USDA Natural Resources
Conservation Service

Ecological site EX043B23B100
Channery Upland (CnU) Absaroka Upper 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) 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.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

EX043B23B150	**Sandy (Sy) Absaroka Upper 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.
EX043B23B166	**Shallow Sandy (SwSy) Absaroka Upper 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.
EX043B23B176	**Very Shallow (VS) Absaroka Upper 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

EX043B23B175	**Skeletal (Sk) Absaroka Upper 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.

EX043B23B112	**Gravelly (Gr) Absaroka Upper 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.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata ssp. vaseyana*
Herbaceous	(1) *Pseudoroegneria spicata* (2) *Leucopoa kingii*

Legacy ID

R043BX600WY

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 > Escarpment (2) Foothills > Erosion remnant (3) Foothills > Colluvial apron
Runoff class	Negligible to high
Elevation	6,000–9,000 ft
Slope	20–75%
Water table depth	60 in
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, Yellowstone Park Mammoth, and Tower Falls are the only available weather stations within a close proximity in location and characteristics for 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)	14-16 in
Frost-free period (actual range)	5-65 days
Freeze-free period (actual range)	22-108 days
Precipitation total (actual range)	14-16 in
Frost-free period (average)	36 days
Freeze-free period (average)	70 days
Precipitation total (average)	15 in

