USDA Natural Resources Conservation Service

Ecological site R035XY233UT
Semidesert Shallow Sandy Loam (Blackbrush)

Accessed: 05/21/2025

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.

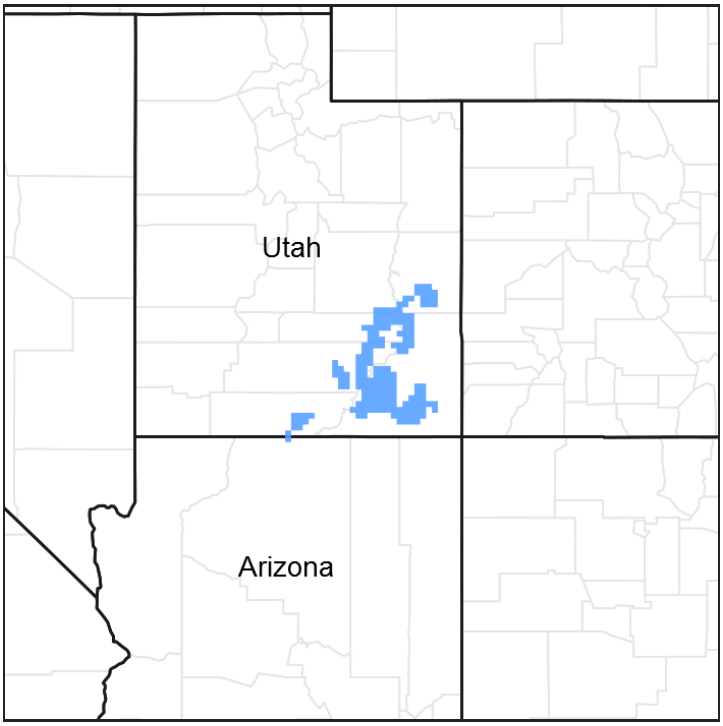


Figure 1. Mapped extent

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 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.

Classification relationships

---The Nature Conservacy---
This site can occur within the Nature Conservancy's vegetation classification system. Colorado Plateau Blackbrush-Mormon-tea Shrubland and can encompass several component associations
CEGL001332 Coleogyne ramosissima Shrubland
CEGL001334 Coleogyne ramosissima / Pleuraphis jamesii Shrubland
CEGL002348 Coleogyne ramosissima - Purshia stansburiana - Quercus havardii var. tuckeri Shrubland
CEGL001648 Ephedra viridis / Achnatherum hymenoides - Bouteloua gracilis Shrub Herbaceous Vegetation
CEGL002351 Ephedra torreyana / Bouteloua gracilis - Pleuraphis jamesii Shrubland
CEGL002352 Ephedra torreyana / Achnatherum hymenoides - Pleuraphis jamesii Shrubland

---Ecoregions of Utah---
20c -Semiarid benchlands and canyonlands
20d -Arid Canyonlands

---Bailey's ecoregions---
341 Intermountain Semidesert and Desert Province

Modal Soil: Rizno FLS — loamy, mixed (calc.), mesic Lithic Ustic Torriorthents
Type Location: Cedar Mesa

Associated sites

R035XY018UT	**Talus Slope (Blackbrush-Shadscale)**
R035XY125UT	**Desert Shallow Clay (Shadscale)**
R035XY130UT	**Desert Shallow Sandy Loam (Shadscale)**
R035XY203UT	**Semidesert Bouldery Fan (Blackbrush)**
R035XY215UT	**Semidesert Sandy Loam (4-Wing Saltbush)**
R035XY217UT	**Semidesert Sandy Loam (Spiny Hopsage)**
R035XY218UT	**Semidesert Sandy Loam (Blackbrush)**
R035XY224UT	**Semidesert Shallow Sand (Blackbrush)** The shallow sand site occurs in areas with more sand deposition. Often it is difficult to separate these sites from aerial photography.

R035XY230UT	**Semidesert Shallow Sandy Loam (Shadscale)**
R035XY236UT	**Semidesert Shallow Sandy Loam (Utah Juniper, Blackbrush)** This site occurs mostly in the drainages that dissect this site or along the edges. The increased presence of Juniper is the main clue that the site changed.
R035XY243UT	**Semidesert Stony Loam (Blackbrush)**

Similar sites

R035XY224UT	**Semidesert Shallow Sand (Blackbrush)** This site is very similar to the shallow sand blackbrush site. The difference is mainly noted by the decrease in blackbrush cover on the shallow sand site.
R035XY133UT	**Desert Shallow Sandy Loam (Blackbrush)** This site looks very similar to the desert version; the difference is lower production on the desert site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Coleogyne ramosissima* (2) *Ephedra torreyana*
Herbaceous	(1) *Pleuraphis jamesii* (2) *Achnatherum hymenoides*

Physiographic features

This site occurs on structural benches, ledges, ridges, hillslopes, mesas, and fan terraces. Runoff is variable and ranges from medium to high. Slopes typically are 2-30 percent but may go to 50%. Elevations are generally 4300 to 6800 feet.

Table 2. Representative physiographic features

Landforms	(1) Structural bench (2) Ledge (3) Mesa
Flooding frequency	None
Ponding frequency	None
Elevation	3,700–6,800 ft
Slope	2–30%
Aspect	Aspect is not a significant factor

Climatic features

Average annual precipitation is 7 to 12 inches. Approximately 75 percent occurs as rain from March through October. On the average, March and July thru October are the wettest months and April, May and June are the driest. The mean annual air temperature is 47-54 degrees Fahrenheit. The average frost-free period is 120 to 190 days. Precipitation is extremely variable from month to month and from year to year. Much of the summer precipitation occurs as convection thunder storms.

