained to poorly drained, and derived from alluvium from mixed sources. A seasonal high-water table is present between 24 and 40 inches below the soil surface. Surface horizon textures are typically loam, silt loam or silty clay loam. Subsurface horizon textures are typically silt loam, silty clay loam, loam or clay loam and contain stratified layers of silt loam, fine sandy loam, fine sand, loamy sand, or clay. Coarse fragments are typically not present in the upper 20 inches of soil. The soil temperature regime is primarily frigid, with smaller areas of mesic temperature regime present. The soil moisture regime is aquic. Figure 5 shows a typical soil profile for this ecological site.

Soil Series:	Horizon	Depth	Texture	pH
Big Sandy	A	0-3	Loam	8
	C	3-20	Loam, consisting of strata of silty clay loam and fine sandy loam	8.4
	Cg	20-60	Loam consisting of strata of silt loam, silty clay loam, and fine sandy loam	8.6

Figure 5. Typical Soil Profile

Table 4. Representative soil features

Parent material	(1) Alluvium–igneous, metamorphic and sedimentary rock
Surface texture	(1) Loam (2) Silt loam (3) Silty clay loam
Drainage class	Somewhat poorly drained to poorly drained
Permeability class	Moderately slow to moderate
Soil depth	152–183 cm
Surface fragment cover ≤3"	0–3%
Surface fragment cover >3"	0–1%
Available water capacity (0-50.8cm)	5.08–8.89 cm
Calcium carbonate equivalent (0-50.8cm)	0–30%
Electrical conductivity (0-10.2cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-50.8cm)	0–4
Soil reaction (1:1 water) (0-50.8cm)	8–8.6
Subsurface fragment volume ≤3" (0-50.8cm)	0%
Subsurface fragment volume >3" (0-50.8cm)	0%

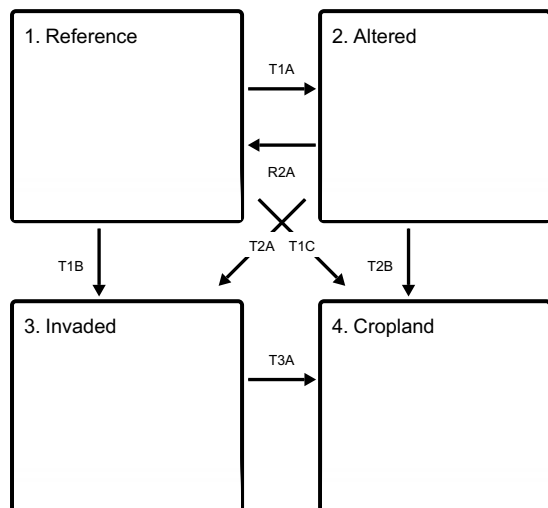
Ecological dynamics

Interpretations are primarily based on the Reference state, which is used as a reference in order to understand the original potential of the site. This ecological site developed under the combined influences of climatic conditions, periodic fire activity, grazing by large herbivores, and impacts from small mammals and insects. Changes may occur to the Reference state due to management actions such as improper grazing management, climatic conditions such as drought, and natural events such as multiple fires in close succession. The Reference state for this ecological site is dominated by a diversity of tall and medium height, cool-season and warm-season grasses, which are tightly intermixed and well distributed over the site. Various forbs, and shrubs are common on this site. The Reference state is not necessarily the management goal, as other vegetative states may be considered desired plant communities as long as critical resource concerns are met.

In addition to the Reference state, other plant communities can occur on this site and are usually the result of historic management practices. Long term overgrazing on this ecological site results in a decrease of mid-grasses and more palatable forbs and in an increase of shortgrasses, sedges, and less palatable forbs. The absence of prescribed fire and wildfire favors half-shrubs and shrubs while more frequent fire intervals favor herbaceous species. There are various transitional stages which may occur on this ecological site.

