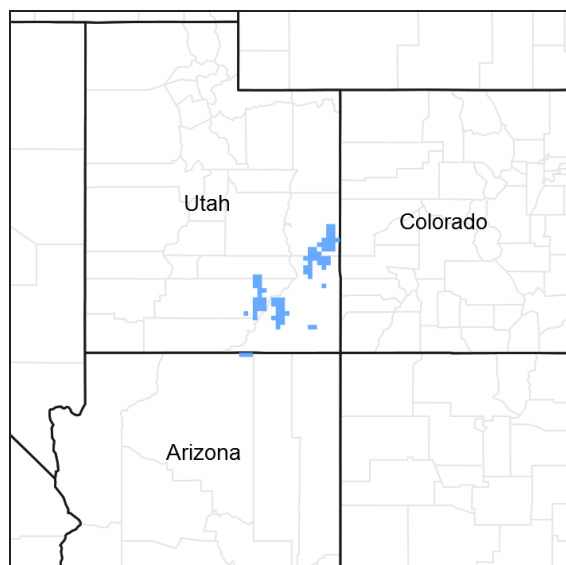


# **Ecological site R035XY243UT** **Semidesert Stony Loam (Blackbrush)**

Accessed: 05/14/2025

## **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.



**Figure 1. Mapped extent**

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

## **MLRA notes**

Major Land Resource Area (MLRA): 035X–Colorado Plateau

This ecological site occurs in the northern portion of MLRA 35, Colorado Plateau Province. It is found principally in the in the Canyon Lands and High Plateaus of Utah sections within that MLRA. This area has been stucturally uplifted over time while rivers flowing across it were cutting down into its bedrock. Areas of shale, sandstone, limestone, dolomite, and volcanic rock outcrop are found throughout the region.

## **Associated sites**

R035XY124UT	<b>Desert Shallow Clay (Mat Saltbush)</b>
R035XY218UT	<b>Semidesert Sandy Loam (Blackbrush)</b>
R035XY233UT	<b>Semidesert Shallow Sandy Loam (Blackbrush)</b>
R035XY236UT	<b>Semidesert Shallow Sandy Loam (Utah Juniper, Blackbrush)</b>

## **Similar sites**

R035XY312UT	<b>Upland Shallow Loam (Black sagebrush)</b>
R035XY226UT	<b>Semidesert Shallow Loam (Black Sagebrush/Indian Ricegrass)</b>

**Table 1. Dominant plant species**

Tree	Not specified
Shrub	(1) <i>Coleogyne ramosissima</i> (2) <i>Ephedra viridis</i>
Herbaceous	(1) <i>Achnatherum hymenoides</i> (2) <i>Pleuraphis jamesii</i>

## Physiographic features

This ecological site typically occurs on alluvial fans, structural benches, stream terraces and escarpments. Slope and aspect will have a moderate influence the vegetative floristics of this ecological site. Runoff is highly variable and can range from low to high. Flooding and ponding do not occur or are very rare due to local landscape positions and the dry nature of the ecosystem. Slopes generally range from 2% to 50%. Elevations range from 4400 to 6000 feet.

**Table 2. Representative physiographic features**

Landforms	(1) Alluvial fan (2) Structural bench (3) Stream terrace
Flooding frequency	None
Ponding frequency	None
Elevation	1,341–1,829 m
Slope	2–50%
Aspect	NE, SW

## Climatic features

The climate is characterized by hot summers and cool to warm winters. Large fluctuations in daily temperatures are common. The mean annual high temperature is 70 degrees Fahrenheit and the mean annual low temperature is 39 degrees Fahrenheit. Approximately 75% of the precipitation occurs as rain from March through October. On the average, February, June, and July are the driest months and March, April, and August through October are the wettest months. Precipitation is extremely variable from month to month and from year to year but averages between 8 and 13 inches per year. Much of the summer precipitation occurs as convection thunderstorms.

**Table 3. Representative climatic features**

Frost-free period (average)	197 days
Freeze-free period (average)	172 days
Precipitation total (average)	279 mm

## Influencing water features

There are no influencing water features on this site.

## Soil features

This site occurs on deep soils. The dry surface layer color is typically reddish brown to brown and surface textures range from gravelly and cobbly loams to very cobbly fine sandy loams. These soils are well developed, well drained, and have low to moderate water holding capacities. Soil temperature regime is mesic and moisture regime is ustic aridic (torric). Erosion potential of soils on reference state sites typically depends on surface rock fragments. Sites with greater than 50% rock fragments have lower wind and water erosion potentials than sites with less than 50%

surface rock fragments. Biological crust cover is characterized as crustless with the possible occurrence of light cyanobacteria and/or isolated lichen and moss pinnacles. This site has been used in the following soils surveys and has been correlated to the following components:

UT631 - Henry Mountains - Stormitt;  
UT633 - Canyonlands Area - Moab;  
UT638 - San Juan County - Strych (warm).

Typical Soil Profile: (Moab).

A—0-3 inches; gravelly fine sandy loam;  
brown (7.5YR 4/4); moderately calcareous; moderately alkaline.

Bw—3-10 inches; gravelly fine sandy loam; brown (7.5YR 5/4); moderately calcareous; moderately alkaline.

Bk1-10-29 inches; very gravelly fine sandy loam; pinkish gray (7.5YR 8/2); very strongly calcareous; strongly alkaline.

Bk2-29-60 inches; very gravelly fine sandy loam; light brown (10YR 7/4); very strongly calcareous; strongly alkaline.

**Table 4. Representative soil features**

Parent material	(1) Alluvium—sandstone and shale (2) Colluvium—diorite
Surface texture	(1) Gravelly fine sandy loam (2) Very cobbly loam
Family particle size	(1) Sandy
Drainage class	Well drained
Permeability class	Moderate to moderately rapid
Soil depth	152 cm
Surface fragment cover <=3"	11–26%
Surface fragment cover >3"	2–44%
Available water capacity (0-101.6cm)	5.08–12.19 cm
Calcium carbonate equivalent (0-101.6cm)	3–15%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	7.4–9
Subsurface fragment volume <=3" (Depth not specified)	15–28%
Subsurface fragment volume >3" (Depth not specified)	12–29%

## Ecological dynamics

This ecological site occurs on deep, well developed cobbly loams to very cobbly fine sandy loam textured soils found on alluvial fans, structural benches, stream terraces and escarpments in Major Land Resource Area (MLRA) 35.

In its reference condition, blackbrush typically forms the dominant visual aspect. Mormon tea, Fourwing saltbush and winterfat commonly occur. Indian ricegrass and James galleta are the major herbaceous species. Utah juniper will invade this site if a seed source is available. This site developed under natural ecological conditions which

included the natural influences of herbivory, fire, and climate.

The natural disturbance regime consisted of infrequent fires ignited by both natural causes and possibly, Native Americans. It is estimated that the historic fire return interval was 35-100+ years depending on fine fuel accumulations (Howard, 2003). Fire would most typically occur on this site following several good moisture years which would create sufficient fine fuels for burning, followed by a source of ignition such as lightening. In some cases, the introduction of domestic livestock reduced the sites fine fuels, increasing fire periods. Blackbrush appears to act as a paleo-endemic species on this site and once removed, may not be able to reestablish itself.

This ecological site has been grazed by domestic livestock since they were first introduced into the area. This livestock introduction, with its the use of fencing and the development of reliable water sources influenced the disturbance regime historically associated with this ecological site. Improperly managed livestock grazing, where it occurred, may have caused this site to depart from the reference plant community. Continued improper domestic livestock grazing likely removed the native perennial grasses and palatable shrubs from the system which created opportunities for invasive plants to establish.

Other disturbance mechanisms including extended drought, changes in the site's drainage patterns, insect herbivory, off road vehicle use, and prolonged rodent activity can facilitate this sites transition into different plant communities or cause the transition from one stable state to another. Once these changes occur, a return to previous states may not be possible without major energy inputs.

The following State and Transition diagram describes the most common plant communities found on this site. They do not represent every possibility, but they are the most prevalent and repeatable. As more data are collected, some of these plant communities may be revised or removed, and new ones may be added. Both ocular and measured data was collected and utilized in developing this model.

