

Ecological site R058AY001MT Loamy (Lo) 10-14 P.Z.

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

MLRA 058A, Northern Rolling High Plains (Northern Part), is an expansive and agriculturally and ecologically significant area consisting of approximately 26,875,928 acres. MLRA 058A stretches approximately 290 miles from east to west and 220 miles from north to south, comprises approximately 42,350 square miles and encompasses 26 counties in southeast Montana (99 percent) and northeast Wyoming (1 percent).

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. Local relief is mainly 10 to 100 feet. 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. In a few mountains, elevations are as high as 6,900 feet. The extent of the major Hydrologic Unit Areas that comprise this MLRA are the Missouri-Musselshell (35 percent), Lower Yellowstone (27 percent), Powder-Tongue (15 percent), Upper Yellowstone (11 percent), Bighorn (6 percent), Missouri-Poplar (4 percent), and Missouri-Little Missouri (2 percent). The Missouri and Yellowstone Rivers flow through this area.

The geology is tertiary continental shale, siltstone, and sandstone which underlie the eastern one-third to one-half of this area. These stream deposits are part of the Fort Union Formation. This formation also contains coalbeds. Marine and continental sediments of the Cretaceous Montana Group underlie the rest of the MLRA, generally at the higher elevations. The Montana Group includes the Bearpaw shale; the Judith River sandstone, siltstone and shale; the Claggett shale; the Eagle sandstone; and the Telegraph Creek sandy shale. A group of younger Cretaceous sediments occurs between the higher elevation Montana Group sediments and the lower elevation Tertiary sediments. These younger deposits include the Hell Creek sandstone and shale, the St. Mary River mudstone and the volcanoclastics of the Livingston Group. 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 generally are shallow to very deep, well drained, and clayey or loamy. Ustorthents formed in residuum on hills and ridges and in alluvium on fans and terraces. Ustifluvents formed in alluvium on fans, terraces, and flood plains. Haplustepts formed in alluvium, eolian deposits, and residuum on terraces, fans, and hills. Calcustepts formed in alluvium, colluvium, and residuum on fans, hills, and plains. Natrustalfs and Haplustolls formed in alluvium and glaciofluvial deposits on fans and terraces and in drainageways.

The area primarily supports grassland vegetation with a variety of shrub species. In the western portion of the area, cool-season species such as western wheatgrass, bluebunch wheatgrass, green needlegrass, and needle and thread are dominant. In the eastern portion of the area, warm-season grasses such as little bluestem and sideoats

grama replace cool-season grasses as the dominant species. 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 rangeland and supports native grasses and shrubs and is grazed by livestock and more than 50 percent of the MLRA consists of privately-owned ranches generally dominated by livestock production. Approximately 15 percent of 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.

Associated sites

R058AE002MT	Clayey (Cy) RRU 58A-E 10-14" p.z.
R058AE003MT	Sandy (Sy) RRU 58A-E 10-14" p.z.
R058AE004MT	Silty-Steep (SiStp) RRU 58A-E 10-14" p.z.
R058AE019MT	Shallow (Sw) RRU 58A-E 10-14" p.z.

Similar sites

R058AE003MT	Sandy (Sy) RRU 58A-E 10-14" p.z. The Clayey and Sandy sites occupy the same landscape positions. The primary difference is soil texture and plant community.
R058AE002MT	Clayey (Cy) RRU 58A-E 10-14" p.z. The Clayey and Sandy sites occupy the same landscape positions. The primary difference is soil texture and plant community.
R058AE193MT	Silty-Saline (SiS) RRU 58A-E 10-14" p.z. The Silty-Saline site will differ by having a significant component of a salt tolerant plant species, soils that are salty in the lower parts of the profile, and lower production.
R058AE004MT	Silty-Steep (SiStp) RRU 58A-E 10-14" p.z. The Silty-Steep differs mainly by being on slopes greater than 15% and having lower production.
R058AE018MT	Sands (Sa) RRU 58A-E 10-14" p.z. The Shallow site differs by being 20 inches or less to a restrictive layer or bedrock.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

This ecological site occurs on nearly level to strongly sloping sedimentary plains, hills, terraces, and fans. The slopes range from 0-15%, but are mainly less than 8%. This site occurs on all exposures. Aspect is not significant.

