

Ecological site R058AC614MT
Coarse Clay (CC) RRU 58A-C 11-14" p.z.

Last updated: 6/14/2023
Accessed: 05/12/2025

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.

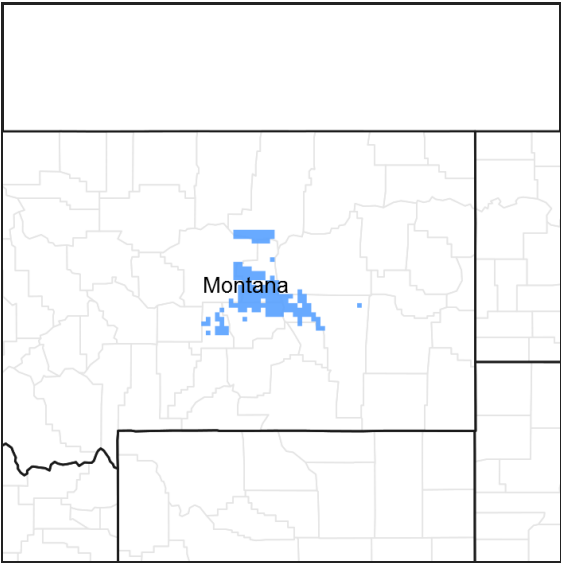


Figure 1. Mapped extent

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

R058AC041MT	Clayey (Cy) RRU 58A-C 11-14" p.z.
R058AC052MT	Shale (Sh) RRU 58A-C 11-14" p.z.
R058AC059MT	Shallow Clay (SwC) RRU 58A-C 11-14" p.z.

Similar sites

R058AC052MT	Shale (Sh) RRU 58A-C 11-14" p.z. The Shale site differs by being very sparse and low producing, and having a much different plant community.
R058AC059MT	Shallow Clay (SwC) RRU 58A-C 11-14" p.z. The Shallow Clay site differs by having a different plant community.
R058AC042MT	Sandy (Sy) RRU 58A-C 11-14" p.z. The Sandy site often has a somewhat similar plant community, but is much more productive, and occurs on sandy soils instead of shales.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Eriogonum microthecum</i> (2) <i>Artemisia longifolia</i>
Herbaceous	(1) <i>Calamovilfa longifolia</i> (2) <i>Pseudoroegneria spicata</i>

Physiographic features

This site is associated with hard, acidic shales that act like sand (dunes can occur). Outcroppings of the shales are common.

Table 2. Representative physiographic features

Landforms	(1) Plain (2) Hill
Flooding frequency	None
Ponding frequency	None
Elevation	686–1,372 m
Slope	0–8%
Ponding depth	0 cm
Water table depth	152 cm
Aspect	Aspect is not a significant factor

Climatic features

Major Land Resource Area (MLRA) 58AC in Montana is 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 80°s F for July and August. Summertime temperatures will typically reach in the 100°s F at some point during the summer, and can reach 90° F any month between May and September. Conversely, winter temperatures can be cold, averaging in the mid teens to mid 20°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 30–40° F below zero, or even colder, most any winter.

Spring can be windy throughout this MLRA, 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.

The majority of the rangeland in MLRA 58AC is within the 11 to 14 inch Mean Annual Precipitation (MAP) 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 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 (32° 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)	135 days
Freeze-free period (average)	155 days
Precipitation total (average)	356 mm

Influencing water features

Soil features

Silt clay loam, silty clay, or clay, to a depth of 40 inches. They are often dark colored due to the color of the shale parent material. There may be up to 60% shale fragments in the upper part of the soil. The characteristics of the shales cause these soils to respond similar to Sands, and have a similar plant community composition. However, they are significantly less productive.

Available water holding capacity to 40 inches is less than 4 inches. Reaction (pH) (1:1 water): extremely acid to slightly acid (3.5 –6.5) mainly because of sodium sulfate.

