USDA Natural Resources
Conservation Service

Ecological site EX043B23A100
Channery Upland (CnU) Absaroka Lower Foothills

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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): 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) 43B23A: Absaroka Lower 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 A is set for the lower elevations within the foothills with 10 to 14 inches of precipitation. To verify or identify the LRU A (the referenced LRU for this ecological site), refer to the Wyoming LRU matrix key contained within the Ecological Site Key. This particular LRU occurs along the eastern lower 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 tracks east with the intersection of the Absaroka and Owl Creek Ranges, 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: Aridic Ustic or Ustic Aridic – Progressive Initial mapping has shown that soil correlations completed prior to 2014 were identified as ustic aridic, after further evaluation of climatic and soil taxonomy information the proper moisture regime is aridic ustic. Both are recorded here until an update project is completed to correct the previous correlations.

Temperature Regime: Frigid
Dominant Cover: Rangeland – Sagebrush Steppe (major species is Wyoming Big Sagebrush)
Representative Value (RV) Effective Precipitation: 10-14 inches (254 – 355 mm)

RV Frost-Free Days: 80-110 days

Classification relationships

Relationship to Other Established Classification Systems:

National Vegetation Classification System (NVC):
3 Xeromorphic Woodland, Scrub & Herb Vegetation Class
3.B Cool Semi-Desert Scrub & Grassland Subclass
3.B.1 Cool Semi-Desert Scrub & Grassland formation
3.B.1.NE Western North American Cool Semi-Desert Scrub & Grassland Division
M169 Great Basin & Intermountain Tall Sagebrush Shrubland & Steppe Macrogroup
G302 Artemisia Tridentata - Artemisia tripartita - Purshia tridentata Big Sagebrush Steppe Group
CEGL001535 - Artemisia tridentata ssp. wyomingensis/Pseudoroegneria spicata Herbaceous Vegetation or
CEGL001009 - Artemisia tridentata ssp. wyomingensis/Pseudoroegneria spicata Shrubland

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.b Big Horn Basin and
10.1.18.d Foothills and Low Mountains

Ecological site concept

• Site receives no additional water.
• Slope is > 20%
• Soils are:
o Textures range from loamy sand to very fine sandy loam in top 4” (10 cm) of mineral soil surface
o Clay content is or < 18% in top 4” (10 cm) of mineral soil surface
o All subsurface horizons in the particle size control section have a weighted average of <18% 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).
o Moderately deep to very deep (20-80+ in. (50-200+ cm)
o <3% stone and boulder cover and >35% cobble and gravel cover
o Skeletal (≥35% rock fragments) within 20” (50 cm) of mineral soil surface
o Rock fragments within the soil profile are channers of sandstone, similar sedimentary flat fragments.
o Non-saline, sodic, or saline-sodic

Associated sites

EX043B23A166	**Shallow Sandy (SwSy) Absaroka Lower Foothills** Typically, the Shallow Sandy ecological site will occur as a band below the channery upland or in pockets with this ecological site where the channers have weathered out or do not appear in the profile, and bedrock controls the site. Shrubs are more distinct and production is slightly higher with a greater diversity of forbs.
EX043B23A150	**Sandy (Sy) Absaroka Lower Foothills** The Sandy ecological site occurs lower on the landscape, below the channery slopes. The positions lower with less slope allows for greater weathering of the sandstone with accumulation of slope alluvium and weathered colluvium. Shrubs are higher in vigor and production is y higher with a different diversity of forbs.
EX043B23A176	**Very Shallow (VS) Absaroka Lower Foothills** Very shallow soils will be prevalent above or intermixed with the Channery Upland ecological site, as the bedrock fluctuates in depth and the channers vary in composition in the profile. Shrubs are very scarce in comparison, and production is lower in Very shallow and the forbs shift in composition.

Similar sites

EX043B23A112	**Gravelly (Gr) Absaroka Lower Foothills** The Gravelly ecological site soils are similar, the difference being the type of rock fragments. Gravels are a mixed alluvium where Channery Uplands have sandstone or sedimentary flat channers rock fragments, altering the roots and water movement in the profile.
EX043B23A175	**Skeletal (Sk) Absaroka Lower Foothills** The Skeletal ecological site soils are similar, the major difference is the soil texture. Skeletal has greater than 18 percent clay, allowing greater water holding capacity. Where Channery Uplands have less than 18 percent clay, shifting the drought tolerance and species prominent on the ecological site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata ssp. wyomingensis*
Herbaceous	(1) *Pseudoroegneria spicata* (2) *Koeleria macrantha*

Legacy ID

R043BX500WY

Physiographic features

This site is found on ridges and slopes, greater than 20 percent, formed by uplifted sandstone and siltstone parent materials.

Table 2. Representative physiographic features

Landforms	(1) Foothills > Erosion remnant (2) Foothills > Colluvial apron (3) Foothills > Escarpment
Runoff class	Negligible to high
Elevation	1,585–2,377 m
Slope	20–75%
Water table depth	152 cm
Aspect	Aspect is not a significant factor

Climatic features

Annual precipitation and modeled relative effective annual precipitation ranges from 10 to 14 inches (254 – 355 mm). The normal precipitation pattern shows peaks in May and June and a secondary peak in September. This amounts to about 50 percent of the mean annual precipitation. Much of the moisture that falls in the latter part of the summer is lost by evaporation and much of the moisture that falls during the winter is lost by sublimation. Average snowfall is about 20 inches annually. Wide fluctuations may occur in yearly precipitation and result in more dry years than those with more than normal precipitation.

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. Extreme storms may occur during the winter, but most severely affect ranch operations during late winter and spring. High winds are generally blocked from the basin by high mountains, but can occur in conjunction with an occasional thunderstorm. Growth of native cool-season plants begins about April 15th and continues until about July 1st. Cool weather and moisture in September may produce some green up of cool season plants that will continue through late October.

Review of a 30 year trend of data for Average Temperature as well as Average Precipitation, there has been a

warming trend, but as the last 12 years graphed, the temperatures have swayed high and low, but overall it has maintained a steady trajectory, neither increasing nor decreasing. Where on the moisture side, the trajectory in trend has been a slow decline. The swings of when spring warm up and first frost hit with the decline in average precipitation have produced a drought effect where the moisture is not being received when the plants and ground is able to utilize the moisture. And in some cases, the late precipitation has encouraged the warm season or mat forming species over the cool season bunchgrasses that are the drivers of the natural system. Early frosts, with dry open winters has created a more arid or desert effect on plants resulting in high rates of winter kill, loss of vigor or overall damage to the plant.

For detailed information visit the Natural Resources Conservation Service National Water and Climate Center at http://www.wcc.nrcs.usda.gov/. Buffalo Bill Dam, Cody 21SW, Thermopolis, Thermopolis 9NE, Thermopolis 25WNW and Wapiti 1NE are the representative weather stations within LRU D. 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)	64-106 days
Freeze-free period (characteristic range)	101-144 days
Precipitation total (characteristic range)	279-330 mm
Frost-free period (actual range)	46-118 days
Freeze-free period (actual range)	88-147 days
Precipitation total (actual range)	254-330 mm
Frost-free period (average)	80 days
Freeze-free period (average)	117 days
Precipitation total (average)	305 mm

