USDA Natural Resources
Conservation Service

Ecological site R058AC059MT
Shallow Clay (SwC) RRU 58A-C 11-14" p.z.

Last updated: 6/14/2023
Accessed: 05/05/2024

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

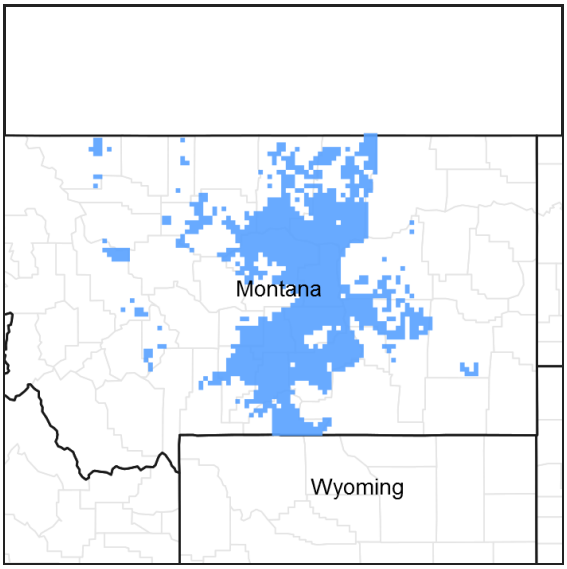


Figure 1. Mapped extent

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

Associated sites

R058AC041MT	**Clayey (Cy) RRU 58A-C 11-14" p.z.**
R058AC049MT	**Silty-Steep (SiStp) RRU 58A-C 11-14" p.z. (combined R058AC046MT, R058AC047MT & R058AC048MT into this site)**
R058AC057MT	**Shallow (Sw) RRU 58A-C 11-14" p.z.**

Similar sites

R058AC057MT	**Shallow (Sw) RRU 58A-C 11-14" p.z.** The Shallow site differs by having a different texture, and generally being over sandstone or loamy beds.
R058AC049MT	**Silty-Steep (SiStp) RRU 58A-C 11-14" p.z. (combined R058AC046MT, R058AC047MT & R058AC048MT into this site)** The Clayey-Steep site is over 20 inches deep to root restricting materials, as well as occurring on slopes over 15%.
R058AC041MT	**Clayey (Cy) RRU 58A-C 11-14" p.z.** Clayey sites have similar textures, but differ mainly by being over 20 inches to rock and having significantly more production. The plant community can be similar because of the restrictive layers of clayey textures.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia frigida* (2) *Artemisia cana*
Herbaceous	(1) *Pseudoroegneria spicata* (2) *Pascopyrum smithii*

Physiographic features

This ecological site can occur on nearly
level to very steep uplands. It often occurs in complex with other ecological sites, particularly in rougher terrain. This site occurs on all slopes and exposures. Slight variations in plant community composition and production can result due to aspect. The amount of exposed rock outcrop tends to increase as slopes increase. Runoff and the potential for water erosion can be important features of this site.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Escarpment
Flooding frequency	None
Ponding frequency	None
Elevation	686–1,372 m
Slope	0–70%
Water table depth	152 cm

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 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 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 (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)	135 days
Freeze-free period (average)	155 days
Precipitation total (average)	356 mm

Influencing water features

Soil features

These are clayey soils that are 10 to 20 inches deep to underlying beds of decomposed shale or nearly impervious clays. Few roots penetrate deeper than 20 inches. Available Water Holding Capacity to 20 inches is 2 to 4 inches.

