Ecological site R048AY366UT
Upland Very Steep Loam (Salina Wildrye)

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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): 048A–Southern Rocky Mountains

MLRA 48A makes up about 45,920 square miles (119,000 square kilometers) and is the southern part of the Rocky Mountains. The Southern Rocky Mountains lies east of the Colorado Plateau, south of the Wyoming Basin, west of the Great Plains, and north of the Rio Grande Rift. It is in western and central Colorado, southeastern Wyoming, eastern Utah, and northern New Mexico. The headwaters of major rivers such as the Colorado, Yampa, Arkansas, Rio Grande, North Platte and South Plate rivers are located here. This MLRA has numerous national forests, including the Medicine Bow National Forest in Wyoming; the Routt, Arapaho, Roosevelt, Pike, San Isabel, White River, Gunnison, Grand Mesa, Uncompahgre, Rio Grande, and San Juan National Forests in Colorado; the Carson National Forest and part of the Santa Fe National Forest in New Mexico. Rocky Mountain National Park also is in this MLRA.

MLRA 48A is the southern Rocky Mountains physiographic region. The Southern Rocky Mountains consist primarily of two belts of strongly sloping to precipitous mountain ranges trending north to south. Several basins, or parks, are between the belts. Some high mesas and plateaus are included. It is characterized by mountain ranges that were uplifted during the Laramide Orogeny and then had periods of glaciation. The ranges include the Sangre de Cristo Mountains, the Laramie Mountains, and the Front Range in the east and the San Juan Mountains and the Sawatch and Park Ranges in the west. The ranges are dissected by many narrow stream valleys having steep gradients. In some areas the upper mountain slopes and broad crests are covered by snowfields and glaciers. Elevation typically ranges from 6,500 to 14,400 feet (1,980 to 4,390 meters) in this area. The part of this MLRA in central Colorado includes the highest point in the Rockies, Mount Elbert, which reaches an elevation of 14,433 feet (4,400 meters). More than 50 peaks in the part of the MLRA in Colorado are at an elevation of more than 14,000 feet (4,270 meters). Many small glacial lakes are in the high mountains.

The mountains in this area were formed mainly by crustal uplifts during the late Cretaceous and early Tertiary periods. This large MLRA can be subdivided into at least 4 large general divisions. First is the Rockies on the east side of this area are called the “Front Range,” which is a fault block that has been tilted up on edge and uplifted and is largely igneous and metamorphic geology. It was tilted up on the east edge, so there is a steep front on the east and the west side is more gently sloping and in the south east there are rocks exposed in the mountains are mostly Precambrian igneous and metamorphic rocks. Second is the tertiary rocks, primarily basalt and andesitic lava flows, tuffs, breccias, and conglomerates, are throughout this area (San Juan Mountains Area). The third division is Northwest part of the MLRA is dominantly sedimentary rock from the cretaceous/tertiary and Permian/ Pennsylvanian periods. The fourth subset is the long and narrow Sangre de Cristos mountains uplifted in the Cenozoic are between the Rio Grande rift and the great plains. Many of the highest mountain ranges were reshaped by glaciation during the Pleistocene. Alluvial fans at the base of the mountains are recharge zones for local basin and valley fill aquifers. They also are important sources of sand and gravel.

The average annual precipitation ranges predominantly from 12 to 63 inches. Summer rainfall commonly occurs as high-intensity, convective thunderstorms. About half of the annual precipitation occurs as snow in winter; this proportion increases with elevation. In the mountains, deep snowpacks accumulate throughout the winter and

generally persist into spring or early summer, depending on elevation. Some permanent snowfields and small glaciers are on the highest mountain peaks. In the valleys at the lower elevations, snowfall is lighter and snowpacks can be intermittent. The average annual temperature is 26 to 54 degrees F (-3 to 12 degrees C). The freeze-free period averages 135 days and ranges from 45 to 230 days, decreasing in length with elevation. The climate of this area is strongly dependent upon elevation; precipitation is greater, and temperatures are cooler at the higher elevations. The plant communities vary with elevation, aspect and change in latitudes due to changing in precipitation kind and timing and temperature.

The dominant soil orders in this MLRA are Mollisols, Alfisols, Inceptisols, and Entisols. The soils in the area dominantly have a frigid or cryic soil temperature regime and an ustic or udic soil moisture regime. Mineralogy is typically mixed, smectitic, or paramicaceous. In areas with granite, gneiss, and schist bedrock, Glossocryalfs (Seitz, Granile, and Leadville series) and Haplocryolls (Rogert series) formed in colluvium on mountain slopes. Dystrocryepts (Leighcan and Mummy series) formed on mountain slopes and summits at the higher elevations. In areas of andesite and rhyolite bedrock, Dystrocryepts (Endlich and Whitecross series) formed in colluvium on mountain slopes. In areas of sedimentary bedrock, Haplustolls (Towave series) formed on mountain slopes at low elevations and with low precipitation. Haplocryolls (Lamphier and Razorba series), Argicryolls (Cochetopa series), and Haplocryalfs (Needleton series) formed in colluvium on mountain slopes at high elevations.

Ecological site concept

The soils of this site formed mostly in colluvium and/or slope alluvium over residuum weathered from sandstone and shale. Surface soils are very channery loam, channery loam to extremely bouldery sandy loam in texture. Rock fragments may be present on the soil surface and throughout the profile, but generally make up less than 35 percent of the soil volume. These soils are very shallow to moderately deep, well to somewhat excessively drained, and have moderately slow to moderately rapid permeability. Available water-holding capacity ranges from 1.1 to 5.3 inches of water in the upper 40 inches of soil. The soil moisture regime is mostly ustic and the soil temperature regime is frigid. Precipitation ranges from 12 to 16 inches annually.

