Ecological site R058AY729MT
Overflow 15-19

Last updated: 8/29/2024
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): 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, Unglaciated, 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 2,950 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: Temperate and Boreal Grassland and Shrubland Subclass (2.B)
• Formation: Temperate Grassland, Meadow, and Shrubland Formation (2.B.2)
• Division: Great Plains Grassland and Shrubland Division (2.b.2.Nb)
• Macrogroup: Hesperostipa comata – Pascopyrum smithii – Festuca hallii Grassland Macrogroup (2.B.2.Nb.2)
• Group: Pascopyrum smithii – Hesperostipa comata – Schizachyrium scoparium Mixedgrass Prairie Group (2.B.2.Nb.2.c)

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 terraces or alluvial fans on floodplains and receives additional moisture from flooding or run-in. The streams associated with this site are generally intermittent or perennial. This site occurs at elevations ranging from 1,900 to 3,500 feet and on slopes ranging from 0 to 5 percent. This site occurs on all aspects, although aspect is not a significant factor. The soils of this ecological site are deep to very deep and are well drained. The soil textures on this site typically range from fine sandy loam to silty clay loam but can have a wide variation since these soils typically result from water deposition.

Associated sites

R058AY738MT	**Subirrigated 10-19** The Subirrigated ecological site is adjacent to the Overflow ecological site, typically on lower terraces where ground water is closer to the surface and contributes significantly to site production.
R058AY736MT	**Riparian Woodland 10-19** The Riparian Woodland ecological site is adjacent to the Overflow ecological site, typically on lower terraces where flooding is more frequent and riparian woody plants are dominant.

Similar sites

R058AY736MT	**Riparian Woodland 10-19** This site differs from the Overflow ecological site in that it occupies lower terraces and is dominated by riparian woody species. Shrubs and trees dominate the site in terms of cover and production.
R058AY738MT	**Subirrigated 10-19** This site differs from the Overflow ecological site in that it occupies lower terraces. It receives additional moisture primarily from ground water whereas the Overflow ecological site receives it from surface water. Depth to a water table is 24 to 40 inches.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia cana*
Herbaceous	(1) *Pascopyrum smithii* (2) *Nassella viridula*

Physiographic features

This ecological site occurs on terraces or alluvial fans on floodplains. The slopes typically range from 0 to 5 percent.

This site occurs on all aspects. Aspect is not a significant factor.

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Alluvial fan (3) Stream terrace
Flooding frequency	None to rare
Ponding frequency	None
Elevation	1,900–3,500 ft
Slope	0–5%
Water table depth	40–72 in
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 lower 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 15 to 19 inches throughout most of the area within this ecological site. 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)	15-19 in
Frost-free period (average)	116 days
Freeze-free period (average)	140 days