Table 4. Representative soil features

Soil depth	25–51 cm
Available water capacity (0-101.6cm)	5.08–10.16 cm

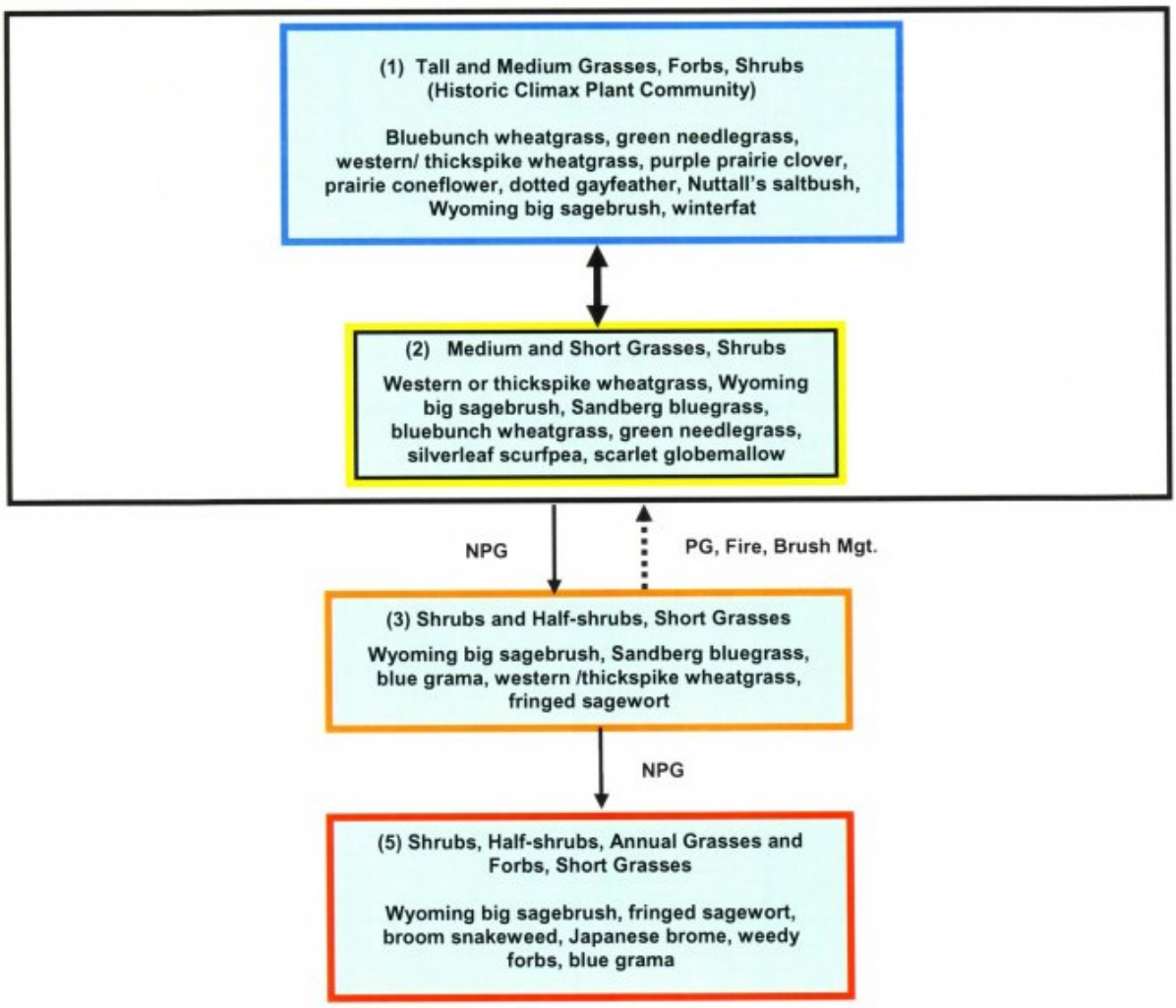
Ecological dynamics

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

State and transition model

MLRA: 58AC – Sedimentary Plains, Central
R058AC059MT

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.

State 1
Tall and Medium Grasses/ Forbs/ Shrubs (HCPC)

Community 1.1
Tall and Medium Grasses/ Forbs/ Shrubs (HCPC)

The physical aspect of this site in the Historical Climax (HCPC) is that of a gentle to steep sloping grassland with scattered shrubs on steeper slopes. Approximately 70–75% of the annual production is from grasses and sedges, 5–10% from forbs, and 5–15% is from shrubs and half-shrubs. The canopy cover of shrubs is 1-5%. Dominant