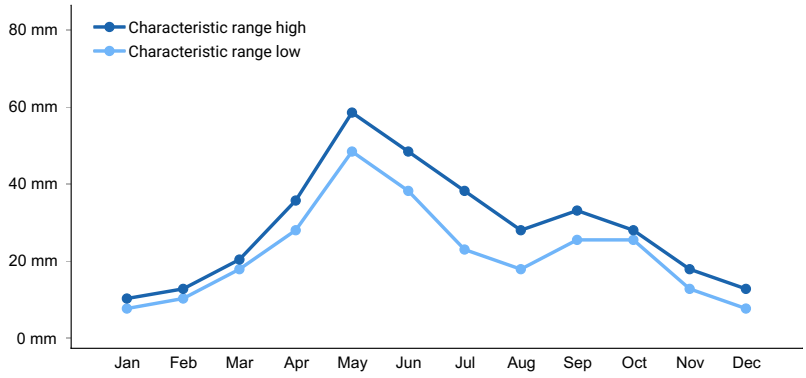


Figure 1. Monthly precipitation range

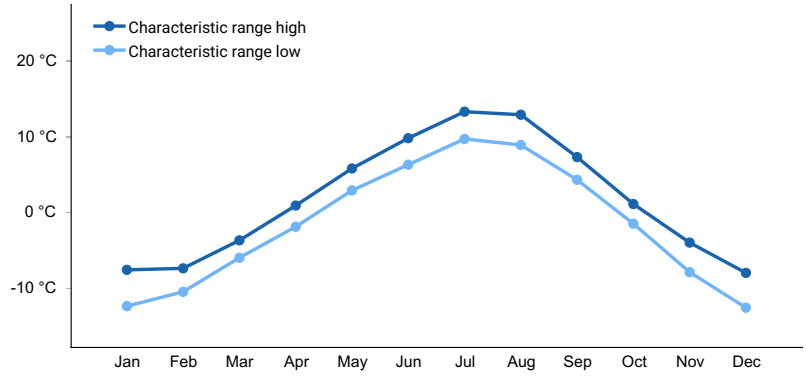


Figure 2. Monthly minimum temperature range

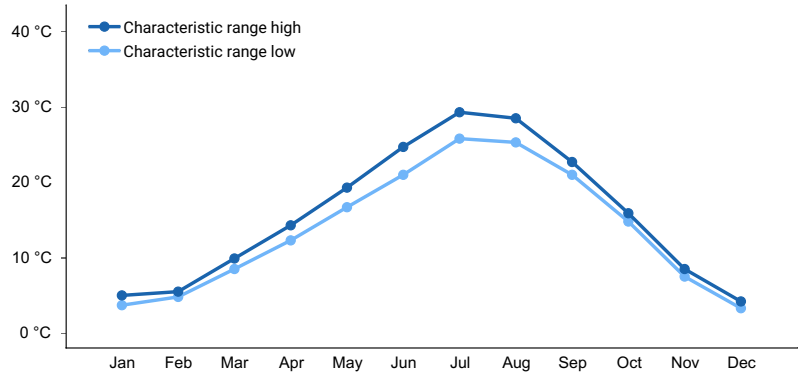


Figure 3. Monthly maximum temperature range

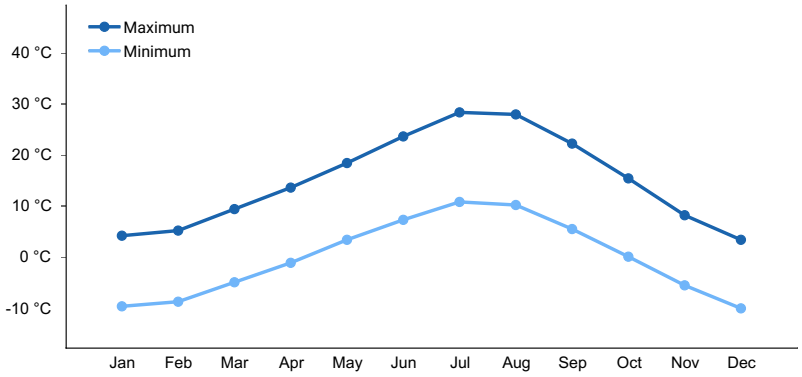


Figure 4. Monthly average minimum and maximum temperature

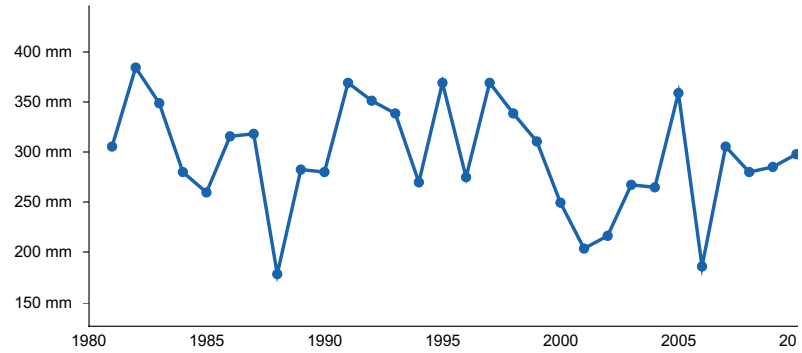


Figure 5. Annual precipitation pattern

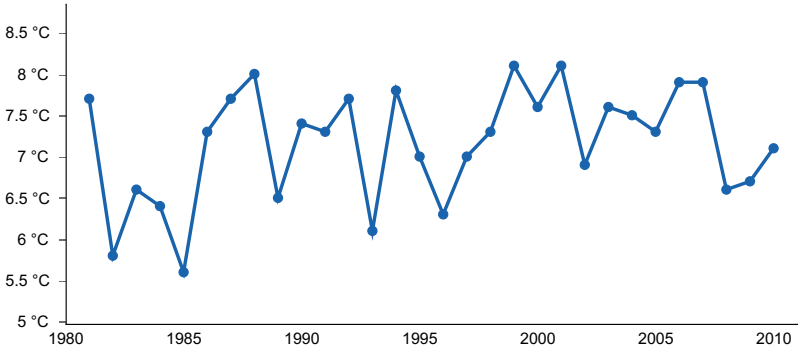


Figure 6. Annual average temperature pattern

Climate stations used

- (1) THERMOPOLIS [USC00488875], Thermopolis, WY
- (2) THERMOPOLIS 25WNW [USC00488888], Thermopolis, WY
- (3) SUNSHINE 3NE [USC00488758], Meeteetse, WY

- (4) CODY 21 SW [USC00481855], Cody, WY
- (5) WAPITI 1NE [USC00489467], Cody, WY
- (6) BUFFALO BILL DAM [USC00481175], Cody, 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 and overland flow. There may be isolated features that are affected by snow pack that persists longer than surrounding areas due to position on the landform (shaded or protected pockets). Coarse texture soils and significant flat rock fragments limits the amount of holding capacity and accessibility, so vegetation responds to rain events more than stored water. Site is sensitive to drought and flash storm events.

Wetland description

N/A

Soil features

The soils of this site are moderately deep (greater than 20 in to bedrock) to very deep, well to excessively well-drained soils that formed in colluvium or over residuum. These soils have moderately rapid or rapid permeability. The surface soil will vary from 3 to 6 inches deep. The coarser topsoil may be included if underlain by finer textured subsoil. The soil characteristic most influential to the plant community is the high volume of flat channers on the surface and in the profile, which reduces plant density and available moisture.

Figure 7. Typical soil profile for the Channery Upland ecological site.

Figure 8. The chugwater formation provides a similar soil profile, with higher silts and the distinct red coloration.

Table 4. Representative soil features

Parent material	(1) Colluvium–sandstone and siltstone (2) Residuum–sandstone and siltstone
Surface texture	(1) Very channery, extremely channery, very flaggy loamy sand (2) Sandy loam (3) Silt loam
Family particle size	(1) Coarse-loamy over sandy or sandy-skeletal (2) Loamy-skeletal (3) Sandy or sandy-skeletal
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderately rapid to rapid
Soil depth	51 cm
Surface fragment cover <=3"	15–30%
Surface fragment cover >3"	0–15%
Available water capacity (0-101.6cm)	3.56–12.19 cm
Calcium carbonate equivalent (0-50.8cm)	0–5%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–13
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.4
Subsurface fragment volume <=3" (0-101.6cm)	5–35%
Subsurface fragment volume >3" (0-101.6cm)	0–20%

Ecological dynamics

The Channery Upland ecological site within the Absaroka Lower Foothills was originally correlated as a Shallow Sandy range site. During the review of the historic range site, several communities presented with more rock fragments throughout the profile than expected. The dominance of bluebunch wheatgrass, dwarfed and limited sagebrush cover, increased bare ground or lichen cover and reduced production express a “shallow” acting characteristic of the site. Wyoming big sagebrush and black sagebrush may be present in scattered areas of this site, and is generally restricted in vigor and production. Minimal research can be found for this particular ecological site.

