USDA Natural Resources Conservation Service

Ecological site EX043B23B110
Dense Clay (DC) Absaroka Upper Foothills

Last updated: 3/04/2024
Accessed: 05/07/2024

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.

MLRA notes

Major Land Resource Area (MLRA): 043B–Central Rocky Mountains

43B – Central Rocky Mountains – The Central Rocky Mountains extends from northern Montana to southern extent of Wyoming and from Idaho to central Wyoming. The southern extent of 43B is comprised of a combination of metamorphic, igneous, and sedimentary mountains and foothills. Climatic changes across this extent are broad and create several unique breaks in the landscape.

Further information regarding MLRAs, refer to: United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296.
Available electronically at: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_053624#handbook.

LRU notes

Land Resource Unit (LRU) 43B23B: Absaroka Upper Foothills

Based on the shifts in geology, precipitation patterns and other climatic factors, as well as elevations and vegetation, the Absaroka Range was divided into LRU 23. Further division of this LRU is necessary due to the gradient moving from the foothills to the summit, as well as aspect shifts (north/east face versus south/west face). Subset B is set for the higher elevations within the foothills, with 15 to 19 inches of precipitation. To verify or identify Subset B (the referenced subset for this ecological site), refer to the Wyoming LRU matrix key contained within the Ecological Site Key. This particular LRU/Subset occurs along the eastern foothills of the Absaroka Range. This LRU starts north of Clark, WY and runs to the Thermopolis, WY area. Once the foothills cross into the Northern Beartooth Range, the climatic patterns and elevational changes shifts the plant community and allows for a break in LRU's near the Montana state line. As the LRU follows to the south and then tracks east to the intersection of the Absaroka Range and the Owl Creek Range, the face changes aspect and geology creating a shift in plant dynamics and a break in the LRU. The extent of soils currently correlated to this ecological site does not fit within the digitized boundary. Many of the noted soils are provisional and will be reviewed and corrected in mapping update projects. Other map units are correlated as small inclusions within other MLRA’s/LRU’s based on elevation, landform, and biological references.

Moisture Regime: Typic Ustic
Temperature Regime: Frigid
Dominant Cover: Rangeland – Sagebrush Steppe (major species is Mountain Big Sagebrush)
Representative Value (RV) Effective Precipitation: 15-19 inches (381 – 483 mm)
RV Frost-Free Days: 37 - 80 days

Classification relationships

Relationship to Other Established Classification Systems:

National Vegetation Classification System (NVC):
2 Shrub & Herb Vegetation Class
2.B Temperate & Boreal Grassland & Shrubland Subclass
2.B.2 Temperate Grassland & Shrubland Formation
2.B.2.Na Western North American Grassland & Shrubland Division Division
M048 Central Rocky Mountain Montane-Foothill Grassland & Shrubland Macrogroup
G273 Central Rocky Mountain Lower Montane, Foothill & Valley Grassland Group

Ecoregions (EPA):
Level I: 10 North American Deserts Level II: 10.1 Cold Deserts
Level III: 10.1.18 Wyoming Basin
Level IV: 10.1.18.d Foothills and Low Mountains

Ecological site concept

• Site receives no additional water.
• Slope is <30%
• Soils are:
o Moderately deep to very deep (<20-80+ in. (50-200+ cm)
o Not skeletal (<35% rock fragments) within 20” (50 cm) of mineral soil surface
o None to Slightly effervescent throughout top 20” (50 cm) of mineral soil surface
o Non-saline, sodic, or saline-sodic
o Textures range from sandy clay loam to clay in top 4” (10 cm) of mineral soil surface
o Clay content is < 35% in top 4” (10 cm) of mineral soil surface
o All subsurface horizons in the particle size control section have a weighted average of ≥ 40% clay. (The particle size control section is the segment of the profile from either the start of an argillic horizon for 50 cm’s or from 25-100 cm’s).

The Dense Clay ecological site is based on heavy clay soils that develop large cracks at the surface when dry. Site has a thin cap of coarser soils on the surface. This community is dominated by birdfoot sagebrush, but with the increased precipitation will have mountain big sagebrush.

Associated sites

EX043B23B104	**Clayey (Cy) Absaroka Upper Foothills** Clayey ecological site does not have the abrupt clay increase and cracking to inhibit plant growth. It generally occurs on around isolated patches of Dense Clay communities.
EX043B23B140	**Saline Lowland Drained (SLDr) Absaroka Upper Foothills** Saline Lowland Drained ecological sites will occur in close proximity and interspersed with Dense Clay along the toe-slopes of benches and on stream terraces.

Similar sites

EX043B23B104	**Clayey (Cy) Absaroka Upper Foothills** Clayey ecological site does not have the abrupt clay increase and cracking to inhibit plant growth. It generally occurs on around isolated patches of Dense Clay communities.
EX043B23B154	**Shale (Sh) Absaroka Upper Foothills** Similar in appearnce with Shale being shallow to salt bearing soils where Dense Clay is lacking the chemistry.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia pedatifida* (2) *Artemisia tridentata ssp. vaseyana*

Herbaceous	(1) *Elymus albicans* (2) *Elymus elymoides*

Legacy ID

R043BX610WY

Physiographic features

The Dense Clay ecological site will usually occur in lower landscape position, on flat to moderately sloping land. It is found on all exposures. Slopes are mostly 5 to 30 percent.

