Ecological site R046XC603MT
Saline Upland (SU) RRU 46-C 15-19 PZ

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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.

MLRA notes

Major Land Resource Area (MLRA): 046X–Northern and Central Rocky Mountain Foothills

Major Land Resource Area (MLRA): 046X–Northern Rocky Mountain Foothills

Major Land Resource Area (MLRA) 46, Rocky Mountain Foothills, is approximately 11.6 million acres. MLRA 46's extent has changed over recent years and is now primarily located in Montana and Wyoming with limited acres in Utah and Colorado. It spans from the Canadian border south to the Uinta Mountains of Northwest Colorado. MLRA 46 is a transitional MLRA between the plains and mountains of primarily non-forested rangeland. In Montana, three Land Resource Units (LRUs) exist based on differences in geology, landscape, soils, water resources, and plant communities. Elevations for this MLRA in Montana vary from a low of 3200 to 6500 feet (975 to 1981 m) however the elevations on the fringes of this MLRA may fall outside of that range in extremely small isolated areas where the boundaries between neighboring MLRAs are not easily defined. Annual precipitation ranges from 8 inches (254 mm) to, in very isolated areas, 42 inches (1083 mm). In general precipitation rarely exceeds 24 inches (610 mm). Frost Free Days are variable from 50 days near the Crazy and Beartooth Mountains to 130 days in the foothills south of the Bear's Paw Mountains of Central Montana. The geology of MLRA 46 is generally Cretaceous and Jurassic marine sediments.

MLRA 46s plant communities are dominated by cool-season bunchgrasses with mixed shrubs. This MLRA is rarely forested; however, ponderosa and limber pine do occupy areas. Portions of this MRLA may have a subdominance of warm-season mid-statured bunchgrasses like little bluestem, however the general concept of the MLRA does not have a large component of warm-season species. Wyoming big sagebrush, mountain big sagebrush, silver sagebrush, common snowberry, and shrubby cinquefoil tend to be the dominant shrub component. The kind and presences of shrubs tends to be driven by a combination of soils and climate. Due to the variable nature of the Land Resources Units, Climatic subsets will be necessary to describe the ecological sites and the variation of plant communities for this MLRA.

LRU notes

LRU C is generally located in Central Montana. It borders the Little Belt Mountains, Highwood Mountains, Snowy Mountains (Big and Little), Crazy Mountains, and Castle Mountains. Included in this LRU are the foothills of the island mountain groups of the Bear's Paw and Little Rocky Mountains. This LRU borders MLRAs 43B, 52 and 58. LRU C is the second largest of the LRUs located in Montana occupying approximately 2.6 million acres. Cities and towns located in this LRU includes Stanford, Lewistown, Grass Range, and Harlowton. Elevation ranges from 2880 feet (878 m) to 6783 feet (2068 m).

The geology is sedimentary in nature with the majority including the Colorado Shale Formation, Kootenai Formation (mixed sedimentary), Mississippian Formation (carbonatic sedimentary), terrace deposits (alluvium), Tertiary mixed sedimentary. Areas of the Claggett Formation (mudstone), Devonian (carbonatic sedimentary) as well as intrusive and extruvise volcanics (mixed) exist in the foothills of the island mountains. Landforms include hillslopes, drainage ways, fan remnants, valleys, and escarpments.

This LRU is dominated by deep, well drained soils. Soil depth is mixed with 45 percent moderately-deep, 45 percent very deep, and 10 percent other soil depth. Slopes are most frequently 0 to 15 percent and 15 to 30 percent, while higher sloping areas (30-45 percent) exist along the Little Belt and Highwood interfaces. Slightly Acid to Moderately Alkaline soils throughout. Small areas of Moderately Acid soils exist in places, in particular around Highwoods. Vast differences in soil texture within LRU exist likely due to the variation in parent material.

The climate of this LRU is classic to the MLRA concept. The precipitation falls primarily as rain in the spring however areas may receive high amounts of snowfall (i.e. Lewistown). Precipitation ranges are from 13.7 inches (348 mm) to a rare 37.4 inches (942 mm) with 18 inches as an average. This LRU has an average air temperature of 44°F (6.75 degrees C) with a range of 38 degrees Fahrenheit (3.38 degrees C) to 47.3 degrees Fahrenheit (8.52 degrees C). Frost free days tends to be one of the longest of the Montana LRUs with a range of 70 to 130 days. Soil moisture regime is Ustic with a Frigid soil temperature regime. Due to the variability in climate of this LRU, climatic subsets will be necessary to accurately describe the ecological processes.