Potential vegetation on the Channery Upland ecological site is dominated by mid-stature cool-season bunchgrasses. Other significant vegetation includes short-stature cool-season bunchgrasses and a variety of forbs. The expected potential composition is 75 percent grasses, 15 percent forbs, and 10 percent woody plants. The composition and production will vary due to historic use and fluctuating precipitation.

As the ecological site deteriorates species such as threadleaf sedge, Sandberg bluegrass, and broom snakeweed will increase. Plains pricklypear and weedy annuals will invade. Cool-season grasses such as bluebunch wheatgrass, needle and thread, and Indian ricegrass will decrease in frequency and production.

Due to the amount and pattern of the precipitation, in combination with soil limitations, the Wyoming big and black sagebrush component has a lower structure than similar ecological sites within the same area. Sagebrush may not be resilient once it has been removed or severely reduced if a vigorous stand of grass exists and is maintained. Threadleaf sedge may become the dominant vegetation if the area is subjected to frequent and severe (continuous season-long) periods of grazing, especially year-long grazing.

During the initial development of the Channery Upland ecological site, a visible difference in communities was noted between varying parent materials. The red sandstone and siltstone formations (chugwater, gypsum springs, and goose egg) express a lower vegetative cover and lower diversity of cover than other sedimentary parent materials. There is a cross over in chemistry and textures within these groups, and highlights that more data is needed to further expand this ecological site concept. Changes may occur as further data is collected within this concept.

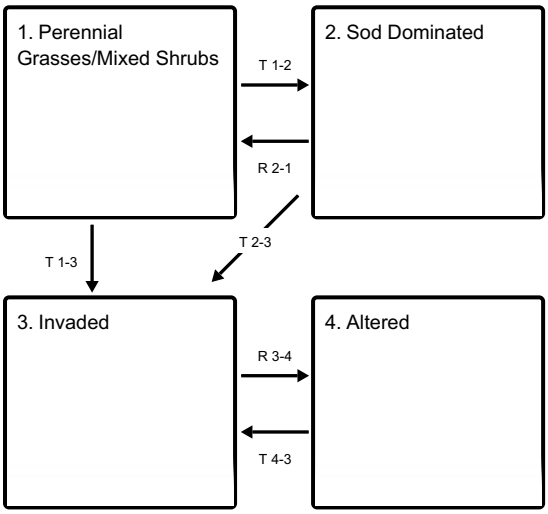
The Reference Plant Community (description follows the plant community diagram) has been determined by study of relic rangeland sites, or areas protected from excessive disturbance. Trends in plant communities going from heavily grazed areas to lightly grazed areas, seasonal use pastures, and historical 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 - State1 or better illustrated by State 1

State and transition model

Ecosystem states



T 1-2 - Frequent and severe grazing (yearlong grazing) or compaction from surface traffic, will weaken the mid-stature grasses and allow threadleaf sedge to increase.

T 1-3 - Disturbance to the soil surface provides the opportunity for invasive species to find their niche in a community.

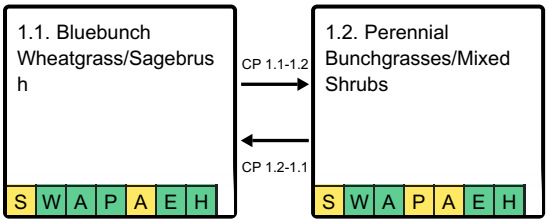
R 2-1 - High impact, followed by a period of recover, and potentially seeding will allow this community to improve.

T 2-3 - Drought with or without hoof impact or mechanical soil impact to displace the sod opens the niche for invasive species to establish.

R 3-4 - Integrated weed management, seeding and grazing management will establish a targeted community.

T 4-3 - Any disturbance to or failure in reclaiming the community leaves this State at risk to invasion.

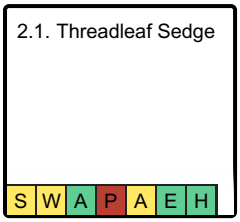
State 1 submodel, plant communities



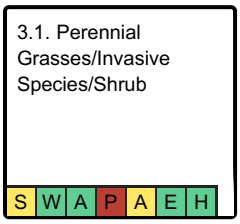
CP 1.1-1.2 - Moderate, continuous season-long grazing, especially with drought, will reduce the mid-stature grasses moving this community to the Perennial Grasses/Mixed Shrub Community Phase.

CP 1.2-1.1 - Prescribed grazing with deferment over time will allow the key bunchgrasses to increase in the community.

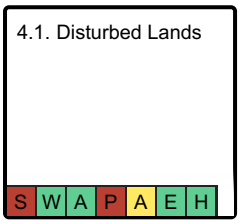
State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 submodel, plant communities



State 1
Perennial Grasses/Mixed Shrubs

The reference state (State 1) for the Channery Upland ecological site is dominated by mid-stature, cool-season bunchgrasses. This State persisted under areas that were grazing by large ungulates, however access limited access by livestock. The associated rock uplifts and steeper slopes provides a resource for forage and habitat for a variety of wildlife.

Characteristics and indicators. The Perennial Grasses/Mixed Shrubs State (State 1 Reference) is characterized by the prominent cover of bluebunch wheatgrass (15-30 percent composition), needle and thread and Indian ricegrass. Rhizomatous wheatgrasses and prairie Junegrass are common, with 10 percent or less cover of shrubs including Wyoming big sagebrush. Minor components to the overall composition is made up of spike fescue, Sandberg bluegrass, bottlebrush squirreltail, threeawn, and threadleaf sedge.

Resilience management. This state occurs in areas that are grazed moderately with periods of rest by large ungulates include livestock (cattle and sheep) as well as antelope, deer, and elk. Prescribed grazing and drought planning allows this State to persist. The community is adaptable to drought with management.

Community 1.1
Bluebunch Wheatgrass/Sagebrush

Figure 9. Bluebunch wheatgrass and needle and thread with Wyoming big sagebrush is the reference community for the Channery Upland ecological site.

Figure 10. Bluebunch wheatgrass and Indian ricegrass with black sagebrush is the reference community on red formations for the Channery Upland ecological site.

The Bluebunch Wheatgrass/Sagebrush plant community (1.1) is the Reference Plant Community. This plant community can be found on areas that are properly managed with grazing or other means of defoliation, and on areas receiving occasional short periods of rest. Historically, the Reference State evolved with grazing pressure by large ungulates (elk, bison, deer, and antelope); as well as under a low fire frequency. The potential vegetation cover is about 70 percent grasses or grass-like plants, 20 percent forbs, and 10 percent woody plants. Dominant grasses include bluebunch wheatgrass, needle and thread, Indian ricegrass, prairie Junegrass, and rhizomatous wheatgrasses. Grasses and grass-like species of secondary importance include Sandberg bluegrass, threeawn, and threadleaf sedge. A variety of forbs are found in this community including fleabanes, wild parsley, lemon scurfpea, and scarlet gaura. Wyoming big sagebrush, fringed sagewort, and rubber rabbitbrush are conspicuous components of the community, and can make up to 10 percent of the annual production. A shift in appearance between the red geologic formations (chugwater and similar) and other sedimentary formations is prominant, however the species composition is similar with a shift between black sagebrush and Wyoming big sagebrush. Images included. The total annual production (air-dry weight) of this community phase is about 400 lbs./acre, but it can range from about 250 lbs./acre in unfavorable years to about 650 lbs./acre in above-average years.

Resilience management. This community, as Reference, is indicative of rangeland health which is based on site and soil stability, watershed function, and biologic integrity. Species diversity of this community provides a high tolerance to drought. The structural diversity of Wyoming big sagebrush in conjunction with the mid-statured bunchgrasses (bluebunch wheatgrass, needle and thread, and Indian ricegrass), rhizomatous species (Montana wheatgrass and western wheatgrass), and the short-statured bunchgrasses (prairie Junegrass, Sandberg bluegrass, and threeawn) helps to provide snow catch and to stabilize the soils.