Table 3. Representative climatic features

Frost-free period (average)	190 days
Freeze-free period (average)	240 days
Precipitation total (average)	12 in

Influencing water features

There are no influencing water features on this site.

Soil features

This sites soils are typically very shallow to shallow, but rarely may be moderately deep. There is typically some exposed bedrock present which may support Utah juniper. The surface colors range from red to reddish brown, light brown or yellowish red. Surface soil textures range from fine sandy loams to loamy sands. These soils are poorly developed, well drained, and have moderate water holding capacities. Soil temperature regime is mesic and moisture regime is ustic aridic. Runoff varies from low to high depending on slope and permeability, usually the coarser the soil the slower the runoff. Soils on reference state sites typically have low wind and water erosion potential due to surface rock fragments and/or a well developed biological crust. Sites with high levels of surface rock fragments (generally >20%) usually have less biological crust and cyanobacteria present. Sites with lower levels of surface rock fragments (generally <20%) often have a well developed biological crust characterized by isolated pinnacles of lichen with little continuity. Surface rock fragments typically show evidence of calcium deposits (small whiteish nodes). The occurrence of water flow patterns is common but may be masked by rock fragments or biological crusts if present. Disturbed areas are marked by increased water flow patterns and gullies, as well as a decrease in plant cover. This site has been used in the following soils surveys and has been correlated to the following components:

UT624—Grand County—Pastern
UT631—Henry Mountains Area—Pastern, Rizno, Wayneco
UT638—Sand Juan County, Central—Pastern, Piute, Rizno, Skos, Wayneco
UT685—Capital Reef National Park—Rizno;

Table 4. Representative soil features

Parent material	(1) Alluvium–limestone and sandstone (2) Colluvium–conglomerate (3) Eolian deposits–siltstone
Surface texture	(1) Channery loam (2) Channery sandy loam (3) Gravelly fine sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderate to moderately rapid
Soil depth	4–20 in
Surface fragment cover <=3"	0–24%
Surface fragment cover >3"	0–5%
Available water capacity (0-40in)	0.5–2.5 in
Calcium carbonate equivalent (0-40in)	0–20%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0–5
Soil reaction (1:1 water) (0-40in)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–35%
Subsurface fragment volume >3" (Depth not specified)	0–6%

Ecological dynamics

This site developed under Colorado Plateau ecological conditions and the natural influences of herbivory and climate. This site’s plant species composition is generally dominated by blackbrush with Torrey's jointfir commonly occurring. Diverse biological crusts are common on this site, however, site with large amount of surface coarse fragments may lack these crusts. The amount of James galleta and Indian ricegrass present is dependant on weather patterns (summer or winter precipitation)and on soil depth to a restrictive layer. The shallower the soil, the fewer herbaceous species. Blackbrush appears to act as a paleo-endenmic species in this MLRA and may not be able to reestablish itself after significient disturbance.

There is no evidence to indicate that this site historically maintained a short burn frequency. Large gaps between plants (very discontinuous fuels)in relic areas indicate that this site may have historically rarely burned. Until further research indicates that fire played a significient role in the ecosystem processes of this site, this ecological site description will not include fire as a disturbance in the reference state. However, due to modern disturbances such as brush treatments and OHV use, the resilience of the historical vegetation may be at risk. Disturbances that result in an opportunity for invasive annuals to enter the system and possibly produce sufficient fuel loads may allow fire to become a risk. Cheatgrass, red brome, and Russian thistle are most likely to invade this site.

This ecological site has been grazed by domestic livestock since they were first introduced into the area around 1860. It is however highly resistant to grazing due to the unpalatable nature of blackbrush and lack of forage plants. Therefore the introduction of domestic livestock and the use of fencing and reliable water sources have only minimally influenced the historic disturbance regime associated with this ecological site.

Improper livestock grazing including, season long grazing and\or heavy stocking rates, may cause this site to depart from the reference plant community. As ecological condition deteriorates, perennial grasses and Torrey's jointfir may decrease while yellow cryptantha, locoweed, desert trumpet, blackbrush, and snakeweed may increase. Improper grazing may also increase the chance of invasion by cheatgrass, red brome and invasive annual forbs. On the Colorado Plateau, however, these species are capable of establishing themselves in blackbrush communities in the abscence of grazing, but they rarely increase to where they dominate them.

Management practices that maintain or improve the rangeland vegetation include prescribed grazing and the proper location of water developments. Severe drought may adversely affect the production of the herbaceous perennial vegetation.

This ecological sites suitability for rangeland seeding is very poor. It is not practical to revegetate large areas because of the shallow soil depth, low annual precipitation, and very low available water capacity. Additionally, some soils have a high hazard of soil blowing because of their sandy textures. To control erosion in areas where the need is critical, small areas can be mechanically treated and seeded. Adapted native plants and forage kochia are suitable for seeding in these areas.