Table 2. Representative physiographic features

Landforms	(1) Foothills > Fan apron (2) Foothills > Fan remnant (3) Foothills > Colluvial apron
Runoff class	Medium to very high
Ponding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Ponding frequency	None to occasional
Elevation	1,829–2,743 m
Slope	0–30%
Aspect	Aspect is not a significant factor

Climatic features

Annual precipitation and modeled relative effective annual precipitation ranges from 15 to 19 inches (381 – 483 mm). The normal precipitation pattern shows peaks in June tapering into September. This amounts to about 50 percent of the mean annual precipitation. Average snowfall is about 150 inches annually. Wide fluctuations may occur in yearly precipitation and result in more dry years than those with more than normal precipitation.
Because of the varied topography, the wind will vary considerably for different parts of the area. The wind is usually much lighter at the lower elevations and in the valleys as compared with the higher terrain. The average winter wind velocity is 8.5 mph while the summer wind velocity averages 7.5 mph. Winds during storms and on ridges may exceed 45 mph.
Temperatures show a wide range between summer and winter and between daily maximums and minimums, due to the high elevation and dry air, which permits rapid incoming and outgoing radiation. Cold air outbreaks from Canada in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Chinook winds may occur in winter and bring rapid rises in temperature. High winds are generally blocked by high mountains but occur in conjunction with thunderstorms, which are common in late summer. Growth of native cool-season plants begins about May 1 to May 15 and continues until about October 15.
For detailed information visit the Natural Resources Conservation Service National Water and Climate Center at http://www.wcc.nrcs.usda.gov/. Historically, Crandall Creek was the representative weather stations within this subset. However, Sunshine 3NE, Tower Falls, Yellowstone Pk Mammoth are the only weather stations available to select within a close proximity in location and characteristics of this subset. The following graphs and charts are a collective sample representing the averaged normals and 30-year annual rainfall data for the selected weather stations from 1981 to 2010.

Table 3. Representative climatic features

Frost-free period (characteristic range)	17-57 days
Freeze-free period (characteristic range)	43-100 days
Precipitation total (characteristic range)	356-406 mm
Frost-free period (actual range)	5-65 days
Freeze-free period (actual range)	22-108 days

Precipitation total (actual range)	356-406 mm
Frost-free period (average)	36 days
Freeze-free period (average)	70 days
Precipitation total (average)	381 mm