Dominant plant species

- Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*), shrub

- black sagebrush (*Artemisia nova*), shrub
- rubber rabbitbrush (*Ericameria nauseosa*), shrub
- skunkbush sumac (*Rhus trilobata*), shrub
- bluebunch wheatgrass (*Pseudoroegneria spicata*), grass
- needle and thread (*Hesperostipa comata*), grass
- Indian ricegrass (*Achnatherum hymenoides*), grass
- woollypod milkvetch (*Astragalus purshii*), other herbaceous
- leafy wildparsley (*Musineon divaricatum*), other herbaceous
- Indian paintbrush (*Castilleja*), other herbaceous
- beardtongue (*Penstemon*), other herbaceous

Dominant resource concerns

- Sheet and rill erosion
- Aggregate instability
- 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	224	336	560
Shrub/Vine	34	78	101
Forb	22	34	67
Total	**280**	**448**	**728**

Table 6. Ground cover

Tree foliar cover	0-2%
Shrub/vine/liana foliar cover	2-15%
Grass/grasslike foliar cover	30-50%
Forb foliar cover	5-10%
Non-vascular plants	0%
Biological crusts	0%
Litter	10-20%
Surface fragments >0.25" and <=3"	0-20%
Surface fragments >3"	0-15%
Bedrock	0%
Water	0%
Bare ground	15-30%

Table 7. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-5%	5-10%	0-5%
>0.15 <= 0.3	–	0-10%	20-30%	0-5%
>0.3 <= 0.6	–	0-5%	0-15%	0-2%
>0.6 <= 1.4	–	0-2%	–	–
>1.4 <= 4	0-2%	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Community 1.2
Perennial Bunchgrasses/Mixed Shrubs

Figure 12. Short-stature grasses have increased with needle and thread to form the community phase 1.2.

The secondary community phase (1.2) of the Reference State 1, is characterized by the significant decrease in bluebunch wheatgrass and the increase in short-stature bunchgrasses. Otherwise, the shift in in species composition and function is minor. The community can be found on areas that are within the scope of historic disturbances, stability of the site and production potential. The vegetation composition is 70 percent grasses or grass-like plants, 10 percent forbs, and 20 percent woody plants. This community is still dominated by cool-season bunchgrasses grasses. The major understory of grasses and grass-like plants includes needle and thread, prairie Junegrass, rhizomatous wheatgrasses, threadleaf sedge, threeawn, and Sandberg bluegrass. The variety of forbs commonly found include scarlet globemallow, lemon scurfpea, scarlet gaura, and spiny phlox. Wyoming big sagebrush and fringed sagewort can make up 20 percent of the annual production. The overstory of Wyoming big sagebrush and understory of grasses and forbs provide a diverse plant community. Threadleaf sedge has increased in the community; however, the tillering sedge is not the most prevalent species. Plains pricklypear cactus will also have increased but occurs only in small patches. Indian ricegrass has decreased and may occur in only trace amounts under the sagebrush canopy or within the patches of pricklypear; needle and thread and rubber rabbitbrush have remained as a common component in this community. The total annual production (air-dry weight) of this community is about 375 lbs./acre, but it can range from about 200 lbs./acre in unfavorable years to about 600 lbs./acre in above-average years.

Resilience management. Rangeland Health Implications/Indicators: This plant community is relatively resistant to change but is at-risk of transitioning with continued stress; however, species composition can be altered through long-term overutilization or increased intensity of defoliation.. The herbaceous cover is intact, and plant vigor and replacement capabilities are sufficient to maintain during periods of moderate grazing pressure or drought. Water flow patterns and litter movement are minimal but are slightly more pronounced on steeper slopes. Incidence of pedestalling is minimal, and soils are mostly stable with only minimum evidence of soil loss. The watershed is

functioning, and the biotic community is intact.

Dominant plant species

- Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*), shrub
- rubber rabbitbrush (*Ericameria nauseosa*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- needle and thread (*Hesperostipa comata*), grass
- prairie Junegrass (*Koeleria macrantha*), grass
- Montana wheatgrass (*Elymus albicans*), grass
- woollypod milkvetch (*Astragalus purshii*), other herbaceous
- leafy wildparsley (*Musineon divaricatum*), other herbaceous
- scarlet globemallow (*Sphaeralcea coccinea*), other herbaceous

Dominant resource concerns

- Sheet and rill erosion
- Ephemeral gully erosion
- Aggregate instability
- Plant structure and composition
- 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)
Grass/Grasslike	168	308	448
Shrub/Vine	28	56	140
Forb	28	56	84
Total	**224**	**420**	**672**

Table 9. Ground cover

Tree foliar cover	0-5%
Shrub/vine/liana foliar cover	5-15%
Grass/grasslike foliar cover	20-45%
Forb foliar cover	5-10%
Non-vascular plants	0%
Biological crusts	0%
Litter	10-15%
Surface fragments >0.25" and <=3"	0-20%
Surface fragments >3"	0-15%
Bedrock	0%
Water	0%
Bare ground	20-35%

Table 10. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	5-10%	10-40%	0-10%
>0.15 <= 0.3	–	0-5%	15-30%	0-5%
>0.3 <= 0.6	–	0-1%	0-5%	0-2%
>0.6 <= 1.4	–	0-1%	–	–
>1.4 <= 4	0-2%	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

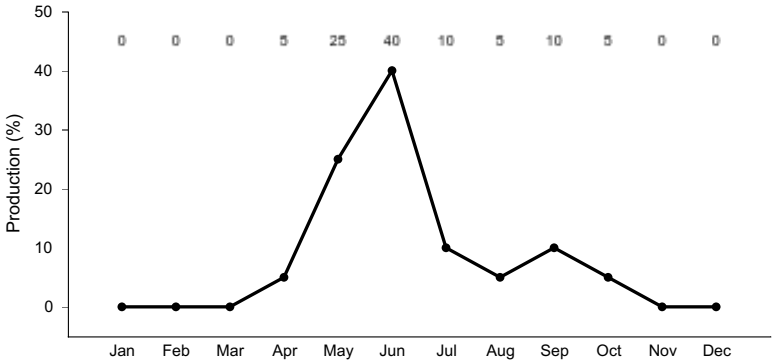
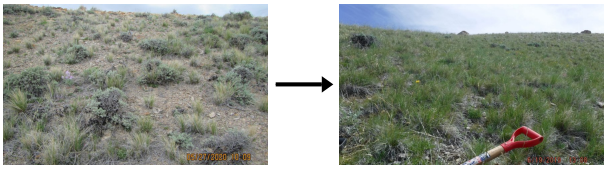


Figure 14. Plant community growth curve (percent production by month). WY0701, 10-14E upland sites.

Pathway CP 1.1-1.2
Community 1.1 to 1.2

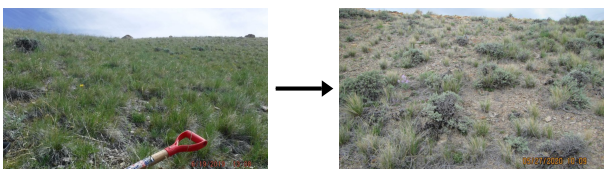


Bluebunch Wheatgrass/Sagebrush

Perennial Bunchgrasses/Mixed Shrubs

Moderate, continuous season-long grazing will convert the plant community to the Perennial Grass/Mixed Shrub Community Phase. Prolonged drought will exacerbate this transition. The continuous use reduces the key mid-stature bunchgrasses such as bluebunch wheatgrass, needle and thread, and Indian ricegrass; allowing the short-stature bunchgrasses and sod-formers to increase in the community. Where present, Rocky Mountain juniper is prone to encroachment or creep and will also impact the overall composition in the community.

