USDA Natural Resources
Conservation Service

Ecological site EX043B23B172
Stony Upland (StU) 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.d Foothills and Low Mountains

Ecological site concept

• Site receives no additional water.
• Slope is <20%
• Soils are:
o Non-saline, sodic, or saline-sodic
o Moderately deep to very deep (20-80+ in. (50-200+ cm)
o > 5% stone and boulder cover and >35% cobble and gravel cover
o Skeletal (≥35% rock fragments) starting within 8-20” (20-50 cm) of mineral soil surface (may have up to but not exceeding 35% rock fragments above 8")
o Textures range from fine sandy loam to clay loam in top 4” (10 cm) of mineral soil surface
o Clay content is ≥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% but < 35% 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).

Associated sites

EX043B23B122	**Loamy (Ly) Absaroka Upper Foothills** Loamy soils will be found in similar areas as the Stony Upland (depositional areas) with a deeper fine-loamy cap lacking the skeletal structure higher in the profile. Will occur intermixed with Stony Upland.
R043BY362WY	**Shallow Loamy (SwLy) 15-19” Foothills and Mountains East Precipitation Zone** Shallow Loamy will be found along outcroppings either above or within the slides. Stony Upland will have incidental or scattered pockets of Shallow loamy intermixed.
EX043B23B175	**Skeletal (Sk) Absaroka Upper Foothills** The skeletal profile is found in erosional positions or convex portions of a landform where the Stony upland will be found in depositional zones on the landform.

Similar sites

EX043B23B109	**Cobbly Upland (CoU) Absaroka Upper Foothills** Cobbly Upland is lacking the stones and boulders on the surface and is generally cobbles and gravels. The deposits include more to the alluvial deposits rather than slide and glacial deposits, although it occurs in all.
R043BY108WY	**Coarse Upland High Mountains** Course Upland was developed to describe any moderately textured soils that had a skeletal or near skeletal profile with intermixed pockets of deeper soils. The Cobbly Upland and Stony Upland ecological sites were derived from this one ESD.

Table 1. Dominant plant species

Tree	Not specified

Shrub	(1) *Artemisia tridentata ssp. vaseyana* (2) *Artemisia frigida*
Herbaceous	(1) *Achnatherum nelsonii* (2) *Festuca idahoensis*

Legacy ID

R043BX672WY

Physiographic features

This site occurs in most positions and is focused on nearly flat to slopes less than 20 percent. This site is commonly associated with glacial deposits, escarpments, or landslides with stones and boulders,.

Table 2. Representative physiographic features

Landforms	(1) Foothills > Landslide (2) Foothills > Outwash fan (3) Foothills > Ridge
Runoff class	Negligible to high
Elevation	2,073–2,743 m
Slope	0–20%
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)	356-406 mm

Frost-free period (actual range)	5-65 days
Freeze-free period (actual range)	22-108 days
Precipitation total (actual range)	356-406 mm
Frost-free period (average)	36 days
Freeze-free period (average)	70 days
Precipitation total (average)	381 mm