Associated sites

F048AY330UT	**Upland Shallow Stony Loam (Two-Needle Pinyon /Douglas Fir)**
R048AY322UT	**Upland Shallow Loam (Two-Needle Pinyon / Utah Juniper)**
R048AY334UT	**Upland Stony Loam (basin big sagebrush-saline wildrye)**
R048AY443UT	**Mountain Shallow Loam (Mixed Conifer)**

Similar sites

R048AY334UT	**Upland Stony Loam (basin big sagebrush-saline wildrye)**

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex confertifolia* (2) *Eriogonum microthecum*
Herbaceous	(1) *Leymus salinus*

Physiographic features

This ecological site typically occurs on steep draw sides and hill slopes, mountain slopes, and on escarpments and ledges. Slope, aspect and elevation influence the vegetative floristics of this ecological site. Sites are located located between 6,500 to 8,100 feet in elevation. Slopes normally range from 50 to 85 percent but may ccasionally be steeper.

Table 2. Representative physiographic features

Landforms	(1) Draw (2) Mountain slope (3) Hillslope (4) Escarpment
Flooding frequency	None
Ponding frequency	None
Elevation	6,500–8,100 ft
Slope	50–85%
Aspect	SE, S, SW

Climatic features

The climate of this site is dry subhumid and semiarid. It is characterized by cold, snowy winters and warm, dry summers. The average annual precipitation ranges from 12 to 16 inches. November and January are typically the wettest months with June being the driest. The most reliable sources of moisture for plant growth are the snow that accumulates over the winter and spring rains. Summer thunderstorms are intermittent and sporadic in nature, and thus, are not reliable sources of moisture to support vegetative growth on this site. The mean annual air temperature ranges from 42 to 45 degrees.

Table 3. Representative climatic features

Frost-free period (characteristic range)	
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	12-16 in
Frost-free period (average)	110 days
Freeze-free period (average)	158 days
Precipitation total (average)	14 in

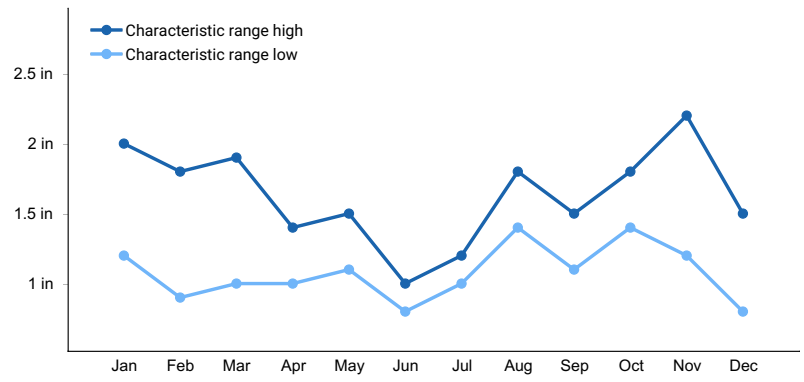


Figure 1. Monthly precipitation range

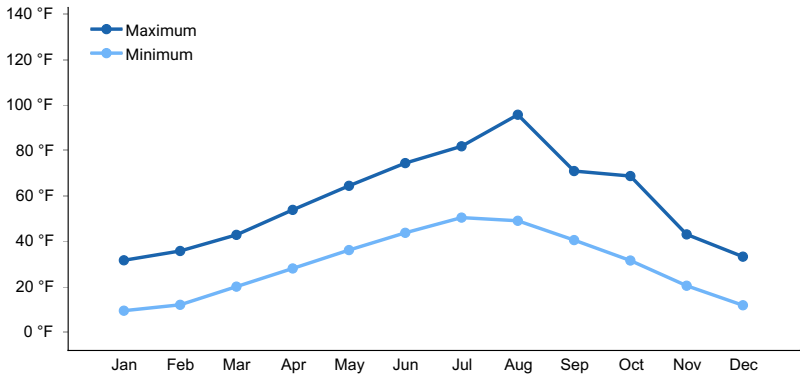


Figure 2. Monthly average minimum and maximum temperature

Influencing water features

There are no influencing water features on this site.

Soil features

The soils of this site formed mostly in colluvium and/or slope alluvium over residuum weathered from sandstone and shale. Surface soils are very channery loam, channery loam to extremely bouldery sandy loam in texture. Rock fragments may be present on the soil surface and throughout the profile, but generally make up less than 35 percent of the soil volume. These soils are very shallow to moderately deep, well to somewhat excessively drained, and have moderately slow to moderately rapid permeability. Available water-holding capacity ranges from 1.1 to 5.3 inches of water in the upper 40 inches of soil. The soil moisture regime is mostly ustic and the soil temperature regime is frigid. Precipitation ranges from 12-16 inches annually.

Table 4. Representative soil features

Parent material	(1) Alluvium–sandstone and shale (2) Residuum–limestone (3) Colluvium–quartzite
Surface texture	(1) Very channery sandy loam (2) Loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderate
Soil depth	60–80 in
Surface fragment cover <=3"	0–45%
Surface fragment cover >3"	0–2%
Available water capacity (Depth not specified)	2.4–3.2 in
Calcium carbonate equivalent (Depth not specified)	1–35%
Electrical conductivity (Depth not specified)	0–4 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0–1
Soil reaction (1:1 water) (Depth not specified)	7.8–8.6
Subsurface fragment volume <=3" (Depth not specified)	0–4%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

This site developed under the Uintah Basin Section of the Southern Rocky Mountain Provence ecological conditions and the natural influences of herbivory, fire and climate. This site occurs on very steep (50 to 85%) slopes with an aspect that is typically in a southerly direction. It is usually found directly below vertical canyon rims and above valley floors. Species composition is generally dominated by Salina wildrye. Shadscale and slender buckwheat are the most common shrub species. Indian ricegrass, blue grama and bluebunch wheatgrass are other common herbaceous species.