Pathway CP 1.2-1.1
Community 1.2 to 1.1



Perennial Bunchgrasses/Mixed Shrubs

Bluebunch Wheatgrass/Sagebrush

Prescribed grazing, over time, will allow recovery to the Reference Community Phase. Rotational grazing with deferment is implemented as part of the prescribed method of use. Mechanical means may be necessary to break down old growth (wolfy plants) to allow rejunvination of the mid-stature bunchgrasses as well as to encourage new

growth on shrubs. Consideration of the risk of invasive species needs to be taken before using prescribed fire on this community.

Context dependence. Access due to slope and rock outcrops and surface fragments is limited and will determine the best means of prescription for this community. Tree growth, specifically Rocky Mountain juniper, and woody downfall may also be a factor to be addressed with prescription fire on this site.

Conservation practices

Brush Management
Prescribed Burning
Critical Area Planting
Prescribed Grazing
Grazing Land Mechanical Treatment
Upland Wildlife Habitat Management

State 2
Sod Dominated

The Sod-former State is a low-stature community that has shifted from the mid- and tall-stature cool-season bunchgrasses to tillering grass-likes (threadleaf sedge). Fringed sagewort and pricklypear cactus are common.

Characteristics and indicators. The prominent cover is threadleaf sedge. Scattered sagebrush may persist with rubber rabbitbrush and skunkbush sumac. Season of use and species of grazing ungulate will be a factor affecting this cover. The shift in hydrology of this State leads to low vigor shrubs. Most other mid-stature cool-season bunchgrasses are limited to within the canopy of the sagebrush or within the protective cactus clumps.

Resilience management. Threadleaf sedge roots form a dense root mat that makes this State resistant to change, and resilient to disturbance. Although the establishment of threadleaf sedge is a slow process, it is opportunistic and competitive in a community. Removal of grazing or disturbance has not demonstrated a significant shift in the herbaceous cover within this community. The overall health and vigor of both the herbaceous as well as woody cover will improve with the removal of the grazing pressure or disturbance over time.

Community 2.1
Threadleaf Sedge

Figure 15. Threadleaf sedge is increasing s bluebunch wheatgrass is removed from this community.

This plant community is the result of frequent and severe year-long grazing, which have adversely affected the perennial grasses as well as the shrub component. These factors include drought, wildfires, heavy browsing, and recreation. A dense sod of threadleaf sedge dominates this community. Pricklypear cactus increases and the shrub component is reduced or in some cases removed. When compared to the Historic Climax Plant Community,

threadleaf sedge and blue grama have increased. Pricklypear has invaded. All cool-season mid-grasses, forbs, and most shrubs have been greatly reduced. Production has been significantly decreased. The total annual production (air-dry weight) of this state is about 300 pounds per acre, but it can range from about 200 lbs./acre in unfavorable years to about 400 lbs./acre in above average years.

Resilience management. Rangeland Health Implications/Indicators: This sod-bound community is extremely resistant to change. Management (continued frequent and severe grazing to the removal of grazing) has no notable affect to the composition or structure of the plant community. The biotic integrity is not functional, plant diversity is extremely low, and vigor is weakened. Replacement capabilities are limited due to the reduced number of mid-statured cool-season bunchgrasses and the loss of structure (woody component snow catch). The dense root mat of threadleaf sedge reduces infiltration and increase runoff. Off-site areas can be affected and degraded with excessive runoff that can cause rills and gully erosion. Rock cover reduces the impacts to water flow patterns, but they are obvious in the bare ground interspaces and pedestalling is apparent along the sod edges. Rill channels are noticeable in the interspaces and downslope. The watershed may or may not be functioning, as runoff may affect adjoining sites. The added competition and rooting nature of cactus produces a threat of invasion of cactus. Although not documented in this LRU at this time, it has been noted in other areas of Wyoming, that plains pricklypear cactus can form in dense patches that inhibit animal movement through the area preventing the use for grazing and hindering wildlife movement and use as well. Surface disturbance (hoof action, large equipment such as vehicules and tractors, or other human impacts) can initially reduce the density of cactus, but the risk of rerootin g of the disturbed pads, may cause a rapid increase in density across an area of impact.

Dominant plant species

- prairie sagewort (*Artemisia frigida*), shrub
- rubber rabbitbrush (*Ericameria nauseosa*), shrub
- Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*), shrub
- threadleaf sedge (*Carex filifolia*), grass
- bluebunch wheatgrass (*Pseudoroegneria spicata*), grass
- needle and thread (*Hesperostipa comata*), grass
- plains pricklypear (*Opuntia polyacantha*), other herbaceous
- fleabane (*Erigeron*), other herbaceous
- scarlet globemallow (*Sphaeralcea coccinea*), other herbaceous

Dominant resource concerns

- Sheet and rill erosion
- Classic gully erosion
- Aggregate instability
- Naturally available moisture use
- Plant productivity and health
- Plant structure and composition
- Inadequate livestock water quantity, quality, and distribution

Table 11. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	196	252	308
Shrub/Vine	–	56	84
Forb	11	28	56
Total	**207**	**336**	**448**

Table 12. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0-10%
Grass/grasslike foliar cover	30-50%
Forb foliar cover	0-10%

Non-vascular plants	0%
Biological crusts	0%
Litter	10-20%
Surface fragments >0.25" and <=3"	0-20%
Surface fragments >3"	0-15%
Bedrock	0%
Water	0%
Bare ground	20-40%

Table 13. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-5%	20-50%	0-5%
>0.15 <= 0.3	–	0-5%	0-5%	0-5%
>0.3 <= 0.6	–	0-2%	0-2%	–
>0.6 <= 1.4	–	–	–	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

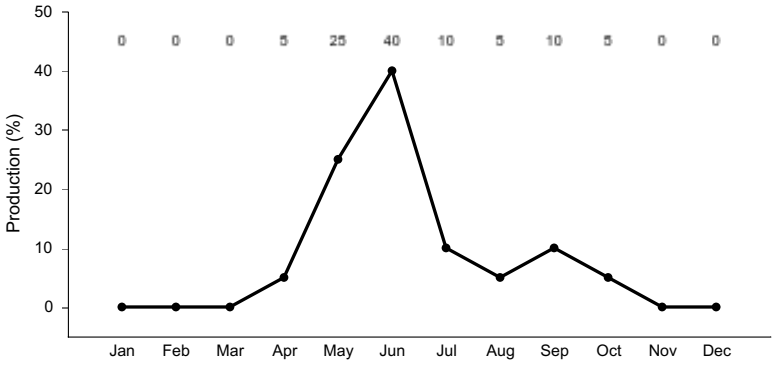


Figure 17. Plant community growth curve (percent production by month). WY0701, 10-14E upland sites.

State 3
Invaded

The Invaded State has a range of variability that is distinguished by its population of invasive or introduced (non-native) species that has successfully established and is significant within the composition of the community.

Characteristics and indicators. The threshold for invasive species within the community (composition by weight) is five percent or greater to transition a community into the Invaded State. The community can be relatively intact, having a representative composition of native species similar to the Reference State, but with a significant composition (minimum of five percent) cover of an invasive species or mix of invasive species. Cheatgrass is the most significant threat at this time; however, there are other aggressive non-native species that pose a concern on this ecological site. These species include field cottonrose, mustards, Russian thistle, and Kochia.

Resilience management. The competitive edge of most invasive species makes this site resistant to change and resilient following disturbance. Cheatgrass has been seen to respond with a positive potential following disturbances (fire, mechanical).

Community 3.1
Perennial Grasses/Invasive Species/Shrub

Figure 18. Cheatgrass encroaching into the Channery Upland ecological site.

The Perennial Grasses/Invasive Species/Shrub phase has maintained a representative sample of the perennial grasses and forbs that are typical of the Channery Upland ecological site with a minor component of shrubs. The invasive species hold a significant (ten percent or greater) composition on the landscape, and are prominent on the site with five percent or greater cover (referring to a more wide scale composition, not one isolated patch in an isolated portion of the landscape). Production of the desired perennial species is generally reduced but the total production is maintained or elevated due to the production potential of the invasive species.