Table 4. Representative soil features

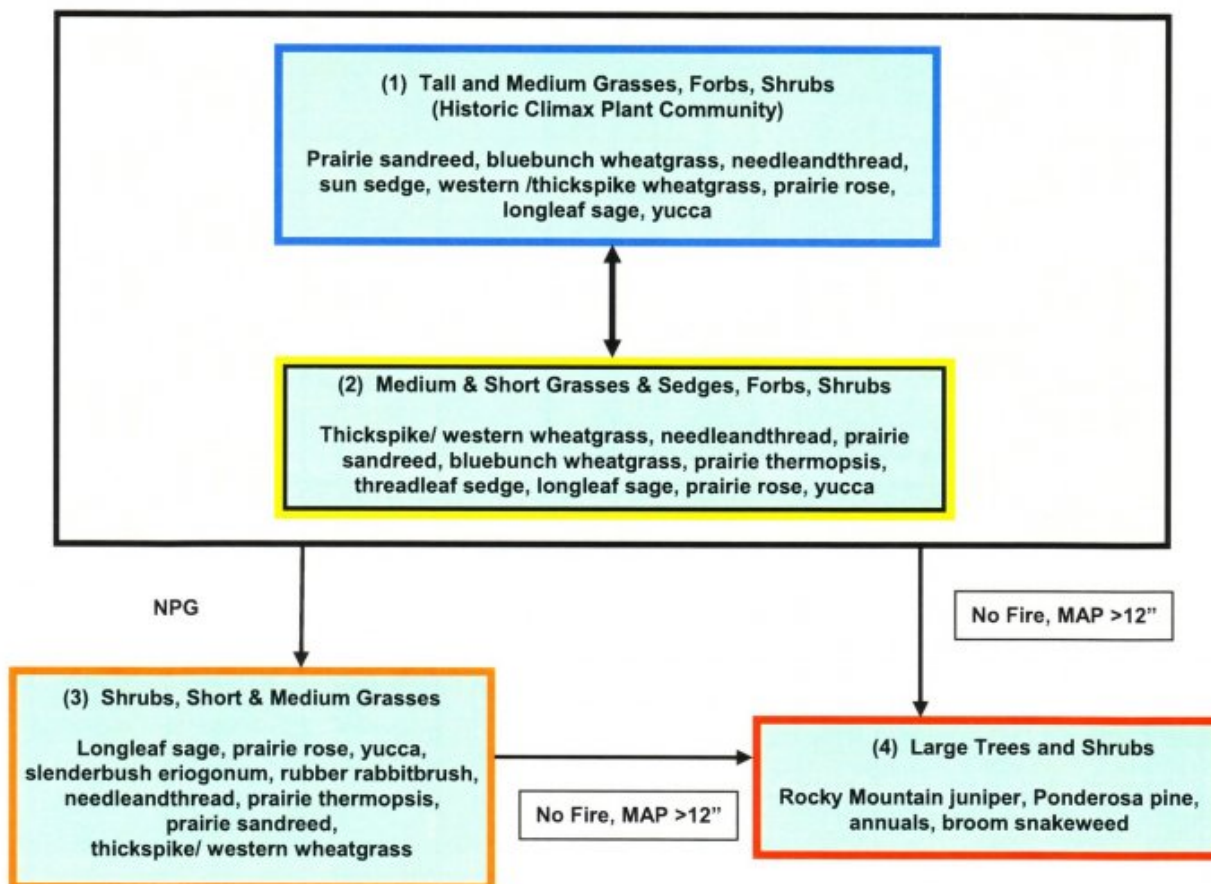
Surface texture	(1) Silty clay loam (2) Silty clay (3) Clay
Soil depth	51–102 cm
Surface fragment cover <=3"	0–5%
Available water capacity (0-101.6cm)	0–10.16 cm
Soil reaction (1:1 water) (0-101.6cm)	3.5–6.5

Ecological dynamics

The following are descriptions of several plant communities that may occupy this site:

State and transition model

5c. 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. Yellow boxes indicate caution that the community may be in danger of crossing a threshold. Orange boxes represent communities that have crossed over thresholds from the HCPC and may be difficult to restore with grazing management alone. Red boxes represent communities that have severely shifted away from the HCPC and probably cannot be restored without mechanical inputs.

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.

Fire: Prescribed fire or non-prescribed wildfire.

Matted: >50% cover

State 1

Tall and Medium Grasses/ Forbs/ Shrubs (HCPC)

Community 1.1

Tall and Medium Grasses/ Forbs/ Shrubs (HCPC)

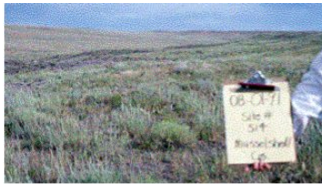


Figure 2. 58AC Coarse Clay 11-14" MAP Plant Community 1

The physical aspect of this site is that of sparse grassland or savannah dominated by warm-season grasses with scattered Ponderosa pine, and/or Rocky Mountain juniper in some locations. Approximately 70–80% of the annual production is from grasses and sedges, 5–10% from forbs, and 15–20% is from shrubs and half-shrubs. This plant community is dominated by species that also commonly occur on a sandy site. Warm season grasses (prairie sandreed) are a major component. Cool season species such as bluebunch wheatgrass, needleandthread, Indian ricegrass, sun sedge, and thickspike/western wheatgrass are the major sub-dominants. Few forbs occur in small amounts. A number of shrubs occur in small percentages, including longleaf sagebrush, prairie rose, yucca, rubber rabbitbrush, and Wyoming big sagebrush. This plant community is well adapted to the Northern Great Plains climatic conditions. The diversity in plant species and presence of tall, deep-rooted perennial grasses allows for drought tolerance. Plants on this site have strong, healthy root systems that allow production to increase significantly with favorable moisture conditions. Abundant 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 (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	409	538	717
Shrub/Vine	90	135	157
Forb	34	67	78
Total	533	740	952