Table 2. Representative physiographic features

Landforms	(1) Plain (2) Alluvial fan (3) Terrace
Flooding frequency	None
Ponding frequency	None
Elevation	579–1,067 m
Slope	0–15%

Water table depth	152 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 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. Annual fluctuations in species composition and total production are typical depending on the amount and timing of rainfall. 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. Snowfall is not heavy in the area, averaging 36 total inches in the Yellowstone Valley and about 39 inches throughout the MLRA. Heavy snowfall occurs infrequently, usually late in the winter or early spring. Snow cover is typically 1 to 3 inches. 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)	85-150 days
Freeze-free period (characteristic range)	115-170 days
Precipitation total (characteristic range)	254-356 mm
Frost-free period (average)	125 days
Freeze-free period (average)	145 days
Precipitation total (average)	330 mm

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) MIZPAH 4 NNW [USC00245754], Ismay, MT
- (13) SAND CREEK [USC00247342], Roy, MT
- (14) ROCK SPRINGS [USC00247136], Angela, MT
- (15) COHAGEN [USC00241875], Cohagen, MT
- (16) MILES CITY F WILEY FLD [USW00024037], Miles City, MT

Influencing water features

None

Soil features

These soils are loams, silt loams, or very fine sandy loams more than 20 inches deep. They include soils that have 2 inches or more of one of these textures over clayey (argillic) subsoils. There are no significant limitations to plant growth.

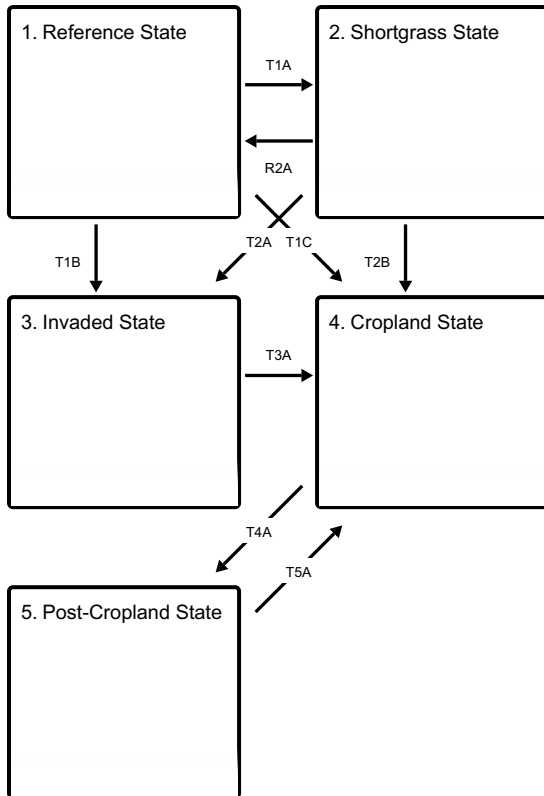
Table 4. Representative soil features

Surface texture	(1) Loam (2) Silt loam (3) Very fine sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderate
Soil depth	51–152 cm
Available water capacity (0-101.6cm)	12.7–25.4 cm
Calcium carbonate equivalent (0-101.6cm)	0–10%
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.4

Ecological dynamics

State and transition model

Ecosystem states



T1A - Prolonged drought, improper grazing, or a combination of these factors

T1B - Introduction of non-native invasive species (annual bromes, crested wheatgrass, noxious weeds, etc.)

T1C - Conversion to cropland

R2A - Range seeding, grazing land mechanical treatment, timely moisture, proper grazing management (management intensive and costly)

T2A - Introduction of non-native invasive species (annual bromes, crested wheatgrass, noxious weeds, etc.)