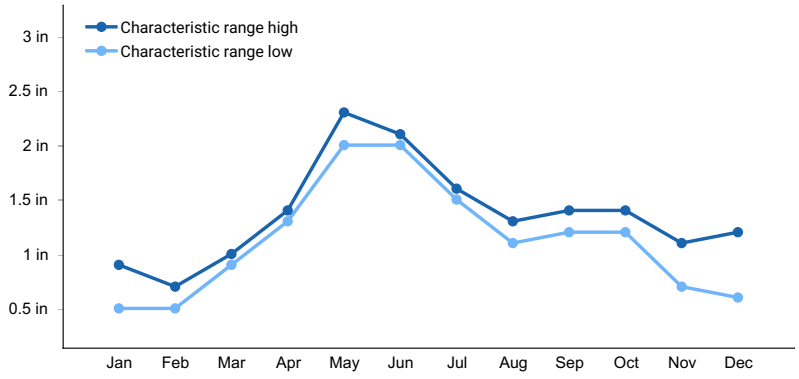


Figure 1. Monthly precipitation range

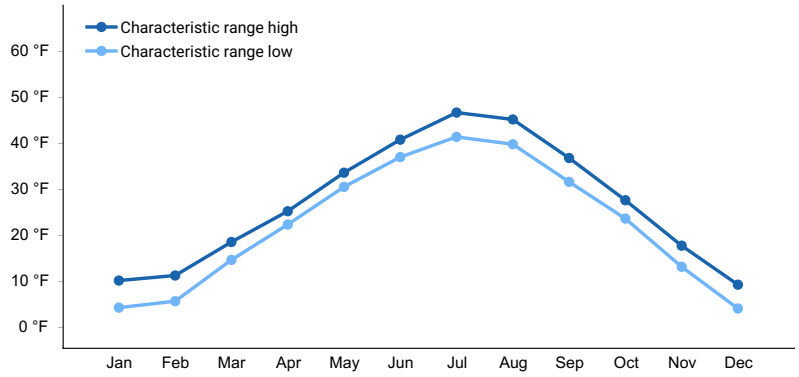


Figure 2. Monthly minimum temperature range

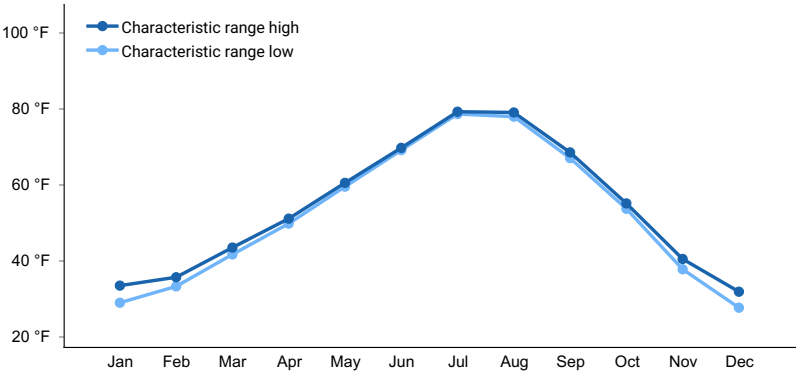


Figure 3. Monthly maximum temperature range

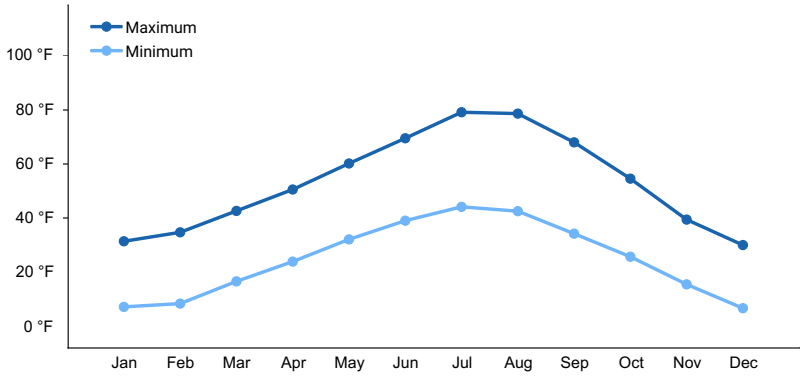


Figure 4. Monthly average minimum and maximum temperature

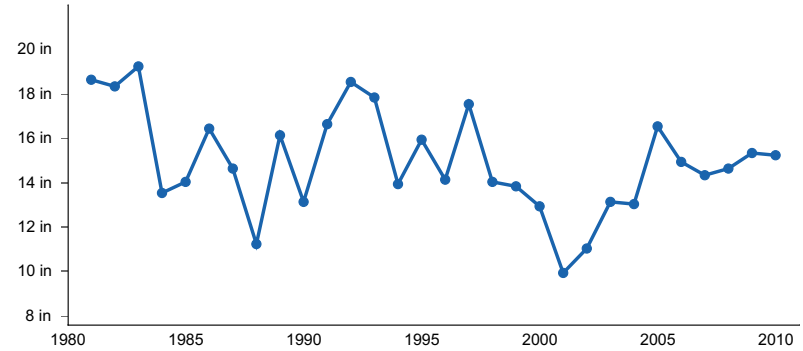


Figure 5. Annual precipitation pattern

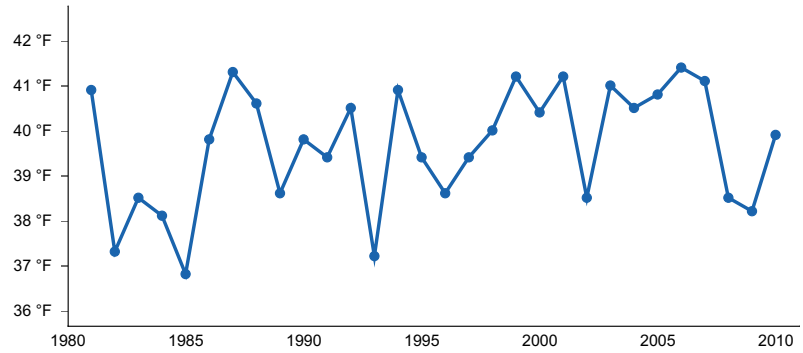


Figure 6. Annual average temperature pattern

Climate stations used

- (1) YELLOWSTONE PK MAMMOTH [USC00489905], Yellowstone National Park, WY
- (2) TOWER FALLS [USC00489025], Yellowstone National Park, WY
- (3) SUNSHINE 3NE [USC00488758], Meeteetse, 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's 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. Size and composition of channers in the profile is variable, but is a limiting soil feature.

Figure 8. The Chugwater formation carries the same or similar soil characteristics but with the distinct red color and are generally higher in silts and chemistry.

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	20 in
Surface fragment cover <=3"	15–30%

Surface fragment cover >3"	0–15%
Available water capacity (0-40in)	0.6–1.4 in
Calcium carbonate equivalent (0-20in)	0–5%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0–3
Soil reaction (1:1 water) (0-40in)	6.6–7.8
Subsurface fragment volume <=3" (0-40in)	0–20%
Subsurface fragment volume >3" (0-40in)	0–10%

Ecological dynamics

Potential vegetation on this site is dominated by mid-stature cool-season perennial bunchgrasses. Other significant vegetation includes a variety of forbs, and black and big sagebrush. The expected potential composition for this site is about 75 percent grasses, 15 percent forbs and 10 percent woody plants.

As this site deteriorates, species such as bluegrasses and rhizomatous wheatgrasses will increase. Cool-season grasses such as spike fescue, bluebunch wheatgrass, and Idaho fescue will decrease in frequency and production. As conditions continue to deteriorate annuals such as cheatgrass will invade.

The woody vegetation on the Channery Upland ecological site is not as resilient once it has been removed or severely reduced. Slope and lack of fine fuels limit the fire frequency. Some communities will support a cover of limber pine, Rocky Mountain juniper, and Douglas fir. The tree cover and resulting litter or duff layer may alter the fire potential over time.

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.

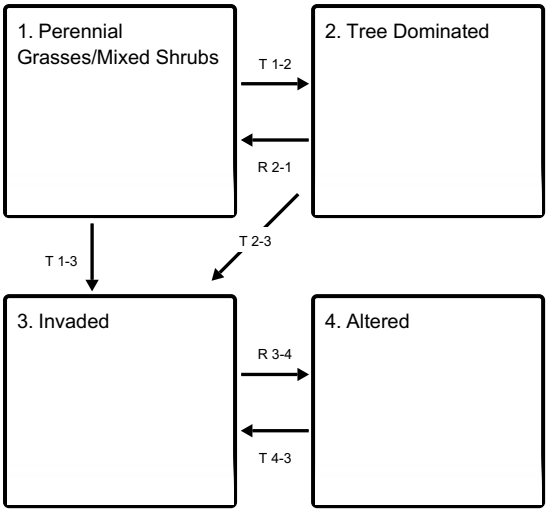
The Reference Plant Community (description follows the plant community diagram) has been determined by study of relic rangeland sites, or areas protected from excessive disturbance. Trends in plant communities going from heavily grazed areas to lightly grazed areas, seasonal use pastures, and historical 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 - Lack of fire, weakened herbaceous cover, and aspect can have an influence on the encroachment or increase of tree cover.