## **State and transition model**

# State and Transition Model

State: Utah

Site Type: Rangeland

MLRA: D-35- Colorado Plateau

R035XY243UT – Semidesert Stony Loam (Blackbrush)

## 1. Reference State

**1.1 Blackbrush/Indian Ricegrass/ Community Phase.** Blackbrush dominates the shrub layer. A mixture of other shrubs including Mormon tea & winterfat commonly occur. Indian ricegrass and James galleta are the most prominent grasses. They along with other herbaceous species makes up to 50% of sites production.

D, IPG, HWB

1.1A →

PWB, T, W, PG

← 1.2A

**1.2 Blackbrush/James Galleta/ Community Phase.** Blackbrush dominates the shrub layer. Less palatable shrubs including green rabbitbrush & snakeweed are increasing. Indian ricegrass is much reduced & James galleta is increasing. Herbaceous species make up to 30% of sites production.

T1A D, NF, IS, IPG, HWB

## 2. Current Potential State

**2.1 Blackbrush/Invasive Weed/ Community Phase.** Blackbrush dominates the shrub layer. Less palatable shrubs including green rabbitbrush & snakeweed are increasing. Palatable herbaceous species are reduced. Invasive species including Russian thistle and cheatgrass are present. Herbaceous species make up to 20% of sites production.

D, T, IPG, NF

2.1A →

← 2.2A

NF, IPG, W

**2.2 Blackbrush/Utah Juniper/Invasive Weed/ Community Phase.** Blackbrush dominates the shrub layer. Utah juniper is invading the site. Palatable herbaceous species are much reduced or missing. Invasive species including Russian thistle and cheatgrass are present. Herbaceous species make up to 10% of sites production.

F, IPG, D T2A

T2B NF, IPG, D

## 3. Disturbed State

**3.1 Burned Community Phase.** Site has burned removing all blackbrush. Site is dominated by pricklypear cactus and invasive grasses and forbs including cheatgrass, Russian thistle and various mustard species. Herbaceous species comprise up to 80% of the sites production.

3.1A →

NF, W

← 3.2A

F, D

**3.2 Blackbrush/Prickly Pear Community Phase.** Site has been highly disturbed and is now dominated by blackbrush and pricklypear cactus. Utah juniper may be invading if a seed source is available. Invasive weeds dominate the herbaceous layer which can comprise up to 40% of the sites production.

### Legend:

F = Fire

NF = No Fire

T = Time

IS = Invasive Species.

W = Wet Weather Periods

D = Drought

HWB= Heavy Wildlife Browsing

PWB= Proper Wildlife Browsing

IPG = Improper Livestock Grazing

PG = Proper Livestock Grazing.

Figure 6. R035XY243UT

## State 1

### Reference State

This reference state describes the various biotic communities that are expected to be found on this ecological site under natural conditions. This state has a well developed shrub layer with blackbrush dominating. Mormon tea and fourwing saltbush are other common shrub species. Indian ricegrass and James galleta are the dominant herbaceous species with bottlebrush squirreltail and needle-and-thread commonly occurring. Other native grasses, forbs, and shrubs will often produce a significant portion of vegetative composition in the plant community. The reference state is self-sustaining and resistant to change due to a good natural resilience to its natural disturbances. The primary natural disturbance mechanisms are wildlife population densities which can affect the shrub layer composition, weather fluctuations, and fire period. Definitions: Reference State: Natural plant communities as influenced by shrub canopy density, long term weather fluctuations, and periodic fire. Indicators: These communities are dominated by blackbrush, James galleta and Indian ricegrass. The density of the shrub canopy determines the amount and composition of the other native species present in the community. Feedbacks: Natural fluctuations in weather patterns that allow for a self-sustaining shrub and native grass community. Prolonged drought, an increase in fire frequency, or other disturbances may allow for the establishment of invasive species. At-risk Community Phase: All communities are at risk when native plants are stressed and conditions are created that may allow invasive plants to establish. Trigger: The establishment of invasive plant species.

### Community 1.1

#### Blackbrush/Indian Ricegrass Community Phase.



Figure 7. Community Phase 1.1

This community phase is characterized by a shrub layer dominated by blackbrush. Mormon tea and four-wing saltbush are other common shrubs. Commonly occurring grasses include Indian ricegrass and James galleta. Other perennial grasses, shrubs, and forbs are also often present. Air dry composition of this site is approximately 10 percent forbs, 40 percent grasses and 50 percent shrubs. Bare ground is variable (2-50%) depending on biological crust cover, which is also variable (1-25%) and surface rock fragments (0-50%). Biological crusts can vary from sites dominated by light cyanobacteria in the plant interspaces, with occasional moss and lichen pinnacles under shrub canopies, to those dominated by lichen and moss pinnacles as well as cyanobacteria in the site interspaces. The following tables provide an example of the typical vegetative floristics of a community phase 1.1 plant community.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	163	280	448
Grass/Grasslike	135	224	308
Forb	39	56	84
<b>Total</b>	<b>337</b>	<b>560</b>	<b>840</b>

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	39-41%
Grass/grasslike foliar cover	19-21%
Forb foliar cover	4-6%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

**Table 7. Canopy structure (% cover)**

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	—	—	—	—
>0.15 <= 0.3	—	—	19-21%	4-6%
>0.3 <= 0.6	—	39-41%	—	—
>0.6 <= 1.4	—	—	—	—
>1.4 <= 4	—	—	—	—
>4 <= 12	—	—	—	—
>12 <= 24	—	—	—	—
>24 <= 37	—	—	—	—
>37	—	—	—	—

## Community 1.2

### Blackbrush/James galleta/Community Phase.



**Figure 9. Community Phase 1.2**

This community phase is characterized by a shrub layer dominated by blackbrush. Mormon tea and four-wing saltbush are other common shrubs. Less palatable shrubs such as snakeweed and green rabbitbrush may be increasing. James galleta is the dominate herbaceous species. Other perennial grasses including Indian ricegrass and needle-and-thread are reduced. Air dry composition of this site is approximately 10 percent forbs, 20 percent grasses and 70 percent shrubs. Bare ground is variable (2-50%) depending on biological crust cover, which is also

variable (1-25%) and surface rock fragments (0-50%). Biological crusts can vary from sites dominated by light cyanobacteria in the plant interspaces, with occasional moss and lichen pinnacles under shrub canopies, to those dominated by lichen and moss pinnacles as well as cyanobacteria in the site interspaces. The following tables provide an example of the typical vegetative floristics of a community phase 1.2 plant community.

**Table 8. Annual production by plant type**

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	163	280	448
Grass/Grasslike	135	224	308
Forb	39	56	84
<b>Total</b>	<b>337</b>	<b>560</b>	<b>840</b>

**Table 9. Ground cover**

Tree foliar cover	0%
Shrub/vine/liana foliar cover	39-41%
Grass/grasslike foliar cover	19-21%
Forb foliar cover	4-6%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

**Table 10. Canopy structure (% cover)**

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	—	—	—	—
>0.15 <= 0.3	—	—	19-21%	4-6%
>0.3 <= 0.6	—	39-41%	—	—
>0.6 <= 1.4	—	—	—	—
>1.4 <= 4	—	—	—	—
>4 <= 12	—	—	—	—
>12 <= 24	—	—	—	—
>24 <= 37	—	—	—	—
>37	—	—	—	—

## Pathway 1.1A

### Community 1.1 to 1.2





**Blackbrush/Indian Ricegrass  
Community Phase.**



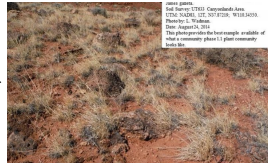
**Blackbrush/James  
galleta/Community Phase.**

This pathway describes the affects of any combination of dry weather periods, improper livestock management and heavy wildlife browsing which can also allow for decreased vigor in these bunchgrass species.

## Pathway 1.2A Community 1.2 to 1.1



**Blackbrush/James  
galleta/Community Phase.**



**Blackbrush/Indian Ricegrass  
Community Phase.**

This pathway occurs when any combination of wet weather cycles, good livestock management and well managed wildlife over time, increase native perennial grasses.