Precipitation total (average)	16 in

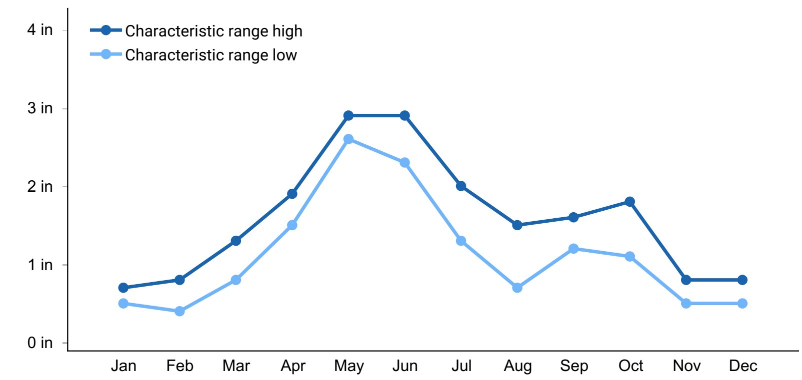


Figure 1. Monthly precipitation range

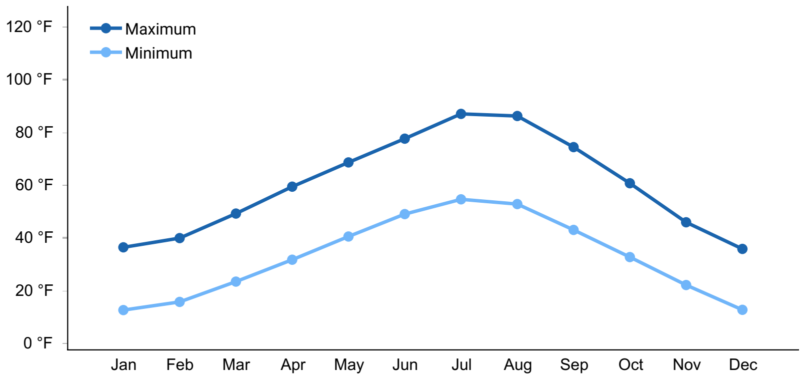


Figure 2. Monthly average minimum and maximum temperature

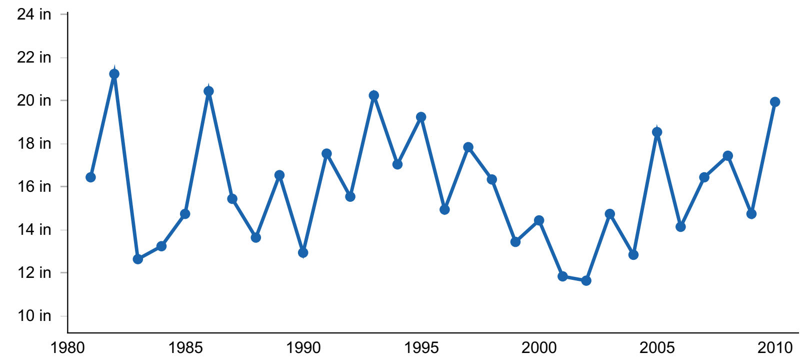


Figure 3. Annual precipitation pattern

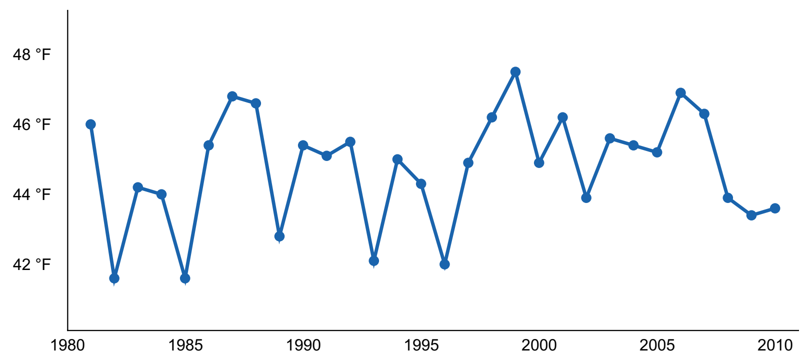


Figure 4. Annual average temperature pattern

Climate stations used

- (1) WINIFRED [USC00249033], Hilger, MT

- (2) COLUMBUS [USC00241938], Columbus, MT
- (3) WYOLA 1 SW [USC00249175], Wyola, MT
- (4) EKALAKA [USC00242689], Ekalaka, MT
- (5) MELSTONE [USC00245596], Musselshell, MT
- (6) YELLOWTAIL DAM [USC00249240], Lodge Grass, MT

Influencing water features

This is a riparian site that receives additional moisture via surface runoff and from stream overflow. Hydrology is typical of upper stream terraces in that the site contributes recharge to the stream reach during peak precipitation cycles (May through June). The site receives additional moisture from surrounding uplands that saturates the soil profile then enters the stream as either surface flow or subsurface flow. During major flood events, the site may be flooded for brief durations. Sometimes, a seasonal groundwater table deeper than 40 inches below the soil surface is present, particularly during spring runoff.

Wetland description

Not Applicable

Soil features

Soils for this ecological site are typically very deep (greater than 60 inches to bedrock), well drained, and derived from alluvium from sedimentary rock. Surface horizon textures are typically loam but may range from fine sandy loam to silty clay loam and can vary widely since these soils typically result from water deposition. Underlying horizons consist of thin layers of clay loam, fine sandy loam, or silt loam that have a loam texture when mixed. Content of coarse fragments is less than 35 percent 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 typic ustic. The following figure shows a typical soil profile for this ecological site.

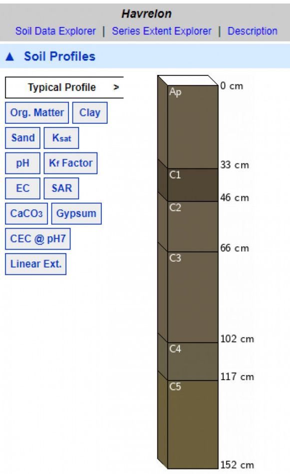


Figure 5. Typical Soil Profile

Table 4. Representative soil features

Parent material	(1) Alluvium–sedimentary rock
Surface texture	(1) Loam
Drainage class	Well drained
Permeability class	Moderate
Soil depth	60–72 in
Surface fragment cover <=3"	0–3%
Surface fragment cover >3"	0–3%

Available water capacity (0-8in)	1.5–2.2 in
Calcium carbonate equivalent (0-40in)	1–10%
Electrical conductivity (0-4in)	0–4 mmhos/cm
Sodium adsorption ratio (0-4in)	0–4
Soil reaction (1:1 water) (0-40in)	7.9–8.2
Subsurface fragment volume <=3" (0-40in)	0%
Subsurface fragment volume >3" (0-40in)	0%