Resilience management. Rangeland Health Implications/Indicators: This plant community is resistant to change. Plant diversity is moderate to poor. The plant vigor is diminished and replacement capabilities are limited due to the reduced number of cool-season grasses. Plant litter is noticeably more when compared to reference communities due to the potential biomass produced by the invasive species (species dependent). Soil erosion is variable depending on the species of invasion and the litter accumulation thus associated. Variability also applies to water flow patterns and pedestalling. Infiltration is reduced and runoff is increased due to loss of perennial vegetation and root density.

Dominant plant species

- prairie sagewort (*Artemisia frigida*), shrub
- rubber rabbitbrush (*Ericameria nauseosa*), shrub
- Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*), shrub
- cheatgrass (*Bromus tectorum*), grass
- bluebunch wheatgrass (*Pseudoroegneria spicata*), grass
- threadleaf sedge (*Carex filifolia*), grass
- broom snakeweed (*Gutierrezia sarothrae*), other herbaceous
- plains pricklypear (*Opuntia polyacantha*), other herbaceous
- pepperweed (*Lepidium*), other herbaceous

Dominant resource concerns

- Sheet and rill erosion
- Classic gully erosion
- Aggregate instability
- Plant productivity and health
- Plant structure and composition
- Feed and forage imbalance
- Inadequate livestock water quantity, quality, and distribution

State 4

Altered

Disturbance to these highly erodible soils (whether it was mechanical, cultural, or natural) removes the resiliency of the native vegetation. Changes to soil structure and hydrologic processes reduce the stability and ability to recover. Reclamation or restoration of an area is limited or restrictive due to slope, access, and extent of rock fragments on and in the soil profile. One catastrophic event or several smaller disturbances can lead to the transition to the Altered State from any state within the State-and-Transition Model. The soils have not been altered to the extent that they are outside the site characteristics, but the potential has shifted enough that it will not respond like the Reference State. The time required to allow the redevelopment of structure is beyond the natural function of management. The initial flush of vegetation is annual forbs and sub-shrubs. This successional plant community allows the site to begin recovery, but the time required to return to the original conditions (pre-disturbance) can be extensive.

Characteristics and indicators. The Altered State is characterized by an area that has had significant soil disturbance. Early successional plant communities, evidence of mining, or the presence of introduced species (crested wheatgrasses, Russian wildrye, etc.) are indicators of this State.

Resilience management. Stabilization and preservation of as much soil as possible is the mechanism to provide resiliency to this State. The use of mulch or other slope stabilization materials will help in reducing erosional impact and allowing vegetation to establish.

Community 4.1
Disturbed Lands

Disturbed or degraded lands are characterized by alteration of the soils to a degree that the functionality (erosional, depositional, hydrological, or chemical) and potential of the soils has been impacted. Site-specific evaluations need to be completed to determine the level of effect. The method and severity of alternation, as well as the spatial extent of the disturbance will determine vegetation response and management needs. Linear disturbances, such as trails and roads, will hold a different risk than patchwork or area disturbances, such as well-pads or parking areas. Small-scale or isolated disturbances (spot fires, prairie dog town) can be just as significant of a risk as a large-scale disturbance (mine lands). The growth curve of this plant community will vary depending upon the successional or seeded species that are able to establish in an area. For an accurate growth curve, a site-specific species inventory and documentation of the climatic tendencies should be collected.

Resilience management. Rangeland Health Implications/Indicators: This plant community is variable and, depending upon the age of the stand and the stage of successional tendencies, determines how stable (resilient/resistant) the community is. Plant diversity is low for successional communities. This flexibility within the community creates a variable level of biotic integrity. In areas of new or frequent disturbance, annual weedy species or early successional plants will be the dominant cover, providing some diversity, but gives minimal structural cover for wildlife. As the site matures or as the period between disturbances is lengthened, perennial or taller-statured, stronger-rooted species will increase providing protection and help to improve hydrologic processes and stability to allow grasses and shrubs to begin to establish. Soil erosion is dependent on the disturbance regime and the biotic integrity of the community which determines water flow, infiltration, and runoff. Other factors that are influential are surface roughness and brokenness (tire tracks, hoof action, smoothed, denuded surfaces, trails that may concentrate water flow).

Dominant resource concerns

- Wind erosion
- Classic gully erosion
- Plant productivity and health
- Plant structure and composition
- Inadequate livestock water quantity, quality, and distribution

Transition T 1-2
State 1 to 2

Frequent and severe (year-long or continuous season-long) grazing or recreational or other surface traffic, will convert the plant community to a threadleaf sedge sod. The impact of frequent or repeated defoliation during

grazing, hoof impact, and lack of rest for recovery weakens and removes the key grass species in the community. As the mid-stature grasses decline, threadleaf sedge is able to increase and alter the hydrology of the site. Long-term drought and shift in precipitation and spring warm up is proving to be a factor in threadleaf sedge expansion.

Constraints to recovery. The dense root mat formed by threadleaf sedge alters the hydrology, effectively removing moisture from the site, limiting the available resources for other native species. The dense sod also limits the available soil space for seedling establishment. Interpspaces between sod patches are prone to erosion and runoff (limited infiltration of moisture).

Transition T 1-3
State 1 to 3

Drought, soil disturbances, or high-intensity grazing with a seed source present can open the soil surface and help encourage invasive species to establish. Although not common, fire can provide the niche for cheatgrass to establish on this site. The movement of wildlife as well as livestock through the landscape is also a way that seeds sources are introduced to the community.

Constraints to recovery. Once invasive species, especially cheatgrass, establish, it is costly and difficult (if even possible) to remove. Slope, rock fragment content as well as access due to landforms, limit the ability and means of invasive control. This also can be a limitation or constraint to recovery for this community. The lack of the key grass species may be a minor limit to recover of this site.

Restoration pathway R 2-1
State 2 to 1

Impacts to the sod cover followed by a period of recovery can allow mid-stature and short-stature native grasses to gain a better hold in this community to improve. Recovery is dependent on the remnant population of herbaceous species that are present, the current weather patterns, and timing. The use of mechanical means or high impact hoof action can also help with breaking up the dominance of the sod to allow native to establish. The use of seeding will assist with recover as well.

Context dependence. The lack of invasive seed sources, accessibility of the site, and the weather or climate at the time of restoration will make a determination of the ability to recover.

Conservation practices

Critical Area Planting
Prescribed Grazing
Grazing Land Mechanical Treatment
Range Planting
Heavy Use Area Protection
Recreation Area Improvement
Upland Wildlife Habitat Management

Transition T 2-3
State 2 to 3

Drought, soil disturbances, or high-intensity grazing with a seed source present can open the soil surface and weaken the sod allowing invasive species to establish. Although not common, fire can provide the niche for cheatgrass to establish on this site. Use and movement of wildlife through the community as well as livestock are a source of invasive species. The wildlife use during the spring and fall can also be a disturbance on these steep slopes to help encourage seed establishment.

Constraints to recovery. Once invasive species, especially cheatgrass, establish, it is costly and difficult (if even possible) to remove. The lack of the key grass species also limits recover of this site.

Restoration pathway R 3-4
State 3 to 4

Integrated Pest Management, with Seeding the site to a native mixture, or a targeted set of select species, assist the restoration of this community. Success is not known to have occurred, and is rated to be low and highly variable for the rate of control of most species. Cheatgrass is one of the most invasive species for many ecological sites, although there are other challenges. With intensive weed control and inputs this community can resemble an at-risk community within the reference state, but it is not possible to reach the reference community condition once annuals have established.

Context dependence. The specific invasive species that is established in the community, the state of the native species that are present and the accessibility of the site is determinate on the ability to achieve or attempt restoration of an invaded community.