## State 2 Current Potential State

This state describes the plant communities that may or have become established on this ecological site under various successional sequences and disturbance conditions. This state typically has a shrub layer dominated by blackbrush. Mormon tea and four-wing saltbush are other common shrub species. Perennial grasses including Indian ricegrass, James galleta, needle-and-thread and other palatable grasses and forbs are much reduced in the community. Non-native species including cheatgrass, Russian thistle, redstem storksbill, various mustard species and other non-native species are now present on the site and under certain circumstances, may visually dominate the sites aspect. Utah juniper will readily invade this site if a seed source is available. The primary disturbance mechanisms are the shrub layer density; the amount of invasive species present; weather fluctuations; and fire. The current potential state is still self-sustaining but may be losing its resistance to change due to the impact of disturbances with less resilience following those disturbances. Definitions: Current Potential State: Plant communities influenced by shrub canopy density, long term weather fluctuations, and periodic fire. Invasive species are present in various amounts. Indicators: A community dominated by blackbrush, few perennial grasses and forbs present. The density of the shrub canopy 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, and/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: A reduction of perennial grass and forb species combined with an increase of invasive plant species.

## Community 2.1 Blackbrush/Invasive Weed/Community Phase.



**Figure 11. Community Phase 2.1**

This community phase is characterized by a shrub layer dominated by blackbrush. Mormon tea and four-wing saltbush are other common shrubs. Less palatable shrubs such as snakeweed and green rabbitbrush may be increasing. Palatable perennial grasses including Indian ricegrass, James galleta and needle-and-thread are much reduced or missing. Invasive annuals including Russian thistle, cheatgrass, and various mustard species are now present in the community and may be increasing. Utah juniper may be beginning to invading the site if a seed source is available. Air dry composition of this site is approximately 10 percent forbs, 10 percent grasses and 80 percent shrubs and trees. Bare ground is variable (2-50%) depending on biological crust cover, which is also variable (1-25%) and surface rock fragments (0-50%). Biological crusts can vary from sites dominated by light cyanobacteria in the plant interspaces, with occasional moss and lichen pinnacles under shrub canopies, to those dominated by lichen and moss pinnacles as well as cyanobacteria in the site interspaces. The following tables provide an example of the typical vegetative floristics of a community phase 2.1 plant community.

**Table 11. Annual production by plant type**

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	163	280	448
Grass/Grasslike	135	224	308
Forb	39	56	84
<b>Total</b>	<b>337</b>	<b>560</b>	<b>840</b>

**Table 12. Ground cover**

Tree foliar cover	0%
Shrub/vine/liana foliar cover	39-41%
Grass/grasslike foliar cover	19-21%
Forb foliar cover	4-6%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

**Table 13. Canopy structure (% cover)**

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	—	—	—	—
>0.15 <= 0.3	—	—	19-21%	4-6%
>0.3 <= 0.6	—	39-41%	—	—
>0.6 <= 1.4	—	—	—	—
>1.4 <= 4	—	—	—	—
>4 <= 12	—	—	—	—
>12 <= 24	—	—	—	—
>24 <= 37	—	—	—	—
>37	—	—	—	—

## Community 2.2

### Blackbrush/Utah Juniper/Invasive Weed/Community Phase.

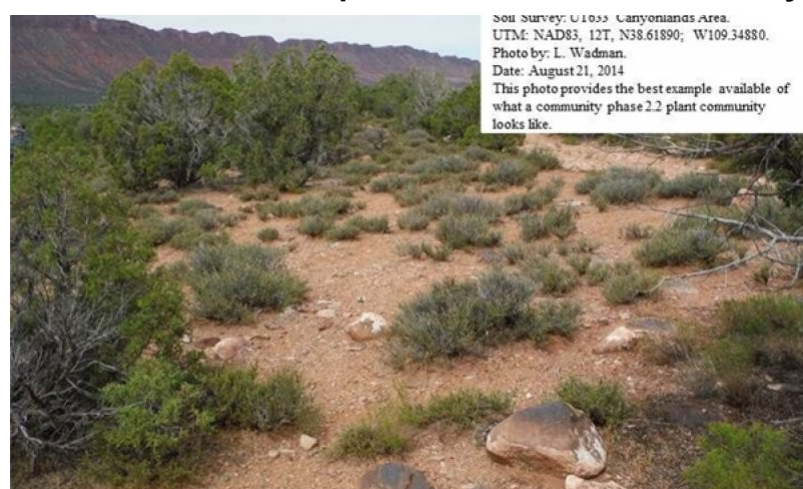


Figure 13. Community Phase 2.2

This community phase is characterized by a shrub layer dominated by blackbrush. Mormon tea and four-wing saltbush are other common shrubs. Less palatable shrubs such as snakeweed and green rabbitbrush may be increasing. Palatable perennial grasses including Indian ricegrass, James galleta and needle-and-thread are much reduced or missing. Invasive annuals including Russian thistle, cheatgrass, and various mustard species are now present in the community and may be increasing. Utah juniper has invaded the site and may dominate the woody layer. Air dry composition of this site is approximately 5 percent forbs, 5 percent grasses and 90 percent shrubs and trees. Bare ground is variable (2-50%) depending on biological crust cover, which is also variable (1-25%) and surface rock fragments (0-50%). Biological crusts can vary from sites dominated by light cyanobacteria in the plant interspaces, with occasional moss and lichen pinnacles under shrub canopies, to those dominated by lichen and moss pinnacles as well as cyanobacteria in the site interspaces. The following tables provide an example of the typical vegetative floristics of a community phase 2.2 plant community.

Table 14. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	163	280	448
Grass/Grasslike	135	224	308
Forb	39	56	84
<b>Total</b>	<b>337</b>	<b>560</b>	<b>840</b>

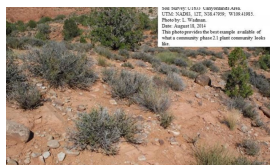
Table 15. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	39-41%
Grass/grasslike foliar cover	19-21%
Forb foliar cover	4-6%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

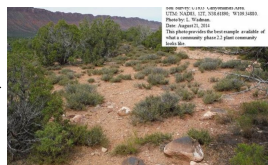
**Table 16. Canopy structure (% cover)**

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	—	—	—	—
>0.15 <= 0.3	—	—	19-21%	4-6%
>0.3 <= 0.6	—	39-41%	—	—
>0.6 <= 1.4	—	—	—	—
>1.4 <= 4	—	—	—	—
>4 <= 12	—	—	—	—
>12 <= 24	—	—	—	—
>24 <= 37	—	—	—	—
>37	—	—	—	—

## Pathway 2.1A Community 2.1 to 2.2



**Blackbrush/Invasive  
Weed/Community Phase.**



**Blackbrush/Utah  
Juniper/Invasive  
Weed/Community Phase.**

This pathway describes the long term effects of no fire in combination of prolonged dry weather periods, improper livestock management and heavy wildlife browsing which can allow for decreased vigor in perennial grass species and allow Utah juniper to invade.

## Pathway 2.2A Community 2.2 to 2.1





**Blackbrush/Utah  
Juniper/Invasive  
Weed/Community Phase.**

**Blackbrush/Invasive  
Weed/Community Phase.**

This pathway describes the effects of periods with no fire in combination with wet weather periods. Improper livestock management and heavy wildlife browsing which can allow for some increased vigor in perennial grass species and slow the invasion of Utah juniper.

### State 3 Disturbed State

The Disturbed State of this ecological site has undergone significant changes. These changes have included recent reoccurring fire and long term overuse by cattle and/or wildlife including wild horses. These disturbances have resulted in new community phases that may have permanently altered the sites original perennial vegetation. Some burned sites appear to be locked into a very short burn-cycle of approximately 5 to 15 years keeping them in a continuous herbaceous state. Prickly pear cactus and various invasive weed species dominate the sites understory. Terminology: Current Potential State: Plant communities influenced by events including overgrazing, burning, chaining and climatic fluctuations. Indicators: Non-native species are now present in all plant communities. Feedbacks: Extended drought and other disturbance that changes the ecological dynamics of the site. At-risk Community Phase: All communities are at risk. Trigger: Disturbance that facilitates permanent vegetative changes.

### Community 3.1 Burned Community Phase.



**Figure 15. Community Phase 3.1**

This community phase is characterized by an altered fire cycle. Re-burn periods may be as short as 5 to 10 years. Species damaged by fire are mostly missing. Fire tolerant perennial grasses including purple threeawn and needle-and-thread may be present in small amounts. Invasive annuals including cheatgrass, Russian thistle and various mustards species may dominate the site. Prickly pear cactus has increased significantly. Air dry composition of this site is approximately 70 percent grasses, 10 percent forbs, and 20 percent shrubs and trees. Bare ground is variable (2-50%) depending on biological crust cover, which is also variable (1-25%) and surface rock fragments (0-50%). Biological crusts can vary from sites dominated by light cyanobacteria in the plant interspaces, with occasional moss and lichen pinnacles under shrub canopies, to those dominated by lichen and moss pinnacles as well as cyanobacteria in the site interspaces. The following tables provide an example of the typical vegetative floristics of a community phase 3.1 plant community.