Major watersheds within this LRU include Big Spring Creek, Judith River, Swimming Woman Creek, and Musselshell River. These watersheds provide irrigation water for production of small grains and hay. As these watersheds leave the neighboring MLRA 43B, these river systems offer fishing and other recreational opportunities.

Cropland conversion is the largest land conversion within this LRU. Small grains such as wheat and barley are the most common particularly in Judith Basin County. Conversion to recreational property is becoming a more frequent occurrence, particularly near Lewistown.

Ecological site concept

Site does not receive additional effective moisture
Soil is saline or saline sodic within surface 20 inches
No columnar structure present in soil
Site is dominated by salt tolerant plants

Associated sites

R046XC602MT	**Dense Clay (DC) RRU 46-C 15-19 PZ** Site is typically lower on the landscape below Saline Upland

Similar sites

R046XC508MT	**Silty (Si) RRU 46-C 13-19 PZ** Silty site shares a similar state and transition model with similar plants. Silty site has higher production

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Sarcobatus vermiculatus*
Herbaceous	(1) *Pseudoroegneria spicata* (2) *Sporobolus airoides*

Physiographic features

The Saline Upland ecological site occurs on nearly level to moderately sloping fans remnants and terraces in the uplands. The site is located at the toe of the slope where evapotranspiration brings subsurface water through subsurface salts to or near the soil surface. It is often associated with shale beds as underlying material. Soils contain salt and/or alkali accumulations and salt-tolerant species dominate the plant community. Slopes are usually less than 8 percent though may be as high as 15 percent. Elevations normally vary from 3000 to 5900 feet.

Table 2. Representative physiographic features

Landforms	(1) Foothills > Fan remnant > Toe (2) Foothills > Terrace > Toe
Elevation	914–1,798 m
Slope	1–8%
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

The climate of the Saline Upland site falls into Climatic Subset B. The central concept of Climatic Subset B is 15 to 19 inches Relative Effective Annual Precipitation (REAP) and 70 to 110 days frost free. Calculated averages based on climate stations suggest, on average, that this ecological site receives an averages just over 16 inches of precipitation with 76 to 111 Frost Free Days.

The soil temperature regime for this Saline Upland Ecological Site is Frigid and the soil moisture regime is Ustic

Table 3. Representative climatic features

Frost-free period (characteristic range)	49-92 days
Freeze-free period (characteristic range)	101-116 days
Precipitation total (characteristic range)	381-432 mm
Frost-free period (actual range)	42-110 days
Freeze-free period (actual range)	70-125 days
Precipitation total (actual range)	356-432 mm
Frost-free period (average)	76 days
Freeze-free period (average)	111 days
Precipitation total (average)	406 mm