species include bluebunch wheatgrass, green needlegrass, plains muhly, and western or thickspike wheatgrass. Short grasses such as Sandberg bluegrass and prairie junegrass are also present. There are abundant forbs (purple and white prairie clover, prairie coneflower, dotted gayfeather) which occur in smaller percentages. Shrubs such as Nuttall's saltbush and winterfat are common. Rocky Mountain juniper may also occur on steeper slopes. The occurrence, frequency, timing, and intensity of fire all have an important affect on this community. The Wyoming big sagebrush is susceptible to fire and will tend to decrease with fire. The Nuttall's saltbush tends to be resistant to fire. Winterfat is very susceptible to burning, depending on the intensity. Some published reports indicate that spring burning may be least detrimental. Reports indicate further that fall burning has resulted in a 95 to 100 percent loss of winterfat in some situations. 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	878	1019	1170
Shrub/Vine	101	121	135
Forb	30	37	40
Total	**1009**	**1177**	**1345**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	1-5%
Grass/grasslike foliar cover	40-60%
Forb foliar cover	5-10%
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%
Shrub/vine/liana basal cover	1-5%
Grass/grasslike basal cover	5-12%
Forb basal cover	1-4%
Non-vascular plants	0%
Biological crusts	0-5%
Litter	40-60%
Surface fragments >0.25" and <=3"	5-10%
Surface fragments >3"	0%

Bedrock	0%
Water	0%
Bare ground	15-30%

Table 8. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	1-5%	–	5-10%
>0.15 <= 0.3	–	–	–	–
>0.3 <= 0.6	–	–	40-60%	–
>0.6 <= 1.4	–	–	–	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

State 2
Medium and Short Grasses/ Shrubs

Community 2.1
Medium and Short Grasses/ Shrubs

This community occurs from shifts in climate or other disturbances, such as grazing that tend to increase Wyoming big sagebrush. Dominant grasses include western or thickspike wheatgrass, Sandberg bluegrass, and prairie junegrass. Bluebunch wheatgrass, green needlegrass, and plains muhly will still be present but in smaller amounts. Palatable and nutritious forbs will be replaced by less desirable and more aggressive species, such as hairy goldenaster, silverleaf scurfpea, and scarlet globemallow. Sweet clover is a common invader on this ecological site. 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. This plant community provides for moderate soil stability.

State 3
Shrubs and Half-shrubs/ Short Grasses

Community 3.1
Shrubs and Half-shrubs/ Short Grasses

This is a disturbance induced community, with dominant species including Wyoming big sagebrush, Sandberg bluegrass, prairie junegrass, blue grama, perennial forbs, and fringed sagewort. Remnant amounts of western or thickspike wheatgrass and needleandthread may be present. Tall grasses and palatable forbs will be mostly absent. Plant Community 3 is much less productive than Plant Communities 1 or 2, and has 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.

State 4
Shrubs/ Half-shrubs/ Annual Grasses and Forbs/ Short Grasses

Community 4.1
Shrubs/ Half-shrubs/ Annual Grasses and Forbs/ Short Grasses

This community is the result of continual adverse disturbances. Dominant species include Wyoming big sagebrush, fringed sagewort and broom snakeweed, and annuals such as cheatgrass, Japanese brome, and six-weeks fescue. Blue grama, Sandberg bluegrass, and prairie junegrass may be present in lesser amounts. Plant community 4 has extremely reduced production of native plants (< 400 lbs. /acre). The lack of litter and short plant heights result in higher soil temperatures, poor water infiltration rates, and increased evaporation, which gives short sod grasses and annual invaders 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. Significant economic inputs and time would be required to move this plant community toward a higher successional stage and a more productive plant community.

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**			706–1076	
	green needlegrass	NAVI4	*Nassella viridula*	303–807	–
	western wheatgrass	PASM	*Pascopyrum smithii*	50–202	–
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	50–202	–
	tufted wheatgrass	ELMA7	*Elymus macrourus*	50–202	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–67	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–67	–
2	**Native grasses and sedges**			0–135	
	Grass, perennial	2GP	*Grass, perennial*	0–67	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–67	–
	needleleaf sedge	CADU6	*Carex duriuscula*	0–67	–
	threadleaf sedge	CAFI	*Carex filifolia*	0–67	–
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–67	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–67	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–67	–
Forb					
3	**Native forbs**			10–67	
	Forb, perennial	2FP	*Forb, perennial*	10–13	–
	common yarrow	ACMI2	*Achillea millefolium*	10–13	–
	pussytoes	ANTEN	*Antennaria*	10–13	–
	tufted milkvetch	ASSP6	*Astragalus spatulatus*	10–13	–
	milkvetch	ASTRA	*Astragalus*	10–13	–
	miner's candle	CRVI4	*Cryptantha virgata*	10–13	–
	white prairie clover	DACA7	*Dalea candida*	10–13	–
	purple prairie clover	DAPU5	*Dalea purpurea*	10–13	–
	buckwheat	ERIOG	*Eriogonum*	10–13	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	10–13	–
	dotted blazing star	LIPU	*Liatris punctata*	10–13	–

