USDA Natural Resources
Conservation Service

Ecological site R060BE570MT
Overflow 10-14

Last updated: 9/07/2023
Accessed: 05/18/2024

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.

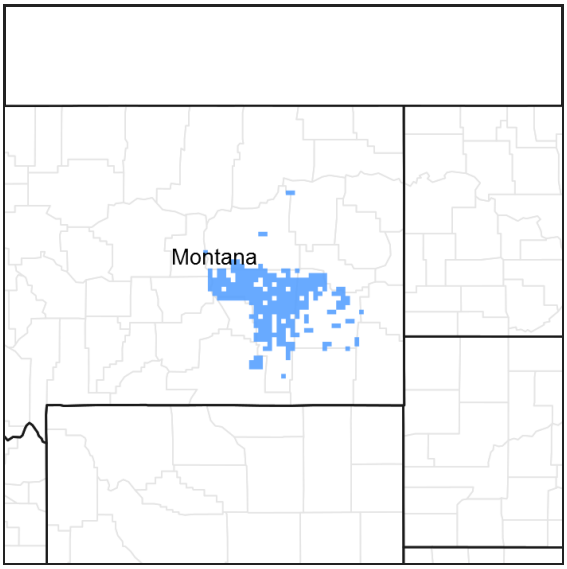


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 060B–Pierre Shale Plains, Northern Part

MLRA 060B, Pierre Shale Plains (Northern Part), is almost entirely in Montana (94 percent) and Wyoming (6 percent). The area makes up about 2,160,000 acres and occurs in the uplands between most of the major rivers in southeastern Montana and northeastern Wyoming. 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 deeply eroded.

The shale plains have long, smooth, gentle to strong slopes. Slopes along drainageways and streams are moderately steep or steep. Elevation ranges from 1,900 to 3,500 feet on uplands. Marine and continental sediments of the Cretaceous Montana Group underlie most of this MLRA.

The average annual precipitation in the area is 14 inches and ranges from 11 to 17 inches. Most of the annual precipitation occurs as high-intensity, convective thunderstorms during the growing season. Precipitation in winter occurs mainly as snow, which usually is accompanied by high winds that cause much drifting.

The average annual temperature is 43 to 46 degrees Fahrenheit. The freeze-free period averages 142 days and ranges from 130 to 160 days. The frost-free period averages 120 days and ranges from 110 to 135 days.

The dominant soil orders in this MLRA are Alfisols, Entisols, and Vertisols. The soils in the area dominantly have a frigid soil temperature regime, an ustic soil moisture regime, and smectitic mineralogy. The soils are shallow to very deep, generally well drained, and clayey.

The area supports native prairie vegetation characterized by a diversity of cool-season and warm-season grasses, sedges, forbs, and shrubs. A majority of this area is in farms or ranches and comprised of rangeland used for livestock grazing. Some small areas of nearly level to moderately sloping soils are used for winter wheat or for livestock feed crops.

Classification relationships

NRCS Soil Geography Hierarchy
• Land Resource Region: Western Great Plains
• Major Land Resource Area (MLRA): 060B Pierre Shale 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 Missouri Plateau Section (331M)

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 ssp. wyomingensis - Artemisia tridentata ssp. tridentata Steppe & Shrubland Group (3.B.1.Ne.3.a)

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: Sagebrush Steppe (43e)

Ecological site concept

This ecological site occurs in swales and drainageways and on stream terraces where it receives additional moisture from flooding or run-in from adjacent areas. The streams associated with this site are ephemeral, meaning they flow only in direct response to a precipitation event or snow melt. 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 surface 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

R060BE566MT	**Clayey 10-14** The Clayey ecological site occurs on slopes of 0 to 15 percent, has soils with greater than 35 percent clay content, and has lower total annual production. The Clayey ecological site is positioned above the Overflow ecological site. The Clayey ecological site does not receive additional moisture from flooding or run-in from adjacent areas.
R060BE579MT	**Loamy 10-14** The Loamy ecological site occurs on slopes of 0 to 15 percent and has lower total annual production. The Loamy ecological site is positioned above the Overflow ecological site. The Loamy ecological site does not receive additional moisture from flooding or run-in from adjacent areas.