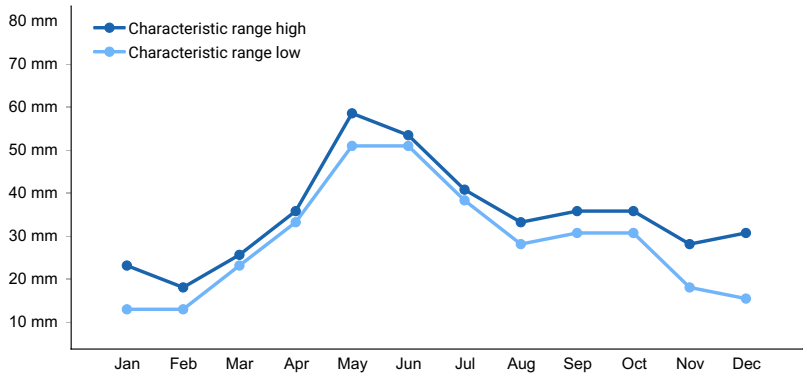


Figure 1. Monthly precipitation range

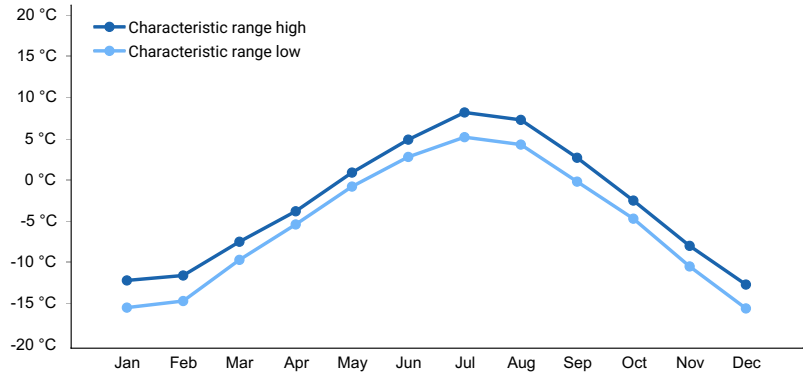


Figure 2. Monthly minimum temperature range

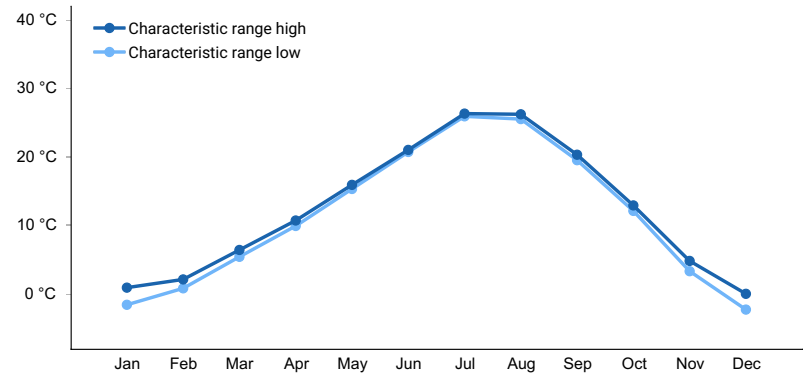


Figure 3. Monthly maximum temperature range

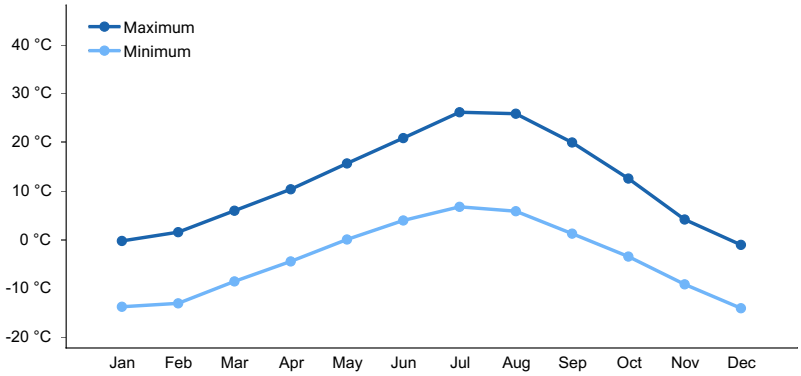


Figure 4. Monthly average minimum and maximum temperature

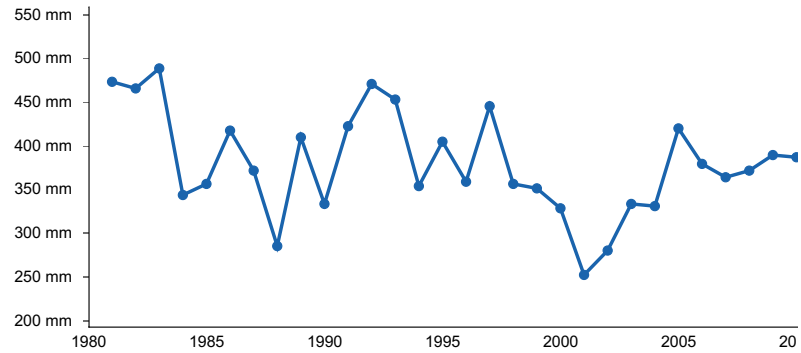


Figure 5. Annual precipitation pattern

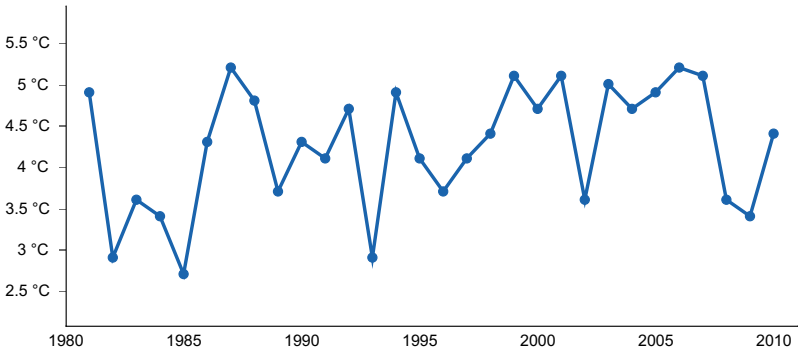


Figure 6. Annual average temperature pattern

Climate stations used

- (1) SUNSHINE 3NE [USC00488758], Meeteetse, WY
- (2) TOWER FALLS [USC00489025], Yellowstone National Park, WY
- (3) YELLOWSTONE PK MAMMOTH [USC00489905], Yellowstone National Park, WY

Influencing water features

The characteristics of these upland soils have no influence from ground water (water table below 60 inches (150 cm)) and have minimal influence from surface water/overland flow. Periods of ponding during storm events may occur, but have little to no effect on the vegetation of the site. Water restriction and movement off site are the key drivers of the vegetation, creating a dry or droughty appearance.

Soil features

The soils of this site are very shallow (less than 10 inches) to very deep, well to poorly drained soils formed in alluvium or alluvium over residuum. Layers of the soil most influential to the plant community varies from 3 to 6 inches thick. These soils have slow to very slow permeability. The topsoil, except for thin ineffectual layers, will be heavy clays and/or soils that develop large cracks when dry and are very sticky when wet. These sites typically

have moderate saline and /or alkaline soils, but high amounts of soluble salt can occur. The soil characteristics having the most influence on plants are the very slow infiltration rate, which reduces the available moisture, and the amount of soluble salts.

Table 4. Representative soil features

Parent material	(1) Slope alluvium–igneous, metamorphic and sedimentary rock (2) Colluvium–interbedded sedimentary rock (3) Residuum–shale
Surface texture	(1) Clay (2) Clay loam (3) Sandy clay loam (4) Silty clay
Drainage class	Moderately well drained to well drained
Permeability class	Very slow to slow
Soil depth	51 cm
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0–5%
Available water capacity (Depth not specified)	1.42–16 cm
Clay content (10.2-50.8cm)	40–60%
Electrical conductivity (Depth not specified)	0–4 mmhos/cm
Soil reaction (1:1 water) (Depth not specified)	6.8–8.2
Subsurface fragment volume <=3" (Depth not specified)	0–10%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

Potential vegetation on the Dense Clay ecological site is dominated by drought resistant, mid-stature cool-season perennial grasses and shrubs. The expected potential composition for this site is 50 percent grasses, 10 percent forbs and 40 percent woody plants. The composition and production will vary naturally due to historical use and fluctuating precipitation.

As this site deteriorates, species such as Sandberg bluegrass and birdfoot sagebrush will increase. Weedy annuals will invade. Cool season grasses such as rhizomatous wheatgrass, bottlebrush squirreltail, and Indian ricegrass will decrease in frequency and production.

Due to the amount and pattern of the precipitation, in combination with soil limitations, the birdfoot sagebrush component does not increase in productivity or resilience as may be expected in this higher precipitation zone. The presence of mountain big sagebrush is possible because of the increased precipitation, however, it may not be as resilient.

The reference plant community (description follows the plant community diagram) has been determined by study of relic rangeland sites, or areas protected from excessive disturbance. Trends in plant communities going from heavily grazed areas to lightly grazed areas, seasonal use pastures, and historical accounts have also been used.