	desertparsley	LOMAT	*Lomatium*	10–13	–
	evening primrose	OENOT	*Oenothera*	10–13	–
	beardtongue	PENST	*Penstemon*	10–13	–
	spiny phlox	PHHO	*Phlox hoodii*	10–13	–
	scurfpea	PSORA2	*Psoralidium*	10–13	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	10–13	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	10–13	–
	prairie thermopsis	THRH	*Thermopsis rhombifolia*	10–13	–
	American vetch	VIAM	*Vicia americana*	10–13	–
4	**Native forbs (toxic properties)**			0–1	
	twogrooved milkvetch	ASBI2	*Astragalus bisulcatus*	0–1	–
	larkspur	DELPH	*Delphinium*	0–1	–
	white locoweed	OXSE	*Oxytropis sericea*	0–1	–
	deathcamas	ZIGAD	*Zigadenus*	0–1	–
Shrub/Vine					
5	**Native shrubs and half-shrubs**			10–67	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	10–67	–
	Nuttall's saltbush	ATNU2	*Atriplex nuttallii*	10–67	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	10–67	–
6	**Native shrubs and half-shrubs**			0–135	
	Shrub, broadleaf	2SB	*Shrub, broadleaf*	0–67	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–67	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–67	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–67	–
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	0–67	–
	prairie rose	ROAR3	*Rosa arkansana*	0–67	–
7	**Native shrubs and half-shrubs**			0–1	
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–1	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–1	–

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. Forage production is somewhat limited by steep slopes and shallow soils, and the potential for runoff, which reduces the effectiveness of the precipitation received for plant growth. The steeper slopes may also limit livestock travel and result in poor grazing distribution, especially in areas away from water. 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) 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 and some type of brush management is often necessary for re-establishment of the desired species and to restore the stability and health of the site.

Wildlife Interpretations:

Complex topography and vegetative structure, along with the tendency to occur in a mosaic with other ecological sites make this site an important component of wildlife habitat diversity. Big game species are particularly attracted to this site, where it occurs in rough topography, because of thermal cover and winter range values. South slopes tend to stay open in winter where important browse species such as winterfat and Nuttall's saltbush are available. Rock outcrops and scattered Rocky Mountain junipers provide hunting perches for a variety of raptors. Golden eagles often hunt low to the ground along the steep sidehills characteristic of this site where they can surprise small mammals as they cruise over small drainages. Ferruginous hawks may nest on rock outcrops. Sites having steeper, rocky topography provide habitat for interesting songbird species such as rock wrens, canyon wrens and spotted towhees. Scattered junipers and pines host field sparrows and chipping sparrows. Springs and seeps may occur along toe slopes. These provide habitat for amphibians and many other wildlife species.

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

The diversity of forbs, half-shrubs and shrubs provides feeding substrate for a variety of pollinating insects, which are prey for many birds, reptiles and small mammals. Springs and seeps provide habitat for amphibians such as tiger salamanders. The short-horned lizard is a representative reptile. The diversity of plant species and life forms, in combination with topographic variation, provides high quality bird habitat. Lark sparrows, chipping sparrows, rock wrens and ferruginous hawks are examples of birds using this community. Sharp-tailed grouse and sage grouse may use this community for lek sites on ridge tops and fairly level topography. 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. Winter range value is often high for mule deer and pronghorn when topographic diversity provides south exposures and browse plants such as Nuttall's saltbush and winterfat are available. Small mammal diversity may be fairly high. Example species include the kangaroo rat, deer mouse, olive-backed pocket mouse and desert cottontail.