This sites gravelly soils combined with its very steep slopes limit its availability for livestock grazing. Grazing is usually limited to the sites lower slopes and a grazing limit line is often visable along most hillsides. Plant

community phases described to date can often be observed by hiking from the bottom to the top a sidehill anywhere this site is found.

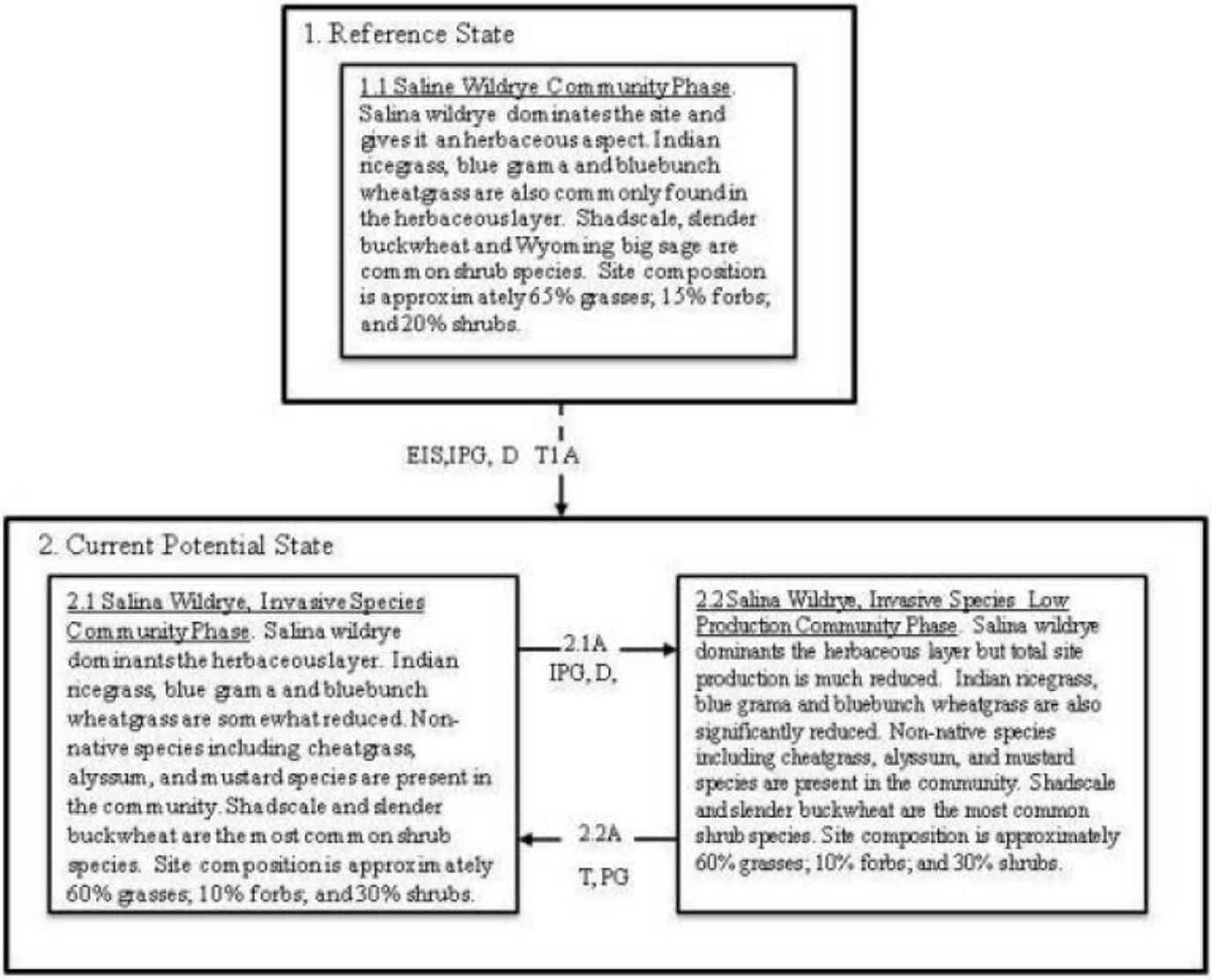
Evidence indicates that this site historically maintained a fairly long burn cycle (100 years or more). Following a fire, any sagebrush species presen are removed and Salina wildrye and other herbaceous species dominate the site.

As vegetative communities respond to changes caused by natural or manmade events that cause them to cross ecological thresholds, a return to previous states may not be possible. The amount of effort needed to affect desired vegetative shifts depends on a sites present biotic and abiotic features and the desired results.

The following State and Transition diagram depicts the most common plant communities found on this ecological site. It does not necessarily depict all the plant communities that can occur, but does show the most prevalent and repeatable. As more data are collected, some of these plant communities may be revised or removed, and new ones added. These descriptions capture the current knowledge and experience at the time of this revision.

State and transition model

State and Transition Model
State: Utah
Site Type: Rangeland
MLRA: D-48A - Southern Rocky Mountain Province, Uintah Basin Extension.
R048AY366UT – Upland Very Steep Loam (Salina Wildrye, Shadscale).



Legend:
D=Drought
T=Time.
EIS = Establishment of invasive species.
PG=Proper Livestock Grazing.
IPG = Improper Livestock Grazing.

State 1
Reference State

This state describes the biotic communities that may become established on this ecological site if all successional sequences are completed under natural disturbance conditions. The reference state is dominated by Salina wildrye.