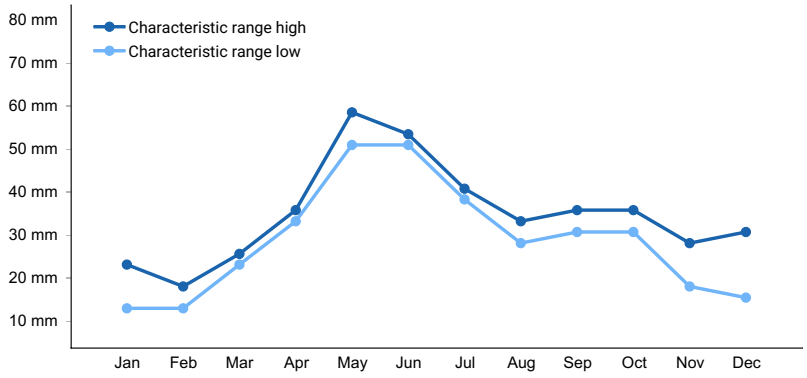


Figure 1. Monthly precipitation range

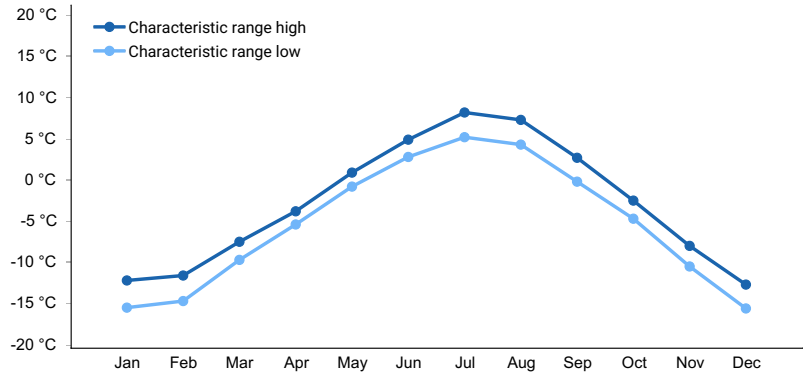


Figure 2. Monthly minimum temperature range

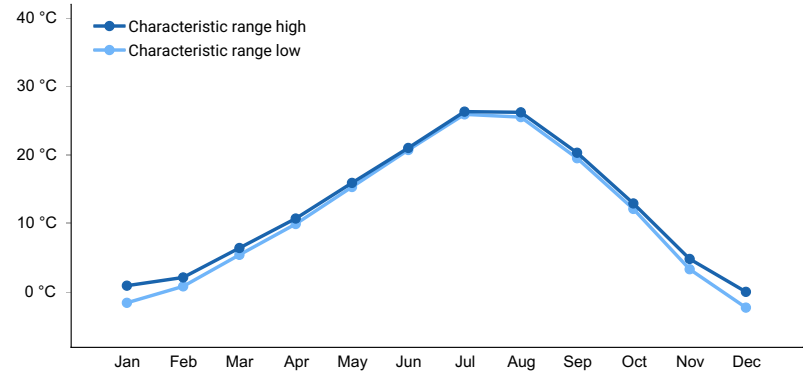


Figure 3. Monthly maximum temperature range

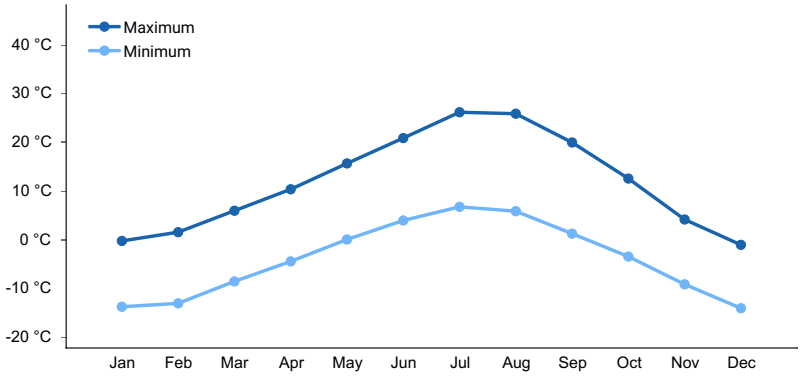


Figure 4. Monthly average minimum and maximum temperature

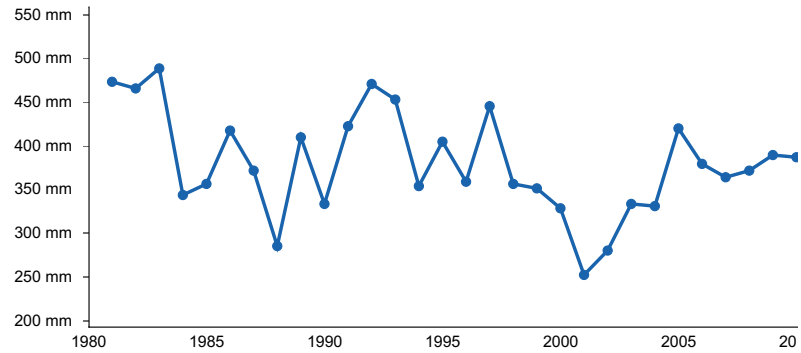


Figure 5. Annual precipitation pattern

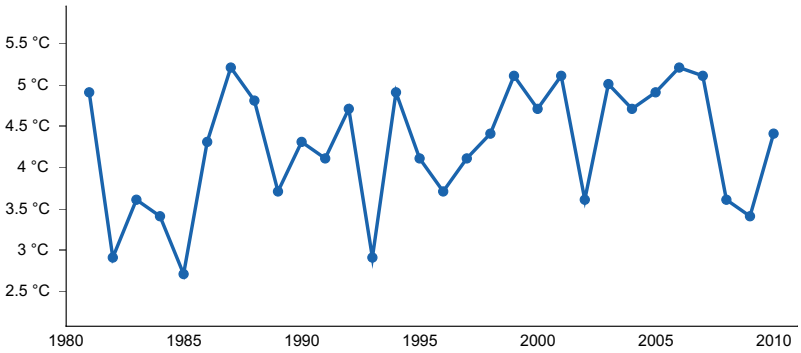


Figure 6. Annual average temperature pattern

Climate stations used

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

Influencing water features

The characteristics of these upland soils have no influence from ground water (water table below 60 inches or 150 cm) and have minimal influence from surface water and overland flow. There may be isolated features that are affected by snowpack that persists longer than surrounding areas due to position on the landform (shaded or protected pockets), but overflow is not a suitable fit. No streams are classified within this ecological site.

Soil features

The soils of this site are deep to moderately deep (greater than 20 inches to bedrock), moderately well to somewhat excessively well-drained, and moderately slow to moderately rapidly permeable. This site consists of bouldery to cobbly coarse fragment soils. The soil surface can be covered extensively with coarse fragments, with stones and boulders common. The high fragment cover limits and causes plant density to be reduced. The soil characteristics

most influential to the plant community are volume of coarse fragments in the profile that reduces the available moisture and vegetative cover.

Figure 7. Soils pit, dug by hand, showing the deeper stony skeletal segment of a fine-loamy profile (upper soil layers 0-10 inches).

Table 4. Representative soil features

Parent material	(1) Residuum–sedimentary rock (2) Slide deposits–igneous, metamorphic and sedimentary rock (3) Slope alluvium
Surface texture	(1) Cobbly, very stony, bouldery loam (2) Silt loam (3) Very fine sandy loam (4) Clay loam
Family particle size	(1) Fine-loamy (2) Loamy-skeletal (3) Fine-loamy over sandy or sandy-skeletal
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderate to moderately rapid
Soil depth	51 cm
Surface fragment cover <=3"	0–35%
Surface fragment cover >3"	5–20%
Available water capacity (0-101.6cm)	4.57–13.72 cm
Calcium carbonate equivalent (0-101.6cm)	0–10%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–5
Soil reaction (1:1 water) (0-101.6cm)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–35%
Subsurface fragment volume >3" (Depth not specified)	5–30%

Ecological dynamics

Potential vegetation on this site is dominated by mid cool-season perennial grasses. Other significant vegetation includes antelope bitterbrush, big sagebrush and a variety of forbs. The expected potential composition for this site is about 75% grasses, 10% forbs and 15% woody plants. The composition and production will vary naturally due to historical use, fluctuating precipitation and fire frequency.

As this site deteriorates from improper grazing management, species such as rhizomatous wheatgrasses, Sandberg bluegrass, spike trisetum, and big sagebrush will increase. Cool season grasses such as bluebunch wheatgrass, spikefescue, Idaho fescue and Columbia needlegrass will decrease in frequency and production.

Big sagebrush and juniper may become dominant on areas with an absence of fire and sufficient amount of precipitation. Wildfires are actively controlled in recent times and as a result old decadent stands of big sagebrush persist. Chemical and mechanical controls have replaced the historic role of fire on this site. Recently, prescribed burning has regained some popularity.

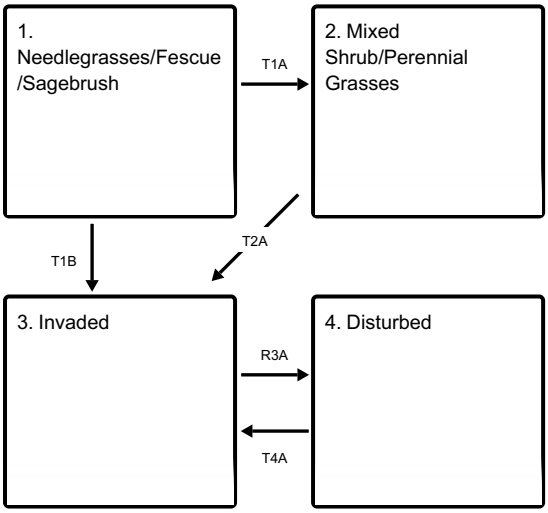
The big sagebrush component may not be as resilient once it has been removed or severely reduced, if a vigorous stand of grass exists and is maintained. The exception to this is where the herbaceous component is severely degraded at the time of treatment, growing conditions are unfavorable after treatment, and/or recovery of herbaceous species are inadequate due to poor grazing management. Regeneration of big sagebrush may also be suppressed if rubber rabbitbrush is established. This situation is more likely to develop in areas where fires have occurred in a relatively short cycle. Rubber rabbitbrush is a strong resprouter and will out compete other shrubs where a site is disturbed. Any thinning project should be designed in a way to maintain the viability of the stand and to consider wildlife requirements.

The Historic Climax Plant Community (description follows the plant community diagram) has been determined by study of rangeland relic areas, 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 Diagram that illustrates the common plant communities (states) that can occur on the site and the transitions between these communities. The ecological processes will be discussed in more detail in the plant community narratives following the diagram.

State and transition model

Ecosystem states



T1A - Frequent and severe grazing with the change in fire frequency, drought, and other significant impacts to the herbaceous cover force this transition.

