USDA Natural Resources
Conservation Service

Ecological site R058AE013MT
Claypan (Cp) RRU 58A-E 10-14" p.z.

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.

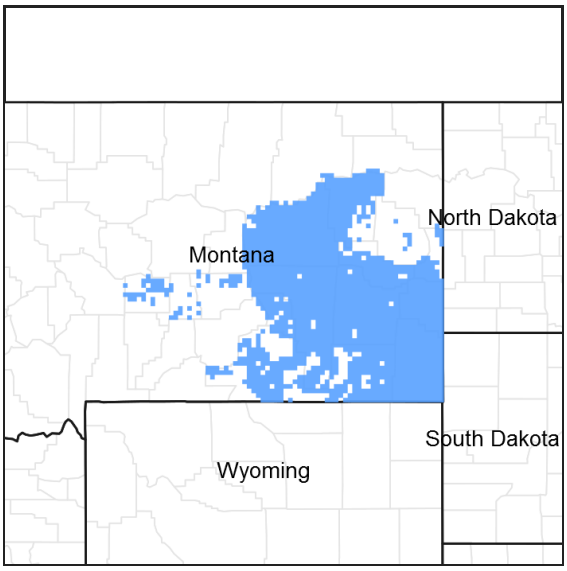


Figure 1. Mapped extent

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.

Associated sites

R058AY001MT	**Loamy (Lo) 10-14 P.Z.**
R058AE002MT	**Clayey (Cy) RRU 58A-E 10-14" p.z.**
R058AE011MT	**Saline Upland (SU) RRU 58A-E 10-14" p.z.**
R058AE014MT	**Dense Clay (DC) RRU 58A-E 10-14" p.z.**

Similar sites

R058AE011MT	**Saline Upland (SU) RRU 58A-E 10-14" p.z.** The Saline Upland site differs by being affected by soluble salts (i.e., electroconductivity will be higher), resulting in a plant community having mainly salt tolerant plants.
R058AE014MT	**Dense Clay (DC) RRU 58A-E 10-14" p.z.** The Dense Clay site has nongranular heavy clays that have a very thin surface layer.
R058AE015MT	**Shale (Sh) RRU 58A-E 10-14" p.z.** The Shale site soils are usually shallow with very little soil development evident. This site is extremely sparse and low producing.

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 uplands, terraces, and fans. Slopes range from 0 to 15 percent, but generally are less than 8 percent. This site occurs on all exposures and aspect is not significant.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Terrace (3) Plain
Flooding frequency	None
Ponding frequency	None
Elevation	1,900–3,500 ft
Slope	0–15%
Water table depth	60 in
Aspect	Aspect is not a significant factor

Climatic features

MLRAs 58A and 60B are considered to have a continental climate characterized by cold winters, hot summers, low humidity, light rainfall, and much sunshine. Extremes in temperature are typical. The climate is the result of this MLRA's location in the geographic center of North America. 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. 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.
Temperatures can be very extreme in this part of Montana. Summer daytime temperatures are typically quite warm, generally averaging in the mid to upper 80º's F for July and August. Summertime temperatures will typically reach in the 100º's F at some point during the summer, and can reach 90º F any month between May and September. Conversely, winter temperatures can be cold, averaging in the mid teens to mid 20º's F for December and January. There will typically be several days of below zero temperatures each winter. It is not uncommon for temperatures to reach 30–40º F below zero, or even colder, most any winter.

Spring can be windy throughout these MLRA's, with winds averaging over 10 mph about 15 percent of the time. Speeds of 50 mph or stronger can occasionally occur as a weather system crosses this part of Montana.

MLRAs 58AE and 60BE have been divided into two distinct precipitation zones for the purpose of developing ecological site descriptions: 10–14" Mean Annual Precipitation (MAP) and 15–19" MAP.

10–14 inch zone:

The majority of the rangeland in these areas falls within the 11 to 13 inch range. During an average year, 70 to 75 percent of the annual precipitation falls between April and September, which are the primary growing season months.

Snowfall is not heavy in the area, averaging 28 total inches in the 10-14 inch MAP (Yellowstone Valley). Heavy snowfall occurs infrequently, usually late in the winter or early spring. Snow cover is typically 1 to 3 inches.

The frost free (32º F.) season averages about 105 to 145 days each year in the uplands, to nearly 170 days along

the Yellowstone River Valley.
For local climate station information, refer to http://www.wcc.nrcs.usda.gov/cgibin/state.pl?state=mt.

