USDA Natural Resources Conservation Service

Ecological site R046XS144MT
Limy (Ly) RRU 46-S 13-19 PZ

Last updated: 7/19/2023
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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.

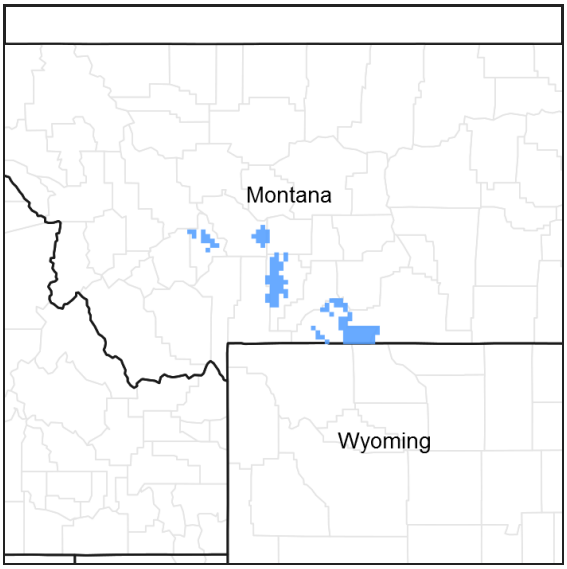


Figure 1. Mapped extent

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.

Associated sites

R046XS104MT	**Silty (Si) RRU 46-S 13-19 PZ**
R046XS106MT	**Sandy (Sy) RRU 46-S 15-19 PZ**
R046XS109MT	**Overflow (Ov) RRU 46-S 13-19 PZ**
R046XS114MT	**Shallow (Sw) RRU 46-S 13-19 PZ**

Similar sites

R046XS106MT	**Sandy (Sy) RRU 46-S 15-19 PZ** This site will differ by being less affected by CaCo3 (lime).
R046XS104MT	**Silty (Si) RRU 46-S 13-19 PZ** This site will differ by being less affected by CaCo3 (lime).

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified

Herbaceous	(1) *Pseudoroegneria spicata*

Physiographic features

This ecological site occurs on nearly level to strongly sloping valleys, terraces, and fans. The slopes mainly range from 0 – 15%, but are typically less than 8%. It will sometimes occur on slopes greater than 15%. This site occurs on all exposures. Aspect is not significant.

Table 2. Representative physiographic features

Landforms	(1) Valley (2) Fan (3) Terrace
Flooding frequency	None
Ponding frequency	None
Slope	0–15%
Water table depth	102 cm
Aspect	Aspect is not a significant factor

Climatic features

See Climatic Data Sheet for more details (Section II of the Field Office Technical Guide) or reference the following climatic web site: http://www.wrcc.sage.dri.edu/ .

Table 3. Representative climatic features

Frost-free period (characteristic range)	49-96 days
Freeze-free period (characteristic range)	105-122 days
Precipitation total (characteristic range)	356-457 mm
Frost-free period (actual range)	47-99 days
Freeze-free period (actual range)	104-125 days
Precipitation total (actual range)	330-457 mm
Frost-free period (average)	76 days
Freeze-free period (average)	114 days
Precipitation total (average)	406 mm

Climate stations used

- (1) NYE 2 [USC00246190], Fishtail, MT
- (2) JOLIET [USC00244506], Joliet, MT
- (3) COLUMBUS [USC00241938], Columbus, MT
- (4) BIG TIMBER [USC00240780], Big Timber, MT
- (5) MELVILLE 4 W [USC00245603], Big Timber, MT
- (6) MARTINSDALE 3 NNW [USC00245387], Martinsdale, MT

Influencing water features

No influencing water features.

Soil features

These soils are mainly loams, silt loams, sandy loams, or light clay loams more than 20 inches deep that are

strongly to violently effervescent within 4 inches of the surface. They form on alluvium, colluvium, and residuum. They have a calcic horizon within 12 inches of the surface. If the surface has been mixed, such as from tillage, these soils will be light colored and strongly or violently effervescent at the surface. Included are soils that have up to 4 inches of dark surface.