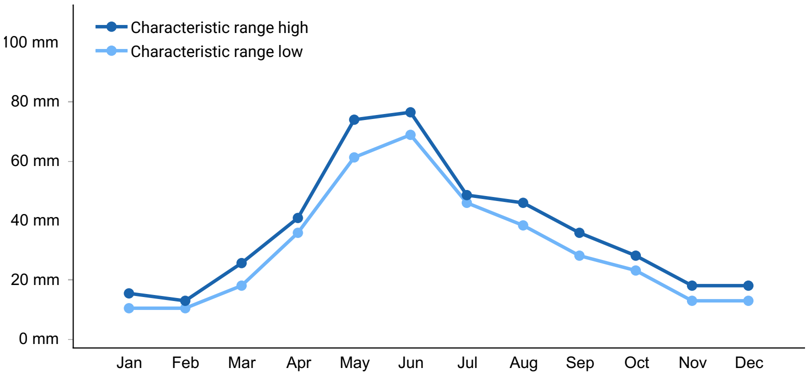


Figure 1. Monthly precipitation range

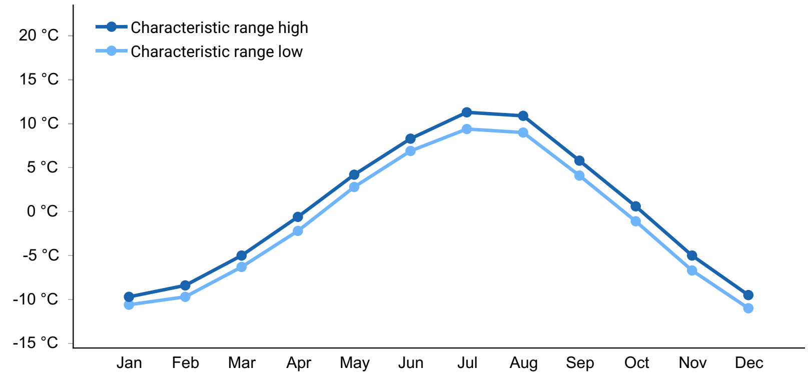


Figure 2. Monthly minimum temperature range

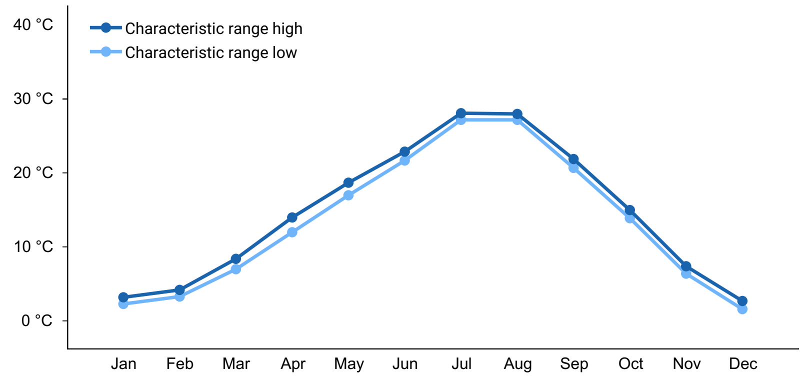


Figure 3. Monthly maximum temperature range

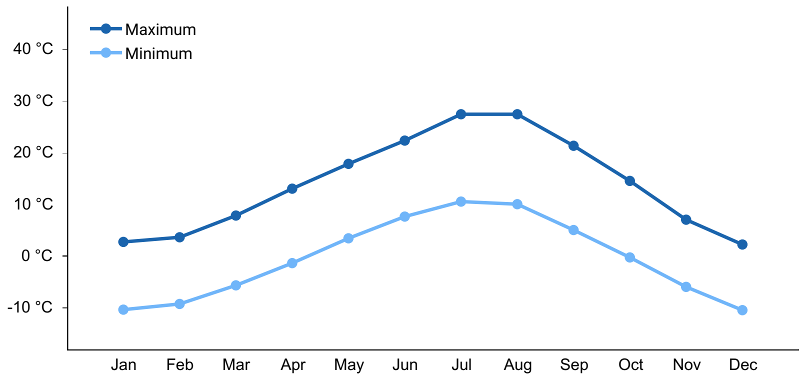


Figure 4. Monthly average minimum and maximum temperature

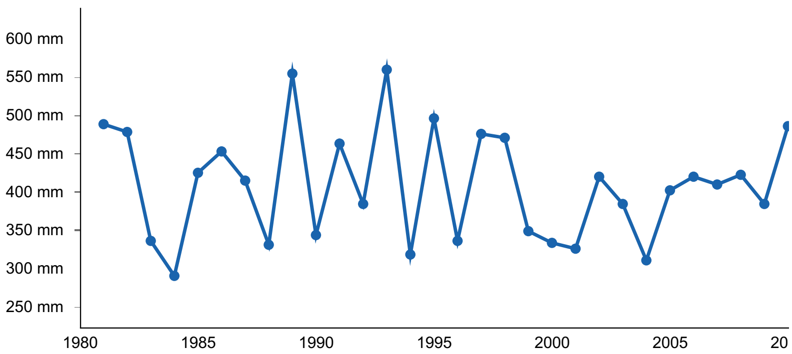


Figure 5. Annual precipitation pattern

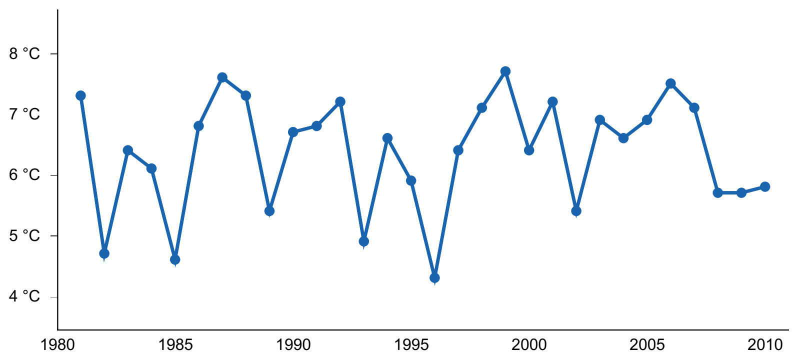


Figure 6. Annual average temperature pattern

Climate stations used

- (1) JUDITH GAP 13 E [USC00244545], Judith Gap, MT
- (2) HOBSON [USC00244193], Hobson, MT
- (3) MOCCASIN EXP STN [USC00245761], Moccasin, MT