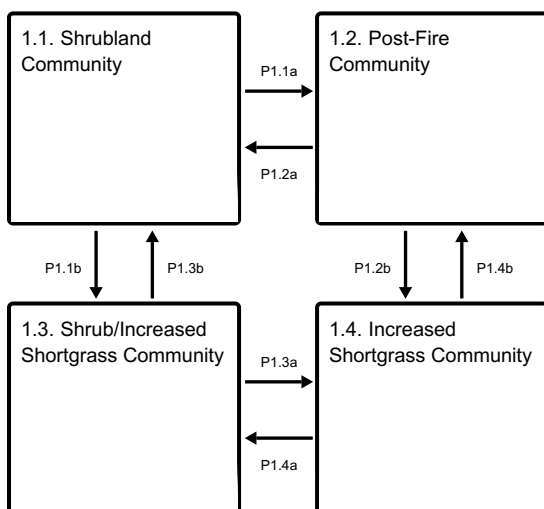
T2B - Conversion to cropland

T3A - Conversion to cropland

T4A - Cessation of annual cropping

T5A - Conversion to cropland

State 1 submodel, plant communities



P1.1a - Fire

P1.1b - Drought, improper grazing management

P1.2a - Approximately 30 years post-fire regrowth

P1.2b - Drought, improper grazing management, multiple fires in close succession

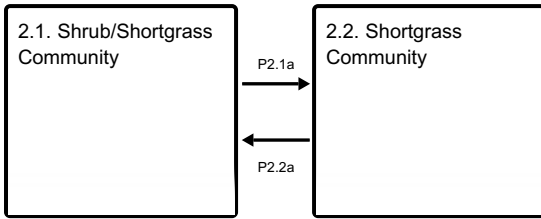
P1.3b - Normal or above average precip., proper grazing management

P1.3a - Fire

P1.4b - Normal or above average precip., proper grazing management

P1.4a - Approximately 30 years post-fire regrowth

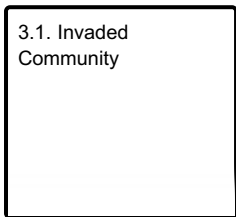
State 2 submodel, plant communities



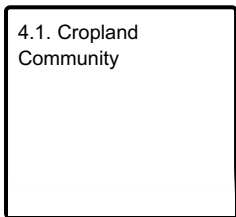
P2.1a - Fire

P2.2a - Approximately 30 years post-fire regrowth

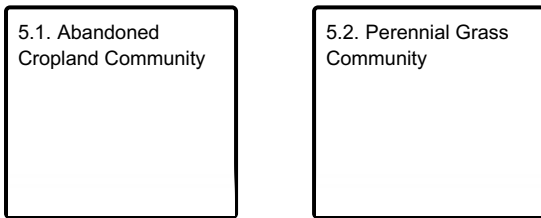
State 3 submodel, plant communities



State 4 submodel, plant communities



State 5 submodel, plant communities



**State 1
Reference State**

**Community 1.1
Shrubland Community**

Mixedgrass/Wyoming big sagebrush community Shortgrasses: low cover Forbs ≈ 10% Big sagebrush: 5-15% cover

**Community 1.2
Post-Fire Community**

Rhizomatous wheatgrass – Mid-statured bunchgrass community Shortgrasses: low cover Forbs: ≈ 10% Big sagebrush: rare

**Community 1.3
Shrub/Increased Shortgrass Community**

Shortgrasses ≈ Mid-statured grasses Mid-statured grasses: decreasing Prairie sagewort: low-moderate cover Big sagebrush: 5-20%

Community 1.4

Increased Shortgrass Community

Shortgrasses≈ Mid-statured grasses Mid-statured grasses: decreasing Prairie sagewort: low-moderate cover Big sagebrush: rare

Pathway P1.1a

Community 1.1 to 1.2

Fire will transition the Shrubland Community (1.1) to the Post-Fire Community (1.2). Wyoming big sagebrush is killed and perennial grasses will dominate the site.

Pathway P1.1b

Community 1.1 to 1.3

Drought, improper grazing management, or a combination of these factors can shift the Shrubland Community (1.1) to the Shrub/Increased Shortgrass Community (1.3). These factors favor an increase in blue grama and a decrease in cool-season midgrasses (Coupland, 1961; Shay et al., 2001). Wyoming big sagebrush cover will be similar to the Shrubland Community Phase (1.1).

Pathway P1.2a

Community 1.2 to 1.1

Thirty years or more of natural vegetative regrowth will transition the Post-Fire Community (1.2) to the Shrubland Community (1.1). Thirty years or more without fire permits Wyoming big sagebrush to recolonize the site.