Table 3. Representative climatic features

Frost-free period (average)	145 days
Freeze-free period (average)	170 days
Precipitation total (average)	14 in

Influencing water features

Soil features

These soils are over 20 inches deep and have a surface texture that can vary from fine sandy loam to clay loam. Within 2 to 8 inches of the surface is a hard to extremely hard clayey (argillic) horizon having strong columnar or strong prismatic structure. Salt and lime (Calcium carbonate) accumulations are often evident in the lower part of the B horizon. Root penetration and water movement is restricted in the argillic horizon, with the roots becoming flattened and tending to follow cracking in the subsoil.

Table 4. Representative soil features

Surface texture	(1) Clay loam (2) Loam (3) Silty clay loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Slow to very slow
Soil depth	20–60 in
Available water capacity (0-40in)	5–10 in
Calcium carbonate equivalent (0-40in)	5–10%
Electrical conductivity (0-40in)	2–8 mmhos/cm
Sodium adsorption ratio (0-40in)	8–20
Soil reaction (1:1 water) (0-40in)	7.4–9

Ecological dynamics

This site developed under Northern Great Plains climatic conditions, which included the natural influence of large herbivores and occasional fire. The plant community upon which interpretations are primarily based is the Historic Climax Plant Community (HCPC). This community is given as a reference to understand the original potential of this site, and is not always considered to be the management goal for every acre of rangeland. The following descriptions should enable the landowner or manager to better understand which plant communities occupy their land, and assist with setting goals for vegetation management. It can also be useful to understand the environmental and economic values of each plant community.

This site has moderate to low resilience to disturbance as it has severe soil limitations for plant growth nd a high percentage of bare ground. Changes may occur to the Historic Climax Plant Community due to management actions and/or climatic conditions. Under continued adverse impacts, a moderate decline in vegetative vigor and composition will occur. Under favorable vegetative management treatments, this site can more readily return to one

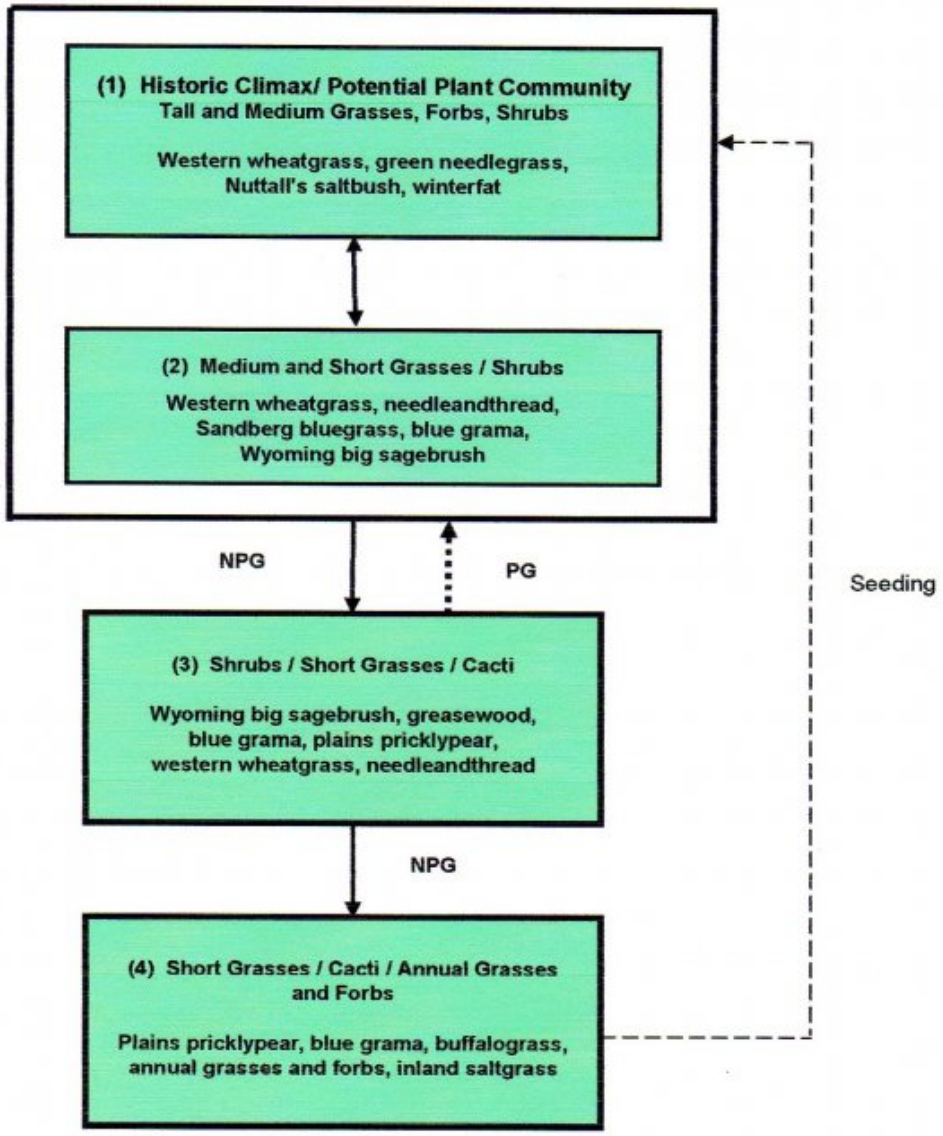
resembling the Historic Climax Plant Community.
Disturbances to this site will result in the decrease of the more palatable species such as western wheatgrass, green needlegrass, Nuttall's saltbush, and winterfat. These plants will be replaced by needleandthread, Sandberg bluegrass, blue grama, and Wyoming big sagebrush. Continued deterioration results in a plant community including, greasewood/sagebrush, blue grama, and plains pricklypear. Greasewood and inland saltgrass can become more dominant when this site is in MLRA 60B.