- (4) DENTON [USC00242347], Denton, MT
- (5) STANFORD [USC00247864], Stanford, MT
- (6) LEWISTOWN MUNI AP [USW00024036], Lewistown, MT
- (7) GRASS RANGE [USC00243727], Grass Range, MT

Influencing water features

Site is located at the bottom third of the slope where evapotranspiration brings slightly saline water to or near the surface where salt accumulate. This site not, however, associated with a water table.

Wetland description

N/A

Soil features

Soils are moderately deep, deep, or very deep and formed in alluvium. The soils usually contain a relatively thin A horizon (less than 5 inches) with a weakly formed B horizon that is high in clay. The C horizon is strongly alkaline and is up to 60 inches deep. The surface texture is loam or silty clay loam; subsoil textures are usually clay or silty clay. Permeability is very slow. Salt tolerant plants dominate the site. Soil pH varies from 7.0 to 9.0.

Table 4. Representative soil features

Parent material	(1) Alluvium–sedimentary rock
Surface texture	(1) Silty clay loam (2) Loam
Drainage class	Somewhat poorly drained to well drained
Permeability class	Slow to moderate
Soil depth	51–254 cm
Surface fragment cover <=3"	0–15%
Surface fragment cover >3"	0–3%
Available water capacity (0-101.6cm)	10.92–19.56 cm
Soil reaction (1:1 water) (0-101.6cm)	7–9
Subsurface fragment volume <=3" (0-25.4cm)	Not specified
Subsurface fragment volume >3" (0-2.5cm)	Not specified

Ecological dynamics

The Saline Upland (SU) Ecological Site is characterized by the production and composition of the Reference Plant Community, which is defined by soils, precipitation, and the temperature regime influencing the site. The Saline Upland ecological site does not receive
additional effective moisture from offsite runoff from precipitation events or stream overflow. The site has saline or saline-sodic conditions within 20 inches of the soil surface which is expressed as an Electrical Conductivity of 8 to 30 mmhos/cm.

In the Rocky Mountain Foothills of Central Montana, MLRA 46X LRU C is found where an Ustic soil moisture regime occurs. This area is typified by a frigid soil temperature phase which receives a yearly representative value of 15 to 19 inches of relative effective annual precipitation and between 70 and 110 consecutive frost-free days annually.

Much of the precipitation comes in May and June. Primary plant growth typically occurs between May and early July however due to the increased soil moisture the growing season is extended longer into the summer than other sites in this MLRA. Dominant plants are those that have adapted to these conditions. A period of fall “green-up” can occur amongst this cool season dominated plant community if adequate precipitation is present.

The reference plant community is dominated by green needlegrass (*Nassella viridula*), alkali sacaton (*Sporobolus airoides*), bluebunch wheatgrass (*Pseudoroegneria spicata*), western wheatgrass (*Pascopyrum smithii*), and thickspike wheatgrass (*Elymus lanceolatus*). Subdominant species may include black greasewood (*Sarcobatus vermiculatus*), big sagebrush (*Artemisia tridentata*), winterfat (*Krascheninnikovia lanata*) and Gardner's saltbush (*Atriplex gardneri*i).

As the community changes away from reference, cool season shortgrasses tend to increase. If allowed to continue non-native grasses (cheatgrass, field brome, and ventenata) tend to take over the site. Throughout this time bare ground increases exponentially. The short rooted nature of the sodforming grasses erosion can occur rapidly.

Historical records indicate, prior to the introduction of livestock (cattle and sheep) during the late 1800’s, elk and bison grazed this ecological site. Due to the nomadic nature and herd structure of bison, areas that were grazed received periodic high intensity short duration grazing pressure.

Livestock grazing has occurred on most of this ecological site for more than 150 years. The gold boom in the 1860s brought the first herds of livestock overland from Texas, and homesteaders began settling the area. During this time cattle were the primary domestic grazers in the area.