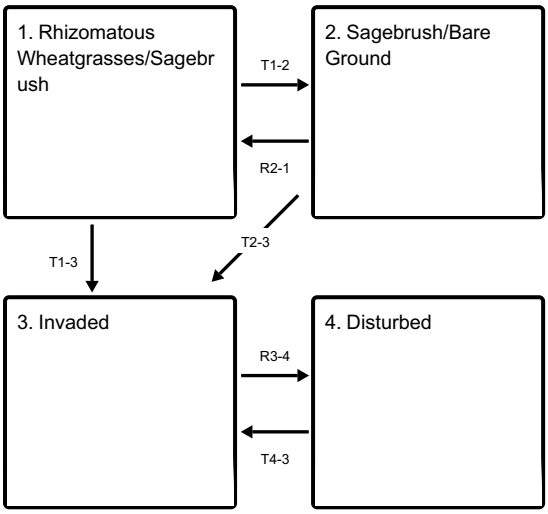
The following is a State and Transition Model (STM) Diagram for this ecological site. An STM has five fundamental components: states, transitions, restoration pathways, community phases and community pathways. The state, designated by the bold box, is a single community phase or suite of community phases. The reference state is

recognized as State 1. It describes the ecological potential and natural range of variability resulting from the natural disturbance regime of the site. The designation of alternative states (State 2, etc) in STMs denotes changes in ecosystem properties that cross a certain threshold.

Transitions are represented by the arrows between states moving from a higher state to a lower state (State 1 - State 2) and are denoted in the legend as a “T” (T1-2). They describe the variables or events that contribute directly to loss of state resilience and result in shifts between states. Restoration pathways are represented by the arrows between states returning back from a lower state to a higher state (State 2 - State 1 or better illustrated by State 1

State and transition model

Ecosystem states



T1-2 - Frequent and severe use is the driver of this transition.

T1-3 - Drought alone or with other surface disturbances, including grazing, with a seed source present will force this transition.

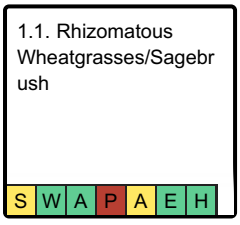
R2-1 - Long-term prescribed grazing will convert this community phase.

T2-3 - Repeated extensive use by recreational traffic, livestock or others with seed sources present leave this state at risk of transitioning to the Invaded State.

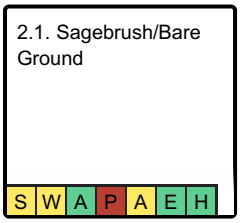
R3-4 - Seeding, soil amendments, weed control and prescribed grazing will aid in recovery of this site.

T4-3 - Drought alone or with other surface disturbances, including grazing, with a seed source present will force this transition.

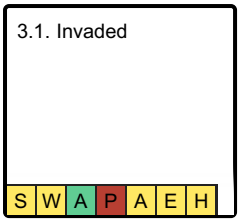
State 1 submodel, plant communities



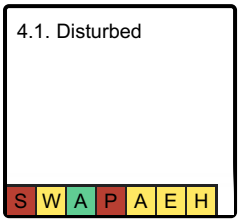
State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 submodel, plant communities



State 1
Rhizomatous Wheatgrasses/Sagebrush

The Dense Clay ecological site is generally small on the landscape, but is also very distinct with the low vegetative profile. This birdfoot sagebrush and dwarfed mountain big sagebrush dominated site is prominently displayed in a patchwork with vigorous mountain big sagebrush of neighboring ecological sites. The herbaceous cover consists of a mixture of mid-stature and short-stature cool-season bunchgrasses and rhizomatous grasses.

Characteristics and indicators. A diverse mixture of key perennial grasses, forbs and short-stature sagebrush is the key characteristic of this State. The high clay content causes significant surface cracking and plants are limited in ground cover as well as in canopy because of the droughty soil conditions.

Resilience management. The vegetation of this State are resilient to drought and and frequent use, creating a community that tends to be resistant to degradation. However, with long-term or repeated pressures, this community will begin to lose the herbaceous understory.

Community 1.1
Rhizomatous Wheatgrasses/Sagebrush

Figure 7. A comparison of a Dense Clay ecological site in the foreground, and a Clayey ecological site in the background.

Figure 8. A closer view of Dense Clay site, this community is degrading towards State 2.

The interpretive plant community for this site is the Reference State. This state evolved with grazing by large herbivores and very droughty soils due to the very slow infiltration rate. Potential vegetation is dominated by drought resistant, mid-stature cool-season perennial grasses and shrubs. The expected potential composition for this site is about 60 percent grasses, 15 percent forbs and 25 percent woody plants. The major grasses include rhizomatous wheatgrasses, bottlebrush squirreltail, and Indian ricegrass. A variety of forbs and half-shrubs also occur, as shown in the preceding table. Mountain big sagebrush and birdfoot saltbush comprise almost half of the total annual production. Winterfat is a common component found on this site. A variety of forbs also occurs in this state and plant diversity is high (see Plant Composition Table). The total annual production (air-dry weight) of this state is about 400 pounds per acre, but it can range from about 200 lbs/acre in unfavorable years to about 600 lbs./acre in above average years.

Resilience management. This state is extremely stable and well adapted to the variable climatic conditions. The diversity in plant species allows for high drought resistance. This is a sustainable plant community (site/soil stability, watershed function, and biologic integrity).

Dominant plant species

- birdfoot sagebrush (*Artemisia pedatifida*), shrub
- mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- western wheatgrass (*Pascopyrum smithii*), grass
- squirreltail (*Elymus elymoides*), grass
- prairie Junegrass (*Koeleria macrantha*), grass
- spiny phlox (*Phlox hoodii*), other herbaceous
- Indian paintbrush (*Castilleja*), other herbaceous
- American vetch (*Vicia americana*), other herbaceous

Dominant resource concerns

- Sheet and rill erosion
- Compaction
- Terrestrial habitat for wildlife and invertebrates
- Inadequate livestock shelter
- Inadequate livestock water quantity, quality, and distribution

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	140	325	476
Shrub/Vine	78	112	168
Forb	6	11	28
Total	**224**	**448**	**672**

Table 6. Soil surface cover

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

Table 7. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-5%	0-5%	0-5%
>0.15 <= 0.3	–	5-15%	15-50%	0-10%
>0.3 <= 0.6	–	0-5%	0-15%	0-5%
>0.6 <= 1.4	–	–	–	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