Plants that are not a part of the climax community that are most likely to invade are annual bromes and forbs.

State and transition model

MLRA: 58A – Sedimentary Plains, East
MLRA: 60B – Pierre Shale Plains, East
R058AE013MT, R060BE565MT

Plant Communities and Transitional Pathways (diagram)



Smaller boxes within a larger box indicate that these communities will normally shift among themselves with slight variations in precipitation and other disturbances. Moving outside the larger box indicates the community has crossed a threshold (heavier line) and will require intensive treatment to return to Community 1 or 2. Dotted lines indicate a reduced probability for success.

NOTE: Not all species present in the community are listed in this table. Species listed are representative of the plant functional groups that occur in the community.

PG = Prescribed Grazing: Use of a planned grazing strategy to balance animal forage demand with available forage resources. Timing, duration, and frequency of grazing are controlled and some type of grazing rotation is applied to allow for plant recovery following grazing.

NPG = Non-Prescribed Grazing: Grazing which has taken place that does not control the factors as listed above, or animal forage demand is higher than the available forage supply.

State 1
Plant Community 1: Tall and Medium Grasses/ Forbs/ Shrubs

Community 1.1
Plant Community 1: Tall and Medium Grasses/ Forbs/ Shrubs

This is the interpretive plant community and is considered to be the Historic Climax Plant Community (HCPC) for this site. This plant community contains a variety of medium cool season grasses (western wheatgrass, green needlegrass), and shrubs that include Nuttall's saltbush, winterfat, silver sagebrush, and Wyoming big sagebrush. This plant community is well adapted to the Northern Great Plains climatic conditions. The diversity in plant species and the presence of deep-rooted perennial grasses allows for moderately high drought tolerance, considering the limited available water holding capacity of the site. Individual species can vary greatly in production depending on growing conditions (timing and amount of precipitation and temperature). Plants on this site have strong, healthy root systems. A moderate amount of plant litter is available for soil building and moisture retention. Plant litter is properly distributed with very little movement off-site and natural plant mortality is very low. This plant community provides for soil stability and a functioning hydrologic cycle.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	400	720	880
Shrub/Vine	75	135	165
Forb	25	45	55
Total	**500**	**900**	**1100**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	2-10%
Grass/grasslike foliar cover	30-50%
Forb foliar cover	5-10%
Non-vascular plants	0%
Biological crusts	0-1%
Litter	0%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

Table 7. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	1-5%
Grass/grasslike basal cover	5-10%
Forb basal cover	1-5%
Non-vascular plants	0%
Biological crusts	1-2%
Litter	5-10%
Surface fragments >0.25" and <=3"	0-4%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	40-60%

Table 8. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	–	–
>0.5 <= 1	–	–	–	–
>1 <= 2	–	2-10%	30-50%	5-10%
>2 <= 4.5	–	–	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

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

Community 2.1
Plant Community 2: Medium Shrubs / Medium and Short Grasses

This community occurs with disturbances to the historical climax plant community but generally having less diversity of shrubs. Wyoming big sagebrush often becomes the dominant shrub. Other species that tend to dominate include western wheatgrass, needleandthread, Sandberg bluegrass, and blue grama. Grass biomass production and litter become reduced on the site as the taller grasses disappear, increasing evaporation and reducing moisture retention. Additional open space in the community can result in undesirable invader species. This plant community provides for moderate soil stability.