**Table 17. Annual production by plant type**

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	163	280	448
Grass/Grasslike	135	224	308
Forb	39	56	84
<b>Total</b>	<b>337</b>	<b>560</b>	<b>840</b>

**Table 18. Ground cover**

Tree foliar cover	0%
Shrub/vine/liana foliar cover	39-41%
Grass/grasslike foliar cover	19-21%
Forb foliar cover	4-6%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

**Table 19. Canopy structure (% cover)**

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	—	—	—	—
>0.15 <= 0.3	—	—	19-21%	4-6%
>0.3 <= 0.6	—	39-41%	—	—
>0.6 <= 1.4	—	—	—	—
>1.4 <= 4	—	—	—	—
>4 <= 12	—	—	—	—
>12 <= 24	—	—	—	—
>24 <= 37	—	—	—	—
>37	—	—	—	—

## Community 3.2

### Blackbrush/Prickly Pear Cactus Community Phase.



**Figure 17. Community Phase 3.2**

This community phase is characterized by a shrub layer dominated by blackbrush and prickly pear cactus. Mormon tea and four-wing saltbush are other common shrubs. Less palatable shrubs such as snakeweed and green rabbitbrush may be increasing. Palatable perennial grasses including Indian ricegrass, James galleta and needle-and-thread are much reduced or missing. Invasive annuals including Russian thistle, cheatgrass, and various mustard species are now present in the community and may be increasing. Utah juniper has invaded the site and may dominate the woody layer. Air dry composition of this site is approximately 5 percent forbs, 5 percent grasses and 90 percent shrubs and trees. Bare ground is variable (2-50%) depending on biological crust cover, which is also variable (1-25%) and surface rock fragments (0-50%). Biological crusts can vary from sites dominated by light cyanobacteria in the plant interspaces, with occasional moss and lichen pinnacles under shrub canopies, to those dominated by lichen and moss pinnacles as well as cyanobacteria in the site interspaces. The following tables provide an example of the typical vegetative floristics of a community phase 2.2 plant community.

**Table 20. Annual production by plant type**

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	163	280	448
Grass/Grasslike	135	224	308
Forb	39	56	84
<b>Total</b>	<b>337</b>	<b>560</b>	<b>840</b>

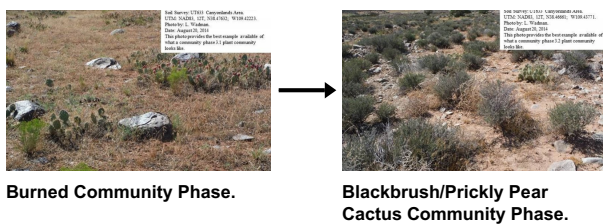
**Table 21. Ground cover**

Tree foliar cover	0%
Shrub/vine/liana foliar cover	39-41%
Grass/grasslike foliar cover	19-21%
Forb foliar cover	4-6%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

**Table 22. Canopy structure (% cover)**

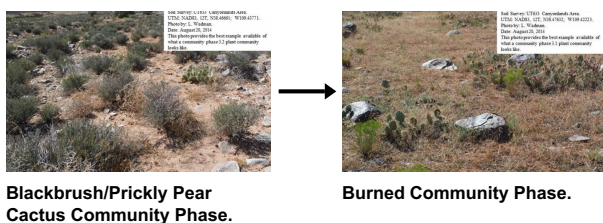
Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	—	—	—	—
>0.15 <= 0.3	—	—	19-21%	4-6%
>0.3 <= 0.6	—	39-41%	—	—
>0.6 <= 1.4	—	—	—	—
>1.4 <= 4	—	—	—	—
>4 <= 12	—	—	—	—
>12 <= 24	—	—	—	—
>24 <= 37	—	—	—	—
>37	—	—	—	—

### Pathway 3.1A Community 3.1 to 3.2



This pathway describes the effects of periods with on fire on highly disturbed sites during wet weather cycles.

### Pathway 3.2A Community 3.2 to 3.1



This pathway describes the effects of long term drought when combined with fire on highly disturbed sites.

### Transition T1A State 1 to 2

This transitional pathway describes the affects of long term drought that may not allow for sufficient precipitation to support herbaceous species and/or long periods without fire. Heavy wildlife browsing can allow for non-palatable shrubs to increase. Heavy livestock grazing will reduce palatable herbaceous species. Invasive species may invade the site.

### Transition T2A State 2 to 3

This transitional pathway describes the affects of reoccurring fire combined with periods of drought and poor livestock management to lock the site into an annual weed prickly pear community.

### Transition T2B State 2 to 3

This transitional pathway describes the affects of no fire combined with periods of drought and poor livestock



management to lock the site into a Blackbrush, prickly pear, invasive weed community.

## Additional community tables

Table 23. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Dominant Grasses</b>			135–202	
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	67–135	–
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	67–112	–
2	<b>Sub-Dominant Grasses</b>			84–146	
	Grass, annual	2GA	<i>Grass, annual</i>	22–34	–
	Grass, perennial	2GP	<i>Grass, perennial</i>	22–34	–
	desert needlegrass	ACSP12	<i>Achnatherum speciosum</i>	22–34	–
	purple threeawn	ARPU9	<i>Aristida purpurea</i>	22–34	–
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	22–34	–
	squirreltail	ELEL5	<i>Elymus elymoides</i>	22–34	–
	needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	22–34	–
	saline wildrye	LESA4	<i>Leymus salinus</i>	22–34	–
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	22–34	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	22–34	–
	spike dropseed	SPCO4	<i>Sporobolus contractus</i>	22–34	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	22–34	–
<b>Forb</b>					
3	<b>Sub-Dominant Forbs</b>			112–179	
	Forb, annual	2FA	<i>Forb, annual</i>	22–34	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	22–34	–
	woolly locoweed	ASMO7	<i>Astragalus mollissimus</i>	11–22	–
	Fendler's sandmat	CHFE3	<i>Chamaesyce fendleri</i>	11–22	–
	Brenda's yellow cryptantha	CRFL5	<i>Cryptantha flava</i>	11–22	–
	red dome blanketflower	GAPI	<i>Gaillardia pinnatifida</i>	11–22	–
	flatspine stickseed	LAOC3	<i>Lappula occidentalis</i>	11–22	–
	mountain pepperweed	LEMO2	<i>Lepidium montanum</i>	11–22	–
	Utah desertparsley	LOPA	<i>Lomatium parryi</i>	11–22	–
	rayless tansyaster	MAGR2	<i>Machaeranthera grindelioides</i>	11–22	–
	tufted evening primrose	OECA10	<i>Oenothera caespitosa</i>	11–22	–
	Utah penstemon	PEUT	<i>Penstemon utahensis</i>	11–22	–
	cleftleaf wildheliotrope	PHCR	<i>Phacelia crenulata</i>	11–22	–
	woolly plantain	PLPA2	<i>Plantago patagonica</i>	11–22	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	11–22	–
	desert princesplume	STPI	<i>Stanleya pinnata</i>	11–22	–
	Pacific aster	SYCHC	<i>Symphotrichum chilense var. chilense</i>	11–22	–
	Mojave woodchickweed	XYTC2	<i>Yulophia confertifolia</i>	11–22	–

	mojave woodyaster	XYT02	<i>Xylorhiza torturolia</i>	11-22	—
<b>Shrub/Vine</b>					
4	<b>Dominant Shrubs</b>			168–280	
	blackbrush	CORA	<i>Coleogyne ramosissima</i>	135–224	—
	mormon tea	EPVI	<i>Ephedra viridis</i>	34–67	—
5	<b>Sub-Dominant Shrubs</b>			90–157	
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	34–67	—
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata ssp. wyomingensis</i>	22–45	—
	California saltbush	ATCA	<i>Atriplex californica</i>	22–45	—
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	22–45	—
	shadscale saltbush	ATCO	<i>Atriplex confertifolia</i>	22–45	—
	yellow rabbitbrush	CHVI8	<i>Chrysothamnus viscidiflorus</i>	22–45	—
	Nevada jointfir	EPNE	<i>Ephedra nevadensis</i>	22–45	—
	rubber rabbitbrush	ERNAN5	<i>Ericameria nauseosa ssp. nauseosa var. nauseosa</i>	22–45	—
	sulphur-flower buckwheat	ERUM	<i>Eriogonum umbellatum</i>	22–45	—
	spiny hopsage	GRSP	<i>Grayia spinosa</i>	22–45	—
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	22–45	—
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	22–45	—
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	22–45	—
	Thompson's dalea	PSTH	<i>Psoralea thompsoniae</i>	22–45	—
	Mexican cliffrose	PUME	<i>Purshia mexicana</i>	22–45	—
	Spanish bayonet	YUHA	<i>Yucca harrimaniae</i>	22–45	—