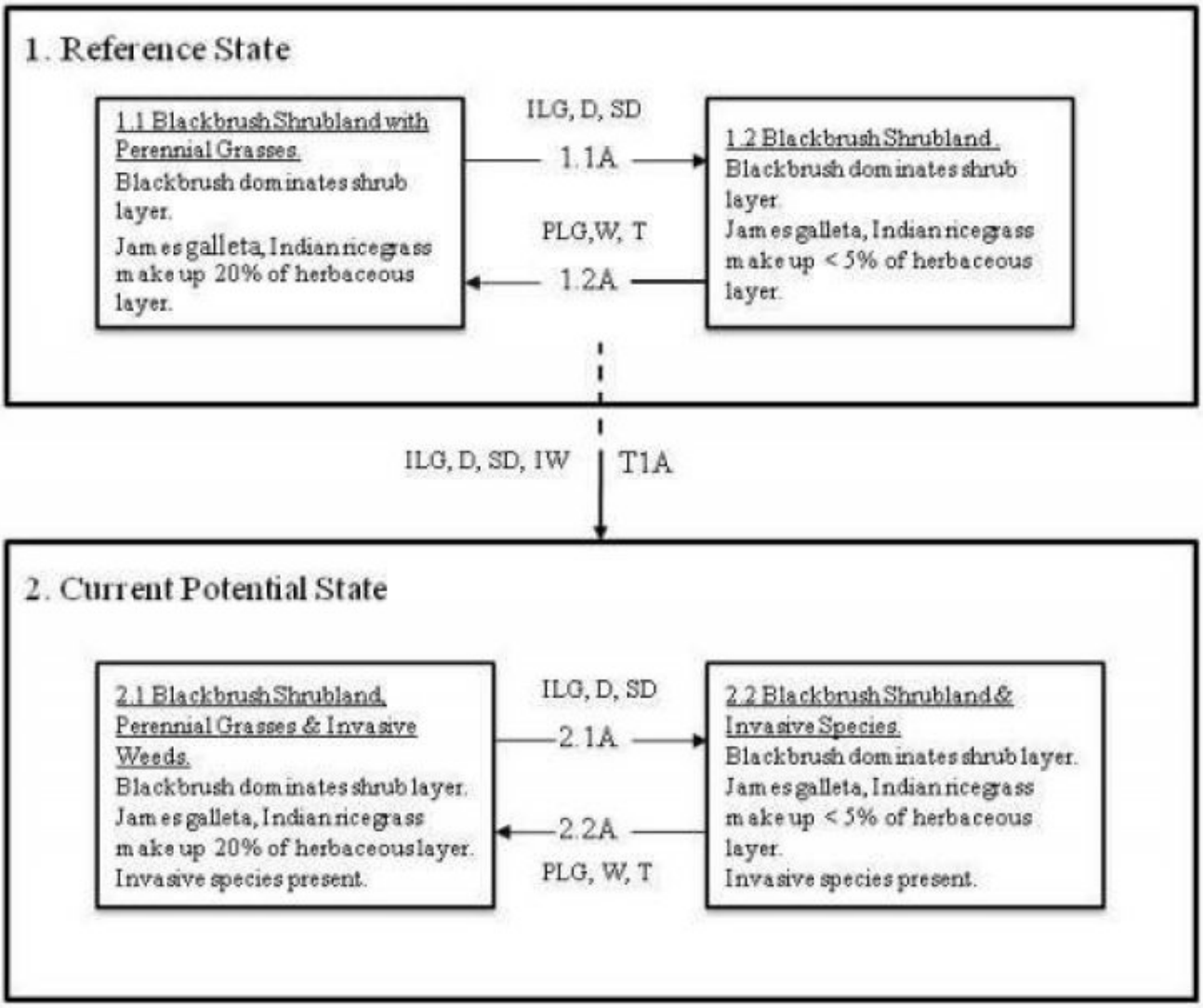
As vegetation communities respond to changes in management or natural influences that move them to different ecological states,a return to previous states may not be possible without major energy inputs. The amount of energy needed to affect vegetative shifts depends on present biotic and abiotic features and the desired results.

The following State and Transition diagram shows some of the most commonly occurring plant communities found on this ecological site. These plant communities may 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. This model was developed using range data collected over the last 40 years in MLRA D35 in southeastern Utah. Both ocular and measured data was collected and utilized.

State and transition model

State and Transition Model
State: Utah
Site Type: Rangeland
MLRA: D-35- Colorado Plateau
R035XY233UT – Semi-desert Shallow Sandy Loam (Blackbrush).



Legend:
D = Drought.
W = Wet weather periods.
T = Time
ILG = Improper Livestock Grazing.
PLG = Proper Livestock Grazing.
SD = Surface Disturbance.
IW = Invasive Weed Source.

State 1
Reference State

The reference state represents the plant communities and ecological dynamics of the

desert shallow sandy loam, blackbrush site. This state includes the biotic communities that become established on the ecological site if all successional sequences are completed under the natural disturbance regimes. The reference state is generally dominated by blackbrush, however depending on disturbance history, native grasses, forbs, or other shrubs may occupy significant composition in the plant community. The reference state is self sustaining and resistant to change due to high resistance to natural disturbances and high resilience following natural disturbances. Reference State: Plant community resistant to fluctuations in climate. Indicators: A community dominated by blackbrush where native perennial grasses and forbs may or may not be present. Feedbacks: Natural fluctuations in climate that allow for a self sustaining blackbrush and native grass community. Any disturbance 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
Blackbrush Shrubland with Perennial Grasses.