Pathway P1.2b

Community 1.2 to 1.4

Drought, improper grazing management, multiple fires in close succession, or a combination of these factors can shift the Post-Fire Community (1.2) to the Increased Shortgrass Community (1.3). These factors favor an increase in blue grama and a decrease in cool-season midgrasses (Coupland, 1961; Shay et al., 2001). Wyoming big sagebrush cover will be similar to the Post-Fire Community Phase (1.2).

Pathway P1.3b

Community 1.3 to 1.1

30 years or more post-fire; normal or above-average precipitation and proper grazing management transitions the Shrub/Increased Shortgrass Community (1.3) to the Shrubland Community (1.1).

Pathway P1.3a

Community 1.3 to 1.4

Fire will transition the Shrub/Increased Shortgrass Community (1.3) to the Increased Shortgrass Community (1.4). Wyoming big sagebrush is killed and perennial grasses will dominate the site.

Pathway P1.4b

Community 1.4 to 1.2

Less than 30 years post-fire; normal or above-average precipitation and proper grazing management transitions the Increased Shortgrass Community (1.4) to the Post-Fire Community (1.2).

Pathway P1.4a

Community 1.4 to 1.3

Thirty years or more of natural shrub regrowth will transition the Increased Shortgrass Community (1.4) to the Shrub/Increased Shortgrass Community (1.3). Thirty years or more without fire permits Wyoming big sagebrush to recolonize the site.

State 2 Shortgrass State

Community 2.1 Shrub/Shortgrass Community

Short-statured grasses dominate community Mid-statured graminoids: rare or absent Prairie sagewort: common Big sagebrush: 5-15% cover

Community 2.2 Shortgrass Community

Short-statured grasses dominate community Mid-statured graminoids: rare or absent Prairie sagewort: common Big sagebrush: rare

Pathway P2.1a Community 2.1 to 2.2

Pathway P2.2a Community 2.2 to 2.1

State 3 Invaded State

Community 3.1 Invaded Community

Encroachment by introduced grasses, noxious weeds, and other invasive species is common. Rangeland health attributes have departed substantially from Reference State (1).

State 4 Cropland State

Annual, cool-season cereal grains such as spring wheat, winter wheat, and barley are the most common crops.

Community 4.1 Cropland Community

Annual, cool-season cereal grains such as spring wheat, winter wheat, and barley are the most common crops.

State 5 Post-Cropland State

Community 5.1 Abandoned Cropland Community

Cropland is abandoned and allowed to revert back to perennial grassland naturally. Short-statured grasses and annual forbs are the primary native species. Nonnative species are common.

Community 5.2

Perennial Grass Community

Annual cropping ceases and site is seeded back to perennial species for grazing and/or wildlife. Seeding may be comprised of introduced grasses/legumes or native grass/forb species.

Transition T1A

State 1 to 2

Prolonged drought, improper grazing practices, or a combination of these factors weaken the resilience of the Reference State (1) and drive its transition to the Shortgrass State (2). The Reference State (1) transitions to the Shortgrass State (2) when mid-statured graminoids become rare and contribute little to production. Shortgrasses such as blue grama, Sandberg bluegrass, and prairie Junegrass dominate the plant community.

Transition T1B

State 1 to 3

The Reference State (1) transitions to the Invaded State (3) when non-native grasses or noxious weeds invade the Shortgrass State (2). Site resilience has been substantially reduced. In addition, other rangeland health attributes, such as reproductive capacity of native grasses (Henderson and Naeth, 2005) and soil quality (Smoliak and Dormaar, 1985; Dormaar et al., 1995), have been substantially altered from the Reference State (1).

Transition T1C

State 1 to 4

Tillage or application of herbicide followed by seeding of cultivated crops, such as winter wheat, spring wheat, and barley, transitions the Reference State (1) to the Cropland State (4).

Restoration pathway R2A

State 2 to 1

Blue grama can resist displacement by other species (Dormaar and Willms, 1990; Laycock, 1991; Dormaar et al., 1994; Lacey et al., 1995). A reduction in livestock grazing pressure alone may not be sufficient to reduce the cover of blue grama in the Shortgrass State (3) (Dormaar and Willms, 1990) and mechanical treatments may be necessary (Hart et al., 1985). Therefore, returning the Shortgrass State (2) to the Reference State (1) can require considerable cost, energy, and time.