Table 4. Representative soil features

Surface texture	(1) Loam (2) Silt loam (3) Very fine sandy loam
Drainage class	Moderately well drained to well drained
Permeability class	Moderate
Soil depth	51 cm
Available water capacity (0-101.6cm)	12.7–25.4 cm
Calcium carbonate equivalent (0-101.6cm)	15%
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	10–20%
Subsurface fragment volume >3" (Depth not specified)	0–10%

Ecological dynamics

This site developed under Northern Rocky Mountain foothills 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 described 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 is considered highly resilient to disturbance as it has very few soil limitations for plant growth. Changes may occur to the Historic Climax Plant Community due to management actions and/or climatic conditions. Under continued adverse impacts, a moderate to extreme decline in vegetative vigor and composition will occur. Under favorable vegetative management treatments this site can more readily return to the Historic Climax Plant Community (HCPC).

Continual adverse impacts to the site over a period of years results in a departure from the HCPC, with a decrease of the taller, more palatable species such as bluebunch wheatgrass and green needlegrass. These plants will typically be replaced by a mixture of medium and short grasses and sedges, including Idaho fescue (mainly 15 inches MAP or more) thickspike wheatgrass, needleandthread (mainly less than 15 inches MAP), Sandberg bluegrass, prairie junegrass, spike oatgrass, and plains reedgrass. Several species of less desirable and non-palatable forbs such as hairy goldenaster, pussytoes, and asters and daisys will be common. Fringed sagewort also becomes abundant.

Continued deterioration to the community results in clubmoss and short grasses (Sandberg bluegrass, prairie junegrass, spike oatgrass, plains reedgrass) becoming dominant. Species such as Fendler’s or red threeawn, annuals, broom snakeweed, and plains pricklypear cactus will also become abundant

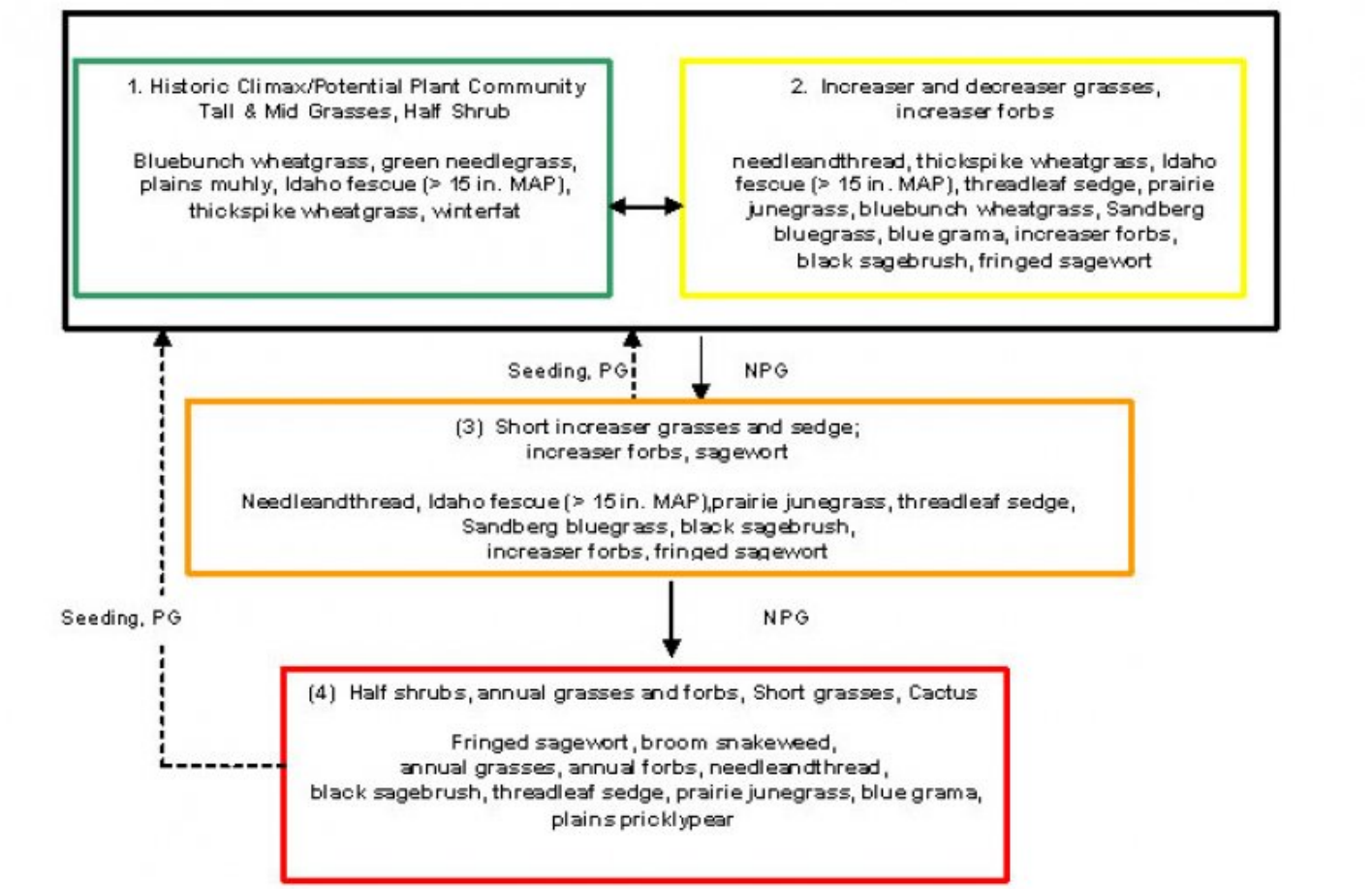
Plants that are not a part of the Historic Climax Plant Community that are most likely to invade are annual grasses