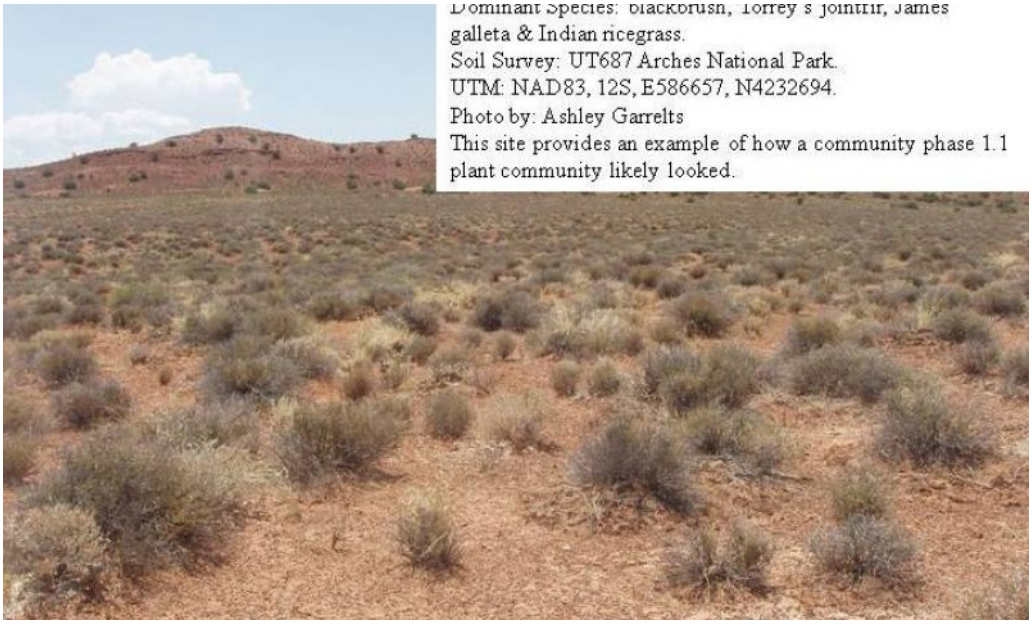


Figure 3. Blackbrush with perennial grasses.

This community phase is characterized by a shrub canopy dominated by blackbrush and Torrey's jointfir, perennial grasses are also present. Commonly occurring grasses include Indian ricegrass, James galleta, needle-and-thread, six weeks fescue, and dropseed species. As perennial grass cover increases, shrub interspaces are filled. Other perennial grasses, shrubs, and forbs may also be present and cover is variable. Air dry weight is approximately 5-10 percent forbs, 15-20 percent grasses, and 70-80 percent shrubs. Bare ground is variable (25-35%) depending on biological crust cover, which is also variable (5-35%) and surface rock fragments (3-60%). Biological crusts can vary between sites. Some are dominated by light cyanobacteria in the plant interspaces, with occasional moss and lichen pinnacles under shrub canopies while others have a dominance of lichen and moss pinnacles in the plant interspaces, with cyanobacteria found in the pinnacle 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 (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	100	150	200
Grass/Grasslike	30	60	80
Forb	10	15	35
Tree	0	0	20
Total	**140**	**225**	**335**

Table 6. Ground cover

Tree foliar cover	0-3%
Shrub/vine/liana foliar cover	15-30%
Grass/grasslike foliar cover	3-18%
Forb foliar cover	1-8%
Non-vascular plants	0%
Biological crusts	5-35%
Litter	3-15%
Surface fragments >0.25" and <=3"	0-24%
Surface fragments >3"	0-5%
Bedrock	4-20%
Water	0%
Bare ground	25-35%

Table 7. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	2-8%	0-5%
>0.5 <= 1	–	5-10%	2-5%	0-5%
>1 <= 2	–	10-20%	2-5%	0-5%
>2 <= 4.5	–	0-5%	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Figure 5. Plant community growth curve (percent production by month). UT0233, HCPC Shallow Blackbrush. The growth curve reflects mostly blackbrush, which flowers early based on winter precipitation. Amount of seed production is dependent on nutrient supplies. Then blackbrush quits growing by June, and enters summer dormancy. Blackbrush is known for mast seeding and will not flower or produce seeds every year..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	10	30	10	30	10	0	0	5	5	0	0

Community 1.2
Blackbrush Shrubland.

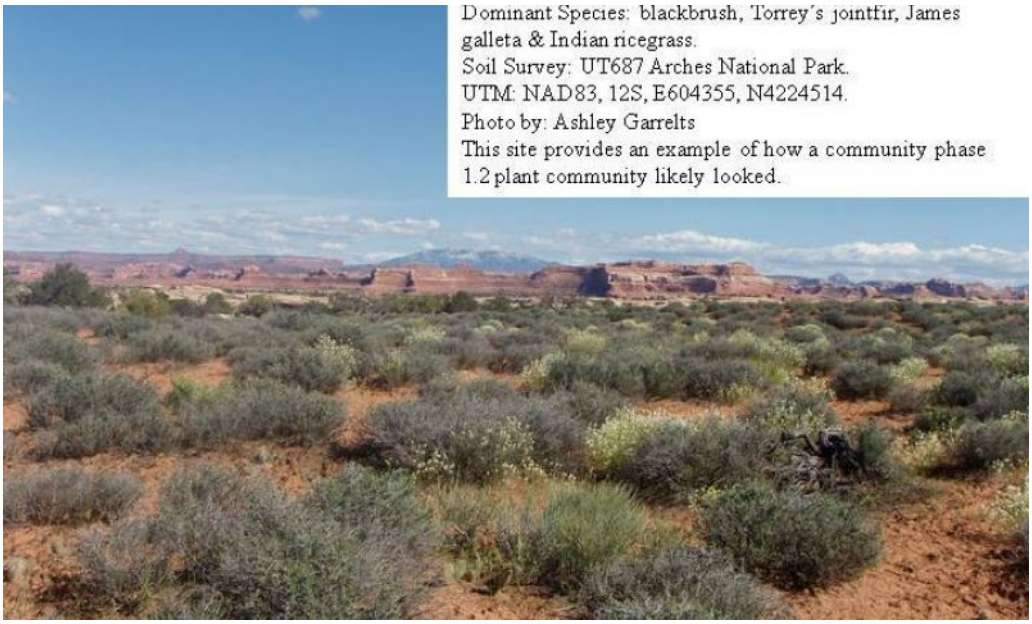


Figure 6. Blackbrush shrubland.