Natural fire was a frequent ecological driver of this Ecological Site however due to the relatively low plant density and fire resistant plants (saltbush and greasewood) stand replacement was rare. The reference community with a high amount of herbaceous growth as a result of favorable growing conditions has the highest susceptibility to extreme fire. A herbaceous invaded community that contains high amounts of exotic annual grasses can greatly increase risk of fire frequency and intensity resulting in potential removal of native species.

Some of the major invasive species that can occur on this site include (but not limited to) spotted knapweed (*Centaurea stoebe*), leafy spurge (*Euphorbia esula*), cheatgrass (Bromus techtorum), Canada thistle (*Cirsium arvense*), dandelion (Taraxicum spp), and Kentucky
bluegrass (*Poa pratensis*). Invasive weeds have a high impact on this Ecological Site.

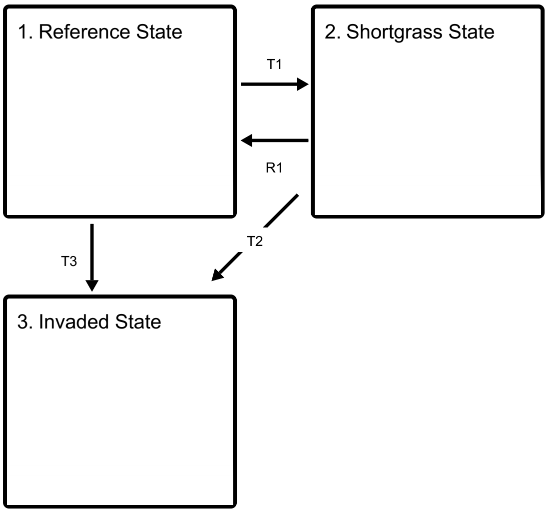
Plant Communities and Transitions
A State and Transition Model for this ecological site is depicted below. Thorough descriptions of each state, transition, plant community, and pathway follow the model. This model is based on available experimental research, field data, field observations, and interpretations by experts. It is likely to change as knowledge increases.

The plant communities within the same ecological site will differ across the MLRA due to the naturally occurring variability in weather, soils, and aspect. The biological processes on this site are complex; therefore, representative values are presented in a land management context. The species lists are representative and are not botanical descriptions of all species occurring, or potentially occurring, on this site. They are intended to cover the core species and known range of conditions and responses. Both percent species composition by weight and percent canopy cover are referenced in this document. Canopy cover drives the transitions between communities and states because of the influence of shade, interception of rainfall and competition for available water. Species composition by dry weight remains an important descriptor of the herbaceous community and of the community as a whole. Woody species are included in species composition for the site. Calculating similarity index requires use of species composition by dry weight.

Although there is considerable qualitative experience supporting the pathways and transitions within the State and Transition Model (STM), no quantitative information exists that specifically identifies threshold parameters between grassland types and invaded types in this ecological site. For information on STMs, see the following citations: Bestelmeyer el al. 2003, Bestelmeyer et al. 2004, Bestelmeyer and Brown 2005, Stringham et al. 2003.

State and transition model

Ecosystem states



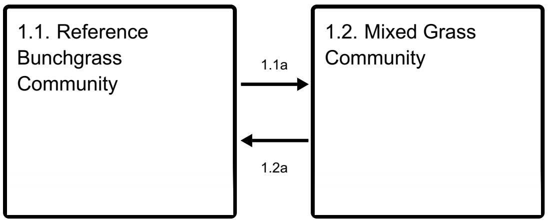
T1 - Transition is triggered by long term overgrazing or other human disturbances. Long term drought or altered hydrologic function is also a factor.

T3 - Invasion of the community by nonnative herbaceous species, often as a result of long term overgrazing or intense fire which reduces vigor of native herbaceous species.

R1 - Improved grazing management with favorable growing conditions may allow deep rooted bunchgrasses to reestablish dominance. Limited prescribed fire may reduce vigor of short grasses and shrubs temporarily.

T2 - Invasion of the community by nonnative herbaceous species, often as a result of long term overgrazing or intense fire which reduces vigor of native herbaceous species.