Indian ricegrass, blue grama and bluebunch wheatgrass are other common herbaceous species. Shadscale and slender buckwheat are the most common shrub species. Other native grasses, forbs, and shrubs may produce significant composition in the plant community. This site occurs on very steep (50 to 85%) slopes with an aspect that typically ranges from southeasterly to southwesterly. It is usually found directly below vertical canyon rims and above valley floors. Its soils are very gravelly, somewhat limiting site production. The primary disturbance mechanisms are grazing impacts, weather fluctuation, and fire. The reference state is self sustaining and resistant to change due to a high resistance to natural disturbances and a high resilience following those disturbances. When natural disturbances occur, the rate of recovery can be somewhat variable. Reference State: Herbaceous plant community composition, long term weather fluctuations, and periodic fire. Indicators: A community dominated by Salina wildrye. The density of the Salina wildrye determines the amount and composition of the other native perennial grasses and forbs that may be present. Feedbacks: Natural fluctuations in weather patterns that allow for a self sustaining native grass community. Prolonged drought, more frequent fires, or other disturbances that may allow for the establishment of invasive species. At-risk Community Phase: All communities are at risk when native plants are stressed and nutrients become available for invasive plants to establish. Trigger: The establishment of invasive plant species.

Community 1.1
Salina Wildrye Community Phase

Figure 3. Community Phase 1.1

This community phase is characterized by a herbaceous layer dominated by Salina wildrye. Other commonly occurring grasses include Indian ricegrass, blue grama and bluebunch wheatgrass. Shadscale and slender buckwheat are the most common shrub species. Other perennial grasses, shrubs, and forbs are also often present. Air dry composition of this site is approximately 15 percent forbs, 65 percent grasses, and 20 percent shrubs. Bare ground is variable (2-20%) depending on biological crust cover, (1-5%) and surface rock fragments (40-60%). Biological crust is typically madeup of cyanobacteria. The following tables provide an example the typical vegetative floristics of a community phase 1.1 plant community.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	293	390	488
Shrub/Vine	90	120	150
Forb	67	90	112
Total	**450**	**600**	**750**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	15-20%
Grass/grasslike foliar cover	35-50%

Forb foliar cover	15-20%
Non-vascular plants	0%
Biological crusts	0%
Litter	5-10%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	30-50%

State 2
Current Potential State

The Current Potential State is similar to the Reference Sate except that non-native species are now present. This state describes the plant communities that may become established on this ecological site if all successional sequences are completed under natural disturbance conditions. This state has a well developed herbaceous layer dominated by Salina wildrye. Indian ricegrass, blue grama and bluebunch wheatgrass are also commonly found. Shadscale and slender buckwheat are common shrub species. Other native grasses, forbs, and shrubs may produce significant composition in the plant community. Cheatgrass, alyssum, and other non-native species are present on the site especially along its lower slopes. This site occurs on very steep (50 to 85%) slopes with an aspect that typically ranges from southeasterly to southwesterly. It is usually found directly below vertical canyon rims and above valley floors. Its soils are very gravelly, somewhat limiting site production. The primary disturbance mechanisms are grazing intensity, the amount of invasive species present, weather fluctuation, and fire. The current potential state is still self sustaining but may be losing its resistance to change due to a lowered resistance to natural disturbances and less resilience following those disturbances. When natural disturbances occur, the rate of recovery can be quite variable. Reference State: Plant communities influenced by grazing activities, long term weather fluctuations, and periodic fire. Indicators: A community dominated by Salina wildrye. The density of Salina wildrye determines the amount and composition of the other native and introduced grasses and forbs that may be present. Feedbacks: Natural fluctuations in weather patterns that allow for a self sustaining shrub and native grass community. Prolonged drought, more frequent fires, or other disturbances that may allow for the increase of invasive species. At-risk Community Phase: All communities are at risk when native plants are stressed and nutrients become available for invasive plants to increase. Trigger: The establishment of invasive plant species. Few disturbed sites have been located to date and so little data exists regarding them.

Community 2.1
Salina Wildrye, Invasive Species Community Phase

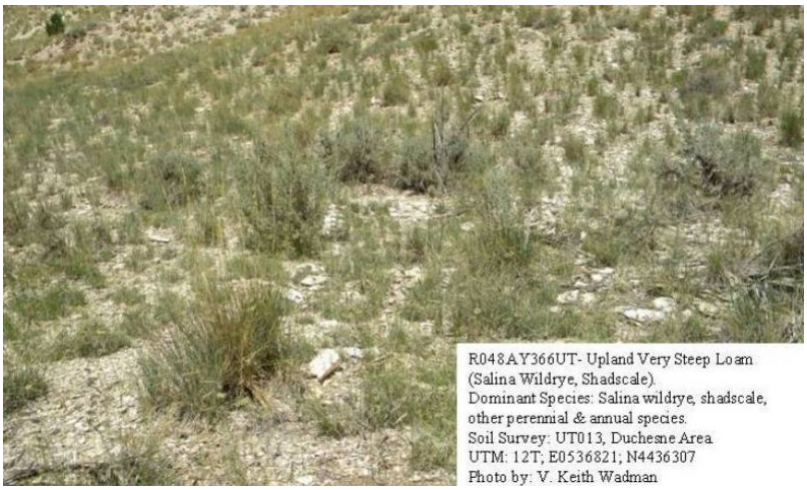


Figure 5. Community Phase 2.1

This community phase is characterized by an herbaceous layer dominated by Salina wildrye. Other grasses

including Indian ricegrass, blue grama and bluebunch wheatgrass are still present but may be somewhat reduced. Shadscale and slender buckwheat are common shrubs. Non-native grasses and forbs are present on site including cheatgrass, alyssum and various mustards. Other grasses, shrubs, and forbs are also often present. Air dry composition of this site is approximately 10 percent forbs, 60 percent grasses, and 30 percent shrubs. Bare ground is variable (2-20%) depending on biological crust cover, (1-5%) and surface rock fragments (40-60%). Biological crust is typically madeup of cyanobacteria. The following tables provide an example the typical vegetative floristics of a community phase 2.1 plant community.