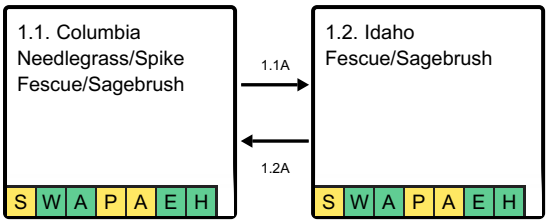
T1B - Significant soil disturbance, drought, and other catastrophic events with a seed source present will transition this site to the Invaded State.

T2A - Continued frequent and severe use patterns, significant soil disturbance, drought, and other catastrophic events with a seed source present will transition this site to the Invaded State.

R3A - An integrated weed management plan with a native seeding and long-term prescribed grazing aids the transition of this site.

T4A - Lack of management, continued disturbance, failure of a reclamation process, or catastrophic events with seed source present will transition this community to the invaded state.

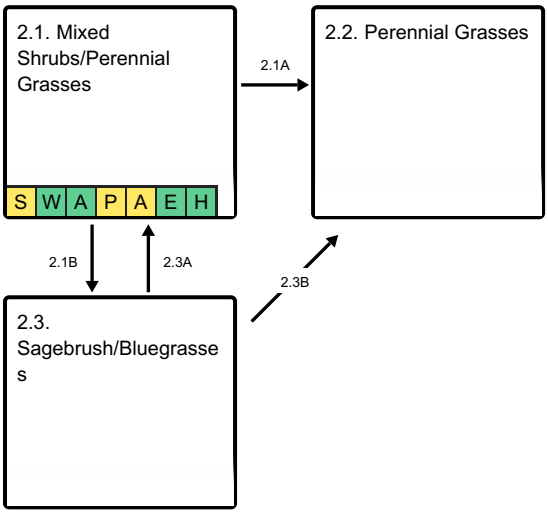
State 1 submodel, plant communities



1.1A - Moderate, continuous season-long grazing will convert the Reference Community Phase, and prolonged drought will exacerbate this transition.

1.2A - Prescribed Grazing with rest and time will allow the tall-stature and desired grasses to regain vigor and sagebrush to recover.

State 2 submodel, plant communities



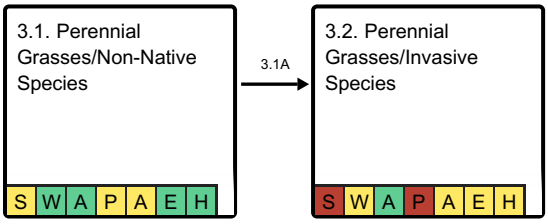
2.1A - Continuous season-long grazing and brush management or wildfire will transition Phase 2.1 to Community Phase 2.2.

2.1B - Continuous, season-long grazing in the absence of fire or drought will assist this transition.

2.3A - Prescribed grazing with brush management will move this community back to Community Phase 2.1 and begin the process of going to State 1.

2.3B - Brush management or Wildfire with no change in grazing management will convert this plant community to the Perennial Grasses Community Phase.

State 3 submodel, plant communities



3.1A - Severe and frequent grazing (continuous season-long) alone, or with drought, fire or other disturbance, will encourage invasive species when a seed source is present.

State 4 submodel, plant communities

4.1. Disturbed Lands

S W A P A E H

State 1
Needlegrasses/Fescue/Sagebrush

Figure 8. A mixture of perennial grasses following a fire (2-year post), with Columbia needlegrass, Idaho fescue and bluebunch wheatgrass prominent on the landscape.

The Needlegrasses/Fescues/Sagebrush State (State 1) is the Reference State for the Stony Upland ecological site. The diverse mix of perennial grasses, and forbs make for a productive and stable site.

Characteristics and indicators. Bluebunch wheatgrass is the dominant herbaceous species on this site with an intermixed composition of mountain big sagebrush, snowberry, and fringed sagewort providing the dominant woody cover. Buckwheat is common in this community with other ground covering forbs.

Resilience management. The vegetation that thrives in the harsh conditions of the Stony Upland ecological site creates a plant community resistant to change. But once disturbed, the shift in the perennial grasses and shift in shrubs is difficult and takes time to recover, reducing the resiliency of the community.

Community 1.1
Columbia Needlegrass/Spike Fescue/Sagebrush

The Columbia Needlegrass/Spike Fescue/Sagebrush Community Phase (1.1) is the Reference Community Phase for the Stony Upland ecological site. Community Phase 1.1 evolved with grazing by large herbivores and periodic fires. This plant community can be found on areas that are properly managed with grazing, and on areas receiving periods of rest. Tall and mid-stature cool-season grasses are the dominant cover with mountain big sagebrush. The major grasses include Columbia needlegrass, spike fescue, Idaho fescue, bluebunch wheatgrass, and rhizomatous wheatgrasses. Mountain big sagebrush is a conspicuous elements of this state, occurring in a mosaic pattern, and making up 10% of the annual production with scattered plants of rubber rabbitbrush, and fringed sagewort . A variety of forbs occur in this community and plant diversity is high (see Plant Composition Table). Annual production on this state ranges from 600 to 1000 pounds depending on climatic conditions. Average annual production is estimated at 850 pounds.

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
- prairie sagewort (*Artemisia frigida*), shrub
- Columbia needlegrass (*Achnatherum nelsonii*), grass
- spike fescue (*Leucopoa kingii*), grass
- Idaho fescue (*Festuca idahoensis*), grass
- arrowleaf balsamroot (*Balsamorhiza sagittata*), other herbaceous
- lupine (*Lupinus*), other herbaceous
- sulphur-flower buckwheat (*Eriogonum umbellatum*), other herbaceous

Dominant resource concerns

- Sheet and rill erosion
- Ephemeral gully erosion
- Aggregate instability
- Plant productivity and health
- Plant structure and composition
- 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	532	729	813
Shrub/Vine	112	168	224
Forb	28	56	84
Total	**672**	**953**	**1121**

Table 6. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	0%
Grass/grasslike basal cover	0%
Forb basal cover	0%
Non-vascular plants	0%
Biological crusts	0-5%
Litter	5-15%
Surface fragments >0.25" and <=3"	0-50%
Surface fragments >3"	5-35%
Bedrock	0%
Water	0%
Bare ground	5-25%

Table 7. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-2%	0-5%	0-10%
>0.15 <= 0.3	–	0-5%	10-50%	0-5%
>0.3 <= 0.6	–	0-10%	10-25%	0-5%
>0.6 <= 1.4	–	0-2%	–	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

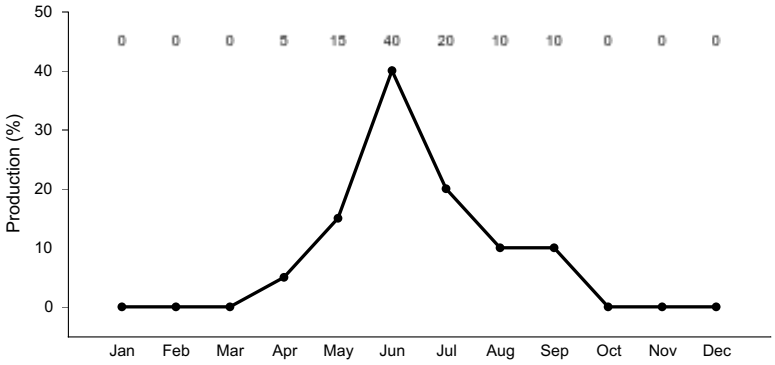


Figure 10. Plant community growth curve (percent production by month). WY0601, 15-19E all upland sites.