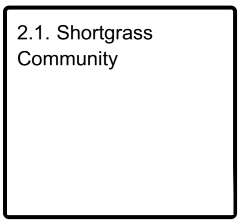
State 1 submodel, plant communities



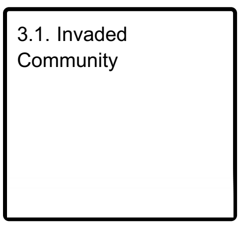
1.1a - The driver for community shift 1.1A is improper grazing management or prolonged drought. This shift is triggered by the loss of vigor of tall grasses, soil erosion, or prolonged drought coupled with improper grazing.

1.2a - Proper grazing management and appropriate grazing intensity with favorable moisture conditions will facilitate or accelerate this transition. The driver is increased vigor of the tall grasses resulting in increase biomass production and dominance of plant community. The trigger for this shift is the change in grazing management favoring basin wildrye.

State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Reference State

The Reference State of the Saline Upland (SU) ecological site consists of two known potential plant communities 1.1 Reference Bunchgrass Community and 1.2 Wheatgrass Community. These are generally characterized by a mid-statured, cool season grass community with limited shrub production. Community 1.1 is dominated by a mix of green needlegrass (*Nassella viridula*), bluebunch wheatgrass, western wheatgrass, winterfat, and alkali sacaton and is considered the reference while Community 1.2 has a codominance of western wheatgrass, alkali sacaton, saltbush, Sandberg bluegrass, and other shrubs including big sagebrush and black greasewood.

Community 1.1
Reference Bunchgrass Community

In the Reference Bunchgrass Community, green needlegrass, alkali sacaton, and western wheatgrass are dominant. On the wettest of sites, basin wildrye and bluebunch wheatgrass will be present although often restricted to a patches as a subdominant species. Sandberg bluegrass, Inland saltgrass, and prairie Junegrass are also component of the Reference State. Big sagebrush, black greasewood, Gardner's saltbush, and winter fat are dominant shrubs.

Community 1.2
Mixed Grass Community

The Mixed Grass Community is defined by a plant community formed primarily of a codominance of mid-statured bunchgrasses and rhizomatous grasses with an increase in forbs and shrubs. This is typically a result of non-prescribed grazing removing some of the green needlegrass and alkali sacaton. If present, basin wildrye may be in such low density it no long contributes to the structural integrity of the community. This community is extremely susceptible to invasive non-native species due to an increase in bare ground. Increased bare ground is expected due to a reduction of basal area occupied by the larger bunchgrasses. In this community, cheatgrass potentially exists in a trace amount which poses a risk to the hydrologic function, biotic integrity, and site stability due to its shallow rooting structure and ability to overtake areas.

Pathway 1.1a
Community 1.1 to 1.2

The community pathway from the Reference Bunchgrass Community (1.1) to the Mixed Grass Community (1.2) is primarily driven by improper grazing. When vigor declines enough for plants to die or become smaller, species with higher grazing tolerance, such as western wheatgrass and Sandberg bluegrass, increase in vigor and production as they access the resources previously used by green needlegrass and other tall grasses. Decrease of species composition by weight of the tall grasses to be equal to that of rhizomatous grasses specifically western wheatgrass and thickspike wheatgrass indicates that the reference plant community has shifted to the Mixed Grass Community (1.2). The driver for community shift 1.1A is improper grazing management or prolonged drought. This shift is triggered by the loss of vigor of tall grasses, soil erosion, or prolonged drought coupled with improper grazing. Blaisdell (1958) stated that drought and warmer than normal temperatures are known to advance plant phenology by as much as one month. During drought years, plants may be especially sensitive or in a critical stage of development earlier than expected.

Pathway 1.2a
Community 1.2 to 1.1

The Mixed Grass Community (1.2) will return to the Reference Bunchgrass Community (1.1) with proper grazing management and appropriate grazing intensity. Favorable moisture conditions will facilitate or accelerate this transition. It may take several years of favorable conditions for the community to transition back to a green needlegrass and alkali sacaton dominated state. The driver for this community shift (1.2a) is increased vigor of the tall grasses resulting in increase biomass production and dominance of plant community. The trigger for this shift is the change in grazing management favoring basin wildrye. In general, conservative grazing management styles such as deferred or rest rotations utilizing moderate grazing (less than 50% use) coupled with favorable growing conditions like cool, wet springs are these triggers. These systems tend to promote increases in soil organic matter which promotes microfauna and can increase infiltration rates. Inversely, long periods of rest at a time when this state is considered to be stable may not result in an increase in native bunchgrasses and it has been suggested (Noy-Meir 1975) that these long periods of rest or underutilization may actually drive the system to a lower level of stability by creating large amounts of standing biomass, dead plant caudex centers, and gaps in the plant canopy.