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	270	360	420
Shrub/Vine	135	180	210
Forb	45	60	70
Total	**450**	**600**	**700**

Table 8. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	15-20%
Grass/grasslike foliar cover	35-50%
Forb foliar cover	15-20%
Non-vascular plants	0%
Biological crusts	0%
Litter	5-10%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	30-50%

Community 2.2
Salina Wildrye, Invasive Species Low Production Community Phase

Figure 7. Community Phase 2.2

This community phase is characterized by an herbaceous layer dominated by Salina wildrye. Other grasses including Indian ricegrass, blue grama and bluebunch wheatgrass are still present but may be much reduced. Shadscale and slender buckwheat are common shrubs. Non-native grasses and forbs are present on site including

cheatgrass, alyssum and various mustards. Other grasses, shrubs, and forbs are also often present. Total site production is reduced by at least 40 percent over reference state vegetation. Air dry composition of this site is approximately 10 percent forbs, 60 percent grasses, and 30 percent shrubs. Bare ground is variable (2-20%) depending on biological crust cover, (1-5%) and surface rock fragments (40-60%). Biological crust is typically madeup of cyanobacteria. The following tables provide an example the typical vegetative floristics of a community phase 2.2 plant community.

Table 9. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	150	210	270
Shrub/Vine	75	105	135
Forb	25	35	45
Total	**250**	**350**	**450**

Table 10. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	10-20%
Grass/grasslike foliar cover	15-20%
Forb foliar cover	5-10%
Non-vascular plants	0%
Biological crusts	0%
Litter	2-5%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	40-60%

Pathway 2.1A
Community 2.1 to 2.2

Salina Wildrye, Invasive Species Community Phase

Salina Wildrye, Invasive Species Low Production Community Phase

This community pathway occurs when drought and/or long term improper livestock grazing reduces palatable native perennial grasses and allows less palatable species to increase. Non-native species often increase and may dominate the herbaceous layer.

Pathway 2.2A
Community 2.2 to 2.1

Salina Wildrye, Invasive Species Low Production Community Phase

Salina Wildrye, Invasive Species Community Phase

This community pathway occurs when normal or wet weather pattern combined with carefully managed livestock grazing allows more palatable native perennial grasses to increase. Non-native species remain but become less dominant on the site.

Transition T1A
State 1 to 2

This transitional pathway occurs when drought and/or improper livestock grazing causes the perennial herbaceous community to become significantly reduced allowing non-native species such as cheatgrass, alyssum, Russian thistle and other invasive weeds to become established. Broom snakeweed may also increase during this time. Once invasive species occupy the site, a threshold has been crossed. Cheatgrass has been known to become established in healthy communities on this site, however.

Additional community tables

Table 11. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Dominant Grasses**			300–500	
	saline wildrye	LESA4	*Leymus salinus*	250–350	–
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	60–90	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	60–90	–
2	**Sub-Dominant Grasses**			100–140	
	blue grama	BOGR2	*Bouteloua gracilis*	20–40	–
	squirreltail	ELEL5	*Elymus elymoides*	20–40	–
	James' galleta	PLJA	*Pleuraphis jamesii*	20–40	–
	Sandberg bluegrass	POSE	*Poa secunda*	20–40	–
Forb					
3	**Forbs**			60–180	
	low pussytoes	ANDI2	*Antennaria dimorpha*	10–20	–
	Holboell's rockcress	ARHO2	*Arabis holboellii*	10–20	–
	woollypod milkvetch	ASPU9	*Astragalus purshii*	10–20	–
	aridland goosefoot	CHDE	*Chenopodium desiccatum*	10–20	–
	narrowstem cryptantha	CRGR3	*Cryptantha gracilis*	10–20	–
	roundspike cryptantha	CRHU2	*Cryptantha humilis*	10–20	–
	sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	10–20	–
	scarlet gilia	IPAG	*Ipomopsis aggregata*	10–20	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	10–20	–
	rock goldenrod	PEPU7	*Petradoria pumila*	10–20	–
	Whipple's penstemon	PEWH	*Penstemon whippleanus*	10–20	–
	spiny phlox	PHHO	*Phlox hoodii*	10–20	–
	longleaf phlox	PHLO2	*Phlox longifolia*	10–20	

	longleaf phlox	PHLO2	*Phlox longifolia*	10–20	–
	basindaisy	PLIN7	*Platyschkuhria integrifolia*	10–20	–
	woolly plantain	PLPA2	*Plantago patagonica*	10–20	–
	stemless mock goldenweed	STAC	*Stenotus acaulis*	10–20	–
	longstalk clover	TRLO	*Trifolium longipes*	10–20	–
	American vetch	VIAM	*Vicia americana*	10–20	–
Shrub/Vine					
4	**Dominant Shrubs**			100–150	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	100–150	–
	slender buckwheat	ERMI4	*Eriogonum microthecum*	60–90	–
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	60–90	–
	basin big sagebrush	ARTRT	*Artemisia tridentata ssp. tridentata*	30–60	–
5	**Sub-Dominant Shrubs**			40–100	
	prairie sagewort	ARFR4	*Artemisia frigida*	10–20	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	10–20	–
	mormon tea	EPVI	*Ephedra viridis*	10–20	–
	spiny hopsage	GRSP	*Grayia spinosa*	10–20	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	10–20	–
	rockspirea	HODU	*Holodiscus dumosus*	10–20	–
	Mexican cliffrose	PUME	*Purshia mexicana*	10–20	–
	antelope bitterbrush	PUTR2	*Purshia tridentata*	10–20	–
	blue elderberry	SANIC5	*Sambucus nigra ssp. cerulea*	10–20	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	10–20	–