This community phase is characterized by a shrub canopy dominated by blackbrush and Torrey's jointfir, perennial grasses may also be present. Where perennial grasses are

present, Indian ricegrass, James galleta, needle-and-thread, six weeks fescue, and dropseed species are most common with many occurring solely in the shrub canopy. There is little herbaceous cover in the shrub interspaces. Other perennial grasses, shrubs, and forbs may or may also be present and cover is variable. Air dry weight is approximately 3-5 percent forbs, 0-5 percent grasses, and 70-80 percent shrubs. Bare ground is variable (25-35%) depending on biological crust cover, which is also variable (5-35%) and surface rock fragments (3-60%). Biological crusts can vary between sites. Some are dominated by light cyanobacteria in the plant interspaces, with occasional moss and lichen pinnacles under shrub canopies while others have a dominance of lichen and moss pinnacles in the plant interspaces, with cyanobacteria found in the pinnacle interspaces. The following tables provide an example of the typical vegetative floristics of a commumity phase 1.2 plant community.

Table 8. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	100	150	200
Grass/Grasslike	10	20	40
Forb	10	15	35
Tree	0	0	20
Total	**120**	**185**	**295**

Table 9. Ground cover

Tree foliar cover	0-3%
Shrub/vine/liana foliar cover	15-30%
Grass/grasslike foliar cover	3-18%
Forb foliar cover	1-8%
Non-vascular plants	0%
Biological crusts	5-35%
Litter	3-15%
Surface fragments >0.25" and <=3"	0-24%
Surface fragments >3"	0-5%
Bedrock	4-20%
Water	0%
Bare ground	25-35%

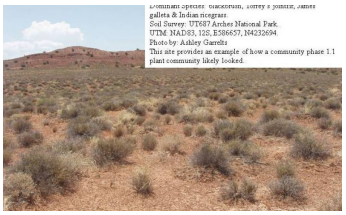
Table 10. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	2-8%	0-5%
>0.5 <= 1	–	5-10%	2-5%	0-5%
>1 <= 2	–	10-20%	2-5%	0-5%
>2 <= 4.5	–	0-5%	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

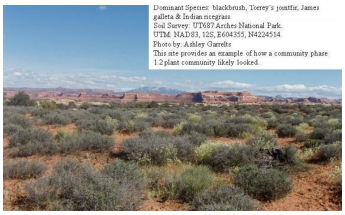
Figure 8. Plant community growth curve (percent production by month). UT0233, HCPC Shallow Blackbrush. The growth curve reflects mostly blackbrush, which flowers early based on winter precipitation. Amount of seed production is dependent on nutrient supplies. Then blackbrush quits growing by June, and enters summer dormancy. Blackbrush is known for mast seeding and will not flower or produce seeds every year..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	10	30	10	30	10	0	0	5	5	0	0

Pathway 1.1A
Community 1.1 to 1.2



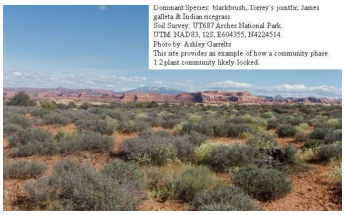
Blackbrush Shrubland with Perennial Grasses.



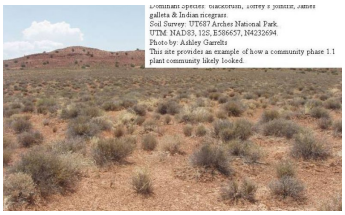
Blackbrush Shrubland.

This community pathway occurs when any combination of improper livestock grazing, drought or surface disturbance reduces the amount of herbaceous vegetation on the site.

Pathway 1.2A
Community 1.2 to 1.1



Blackbrush Shrubland.



Blackbrush Shrubland with Perennial Grasses.

This community pathway occurs when proper livestock grazing, wet weather periods and time allow for the recovery of surface disturbance which increases the amount of perennial herbaceous vegetation on the site.

State 2
Current Potential State

The current potential state is similar to the reference state, however invasive species are now present in all community phases of the current potential state. This state is generally dominated by blackbrush and Torrey's jointfir, however, depending on disturbance history, native grasses, forbs, or other shrubs may also commonly occupy the site. Primary disturbance mechanisms include weather fluctuations, native herbivore grazing, domestic livestock grazing, and surface disturbances such as road and pipeline development and off road vehicle (OHV) use. Due to lack of disturbed areas, the community responses to such disturbances are not well documented. The current potential state is still self sustaining; but can be losing resistance to change due to lower resistance to disturbances and lower resilience following disturbances. Where annual species such as cheatgrass is present, disturbances such as fire are more likely to occur. Current Potential State: Plant community is resistant to weather fluctuations. Indicators: A community dominated by blackbrush where native perennial grasses and forbs may also be present. Invasive grasses and forbs are present. Feedbacks: Natural fluctuations in weather that allow for a self sustaining blackbrush and grass community. Improper livestock grazing may result in a decrease in perennial grasses.

Community 2.1
Blackbrush Shrubland with Perennial Grasses & Invasive Species.