Table 24. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Dominant Grasses</b>			135–202	
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	101–179	—
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	34–67	—
2	<b>Sub-Dominant Grasses</b>			84–146	
	Grass, annual	2GA	<i>Grass, annual</i>	22–34	—
	Grass, perennial	2GP	<i>Grass, perennial</i>	22–34	—
	desert needlegrass	ACSP12	<i>Achnatherum speciosum</i>	22–34	—
	purple threeawn	ARPU9	<i>Aristida purpurea</i>	22–34	—
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	22–34	—
	squirreltail	ELEL5	<i>Elymus elymoides</i>	22–34	—
	needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	22–34	—
	saline wildrye	LESA4	<i>Leymus salinus</i>	22–34	—
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	22–34	—
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	22–34	—
	spike dropseed	SPCO4	<i>Sporobolus contractus</i>	22–34	—
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	22–34	—

Forb					
3	Sub-Dominant Forbs			112–179	
	Forb, annual	2FA	<i>Forb, annual</i>	22–34	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	22–34	–
	woolly locoweed	ASMO7	<i>Astragalus mollissimus</i>	11–22	–
	Fendler's sandmat	CHFE3	<i>Chamaesyce fendleri</i>	11–22	–
	Brenda's yellow cryptantha	CRFL5	<i>Cryptantha flava</i>	11–22	–
	red dome blanketflower	GAPI	<i>Gaillardia pinnatifida</i>	11–22	–
	flatspine stickseed	LAOC3	<i>Lappula occidentalis</i>	11–22	–
	mountain pepperweed	LEMO2	<i>Lepidium montanum</i>	11–22	–
	Utah desertparsley	LOPA	<i>Lomatium parryi</i>	11–22	–
	rayless tansyaster	MAGR2	<i>Machaeranthera grindelioides</i>	11–22	–
	tufted evening primrose	OECA10	<i>Oenothera caespitosa</i>	11–22	–
	Utah penstemon	PEUT	<i>Penstemon utahensis</i>	11–22	–
	cleftleaf wildheliotrope	PHCR	<i>Phacelia crenulata</i>	11–22	–
	woolly plantain	PLPA2	<i>Plantago patagonica</i>	11–22	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	11–22	–
	desert princesplume	STPI	<i>Stanleya pinnata</i>	11–22	–
	Pacific aster	SYCHC	<i>Symphyotrichum chilense</i> var. <i>chilense</i>	11–22	–
	Mojave woodyaster	XYTO2	<i>Xylorhiza tortifolia</i>	11–22	–
Shrub/Vine					
4	Dominant Shrubs			280–392	
	blackbrush	CORA	<i>Coleogyne ramosissima</i>	179–291	–
	mormon tea	EPVI	<i>Ephedra viridis</i>	34–67	–
5	Sub-Dominant Shrubs			90–157	
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	34–67	–
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i>	22–45	–
	California saltbush	ATCA	<i>Atriplex californica</i>	22–45	–
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	22–45	–
	shadscale saltbush	ATCO	<i>Atriplex confertifolia</i>	22–45	–
	yellow rabbitbrush	CHVI8	<i>Chrysothamnus viscidiflorus</i>	22–45	–
	Nevada jointfir	EPNE	<i>Ephedra nevadensis</i>	22–45	–
	rubber rabbitbrush	ERNAN5	<i>Ericameria nauseosa</i> ssp. <i>nauseosa</i> var. <i>nauseosa</i>	22–45	–
	sulphur-flower buckwheat	ERUM	<i>Eriogonum umbellatum</i>	22–45	–
	spiny hopsage	GRSP	<i>Grayia spinosa</i>	22–45	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	22–45	–
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	22–45	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	22–45	–
	Thompson's dalea	PSTH	<i>Psoralea thompsoniae</i>	22–45	–
	Mexican cliffrose	PUME	<i>Purshia mexicana</i>	22–45	–

	Spanish bayonet	YUHA	<i>Yucca harrimaniae</i>	22–45	–
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Table 25. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Dominant Grasses</b>			135–202	
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	101–179	–
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	34–67	–
	cheatgrass	BRTE	<i>Bromus tectorum</i>	34–67	–
2	<b>Sub-Dominant Grasses</b>			84–146	
	Grass, annual	2GA	<i>Grass, annual</i>	22–34	–
	Grass, perennial	2GP	<i>Grass, perennial</i>	22–34	–
	desert needlegrass	ACSP12	<i>Achnatherum speciosum</i>	22–34	–
	purple threeawn	ARPU9	<i>Aristida purpurea</i>	22–34	–
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	22–34	–
	squirreltail	ELEL5	<i>Elymus elymoides</i>	22–34	–
	needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	22–34	–
	saline wildrye	LESA4	<i>Leymus salinus</i>	22–34	–
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	22–34	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	22–34	–
	spike dropseed	SPCO4	<i>Sporobolus contractus</i>	22–34	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	22–34	–
<b>Forb</b>					
3	<b>Forbs</b>			112–179	
	crossflower	CHTE2	<i>Chorisporea tenella</i>	34–101	–
	field pennycress	THAR5	<i>Thlaspi arvense</i>	34–101	–
	western tansymustard	DEPI	<i>Descurainia pinnata</i>	34–101	–
	herb sophia	DESO2	<i>Descurainia sophia</i>	34–101	–
	Russian thistle	SAKA	<i>Salsola kali</i>	34–101	–
	tall tumblemustard	SIAL2	<i>Sisymbrium altissimum</i>	34–101	–
	Forb, annual	2FA	<i>Forb, annual</i>	22–34	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	22–34	–
	woolly locoweed	ASMO7	<i>Astragalus mollissimus</i>	11–22	–
	Fendler's sandmat	CHFE3	<i>Chamaesyce fendleri</i>	11–22	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	11–22	–
	desert princesplume	STPI	<i>Stanleya pinnata</i>	11–22	–
	Pacific aster	SYCHC	<i>Symphyotrichum chilense var. chilense</i>	11–22	–
	red dome blanketflower	GAPI	<i>Gaillardia pinnatifida</i>	11–22	–
	flatspine stickseed	LAOC3	<i>Lappula occidentalis</i>	11–22	–
	mountain pepperweed	LEMO2	<i>Lepidium montanum</i>	11–22	–
	Utah desertparsley	LOPA	<i>Lomatium parryi</i>	11–22	–
	rayless tansyaster	MAGR2	<i>Machaeranthera grindelioides</i>	11–22	–
	tufted evening	DECA10	<i>Oenothera occidentalis</i>	11–22	–

	tufted evening primrose	UECA10	<i>Oenothera caespitosa</i>	11–22	–
	Utah penstemon	PEUT	<i>Penstemon utahensis</i>	11–22	–
	cleftleaf wildheliotrope	PHCR	<i>Phacelia crenulata</i>	11–22	–
	woolly plantain	PLPA2	<i>Plantago patagonica</i>	11–22	–
	Mojave woodyaster	XYTO2	<i>Xylorhiza tortifolia</i>	11–22	–
	Brenda's yellow cryptantha	CRFL5	<i>Cryptantha flava</i>	11–22	–
<b>Shrub/Vine</b>					
4	<b>Dominant Shrubs</b>			280–392	
	blackbrush	CORA	<i>Coleogyne ramosissima</i>	179–291	–
	mormon tea	EPVI	<i>Ephedra viridis</i>	34–67	–
5	<b>Sub-Dominant Shrubs</b>			90–157	
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	34–67	–
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata ssp. wyomingensis</i>	22–45	–
	California saltbush	ATCA	<i>Atriplex californica</i>	22–45	–
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	22–45	–
	shadscale saltbush	ATCO	<i>Atriplex confertifolia</i>	22–45	–
	yellow rabbitbrush	CHVI8	<i>Chrysothamnus viscidiflorus</i>	22–45	–
	Nevada jointfir	EPNE	<i>Ephedra nevadensis</i>	22–45	–
	rubber rabbitbrush	ERNAN5	<i>Ericameria nauseosa ssp. nauseosa var. nauseosa</i>	22–45	–
	sulphur-flower buckwheat	ERUM	<i>Eriogonum umbellatum</i>	22–45	–
	spiny hopsage	GRSP	<i>Grayia spinosa</i>	22–45	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	22–45	–
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	22–45	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	22–45	–
	Thompson's dalea	PSTH	<i>Psoralea thompsoniae</i>	22–45	–
	Mexican cliffrose	PUME	<i>Purshia mexicana</i>	22–45	–
	Spanish bayonet	YUHA	<i>Yucca harrimaniae</i>	22–45	–
<b>Tree</b>					
6	<b>Trees</b>			22–45	
	Utah juniper	JUOS	<i>Juniperus osteosperma</i>	22–45	–