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

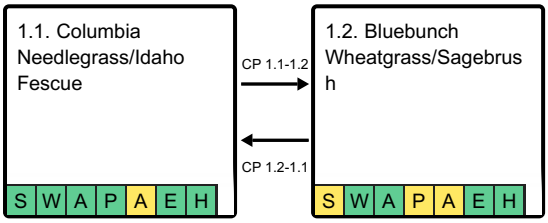
R 2-1 - Fire or tree control, followed by a period of recover, and potentially seeding will allow this community to improve.

T 2-3 - Fire or lack of fire, drought with or without hoof impact or mechanical soil impact to displace the understory species, opens the niche for invasive species to encroach and 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.

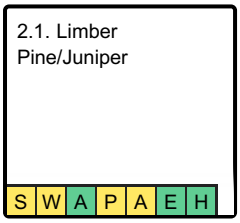
State 1 submodel, plant communities



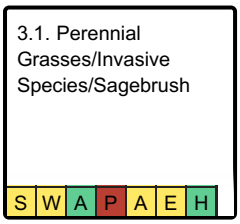
CP 1.1-1.2 - Moderate, continuous season-long grazing, especially with drought, will reduce the tall-stature grasses moving this community to the Bluebunch Wheatgrasses/Mixed Shrub Community Phase.

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

State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 submodel, plant communities

4.1. Disturbed Lands

S W A P A E H

State 1
Perennial Grasses/Mixed Shrubs

The reference state (State 1) for the Channery Upland ecological site is dominated by tall-stature, cool-season bunchgrasses. This State persisted under areas that were grazing by large ungulates, however there is limited access by livestock. The associated rock uplifts and steeper slopes provides a forage resource 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 Columbia needlegrass, Idaho fescue, spike fescue, and bluebunch wheatgrass (15-30 percent composition). Rhizomatous wheatgrasses and prairie Junegrass are common, with 10 percent or less cover of shrubs including Mountain big sagebrush. Minor components to the overall composition is made up of Sandberg bluegrass, bottlebrush squirreltail, and threadleaf sedge.

Resilience management. This state occurs in areas that are grazed moderately with periods of rest by large ungulates including 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
Columbia Needlegrass/Idaho Fescue

Figure 9. During a droughty year, grasses are struggling but they still are present. Columbia needlegrass and Idaho fescue are a major component of this community.

The Columbia Needlegrass/Idaho Fescue Plant Community is the Reference community. This community evolved with grazing by large herbivores, and periodic fires. Potential vegetation is about 75% grasses or grass-like plants, 15% forbs, and 10% woody plants. The soil limitations, slope, and potential fire regime in this community prevents big sagebrush, juniper, and limber pine from being the dominant landscape. This plant community can be found on areas that are properly managed with grazing receiving periods of rest. Cool-season tall- and mid-stature bunchgrasses dominate this community. The major grasses include Columbia needlegrass, Idaho fescue, and bluebunch wheatgrass. Mountain big sagebrush and rubber rabbitbrush are conspicuous elements, occurring in a mosaic pattern, and make up 5 to 10% of the annual production. A variety of forbs also occur in this state and plant diversity is high (see Plant Composition Table). The total annual production (air-dry weight) of this community phase is about 650 lbs./acre, but it can range from about 400 lbs./acre in unfavorable years to about 800 lbs./acre in above-average years.

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

Dominant plant species

- mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*), shrub
- rubber rabbitbrush (*Ericameria nauseosa*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- Columbia needlegrass (*Achnatherum nelsonii*), grass
- Idaho fescue (*Festuca idahoensis*), grass
- spike fescue (*Leucopoa kingii*), grass
- arrowleaf balsamroot (*Balsamorhiza sagittata*), other herbaceous
- Indian paintbrush (*Castilleja*), other herbaceous
- lupine (*Lupinus*), other herbaceous

Dominant resource concerns

- Inadequate livestock water quantity, quality, and distribution

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	350	515	600
Forb	25	75	100
Shrub/Vine	25	50	75
Tree	0	10	25
Total	**400**	**650**	**800**

Table 6. Ground cover

Tree foliar cover	0-2%
Shrub/vine/liana foliar cover	0-10%
Grass/grasslike foliar cover	30-50%
Forb foliar cover	5-15%
Non-vascular plants	0%
Biological crusts	0%
Litter	15-25%
Surface fragments >0.25" and <=3"	0-20%
Surface fragments >3"	0-15%
Bedrock	0%
Water	0%
Bare ground	10-20%

Table 7. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	0-2%	0-2%
>0.5 <= 1	–	0-5%	5-10%	0-10%
>1 <= 2	–	0-10%	5-25%	0-5%
>2 <= 4.5	–	0-2%	2-10%	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

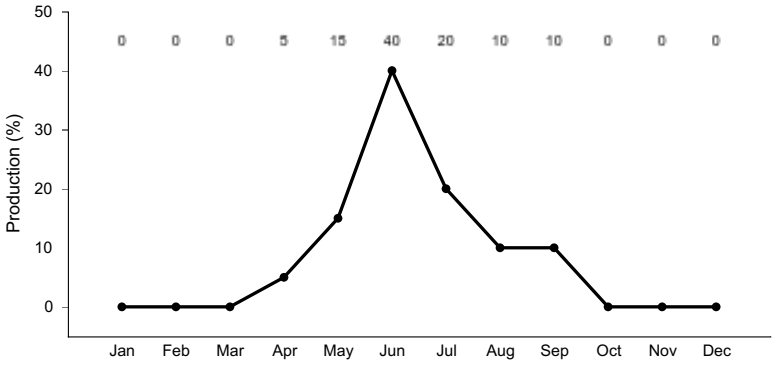


Figure 11. Plant community growth curve (percent production by month). WY0601, 15-19E all upland sites.