R060BE583MT	**Clayey Steep 10-14** The Clayey Steep ecological site occurs on slopes of 15 to 45 percent, has greater than 35 percent clay content, and has lower total annual production. The Clayey Steep ecological site is positioned above the Overflow ecological site. The Clayey Steep ecological site does not receive additional moisture from flooding or run-in from adjacent areas.

Similar sites

R060BE571MT	**Saline Lowland 10-14** The Saline Lowland ecological site occurs on similar slopes and landform positions and has similar total annual production as the Overflow ecological site, but the Saline Lowland ecological site is dominated by salt tolerant species. The Saline Lowland ecological site does not receive additional moisture from flooding or run-in from adjacent areas.

Table 1. Dominant plant species

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

Physiographic features

This ecological site occurs in swales and drainageways and on stream terraces where it receives additional moisture from flooding or run-in from adjacent areas. The streams associated with this site are ephemeral, meaning they flow only in direct response to a precipitation event or snow melt. 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.

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Terrace (3) Alluvial fan
Flooding frequency	None to rare
Ponding frequency	None
Elevation	579–1,067 m
Slope	0–5%
Aspect	Aspect is not a significant factor

Climatic features

MLRA 060B 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 43 to 46 degrees Fahrenheit. Summer daytime temperatures are typically quite warm, generally averaging in the lower to mid-80's 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 mid-teens to mid-20's 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.

The average annual precipitation in this area is 14 inches, and ranges from 11 to 17 inches. During an average year, 70 to 75 percent of the annual precipitation falls between April and September, which are the primary growing

season months. A majority of the annual precipitation occurs as frontal storms early in the growing season during the months of May and June and high-intensity, convective thunderstorms during July and August. Some rainfall occurs during the fall.

Seasonal precipitation is often limiting for plant growth. Annual fluctuations in species composition and total production are typical depending on the amount and timing of rainfall. Precipitation during the winter occurs primarily as snow, although snowfall is generally not heavy. Snow cover is typically 1 to 3 inches. Heavy snowfall occurs infrequently, usually late in the winter or early spring. Snowfall is generally accompanied by high winds that causes drifting.

The prevailing wind direction is from the northwest. 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.

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

Table 3. Representative climatic features

Frost-free period (characteristic range)	110-135 days
Freeze-free period (characteristic range)	130-160 days
Precipitation total (characteristic range)	254-356 mm
Frost-free period (actual range)	
Freeze-free period (actual range)	
Precipitation total (actual range)	254-432 mm
Frost-free period (average)	120 days
Freeze-free period (average)	142 days
Precipitation total (average)	356 mm

Climate stations used

- (1) RIDGEWAY 1 S [USC00247034], Hammond, MT
- (2) INGOMAR 14 NE [USC00244386], Ingomar, MT
- (3) BAKER MUNI AP [USW00094055], Baker, MT
- (4) ALBION 1 N [USC00240088], Alzada, MT

Influencing water features

This upland ecological site is associated with ephemeral streams and adjacent upslope sites. During intense precipitation events, this site receives additional moisture from overflow of ephemeral streams and surface runoff moisture from adjacent upslope sites resulting in increased vegetative production. Due to the semi-arid climate in which it occurs, the water budget is normally contained within the soil pedon. Soil moisture rarely exceeds field capacity in the upper 40 inches before being depleted by evapotranspiration. This site has no permanent water table.

Wetland description

Not Applicable

Soil features

The soils of this ecological site are typically very deep, well drained, and derived from alluvium from sedimentary rock. The depth to a soil restrictive layer is greater than 60 inches from the soil surface. The soil surface textures on

this site are typically clay loam, silty clay, or silty clay loam. Soil surface textures may vary since they are alluvial soils and have been deposited by flowing water. The soil temperature regime is primarily frigid and the soil moisture regime is aridic ustic.