Table 6. Ground cover

Tree foliar cover	0-10%
Shrub/vine/liana foliar cover	5-10%
Grass/grasslike foliar cover	30-50%
Forb foliar cover	1-5%
Non-vascular plants	0%
Biological crusts	0%
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	0-1%
Shrub/vine/liana basal cover	0-1%
Grass/grasslike basal cover	3-7%
Forb basal cover	1-2%
Non-vascular plants	0%
Biological crusts	0-1%
Litter	15-25%
Surface fragments >0.25" and <=3"	0-5%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	60-80%

Table 8. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	—	—	—	—
>0.15 <= 0.3	—	—	—	—
>0.3 <= 0.6	—	5-10%	30-50%	1-5%
>0.6 <= 1.4	—	—	—	—
>1.4 <= 4	—	—	—	—
>4 <= 12	0-10%	—	—	—
>12 <= 24	—	—	—	—
>24 <= 37	—	—	—	—
>37	—	—	—	—

State 2

Medium and Short Grasses and Sedges/ Shrubs and Half-shrubs

Community 2.1

Medium and Short Grasses and Sedges/ Shrubs and Half-shrubs

This community occurs due to minor climate shifts or slight variations in soils and/or topography or disturbance, including non-prescribed grazing. Dominants include medium and short grasses and sedges such as thickspike/western wheatgrass, needleandthread, prairie junegrass, and threadleaf sedge. Most of the taller and more palatable grasses (prairie sandreed, bluebunch wheatgrass, Indian ricegrass) will still be present but in smaller amounts. Shrubs and half-shrubs such as Wyoming big sagebrush, longleaf sage, slenderbush eriogonum, yucca, and Rocky Mountain juniper become more common. Palatable and nutritious forbs will begin to be replaced by less desirable and more aggressive species such as prairie thermopsis and green sagewort. Grass biomass production and litter become reduced on Community 2 as the taller grasses become less prevalent, increasing evaporation and reducing moisture retention. Additional open space in the community can result in undesirable invader species. These plant communities provide for moderate soil stability.

State 3

Shrubs, Short Grasses

Community 3.1

Shrubs, Short Grasses

This is a disturbance induced community, with dominants including shrubs, short grasses and sedges such as Rocky Mountain juniper, Wyoming big sagebrush, longleaf sage, yucca, slenderbush eriogonum, prairie rose, threadleaf sedge, perennial forbs, and prairie junegrass. Undesirable species such as red or Fendler's threeawn can become more abundant. There may still be remnant amounts of some of the late and mid-seral species such as prairie sandreed, bluebunch wheatgrass, thickspike/ western wheatgrass, Indian ricegrass, and needleandthread present, usually underneath the shrubs. Palatable forbs will be mostly absent. Broom snakeweed and plains pricklypear may begin to become common.

State 4

Trees and Large Shrubs

Community 4.1

Trees and Large Shrubs

In the absence of fire, probably coupled with continual adverse disturbances, this community can shift to one that is nearly all Rocky Mountain juniper and/or ponderosa pine. There is typically very little understory vegetation in this situation, primarily because of the droughty nature of the soils. The understory that is present is typically comprised of species such as broom snakeweed, annual grasses plus a few remnant species such as threadleaf sedge, needleandthread, thickspike/western wheatgrass, and prairie junegrass. (When the canopy cover of trees exceeds 10 percent, the forested guide "Ponderosa Pine Series, Dry Environment" should be used.) Plant Communities 3 and 4 are much less productive than Plant Communities 1 or 2, and have lost many of the attributes of a healthy rangeland. The loss of deep perennial root systems reduces total available moisture for plant growth. Reduction of plant litter will result in higher surface soil temperatures and increased evaporation losses. Annual species are often aggressive and competitive with seedlings of perennial plants. This community can respond positively to improved grazing management but it will take additional inputs to move it towards a community similar in production and composition to that of Plant Community 1 or 2. The landscape features often associated with this ecological site as well as the droughty nature of the soils severely limits the use of most common str