Community 1.2
Bluebunch Wheatgrass/Sagebrush

Figure 12. Fringed sagewort, mountain sagebrush, and gooseberry are a common shrub community with bluebunch wheatgrass and Idaho fescue.

Historically, this plant community evolved under grazing by large ungulates and a low fire frequency. Currently, this site is normally found under a moderate, season-long grazing regime and will be exacerbated by prolonged drought conditions. In addition, the fire regime for this site has been modified and extended periods without fire is now common. Shrubs are important components of this plant community. Cool-season grasses make up the majority of the understory with the balance made up of miscellaneous forbs. Dominant grasses include bluebunch wheatgrass, Idaho fescue, needle and thread, prairie Junegrass, mountain brome, and of less frequency Columbia needlegrass. Grasses of secondary importance include rhizomatous wheatgrass, spike fescue, slender wheatgrass, bluegrasses, Indian ricegrass, and upland sedges. Forbs commonly found in this plant community include arrowleaf balsamroot, asters, phlox, hawksbeard, buckwheat, pussytoes, lupine, paintbrush, agoseris, and larkspurs. Mountain big sagebrush and rubber rabbitbrush make up from 15% to 20% of the total annual production and to a lesser extent

juniper and limber pine will be included. When compared to the Reference Plant Community, mountain big sagebrush, rhizomatous wheatgrasses, and bluegrasses have increased. Columbia needlegrass and Idaho fescue have decreased, often occurring only where protected from grazing by the sagebrush canopy. Juniper may have encroached on the site but are in small or scattered patches. The total annual production (air-dry weight) of this community is about 500 lbs./acre, but it can range from about 300 lbs./acre in unfavorable years to about 700 lbs./acre in above-average years.

Resilience management. Rangeland Health Implications/Indicators: This plant community is resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. The herbaceous component is mostly intact and plant vigor and replacement capabilities are sufficient. Water flow patterns and litter movement may be occurring but only on steeper slopes. Incidence of pedestalling is minimal. Soils are mostly stable and the surface shows minimum soil loss. Wind scouring and deposition areas are few. The watershed is functioning and the biotic community is intact.

Dominant plant species

- mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- gooseberry currant (*Ribes montigenum*), shrub
- bluebunch wheatgrass (*Pseudoroegneria spicata*), grass
- Idaho fescue (*Festuca idahoensis*), grass
- prairie Junegrass (*Koeleria macrantha*), grass
- arrowleaf balsamroot (*Balsamorhiza sagittata*), other herbaceous
- rosy pussytoes (*Antennaria rosea*), other herbaceous
- Indian paintbrush (*Castilleja*), other herbaceous

Dominant resource concerns

- Sheet and rill erosion
- Classic gully erosion
- Plant structure and composition
- Inadequate livestock water quantity, quality, and distribution

Table 8. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	225	350	450
Shrub/Vine	50	75	150
Forb	25	50	75
Tree	0	25	25
Total	**300**	**500**	**700**

Table 9. Ground cover

Tree foliar cover	0-5%
Shrub/vine/liana foliar cover	5-20%
Grass/grasslike foliar cover	20-40%
Forb foliar cover	2-10%
Non-vascular plants	0%
Biological crusts	0%
Litter	15-25%
Surface fragments >0.25" and <=3"	0-20%
Surface fragments >3"	0-15%
Bedrock	0%

Water	0%
Bare ground	20-30%

Table 10. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	2-5%	2-5%
>0.5 <= 1	–	0-5%	5-15%	2-10%
>1 <= 2	–	5-10%	0-20%	0-5%
>2 <= 4.5	–	0-5%	–	–
>4.5 <= 13	0-5%	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

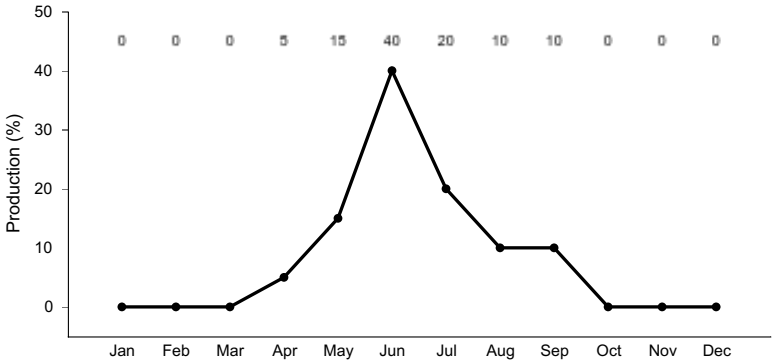


Figure 14. Plant community growth curve (percent production by month). WY0601, 15-19E all upland sites.