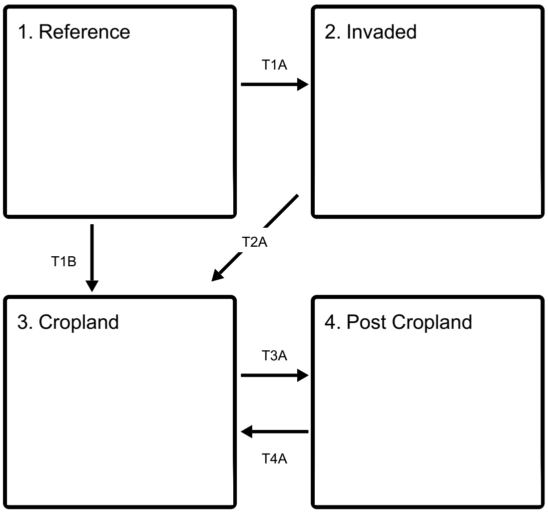
Ecological dynamics

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 medium height, cool-season and warm-season grasses, which are tightly intermixed and well distributed over the site. Various forbs, half-shrubs, 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 - Introduction of non-native invasive species (non-native perennial grasses, noxious weeds, etc.)

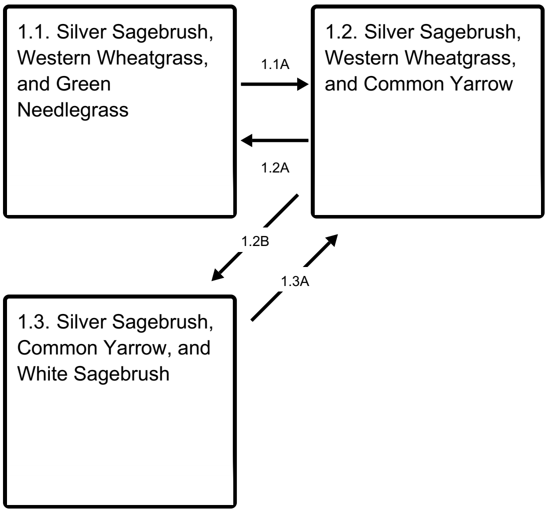
T1B - Tillage or herbicide application and seeding of annual crops or non-native hayland (frequently combined with irrigation practices)

T2A - Tillage or herbicide application and seeding of annual crops or non-native hayland (frequently combined with irrigation practices)

T3A - Cessation of cultivation

T4A - Tillage or herbicide application and seeding of annual crops or non-native hayland (frequently combined with irrigation practices)

State 1 submodel, plant communities



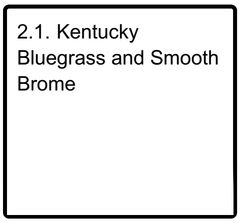
1.1A - Drought, improper grazing management

1.2A - Normal or above-normal spring moisture, proper grazing management

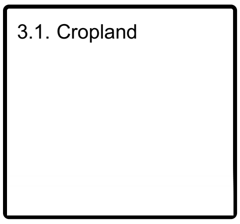
1.2B - Prolonged drought, continued improper grazing, or a combination of these factors

1.3A - Normal or above-normal spring moisture, proper grazing management

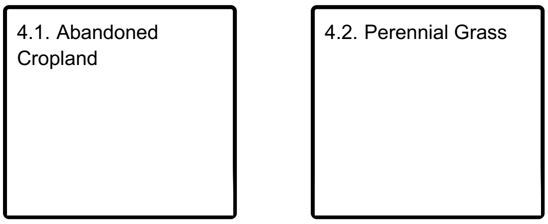
State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 submodel, plant communities



State 1
Reference

The Reference state for this ecological site consists of three 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

- silver sagebrush (*Artemisia cana*), shrub
- western wheatgrass (*Pascopyrum smithii*), grass
- green needlegrass (*Nassella viridula*), grass
- common yarrow (*Achillea millefolium*), other herbaceous
- white sagebrush (*Artemisia ludoviciana*), other herbaceous

Community 1.1
Silver Sagebrush, Western Wheatgrass, and Green Needlegrass

This plant community is characterized by rhizomatous wheatgrasses, bunchgrasses, and silver sagebrush. The predominant species may include western wheatgrass, prairie cordgrass, green needlegrass, Canada wildrye, and needle and thread. Forbs such as Canada goldenrod, American vetch, scarlet globemallow, and common yarrow occur at approximately 15 percent canopy cover. Shrubs occur at approximately 30 percent canopy cover. The most dominant shrub species is silver sagebrush, but snowberry, Wood’s rose, and chokecherry may occur at lower canopy covers.