State 2
Shortgrass State

State 2, Shortgrass State, has been altered by long term unmanaged, heavy grazing. In this State, drought conditions may speed the departure from reference.

Community 2.1
Shortgrass Community

The Shortgrass Community (2.1) receives its name by the overall dominance of shortgrasses such as Sandberg bluegrass, inland saltgrass, bottlebrush squirreltail, and alkaligrass. Winterfat is removed from this plant community and replaced by a dominance of black greasewood, saltbush, and plains pricklypear cactus. This is a result of a combination of long term drought and overgrazing (grazing that exceeds 50 percent utilization without proper rest period and/or repeated seasonal use).

State 3
Invaded State

Invaded State is invaded by nonnative herbaceous species primarily cheatgrass, field brome, ventenata, and halogeton. This is often a result of reduced vigor in States 1 and 2. The reduced vigor may be attributed to overgrazing however long-term drought may also trigger reduced vigor of these communities

Community 3.1
Invaded Community

The Invaded Community consists primarily of non-native grasses and forbs. The primary non-native invader species is cheatgrass, however ventenata is known to be present in this MLRA allowing for rapid invasion. There tends to be an increase in sagebrush and greasewood cover. Native grasses are often limited to short bunchgrasses although some taller grasses may exist in the protective bases of shrubs. The increase of annual grasses can increase the intensity and severity of wildfire. The transition to this community is driven by two likely disturbances. The first being repeated heavy, unmanaged grazing and the other is intense fire. These often occur in combination which creates bare ground, depletes organic matter, and increases evapotranspiration. Extensive restoration practices are needed to make this community resemble the Reference State however it will never return to reference due to the severe departure and often loss of soil resources needed to maintain reference. Restoration to a community that resembles reference will require extensive and expensive inputs such as pest management, brush management and range seeding; however, removal of existing species may actually accelerate erosion of the soil surface if not properly managed.

Transition T1
State 1 to 2

This transition is often triggered by long term overgrazing or other human disturbances. Long term drought or altered hydrologic function is also a factor. Short grasses are able to take advantage of limited resources and interspaces between larger bunchgrasses.

Transition T3
State 1 to 3

Invasion of the community by nonnative herbaceous species including cheatgrass, field brome, and halogeton (Halogeton glomerata). Often as a result of long term overgrazing and/or intense fire which reduces vigor of native herbaceous species. This transition is often irreversible to due the high salinity

Restoration pathway R1
State 2 to 1

Improved grazing management with favorable growing conditions may allow deep rooted bunchgrasses to reestablish dominance. Limited prescribed fire may reduce vigor of short grasses and shrubs temporarily.

Transition T2
State 2 to 3

Invasion of the community by nonnative herbaceous species including cheatgrass, field brome, and halogeton (Halogeton glomerata). Often as a result of long term overgrazing and/or intense fire which reduces vigor of native herbaceous species. This transition is often irreversible to due the high salinity.

Additional community tables

Animal community

The Saline Upland Ecological site provides for a variety of wildlife habitat for an array of species. Prior to the settlement of this area, large herds of antelope, elk and bison roamed. Though the bison that once utilized this landscape have been replaced with domestic livestock, wildlife still utilize this largely intact landscape for habitat The relatively high grass component of the Reference Community provides excellent nesting cover for multiple neotropical migratory birds as well as provide hiding habitat for larger animals.
Greater Sage Grouse likely utilize most states of this ecological site as there are high amounts of forbs and insects as a result of the favorable soil moisture. Even in the Shortgrass State, sage grouse will utilize the increased forb and shrub cover for both foraging and hiding cover. This site would be considered critical habitat for most lifestages of Greater Sage Grouse.

Managed livestock grazing is suitable on this site due to the potential to produce an abundance of high quality forage. This is often a preferred site for grazing by livestock, and animals tend to congregate in these areas. In order to maintain the productivity of this site,grazing on adjoining sites with less production must be managed carefully to be sure utilization on this site is not excessive. Management objectives should include maintenance or improvement of the native plant community. Careful management of timing and duration of grazing is important. Shorter grazing periods and adequate deferment during the growing season are recommended for plant maintenance, health, and recovery.
Continual non-prescribed grazing of this site will be injurious, will alter the plant composition and production over time, and will result in transition to the Shortgrass State. Transition to other states will depend on duration of poorly managed grazing as well as other circumstances such as weather conditions and fire frequency. Further degradation will result in transition to the Invaded State. Management should focus on grazing management strategies that will prevent further degradation, such as seasonal grazing deferment or winter grazing where feasible. Communities within this state are still stable and healthy under proper management. Forage quantity and/or quality may be substantially decreased from the Reference State.