Table 26. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Dominant Grasses</b>			135–202	
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	101–179	–
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	34–67	–
	cheatgrass	BRTE	<i>Bromus tectorum</i>	34–67	–
2	<b>Sub-Dominant Grasses</b>			84–146	
	Grass, annual	2GA	<i>Grass, annual</i>	22–34	–
	Grass, perennial	2GP	<i>Grass, perennial</i>	22–34	–

	desert needlegrass	ACSP12	<i>Achnatherum speciosum</i>	22–34	–
	purple threeawn	ARPU9	<i>Aristida purpurea</i>	22–34	–
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	22–34	–
	squirreltail	ELEL5	<i>Elymus elymoides</i>	22–34	–
	needle and thread	HECOC8	<i>Hesperostipa comata</i> ssp. <i>comata</i>	22–34	–
	saline wildrye	LESA4	<i>Leymus salinus</i>	22–34	–
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	22–34	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	22–34	–
	spike dropseed	SPCO4	<i>Sporobolus contractus</i>	22–34	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	22–34	–

## Forb

3	<b>Forbs</b>			112–179	
	crossflower	CHTE2	<i>Chorispora tenella</i>	34–101	–
	field pennycress	THAR5	<i>Thlaspi arvense</i>	34–101	–
	western tansymustard	DEPI	<i>Descurainia pinnata</i>	34–101	–
	herb sophia	DESO2	<i>Descurainia sophia</i>	34–101	–
	Russian thistle	SAKA	<i>Salsola kali</i>	34–101	–
	tall tumbledustard	SIAL2	<i>Sisymbrium altissimum</i>	34–101	–
	Forb, annual	2FA	<i>Forb, annual</i>	22–34	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	22–34	–
	woolly locoweed	ASMO7	<i>Astragalus mollissimus</i>	11–22	–
	Fendler's sandmat	CHFE3	<i>Chamaesyce fendleri</i>	11–22	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	11–22	–
	desert princesplume	STPI	<i>Stanleya pinnata</i>	11–22	–
	Pacific aster	SYCHC	<i>Symphotrichum chilense</i> var. <i>chilense</i>	11–22	–
	red dome blanketflower	GAPI	<i>Gaillardia pinnatifida</i>	11–22	–
	flatspine stickseed	LAOC3	<i>Lappula occidentalis</i>	11–22	–
	mountain pepperweed	LEMO2	<i>Lepidium montanum</i>	11–22	–
	Utah desertparsley	LOPA	<i>Lomatium parryi</i>	11–22	–
	rayless tansyaster	MAGR2	<i>Machaeranthera grindelioides</i>	11–22	–
	tufted evening primrose	OECA10	<i>Oenothera caespitosa</i>	11–22	–
	Utah penstemon	PEUT	<i>Penstemon utahensis</i>	11–22	–
	cleftleaf wildheliotrope	PHCR	<i>Phacelia crenulata</i>	11–22	–
	woolly plantain	PLPA2	<i>Plantago patagonica</i>	11–22	–
	Mojave woodyaster	XYTO2	<i>Xylorhiza tortifolia</i>	11–22	–
	Brenda's yellow cryptantha	CRFL5	<i>Cryptantha flava</i>	11–22	–

## Shrub/Vine

4	<b>Dominant Shrubs</b>			280–392	
	blackbrush	CORA	<i>Coleogyne ramosissima</i>	179–291	–
	mormon tea	EPVI	<i>Ephedra viridis</i>	34–67	–
5	<b>Sub-Dominant Shrubs</b>			90–157	

	SHRUB (>.5m)	2SHRUB	SHRUB (>.5m)	34-67	-
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata ssp. wyomingensis</i>	22-45	-
	California saltbush	ATCA	<i>Atriplex californica</i>	22-45	-
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	22-45	-
	shadscale saltbush	ATCO	<i>Atriplex confertifolia</i>	22-45	-
	yellow rabbitbrush	CHVI8	<i>Chrysothamnus viscidiflorus</i>	22-45	-
	Nevada jointfir	EPNE	<i>Ephedra nevadensis</i>	22-45	-
	rubber rabbitbrush	ERNAN5	<i>Ericameria nauseosa ssp. nauseosa var. nauseosa</i>	22-45	-
	sulphur-flower buckwheat	ERUM	<i>Eriogonum umbellatum</i>	22-45	-
	spiny hopsage	GRSP	<i>Grayia spinosa</i>	22-45	-
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	22-45	-
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	22-45	-
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	22-45	-
	Thompson's dalea	PSTH	<i>Psoralea thompsoniae</i>	22-45	-
	Mexican cliffrose	PUME	<i>Purshia mexicana</i>	22-45	-
	Spanish bayonet	YUHA	<i>Yucca harrimaniae</i>	22-45	-
<b>Tree</b>					
6	<b>Trees</b>			90-179	
	Utah juniper	JUOS	<i>Juniperus osteosperma</i>	90-179	-

Table 27. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Dominant Grasses</b>			135-202	
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	101-179	-
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	34-67	-
	cheatgrass	BRTE	<i>Bromus tectorum</i>	34-67	-
2	<b>Sub-Dominant Grasses</b>			84-146	
	Grass, annual	2GA	<i>Grass, annual</i>	22-34	-
	Grass, perennial	2GP	<i>Grass, perennial</i>	22-34	-
	desert needlegrass	ACSP12	<i>Achnatherum speciosum</i>	22-34	-
	purple threeawn	ARPU9	<i>Aristida purpurea</i>	22-34	-
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	22-34	-
	squirreltail	ELEL5	<i>Elymus elymoides</i>	22-34	-
	needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	22-34	-
	saline wildrye	LESA4	<i>Leymus salinus</i>	22-34	-
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	22-34	-
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	22-34	-
	spike dropseed	SPCO4	<i>Sporobolus contractus</i>	22-34	-
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	22-34	-
<b>Forb</b>					
3	<b>Forbs</b>			112-179	

	western tansymustard	DEPI	<i>Descurainia pinnata</i>	34–101	–
	herb sophia	DESO2	<i>Descurainia sophia</i>	34–101	–
	crossflower	CHTE2	<i>Chorisporea tenella</i>	34–101	–
	field pennycress	THAR5	<i>Thlaspi arvense</i>	34–101	–
	Russian thistle	SAKA	<i>Salsola kali</i>	34–101	–
	tall tumbledmustard	SIAL2	<i>Sisymbrium altissimum</i>	34–101	–
	Forb, annual	2FA	<i>Forb, annual</i>	22–34	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	22–34	–
	woolly locoweed	ASMO7	<i>Astragalus mollissimus</i>	11–22	–
	Fendler's sandmat	CHFE3	<i>Chamaesyce fendleri</i>	11–22	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	11–22	–
	desert princesplume	STPI	<i>Stanleya pinnata</i>	11–22	–
	Pacific aster	SYCHC	<i>Symphotrichum chilense</i> var. <i>chilense</i>	11–22	–
	Mojave woodyaster	XYTO2	<i>Xylorhiza tortifolia</i>	11–22	–
	Brenda's yellow cryptantha	CRFL5	<i>Cryptantha flava</i>	11–22	–
	red dome blanketflower	GAPI	<i>Gaillardia pinnatifida</i>	11–22	–
	flatspine stickseed	LAOC3	<i>Lappula occidentalis</i>	11–22	–
	mountain pepperweed	LEMO2	<i>Lepidium montanum</i>	11–22	–
	Utah desertparsley	LOPA	<i>Lomatium parryi</i>	11–22	–
	rayless tansyaster	MAGR2	<i>Machaeranthera grindelioides</i>	11–22	–
	tufted evening primrose	OECA10	<i>Oenothera caespitosa</i>	11–22	–
	Utah penstemon	PEUT	<i>Penstemon utahensis</i>	11–22	–
	cleftleaf wildheliotrope	PHCR	<i>Phacelia crenulata</i>	11–22	–
	woolly plantain	PLPA2	<i>Plantago patagonica</i>	11–22	–