Community 1.2
Silver Sagebrush, Western Wheatgrass, and Common Yarrow

This plant community is characterized by rhizomatous wheatgrasses, unpalatable forbs, and silver sagebrush. The predominant grass species include western wheatgrass and prairie cordgrass. Bunchgrasses such as green needlegrass may occur at low canopy cover and exhibit low vigor. Unpalatable forbs such as Canada goldenrod, American vetch, scarlet globemallow, and common yarrow are increasing under this community phase. Shrubs occur at approximately 30 percent canopy cover, with silver sagebrush the predominant shrub species.

Community 1.3
Silver Sagebrush, Common Yarrow, and White Sagebrush

This plant community is characterized by a silver sagebrush and forb dominated community. Rhizomatous wheatgrasses such as western wheatgrass occur at low canopy cover and exhibit low vigor. Bunchgrasses such as green needlegrass are rare or absent. Unpalatable forbs such as Canada goldenrod, American vetch, scarlet globemallow, and common yarrow are common.

Pathway 1.1A
Community 1.1 to 1.2

Drought, 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

Normal or above-average precipitation and proper grazing management shifts community 1.2 to community 1.1.

Pathway 1.2B
Community 1.2 to 1.3

Prolonged drought, continued improper grazing practices such as continuous season-long or year-long grazing, or a combination of these factors can shift community 1.2 to community 1.3.

Pathway 1.3A
Community 1.3 to 1.2

Normal or above-average precipitation and proper grazing management shifts community 1.3 to community 1.2.

State 2

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
- smooth brome (*Bromus inermis*), grass

Community 2.1
Kentucky Bluegrass and Smooth Brome

Observations suggest that native species diversity declines significantly when invasive or noxious species exceed approximately 30 percent of the plant community. Introduced perennial grasses, such as Kentucky bluegrass and smooth brome, or noxious weed species can displace native species by forming dense root mats, altering nitrogen cycling, and dominating the seedbank (Toledo et al., 2014; DeKeyser et al., 2013). Reduced plant species diversity, simplified structural complexity, and altered ecological processes result in a state that is substantially departed from the Reference state.

State 3
Cropland

The Cropland state occurs when cultivation occurs to the land. The Cropland state consists of 1 community.

Community 3.1
Cropland

The land is cultivated and converted to crop production. Annual, crops such as wheat, barley, silage corn, or sugar beets replace native plant communities. Non-native, perennial hay with annual, cool-season cereal grains such as wheat or barley in rotation are also grown. Cultivation is frequently accompanied by irrigation practices resulting in vastly altered vegetation, soil morphology, and hydrology on the site.

State 4
Post Cropland

The Post Cropland state occurs when cultivated cropland is abandoned and allowed to either re-vegetate naturally or is seeded back to perennial species for livestock grazing or wildlife use. This state can transition back to the Cropland state if the site is returned to cultivation. The Post Cropland state has two communities.

Community 4.1
Abandoned Cropland

In the absence of active management, the site can re-vegetate naturally and potentially return to a perennial grassland community over time. Shortly after cropland is abandoned, annual and biennial forbs and annual brome grasses invade the site. The site is highly susceptible to erosion due to the absence of perennial species. Eventually, these pioneering annual species are replaced by perennial forbs and perennial shortgrasses. Depending on the historical management of the site, mid-statured perennial grasses may also return; however, species composition will depend upon the seed bank. This community is highly susceptible to invasion by exotic species, such as smooth brome and Kentucky bluegrass, and noxious weeds. Fifty or more years after cultivation, these sites may have species composition similar to communities in the Reference state. However, soil quality and morphology have been substantially altered and a shift to the Reference state is unlikely within a reasonable timeframe (Dormaar, J.F., and S. Smoliak. 1985).

Community 4.2
Perennial Grass

When the site is seeded to perennial forage species this community can persist for several decades. Introduced perennial grasses, in particular, may form monocultures that persist for 60 years or more (Samuel, M.J., and R.H. Hart. 1994). A mixture of native species may also be seeded to provide species composition and structural complexity similar to that of the Reference state. However, soil quality and morphology have been substantially altered and will not return to pre-cultivation conditions within a reasonable timeframe.

Transition T1A
State 1 to 2

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 T1B
State 1 to 3

Tillage or application of herbicide followed by seeding of cultivated crops, such as winter wheat, spring wheat, and barley, transitions the Reference state to the Cropland state.

Transition T2A
State 2 to 3

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

Transition T3A
State 3 to 4

The transition from the Cropland state to the Post Cropland state occurs with the cessation of cultivation. The site may also be seeded to perennial forage species, such as crested wheatgrass and alfalfa, or a mix of native species.

Transition T4A
State 4 to 3

Tillage or application of herbicide followed by seeding of cultivated crops, such as winter wheat, spring wheat, and barley, transitions the Post Cropland state to the Cropland state.

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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Approval

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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	05/11/2025
Approved by	Kirt Walstad
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):**

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:**