(cheatgrass, Japanese brome), and annual and biennial forbs. Leafy spurge, knapweeds, dalmation toadflax, and sulphur cinquefoil are potential noxious weed invaders on this site.

Long-term non-use (e.g., >3 years) combined with the absence of fire will result in excessive litter and decadent plants in the bunchgrass communities at higher precipitation zones.

10a. Major Plant Community States and Thresholds : Following are descriptions of several plant communities that may occupy this site. Minor variations in the plant community will occur as an expression of climatic patterns, topography and landform, elevation, soils, fire pattern

State and transition model



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.

Figure 8. State and Transition Model

State 1

Tall & Mid Grasses, Half Shrub

Community 1.1
Tall & Mid Grasses, Half Shrub

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 high diversity of tall and medium height, cool and warm season grasses (bluebunch wheatgrass, green needlegrass, thickspike wheatgrass, plains muhly), and short grasses and sedges (Sandberg or Cusick bluegrass, plains reedgrass, prairie junegrass, threadleaf sedge). There are abundant forbs (prairie clovers, dotted gayfeather) which occur in smaller percentages. Sub-shrubs (winterfat) and shrubs (black sagebrush) can be common in some locations. This plant community is well adapted to the Northern Rocky Mountain foothills climatic conditions. The diversity in plant species allows for drought tolerance. Individual species can vary greatly in production depending on growing conditions (timing and amount of precipitation, and temperature). This plant community is well suited to managed livestock grazing and provides diverse habitat for many wildlife species. Plants on this site have strong, healthy root systems that allow production to increase significantly with favorable moisture conditions. This plant community provides for soil stability and a properly functioning hydrologic cycle. 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. The soils associated with this site provide a moderate soil-water-plant relationship.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1076	1345	1614
Forb	135	211	303
Shrub/Vine	–	43	101
Total	**1211**	**1599**	**2018**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	1-5%
Grass/grasslike foliar cover	20-40%
Forb foliar cover	1-5%
Non-vascular plants	0-1%
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	0-2%
Grass/grasslike basal cover	14-21%
Forb basal cover	1-3%
Non-vascular plants	0-1%
Biological crusts	0%

Litter	55-65%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0-5%
Bedrock	0%
Water	0%
Bare ground	10-20%