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	Native grasses and sedges			370–667	
	prairie sandreed	CALO	<i>Calamovilfa longifolia</i>	163–476	–
	sun sedge	CAINH2	<i>Carex inops ssp. heliophila</i>	50–140	–
	bluebunch wheatgrass	PSSP6	<i>Pseudoroegneria spicata</i>	50–140	–
	tufted wheatgrass	ELMA7	<i>Elymus macrourus</i>	28–95	–
	needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	0–95	–
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	28–95	–
	little bluestem	SCSCS	<i>Schizachyrium scoparium var. scoparium</i>	0–45	–
2	Native grasses and sedges			6–95	
	Grass, perennial	2GP	<i>Grass, perennial</i>	6–45	–
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	6–45	–
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	6–45	–
	plains reedgrass	CAMO	<i>Calamagrostis montanensis</i>	6–45	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	6–45	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	6–45	–
3	Native grasses			0–1	

	Fendler's threeawn	ARPUF	<i>Aristida purpurea</i> var. <i>fendleriana</i>	0–1	–
Forb					
4	Native forbs			28–95	
	Forb, perennial	2FP	<i>Forb, perennial</i>	6–45	–
	common yarrow	ACMI2	<i>Achillea millefolium</i>	6–45	–
	tarragon	ARDR4	<i>Artemisia dracunculus</i>	6–45	–
	milkvetch	ASTRA	<i>Astragalus</i>	6–45	–
	bastard toadflax	COUM	<i>Comandra umbellata</i>	6–45	–
	buckwheat	ERIOG	<i>Eriogonum</i>	6–45	–
	hairy false goldenaster	HEVI4	<i>Heterotheca villosa</i>	6–45	–
	dotted blazing star	LIPU	<i>Liatris punctata</i>	6–45	–
	desertparsley	LOMAT	<i>Lomatium</i>	6–45	–
	spiny phlox	PHHO	<i>Phlox hoodii</i>	6–45	–
	scurfpea	PSORA2	<i>Psoralegium</i>	6–45	–
	Missouri goldenrod	SOMI2	<i>Solidago missouriensis</i>	6–45	–
	prairie thermopsis	THRH	<i>Thermopsis rhombifolia</i>	6–45	–
	American vetch	VIAM	<i>Vicia americana</i>	6–45	–
Shrub/Vine					
5	Native shrubs and half-shrubs			78–191	
	Shrub, broadleaf	2SB	<i>Shrub, broadleaf</i>	6–45	–
	longleaf wormwood	ARLO7	<i>Artemisia longifolia</i>	6–45	–
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i>	6–45	–
	slender buckwheat	ERMI4	<i>Eriogonum microthecum</i>	6–45	–
	rubber rabbitbrush	ERNAN5	<i>Ericameria nauseosa</i> ssp. <i>nauseosa</i> var. <i>nauseosa</i>	6–45	–
	creeping juniper	JUHO2	<i>Juniperus horizontalis</i>	6–45	–
	skunkbush sumac	RHTR	<i>Rhus trilobata</i>	6–45	–
	prairie rose	ROAR3	<i>Rosa arkansana</i>	6–45	–
	soapweed yucca	YUGL	<i>Yucca glauca</i>	6–45	–
6	Native shrubs and half-shrubs			0–1	
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	0–1	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0–1	–

Animal community

Livestock Grazing Interpretations:

Managed livestock grazing is suitable on this site as it has the potential to produce high quality forage. However, forage production can be severely limited by the soil properties. 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 (medium and short grasses and sedges) occurs, 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 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. Practices such as range seeding or mechanical treatment are generally not recommended on this site.

Wildlife Interpretations:

Although not as productive as many sites, the Coarse Clay ecological site provides habitat diversity in an otherwise fairly uniform landscape. Historically, mule deer, pronghorn and a variety of song birds were probably the most conspicuous wildlife species using this site as they are today. Trees, shrubs and a relatively sparse herbaceous layer form a relatively complex vertical structure that is unavailable in adjacent grasslands. Topographic diversity, combined with a number of nutritious browse plants, provides mule deer and pronghorn with winter range habitat. A variety of birds find perch sites and nesting habitat in pine and juniper trees and shrubs in the middle canopy layer.