Table 12. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Dominant Grasses**			300–425	
	saline wildrye	LESA4	*Leymus salinus*	225–325	–
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	40–60	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	40–60	–
2	**Sub-Dominant Grasses**			100–140	
	blue grama	BOGR2	*Bouteloua gracilis*	20–40	–
	cheatgrass	BRTE	*Bromus tectorum*	20–40	–
	squirreltail	ELEL5	*Elymus elymoides*	20–40	–
	James' galleta	PLJA	*Pleuraphis jamesii*	20–40	–
	Sandberg bluegrass	POSE	*Poa secunda*	20–40	–
Forb					
3	**Forbs**			60–90	
	desert madwort	ALDE	*Alyssum desertorum*	10–20	–
	annual ragweed	AMAR2	*Ambrosia artemisiifolia*	10–20	–
	low pussytoes	ANDI2	*Antennaria dimorpha*	10–20	–
	Holboell's rockcress	ARHO2	*Arabis holboellii*	10–20	

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	woollypod milkvetch	ASPU9	*Astragalus purshii*	10–20	–
	aridland goosefoot	CHDE	*Chenopodium desiccatum*	10–20	–
	narrowstem cryptantha	CRGR3	*Cryptantha gracilis*	10–20	–
	roundspike cryptantha	CRHU2	*Cryptantha humilis*	10–20	–
	herb sophia	DESO2	*Descurainia sophia*	10–20	–
	sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	10–20	–
	scarlet gilia	IPAG	*Ipomopsis aggregata*	10–20	–
	African mustard	MAAF	*Malcolmia africana*	10–20	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	10–20	–
	rock goldenrod	PEPU7	*Petradoria pumila*	10–20	–
	Whipple's penstemon	PEWH	*Penstemon whippleanus*	10–20	–
	spiny phlox	PHHO	*Phlox hoodii*	10–20	–
	longleaf phlox	PHLO2	*Phlox longifolia*	10–20	–
	basindaisy	PLIN7	*Platyschkuhria integrifolia*	10–20	–
	woolly plantain	PLPA2	*Plantago patagonica*	10–20	–
	Russian thistle	SAKA	*Salsola kali*	10–20	–
	tall tumblemustard	SIAL2	*Sisymbrium altissimum*	10–20	–
	stemless mock goldenweed	STAC	*Stenotus acaulis*	10–20	–
	longstalk clover	TRLO	*Trifolium longipes*	10–20	–
	American vetch	VIAM	*Vicia americana*	10–20	–
Shrub/Vine					
4	**Dominant Shrubs**			100–150	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	100–125	–
	slender buckwheat	ERMI4	*Eriogonum microthecum*	60–90	–
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	60–90	–
	basin big sagebrush	ARTRT	*Artemisia tridentata ssp. tridentata*	30–60	–
5	**Sub-Dominant Shrubs**			80–120	
	prairie sagewort	ARFR4	*Artemisia frigida*	10–20	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	10–20	–
	mormon tea	EPVI	*Ephedra viridis*	10–20	–
	spiny hopsage	GRSP	*Grayia spinosa*	10–20	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	10–20	–
	rockspirea	HODU	*Holodiscus dumosus*	10–20	–
	Mexican cliffrose	PUME	*Purshia mexicana*	10–20	–
	antelope bitterbrush	PUTR2	*Purshia tridentata*	10–20	–
	blue elderberry	SANIC5	*Sambucus nigra ssp. cerulea*	10–20	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	10–20	–

Table 13. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Dominant Grasses**			60–100	

1	**Dominant Grasses**			30–100	
	saline wildrye	LESA4	*Leymus salinus*	70–120	–
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	20–30	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	20–30	–
2	**Sub-Dominant Grasses**			40–100	
	cheatgrass	BRTE	*Bromus tectorum*	100–150	–
	squirreltail	ELEL5	*Elymus elymoides*	10–20	–
	James' galleta	PLJA	*Pleuraphis jamesii*	10–20	–
	Sandberg bluegrass	POSE	*Poa secunda*	10–20	–
	blue grama	BOGR2	*Bouteloua gracilis*	10–20	–
Forb					
3	**Forbs**			30–60	
	desert madwort	ALDE	*Alyssum desertorum*	10–20	–
	annual ragweed	AMAR2	*Ambrosia artemisiifolia*	10–20	–
	low pussytoes	ANDI2	*Antennaria dimorpha*	10–20	–
	Holboell's rockcress	ARHO2	*Arabis holboellii*	10–20	–
	woollypod milkvetch	ASPU9	*Astragalus purshii*	10–20	–
	aridland goosefoot	CHDE	*Chenopodium desiccatum*	10–20	–
	narrowstem cryptantha	CRGR3	*Cryptantha gracilis*	10–20	–
	roundspike cryptantha	CRHU2	*Cryptantha humilis*	10–20	–
	herb sophia	DESO2	*Descurainia sophia*	10–20	–
	sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	10–20	–
	scarlet gilia	IPAG	*Ipomopsis aggregata*	10–20	–
	African mustard	MAAF	*Malcolmia africana*	10–20	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	10–20	–
	rock goldenrod	PEPU7	*Petradoria pumila*	10–20	–
	Whipple's penstemon	PEWH	*Penstemon whippleanus*	10–20	–
	spiny phlox	PHHO	*Phlox hoodii*	10–20	–
	longleaf phlox	PHLO2	*Phlox longifolia*	10–20	–
	basindaisy	PLIN7	*Platyschkuhria integrifolia*	10–20	–
	woolly plantain	PLPA2	*Plantago patagonica*	10–20	–
	Russian thistle	SAKA	*Salsola kali*	10–20	–
	tall tumblemustard	SIAL2	*Sisymbrium altissimum*	10–20	–
	stemless mock goldenweed	STAC	*Stenotus acaulis*	10–20	–
	longstalk clover	TRLO	*Trifolium longipes*	10–20	–
	American vetch	VIAM	*Vicia americana*	10–20	–
Shrub/Vine					
4	**Dominant Shrubs**			100–175	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	80–100	–
	slender buckwheat	ERMI4	*Eriogonum microthecum*	30–50	–
	basin big sagebrush	ARTRT	*Artemisia tridentata ssp. tridentata*	20–40	–
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	20–40	–
5	**Sub-Dominant Shrubs**			80–150	