Conservation practices

Critical Area Planting
Grazing Land Mechanical Treatment
Range Planting
Recreation Area Improvement
Integrated Pest Management (IPM)
Upland Wildlife Habitat Management
Native Plant Community Restoration and Management

Transition T 4-3
State 4 to 3

Frequent or Severe Grazing, Disturbance with a seed Source, or Drought - Any disturbance that occurs or stress that is placed on the herbaceous cover, weakens the canopy and allows for invasive species to establish if a seed source is present. This State is at high risk of transitioning to an Invaded State. The limited abilities to complete a seeding on rocky soil opens the community to invasion.

Context dependence. The challenge of eradicating or reducing invasive species such as cheatgrass prevents recovery of most invaded communities without significant inputs for weed control, seeding with long-term grazing management.

Additional community tables

Table 14. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Mid-stature Cool-season Bunchgrasses**			112–280	
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	101–224	15–30
	needle and thread	HECO26	*Hesperostipa comata*	17–67	0–10
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–67	0–10
2	**Rhizomatous Wheatgrasses**			34–84	
	Montana wheatgrass	ELAL7	*Elymus albicans*	17–67	2–10
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–34	0–5
	western wheatgrass	PASM	*Pascopyrum smithii*	17–34	2–5
3	**Short-stature Cool-season Bunchgrasses**			0–67	
	squirreltail	ELEL5	*Elymus elymoides*	0–34	0–5

	prairie Junegrass	KOMA	*Koeleria macrantha*	6–34	1–5
	Sandberg bluegrass	POSE	*Poa secunda*	0–34	0–5
4	**Tillering Cool-season Grass-likes**			0–34	
	threadleaf sedge	CAFI	*Carex filifolia*	0–34	0–5
5	**Miscellaneous Grasses/Grass-likes**			0–34	
	threeawn	ARIST	*Aristida*	0–34	0–5
	needleleaf sedge	CADU6	*Carex duriuscula*	0–34	0–5
	Grass, perennial	2GP	*Grass, perennial*	0–34	0–5
Forb					
6	**Perennial Forbs**			22–67	
	fleabane	ERIGE2	*Erigeron*	0–34	0–5
	leafy wildparsley	MUDI	*Musineon divaricatum*	0–34	0–5
	spiny phlox	PHHO	*Phlox hoodii*	0–34	0–5
	woollypod milkvetch	ASPU9	*Astragalus purshii*	0–34	0–5
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–34	0–5
	lemon scurfpea	PSLA3	*Psoralidium lanceolatum*	0–34	0–5
	little larkspur	DEBI	*Delphinium bicolor*	0–34	0–5
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–34	0–5
	Indian paintbrush	CASTI2	*Castilleja*	0–34	0–5
	beardtongue	PENST	*Penstemon*	0–34	0–5
	Forb, perennial	2FP	*Forb, perennial*	0–34	0–5
Shrub/Vine					
7	**Miscellaneous Shrubs**			34–101	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	0–34	0–5
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–34	0–5
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–34	0–5
	skunkbush sumac	RHTR	*Rhus trilobata*	0–34	0–5
	prairie sagewort	ARFR4	*Artemisia frigida*	0–34	0–5
Tree					
8	**Miscellaneous Trees**			–	
	limber pine	PIFL2	*Pinus flexilis*	–	0–2
	Douglas-fir	PSME	*Pseudotsuga menziesii*	–	0–2
	Rocky Mountain juniper	JUSC2	*Juniperus scopulorum*	–	0–1

Table 15. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Mid-stature Cool-season Bunchgrasses**			34–101	
	needle and thread	HECO26	*Hesperostipa comata*	34–101	5–15
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	0–67	0–10
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–34	0–5
2	**Rhizomatous Wheatgrasses**			34–135	

	Montana wheatgrass	ELAL7	*Elymus albicans*	34–101	5–15
	western wheatgrass	PASM	*Pascopyrum smithii*	0–67	0–10
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–34	0–5
3	**Short-stature Cool-season Bunchgrasses**			34–101	
	prairie Junegrass	KOMA	*Koeleria macrantha*	34–67	5–10
	Sandberg bluegrass	POSE	*Poa secunda*	0–34	0–5
	squirreltail	ELEL5	*Elymus elymoides*	0–34	0–5
4	**Tillering Cool-season Grsas-likes**			0–67	
	threadleaf sedge	CAFI	*Carex filifolia*	0–67	0–10
5	**Miscellaneous Grasses/Grass-likes**			0–34	
	threeawn	ARIST	*Aristida*	0–34	0–5
	needleleaf sedge	CADU6	*Carex duriuscula*	0–34	0–5
	Grass, perennial	2GP	*Grass, perennial*	0–34	0–5
Forb					
6	**Perennial Forbs**			0–67	
	woollypod milkvetch	ASPU9	*Astragalus purshii*	0–34	0–5
	fleabane	ERIGE2	*Erigeron*	0–34	0–5
	leafy wildparsley	MUDI	*Musineon divaricatum*	0–34	0–5
	spiny phlox	PHHO	*Phlox hoodii*	0–34	0–5
	Indian paintbrush	CASTI2	*Castilleja*	0–34	0–5
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–34	0–5
	beardtongue	PENST	*Penstemon*	0–34	0–5
	lemon scurfpea	PSLA3	*Psoralidium lanceolatum*	0–34	0–5
	little larkspur	DEBI	*Delphinium bicolor*	0–34	0–5
	plains pricklypear	OPPO	*Opuntia polyacantha*	22–34	0–5
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–34	0–5
	Forb, perennial	2FP	*Forb, perennial*	0–34	0–5
7	**Annual Forbs**			0–34	
	woolly plantain	PLPA2	*Plantago patagonica*	0–34	0–5
	pepperweed	LEPID	*Lepidium*	0–34	0–5
	Forb, annual	2FA	*Forb, annual*	0–34	0–5
Shrub/Vine					
8	**Miscellaneous Shrubs**			28–140	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	17–67	2–10
	prairie sagewort	ARFR4	*Artemisia frigida*	11–67	2–10
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–34	0–5
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–34	0–5
	skunkbush sumac	RHTR	*Rhus trilobata*	0–34	0–5
Tree					
9	**Miscellaneous Trees**			–	
	limber pine	PIFL2	*Pinus flexilis*	–	0–2
	Douglas-fir	PSME	*Pseudotsuga menziesii*	–	0–2
	Rocky Mountain juniper	JUSC2	*Juniperus scopulorum*	–	0–1

	juniper				

Table 16. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Mid-stature Cool-season Bunchgrasses**			28–84	
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	28–84	5–15
	needle and thread	HECO26	*Hesperostipa comata*	0–56	0–10
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–28	0–5
2	**Rhizomatous Cool-season Grasses**			0–28	
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–28	0–5
	western wheatgrass	PASM	*Pascopyrum smithii*	0–28	0–5
	Montana wheatgrass	ELAL7	*Elymus albicans*	0–28	0–5
3	**Short-stature Cool-season Bunchgrasses**			0–56	
	squirreltail	ELEL5	*Elymus elymoides*	0–28	0–5
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–28	0–5
	Sandberg bluegrass	POSE	*Poa secunda*	0–28	0–5
4	**Tillering Cool-season Grass-likes**			112–280	
	threadleaf sedge	CAFI	*Carex filifolia*	112–280	20–50
5	**Miscellaneous Grasses/Grass-likes**			0–28	
	threeawn	ARIST	*Aristida*	0–28	0–5
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–28	0–5
	Grass, perennial	2GP	*Grass, perennial*	0–28	0–5
	Grass, annual	2GA	*Grass, annual*	0–28	0–5
Forb					
6	**Perennial Forbs**			0–56	
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–56	0–10
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–28	0–5
	Forb, perennial	2FP	*Forb, perennial*	0–28	0–5
	sandwort	ARENA	*Arenaria*	0–28	0–5
	fleabane	ERIGE2	*Erigeron*	0–28	0–5
	leafy wildparsley	MUDI	*Musineon divaricatum*	0–28	0–5
	spiny phlox	PHHO	*Phlox hoodii*	0–28	0–5
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–28	0–5
	lemon scurfpea	PSLA3	*Psoralidium lanceolatum*	0–28	0–5
	little larkspur	DEBI	*Delphinium bicolor*	0–28	0–5
7	**Annual Forbs**			0–28	
	woolly plantain	PLPA2	*Plantago patagonica*	0–28	0–5
	pepperweed	LEPID	*Lepidium*	0–28	0–5
	Forb, annual	2FA	*Forb, annual*	0–28	0–5
Shrub/Vine					
8	**Miscellaneous Shrubs**			0–84	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	0–28	0–5