Community 1.2
Idaho Fescue/Sagebrush

Historically, this plant community evolved under grazing by large ungulates and a low fire frequency. Currently, it occurs under moderate, season-long grazing by livestock and is 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 significant 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 Idaho fescue, prairie junegrass, Cusick's bluegrass, and Montana wheatgrass. Columbia needlegrass, bluebunch wheatgrass, and spike fescue still occur but in lower frequency. Grasses of secondary importance include bluegrasses and onespike oatgrass. Forbs commonly found in this plant community include hawksbeard, lupine, groundsel, balsamroot, asters, buckwheat, phlox, and penstemons. Shrubs such as mountain big and black sagebrushes, rubber rabbitbrush, fringed sagewort, and juniper can make up to 25% of the total annual production. When compared to the Reference Community Phase, mountain big sagebrush, rubber rabbitbrush, fringed sagewort, and bluegrasses have increased. Production of specific species such as Columbia needlegrass and spike fescue has been reduced. Annual production ranges from 600 to 1100 pounds; with average annual production of 750 pounds.

Resilience management. 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 continuous season-long or year-long grazing. The herbaceous component is mostly intact and plant vigor and replacement capabilities are sufficient. Water flow patterns and litter movement is not uncommon especially on steeper slopes. Incidence of pedestalling is minimal but normal. Soils are mostly stable and the surface shows minimum soil loss. 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
- rubber rabbitbrush (*Ericameria nauseosa*), shrub
- Idaho fescue (*Festuca idahoensis*), grass

- prairie Junegrass (*Koeleria macrantha*), grass
- Cusick's bluegrass (*Poa cusickii*), grass
- arrowleaf balsamroot (*Balsamorhiza sagittata*), other herbaceous
- lupine (*Lupinus*), other herbaceous
- sulphur-flower buckwheat (*Eriogonum umbellatum*), other herbaceous

Dominant resource concerns

- Ephemeral gully erosion
- Aggregate instability
- Plant productivity and health
- Plant structure and composition
- Feed and forage imbalance
- 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	476	560	729
Shrub/Vine	168	224	392
Forb	28	56	112
Total	**672**	**840**	**1233**

Table 9. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	0%
Grass/grasslike basal cover	0%
Forb basal cover	0%
Non-vascular plants	0%
Biological crusts	0-5%
Litter	15-30%
Surface fragments >0.25" and <=3"	0-50%
Surface fragments >3"	5-35%
Bedrock	0%
Water	0%
Bare ground	5-20%

Table 10. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-5%	0-15%	0-10%
>0.15 <= 0.3	–	5-5%	5-50%	0-10%
>0.3 <= 0.6	–	5-20%	0-10%	0-5%
>0.6 <= 1.4	–	0-5%	0-2%	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Pathway 1.1A
Community 1.1 to 1.2

The driver for this transition is the removal or reduction in the woody cover, namely sagebrush from this community with an impact to the tall-statured cool-season grasses. Grazing impacts with fire will convert this plant community to the Idaho Fescue/Sagebrush Community Phase. Prolonged drought will help to exacerbate this transition.

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing to allow rest (rest-rotation or deferred grazing) will encourage the desirable tall and mid-stature cool-season grasses to recover. With time, the shrub component may recover. If grass stands are too dense, they can shade out or inhibit sagebrush and other shrub species form establishing.

Conservation practices

Prescribed Grazing
Heavy Use Area Protection
Upland Wildlife Habitat Management

State 2
Mixed Shrub/Perennial Grasses

After significant pressure on the herbaceous understory and with the lack of fire to rejuvenate the woody component, this State has shifted to a mid and short-stature cool-season grasses with shrubs becoming a significant component of this state. Some of the preferred grasses have been reduced or are absent, and forbs (ground covering) have increased in the community. When compared to the Reference State, sagebrush, native bluegrasses, prairie junegrass, and rhizomatous wheatgrasses have increased. Most of the preferred grasses have been reduced and some are absent.

Characteristics and indicators. Dominant grasses include rhizomatous wheatgrasses, prairie junegrass, and bluegrasses. Columbia needlegrass, spike fescue, Idaho fescue, and bluebunch wheatgrass are significantly reduced or absent. Grasses of secondary importance include slender wheatgrass, spike trisetum, one-spike oatgrass. Forbs commonly found in this plant community include balsamroot, agoseris, buckwheat, arnica, phlox, lupine, asters, and pussytoes. Fringed sagewort, mountain big sagebrush, and juniper can make up to 30% of the total annual production.

Resilience management. This State is resistant to change without a major disturbance or inputs to start the change. But it is also at risk of degrading further and is susceptible to invasion due to the decreased herbaceous cover and increased woody structure.

Community 2.1
Mixed Shrubs/Perennial Grasses

Historically, this plant community evolved under grazing by large ungulates and a low fire frequency. Currently, it occurs under moderate, season-long grazing by livestock and is 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 major 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, prairie junegrass, spike fescue, Montana wheatgrass, Idaho fescue, and of less frequency Columbia needlegrass. Grasses of secondary importance include bluegrasses and onespike oatgrass. Forbs commonly found in this plant community include hawksbeard, groundsel, balsamroot, asters, buckwheat, phlox, and penstemons. Shrubs such as mountain big sagebrush, rubber rabbitbrush, fringed sagewort, snowberry, and wild rose can make up to 25% of the total annual production. When compared to the Reference Community Phase, mountain big sagebrush, rubber rabbitbrush, fringed sagewort, bluegrasses, and rhizomatous wheatgrasses have increased. Production of specific species such as Columbia needlegrass and spike fescue has been reduced. Annual production ranges from 450 to 950 pounds; with average annual production of 700 pounds.