State 2
Medium and Short Grasses, Sedge, and Increaser Forbs

Community 2.1
Medium and Short Grasses, Sedge, and Increaser Forbs

Early stages of degradation, including non-prescribed grazing, will tend to change the HCPC to a community dominated by medium and short grasses and sedges such as needleandthread, thickspike wheatgrass, Idaho fescue (mainly above 15 inch MAP), threadleaf sedge, prairie junegrass, and Sandberg bluegrass. A near monoculture of needleandthread will tend to occur on some sites, particularly where the darker soil surface has either been removed through erosion or mixed with sub soil material by tillage. The taller and more palatable plants (bluebunch wheatgrass, green needlegrass) can still be present but in smaller amounts, provided some of the darker surface soil horizon is present. There may be an increase in the amount of shrubs, such as black sagebrush. Palatable and nutritious forbs will be replaced by less desirable and more aggressive species such as pussytoes and hairy goldenaster. Biomass production and litter become reduced on the site with as the taller grasses become replaced by shorter ones, especially the non-native grasses. Evapotranspiration tends to increase, moisture retention is reduced, and soil surface temperatures increase. Some natural ecological processes will be altered. These plant communities provide for moderate soil stability. Increased amounts of bare ground can result in undesirable species invading. Common invaders can include spotted knapweed, dalmation toadflax, sulphur cinquefoil, and leafy spurge. This plant community will readily respond to improved grazing management, but a significant amount of time can be necessary to move it toward a higher successional stage and a more productive plant community similar to community 1. The chances of returning to a community similar to number 1 with grazing management alone are significantly reduced when the darker soil surface horizon is absent, either due to erosion or tillage. However, this ecological site is suitable for re-seeding. The major limitation is from soil blowing.

State 3
Short and Mid Increaser Grasses and Sedge, Fringed Sagewort, Increaser Forbs, Cactus

Community 3.1
Short and Mid Increaser Grasses and Sedge, Fringed Sagewort, Increaser Forbs, Cactus

If the heavy disturbance, including non prescribed grazing, continues the site will become dominated by short and medium increaser grasses such as Sandberg bluegrass, plains reedgrass, prairie junegrass, thickspike wheatgrass, and Idaho fescue, fringed sagewort, and increaser forbs such as pussytoes and western yarrow. There may still be remnant amounts of some of the late-seral species such as bluebunch wheatgrass and green needlegrass present if there is still some of the darker soil surface present. The taller grasses will occur only occasionally. Palatable forbs will be mostly absent. Undesirable species such as red threeawn, plains pricklypear cactus and broom snakeweed may become common. Annuals and weedy species may begin to be apparent. This plant community is the result of long-term, heavy, continuous grazing and/or annual, early spring seasonal grazing. Repeated spring grazing depletes stored carbohydrates, resulting in weakening and eventual death of the cool season tall and medium grasses. This plant community can occur throughout the pasture, on spot grazed areas, and around water sources where season-long grazing patterns occur. This community will respond positively to improved grazing management, but significant economic inputs and a signinicant amount of time are usually required to move this plant community toward a higher successional stage and a more productive plant community. As noted with plant community 2, the probability for returning this community to one resembling 1 using grazing management alone is significantly less when the dark soil surface is gone or has been mixed with the subsoil. Reseeding may be the best option for accomplishing that.

State 4
Half Shrubs, Annuals and Weedy Species, Clubmoss, Short Grasses, Cactus

Community 4.1
Half Shrubs, Annuals and Weedy Species, Clubmoss, Short Grasses, Cactus