Grazing is possible in the Invaded State. Invasive species are generally less palatable than native grasses. Forage production is typically greatly reduced in this state. Due to the aggressive nature of invasive species, sites in the Invaded State face increased risk for further degradation. Grazing has to be carefully managed to avoid further soil loss and degradation and possible livestock health issues.

Prescriptive grazing can be used to manage invasive species. In some instances, carefully targeted grazing (sometimes in combination with other treatments) can reduce or maintain species composition of invasive species.

Hydrological functions

The hydrologic cycle functions best in the Reference State (1) with good infiltration and deep percolation of rainfall; however, the cycle degrades as the vegetation community declines. Rapid rainfall infiltration, high soil organic matter, good soil structure, and good porosity accompany high bunchgrass canopy cover. High ground cover reduces rain drop impact on the soil surface, which keeps erosion and sedimentation transport low. Water leaving the site will have minimal sediment load, which allows for high water quality in associated streams. High rates of infiltration will allow water to move below the rooting zone during periods of heavy rainfall. The Reference Bunchgrass Community (1.1) should have no rills or gullies present and drainage ways should be vegetated and stable. 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 wind or water.

Improper grazing management results in a community shift to the Mixed Bunchgrass Community (1.2). This plant community has a similar canopy, cover, but only slightly higher bare ground. Therefore, the hydrologic cycle is functioning at a level similar to the water cycle in the Reference Bunchgrass Community (1.1).

In the Invaded State (3) canopy and ground cover are greatly reduced compared to the Reference State (1), which impedes the hydrologic cycle. Infiltration will decrease and runoff will increase due to reduced ground cover, presence of shallow-rooted species, rainfall splash, soil capping, reduced organic matter, and poor structure. Sparse ground cover and decreased infiltration can combine to increase frequency and severity of flooding within a watershed. Soil erosion is accelerated, quality of surface runoff is poor, and sedimentation increases.

Recreational uses

This site provides some limited 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.

Wood products

n/a

Other products

n/a

Inventory data references

Information presented was derived from NRCS inventory data, National Resources Inventory (NRI) Data, literature, field observations, and personal contacts with range-trained personnel (i.e., used professional opinion of agency specialists, observations of land managers, and outside scientists).

Other references

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Contributors

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Approval

Kirt Walstad, 9/07/2023

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	08/05/2020
Approved by	Kirt Walstad
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 35-40%. 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 4-5 under plant canopies and 3-4 in canopy 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 3 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 Saline Upland ecological site is moderately slow to moderate but is well drained. Site has inherent slow infiltration due to clay content of soil. An even distribution of cool season shortgrasses (30%), warm season bunchgrasses (30%), rhizomatous grass (30%), forbs (5%), and shrubs (5%) is the most efficient community for infiltration and reduce runoff for this site.

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. Soil profile may contain an abrupt transition to an Argillic horizon which can be misinterpreted as compaction, however, the soil structure will be fine to medium subangular blocky, where a compaction layer will be platy or structureless (massive).

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: Dominant: mid-statured, warm season, perennial bunchgrasses (Primarily alkali sacaton) = cool season midstatured bunchgrasses (green needlegrass, bluebunch wheatgrass) = rhizomatous grasses (western wheatgrass, plains reedgrass) > cool season short bunchgrasses (Sandberg (alkali) bluegrass, bottlebrush squirreltail)

    Sub-dominant: Shrubs = forbs

Other:

Additional:

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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.

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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.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Average annual production is 750. Low: 625 High 900. Production varies based on effective precipitation and natural variability of soil properties for this ecological site.

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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:** Potential invasive (including noxious) species (native and non-native). Invasive species on this ecological site include (but not limited to) annual brome spp, crested wheatgrass, pale alyssum, field pennycress (fanweed)

    Native species such as broom snakeweed, alkali sacaton, inland saltgrass, greasewood, Sandberg (alkali) bluegrass, curlycup gumweed, blue grama, pricklypear cactus etc. when their populations are significant enough to affect ecological function, indicate site condition departure.

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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.