Resilience management. 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 continuous season-long or year-long grazing. The herbaceous component is mostly intact and plant vigor and replacement capabilities are sufficient. Water flow patterns and litter movement is not uncommon especially on steeper slopes. Incidence of pedestalling is minimal but normal. Soils are mostly stable and the surface shows minimum soil loss. 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
- rubber rabbitbrush (*Ericameria nauseosa*), shrub
- bluebunch wheatgrass (*Pseudoroegneria spicata*), grass
- prairie Junegrass (*Koeleria macrantha*), grass
- Cusick's bluegrass (*Poa cusickii*), grass
- Idaho fescue (*Festuca idahoensis*), grass
- arrowleaf balsamroot (*Balsamorhiza sagittata*), other herbaceous
- lupine (*Lupinus*), other herbaceous
- sulphur-flower buckwheat (*Eriogonum umbellatum*), other herbaceous

Dominant resource concerns

- Ephemeral gully erosion
- Aggregate instability
- Plant productivity and health
- Plant structure and composition
- Feed and forage imbalance
- 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	364	392	476
Shrub/Vine	168	280	392
Forb	28	56	84
Total	**560**	**728**	**952**

Table 12. Soil surface cover

Tree basal cover	0%

Shrub/vine/liana basal cover	0%
Grass/grasslike basal cover	0%
Forb basal cover	0%
Non-vascular plants	0%
Biological crusts	0-5%
Litter	5-20%
Surface fragments >0.25" and <=3"	0-50%
Surface fragments >3"	5-35%
Bedrock	0%
Water	0%
Bare ground	5-25%

Table 13. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-10%	0-15%	0-10%
>0.15 <= 0.3	–	0-15%	0-50%	0-5%
>0.3 <= 0.6	–	0-5%	0-5%	0-2%
>0.6 <= 1.4	–	–	–	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

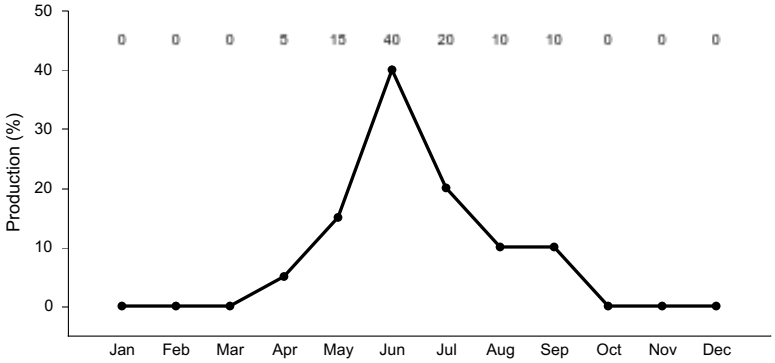


Figure 13. Plant community growth curve (percent production by month). WY0601, 15-19E all upland sites.

Community 2.2
Perennial Grasses

This plant community currently is found under heavy continuous season-long grazing by livestock and is perpetuated by either brush management or a wildfire, which removes mountain big sagebrush from this plant community. Fringed sagewort and rubber rabbitbrush can be a components of this plant community but generally is also lacking. Some of the major cool-season bunchgrasses associated with this ecological site have been reduced and some may have been removed. Dominant grasses include rhizomatous wheatgrasses, prairie junegrass, bluegrasses, spike trisetum, and Montana wheatgrass. Columbia needlegrass, Idaho fescue, bluebunch wheatgrass, and spike fescue occur in only small fragmented populations. Forbs commonly found in this plant community include phlox, groundsel, penstemon, larkspur, lupine, pussytoes, miner’s candle, hawksbeard, and

milkvetch. When compared to the Reference State, rhizomatous wheatgrasses, prairie junegrass, Montana wheatgrass, and possibly fringed sagewort have increased. Columbia needlegrass, bluebunch wheatgrass, Idaho fescue, and mountain big sagebrush have decreased or have been removed. Production of the preferred cool-season grasses has been reduced.

Resilience management. This plant community is resistant to change as the herbaceous species present are well adapted to grazing and if three-tip sagebrush and rubber rabbitbrush become the dominant shrubs it is difficult for other shrubs to become established. However, species composition can be altered through long-term overgrazing. The herbaceous component is mostly intact, but some cool-season bunchgrasses associated with the site have been reduced or removed. Plant vigor and replacement capabilities are sufficient for some species but not all. Water flow patterns and litter movement is occurring but only on steeper slopes. Incidence of pedestalling is moderate to slight. Soils are mostly stable and the surface shows minimum soil loss. The watershed is functioning and the biotic community is partially intact.

Community 2.3
Sagebrush/Bluegrasses

This plant community is the result of frequent and severe grazing and protection from fire. Big sagebrush is the dominant shrub of this plant community as the annual production of shrubs exceeds 30%. Shrubs comprise the significant component of the plant community and the preferred cool season grasses have been eliminated or greatly reduced. The dominant grasses are the bluegrass such as Sandberg, mutton, big, and Canby. Mountain big sagebrush is the dominant shrub, but other shrubs may include fringed sagewort, juniper, rubber rabbitbrush and wild rose. The interspaces between plants have expanded leaving the amount of bare ground more prevalent. When compared with the Reference State the annual production is less, as the major cool-season grasses are reduced, but the shrub production has increased significantly and compensates for the decline in some of the herbaceous production.

Resilience management. 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 may be noticeable in the interspaces and gullies may be establishing where rills have concentrated down slope.

Pathway 2.1A
Community 2.1 to 2.2

Heavy, continuous, season-long grazing with brush management or fire will convert this plant community to a Perennial Grasses Community Phase. More than likely, the fringed sagewort or the rubber rabbitbrush will persist in varying degrees due to the difficulty of controlling both species and their strong resprouting capabilities.

Pathway 2.1B
Community 2.1 to 2.3

Heavy, continuous season-long grazing plus no fires will convert the community phase to the Big Sagebrush/Bluegrass Community Phase. The probability of this occurring is high. This is especially evident on areas where drought or heavy browsing does not adversely impact the shrub stand.

Pathway 2.3A
Community 2.3 to 2.1

Prescribed grazing plus brush management will convert this plant community to near Reference. If prescribed fire is used as a means to reduce or remove the shrubs, sufficient fine fuels will need to be present. This may require deferment from grazing prior to treatment. Post management is critical to ensure success. This can range from two or more years of rest to partial growing season deferment, depending on the condition of the understory at the time of treatment and the growing conditions following treatment. Seeding will be required regardless of the brush treatment to reestablish the major cool-season grasses.

Conservation practices

Prescribed Burning
Critical Area Planting
Prescribed Grazing
Grazing Land Mechanical Treatment
Range Planting
Heavy Use Area Protection

Pathway 2.3B
Community 2.3 to 2.2

Brush management or Wildfire with no change in grazing management will convert this plant community to the Perennial Grasses Community Phase. Removal of the shrub component by wildfire, presecribed fire or other chemical or mechanical means will shift this community. The open canopy may allow species to respond improving the herbaceous cover, however, bluegrasses will remain prominent in this shift.

Conservation practices

Prescribed Burning

State 3
Invaded

Any disturbance provides an opportunity for aggressive species, such as many of our introduced invaders, to establish in a community. Catastrophic events or natural climatic events (drought, wildfire, etc) can be a source of this invasion.

Characteristics and indicators. The major indication of entering this State is the abundant or significant presence of an introduced species, whether invasive or just an invader. To meet the terms of abundant or significant, the presence has to account for greater than or equal to ten percent cover of the community. Species considered in this category are Kentucky bluegrass, smooth brome, or timothy for non-native invaders; or cheatgrass for invasive species. Thistle and common dandelion are other species of concern on this ecological site.