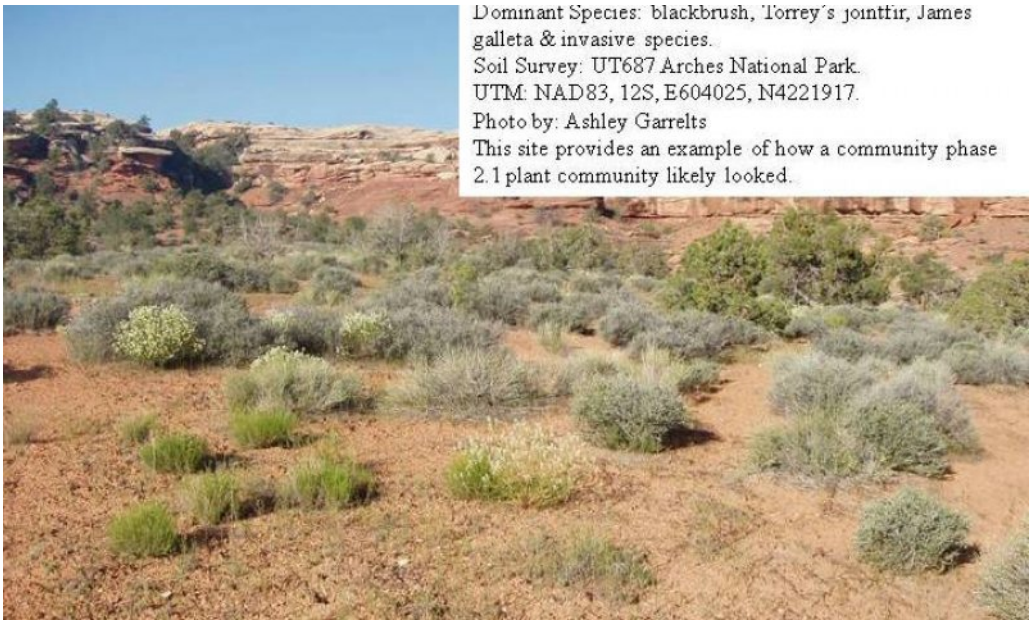


Figure 9. Blackbrush with native grasses

This community phase is characterized by a shrub canopy dominated by blackbrush and Torrey's jointfir, perennial grasses are also present. Commonly occurring grasses include Indian ricegrass, James galleta, needle-and-thread, six weeks fescue, and dropseed species. Non-native and/or invasive species are now present with cheatgrass being most common. As both annual and perennial grass cover increases, shrub interspaces are filled. Other perennial grasses, shrubs, and forbs may also be present and cover is variable. Air dry weight is approximately 5-10 percent forbs, 20-30 percent grasses, and 70-80 percent shrubs. Bare ground is variable (25-35%) depending on biological crust cover, which is also variable (5-35%) and surface rock fragments (3-60%). Biological crusts can vary between sites. Some are dominated by light cyanobacteria in the plant interspaces, with occasional moss and lichen pinnacles under shrub canopies while others have a dominance of lichen and moss pinnacles in the plant interspaces, with cyanobacteria found in the pinnacle interspaces. The following tables provide an example of the typical vegetative floristics of a commumity phase 2.1 plant community.

Table 11. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	100	150	200
Grass/Grasslike	30	50	70
Forb	10	15	35
Tree	0	0	20
Total	**140**	**215**	**325**

Table 12. Ground cover

Tree foliar cover	0-3%

Shrub/vine/liana foliar cover	15-30%
Grass/grasslike foliar cover	3-10%
Forb foliar cover	1-8%
Non-vascular plants	0%
Biological crusts	5-35%
Litter	3-15%
Surface fragments >0.25" and <=3"	0-24%
Surface fragments >3"	0-5%
Bedrock	4-20%
Water	0%
Bare ground	25-35%

Table 13. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	2-8%	0-5%
>0.5 <= 1	–	2-10%	2-5%	0-5%
>1 <= 2	–	10-20%	2-5%	0-5%
>2 <= 4.5	–	0-5%	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 2.2
Blackbrush Shrubland with Invasive Species.

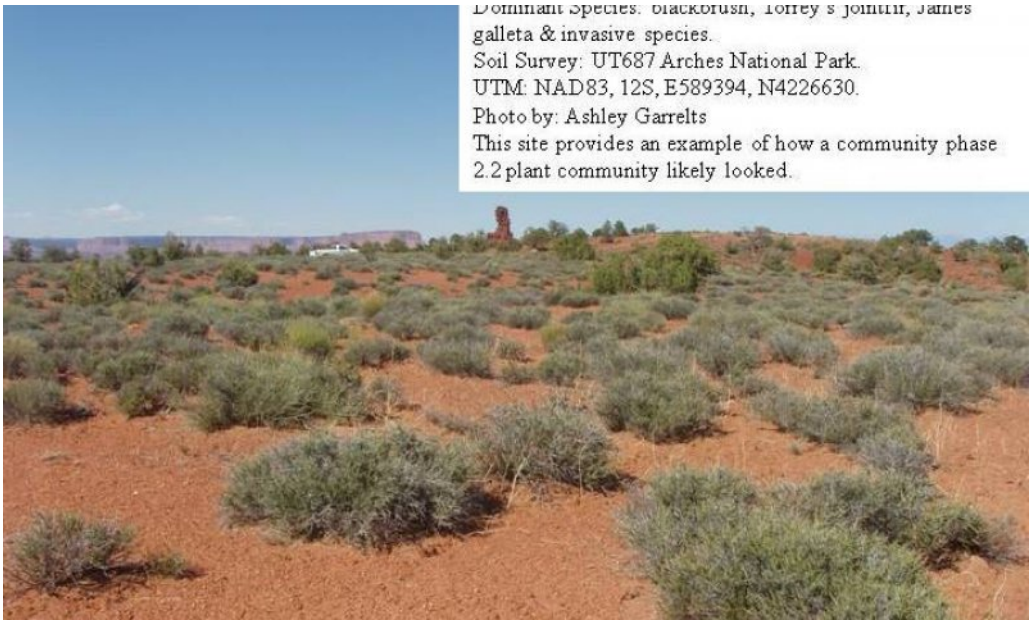


Figure 11. Blackbrush with invasive species.