Plant Community 2: Medium and Short Grasses/ Shrubs:

Pollinator insect species diversity may decline with the loss of some succulent, palatable forbs. Livestock trampling and grazing around springs and seeps degrades amphibian habitat. A reduction in litter cover and residual plant material during early spring decreases nesting habitat value for sage grouse and other ground-nesting birds. The potential increase in big sagebrush cover may benefit sage grouse nesting and winter habitat to some extent. Pronghorn and mule deer still find winter browse but overall nutrition value declines with the reduction in winterfat and Nuttall's saltbush cover. Herbivorous small mammals, such as voles, may decline with the reduction in litter cover.

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

Insect species diversity further declines with the simplification of the plant community, although some species, such as grasshoppers, may be very abundant during population highs. The general drying of the site following loss of litter cover and residual vegetation continues to degrade amphibian habitat. Sparse vegetation and increased bare ground may provide suitable habitat for a few nesting bird species (i.e. horned larks) but the lack of complex vegetative structure and residual cover makes this community poor habitat in general for most ground-nesting birds and relatively poor big game habitat. Pronghorn and mule deer may forage in this type throughout the year. However, nutritional levels for big game are greatly reduced and are available for a much shorter period as compared to the HCPC.

Plant Community 4: Shrubs and Half-shrubs/ Annual Grasses and Forbs/ Short Grasses:

Insects may be very abundant during population highs (i.e. grasshoppers) but diversity is low, especially of pollinators. Amphibian habitat is very degraded; ephemeral pools evaporate rapidly and the soil surface is very dry and hot during summer. Ground nesting bird habitat value is poor because of the lack of litter cover and residual plant cover in early spring. Sage grouse and Brewer's sparrows may be fairly abundant in the heavier sagebrush cover but probably suffer heavy losses while nesting on the poorly protected ground surface. Mountain plovers prefer to nest in this community type if a somewhat pebbly surface is present. Mule deer and pronghorn may utilize sagebrush and fringed sagewort during winter in this community.

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 slow to very slow. The runoff potential for this site is moderate to high, depending on slope and ground cover/health. Runoff curve numbers generally range from 79 to 94.

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

Supporting Data for Site Development:

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): 10

NRCS Range/Soil Correlation Observations & Soil 232 notes: 10

Ecological Site Reference:
NRCS 417 No.: Sweetgrass County 506 & 516, Musselshell County 516

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

Site Documentation:

Authors:

Original: NRCS, 1983

Revised: Matthew J. Ricketts, Robert E. Leiland, 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	04/06/2005
Approved by	Kirt Walstad
Approval date	

Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills should not be evident in the reference state. Exceptions include steep slopes (>55%) following heavy thunderstorms. Rills may then be present, but will generally be less than 8 feet in length.

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2. **Presence of water flow patterns:** Water flow patterns are generally not evident on lesser slopes, but can be apparent on steeper slopes in the reference state. When they are present, they are short (< 2 feet long) and discontinuous.

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3. **Number and height of erosional pedestals or terracettes:** Both may be evident in the reference state, especially on steeper slopes (>45%). If present, they do not exceed 1.5 inches in height.

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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 less than 30% in the reference state. In HCPC, bare ground should not exceed 18%.

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5. **Number of gullies and erosion associated with gullies:** Gully erosion is not evident in the reference state.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** These are not evident in the reference state.

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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 3 inches in length, plus small shrub leaves. Litter will not move more than a couple of inches from where it originated.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Stability values of 4-5 in plant interspaces. Stability values of 5-6 under plant canopies and at plant bases.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Granular surface structure of 1 to 3 inches in depth; brown color. Organic matter approx 1-3%.

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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 2 to 3 feet apart in the reference state.

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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 present in reference state.

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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: Mid-height, native perennial bunchgrasses >> shrubs >= native perennial and annual forbs.

    Sub-dominant:

    Other:

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Plant mortality of deep-rooted perennial bunchgrases is very low; mortality of shrubs is very low. Decadence during periods of prolonged drought will be evident on all plant species.

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

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 900 – 1200 #/acre.

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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:** plains pricklypear, broom snakeweed, cheatgrass, Japanese brome, curlycup gumweed, Wyoming big sagebrush, fringed sagewort, blue grama.

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