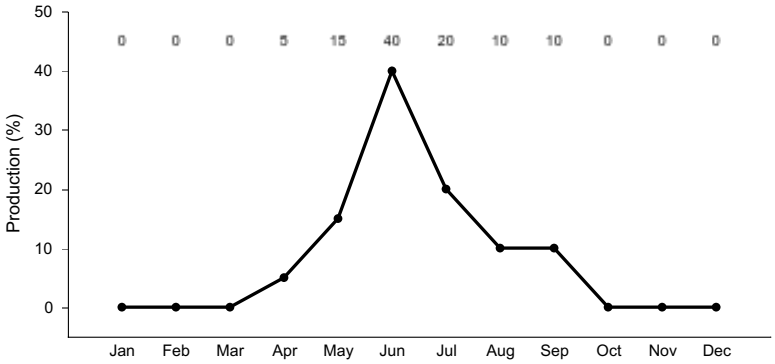


Figure 10. Plant community growth curve (percent production by month). WY0601, 15-19E all upland sites.

State 2
Sagebrush/Bare Ground

The harsh environment presented by the soils of the Dense Clay ecological site limit the persistence of most perennial grasses. Although, the species that are key to this site are resilient species, after long term pressure, the community will shift to a sagebrush community with significant bare ground.

Characteristics and indicators. The lack of herbaceous vegetation within the sagebrush canopy is the key indication of being in this community. A small cover of forbs may occur a scattering of short-stature grasses, but most grasses are not present.

Resilience management. Once this community has established recruitment of key grasses is difficult making this community resilient and resistant to change. The tight soil surface, and droughty nature of the fine textured soils, limits seedling establishment.

Community 2.1
Sagebrush/Bare Ground

Figure 11. Grasses are reduced to a few short stature cool-season bunchgrasses, and bare ground has significantly increased.

This plant community is the result of frequent and severe grazing and is exacerbated by prolonged periods of drought. Low stature sagebrush dominates this plant community, as the annual production is in excess of 50 percent. The preferred cool-season grasses have been eliminated or greatly reduced. The dominant grass is prairie Junegrass, Sandberg bluegrass, and mutton bluegrass. Plant diversity is poor. The interspaces between plants have expanded significantly leaving mostly bare ground. When compared to the Reference State, the perennial cool-season grasses are significantly reduce and key species may be absent; and sagebrush cover is dominant. It is pertinent to note that total cover of sagebrush does not increase overall, except for possible increases in fringed sagewort. The loss of herbaceous cover is the difference in composition for this plant community. The total annual production (air-dry weight) of this state is about 300 pounds per acre, but it can range from about 150 lbs/acre in unfavorable years to about 550 lbs./acre in above average years.

Resilience management. This plant community is resistant to change as the stand becomes more decadent. Continued frequent and severe grazing or the removal of grazing does not seem to affect the plant composition or structure of the plant community. Plant diversity is greatly altered and the herbaceous component is not intact. Recruitment of perennial grasses is not occurring and the replacement potential is absent. The biotic integrity is missing. Soil erosion is accelerated because of increased bare ground. Water flow patterns and pedestalling are obvious. Infiltration is reduced and runoff is increased. Rill channels are noticeable in the interspaces and gullies are being establishing where rills have concentrated down slope. The watershed may or may not be functional.

Dominant plant species

- birdfoot sagebrush (*Artemisia pedatifida*), shrub
- mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- prairie Junegrass (*Koeleria macrantha*), grass

- Sandberg bluegrass (*Poa secunda*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- American vetch (*Vicia americana*), other herbaceous
- spiny phlox (*Phlox hoodii*), other herbaceous
- leafy wildparsley (*Musineon divaricatum*), other herbaceous

Dominant resource concerns

- Sheet and rill erosion
- Classic gully erosion
- Compaction
- Sediment transported to surface water
- Plant productivity and health
- Plant structure and composition
- Terrestrial habitat for wildlife and invertebrates
- Feed and forage imbalance
- Inadequate livestock shelter
- Inadequate livestock water quantity, quality, and distribution

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	112	168	308
Grass/Grasslike	56	157	280
Forb	–	11	28
Total	**168**	**336**	**616**

Table 9. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	0%
Grass/grasslike basal cover	0%
Forb basal cover	0%
Non-vascular plants	0%
Biological crusts	0-5%
Litter	5-20%
Surface fragments >0.25" and <=3"	0-10%
Surface fragments >3"	0-5%
Bedrock	0%
Water	0%
Bare ground	25-40%

State 3
Invaded

This state, the Invaded State, is less conspicuous than neighboring ecological sites. Cheatgrass and other invasive species will establish in this community, but do not tend to become extensive. The restrictive traits of the dense clays limit seedling establishment of most weedy species. Field cottonrose, thistle, and cheatgrass are potential invaders.

Characteristics and indicators. The significant presence of an invader species, at least 5 percent by cover, qualifies a State as being invaded. The species of consideration are any non-native species, listed noxious weed

(native or introduced) and species of local concerns (weed issues).

Resilience management. As annuals or other invasive species increase the native grasses are weakened and will be significantly reduced in the community. This limited community is resistant and resilient against change. Cheatgrass may be a common threat, but unlike other sagebrush communities, the woody cover is able to maintain and prevent the dense monoculture stands of Cheatgrass. The corresponding fire risk of cheatgrass is muted by the reduced fine fuels.

Community 3.1
Invaded

The major invasive species that are moving up into the foothill regions are: Cheatgrass, Russian Knapweed, Whitetop, and a variety of thistles. Cheatgrass is the major threat to the foothills. The potential risk of becoming a monoculture of Cheatgrass has been minimal on the Dense Clay ecological site due to the low herbaceous potential pre-disturbance. Many of these areas are used frequently by recreationalists for 4-wheeling, shooting, etc due to the open barren nature. With the increased “traffic” and corresponding increase in soil disturbance provides for a more prevalent and abundant seed source as well as improved seedling establishment created by the loosening of the soil surface.