Resilience management. Once established, these aggressive and persistent species will exclude many of the native species and are extremely difficult to reduce or remove from the community. These species are able to tolerate repeated abuse and drastic climatic swings without losing their foothold in the community, creating a resistant and resilient community.

Community 3.1
Perennial Grasses/Non-Native Species

The Perennial Grasses/Non-Native Species Community Phase has maintained a representative sample of the perennial grasses and forbs that are typical of the site with a mixed shrub community. Non-native or invader species have established in the community and are a significant component in the community (10 percent or greater by foliar cover or 5 percent or greater by weight), and are prominent (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 non-native species. The species most common are timothy, Kentucky bluegrass, and common dandelion.

Resilience management. Rangeland Health Implications/Indicators: This plant community is resistant to change. These areas may be more prone to fire as fine fuels are more available. 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 non-native species (species dependent). Soil erosion is variable depending on the species of

invasion and the litter accumulation thus associated, this 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
- mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*), shrub
- Woods' rose (*Rosa woodsii*), shrub
- rubber rabbitbrush (*Ericameria nauseosa*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- Kentucky bluegrass (*Poa pratensis*), grass
- timothy (*Phleum pratense*), grass
- Idaho fescue (*Festuca idahoensis*), grass
- bluebunch wheatgrass (*Pseudoroegneria spicata*), grass
- Sandberg bluegrass (*Poa secunda*), grass
- thistle (*Cirsium*), other herbaceous
- phlox (*Phlox*), other herbaceous
- sulphur-flower buckwheat (*Eriogonum umbellatum*), other herbaceous
- common dandelion (*Taraxacum officinale*), other herbaceous

Dominant resource concerns

- Classic gully erosion
- Plant structure and composition
- Wildfire hazard from biomass accumulation
- Terrestrial habitat for wildlife and invertebrates
- Inadequate livestock water quantity, quality, and distribution

Community 3.2
Perennial Grasses/Invasive Species

The Perennial Grasses/Invasive Species Community Phase has maintained a fractured sample of the perennial grasses and forbs that are typical of the site with invasive species. This plant community evolved under frequent and severe grazing. The shrub component has been impacted and possibly removed by heavy browsing, wildfire or human means. Weedy annuals and bluegrasses are the most dominant plants. Invasive species, most commonly cheatgrass, hold a significant (10 percent or greater) composition of the landscape, and are prominent (referring to a more wide scale composition, not isolated patches on the landscape). Fringed sagewort and rubber rabbitbrush may be more abundant than other shrubs, as they are strong resprouters and may quickly re-establish the site after a disturbance. The interspaces between plants have expanded leaving the amount of bare ground more prevalent and more soil surface exposed to erosive elements. With the decrease or loss of most desirable mid-stature cool-season grasses, bluegrass will persist on the site (bluegrass includes natives: Sandberg, mutton, Canby, and big; as well as introduced species: Kentucky). Smooth brome, dandelion, and other introduced species will increase if present on the site. Other noxious weeds such as Canada thistle may invade the site if a seed source is available. 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 continued herbivory. Annuals and bluegrasses are effectively competing against the establishment of perennial cool-season grasses. Plant diversity is greatly altered and the herbaceous component is not intact. Recruitment of the major perennial grasses is not occurring and the replacement potential is absent. The biotic integrity is missing. The state is unstable and is not protected from excessive erosion. Rill channels and maybe even gullies may be present on site and adjacent areas are impacted by excessive runoff. Water flow patterns and pedestalling are obvious. The watershed is not functioning.

Dominant plant species

- Rocky Mountain juniper (*Juniperus scopulorum*), tree
- mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- snowberry (*Symphoricarpos*), shrub

- Woods' rose (*Rosa woodsii*), shrub
- cheatgrass (*Bromus tectorum*), grass
- sixweeks fescue (*Vulpia octoflora*), grass
- Sandberg bluegrass (*Poa secunda*), grass
- Idaho fescue (*Festuca idahoensis*), grass
- phlox (*Phlox*), other herbaceous
- sulphur-flower buckwheat (*Eriogonum umbellatum*), other herbaceous
- common dandelion (*Taraxacum officinale*), 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
- Plant pest pressure
- Wildfire hazard from biomass accumulation
- Terrestrial habitat for wildlife and invertebrates
- Feed and forage imbalance
- Inadequate livestock water quantity, quality, and distribution

Pathway 3.1A
Community 3.1 to 3.2

Frequent and Severe Grazing will convert this plant community to a Perennial Grasses/Invasive Species Community Phase. Drought or a fire (man-made or wild) are drivers that will encourage this transition as well, if a seed source is present. If fringed sagewort and common yarrow are present more than likely it will persist in varying degrees as it is difficult to control.

State 4
Disturbed

Catastrophic natural events, including fresh land slides, fire followed by extreme climatic events, or areas that are heavily impacted by recreational vehicles, trails, roadways, or other land disturbances have reduced or removed most native perennial vegetation and left a highly disturbed land. These points of disturbance can be large scale, encompassing several ecological sites. However, many times they are isolated in nature, especially on steeper sloeps. The Disturbed State could be drafted as a stand-alone box within the state and transition model diagram. No matter what state a site originally is ranked in, once the site is mechanically disturbed, or suffers a catastrophic or significant natural disaster that alters the soil properties (erosional, depositional, hydrological or chemical), the site potential is altered. Mechanical disturbances and reclamation practices using non-native species could qualify some stages of this state to be considered as a land use shift. The result is the shift in potential and response in management so that it is no longer similar to the reference community. The potential shifts are highly variable, so a dynamic state was captured to highlight the altered communities that exist on the landscape.

Characteristics and indicators. The soil disturbance and mechanical or physical removal of the vegetative canopy is the key characteristic of the Disturbed State. The initial indicators are the primary successional species that establish following a disturbance including Russian thistle, kochia, six weeks fescue, and sunflowers. These initial colonizers will then be followed by any seeded species, or other species from within the locations seed bank.

Resilience management. The Disturbed State is highly variable and in a state of flux as the successional processes occur. Continued disturbance of this community is a potential threat; and the community is at high risk of transitioning to the Invaded State.

Community 4.1

Disturbed Lands

The title Disturbed Lands is encompassing two broad classifications of these land types. Go-back fields or tilled areas form Type one. The slope and rock cover of the Steep Stony Upland ecological site does not lend well for this type of disturbance. However, in a similar process, mined lands or lands affected by energy development including gravel or mineral excavation pits, transmission corridors, transportation corridors and oil and gas development sites provide a host of successional processes. Many times, these locations are re-exposed to disturbance frequently by mechanical means leaving annual weeds and primary successional species as the dominate canopy. Older, established sites or abandoned locations, have established communities similar to those expected on go-back fields and may be stable in nature. A subset of Type one are those areas that were or currently are being impacted by recreation - camp sites, trails, parking areas, roadways. The varying stages of healing once abandoned, or the state of disturbance at each location leave a variable community. The growth curve of this plant community will vary depending on the species that are selected for seeding. For a more accurate portrait of the growth curve for the seeded community, the species used and the climatic tendencies of the region must be considered.