State and transition model

Ecosystem states



T1A - Prolonged improper grazing management

T1B - Introduction of invasive species (non-native perennial grasses, noxious weeds, etc.)

T1C - Tillage or herbicide application and seeding of annual crops or non-native hayland

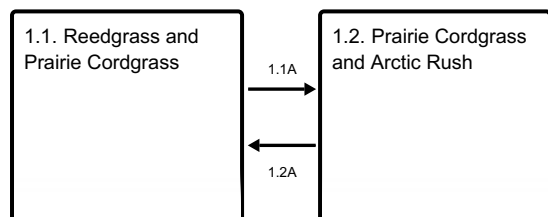
R2A - Proper grazing management in combination with revegetation practices and timely moisture (management intensive and costly).

T2A - Introduction of non-native invasive species (non-native perennial grasses, noxious weeds, etc.)

T2B - Tillage or herbicide application and seeding of annual crops or non-native hayland

T3A - Tillage or herbicide application and seeding of annual crops or non-native hayland

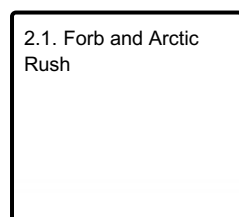
State 1 submodel, plant communities



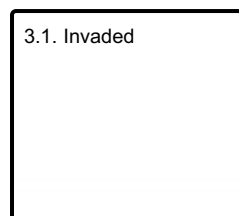
1.1A - Improper grazing management

1.2A - Proper grazing management

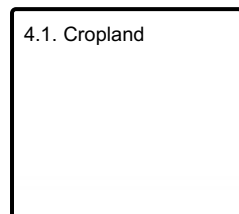
State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 submodel, plant communities



State 1 Reference

The Reference state for this ecological site consists of two communities and evolved under the combined influences of climatic conditions, periodic fire activity, grazing by large herbivores, and impacts from small mammals and insects. The Reference state is the plant communities in which interpretations are primarily based and is used as a reference in order to understand the original potential of the site.

Dominant plant species

- bluejoint (*Calamagrostis canadensis*), grass
- slimstem reedgrass (*Calamagrostis stricta*), grass
- prairie cordgrass (*Spartina pectinata*), grass

Community 1.1 Reedgrass and Prairie Cordgrass

This plant community is characterized by a plant community comprised of tall rhizomatous grasses and a diversity of sedges including prairie cordgrass, fowl mannagrass, bluejoint reedgrass, slimstem reedgrass, clustered field sedge, Nebraska sedge, woolly sedge, and beaked sedge. Forbs such as silverweed cinquefoil, goldenrod, fringed willowherb, wild mint, and wild bergamot occur at approximately 10 percent canopy cover. Shrubs such as rose, willow, chokecherry, and common snowberry occur at from 10 to 30 percent canopy cover.

Community 1.2 Prairie Cordgrass and Arctic Rush

This plant community is characterized by a plant community comprised of tall rhizomatous grasses and rush species such as prairie cordgrass, fowl mannagrass, and arctic rush. Tall rhizomatous grasses are declining in both cover and vigor. Sedges such as clustered field sedge, Nebraska sedge, woolly sedge, and beaked sedge are declining in diversity. Unpalatable forbs such as silverweed cinquefoil, goldenrod, fringed willowherb, wild mint, and wild bergamot are increasing. Shrubs such as rose, willow, chokecherry, and common snowberry occur at from 10 to 30 percent canopy cover.

Pathway 1.1A Community 1.1 to 1.2

Improper grazing management such as continuous season-long or year-long grazing, or a combination of these factors can shift community 1.1 to community 1.2.

Pathway 1.2A Community 1.2 to 1.1

Proper grazing management shifts community 1.2 to community 1.1.

State 2 Altered

The dynamics of the Altered state are driven by long-term improper grazing management such as continuous season-long or year-long grazing. The Altered state for this ecological site consists of one community.