Further deterioration of community 3 results in a plant community dominated by undesirable plants such as broom snakeweed, plains pricklypear cactus, fringed sagewort, weedy forbs (e.g., pussytoes and thistles), annuals and biennials such as cheatgrass and Japanese bromes and curlycup gumweed, and red threeawn. Many increaser sedges and short grasses such as threadleaf sedge, prairie junegrass, Sandberg bluegrass and plains reedgrass will be abundant. Most of the climax species such as bluebunch wheatgrass will be gone. Black sagebrush will become abundant. Plant communities 3 and 4 produce less usable forage for wildlife and livestock than the others described. The continuation of the downward trend and degradation of this site has resulted in higher soil surface temperatures, reduced water infiltration, and higher evapotranspiration. This has resulted in plant species that are more adapted to drier conditions, including cactus. Most of the attributes of a healthy rangeland, including good infiltration, minimal erosion and runoff, nutrient cycling and energy flow, have been lost. Community 4 can respond positively to improved grazing management but it will take additional inputs to move them towards communities similar in production and composition to others that have been described. Because of the high lime content at or near the surface, practices such as mechanical treatment or seeding should be used carefully to reduce the hazard of soil blowing.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Shrubs and Half-shrubs**			0–101	
	Shrub, broadleaf	2SB	*Shrub, broadleaf*	0–101	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–101	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–101	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–1	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–1	–
Grass/Grasslike					
0	**Grasses and Sedges**			1076–1614	
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	135–1412	–
	green needlegrass	NAVI4	*Nassella viridula*	67–202	–
	Idaho fescue	FEID	*Festuca idahoensis*	67–202	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	67–202	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	67–101	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–101	–
	needleleaf sedge	CADU6	*Carex duriuscula*	67–101	–
	threadleaf sedge	CAFI	*Carex filifolia*	67–101	–
	plains reedgrass	CAMO	*Calamagrostis montanensis*	67–101	–
	poverty oatgrass	DASP2	*Danthonia spicata*	67–101	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	67–101	–
	Cusick's bluegrass	POCU3	*Poa cusickii*	0–101	–
	Sandberg bluegrass	POSE	*Poa secunda*	67–101	–

	Grass, perennial	2GP	*Grass, perennial*	0–101	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–1	–
	Fendler's threeawn	ARPUF	*Aristida purpurea var. fendleriana*	0–1	–
Forb					
0	**Forbs**			135–303	
	Forb, perennial	2FP	*Forb, perennial*	0–101	–
	common yarrow	ACMI2	*Achillea millefolium*	0–101	–
	onion	ALLIU	*Allium*	0–101	–
	pussytoes	ANTEN	*Antennaria*	0–101	–
	aster	ASTER	*Aster*	0–101	–
	milkvetch	ASTRA	*Astragalus*	0–101	–
	prairie clover	DALEA	*Dalea*	0–101	–
	fleabane	ERIGE2	*Erigeron*	0–101	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	13–101	–
	dotted blazing star	LIPU	*Liatris punctata*	13–101	–
	desertparsley	LOMAT	*Lomatium*	0–101	–
	beardtongue	PENST	*Penstemon*	0–101	–
	spiny phlox	PHHO	*Phlox hoodii*	0–101	–
	scurfpea	PSORA2	*Psoralidium*	0–101	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	13–101	–
	American vetch	VIAM	*Vicia americana*	13–101	–
	hymenaea	HYMEN	*Hymenaea*	0–56	–
	lupine	LUPIN	*Lupinus*	0–1	–
	deathcamas	ZIGAD	*Zigadenus*	0–1	–
	little larkspur	DEBIC	*Delphinium bicolor ssp. calcicola*	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. Grazing must be managed carefully on this site to be sure livestock drift onto the better, more productive sites is not excessive. Management objectives should include maintenance or improvement of the native plant community.

Using shorter grazing periods and providing for adequate re-growth after grazing are recommended for plant maintenance, health, and recovery. Continual non prescribed grazing of this site can be detrimental and will alter the plant composition and production over time. The result will be plant communities that resemble numbers 3 and 4, depending on how long this grazing management is used as well as other circumstances such as weather conditions and fire frequency.

Whenever Plant Community 2 (medium and short grasses) occurs, grazing management strategies that will prevent further degradation need to be implemented. This community is still stable, productive, and healthy provided it receives proper management. It will respond fairly quickly to improved grazing management, including increased growing season rest of key forage plants. Grazing management alone can usually move this back towards the potential / historic climax community. However, the probability for success is significantly reduced if the darker soil surface is gone.

Plant community 3 is the result of long-term, heavy, continuous grazing and/or annual, early spring seasonal grazing. Repeated heavy early spring grazing, especially during stem elongation (generally mid May through mid June), can also have detrimental affects on the taller, key forage species. Repeated spring grazing depletes stored

carbohydrates, resulting in weakening and eventual death of the cool season tall and medium grasses. This plant community can occur throughout the pasture, on spot grazed areas, and around water sources where season-long grazing patterns occur.

