Ecological site R058AY734MT
Shallow Clay 15-19

Last updated: 8/29/2024
Accessed: 09/24/2026

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 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: Xeromorphic Woodland, Scrub and Herb Vegetation Class (3) • Subclass: Cool Semi-Desert Scrub and Grassland Subclass (3.B) • Formation: Cool Semi-Desert Scrub and Grassland Formation (3.B.1) • Division: Cool Semi-Desert Scrub and Grassland Division (3.B.1.Ne) • Macrogroup: Artemisia tridentata - Artemisia tripartita ssp. tripartita - Purshia tridentata Steppe and Shrubland Macrogroup (3.B.1.Ne.3) • Group: Artemisia tridentata - Artemisia tripartita - Purshia tridentata Big Sagebrush Steppe and Shrubland Group (3.B.1.Ne.3.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 plains, hills, and escarpments at elevations ranging from 1,900 to 3,500 feet. Slopes range from 0 to 70 percent. This site occurs on all aspects and aspect can be significant, particularly on steep and very steep slopes. Slight variations in plant community composition and production can result due to aspect. The soil textures are typically clay, clay loam, silty clay, and silty clay loam. These soils are generally 10 to 20 inches deep to shale and plant root penetration is restricted at that depth.

Associated sites

R058AY735MT	**Very Shallow 15-19**	This site occurs on nearly level to steeply sloping uplands that are adjacent to or upslope from the Shallow Clay ecological site. It occurs on upper backslope, crest, or summit positions and is often associated with rock outcrops.
R058AY725MT	**Clayey Steep 15-19**	This site occurs on moderate to steeply sloping hillslopes adjacent to or downslope from the Shallow Clay ecological site. It occurs in backslope positions where slopes are 15 percent or greater and depth to bedrock is 20 inches or more.
R058AY724MT	**Clayey 15-19**	This site occurs on nearly level to gently sloping areas adjacent to the Shallow Clay ecological site. It occurs in footslope and summit positions where slopes are less than 15 percent and depth to bedrock is 20 inches or more.
R058AY733MT	**Shallow 15-19**	This site occurs on moderate to steeply sloping hillslopes adjacent to the Shallow Clay ecological site. It occurs in backslope positions where slopes are 15 percent or greater and clay content of the soil is 32 percent or less.

Similar sites

R058AY725MT	**Clayey Steep 15-19**	This site differs from the Shallow Clay ecological site in that that the depth to bedrock is 20 inches or more whereas the Shallow Clay ecological site is between 10 and 20 inches to bedrock.
R058AY724MT	**Clayey 15-19**	This site differs from the Shallow Clay ecological site in that that the depth to bedrock is 20 inches or more whereas the Shallow Clay ecological site is between 10 and 20 inches to bedrock.
R058AY735MT	**Very Shallow 15-19**	This site differs from the Shallow Clay ecological site in that that the depth to bedrock is less than 10 inches whereas the Shallow Clay ecological site is between 10 and 20 inches to bedrock.
R058AY733MT	**Shallow 15-19**	This site differs from the Shallow Clay ecological site in that its soils have coarser textures. Soil textures are typically loam, silt loam, sandy loam, fine sandy loam, and very fine sandy loam.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata ssp. wyomingensis*

Herbaceous	(1) *Pascopyrum smithii* (2) *Nassella viridula*

Physiographic features

This ecological site occurs on plains, hills, and escarpments. Slopes typically range from 0 to 70 percent. This site occurs on all aspects. Aspect can be a significant factor.

Table 2. Representative physiographic features

Landforms	(1) Plain (2) Hill (3) Escarpment
Runoff class	Medium to high
Flooding frequency	None
Ponding frequency	None
Elevation	580 – 1,070 m
Slope	0 – 70 %
Aspect	W, NW, N, NE, E, SE, S, SW

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 11 to 17 inches throughout most of the area. This site occurs in the higher range of 15 to 19 inches of precipitation. 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)	380-480 mm
Frost-free period (average)	120 days
Freeze-free period (average)	140 days
Precipitation total (average)	410 mm

- (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 upland ecological site and is not influenced by a water table or run in from adjacent sites. Due to the semi-arid climate in which it occurs, the water budget is normally contained within the soil pedon. Soil moisture is recharged by spring rains, but it but rarely exceeds field capacity before being depleted by evapotranspiration. Steep slopes and high clay content combined with bedrock at relatively shallow depths result in very high runoff potential. During intense precipitation events, the site delivers moisture to downslope sites via surface runoff. Moisture loss through evapotranspiration exceeds precipitation for the majority of the growing season and soil moisture is the primary limiting factor for plant production on this ecological site.

Wetland description

Not Applicable

Soil features

Soils for this ecological site are typically shallow (10 to 20 inches) to paralithic bedrock, well drained, and derived from shale residuum. Surface horizon textures range from clay loam to clay and contain greater than 32 percent clay. The underlying horizons typically contain 35 percent clay or more and have clay loam, silty clay loam, silty clay, or clay textures. The soil temperature regime is primarily frigid, with smaller areas of mesic temperature regime present. The soil moisture regime is typic ustic. Figure 5 shows a typical soil profile for this ecological site.

Figure 5. Typical Soil Profile

Table 4. Representative soil features

Parent material	(1) Residuum – shale
Surface texture	(1) Clay loam (2) Silty clay loam (3) Silty clay (4) Clay
Drainage class	Well drained
Permeability class	Very slow to slow
Soil depth	30 – 50 cm
Surface fragment cover <=3"	0 – 20 %
Surface fragment cover >3"	0 – 10 %
Available water capacity (0-50.8cm)	5.08 – 10.16 cm
Electrical conductivity (0-50.8cm)	Not specified
Sodium adsorption ratio (0-50.8cm)	Not specified
Subsurface fragment volume <=3" (0-50.8cm)	0 – 10 %
Subsurface fragment volume >3" (0-50.8cm)	0 – 10 %

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. Half-shrubs and shrubs increase in the absence of prescribed fire and wildfire. More frequent fire intervals decreases the shrub component resulting in a site dominated by herbaceous species. There are various transitional stages which may occur on this ecological site.

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 6. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 7. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 8. Community 1.4 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 9. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 10. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 11. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

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	09/24/2026
Approved by	
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):**

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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:**