This community phase is characterized by a shrub canopy dominated by blackbrush and Torrey's jointfir, perennial grasses may also be present. Where perennial grasses are present, Indian ricegrass, James galleta, needle-and-thread, six weeks fescue, and dropseed species are most common with many occurring solely in the shrub canopy. Non-native, invasive species are now present on the site and may increase following wet weather periods. There is little perennial herbaceous cover in the shrub interspaces but annuals may be present. Other perennial grasses, shrubs, and forbs may or may also be present and cover is variable. Air dry weight is approximately 3-5 percent forbs, 0-5 percent perennial grasses, 5-25 percent annual invasive species, and 70-80 percent shrubs. Bare ground is variable (25-35%) depending on biological crust cover, which is also variable (5-35%) and surface rock fragments (3-60%). Biological crusts can vary between sites. Some are dominated by light cyanobacteria in the plant interspaces, with occasional moss and lichen pinnacles under shrub canopies while others have a dominance of lichen and moss pinnacles in the plant interspaces, with cyanobacteria found in the pinnacle interspaces. The following tables provide an example of the typical vegetative floristics of a commumity phase 2.2 plant community.

Table 14. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	100	150	200
Grass/Grasslike	30	50	70
Forb	10	15	35
Tree	0	0	20
Total	**140**	**215**	**325**

Table 15. Ground cover

Tree foliar cover	0-3%
Shrub/vine/liana foliar cover	15-30%
Grass/grasslike foliar cover	3-10%
Forb foliar cover	1-8%
Non-vascular plants	0%
Biological crusts	5-35%
Litter	3-15%
Surface fragments >0.25" and <=3"	0-24%
Surface fragments >3"	0-5%
Bedrock	4-20%
Water	0%
Bare ground	25-35%

Table 16. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	2-8%	0-5%
>0.5 <= 1	–	2-10%	2-5%	0-5%
>1 <= 2	–	10-20%	2-5%	0-5%
>2 <= 4.5	–	0-5%	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

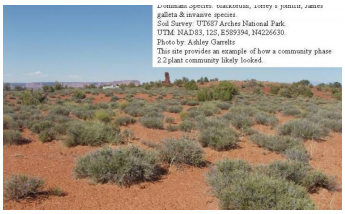
Pathway 2.1A
Community 2.1 to 2.2

Blackbrush Shrubland with Perennial Grasses & Invasive Species.

Blackbrush Shrubland with Invasive Species.

This community pathway occurs when any combination of improper livestock grazing, drought or surface disturbance reduces the amount of perennial herbaceous vegetation on the site. Invasive annual species may increase following short term wet periods.

Pathway 2.2A
Community 2.2 to 2.1



Blackbrush Shrubland with Invasive Species.

Blackbrush Shrubland with Perennial Grasses & Invasive Species.

This community pathway occurs when proper livestock grazing, wet weather periods and time allow for the recovery of surface disturbance which increases the amount of perennial herbaceous vegetation on the site. Non-native invasive species may also increase during this time.

Transition T1A
State 1 to 2

Transition from Reference State (State 1) to Current Potential State (State 2). This transition is from the native perennial warm and cool season grass understory in the reference state to a state that contains invasive species. Events may include any combination of improper livestock grazing, prolonged drought, and/or surface disturbances. However, invasive species such as cheatgrass have been known to invade intact perennial plant communities with little to no disturbances. Once invasive plants are found in the plant community a threshold has been crossed.

Additional community tables

Table 17. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrub**			80–160	
	blackbrush	CORA	*Coleogyne ramosissima*	80–160	–
3	**Sub-dominant Shrubs**			20–50	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–62	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–20	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–20	–

	mormon tea	EPVI	*Ephedra viridis*	0–20	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–18	–
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–15	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–10	–
	sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	0–8	–
	singleleaf ash	FRAN2	*Fraxinus anomala*	0–8	–
	spiny hopsage	GRSP	*Grayia spinosa*	0–8	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–8	–
	desert pepperweed	LEFR2	*Lepidium fremontii*	0–8	–
	Fremont's mahonia	MAFR3	*Mahonia fremontii*	0–8	–
	littleleaf mountain mahogany	CEIN7	*Cercocarpus intricatus*	0–8	–
	Nevada jointfir	EPNE	*Ephedra nevadensis*	0–8	–
	Thompson's dalea	PSTH	*Psorothamnus thompsoniae*	0–8	–
	Mexican cliffrose	PUME	*Purshia mexicana*	0–8	–
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	0–7	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–5	–
	matted crinklemat	TILA6	*Tiquilia latior*	0–2	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–2	–
Grass/Grasslike					
0	**Dominant Grasses**			30–60	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	20–30	–
	James' galleta	PLJA	*Pleuraphis jamesii*	10–20	–
1	**Sub-Dominant Grasses**			0–20	
	blue grama	BOGR2	*Bouteloua gracilis*	0–15	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–14	–
	squirreltail	ELEL5	*Elymus elymoides*	0–11	–
	arrowfeather threeawn	ARPU8	*Aristida purpurascens*	0–10	–
	Grass, annual	2GA	*Grass, annual*	0–10	–
	Grass, perennial	2GP	*Grass, perennial*	0–10	–
	desert needlegrass	ACSP12	*Achnatherum speciosum*	0–8	–