State 3
Plant Community 3: Shrubs/ Short Grasses/ Cacti

Community 3.1
Plant Community 3: Shrubs/ Short Grasses/ Cacti

Continued degradation in the plant community usually results in a community dominated by species such as Wyoming big sagebrush, greasewood, blue grama, and plains pricklypear. There may still be remnant amounts of species such as western wheat grass and needleandthread. This community tends to have a higher salt content and an increase in bareground (often as "pans").

State 4
Plant Community 4: Short Grasses/ Cacti/ Annual Grasses and Forbs

Community 4.1
Plant Community 4: Short Grasses/ Cacti/ Annual Grasses and Forbs

Continued degradation in the plant community usually results in a community dominated by plains pricklypear, blue grama/ buffalograss sod, annual bromes and forbs, and inland saltgrass. This community may be associated with prairie dog towns. Plant communities 3 and 4 are less productive than Plant Communities 1 or 2. The lack of litter and short plant heights result in higher soil temperatures, poor water infiltration rates, and high evaporation, which gives short grasses, shrubs, and annuals a competitive advantage over the tall and medium grasses. This community has lost many of the attributes of a healthy rangeland, including good infiltration, minimal erosion and runoff, nutrient cycling and energy flow.

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Native grasses**			395–715	
	tufted wheatgrass	ELMA7	*Elymus macrourus*	100–385	–
	western wheatgrass	PASM	*Pascopyrum smithii*	100–385	–
	green needlegrass	NAVI4	*Nassella viridula*	50–220	–
	Montana wheatgrass	ELAL7	*Elymus albicans*	25–110	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	25–110	–
	alkali sacaton	SPAI	*Sporobolus airoides*	25–110	–
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	0–55	–
2	**Native grasses and sedges**			5–165	
	Grass, perennial	2GP	*Grass, perennial*	5–55	–
	blue grama	BOGR2	*Bouteloua gracilis*	5–55	–
	needleleaf sedge	CADU6	*Carex duriuscula*	5–55	–
	threadleaf sedge	CAFI	*Carex filifolia*	5–55	–
	plains reedgrass	CAMO	*Calamagrostis montanensis*	5–55	–
	saltgrass	DISP	*Distichlis spicata*	5–55	–
	squirreltail	ELEL5	*Elymus elymoides*	5–55	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	5–55	–
	Sandberg bluegrass	POSE	*Poa secunda*	5–55	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	5–55	–
3	**Native grasses**			1–2	
	purple threeawn	ARPUP6	*Aristida purpurea var. purpurea*	1–2	–
	tumblegrass	SCPA	*Schedonnardus paniculatus*	1–2	–
Forb					
4	**Native forbs**			25–55	
	Forb, perennial	2FP	*Forb, perennial*	5–55	–
	onion	ALLIU	*Allium*	5–55	–
	milkvetch	ASTRA	*Astragalus*	5–55	–
	white prairie clover	DACA7	*Dalea candida*	5–55	–
	purple prairie clover	DAPU5	*Dalea purpurea*	5–55	–
	buckwheat	ERIOG	*Eriogonum*	5–55	–
	spiny phlox	PHHO	*Phlox hoodii*	5–55	–
	scurfpea	PSORA2	*Psoralidium*	5–55	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	5–55	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	5–55	–
	American vetch	VIAM	*Vicia americana*	5–55	–
Shrub/Vine					
5	**Native shrubs and half-shrubs**			10–110	
	Nuttall's saltbush	ATNU2	*Atriplex nuttallii*	5–55	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	5–55	–
6	**Native shrubs and half-shrubs**			5–165	

6	**Native shrubs and half-shrubs**			5–165	
	Shrub, broadleaf	2SB	*Shrub, broadleaf*	5–110	–
	silver sagebrush	ARCA13	*Artemisia cana*	5–110	–
	prairie sagewort	ARFR4	*Artemisia frigida*	5–110	–
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	5–110	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	5–110	–
7	**Native shrubs and half-shrubs**			1–2	
	plains pricklypear	OPPO	*Opuntia polyacantha*	1–2	–

Animal community

Livestock Grazing Interpretations:

Managed livestock grazing is suitable on this site as it has the potential to produce a moderate amount of high quality forage. 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 Community 2 occurs (medium and short grasses), grazing management strategies need to be implemented to avoid further deterioration. This community is still stable, productive, and healthy provided it receives proper management. This community will respond fairly quickly to improved grazing management including increased growing season rest of key forage plants. Grazing management alone can usually move this community back to one more similar to potential if a good seed source of the taller grasses still exists.