Transition T2A

State 2 to 3

The Shortgrass State (2) transitions to the Invaded State (3) when non-native grasses, noxious weeds, and other invasive plants invade the Shortgrass State (2). Exotic plant species dominate the site in terms of cover and production. Site resilience has been substantially reduced.

Transition T2B

State 2 to 4

Tillage or application of herbicide followed by seeding of cultivated crops, such as winter wheat, spring wheat, and barley, transitions the Shortgrass State (2) to the Cropland State (4).

Transition T3A

State 3 to 4

The Invaded State (3) will transition to the Cropland State (4) when the site is placed under cultivation.

Transition T4A

State 4 to 5

The transition from the Cropland State (4) to the Post-Cropland State (5) 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 T5A State 5 to 4

Tillage or application of herbicide followed by seeding of cultivated crops, such as winter wheat, spring wheat, and barley, transitions the Post-Cropland State (5) to the Cropland State (4).

Additional community tables

Animal community

Livestock Grazing Interpretations:

Managed livestock grazing is suitable on this site as it has the potential to produce a high amount of high quality forage. This is often a preferred site for grazing by livestock, and animals tend to congregate in these areas. In order to maintain the productivity of this site, stocking rates must be managed carefully on adjoining sites with less production to be sure livestock drift onto the Silty site is not excessive. Management objectives should include maintenance or improvement of the plant community. Shorter grazing periods and adequate re-growth after grazing are recommended for plant maintenance and recovery. Heavy stocking and season-long use of this site can be detrimental and will alter the plant community composition and production over time.

Whenever Plant Communities 2a or 2b (medium and short grasses) occur, grazing management strategies need to be implemented to avoid further deterioration. These communities are still stable, productive, and healthy provided they receive proper management. These communities will respond fairly quickly to improved grazing management, including increased growing season rest of key forage plants. Grazing management alone can usually move these communities back towards the potential community.

Plant Communities 3 and 4 have substantially reduced forage production, and a high percentage of aggressive, non-palatable species. Once these plant communities become established, it will be much more difficult to restore the site to a community that resembles the potential with grazing management alone. Additional growing season rest is often necessary for re-establishment of the desired species and to restore the stability and health of the site. Brush management and/or mechanical treatment are often needed to restore tall perennial grasses onto this site.

Plant Community 5 has extremely limited forage production (< 300 pounds per acre), and a high percentage of non-preferred species for cattle and sheep. Seeding may be necessary to restore desirable native perennial species.

Wildlife Interpretations:

The following is a description of habitat values for the different plant communities that may occupy the site:

Plant Community 1: Tall & Medium Grasses/ Forbs/ Shrubs (HCPC):

The predominance of grasses plus a diversity of forbs, shrubs and half-shrubs in this community favors grazers and mixed feeders such as bison, pronghorn and elk. Suitable thermal and escape cover for mule deer is limited because of low shrub cover. Large animal nutrition levels are relatively high year-long because of the diversity of plant life forms and seasonality. When this plant community is adjacent to large blocks of sagebrush-grassland, it can provide quality sage grouse lek sites and brood habitat. Complex plant structural diversity and litter cover provide habitat for a wide array of small mammals (both seed-eaters, i.e., deer mice and herbivores, i.e., voles and jackrabbits) and neotropical migratory birds. Diverse prey populations are available for raptors such as golden eagle, redtail, ferruginous and Swainson's hawks. The diversity of grass stature and life forms, along with scattered shrubs and a variety of forbs, provides habitat for many bird species including the upland sandpiper, sharp-tailed grouse, loggerhead shrike, Baird's/grasshopper/savanna sparrow, chestnut-collared longspur and western meadowlark. This community is especially favorable for ground-nesting birds because of the abundant residual plant material and litter available for nesting, escape and thermal cover.

Plant Community 2a: Medium and Short Grasses/ Half-shrubs:

The partial loss of structural diversity makes this plant community somewhat less attractive to the variety of wildlife species using the HPCP. A decrease in residual plant material and litter cover is usually associated with degradation of the HPCP, which makes this community less attractive for ground-nesting birds. Pronghorn make considerable use of this type because of forb and half-shrub availability in the generally open landscape.