Resilience management. The plant community is variable and depending on the slope extent, age of the stand, and the stage of successional tendencies that the location is in will determine how stable (resilient/resistant) the community is. Plant diversity is generally strong, but is usually lacking in the structural and functional groups that are desired on the site. Soil erosion is variable depending on the slope extent and the disturbance regime that is occurring on the site and will vary with the specific community that has established on a specific location. Site-specific evaluation is needed to determine the water flow and pedestalling as well as infiltration and runoff potential and associated risks for each community.

Dominant resource concerns

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

Transition T1A
State 1 to 2

Heavy, continuous, season-long grazing plus no fires or altered fire frequency will convert the plant community to the Mixed Shrub/Idaho Fescue State. This is especially evident on areas where drought or heavy browsing has adversely impact the shrub stand. The impacts required to force this transition are significant, and this does not happen in a short time period.

Constraints to recovery. The loss of sagebrush in some of these communities and the lack of necessary seed bank and recovery time are limiting factors for this State to recover. Slope and erosional risks are also slows or inhibits recovery.

Transition T1B
State 1 to 3

Drought, soil disturbances, or high-intensity grazing with a seed source present can open the soil surface and weaken the native grasses and forbs providing the open niche for invasive species to establish. Long-term drought or a mechanical/physical disturbance is a primary means of provide the niche for cheatgrass to establish on this site. Fire, however, is a major threat that will force this transition.

Constraints to recovery. The nature of non-native (introduced) as well as invasive species, especially cheatgrass, once they are established, they are prolific reproducers and are hardy plants, making it costly and difficult (if even

possible) to remove. The lack of key grass species also limits recover of this site.

Transition T2A
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. Fire is a primary means of provide the niche for cheatgrass to establish on this site.

Constraints to recovery. The nature of non-native (introduced) as well as invasive species, especially cheatgrass, once they are established, they are prolific reproducers and are hardy plants, making it costly and difficult (if even possible) to remove. The lack of key grass species also limits recover of this site.

Restoration pathway R3A
State 3 to 4

Integrated Pest Management, with Seeding the site to a native mixture - 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 of these 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 there is a significant composition of non-native and invasive species that have established on a site.

Context dependence. Access due to slope and large rock fragments limit areas that can readily be treated.

Conservation practices

Critical Area Planting
Prescribed Grazing
Grazing Land Mechanical Treatment
Range Planting
Heavy Use Area Protection
Integrated Pest Management (IPM)
Upland Wildlife Habitat Management

Transition T4A
State 4 to 3

Lack of management resulting in continued disturbance, catastrophic events, or failure in the restoration process are major causes for a disturbed or altered landscape to transition to an invaded state.

Constraints to recovery. The change in the soils and potentially the hydrology of the site as well as the presence of invasive species limit the recovery potential of this community. Access limitations due to slope and surface roughness will limit the types of treatment and ability to manage a community.

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	**Tall-stature, Cool-season Bunchgrasses**			84–224	
	Columbia needlegrass	ACNE9	*Achnatherum nelsonii*	56–168	5–15
	Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	0–56	0–5

	blue wildrye	ELGL	*Elymus glaucus*	0–56	0–5
2	**Mid-stature, Cool-season Bunchgrasses**			112–392	
	Idaho fescue	FEID	*Festuca idahoensis*	56–224	5–20
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	0–168	0–15
3	**Rhizomatous, Cool-season Grasses**			28–112	
	Montana wheatgrass	ELAL7	*Elymus albicans*	0–56	0–5
	western wheatgrass	PASM	*Pascopyrum smithii*	0–56	0–5
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–56	0–5
4	**Short-stature, Cool-season Bunchgrasses**			0–84	
	Cusick's bluegrass	POCU3	*Poa cusickii*	0–56	0–5
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–56	0–5
	spike trisetum	TRSP2	*Trisetum spicatum*	0–56	0–5
	Sandberg bluegrass	POSE	*Poa secunda*	0–56	0–5
5	**Miscellaneous Grasses/Grass-likes**			0–56	
	Grass, perennial	2GP	*Grass, perennial*	0–56	0–5
	threadleaf sedge	CAFI	*Carex filifolia*	0–28	0–5
	needleleaf sedge	CADU6	*Carex duriuscula*	0–28	0–5
Forb					
6	**Perennial Forbs**			28–112	
	arrowleaf balsamroot	BASA3	*Balsamorhiza sagittata*	0–112	0–10
	lupine	LUPIN	*Lupinus*	0–56	0–5
	sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	0–56	0–5
	phlox	PHLOX	*Phlox*	0–56	0–5
	beardtongue	PENST	*Penstemon*	0–56	0–5
	Indian paintbrush	CASTI2	*Castilleja*	0–56	0–5
	American vetch	VIAM	*Vicia americana*	0–56	0–5
	milkvetch	ASTRA	*Astragalus*	0–56	0–5
	Forb, perennial	2FP	*Forb, perennial*	0–56	0–5
Shrub/Vine					
7	**Dominant Shrubs**			56–224	
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	56–224	5–20
8	**Miscellaneous Shrubs**			0–84	
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–56	0–5
	snowberry	SYMPH	*Symphoricarpos*	0–56	0–5
	Woods' rose	ROWO	*Rosa woodsii*	0–56	0–5
	prairie sagewort	ARFR4	*Artemisia frigida*	0–56	0–5
	Shrub, other	2S	*Shrub, other*	0–56	0–5

Animal community

Animal Community – Wildlife Interpretations

Columbia Needlegrass/Spikefescue Plant Community (Reference):
The predominance of grasses in this plant community favors grazers and mixed-feeders, such as deer, 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. Due to the location of these sites on the foot slopes of mountains, they are valuable for elk and deer winter ranges. 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 meadowlark, lark bunting, sage thrasher, horned larks, red-tail and ferruginous hawks, and golden eagles. Many grassland obligate small mammals would occur here.

Idaho Fescue/Mixed Shrub Plant Community:
The combination of an overstory of antelope bitterbrush and 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% 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.

Rhizomatous Wheatgrass/Big Sagebrush 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% 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.

Montana Wheatgrass/Rubber Rabbitbrush Plant Community:
The production of herbaceous species provided for good foraging to grazers. However, the lack of tall or mid growing shrubs does not benefit browsers nor provides cover for many wildlife species. As these site greens-up sooner in the spring, this site tends to provide early new growth for foraging large and small mammals. If located adjacent to shrub dominated sites, It provides good foraging habitat for sage grouse.

Rhizomatous Wheatgrass/Prairie Junegrass Plant Community:
The production of herbaceous species provided for good foraging for grazers. However, the lack of tall or mid growing shrubs does not benefit browsers nor provides cover for many wildlife species. As these site greens-up sooner in the spring, this site tends to provide early new growth for foraging large and small mammals. If located adjacent to shrub dominated sites, It provides good foraging habitat for sage grouse.