	prairie sagewort	ARFR4	*Artemisia frigida*	10–20	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	10–20	–
	mormon tea	EPVI	*Ephedra viridis*	10–20	–
	spiny hopsage	GRSP	*Grayia spinosa*	10–20	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	10–20	–
	rockspirea	HODU	*Holodiscus dumosus*	10–20	–
	Mexican cliffrose	PUME	*Purshia mexicana*	10–20	–
	antelope bitterbrush	PUTR2	*Purshia tridentata*	10–20	–
	blue elderberry	SANIC5	*Sambucus nigra ssp. cerulea*	10–20	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	10–20	–

Animal community

--Wildlife Interpretation--
The very steep slopes and scarcity of water on this site limits its species richness and the abundance of large mammals. It does provide limited browsing opportunities for mule deer and elk. Birds, bats, lizards, snakes and rodents are quite common. Several species of birds can be found using this site. Golden eagles and red-tailed hawks are common as well as great horned-owls. Other species typical of mixed forest areas including black-chinned and rufous hummingbirds, several fly catchers, wood peckers, and corvids will use this site for nesting and foraging. Several species of rodents occupy this site including desert cottontail, black tailed jack rabbit, Colorado chipmunk, white–tailed Antelope squirrel, Apache pocket mouse, and several species of Peromyscus. Bats (Myotis, Pipisturellus, and others) can be observed in this ecological site, but are likely limited to areas near water or canyons.

--Grazing Interpretations—
This sites plant community primarily consists of a perennial bunchgrass community growing on very steep slopes. Common shrubs include shadscale and slender buckwheat. Grasses include Salina wildrye, Indian ricegress and bluebunch wheatgrass.

This sites very steep slopes seriously limit its use for livestock grazing. Its lack natural perennial water sources also reduces its suitability. A grazing extent line is often evident where livestock are not able to reach the sites higher slopes. Mule deer and Rocky Mountain Elk often utilize this site, and wildlife browsing on palatable shrub species is common.

Hydrological functions

The soils associated with this ecological site are generally in Hydrologic Soil Group B (NRCS National Engineering Handbook). Once these soils become saturated, hoewver, because of their steep slopes, run off potential is high. Hydrological groups are used in equations that estimate runoff from rainfall. These estimates are needed for solving hydrologic problems that arise in planning watershed-protection and flood-prevention projects and for designing structures for the use, control and disposal of water. Heavy grazing can alter the hydrology by decreasing plant cover and increasing bare ground. Fire can also affect hydrology, but its affect is variable. Fire intensity, fuel type, soil, climate, and topography can each have different influences. Fires can increase areas of bare ground and hydrophobic layers that reduce infiltration and increase runoff (National Range and Pasture Handbook, 2003).

Recreational uses

Recreation activities include aesthetic value and fair opportunities for hiking and hunting. In good condition there are several forbs and shrubs that bloom in the spring. Steep slopes limit this site’s ability to be used for vacation homes, other residences, or deep ponds.

Wood products

None.

Other information

--Poisonous and Toxic Plant Communities--
Toxic plants associated with this site include woolly locoweed, broom snakeweed, and Russian thistle.

Woolly locoweed is toxic to all classes of livestock and wildlife. Locoweed is palatable and has similar nutrient value to alfalfa, which may cause animals to consume it even when other forage is available. Locoweed contains swainsonine (indolizdine alkaloid) and is poisonous at all stages of growth. Poisoning will become evident after 2-3 weeks of continuous grazing and is associated with 4 major symptoms: 1) neurological damage, 2) emaciation, 3) reproductive failure and abortion, and 4) congestive heart failure linked with “high mountain disease”.

Broom snakeweed contains steroids, terpenoids, saponins, and flavones that can cause abortions or reproductive failure in sheep and cattle, however, cattle are most susceptible. These toxins are most abundant during active growth and leafing stage. Cattle and sheep generally will only graze broom snakeweed when other forage is unavailable, typically in winter when toxicity levels are at their lowest (Knight and Walter, 2001).

Russian thistle is an invasive toxic plant, causing nitrate and to a lesser extent oxalate poisoning, which affects all classes of livestock. The buildup of nitrates in these plants is highly dependent upon environmental factors such as after a rain storm, during a drought, during periods with cool/cloudy days, and when growing on soils high in nitrogen and low in sulfur and phosphorus. Nitrate collects in the stems and can persist throughout the growing season. Clinical signs of nitrate poisoning include drowsiness, weakness, muscular tremors, increased heart and respiratory rates, staggering gait, and death. Conversely, oxalate poisoning causes kidney failure; clinical signs include muscle tremors, tetany, weakness, and depression. Poisoning generally occurs when livestock consume and are not accustomed to grazing oxalate-containing plants. Animals with prior exposure to oxalates have increased numbers of oxalate-degrading rumen microflora, and thus, are able to degrade the toxin before clinical poisoning can occur.

--Invasive Plant Communities--
Generally, as ecological conditions deteriorate and perennial vegetation decreases due to disturbance (fire, drought, off road vehicle overuse, erosion, etc.) annual forbs and grasses may invade the site. Of particular concern in semi-arid environments are annual invaders including cheatgrass, Russian thistle, alyssum and annual mustards. The presence of these species will depend on soil properties and moisture availability; however, these invaders are highly adaptive and can flourish in many locations. Once established, complete removal is difficult, but suppression may be possible.