Table 4. Representative soil features

Parent material	(1) Alluvium–sedimentary rock
Surface texture	(1) Clay loam (2) Silty clay (3) Silty clay loam
Drainage class	Well drained
Permeability class	Moderate
Depth to restrictive layer	152 cm
Soil depth	152 cm
Surface fragment cover <=3"	0–3%
Surface fragment cover >3"	0–3%
Available water capacity (0-20.3cm)	3.81–5.59 cm
Calcium carbonate equivalent (0-101.6cm)	1–10%
Electrical conductivity (0-20.3cm)	0–8 mmhos/cm
Sodium adsorption ratio (0-20.3cm)	0–4
Soil reaction (1:1 water) (0-101.6cm)	7.9–8.2
Subsurface fragment volume <=3" (0-101.6cm)	0%
Subsurface fragment volume >3" (0-101.6cm)	0%

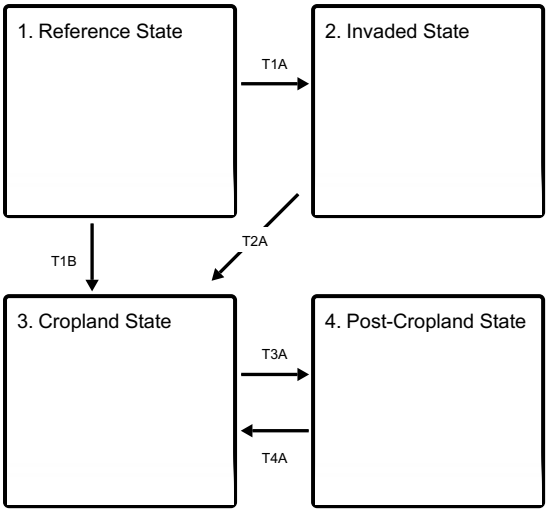
Ecological dynamics

The Reference State is the plant community in which interpretations are primarily based and is used as a reference in order to understand the original potential of the site. The Reference State evolved 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 Plant Community 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, half-shrubs, and shrubs are common on this site. The Reference Plant Community 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 tallgrasses, 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

Ecosystem states



T1A - Introduction of non-native invasive species (annual bromes, non-native perennial grasses, noxious weeds)

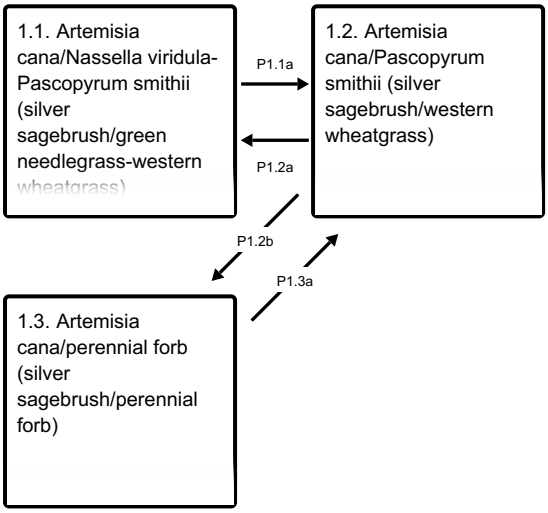
T1B - Tillage or herbicide application and seeding of annual crops or non-native hayland (frequently combined with irrigation practices)

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



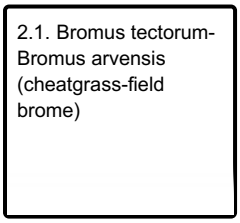
P1.1a - Drought, improper grazing management

P1.2a - Normal or above-normal spring moisture, proper grazing management

P1.2b - Prolonged drought, continued improper grazing, or a combination of these factors

P1.3a - Normal or above-normal spring moisture, proper grazing management

State 2 submodel, plant communities



State 3 submodel, plant communities

3.1. Cropland Community

State 4 submodel, plant communities

4.1. Abandoned Cropland Community

4.2. Perennial Grass Community

State 1
Reference State

The Reference State (1) 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 community in which interpretations are primarily based and is used as a reference in order to understand the original potential of the site. The Reference State (1) for this ecological site consists of 3 community phases.