Plant Community 2b: Medium and Short Grasses/ Shrubs:

Wyoming big sagebrush, with canopy cover of 15-30 percent, and an understory of grasses and forbs, is excellent nesting, winter, brood-rearing and foraging habitat for sage grouse. Other obligate sagebrush-grassland species, notably Brewer's sparrow, also benefit from an increase in sagebrush cover. When residual grass and litter cover decrease in this community, ground nesting bird habitat values decline. This community often provides important winter range for mule deer and pronghorn. The sagebrush crowns break up hard crusted snow and provide about 15% protein and 40-60% digestibility for ungulates.

Plant Community 3: Medium and Short Grasses/ Shrubs and Half-shrubs:

Heavy stands of big sagebrush can provide winter cover and foraging habitat for mule deer, elk, pronghorn and sage grouse. However, a decline in herbaceous cover and litter reduces overall wildlife species diversity and habitat value for ground-nesting birds. When this seral stage is dominated by forbs and fringed sagewort, it may provide lek sites for sage grouse and habitat for birds such as horned larks, McCown's longspurs, mountain plovers and long-billed curlews. Prairie dogs will have an easier time establishing and expanding towns in this community to the benefit of burrowing owls, mountain plovers and black-footed ferrets.

Plant Community 4: Short and Medium Grasses/ Half-shrubs/ Annuals:

Sparse vegetation and greater amounts of bare ground provide suitable habitat for mountain plovers, prairie dogs, horned larks and McCown's longspurs. However, a lack of complex vegetation structure and residual cover makes this community poor habitat in general for most ground-nesting birds and relatively poor big game habitat. Pronghorn may forage in this community spring through fall.

Plant Community 5: Short Grasses/ Shrubs & Half-shrubs/ Annuals/ Cacti:

This community has low habitat value for most wildlife species except when it occurs in prairie dog towns. It may be important in providing lek sites for sage grouse when adjacent to sagebrush stands and provides forage for pronghorn seasonally. Pronghorn forage on fringed sagewort and forbs.

Prairie dog towns are significant sources of biodiversity and provide a source of palatable, high protein forage for ungulates during part of the year. Black-footed ferrets, an endangered species, and burrowing owls are dependent on the subterranean habitat provided by prairie dog burrow systems. Mountain plovers often nest and raise broods in prairie dog towns. Golden eagles and ferruginous hawks commonly hunt in these areas. Researchers have found that bird species diversity and rodent abundance are greater on prairie dog towns than on adjacent mixed prairie.

Hydrological functions

The soils associated with this ecological site are generally in Hydrologic Soil Group B. The infiltration rates for these soils will normally be moderate. The runoff potential for this site is moderate, depending on slope and ground cover/health. Runoff curve numbers generally range from 64 to 82.

Good hydrologic conditions exist on rangelands if plant cover (grass, litter, and brush canopy) is greater than 70%. Fair conditions exist when cover is between 30% and 70%, and poor conditions exist when cover is less than 30%. Sites in high similarity to HPCP (Plant Communities 1 and 2) generally have enough plant cover and litter to optimize infiltration, minimize runoff and erosion, and have a good hydrologic condition. The deep root systems of the potential vegetation help maintain or increase infiltration rates and reduce runoff.

Sites in low similarity (Plant Communities 3, 4 and 5) are generally considered to be in poor hydrologic condition as a majority of the plant cover is from shallow-rooted species such as blue grama and annual grasses.

Erosion is minor for sites in high similarity. Rills and gullies should not be present. Water flow patterns, if present, will be barely observable. Plant pedestals are essentially non-existent. Plant litter remains in place and is not moved by erosion. Soil surfaces should not be compacted or crusted. Plant cover and litter helps retain soil moisture for use by the plants. Maintaining a healthy stand of perennial vegetation will optimize the amount of precipitation that is received. (Reference: Engineering Field Manual, Chapter 2 and Montana Supplement 4).

Recreational uses

This site provides recreational opportunities for big game and upland bird hunting, and hiking. The forbs have flowers that appeal to photographers. This site provides valuable open space and visual aesthetics.