Pathway CP 1.1-1.2
Community 1.1 to 1.2

Columbia Needlegrass/Idaho Fescue

Bluebunch Wheatgrass/Sagebrush

Moderate, continuous season-long grazing will convert the plant community to the Bluebunch wheatgrass/Mixed Shrub Community Phase. Prolonged drought will exacerbate this transition. The continuous use reduces the key tall-stature bunchgrasses such as Columbia needlegrass and spike fescue; allowing the mid- and short-stature bunchgrasses 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

Bluebunch Wheatgrass/Sagebrush

Columbia Needlegrass/Idaho Fescue

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 rejuvenation of the tall- and 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

Prescribed Burning
Critical Area Planting
Prescribed Grazing
Range Planting
Integrated Pest Management (IPM)
Upland Wildlife Habitat Management
Forest Stand Improvement

State 2
Tree Dominated

Limber pine and Rocky Mountain juniper cover is common on the Channery Upland ecological site, in trace amounts (less than five percent cover). On certain aspects or when climatic conditions are slightly altered, the tree cover will increase in the absence of fire. A weakened herbaceous cover provides the opportunity for the trees to establish and become dominant.

Characteristics and indicators. The key indicator of becoming tree dominated, is the presence of tree cover in greater than 15 percent cover. The composition includes a productive (although limited) understory of grasses with minor cover of shrubs and forbs.

Resilience management. The lack of fine fuels with a decreased herbaceous cover, and a crown cover that is relatively open, providing a low fire threat. This State is resistant to change in the absence of fire. Grazing pressure will have an impact on the understory, but has minimal effect on the woody cover. If the community is impacted by fire or other disturbances, it holds a low resilience.

Community 2.1
Limber Pine/Juniper

Figure 15. A mature stand of limber pine, Rocky Mountain juniper, and Douglas fir is common and North and East aspects of the Channery Upland ecological site.

Figure 16. In decadent stands, and following a catastrophic evet, the Limber Pine/Juniper plant community is a scare on this landscape.

This plant community is the result of aspect or protection from fire. The Limber pine/Juniper plant community is likely only where conditions are more conducive and a seed source is available for limber pine. Rocky Mountain juniper is a common component with limber pine, where Douglas fir is present in a more select locations. Limber pine can occur in sufficient numbers to give the site an open forestland appearance. The under story has been significantly altered and the tall-stature cool-season bunchgrasses have been eliminated or greatly reduced. The dominant grasses are bluebunch wheatgrass, prairie Junegrass, and sanberg bluegrass. A minor component of mountain big sagebrush persists with a mix of other shrubs. In chugwater or similar red geology soils, black sagebrush is common. When compared with the Reference State, the annual production is less, as the major cool-season grasses are reduced, but the shrub and tree production has increased significantly and compensates for some of the decline in the herbaceous production. The interspaces between plants have expanded leaving the amount of bare ground more prevalent and more soil surface exposed to erosive elements. The total annual production (air-dry weight) of this state is about 350 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. Rangeland Health Implications/Indicators: This plant community is resistant to change as the stand becomes more decadent. These areas may actually be more resistant to fire as less fine fuels are available and the bare ground between the shrubs is increased. The herbaceous component is not as diverse and plant vigor and species regeneration capabilities of cool-season perennials are deficient. The removal of grazing does not seem to affect the plant composition or structure of the plant community. 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 may be establishing where rills have concentrated down slope.

Dominant plant species

- limber pine (*Pinus flexilis*), tree

- Rocky Mountain juniper (*Juniperus scopulorum*), tree
- Douglas-fir (*Pseudotsuga menziesii*), tree
- mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*), shrub
- black sagebrush (*Artemisia nova*), shrub
- common juniper (*Juniperus communis*), shrub
- bluebunch wheatgrass (*Pseudoroegneria spicata*), grass
- prairie Junegrass (*Koeleria macrantha*), grass
- Idaho fescue (*Festuca idahoensis*), grass
- lupine (*Lupinus*), other herbaceous
- hairy false goldenaster (*Heterotheca villosa*), other herbaceous
- aster (*Aster*), other herbaceous

Dominant resource concerns

- Sheet and rill erosion
- Classic gully erosion
- Aggregate instability
- Naturally available moisture use
- Sediment transported to surface water
- Plant structure and composition
- Inadequate livestock water quantity, quality, and distribution

Table 11. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	65	125	250
Tree	100	150	200
Shrub/Vine	25	50	100
Forb	10	25	50
Total	**200**	**350**	**600**

Table 12. Ground cover

Tree foliar cover	15-40%
Shrub/vine/liana foliar cover	5-20%
Grass/grasslike foliar cover	10-35%
Forb foliar cover	5-10%
Non-vascular plants	0%
Biological crusts	0%
Litter	15-30%
Surface fragments >0.25" and <=3"	0-20%
Surface fragments >3"	0-15%
Bedrock	0%
Water	0%
Bare ground	5-15%

Table 13. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-2%	0-5%	0-5%
>0.5 <= 1	–	0-5%	0-10%	0-10%
>1 <= 2	–	0-10%	10-20%	0-5%
>2 <= 4.5	–	0-5%	0-5%	–
>4.5 <= 13	15-40%	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

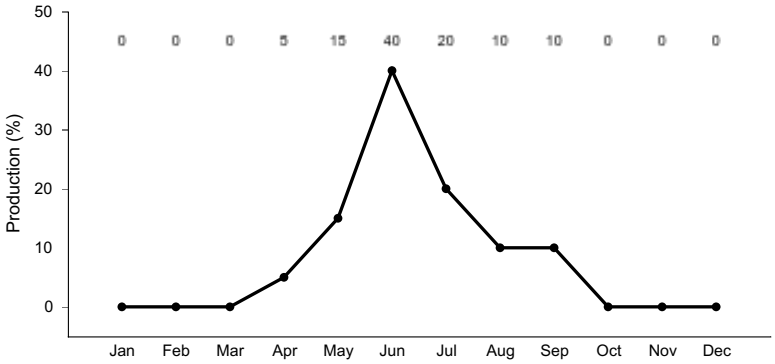


Figure 18. Plant community growth curve (percent production by month). WY0601, 15-19E all upland sites.