It becomes critical at this point to implement a grazing strategy that will restore the stability and health of the site and prevent further degradation to Plant Community 4. Rest, usually for a number of years, can sometimes help with re-establishment of the desired species, depending on the amount of desirable species and dark colored soil surface remaining.

Plant Community 4 has a high percentage of aggressive, less-desirable species. It has lost most of the attributes of a healthy rangeland. Grazing management alone is seldom able to restore the site to one that resembles the HCPC/PPC once this plant community has become established. There are limitations to using seeding and/or mechanical treatment on this site due to the limy (calcareous) soils.

Calculating Safe Stocking Rates: Proper stocking rates should be incorporated into a grazing management strategy that protects the resource, maintains or improves rangeland health, and is consistent with management objectives. Safe stocking rates will be based on useable forage production, and should consider ecological condition and trend of the site, and past grazing use history.

Calculations used to determine a safe stocking rate are based on the amount of useable forage available, taking into account the harvest efficiency of the animal and the grazing strategy to be implemented. Average annual production must be measured or estimated to properly assess useable forage production and stocking rates.

Stocking rates are calculated from average forage production values using a 25% Harvest Efficiency factor for preferred and desirable plants, and 10% Harvest Efficiency for less desirable species. AUM calculations are based on 915 pounds (air-dry) per animal unit month (AUM) for a 1,000-pound cow with calf up to 4 months. No adjustments have been made for site grazability factors, such as steep slopes, site inaccessibility, or distance to drinking water.

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 AU! M/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).

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 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, 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 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.

Wood products

None

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Approval

Kirt Walstad, 7/19/2023

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	03/01/2020
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Approval date	

Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills are not present in the reference condition.

2. **Presence of water flow patterns:** Water flow patterns are not present in the reference condition.

3. **Number and height of erosional pedestals or terracettes:** Pedestals are not evident in the reference condition.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is 10-20%. It consists of small, randomly scattered patches.

5. **Number of gullies and erosion associated with gullies:** Gullies are not present in the reference condition.

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

7. **Amount of litter movement (describe size and distance expected to travel):** Litter movement is not evident in the reference condition.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** The average soil stability rating is 5-6 under plant canopies and 4-6 under plant interspaces. The A horizon is 4-6 inches thick.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil Structure at the surface is weak fine granular. A Horizon should be 4-6 inches thick with color, when wet, typically ranging in Value of 4 or less and Chroma of 4 or less. Local geology may affect color, it is important to reference the Official Series Description (OSD) for characteristic range. https://soilseries.sc.egov.usda.gov/osdname.aspx

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Infiltration of the Limy ecological site is moderate. The site is well drained. An even distribution of mid stature grasses (70-75%), cool season bunchgrasses (10-20%) along with rhizomatous grass (5-10%), forbs (5-15%), and shrubs (5-10-5%)

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** A compaction layer is not present in the reference condition.

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-statured, cool season, perennial bunchgrasses (Primarily bluebunch wheatgrass, spike fescue, and green needlegrass)

    Sub-dominant: shortgrass grasses/grasslikes (needle and thread, Sandberg bluegrass) ≥ forbs ≥ rhizomatous grasses ≥ shrubs

    Other:

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Mortality in herbaceous species is not evident. Species with bunch growth forms may have some natural mortality in centers is 3% or less.

14. **Average percent litter cover (%) and depth (in):** Total litter cover ranges from 55 to 65%. Most litter is irregularly distributed on the soil surface and is not at a measurable depth.

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Average annual production is 1600. Low: 1200 High 1800. Production varies based on effective precipitation and natural variability of soil properties for this ecological site.

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:** Potential invasive (including noxious) species (native and non-native). Invasive species on this ecological site include (but not limited to) sulphur cinquefoil, houndstongue, whitetop, Canada thistle, annual brome spp., spotted knapweed, yellow toadflax, leafy spurge, crested wheatgrass
    Native species such as Rocky Mountain juniper, limber pine, ponderosa pine, Douglas fir, lupine, broom snakeweed, Sandberg's bluegrass, etc. when their populations are significant enough to affect ecological function, indicate site condition departure.

17. **Perennial plant reproductive capability:** In the reference condition, all plants are vigorous enough for reproduction either by seed or rhizomes in order to balance natural mortality with species recruitment.