#### Shrub/Vine

4	<b>Dominant Shrubs</b>			280–392	
	blackbrush	CORA	<i>Coleogyne ramosissima</i>	179–291	–
	mormon tea	EPVI	<i>Ephedra viridis</i>	34–67	–
5	<b>Sub-Dominant Shrubs</b>			90–157	
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	67–135	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	34–67	–
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i>	22–45	–
	California saltbush	ATCA	<i>Atriplex californica</i>	22–45	–
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	22–45	–
	shadscale saltbush	ATCO	<i>Atriplex confertifolia</i>	22–45	–
	Thompson's dalea	PSTH	<i>Psoralea thompsoniae</i>	22–45	–
	Mexican cliffrose	PUME	<i>Purshia mexicana</i>	22–45	–
	Spanish bayonet	YUHA	<i>Yucca harrimaniae</i>	22–45	–
	yellow rabbitbrush	CHVI8	<i>Chrysothamnus viscidiflorus</i>	22–45	–
	Nevada jointfir	EPNE	<i>Ephedra nevadensis</i>	22–45	–
	rubber rabbitbrush	ERNAN5	<i>Ericameria nauseosa</i> ssp. <i>nauseosa</i> var.	22–45	–



			<i>nauseosa</i>		
	sulphur-flower buckwheat	ERUM	<i>Eriogonum umbellatum</i>	22–45	–
	spiny hopsage	GRSP	<i>Grayia spinosa</i>	22–45	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	22–45	–
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	22–45	–
<b>Tree</b>					
6	<b>Trees</b>			22–45	
	Utah juniper	JUOS	<i>Juniperus osteosperma</i>	22–45	–

Table 28. Community 3.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Dominant Grasses</b>			135–202	
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	101–179	–
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	34–67	–
	cheatgrass	BRTE	<i>Bromus tectorum</i>	34–67	–
2	<b>Sub-Dominant Grasses</b>			84–146	
	Grass, annual	2GA	<i>Grass, annual</i>	22–34	–
	Grass, perennial	2GP	<i>Grass, perennial</i>	22–34	–
	desert needlegrass	ACSP12	<i>Achnatherum speciosum</i>	22–34	–
	purple threeawn	ARPU9	<i>Aristida purpurea</i>	22–34	–
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	22–34	–
	squirreltail	ELEL5	<i>Elymus elymoides</i>	22–34	–
	needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	22–34	–
	saline wildrye	LESA4	<i>Leymus salinus</i>	22–34	–
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	22–34	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	22–34	–
	spike dropseed	SPCO4	<i>Sporobolus contractus</i>	22–34	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	22–34	–
<b>Forb</b>					
3	<b>Forbs</b>			112–179	
	western tansymustard	DEPI	<i>Descurainia pinnata</i>	34–101	–
	herb sophia	DESO2	<i>Descurainia sophia</i>	34–101	–
	Russian thistle	SAKA	<i>Salsola kali</i>	34–101	–
	tall tumbled mustard	SIAL2	<i>Sisymbrium altissimum</i>	34–101	–
	crossflower	CHTE2	<i>Chorispora tenella</i>	34–101	–
	field pennycress	THAR5	<i>Thlaspi arvense</i>	34–101	–
	Forb, annual	2FA	<i>Forb, annual</i>	22–34	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	22–34	–
	woolly locoweed	ASMO7	<i>Astragalus mollissimus</i>	11–22	–
	Fendler's sandmat	CHFE3	<i>Chamaesyce fendleri</i>	11–22	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	11–22	–
	desert princesplume	STPI	<i>Stanleya pinnata</i>	11–22	–

	Pacific aster	SYCHC	<i>Symphyotrichum chilense</i> var. <i>chilense</i>	11–22	–
	red dome blanketflower	GAPI	<i>Gaillardia pinnatifida</i>	11–22	–
	flatspine stickseed	LAOC3	<i>Lappula occidentalis</i>	11–22	–
	mountain pepperweed	LEMO2	<i>Lepidium montanum</i>	11–22	–
	Utah desertparsley	LOPA	<i>Lomatium parryi</i>	11–22	–
	rayless tansyaster	MAGR2	<i>Machaeranthera grindelioides</i>	11–22	–
	tufted evening primrose	OECA10	<i>Oenothera caespitosa</i>	11–22	–
	Utah penstemon	PEUT	<i>Penstemon utahensis</i>	11–22	–
	cleftleaf wildheliotrope	PHCR	<i>Phacelia crenulata</i>	11–22	–
	woolly plantain	PLPA2	<i>Plantago patagonica</i>	11–22	–
	Mojave woodyaster	XYTO2	<i>Xylorhiza tortifolia</i>	11–22	–
	Brenda's yellow cryptantha	CRFL5	<i>Cryptantha flava</i>	11–22	–

#### Shrub/Vine

4	<b>Dominant Shrubs</b>			280–392	
	blackbrush	CORA	<i>Coleogyne ramosissima</i>	179–291	–
	mormon tea	EPVI	<i>Ephedra viridis</i>	34–67	–
5	<b>Sub-Dominant Shrubs</b>			90–157	
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	157–269	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	34–67	–
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i>	22–45	–
	California saltbush	ATCA	<i>Atriplex californica</i>	22–45	–
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	22–45	–
	shadscale saltbush	ATCO	<i>Atriplex confertifolia</i>	22–45	–
	yellow rabbitbrush	CHVI8	<i>Chrysothamnus viscidiflorus</i>	22–45	–
	Nevada jointfir	EPNE	<i>Ephedra nevadensis</i>	22–45	–
	rubber rabbitbrush	ERNAN5	<i>Ericameria nauseosa</i> ssp. <i>nauseosa</i> var. <i>nauseosa</i>	22–45	–
	sulphur-flower buckwheat	ERUM	<i>Eriogonum umbellatum</i>	22–45	–
	spiny hopsage	GRSP	<i>Grayia spinosa</i>	22–45	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	22–45	–
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	22–45	–
	Thompson's dalea	PSTH	<i>Psoralea thompsoniae</i>	22–45	–
	Mexican cliffrose	PUME	<i>Purshia mexicana</i>	22–45	–
	Spanish bayonet	YUHA	<i>Yucca harrimaniae</i>	22–45	–

#### Tree

6	<b>Trees</b>			90–179	
	Utah juniper	JUOS	<i>Juniperus osteosperma</i>	90–179	–

## Animal community

--Livestock and Wildlife Grazing--

This site provides poor/fair grazing conditions for livestock due to the high tannins, and low available nutrition in blackbrush. However has relatively high importance for winter livestock grazing due to the preferable climate. For goats, the grazing value is increased (poor to good). For any class of livestock used, the carrying capacity is always low. This site often lacks natural perennial water sources, which can influence the suitability for livestock and wildlife grazing. Care should be taken to maintain the native perennial grasses and shrubs due to the poor suitability for re-seeding or restoring this site. Reseeding and/or restoration are difficult due to the extreme temperatures and variability in time and amount of precipitation. This site may occur in desert bighorn sheep, mule deer, elk and pronghorn antelope ranges, and can be important winter areas for bighorn sheep. However, in many places the populations will be small and have little grazing impact on the site.

The plant community is primarily shrubs, with the majority of canopy cover being attributed to blackbrush; sub dominants include green Mormon tea and winterfat. These shrubs provide good year round browse for cattle, sheep, goats, bighorn sheep, mule deer, elk, and pronghorn antelope. When present, grasses, primarily Indian ricegrass and James galleta, provide fair year round grazing conditions for horses, cattle, sheep, elk, and bighorn sheep. Forb composition and annual production depends primarily on precipitation amounts and thus is challenging to use in livestock grazing management decisions. However, forb composition should be monitored for species diversity, as well as poisonous or injurious plant communities which may be detrimental to livestock if grazed. Before making specific grazing management recommendations, an onsite evaluation must be made.