Dominant plant species

- arctic rush (*Juncus arcticus*), grass

Community 2.1 Forb and Arctic Rush

This plant community is characterized by a community dominated by arctic rush and unpalatable forbs. Tall rhizomatous grasses such as prairie cordgrass, fowl mannagrass, bluejoint reedgrass, and slimstem reedgrass are rare or absent. Sedges such as clustered field sedge, Nebraska sedge, woolly sedge, and beaked sedge have declined in diversity. Unpalatable forbs such as silverweed cinquefoil, goldenrod, fringed willowherb, wild mint, and wild bergamot are common. Shrubs such as rose and common snowberry occur at from 10 to 30 percent canopy cover.

State 3 Invaded

The Invaded state occurs when invasive plant species invade native plant communities and displace the native species. The Invaded state consists of one community.

Dominant plant species

- Kentucky bluegrass (*Poa pratensis*), grass

Community 3.1 Invaded

Observations suggest that native species diversity declines significantly when invasive or noxious species exceed approximately 30 percent of the plant community. Non-native, perennial grasses such as quackgrass and Kentucky bluegrass, and noxious weed species can eventually dominate the seedbank of this site and displace native species. Reduced plant species diversity, simplified structural complexity, and altered ecological processes result in a state that is substantially departed from the Reference state.

State 4 Cropland

The Cropland state occurs when cultivation occurs to the land. The Cropland state consists of one community.

Community 4.1 Cropland

The land is cultivated and converted to crop production. Typically, the site is planted to non-native perennial hay such as alfalfa, orchardgrass, creeping foxtail, and grass/alfalfa mixes. Occasionally, cereal grains such wheat and barley are grown in rotation. Cultivation may be accompanied by irrigation practices resulting in vastly altered vegetation, soil morphology, and hydrology on the site. Once the site is converted to production agriculture, land values increase significantly and it is unlikely that the site will be converted back to natural vegetation.

Transition T1A State 1 to 2

Prolonged improper grazing management such as continuous season-long or year-long grazing weaken the resilience of the Reference state and drive its transition to the Altered state. The Reference state transitions to the Altered state when of tall rhizomatous grasses become rare and species such as arctic rush and unpalatable forbs dominate the plant community.

Transition T1B

State 1 to 3

The Reference state transitions to the Invaded state when non-native grasses or noxious weeds invade the plant community. Exotic plant species dominate the site in terms of cover and production and site resilience has been substantially reduced. In addition, other rangeland health attributes, such as reproductive capacity of native grasses and soil quality, have been substantially altered from the Reference state.

Transition T1C

State 1 to 4

Tillage or application of herbicide followed by seeding of cultivated crops, such as non-native hay, wheat, and barley, transitions the Reference state to the Cropland state.

Restoration pathway R2A

State 2 to 1

Proper grazing management in combination with normal or above-normal moisture, and revegetation transition the Altered state back to the Reference state. These practices are typically management intensive and costly, therefore, returning the Altered state to the Reference state can require considerable cost, energy, and time.

Conservation practices

Prescribed Grazing

Transition T2A

State 2 to 3

The Altered state transitions to the Invaded state when non-native grasses or noxious weeds invade the plant community. Exotic plant species dominate the site in terms of cover and production and site resilience has been substantially reduced. In addition, other rangeland health attributes, such as reproductive capacity of native grasses and soil quality, have been substantially altered from the Reference state.

Transition T2B

State 2 to 4

Tillage or application of herbicide followed by seeding of cultivated crops, such as non-native hay, wheat, and barley, transitions the Altered state to the Cropland state.

Transition T3A

State 3 to 4

The Invaded state will transition to the Cropland state when the site is placed under cultivation.

Additional community tables

Inventory data references

Specific field data was not obtained for this provisional ecological site description. Existing field data were used in conjunction with a review of the scientific literature and professional experience to approximate the plant communities, states, and transitions. All community phases are considered provisional based on the sources identified in this ecological site description.

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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	12/22/2024
Approved by	Kirt Walstad
Approval date	

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:**
-