Big Sagebrush/Bluegrass Plant Community:
This plant community can provide important winter foraging for elk, mule deer and antelope, as sagebrush can approach 15% protein and 40-60% digestibility during that time. This community provides escape and thermal cover for large ungulates, as well as nesting and brood rearing habitat for sage grouse. Due to the lack of herbaceous production and diversity of mid cool season grasses on this site, it is not as beneficial to grazers. 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.

Invaded Plant Communities:
This community provides limited foraging for elk and other grazers. They may be used as a foraging site by sage grouse if proximal to woody cover. Generally, these are not target plant communities for wildlife habitat management.

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.

Plant Community Production Carrying Capacity*
(lb./ac) (AUM/ac)
Columbia Needlegrass/Spikefescue 600-1000 .5
Idaho Fescue/Mixed Sagebrush 500-1000 .4
Rhizomatous WG/Big Sagebrush ** **
Montana WG/R. Rabbitbrush ** **
Rhizomatous WG/Prairie Junegrass ** **
Big Sagebrush/Bluegrass ** **
Invaded ** **

* - 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% of a management unit may have 25% slopes and distances of greater than one mile from water; therefore, the adjustment is only calculated for 30% of the unit (i.e. 50% reduction on 30% 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 and C, with localized areas in hydrologic group D. Infiltration ranges from moderate to moderately rapid. Runoff potential for this site varies from moderate to high depending on soil hydrologic group and ground cover. In many cases, areas with greater than 75% ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where; short-grasses form a strong sod and dominate the site. Areas where ground cover is less than 50% have the greatest potential to have reduced infiltration and higher runoff (refer to Part 630, NRCS National Engineering Handbook for detailed hydrology information).

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

Recreational uses

This site provides hunting opportunities for upland game species. The wide varieties of plants that bloom from spring until fall have an esthetic value that appeals to visitors. Other recreational uses may included hiking, camping, mountain biking, and in the winter snowshoeing and cross-country skiing.

Wood products

No appreciable wood products are present on the site.

Other products

None noted.

Other information

Herbs: Several of the forb species within the communities of the Stony Upland 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 here has been derived from NRCS inventory data, Field observations from range trained personnel, and the existing range site descriptions. Those involved in the development of the new concept for the Stony Upland ecological site include: Blaise Allen, Area Range Management Specialist, NRCS; Jim Wolf, Resource Manager, USDI-BLM; Daniel Wood, MLRA Soil Survey Leader, NRCS; Jane Karinen, Soil Data Quality Specialist, NRCS; and Marji Patz, Ecological Site Specialist, NRCS. Other sources used as references include USDA NRCS Water and Climate Center, USDA NRCS National Range and Pasture Handbook, USDI and USDA Interpreting Indicators of Rangeland Health Version IV, and USDA NRCS Soil Surveys from various counties.

Inventory Data References:
Ocular field estimations observed by trained personnel were completed at each site. Then sites were selected where a 100 foot 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 3 of these estimated points, with two 21 foot X 21 foot square extended shrub plots).
• Line Point Intercept (over story 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 of a 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 (10 – 1 meter square point photographs taken at set distances on transect. Red 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, 3/06/2025

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

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Date	04/18/2020
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. Some increase in rill development may occur on steeper slopes or on areas located below exposed bedrock or other water shedding areas where increased runoff may occur. Where rills are present, they should be fairly short (2-5 feet), <1 inch deep and somewhat widely spaced (4-8 feet). Rills may increase in length (3-6 feet) and decrease in spacing (3-6 feet)on slopes greater than 40 percent. A minor increase in rill development may be observed on all slopes following major thunderstorm or spring runoff events but should heal during the next growing season.

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2. **Presence of water flow patterns:** Barely observable. Some very minor evidence of water flow patterns may be found around perennial plant bases. They show little evidence of current erosion. They are expected to be short (3-6 feet), stable, sinuous, and not connected. There may be very minor evidence of deposition. Evidence of water flow may increase somewhat with slope.

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3. **Number and height of erosional pedestals or terracettes:** Perennial vegetation shows little evidence of erosional pedestalling (1 to 2% of individual plants). Plant roots are covered and litter remains in place around plant crowns. Terracettes should be absent or, if present, stable. A slight increase in both pedestal and terracette development may occur with increasing slope.

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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 0-20%. Bare ground spaces should not be greater than 2 foot in diameter.

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

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6. **Extent of wind scoured, blowouts and/or depositional areas:** Rare to nonexistent. No evidence of wind generated soil movement is present. Wind caused blowouts and deposition are not present.

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7. **Amount of litter movement (describe size and distance expected to travel):** Herbaceous and large woody litter not expected to move. Most litter resides in place with some redistribution downslope caused by water movement. The majority of litter accumulates at the base of plants. Some grass leaves and stems may accumulate in soil depressions adjacent to plants. Woody stems are not likely to move. However, some litter movement is expected (up to 6 feet) with increases in slopes >25% and/or increased runoff resulting from heavy thunderstorms.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil Stability Index ratings range from 3 (interspaces) to 6 (under plant canopy), but average values should be

4.0 or greater.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil data is limited for this site. Soil OM of 2 to 5% is expected.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Plant community consists of 50-80% grasses, 15% forbs, and 5-35% shrubs. Evenly distributed plant canopy (60-95%) and litter plus moderate infiltration rates result in minimal runoff. Basal cover is typically 5-15% for this site and does affect runoff on this site. Surface rock fragments of 5-20% provide stability to the site, but reduce infiltration.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None.

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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>>

    Sub-dominant: perennial shrubs>>

    Other: perennial forbs>>tall, cool season bunchgrasses=cool season rhizomatous grasses=short cool season bunchgrasses

    Additional: Following a disturbance such as fire, drought, rodents or insects that remove woody vegetation, forbs and perennial grasses (herbaceous species) may dominate the community for a period of time. If a disturbance has not occurred for an extended period of time, woody species may continue to increase. These conditions would reflect a functional community phase within the reference state.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** All age classes of perennial grasses should be present under average to above average growing conditions. There may be partial mortality on individual bunchgrasses and shrubs during drought periods, and complete mortality of individual plants during severe drought periods. Slight decadence in the principle shrubs could occur near the end of the fire cycle or during periods of extended drought, or insect infestations. In general, a mix of age classes should be expected with some dead and decadent plants present.

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14. **Average percent litter cover (%) and depth (in):** Litter ranges from 5-40% of total canopy measurement with total litter (including beneath the plant canopy) from 50-90% expected. Herbaceous litter depth typically ranges from 5-15mm. Woody litter can be up to a couple inches (4-6 cm).

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** English: 600-1000 lb/ac (850 lb/ac average); Metric 672 -1121 kg/ha (952 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 30% is the most common indicator of a threshold being crossed. Rhizomatous wheatgrasses, Sandberg bluegrass, spike trisetum, juniper and big sagebrush are common increasers. Kentucky bluegrass, common dandelion, thistles, and 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 extreme drought years.