## **Hydrological functions**

The soils associated with this ecological site are generally in Hydrologic Soil Groups B and C due to steep slopes (NRCS National Engineering Handbook). Once these soils become saturated, 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. 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**

This site has fair to good values for aesthetics and natural beauty. Hunting is fair for deer, upland game, and rabbits. Potential is poor to fair for camping and picnicking on the basis of vegetation.

## **Wood products**

There Utah juniper has invaded this site, wood products could include fence posts and firewood.

## **Other information**

--Poisonous/Toxic Plant Communities--

Toxic plants associated with this site include woolly locoweed and broom snakeweed. Woolly locoweed is toxic to all classes of livestock and wildlife. This plant 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 (indolizidine 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 will generally graze broom snakeweed when other forage is unavailable, typically in winter when toxicity levels are at their lowest.

Potentially toxic plants associated with this site include fourwing saltbush, which may accumulate selenium, but

only when growing on selenium enriched soils. These plants, when consumed will cause alkali disease or chronic selenosis, which affects all classes of livestock (excluding goats). Typically animals consuming 5-50 ppm selenium will develop chronic selenosis and animals consuming greater than 50 ppm selenium will develop acute selenosis. Clinical signs include lameness, souging of the hoof, hair loss, blindness, and aimless wondering.

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, cool/cloudy days, and soils high in nitrogen and low in sulfur and phosphorus, all which cause increased nitrate accumulation. 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, over grazing, drought, off road vehicle overuse, erosion, etc.) annual forbs and grasses will invade the site. Of particular concern in semi-arid environments are annual invaders including cheatgrass, Russian thistle, kochia, halogeton, 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. At this time, in most of the Colorado Plateau area, cheatgrass is not known to invade blackbrush associations as it does in areas of southwest Utah and the Mojave.

#### --Fire Ecology--

The ability for an ecological site to carry fire depends primarily on the 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. Many semi-desert communities in the Colorado Plateau may have evolved without the influence of fire. However a year of exceptionally heavy winter rains can generate fuels by producing heavy stands of annual forbs and grasses. When fires do occur, the effect on the plant community may be extreme due to the harsh environment and slow rate of recovery.

The fire regime for blackbrush is not well understood due to few species in the association that show fire scars and can be aged. Research has noted that a burned blackbrush site in Arizona has recovered, and in Nevada, fire in blackbrush communities has increased forage diversity. In these areas, a fire return interval has been suggested at 35-100 years. However, communities in southeastern Utah do not show evidence of burning within that time frame. This ecological site is comprised of dense to scattered low stature blackbrush plants with bare interspaces to patchy occurrence of grasses, which is unlikely to carry a fire unless under high winds, high temperature, and low humidity. Blackbrush is a non-sprouter and is slow to re-establish on burned sites. Studies indicate that blackbrush sites do not recover well in Utah. So currently burning is not a recommended brush management tool. Because of the apical dominance trait, removal through grazing or mechanical treatment will increase sprouting/new growth. If at sometime there are species that can be used successfully to re-vegetate the community, then mechanical treatment could be used. Of caution, blackbrush is thought to be very flammable due to the dense spacing of the brush and the tinder-like nature, and resinous foliage. So, if annual grasses or forbs dominate the area after disturbance, re-vegetating efforts could be hampered due to several factors including an increase in fire frequency.

#### **Other references**

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## Contributors

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## 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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Contact for lead author	Shane.Green@ut.usda.gov
Date	09/05/2014
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

## Indicators

- 1. Number and extent of rills:** None to very few rills present. Some very minor rill development may occur on steeper slopes or on areas located below exposed bedrock or other water shedding areas where increased runoff may occur. Any rills present should be <1 inch deep, fairly short (<8 feet long) and somewhat widely spaced (6-8 feet). Minor rill development may be observed 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:** Very few sinuous flow patterns wind around perennial plants and surface rock. Evidence of flow patterns is expected to increase somewhat with increased slope. Water flow patterns are long (15-20 feet), narrow (<1 foot wide), and spaced widely (10-20 yards) on gentle slopes (<15%) and more closely (<10 yards) on steeper slopes.

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3. **Number and height of erosional pedestals or terracettes:** Small pedestals may form at the base of plants that occur on the edge of water flow patterns, but should not show any exposed roots. Terracettes are fairly common, forming behind debris dams of small to medium sized litter (up to 2 inches in diameter) in water flow patterns. These debris dams may accumulate smaller litter (leaves, grass and forb stems) and sediment.
- 
4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 20–30%. (Soil surface is typically has 25 to 50% surface fragments). Most bare ground is associated with water flow patterns, rills, and gullies. 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.
- 
5. **Number of gullies and erosion associated with gullies:** None to very few. Some gullies may be present in landscape settings where increased runoff may accumulate (such as areas below exposed bedrock). Such gully development is expected to be limited to sites adjacent to areas where runoff accumulation occurs. Any gullies present should show little sign of accelerated erosion and should be stabilized with perennial vegetation.
- 
6. **Extent of wind scoured, blowouts and/or depositional areas:** No evidence of wind generated soil movement. Wind caused blowouts and depositions are not expected to be present.
- 
7. **Amount of litter movement (describe size and distance expected to travel):** Most litter resides in place with some redistribution caused by water movement. Minor litter removal may occur in flow patterns and rills with deposition occurring at points of obstruction. The majority of litter accumulates at the base of plants. Some grass leaves and small twigs (grass stems) may accumulate in soil depressions adjacent to plants. Woody stems not likely to move.
- 
8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** This site should have a soil stability rating of 5 to 6 under the plant canopies using the soil stability kit test, and a rating of 4 to 5 in the interspaces. The average should be a 5. Surface textures are silty clay loams clays. Vegetation cover, litter, and biological soil crusts reduce erosion.
- 
9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** (Moab) Soil surface horizon is 0-3 inches deep. Structure is weak fine granular. Color is brown (7.5YR-5/4). There is little if any difference under canopy or in interspaces and a recognizable A horizon is expected to be present throughout. 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:** Bare spaces are small and rounded in shape and are usually not connected, perennial grasses, sagebrush, and biological soil crusts (where present) are usually distributed in sufficient density to intercept raindrops, increase surface detention of water, to increase infiltration and reduce erosive energy of runoff. When perennial grasses decrease, reducing ground cover and increasing bare ground, runoff would be expected to increase and associated infiltration would be reduced. A reduction in vegetative structure can reduce snow capture.
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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. Some soils have increase in clay content at 3 to 9 inches and that should not be mistaken for a compaction layer. Naturally occurring hard layer (i.e., calcic horizons) should not be considered as 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: Non-sprouting shrubs (Blackbrush) > Perennial bunchgrasses (Indian ricegrass) > Rhizomatous grasses (James galleta).
- Sub-dominant: Sprouting shrubs (Mormon tea, fourwing saltbush) > Perennial bunchgrasses (bottlebrush squirreltail) > Rhizomatous grasses (blue grama).
- Other: Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species in the reference state (e.g. Crested wheatgrass, Intermediate wheatgrass, Small burnet, etc.)
- Additional: Disturbance regime includes infrequent fire, insects, and drought. Biological soil crust is variable in its expression where present on this site and is measured as a component of ground cover.
- Following a recent disturbance such as fire, drought, or insects that removes the woody vegetation, forbs and perennial grasses (herbaceous species) may dominate the community. These conditions would reflect a functional community phase within the reference state. The perennial grass and non-sprouting shrub functional groups are expected on this site. Perennial and annual forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions.
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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 with age class expression likely subdued under below average conditions, or on sites with high (usually greater than 65%) similarity index (late seral to historic climax). Slight decadence in the principle shrubs could occur near the end of the fire cycle. In general, a mix of age classes may be expected with some dead and decadent plants present.
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14. **Average percent litter cover (%) and depth ( in):** Litter cover (including under plants) nearly all of which should be fine litter. Depth should be 1/4 inch thickness in the interspaces and up to 1/2 inch under shrub canopies. Litter cover may increase to 30% on some years due to increased production of plants.
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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Annual production in air-dry herbage should be approximately 300 - 750#/acre on an average year, but could range from 200 to 1000#/acre during periods of prolonged drought or above average precipitation.
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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:** Invasive species capable of dominating this site include cheatgrass, Russian thistle and mustard species.

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17. **Perennial plant reproductive capability:** All perennial plants should have the ability to reproduce in all years, except in extreme drought years. There are no restrictions on either seed or vegetative reproduction. Some seedling recruitment of major species is present during average and above average growing years.
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