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. Non-native species such as smooth brome, Kentucky bluegrass, and native species such as Rocky Mountain juniper encroach into this community.

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). Management of smooth brome and Kentucky bluegrass pose a challenge, but do provide a grazing resource. Rocky Mountain juniper is a natural part of the community, but with shift of disturbance regimes, does become an aggressive species that can be controlled and reduced in the community.

Community 3.1
Perennial Grasses/Invasive Species/Sagebrush

Figure 19. The encroachment of cheatgrass into the upper foothills and 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. The plant vigor is diminished and replacement capabilities are limited due to the reduced number of native 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

- Rocky Mountain juniper (*Juniperus scopulorum*), tree
- limber pine (*Pinus flexilis*), tree
- Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*), shrub
- rubber rabbitbrush (*Ericameria nauseosa*), shrub
- cheatgrass (*Bromus tectorum*), grass
- bluebunch wheatgrass (*Pseudoroegneria spicata*), grass
- threadleaf sedge (*Carex filifolia*), grass
- thistle (*Cirsium*), other herbaceous
- rosy pussytoes (*Antennaria rosea*), other herbaceous
- common yarrow (*Achillea millefolium*), other herbaceous

Dominant resource concerns

- Sheet and rill erosion
- Ephemeral gully erosion
- Classic gully erosion
- Sediment transported to surface water
- Plant productivity and health
- Plant structure and composition
- Wildfire hazard from biomass accumulation
- 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

- Sheet and rill 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

The transition to a tree dominant state requires more consideration and analysis. It is known to be a factor of temperature an effective moisture, encouraging higher rates of establishment on the landscape. North and east aspects that are still within the frigid temperature range but with higher relative effective precipitation have a higher

potential for tree establishment. In areas that are more southerly favors juniper encroachment in the absence of a strong herbaceous cover. Grazing pressure, wildlife movement, especially bird activity, and lack of fire attribute to the ability for trees to increase in density and vigor.

Constraints to recovery. The lack of fine fuels and canopy closer to easily carry fire, the aggressive nature of Rocky Mountain Juniper, and slope coupled with the lack of key herbaceous species are the major constraints to recovery.

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.

Conservation practices

Brush Management
Prescribed Burning
Critical Area Planting
Prescribed Grazing
Grazing Land Mechanical Treatment
Range Planting
Integrated Pest Management (IPM)
Upland Wildlife Habitat Management
Forest Stand Improvement

Transition T 2-3
State 2 to 3

Fire, drought or insect degradation, soil disturbances, or grazing with a seed source present can open the soil surface and weaken the understory cover allowing invasive species to establish. Fire can provide the niche for cheatgrass to establish on this site, while a lack of fire with juniper present can encourage juniper encroachment and cheatgrass to establish with the loss of other understory species. Use and movement of wildlife through the community as well as livestock are a source of invasive species.

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 recovery of this site.

Context dependence. In the instances where Rocky Mountain juniper is considered an invasive species, juniper

control provides a greater potential for control and site improvement. But management considerations may shift depending on extent of encroachment and community shift.

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

Prescribed Burning
Critical Area Planting
Prescribed Grazing
Grazing Land Mechanical Treatment
Heavy Use Area Protection
Integrated Pest Management (IPM)
Upland Wildlife Habitat Management
Forest Stand Improvement
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.

Constraints to recovery. 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 (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall-stature Cool-season Bunchgrasses**			150–350	
	Columbia needlegrass	ACNE9	*Achnatherum nelsonii*	90–250	10–25
	spike fescue	LEKI2	*Leucopoa kingii*	45–135	5–15
	mountain brome	BRMA4	*Bromus marginatus*	0–45	0–5
2	**Mid-stature Cool-season Bunchgrasses**			50–200	
	Idaho fescue	FEID	*Festuca idahoensis*	45–200	10–20