--Fire Ecology--
The ability for an ecological site to carry fire depends primarily on its' present fuel load and plant moisture content. Sites with small fuel loads will burn more slowly and less intensely than sites with large fuel loads. Most research agrees that historic fire return intervals are at a minimum 100 years, indicating that fire may have not played an important role in short term community dynamics. Fires are more common when plants are stressed or dead due to drought. Continuous (every 20-40 years) burning of these ecological sites can result in more herbaceous dominated communities, due to the relatively fast recovery of grasses and forbs when compared to shrubs. If invasive annual grasses are allowed to establish, fires may become more frequent, inhibiting the site’s ability to recover.

Inventory data references

Data supporting this ecological site was gathered from historic inventory data collected by USDA range professionals.

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Contributors

V. Keith Wadman

Approval

Kirt Walstad, 3/05/2024

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.

Author(s)/participant(s)	Jacob Owens (NRCS, Shane Green (NRCS); adapted to this site by V. Keith Wadman, (NRCS Retired).
Contact for lead author	shane.green@ut.usda.gov
Date	08/15/2011
Approved by	Kirt Walstad

Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Very few. Due to the surface rock fragments on this site, traditional rill formation is reduced. The overall gravelly to channery surface is expected to be resistant to rill formation and accelerated erosion in general. Where rills do occur, they may extend down entire slope.

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2. **Presence of water flow patterns:** Due to the steep slopes, flow patterns are present and tend to be very sinuous and wind around rock fragments and perennial plant bases. They show some evidence of erosion with fines and litter depositing against the uphill side of gravel, rocks and plants. During episodic precipitation events e.g. thunderstorms, these sites are expected to shed large volumes of water to adjacent ecological sites.

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3. **Number and height of erosional pedestals or terracettes:** Pedestals may form at the base of plants that occur on the edge of primary flow patterns and rills. Interspaces between any well developed biological soil crusts resemble pedestals and may be up to 2 inches high. Terracettes are present. Debris dams of small to medium sized litter (up to 2 inches in diameter) may form in water flow patterns, rills, and gullies. These debris dams may accumulate smaller litter (leaves, grass and forb stems).

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 30 – 50 %. Most bare ground is associated with water flow patterns, rills, and gullies. Soil is covered by up to 50 percent rock fragments. Any areas with well developed biological soil crusts should not be counted as bare ground. Poorly developed biological soil crusts that are interpreted as functioning as bare ground (therefore they would be susceptible to raindrop splash erosion) should be recorded as bare ground. Ground cover is based on first raindrop impact, and bare ground is the opposite of ground cover.

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5. **Number of gullies and erosion associated with gullies:** Few gullies may be present. Length often extends from exposed bedrock until gully reaches a stream or an area where water and sediment accumulate, but they may be wide and shallow and armored with very large rocks.

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

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7. **Amount of litter movement (describe size and distance expected to travel):** Due to the steepness of slope being between 50 to 80 percent, down slope redistribution of any incident litter caused by water is expected. Deposition would likely occur at points of obstruction such as the uphill side of gravel, rocks and plants, especially following major storm events. Fine litter is moved with even moderate precipitation events and spring runoff. Woody stems may be washed from site. Gullies may remove accumulated litter from under trees.

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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):** 80 to 90% of this site should have an erosion rating of 3 or 4. 10 to 20% may have a rating of 2 to 3. The

average should be a 4. Surface texture is boulderly sandy loam to very channery sandy loam. Vegetation cover, litter, biological soil crusts and surface rock reduce erosion.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface is 3 inches deep. Structure is moderate, very thin and thin platy. Color is dark brown (10YR 4/4). The A horizon would be expected to be more strongly developed under plant canopies. It is important if you are sampling to observe the A horizon under plant canopies as well as the interspaces. Use the specific information for the soil you are assessing found in the published soil survey to supplement this description.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Spatial distribution of plants and/or well developed biological soil crusts (where present) intercept raindrops reducing splash erosion and provide areas of surface detention to store water allowing additional time for infiltration. Crowns of shrubs and accumulating litter at base of shrubs appear to create a micro-topography that may enhance development of water flow patterns below the drip line of the canopy. Significant increases in shrub canopy reduces understory vegetation causing an associated increase in runoff.

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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. There may be layers of calcium carbonate, gravel, cobbles or other naturally occurring hard layers found in the soil subsurface. These should not be considered to be compaction layers.

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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: Dominance by average annual production: Shrubs (shadscale, slender buckwheat)> Cool season perennial grasses (Salina wildrye, Indian ricegrass, bluebunch wheatgrass).

    Sub-dominant: Shrubs (rockspirea) > Grasses (bottlebrush squirreltail, blue grama).

    Other: Biological soil crust is variable in it's expression where present on this site and is measured as a component of ground cover.

    Additional: Following a recent disturbance such as fire, drought, or insects that removes woody vegetation, forbs and perennial grasses (herbaceous species) may dominate the community for a time. If a disturbance has not occurred for an extended period of time, woody species may continue to increase crowding out the perennial herbaceous understory species. In either case, 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):** In general, a mix of age classes may be expected with a few dead and decadent plants present.

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14. **Average percent litter cover (%) and depth (in):** Litter cover 5-10%. Depth is highly variability due to slope and the stability of the soil surface.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-**

production): 550-650 #/acre on an average year.

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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:** Possible invaders or increasers on this site are cheatgrass, alyssum and mustard species.

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17. **Perennial plant reproductive capability:** All perennial plants should have the ability to reproduce sexually or asexually in most years, except in drought years.