Community 1.1
Artemisia cana/Nassella viridula-Pascopyrum smithii (silver sagebrush/green needlegrass-western wheatgrass)

This plant community is characterized by rhizomatous wheatgrasses, bunchgrasses, and silver sagebrush. The predominant species may include western wheatgrass, green needlegrass, needle and thread, Canada wildrye, switchgrass, big bluestem, and prairie cordgrass. Forbs such as Canada goldenrod, Missouri goldenrod, prairie coneflower, sunflower, scurfpea, American licorice, wild bergamot, white sagebrush, 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
Artemisia cana/Pascopyrum smithii (silver sagebrush/western wheatgrass)

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, Missouri goldenrod, prairie coneflower, scurfpea, American licorice, 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
Artemisia cana/perennial forb (silver sagebrush/perennial forb)

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, Missouri goldenrod, prairie coneflower, scurfpea, American licorice, American vetch, scarlet globemallow, and common yarrow are common.

Pathway P1.1a
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 Phase 1.1 to Community Phase 1.2.

Pathway P1.2a
Community 1.2 to 1.1

Normal or above-normal spring precipitation and proper grazing management transitions Community Phase 1.2 back to Community Phase 1.1.

Pathway P1.2b
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 Phase 1.2 to Community Phase 1.3. Community Phase 1.2 transitions to Community Phase 1.3 when mid-statured bunchgrasses become rare and contribute little to production. In addition, mid-statured rhizomatous grass cover and vigor are substantially reduced.

Pathway P1.3a
Community 1.3 to 1.2

Normal or above-normal spring precipitation and proper grazing management transition Community Phase 1.3 back to Community Phase 1.2.

State 2
Invaded State

The Invaded State (2) occurs when invasive plant species invade native grassland communities and displace the native species. Encroachment by introduced grasses, noxious weeds, and other invasive species is common. The Invaded State (3) consists of 1 community phase.

Community 2.1
Bromus tectorum-Bromus arvensis (cheatgrass-field brome)

Observations suggest that native species diversity declines significantly when invasive or noxious species exceed approximately 30 percent of the plant community. Non-native, perennial, drought tolerant grasses such as crested wheatgrass, non-native, annual, invasive species such as cheatgrass and field brome, 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 (1). The dominance of annual, invasive grasses such as cheatgrass and field brome increases the fire cycle frequency.

State 3
Cropland State

The Cropland State (3) occurs when cultivation occurs to the land. The Cropland State (4) consists of 1 community phase.

Community 3.1
Cropland Community

The land is typically used for non-native, perennial grass hay with annual, cool-season cereal grains such as spring wheat, winter wheat, and barley used in crop rotation practices.

State 4
Post-Cropland State

The Post-Cropland State (4) 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 (3) if the site is returned to cultivation. The Post-Cropland State (4) has 2 community phases.

Community 4.1
Abandoned Cropland Community

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. Invasion of the site by exotic species, such as crested wheatgrass and annual bromes, will depend upon the site's proximity to a seed source. Approximately 50 or more years after cultivation, these sites may have species composition similar to phases in the Reference State (1) (Dormaar, J.F., and S. Smoliak. 1985). However, soil quality is consistently lower than conditions prior to cultivation and a shift to the Reference State (1) is unlikely.

Community 4.2
Perennial Grass Community

When the site is seeded to perennial forage species this community phase can persist for several decades. Introduced perennial grasses, in particular, may form monocultures that persist for approximately 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 (1). However, soil quality conditions have been substantially altered and will not return to pre-cultivation conditions.

Transition T1A
State 1 to 2

The Reference State (1) transitions to the Invaded State (2) when non-native grasses, invasive species, 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 (1).

Transition T1B
State 1 to 3

Tillage or application of herbicide followed by seeding of cultivated crops transitions the Reference State (1) to the Cropland State (3).

Transition T2A
State 2 to 3

Tillage or application of herbicide followed by seeding of cultivated crops transitions the Invaded State (2) to the Cropland State (3).

Transition T3A
State 3 to 4

The transition from the Cropland State (3) to the Post-Cropland State (4) 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 (4) to the Cropland State (3).

Additional community tables

Inventory data references

Specific field data was not obtained for this provisional ecological site description. Existing field data was used in conjunction with a review of 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.

Other references

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Contributors

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Approval

Kirt Walstad, 9/07/2023

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	05/18/2024
Approved by	Kirt Walstad
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:**

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

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

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

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

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

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

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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

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

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

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state**

for the ecological site:

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17. **Perennial plant reproductive capability:**