	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	0–90	0–10
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–45	0–5
	needle and thread	HECO26	*Hesperostipa comata*	0–45	0–5
3	**Rhizomatous Wheatgrasses**			25–75	
	Montana wheatgrass	ELAL7	*Elymus albicans*	45–75	5–10
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–45	0–5
	western wheatgrass	PASM	*Pascopyrum smithii*	0–45	0–5
4	**Short-stature Cool-season Bunchgrasses**			0–45	
	squirreltail	ELEL5	*Elymus elymoides*	0–45	0–5
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–45	0–5
	Sandberg bluegrass	POSE	*Poa secunda*	0–45	0–5
5	**Tillering Cool-season Grass-likes**			0–45	
	threadleaf sedge	CAFI	*Carex filifolia*	0–45	0–5
6	**Miscellaneous Grasses/Grass-likes**			0–45	
	needleleaf sedge	CADU6	*Carex duriuscula*	0–45	0–5
	Grass, perennial	2GP	*Grass, perennial*	0–45	0–5
Forb					
7	**Perennial Forbs**			25–100	
	woollypod milkvetch	ASPU9	*Astragalus purshii*	0–45	0–5
	rosy pussytoes	ANRO2	*Antennaria rosea*	0–45	0–5
	arrowleaf balsamroot	BASA3	*Balsamorhiza sagittata*	0–45	0–5
	Indian paintbrush	CASTI2	*Castilleja*	0–45	0–5
	sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	0–45	0–5
	little larkspur	DEBI	*Delphinium bicolor*	0–45	0–5
	fleabane	ERIGE2	*Erigeron*	0–45	0–5
	lupine	LUPIN	*Lupinus*	0–45	0–5
	beardtongue	PENST	*Penstemon*	0–45	0–5
	Forb, perennial	2FP	*Forb, perennial*	0–45	0–5
Shrub/Vine					
8	**Miscellaneous Shrubs**			25–75	
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	0–45	0–5
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–45	0–5
	gooseberry currant	RIMO2	*Ribes montigenum*	0–45	0–5
	Woods' rose	ROWO	*Rosa woodsii*	0–45	0–5
	prairie sagewort	ARFR4	*Artemisia frigida*	0–45	0–5
	common snowberry	SYAL	*Symphoricarpos albus*	0–45	0–5
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–45	0–5
Tree					
9	**Trees**			0–25	
	limber pine	PIFL2	*Pinus flexilis*	0–25	0–5
	Rocky Mountain juniper	JUSC2	*Juniperus scopulorum*	0–25	0–5
	Douglas-fir	PSME	*Pseudotsuga menziesii*	0–25	0–5

	Tree	2TREE	*Tree*	0–25	0–5

Table 15. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall-stature Cool-season Bunchgrasses**			0–80	
	spike fescue	LEKI2	*Leucopoa kingii*	0–80	0–10
	mountain brome	BRMA4	*Bromus marginatus*	0–40	0–5
	Columbia needlegrass	ACNE9	*Achnatherum nelsonii*	0–40	0–5
2	**Mid-stature Cool-season Bunchgrasses**			100–250	
	Idaho fescue	FEID	*Festuca idahoensis*	80–200	10–20
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	40–150	5–15
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–25	0–5
	needle and thread	HECO26	*Hesperostipa comata*	0–25	0–5
3	**Rhizomatous Wheatgrasses**			40–80	
	Montana wheatgrass	ELAL7	*Elymus albicans*	40–80	5–10
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–40	0–5
	western wheatgrass	PASM	*Pascopyrum smithii*	0–40	0–5
4	**Short-stature Cool-season Bunchgrasses**			20–80	
	prairie Junegrass	KOMA	*Koeleria macrantha*	10–80	2–10
	Sandberg bluegrass	POSE	*Poa secunda*	10–40	2–5
	squirreltail	ELEL5	*Elymus elymoides*	0–40	0–5
5	**Tillering Cool-season Grass-likes**			0–40	
	threadleaf sedge	CAFI	*Carex filifolia*	0–40	0–5
6	**Miscellaneous Grasses**			0–40	
	needleleaf sedge	CADU6	*Carex duriuscula*	0–40	0–5
	Grass, perennial	2GP	*Grass, perennial*	0–40	0–5
Forb					
7	**Perennial Forbs**			0–75	
	woollypod milkvetch	ASPU9	*Astragalus purshii*	0–40	0–5
	rosy pussytoes	ANRO2	*Antennaria rosea*	0–40	0–5
	arrowleaf balsamroot	BASA3	*Balsamorhiza sagittata*	0–40	0–5
	Indian paintbrush	CASTI2	*Castilleja*	0–40	0–5
	sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	0–40	0–5
	little larkspur	DEBI	*Delphinium bicolor*	0–40	0–5
	fleabane	ERIGE2	*Erigeron*	0–40	0–5
	lupine	LUPIN	*Lupinus*	0–40	0–5
	beardtongue	PENST	*Penstemon*	0–40	0–5
	Forb, perennial	2FP	*Forb, perennial*	0–40	0–5
8	**Annual Forbs**			0–25	
	bladderpod	LESQU	*Lesquerella*	0–25	0–5
	mustard	BRASS2	*Brassica*	0–25	0–5

	Forb, annual	2FA	*Forb, annual*	0–25	0–5
Shrub/Vine					
9	**Miscellaneous Shrubs**			50–150	
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	40–120	0–15
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–40	0–5
	gooseberry currant	RIMO2	*Ribes montigenum*	0–40	0–5
	Woods' rose	ROWO	*Rosa woodsii*	0–40	0–5
	prairie sagewort	ARFR4	*Artemisia frigida*	0–40	0–5
	common snowberry	SYAL	*Symphoricarpos albus*	0–40	0–5
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–40	0–5
Tree					
10	**Trees**			0–25	
	limber pine	PIFL2	*Pinus flexilis*	0–25	0–5
	Rocky Mountain juniper	JUSC2	*Juniperus scopulorum*	0–25	0–5
	Douglas-fir	PSME	*Pseudotsuga menziesii*	0–25	0–5
	Tree	2TREE	*Tree*	0–25	0–5