Once this site is occupied by Plant Community 3 or 4, it will be more difficult to restore it to a community that resembles the potential with grazing management alone. Additional growing season rest and accelerated practices (e.g. range seeding, chiseling) are often necessary for re-establishment of the desired species and to restore the stability and health of the site. The response to these treatments is limited by the presence of sodium.

Wildlife Interpretations:

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

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

The prevalence of Nuttall's saltbush, winterfat and Wyoming big sagebrush favors mixed feeders like the pronghorn. Nutritious early to mid-season forage is also available for grass feeders, including bison and elk. Sage grouse may use this open habitat for lek sites and feeding on sagebrush. Small mammal species composition will be dominated by seed-eaters, particularly deer mice. Brewer’s sparrows and mountain plovers are examples of breeding bird species potentially using this community spring-fall. Relatively low amounts of litter and residual grass cover limit use by a number of ground-nesting bird species.

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

The reduction in decreaser grasses, saltbush and winterfat reduces habitat value for pronghorn and other ungulates, as well as seed-eating small mammals. An increase in big sagebrush cover may improve winter and nesting habitat for sage grouse and spring-fall habitat for Brewer’s sparrows and sage thrashers, but the decrease in litter and residual grass cover generally reduces nesting habitat quality for ground-nesting birds.

Plant Community 3: Shrubs/ Short Grasses/ Cacti:

Sagebrush specialists, including pronghorn, sage grouse and Brewer’s sparrow may use this community seasonally; pronghorn during winter, sage grouse during winter and the nesting season, and Brewer’s sparrow spring through fall migration. Seed-eating small mammals, especially deer mice, may thrive on annual forb seed

production. The community has relatively low value for most wildlife species considering the lack of vegetative structural diversity, residual grass
carry-over and litter cover.

Plant Community 4: Short Grasses/ Cacti / Annual Grasses and Forbs:

Wildlife habitat values are very limited in this community with the loss of plant species and structural diversity. Deer mice may make use of seed production from annual grasses and forbs.

Hydrological functions

The runoff potential for this site is very high depending on slope and ground cover/health. Runoff curve numbers generally range from 84 to 93. The soils associated with this ecological site are generally in Hydrologic Soil Group D. The infiltration rates for these soils will normally be very slow.

Good hydrologic conditions exist on rangelands if plant cover 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 HCPC (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 and 4) are generally considered to be in poor hydrologic condition as the majority of plant cover is from shallow-rooted species such as blue grama, annual grasses, and cacti.
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 some recreational opportunities for hiking, horseback riding, big game and upland bird hunting. The forbs have flowers that appeal to photographers. This site provides valuable open space and visual aesthetics. Caution should be used during wet weather periods.

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 lbs/month for one AU = 0.46 AUM/AC

AC/AUM = (1.0 AU)/(0.46AUM/AC) = 2.2 AC/AUM

> 30% slopes: AUM/AC = [(2200-800)(0.25)]/915 lbs/month for one AU = 0.38 AUM/AC
AC/AUM = (1.0 AU)/(0.38 AUM/AC) = 2.6 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): 3

BLM-Soil & Vegetation Inventory Method (SVIM) Data: 6

NRCS-Range Condition Record (ECS-2): 15

NRCS-Range/Soil Correlation Observations & Soil 232 notes: 38

Contributors

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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)	T. DeCock; R Kilian
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Date	06/11/2014
Approved by	Jon Siddoway
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills should not be present.

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2. **Presence of water flow patterns:** Barely observable.

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3. **Number and height of erosional pedestals or terracettes:** Essentially non-existent.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is < 40%. 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.

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.

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. Do not mistake the natural occurring clay pan (abrupt horizon change to columnar or prismatic structure) in the soil profile for a compaction layer.

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 rhizomatous grasses = Cool season, mid-stature, bunch grasses

    Sub-dominant: Warm season, mid-stature, bunch grasses > shrubs and half shrubs = Cool season, short-stature, bunch grasses and sedges

    Other: Minor components: Cool season, short – stature, rhizomatous grasses and sedges = Warm season, short-stature, bunch grasses = Warm season, short-stature, rhizomatous grasses and sedges = Warm season, mid-stature, rhizomatous grasses = forbs

    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):** 1000 to 1100 #/acre (13 to 14 inch precip. Zone) 500 to 900 #/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:** Halogeton, 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.

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

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