Other information

The following is an example of how to calculate the recommended stocking rate. This example does not use production estimates from this specific ecological site. You will need to adjust the annual production values and run the calculations using total annual production values from the ecological sites encountered on each individual ranch/pasture. Before making specific recommendations, an on-site evaluation must be made.

Example of total annual production amounts by type of year:

Favorable years = 2200 lbs/acre

Normal years = 1480 lbs/acre

Unfavorable years = 1200 lbs/acre

It is recommended that on slopes of 30% or less, stocking rate should be derived from the total annual production pounds minus 500 pounds for residual dry matter and 25% harvest efficiency. On slopes over 30%, stocking rate is derived from total annual production pounds minus 800 pounds for residual dry matter and 25% harvest efficiency. Refer to the NRCS National Range and Pasture Handbook for a list of Animal Unit Equivalents.

Sample Calculations using Favorable Year production amounts:

< 30% slopes: $AUM/AC = [(2200-500)(0.25)]/915 \text{ lbs/month for one AU} = 0.46 \text{ AUM/AC}$
 $AC/AUM = (1.0 \text{ AU})/(0.46 \text{ AUM/AC}) = 2.2 \text{ AC/AUM}$

> 30% slopes: $AUM/AC = [(2200-800)(0.25)]/915 \text{ lbs/month for one AU} = 0.38 \text{ AUM/AC}$
 $AC/AUM = (1.0 \text{ AU})/(0.38 \text{ AUM/AC}) = 2.6 \text{ AC/AUM}$

NOTE: 915 lbs/month for one Animal Unit is used as the baseline for maintenance requirements. This equates to 30 lbs/day of air-dry forage (1200 lb cow at 2.5% of body weight).

Inventory data references

NRCS-Production & Composition Record for Native Grazing Lands (Range-417): 42

BLM-Soil & Vegetation Inventory Method (SVIM) Data: 25

NRCS-Range Condition Record (ECS-2): 55

NRCS-Range/Soil Correlation Observations & Soil 232 notes: 180

Contributors

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Approval

Kirt Walstad, 6/14/2023

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.

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Date	06/11/2014
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None.

2. **Presence of water flow patterns:** None.

3. **Number and height of erosional pedestals or terracettes:** None.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is < 20%. Bare ground will occur as small areas less than 2 inches in diameter.

5. **Number of gullies and erosion associated with gullies:** Active gullies should not be present. Existing gullies should be "healed" with a good vegetative cover.

6. **Extent of wind scoured, blowouts and/or depositional areas:** None.

7. **Amount of litter movement (describe size and distance expected to travel):** Little to no plant litter movement. Plant litter remains in place and is not moved by erosional forces.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Surface Soil Aggregate Stability under plant canopy should typically be 5 or greater. Surface Soil Aggregate

Stability not under plant canopy should typically be 5 or slightly less.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Use soil survey series description.
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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** High grass canopy and basal cover and small gaps between plants should reduce raindrop impact and slow overland flow, providing increased time for infiltration to occur. A combination of shallow and deep rooted species has a positive effect on infiltration.
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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):** No compaction layer or soil surface crusting should be evident.
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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: Cool season, mid-stature, bunch grasses

Sub-dominant: Cool Season, mid-stature Rhizomatous grasses >> Warm season, mid-stature, bunch grasses = forbs > Cool season, short stature bunch grasses and sedges

Other: Minor components: Shrubs = Short - stature warm season rhizomatous grasses, warm season tall-stature rhizomatous grasses, warm season mid-stature rhizomatous grasses, cool season, short-stature rhizomatous sedges

Additional: (Blue grama should be grouped with warm season, short-stature, rhizomatous grasses due to its growth form)

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very low.
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14. **Average percent litter cover (%) and depth (in):** Litter cover is in contact with soil surface
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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 1800 to 2200 #/acre (13 to 14 inch precip. Zone) 1050 to 1400 #/ac (10 to 12 inch precip. Zone).
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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:** Sulphur cinquefoil, common tansy, oxeye daisy, Leafy spurge, knapweeds, whitetop, Dalmatian toadflax, yellow toadflax, St. Johnswort, perennial pepperweed. Kentucky bluegrass and smooth brome can be invasive on the eastern boarder of Montana for these MLRAs.

17. **Perennial plant reproductive capability:** All species are capable of reproducing.