Table 16. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall-stature Cool-season Bunchgrasses**			0–50	
	Columbia needlegrass	ACNE9	*Achnatherum nelsonii*	0–50	0–10
	spike fescue	LEKI2	*Leucopoa kingii*	0–50	0–10
	mountain brome	BRMA4	*Bromus marginatus*	0–25	0–5
2	**Mid-stature Cool-season Bunchgrasses**			50–150	
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	25–150	5–30
	Idaho fescue	FEID	*Festuca idahoensis*	25–100	5–20
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–25	0–5
	needle and thread	HECO26	*Hesperostipa comata*	0–25	0–5
3	**Rhizomatous Wheatgrasses**			0–50	
	Montana wheatgrass	ELAL7	*Elymus albicans*	0–50	0–10
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–25	0–5
	western wheatgrass	PASM	*Pascopyrum smithii*	0–25	0–5
4	**Short-stature Cool-season Bunchgrasses**			10–25	
	squirreltail	ELEL5	*Elymus elymoides*	0–25	0–5
	prairie Junegrass	KOMA	*Koeleria macrantha*	5–25	1–5
	Sandberg bluegrass	POSE	*Poa secunda*	5–25	1–5
5	**Tillering Cool-season Grass-likes**			0–25	
	threadleaf sedge	CAFI	*Carex filifolia*	0–25	0–5
6	**Miscellaneous Grass/Grass-likes**			0–25	
	Grass, perennial	2GP	*Grass, perennial*	0–25	0–5
	Grass, annual	2GA	*Grass, annual*	0–25	0–5
	needleleaf sedge	CADU6	*Carex duriuscula*	0–25	0–5
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–23	0–5

	sixweeks fescue	VUOC	*Vulpia octoflora*	0–25	0–5
Forb					
7	**Perennial Forbs**			10–50	
	arrowleaf balsamroot	BASA3	*Balsamorhiza sagittata*	0–50	0–5
	Indian paintbrush	CASTI2	*Castilleja*	0–25	0–5
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	0–25	0–5
	little larkspur	DEBI	*Delphinium bicolor*	0–25	0–5
	fleabane	ERIGE2	*Erigeron*	0–25	0–5
	lupine	LUPIN	*Lupinus*	0–25	0–5
	beardtongue	PENST	*Penstemon*	0–25	0–5
	yellow salsify	TRDU	*Tragopogon dubius*	0–25	0–5
	Forb, perennial	2FP	*Forb, perennial*	0–25	0–5
	woollypod milkvetch	ASPU9	*Astragalus purshii*	0–25	0–5
	aster	ASTER	*Aster*	0–25	0–5
8	**Annual Forbs**			0–25	
	bladderpod	LESQU	*Lesquerella*	0–25	0–5
	mustard	BRASS2	*Brassica*	0–25	0–5
	Forb, annual	2FA	*Forb, annual*	0–25	0–5
Shrub/Vine					
9	**Miscellaneous Shrubs**			25–100	
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	25–50	5–10
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–25	0–5
	prairie sagewort	ARFR4	*Artemisia frigida*	0–25	0–5
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–25	0–5
Tree					
10	**Trees**			100–200	
	limber pine	PIFL2	*Pinus flexilis*	50–150	10–30
	Rocky Mountain juniper	JUSC2	*Juniperus scopulorum*	25–100	5–20
	Douglas-fir	PSME	*Pseudotsuga menziesii*	0–25	0–5
	Tree	2TREE	*Tree*	0–25	0–5

Animal community

Animal Community – Wildlife Interpretations:

1.1 - Columbia Needlegrass/Idaho fescue Plant Community (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 - Bluebunch Wheatgrass/Mixed Shrub Plant Community: The combination of an overstory of big sagebrush and an understory of grasses and forbs provides a very diverse plant community for wildlife. The crowns of sagebrush tend to break up hard crusted snow on winter ranges, so mule deer, elk, 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 20-30 percent cover range. Other birds that would frequent this plant community include western meadowlark, lark bunting, sage thrasher, horned larks, red-tail and ferruginous hawks, and golden eagles.

2.1 - Juniper/Limber Pine Plant Community: This plant community can provide important winter and escape cover for elk, mule deer and antelope, as the juniper and limber pine can approach 70% cover. However, due to the lack of quality browsing and herbaceous species, this site provides only a minimal source of forage for most wildlife species. Specific bird species such as the nuthatches, western tanager, western kingbird, mountain bluebird, wood-warblers, and northern flicker frequent this site.

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 Columbia Needlegrass/Idaho Fescue 400-650-800 0.18 5.62
1.2 Bluebunch Wheatgrass/Mixed Shrub 300-500-700 0.14 7.3
2.1 Juniper/Limber Pine 200-350-500 0.10 10.43
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

Climate is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group D due to its shallow feature. Infiltration and runoff potential for this site varies from moderate to high depending on soil hydrologic group and water table. Runoff will be high on this site since the soil saturate easy and due to its shallow characteristic and water holding capacity. (Refer to Part 630, NRCS National Engineering Handbook for detailed hydraulic 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. 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 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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Contributors

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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	02/11/2022
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.

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

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

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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 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.

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: Tall-stature cool-season bunchgrasses > mid-size, cool season bunchgrasses

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

    Other: perennial forbs > shrubs > trees

    Additional:

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.

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: 400-800 lb/ac (650 lb/ac average); Metric: 448-897 kg/ha (729 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:** Bare ground greater than 35% is the most common indicator of a threshold being crossed. Big sagebrush and bluegrasses are common increasers. Annual weeds such as cheatgrass and mustards 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.