Resilience management. This plant community is resistant to change as the stand becomes more decadent. Continued frequent and severe grazing, or the removal of grazing, does not seem to affect the plant composition or structure of this plant community. Plant diversity is greatly altered and the herbaceous component is not intact. Recruitment of perennial grasses is not occurring and the replacement potential is minimal. The biotic integrity is missing.

Dominant plant species

- birdfoot sagebrush (*Artemisia pedatifida*), shrub
- mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- Sandberg bluegrass (*Poa secunda*), grass
- sixweeks fescue (*Vulpia octoflora*), grass
- cheatgrass (*Bromus tectorum*), grass
- thistle (*Cirsium*), other herbaceous
- field cottonrose (*Logfia arvensis*), other herbaceous
- whitetop (*Cardaria draba*), other herbaceous

Dominant resource concerns

- Classic gully erosion
- Compaction
- Sediment transported to surface water
- Plant productivity and health
- Plant structure and composition
- Terrestrial habitat for wildlife and invertebrates
- Feed and forage imbalance
- Inadequate livestock shelter
- Inadequate livestock water quantity, quality, and distribution

State 4
Disturbed

This state is a dynamic state to capture those communities that have been disturbed or altered due to alternative uses including recreation, farming, energy development and other general land uses with soil surface disturbances.

Characteristics and indicators. The visual signs of disturbance or manipulation are obvious in the soil surface and vegetation patterns. The presence of seeded species is a key indication of an altered landscape, or the visible rows of vegetation that will persist for years following a drill seeding. Many times, pitting or surface roughening techniques will remain visible on the soil for significant periods of time.

Resilience management. The level and extent of disturbance varies greatly between uses. These are all factors considered in the following Community description and limits the resilience and resistance.

Community 4.1
Disturbed

This ecological site is generally small in size on the landscape, and is intermixed with other productive sites. So many times, these areas are used for parking vehicles or are incidental in many other land alteration practices, and are not a focus for management. Increased vehicle or motorized traffic, reacreational uses, and lounging areas for livestock and wildlife can significantly impact these areas. The barren tendancy/nature of this ecological site provides an easy location for a salt lick or mineral tub. As this increased pressure impacts the vegetation shifts to an annual driven community, until time or rest is provided to allow natural succession to occur or reclamation of the site occurs. Natural succession is slow, and limited by the droughty nature of the soils. Seeding is also difficult, but has proven more successful with higher precipitation.

Resilience management. Climatic conditions and soil limitations restrict the feasibility of manipulating the native vegetation or degraded sites with much success. Additional inputs to help improve soil quality as well as artificial watering systems to assist in seedling establishment have been costly, and troublesome. Irrigating/watering these sites has created issues with surface crusting, inhibiting seedling emergence. Intensity and timing of natural precipitation is limiting, but has had greater success than at lower elevations. Areas have had acceptable establishment with introduced or improved plant varieties.

Dominant resource concerns

- Sheet and rill erosion
- Classic gully erosion
- Compaction
- Sediment transported to surface water
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Terrestrial habitat for wildlife and invertebrates
- Feed and forage imbalance
- Inadequate livestock shelter
- Inadequate livestock water quantity, quality, and distribution

Transition T1-2
State 1 to 2

Frequent and severe grazing, will convert the plant community to the Birdfoot Sagebrush/*Bare Ground* Community Phase. The probability of this occurring is high on areas where birdfoot sagebrush is not adversely impacted by heavy browsing and prolong drought has occurred.

Constraints to recovery. The ability for native grasses to establish in this tough soil.

Transition T1-3
State 1 to 3

Drought, Disturbance or Over-use with Seed Source present - When drought or a disturbance such as over-use by grazers occurs the vulnerability of the state is opened and when there is a seed source present, invasive species can gain a foot hold quickly due to the open canopy and low plant density.

Constraints to recovery. Recovery is limited to the ability to control or eradicate the species of invasion.

Restoration pathway R2-1
State 2 to 1

Prescribed grazing or possibly long-term prescribed grazing, will convert this plant community to the Reference

State. The probability of this occurring is high especially if rotational grazing along with short deferred grazing is implemented as part of prescribed method of use. Brush management is not usually necessary at the time these grazing systems are implemented.

Context dependence. The seed bank or nursery stock is needed to aid the recovery process in the system.

Transition T2-3
State 2 to 3

Continued Disturbance or Lack of Use/Management with Seed Source present - Repeated extensive use by recreational traffic is common on the raw or "disturbed" appearance of reclaimed or manipulated areas. These at-risk locations are vulnerable to weed encroachment, especially by aggressive invasive species that are persistent within the Big Horn Basin and lower foothills. Cheatgrass has seed sources readily available and easily transported on tires, undercarriages, animals, and humans. With continued presence of activity or movement through disturbed or establishing communities, the risk of transitioning to an invaded state increases.

Constraints to recovery. The ability to control the invasive species is the major constraint to recovery for this community.

Restoration pathway R3-4
State 3 to 4

Grazing management after the use of seedings following soil amendments or other techniques to aid establishment of native or improved varieties and an intense weed management plan will aid the recovery of this community.

Transition T4-3
State 4 to 3

Drought, Disturbance or Over-use with Seed Source present - When drought or a disturbance such as over-use by grazers occurs the vulnerability of the state is opened and when there is a seed source present, invasive species can gain a foot hold quickly due to the open canopy and low plant density.

Constraints to recovery. Recovery is limited to the ability to control or eradicate the species of invasion.