	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–28	0–5
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–28	0–5
	skunkbush sumac	RHTR	*Rhus trilobata*	0–28	0–5
	prairie sagewort	ARFR4	*Artemisia frigida*	0–28	0–5

Animal community

Animal Community – Wildlife Interpretations:

1.1 - Bluebunch Wheatgrass/Sagebrush (Reference Community): The predominance of grasses in this plant community favors grazers and mixed-feeders, such as bison, elk, and antelope. Suitable thermal and escape cover for deer may be limited due to the low quantities of woody plants. However, topographical variations could provide some escape cover. When found adjacent to sagebrush dominated states, this plant community may provide brood rearing/foraging areas for sage grouse, as well as lek sites. Other birds that would frequent this plant community include western meadowlarks, horned larks, and golden eagles. Many grassland obligate small mammals would occur here.

1.2 - Perennial Grasses/Sagebrush Plant Community: The combination of an overstory of sagebrush and an understory of grasses and forbs provide a very diverse plant community for wildlife. The crowns of sagebrush tend to break up hard crusted snow on winter ranges, so mule deer and antelope may use this state for foraging and cover year-round, as would cottontail and jack rabbits. It provides important winter, nesting, brood-rearing, and foraging habitat for sage grouse. Brewer’s sparrows’ nest in big sagebrush plants and hosts of other nesting birds utilize stands in the 20 to 30 percent cover range.

2.1 - Threadleaf Sedge Plant Community: This community provides limited foraging for antelope and other grazers. They may be used as a foraging site by sage grouse where reference state community phases are limited. Generally, these are not target plant communities for wildlife habitat management.

3.1 - Perennial Grasses/Invasive Species/Sagebrush Plant Community: The retained combination of sagebrush and the added diversity with the invasive grasses and/or forbs provide an extended plant community for wildlife. The similarities to Community Phase 1.2 are to some extent enhanced for some species with the added forage provided by the invasive species. But as the invasive species increase, decreasing the desirable species, the wildlife species benefits are decreased as well.

4.1 - Disturbed Lands Plant Community: The variability of this site prevents a detailed review of wildlife benefits. However, many of the introduced grasses, forbs and shrubs can provide adequate cover, feed and nesting sites for those wildlife species that would have selected the site prior to disturbance. Limitations and enhancements need to be considered by specific locations.

Animal Community – Grazing Interpretations:

The following table lists suggested stocking rates for cattle under continuous season-long grazing under 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.

The Carrying capacity is calculated as the production for a normal year X .25 efficiency factor / 912.5 #/AUM to calculate the AUM's/Acre.

Plant Community Production Carrying Capacity*
Plant Community Description/Title: Lbs./Acre AUM/Acre Acres/AUM
1.1 Bluebunch Wheatgrass/Sagebrush 250-400-650 0.11 9.13
1.2 Perennial Grasses/Sagebrush 200-375-600 0.10 9.73

2.1 Threadleaf Sedge 200-300-400 0.08 12.17
3.1 Perennial Grasses/Invasive Species/Sagebrush ** **
4.1 Disturbed Lands ** **

* - Carry Capacity is figured for continuous, season-long grazing by cattle under average growing conditions.
** - Sufficient data for invaded and reclaimed communities has not be collected or evaluated, at this time, 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 needs to be supplemented with protein because the 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 graze-able 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 B, with localized areas in hydrologic group C. Infiltration potential for this site varies from moderately rapid to rapid depending on soil hydrologic group and ground cover. Runoff varies from low to moderate. In many cases, areas with greater than 75 percent 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 percent 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 one to two percent of the soil surface.

Recreational uses

This site provides hunting opportunities for upland game species. The wide varieties of plants which bloom from spring until fall have an aesthetic value that appeals to visitors. The extent of this ecological site is found within wild horse use areas; Pryor Mountain and McCullough Peaks. Wild horse/Wildlife Excursions are found as recreational venues for BLM lands and State lands within the Big Horn Basin. This ecological site, however, can prove to have limitations when associated with roadways and trails in relation to erosion potential and functionality. The slopes are steep and the soils are erosive.

Wood products

No appreciable wood products are present on the site. Rocky Mountain juniper, limber pine, and Douglas fir may be present in scattered patches, but no logging or timber harvest for commercial use is occurring.

Other products

Herbs: Several of the forb species within the communities of the Loamy Calcareous Ecological site have medicinal characteristics and have been used by the Native Americans in this area and more recently by the naturopathic profession.

Ornamental Species: The forbs commonly found as well as the shrub component of these communities have been used in landscaping and xeriscaping.

Inventory data references

Information presented was derived from NRCS inventory data. Field observations from range-trained personnel also were used. Those involved in the development of the new concept for the Channery Upland ecological site include Blaise Allen, Multi-county Rangeland Management Specialist, NRCS; and Marji Patz, Ecological Site Specialist, NRCS. 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 3 and 4, and USDA NRCS Soil Surveys from various counties.

Quality control and quality assurance completed by NRCS: Dan Mattke, Area Resource Soil Scientist; Daniel Wood, MLRA Soil Survey Leader; John Hartung, Wyoming State Rangeland Management Specialist; Jeff Goats, Wyoming State Soil Scientist; and Kirt Walstad, Senior Regional Ecological Site Specialist.

For specific data inquiries, contact the Powell, Wyoming Soil Survey Office (USDA-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 three of these estimated points, with two 21-foot X 21-foot 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	02/07/2022
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rare to nonexistent. Where present, short and widely spaced.

2. **Presence of water flow patterns:** Some observable.

3. **Number and height of erosional pedestals or terracettes:** Rare to nonexistent.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground can range from 25-50%.

5. **Number of gullies and erosion associated with gullies:** Active gullies should not be present.

6. **Extent of wind scoured, blowouts and/or depositional areas:** Minimal to nonexistent.

7. **Amount of litter movement (describe size and distance expected to travel):** Herbaceous litter expected to move in moderate amounts. Large woody debris will show only slight movement down slope.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil Stability Index ratings range from 2 (interspaces) to 5 (under plant canopy), but average values should be 2.5 or greater.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil data is limited for this site. Described A-horizons vary from 2-11 inches (5-28 cm) with OM of .5 to 1%.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Plant community consists of 70-85% grasses, 15% forbs, and 0-15% shrubs. Minimal plant canopy (15-50%) and litter plus slow to moderately rapid infiltration rates result in slight to moderate runoff. Basal cover is typically less than 5% and does very little to effect runoff on this site. Surface rock fragments of 20-50% provide site stability from erosion, but decrease infiltration.

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 exists, but large amounts of subsurface coarse fragments may be mistaken for a compaction layer.

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant: mid-size, cool season bunchgrasses >> perennial forbs

    Sub-dominant: short cool season bunchgrasses > cool season rhizomatous grasses

    Other: perennial shrubs

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Minimal decadence, typically associated with shrub component.

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14. **Average percent litter cover (%) and depth (in):** Litter ranges from 5-25% of total canopy measurement with total litter (including beneath the plant canopy) from 15-50% expected. Herbaceous litter depth is typically shallow, ranging from 2-8mm. Woody litter is very limited and is less than one inch thick (1-2 cm).

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** English: 250-600 lb/ac (425 lb/ac average); Metric: 280-672 kg/ha (476 kg/ha average).

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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:** Threadleaf sedge big and/or black sagebrush and juniper are common increasers. Annual weeds such as cheatgrass, mustards, kochia, and Russian thistle are common invasive species in disturbed sites.

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17. **Perennial plant reproductive capability:** All species are capable of reproducing, except in drought years.