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

The diversity of plant life forms and seasonality provides habitat for a variety of pollinating insects. The short-horned lizard and prairie rattlesnake are representative reptiles. Ground-nesting bird habitat value is limited because of the high proportion of bare soil. Common nighthawks may nest on the sparsely covered surface. Scattered pines, junipers and bur oak provide valuable habitat for a variety of raptors and songbirds including American kestrels, Townsend's solitaires, chipping sparrows, field sparrows, lark sparrows and white-crowned sparrows. Mountain bluebirds may nest in tree cavities and mourning doves on tree branches. Although this community has relatively low productivity, the diversity of warm and cool season grasses and sedges, forbs, shrubs and half-shrubs provides a high plane of nutrition for grazers and mixed feeders throughout the growing season and beyond. Mule deer and pronghorn will use the variety of browse species throughout the year. Small mammal populations are dominated by seed-eaters such as deer mice and the least chipmunk

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

Insect diversity may decline as the variety of grasses and forbs is reduced. Structural habitat diversity for a wide range of non-game species is also decreased. An increase in shrubs and half-shrubs provides seasonal browse for mule deer and pronghorn although nutritional value declines with a partial loss of shrub diversity.

Plant Community 3: Shrubs, Short Grasses:

General wildlife habitat values have declined significantly at this stage. Very little forage is available for ungulates, although an increase in shrubs and half-shrubs provides fall-spring browse for mule deer and pronghorn. Habitat structure has been greatly simplified which reduces small mammal and song bird diversity.

Plant Community 4: Trees and Large Shrubs:

Pollinating insect diversity is considerably reduced as the plant community is simplified. A significant increase in ponderosa pine, juniper or, in some cases, bur oak, benefits some songbird species such as those listed in #1, above. Ground-nesting bird and small mammal habitat values are very significantly reduced with the loss of ground cover.

Hydrological functions

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

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

Supporting Data for Site Development:

NRCS Production & Composition Record for Native Grazing Lands (Range-417): 8

BLM Soil & Vegetation Inventory Method (SVIM) Data: 2

NRCS Range Condition Record (ECS-2): 25

NRCS Range/Soil Correlation Observations & Soil 232 notes: 13

Ecological Site Reference: NRCS 417 No.: Golden Valley County 520

Field Offices where this site occurs within the state:

Big Sandy
Big Timber
Billings
Chinook
Columbus
Crow Agency
Fort Belknap
Hardin
Harlowton
Joliet
Lewistown
Malta
Roundup

Stanford
White Sulphur Springs
Winnett

Other references

Authors:

Original: NRCS, 1983

Revised: Matthew J. Ricketts, Robert E. Leinard, Rhonda Sue Noggles, Peter O. Husby, 2003

Contributors

MJR, REL, RSN, POH
RSN

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.

Author(s)/participant(s)	Loretta Metz
Contact for lead author	
Date	04/10/2005
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Minor rills (less than 2.0 inches in depth; less than 3 feet long) may be present in the reference state when slopes are greater than 8%. Plant community 2 has more rills than Plant community 1.

2. **Presence of water flow patterns:** Water flow patterns are generally not evident in the reference state.

3. **Number and height of erosional pedestals or terracettes:** These should not be evident in the reference state. Do not confuse these features with normal frost heave actions that occur on applicable soils.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is less than 80% in the reference state. In HCPC, bare ground should not exceed 65%.
-
5. **Number of gullies and erosion associated with gullies:** Gully erosion is not evident in the reference state.
-
6. **Extent of wind scoured, blowouts and/or depositional areas:** Under normal climatic conditions, these should not be evident in the reference state.
-
7. **Amount of litter movement (describe size and distance expected to travel):** Litter movement varies by size and depth of litter. In the reference state, litter should be coarse perennial grass leaves, anywhere from 1.5 inches up to 4 inches in length, plus small shrub leaves and minimal forb litter. Litter will not move more than a couple of inches from where it originated.
-
8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Stability values of 4-5 in plant interspaces. Stability values of 5-6 under plant canopies and at plant bases.
-
9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Granular surface structure; brown to dark brown color. Organic matter approx 2-4%. Coarse fragments on surface are less than 5% by volume.
-
10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Deep-rooted native perennial grasses optimize infiltration and runoff. Perennial plants (grasses, forbs and shrubs) should be spaced approximately 3 to 5 feet apart in the reference state.
-
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 present in reference state. Do not mistake the naturally occurring clay increase 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-height, native perennial bunchgrasses >> native shrubs > native perennial and annual forbs
>= warm season, short-height, native perennial grasses.
- Sub-dominant:
- Other:
- Additional:
-
13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or**

decadence): Plant mortality is very low; decadence is minimal except in prolonged periods of drought.

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

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 475 – 850 #/acre.

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:** Rocky Mountain juniper, Wyoming big sagebrush, broom snakeweed, plains pricklypear, threeawn species, annual grasses (cheatgrass, Japanese brome, others), etc.

17. **Perennial plant reproductive capability:** This is not impaired in the reference state.