Additional community tables

Table 10. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrasses**			56–392	
	western wheatgrass	PASM	*Pascopyrum smithii*	56–224	10–30
	Montana wheatgrass	ELAL7	*Elymus albicans*	0–112	0–20
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–56	0–10
2	**Mid-stature Cool-season Bunchgrasses**			0–112	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–56	0–5
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	0–56	0–5
3	**Short-stature Cool-season Bunchgrasses**			0–56	
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–28	0–5
	Sandberg bluegrass	POSE	*Poa secunda*	0–28	0–5
	muttongrass	POFE	*Poa fendleriana*	0–28	0–5
4	**Miscellaneous Grasses/Grass-likes**			0–28	
	needleleaf sedge	CADU6	*Carex duriuscula*	0–28	0–5
	Grass, perennial	2GP	*Grass, perennial*	0–28	0–5
Forb					
5	**Perennial Forbs**			6–28	
	Indian paintbrush	CASTI2	*Castilleja*	0–28	0–5
	milkvetch	ASTRA	*Astragalus*	0–28	0–5
	American vetch	VIAM	*Vicia americana*	0–28	0–5
	leafy wildparsley	MUDI	*Musineon divaricatum*	0–28	0–5
	spiny phlox	PHHO	*Phlox hoodii*	0–28	0–5
	Forb, perennial	2FP	*Forb, perennial*	0–28	0–5
Shrub/Vine					
6	**Dominant Shrubs**			56–112	
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	0–112	0–20
	birdfoot sagebrush	ARPE6	*Artemisia pedatifida*	0–56	0–20
7	**Miscellaneous Shrubs**			0–56	
	prairie sagewort	ARFR4	*Artemisia frigida*	0–28	0–5
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–28	0–5
	Shrub, other	2S	*Shrub, other*	0–28	0–5

Animal community

Animal Community – Wildlife Interpretations:

1.1 – Sagebrush/Rhizomatous Wheatgrasses: This plant community exhibits a low level of plant species diversity. It may have forage value for antelope and deer, but in most cases is not a desirable plant community due to the lack of cover and selectivity by the wildlife. It is not, for most cases, a desirable plant community to select for in wildlife habitat management. Due to the open and exposed nature of this community, it may be a location for sage grouse leks, if there is edge effect provided by a mountain big sagebrush site surrounding the birdfoot sagebrush community.

2.1 – Sagebrush/*Bare Ground*: This plant community exhibits a low level of plant species diversity. It may have

forage value for antelope and deer, but in most cases is not a desirable plant community due to the lack of cover and selectivity by the wildlife. It is not, for most cases, a desirable plant community to select for in wildlife habitat management. Due to the open and exposed nature of this community, it may be a location for sage grouse leks, if there is edge effect provided by a sagebrush site surrounding the birdfooth community.

3.1 – Invaded: This plant community exhibits a low level of plant species diversity. It is not a desirable plant community to select as a wildlife habitat management objective. However, seeds produced by many of the invasive species serve as a forage source for sage grouse and other birds as well as grassland obligate small mammals.

4.1 – Disturbed: This is not a desirable plant community to select as a wildlife habitat management objective. After establishment, this community exhibits a low level of plant species diversity. However, seeds produced by seeded species may serve as a forage source for sage grouse and other birds as well as grassland obligate small mammals. Depending upon the stage of succession, or selected seed mixture, locations may vary widely on value for wildlife habitat management.

Animal Community – Grazing Interpretations:

The following table lists suggested stocking rates for cattle under continuous, season-long grazing with normal growing conditions. These are conservative estimates that should be used only as guidelines in the initial stages of the conservation planning process. Often, the current plant composition does not entirely match any particular plant community (as described in this ecological site description). Because of this, a field visit is recommended in all cases, to document plant composition and production. More precise carrying capacity estimates should eventually be calculated using this information along with animal preference data, particularly when grazers other than cattle are involved. Under more intensive grazing management, improved harvest efficiencies can result in an increased carrying capacity. If distribution problems occur, stocking rates must be reduced to maintain plant health and vigor.

Plant Community Production Carrying Capacity*
The carrying capacity is calculated as the production (normal year) X .25 efficiency factor / 912.5 lbs. /AUM (Animal Unit Month, the amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month) to calculate the AUMs/Acre.

Plant Community Description/Title Lbs./Acre AUM/Acre* Acres/AUM*
Below Ave. Normal Above Ave.
1.1 Sagebrush/Rhizomatous Wheatgrasses 200-400-600 0.07 14.6
2.1 Sagebrush/*Bare Ground* 150-300-550 0.08 12.2
3.1 Invaded ** ** ** ** **
4.1 Disturbed ** ** ** ** **

* - Carrying capacity is figured for continuous, season-long grazing by cattle under average growing conditions.
** - Sufficient data for invaded and reclaimed communities has not yet been collected or evaluated, so no projection of a stocking rate recommendation or production range will be established at this time.

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide yearlong forage for cattle, sheep, or horses. During the dormant period, the forage for livestock use must be supplemented with protein because the forage quality does not meet minimum livestock requirements.

Distance to water, shrub density, and slope can affect carrying capacity (grazing capacity) within a management unit. Adjustments should be made for the area that is considered necessary for reduction of animal numbers. For example, 30 percent of a management unit may have 25 percent slopes and distances of greater than one mile from water; therefore, the adjustment is only calculated for 30 percent of the unit (i.e. 50 percent reduction on 30 percent of the management unit).

Fencing, slope length, management, access, terrain, kind and class of livestock, and breeds are all factors that can increase or decrease the percent of grazeable acres within a management unit. Adjustments should be made that incorporate these factors when calculating stocking rates.

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group C and D. Infiltration ranges from slow to very slow. Runoff potential for this site varies from high to very high depending on soil hydrologic group and ground cover. In many cases, areas with greater than 75% ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where short-grasses form a strong sod and dominate the site. Areas where ground cover is less than 50% have the greatest potential to have reduced infiltration and higher runoff (refer to Part 630, NRCS National Engineering Handbook for detailed hydrology information).

Rills and gullies should not typically be present. Water flow patterns should be barely distinguishable if at all present. Pedestals are only slightly present in association with bunchgrasses. Litter typically falls in place, and signs of movement are not common. Chemical and physical crusts are rare to non-existent. Cryptogamic crusts are present, but only cover 1-2% of the soil surface.

Recreational uses

This site provides limited hunting opportunities for upland game species. Because of the raw nature of these sites, cultural artifacts can be viewed in the area of these sites especially along the drainageways that dissect the area. The locations generally are close or include a diverse geology that offers a chance to explore the unique and varied geology of the area. This ecological site, however, proves to be very limited in association with roadways and trails in relation to erosion potential and functionality. The soils will be sticky or slick when wet and are more erosive than other associated ecological sites. These soils must be taken into consideration when crossing the area with trails or roadways. The site generally is rough as well, and provides no soft cover for camping or resting.

Wood products

No appreciable wood products are present on the site.

Other products

This site is limited with minimal vegetative cover to provide other products.

Inventory data references

Information presented in the original site description was derived from NRCS inventory data. Field observations from range-trained personnel also were used . Those involved in developing the original site include Chris Krassin, Range Management Specialist, NRCS and Everet Bainter, Range Management Specialist. Other sources used as references include USDA NRCS Water and Climate Center, USDA NRCS National Range and Pasture Handbook, USDI and USDA Interpreting Indicators of Rangeland Health Version IV, and USDA NRCS Soil Surveys from various counties.

Those involved in the development of the new concept for Saline Upland Ecological site include Blaise Allen, Area Range Management Specialist, NRCS; Jim Wolf, Resource Manager, USDI-BLM; Daniel Wood, MLRA Soil Survey Leader, NRCS; Jane Karinen, Soil Data Quality Specialist, NRCS; and Marji Patz, Ecological Site Specialist, NRCS.

Quality control and quality assurance completed by John Hartung, State Rangeland Management Specialist, NRCS; Brian Jensen, State Wildlife Biologist, NRCS; and Scott Woodall, Regional Quality Assurance Ecological Site Specialist, NRCS.

Inventory Data References:
Ocular field estimations observed by trained personnel were completed at each site. Then sites were selected where a 100-feet tape was stretched and the following sample procedures were completed by inventory staff. For full sampling protocol and guidelines with forms, please refer to the Wyoming ESI Operating Procedures, compiled in 2012 for the Powell and Rock Springs Soil Survey Office, USDA-NRCS.
• Double Sampling Production Data (9.6 hoop used to estimate 10 points, clipped a minimum of two of these estimated points, with two 21 ft. X 21 ft. square extended shrub plots)
• Line Point Intercept (overstory and understory captured with soil cover). Height of herbaceous and woody cover is collected every three feet along established transect

• Continuous Line Intercept (Woody canopy cover, with minimum gap of 0.2 foot for all woody species and succulents. Intercept height collected at each measurement.)
• Gap Intercept (Basal Gap measured with a minimum gap requirement of 0.7 foot.)
• Sample Point (Ten 1-meter square point photographs taken at set distances on transect. Read using the sample point computer program established by the High Plains Agricultural Research Center, WY.)
• Soil Stability (Slake test: surface and subsurface samples collected and processed according to the soil stability guidelines provided by the Jornada Research Center, NM.)

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Approval

Kirt Walstad, 3/04/2024

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	04/30/2020
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Due to the wide slope range associated with this site, the number and extent of rills will vary from none on slope < 10% to common on slopes > 20%

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2. **Presence of water flow patterns:** Barely observable Due to the wide slope range associated with this site, water flow patterns vary from barely observable on slopes of <10% and from broken and irregular in appearance to continuous on slopes >20%

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3. **Number and height of erosional pedestals or terracettes:** Not evident on slopes <20%. Erosional pedestals will be present with terracettes present at debris dams on slopes >20%.

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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 15-50%, occurring in small openings throughout the site.

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5. **Number of gullies and erosion associated with gullies:** Active gullies should not be present. Active gullies restricted to concentrated water flow patterns.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None

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7. **Amount of litter movement (describe size and distance expected to travel):** Little to no plant litter movement. Plant litter remains in place and is not moved by erosional forces. Little to no plant litter movement occurs on slopes <20%. Litter movement does occur on slopes >20%.

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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):** Plant cover and litter is at 50% or greater of soil surface and maintains soil surface integrity. Soil Stability class is anticipated to be 5 or greater.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Use Soil Series description for depth and color of A-horizon

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Grass canopy and basal cover should reduce raindrop impact and slow overland flow providing increased time for infiltration to occur. However, on a sparse plant canopy, slow infiltration rates, and the high amount of bare ground contribute . Infiltration varies with soil texture from moderately rapid to rapid. very slow to slow infiltration rates, the amount of bare ground, and steepness of slopes results in a naturally high runoff rate on slopes >20%, even in Reference.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No compaction layer or soil surface crusting should be present.

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: Shrubs >

    Sub-dominant: Rhizomatous wheatgrasses > Mid stature Grasses >

    Other: Forbs = short stature grasses

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Some plant mortality and decadence is expected

14. **Average percent litter cover (%) and depth (in):** Average litter cover is 10-20% with depths of 0.10 to 0.25 inches

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Total annual production ranges from 200-600 lbs/ac (224-673 kg/ha), with an average production of 400 lbs/ac (448 kg/ha).

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:** Birdfoot sagebrush and fringed sagewort are increasers as well as rubber rabbitbrush. Sandberg bluegrass and foxtail barley are also common. Cheatgrass, povertyweeds, field cottonrose and other annuals, exotics, and invasive species listed on the county and state Noxious Weed List.

17. **Perennial plant reproductive capability:** May be Limited due to effective moisture and seed to soil contact