	desert needlegrass	ACSP12	*Achnatherum speciosum*	0–8	–
	black grama	BOER4	*Bouteloua eriopoda*	0–8	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–8	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–4	–
Forb					
2	**Forbs**			10–35	
	desert princesplume	STPI	*Stanleya pinnata*	0–30	–
	buckwheat	ERIOG	*Eriogonum*	0–15	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–12	–
	pointed gumweed	GRFA	*Grindelia fastigiata*	0–10	–
	mountain pepperweed	LEMO2	*Lepidium montanum*	0–10	–
	Shockley's buckwheat	ERSH	*Eriogonum shockleyi*	0–10	–
	Forb, annual	2FA	*Forb, annual*	0–10	–
	Forb, perennial	2FP	*Forb, perennial*	0–10	–
	tansyaster	MACHA	*Machaeranthera*	0–9	–
	cleftleaf wildheliotrope	PHCR	*Phacelia crenulata*	0–6	–
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	3–5	–
	Pacific aster	SYCHC	*Symphyotrichum chilense var. chilense*	0–4	–
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	0–4	–
	canaigre dock	RUHY	*Rumex hymenosepalus*	0–4	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–4	–
	dwarf milkweed	ASIN14	*Asclepias involucrata*	0–4	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–4	–
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–4	–
	horned spurge	EUBR	*Euphorbia brachycera*	0–4	–
	shy gilia	GIIN2	*Gilia inconspicua*	0–4	–
	pale evening primrose	OEPA	*Oenothera pallida*	0–3	–
Tree					
4	**Trees**			0–20	

	Utah juniper	JUOS	*Juniperus osteosperma*	0–20	–

Table 18. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrub**			80–160	
	blackbrush	CORA	*Coleogyne ramosissima*	80–160	–
3	**Sub-dominant Shrubs**			20–50	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–62	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–20	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–20	–
	mormon tea	EPVI	*Ephedra viridis*	0–20	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–18	–
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–15	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–10	–
	sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	0–8	–
	singleleaf ash	FRAN2	*Fraxinus anomala*	0–8	–
	spiny hopsage	GRSP	*Grayia spinosa*	0–8	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–8	–
	desert pepperweed	LEFR2	*Lepidium fremontii*	0–8	–
	Fremont's mahonia	MAFR3	*Mahonia fremontii*	0–8	–
	littleleaf mountain mahogany	CEIN7	*Cercocarpus intricatus*	0–8	–
	Nevada jointfir	EPNE	*Ephedra nevadensis*	0–8	–
	Thompson's dalea	PSTH	*Psorothamnus thompsoniae*	0–8	–
	Mexican cliffrose	PUME	*Purshia mexicana*	0–8	–
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	0–7	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–5	–
	matted crinklemat	TILA6	*Tiquilia latior*	0–2	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–2	–
Grass/Grasslike					
0	**Dominant Grasses**			5–25	

	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–20	–
	James' galleta	PLJA	*Pleuraphis jamesii*	5–20	–
1	**Sub-Dominant Grasses**			0–20	
	blue grama	BOGR2	*Bouteloua gracilis*	0–15	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–14	–
	squirreltail	ELEL5	*Elymus elymoides*	0–11	–
	arrowfeather threeawn	ARPU8	*Aristida purpurascens*	0–10	–
	Grass, annual	2GA	*Grass, annual*	0–10	–
	Grass, perennial	2GP	*Grass, perennial*	0–10	–
	desert needlegrass	ACSP12	*Achnatherum speciosum*	0–8	–
	black grama	BOER4	*Bouteloua eriopoda*	0–8	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–8	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–4	–
Forb					
2	**Forbs**			10–35	
	desert princesplume	STPI	*Stanleya pinnata*	0–30	–
	buckwheat	ERIOG	*Eriogonum*	0–15	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–12	–
	pointed gumweed	GRFA	*Grindelia fastigiata*	0–10	–
	mountain pepperweed	LEMO2	*Lepidium montanum*	0–10	–
	Shockley's buckwheat	ERSH	*Eriogonum shockleyi*	0–10	–
	Forb, annual	2FA	*Forb, annual*	0–10	–
	Forb, perennial	2FP	*Forb, perennial*	0–10	–
	tansyaster	MACHA	*Machaeranthera*	0–9	–
	cleftleaf wildheliotrope	PHCR	*Phacelia crenulata*	0–6	–
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	3–5	–
	Pacific aster	SYCHC	*Symphyotrichum chilense var. chilense*	0–4	–
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	0–4	–

	canaigre dock	RUHY	*Rumex hymenosepalus*	0–4	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–4	–
	dwarf milkweed	ASIN14	*Asclepias involucrata*	0–4	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–4	–
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–4	–
	horned spurge	EUBR	*Euphorbia brachycera*	0–4	–
	shy gilia	GIIN2	*Gilia inconspicua*	0–4	–
	pale evening primrose	OEPA	*Oenothera pallida*	0–3	–
Tree					
4	**Trees**			0–20	
	Utah juniper	JUOS	*Juniperus osteosperma*	0–20	–

Table 19. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			80–160	
	blackbrush	CORA	*Coleogyne ramosissima*	80–160	–
3	**Sub-dominant Shrubs**			20–50	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–62	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–20	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–20	–
	mormon tea	EPVI	*Ephedra viridis*	0–20	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–18	–
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–15	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–10	–
	sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	0–8	–
	singleleaf ash	FRAN2	*Fraxinus anomala*	0–8	–
	spiny hopsage	GRSP	*Grayia spinosa*	0–8	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–8	–
	desert pepperweed	LEFR2	*Lepidium fremontii*	0–8	–
	Fremont's mahonia	MAFR3	*Mahonia fremontii*	0–8	–

	littleleaf mountain mahogany	CEIN7	*Cercocarpus intricatus*	0–8	–
	Nevada jointfir	EPNE	*Ephedra nevadensis*	0–8	–
	Thompson's dalea	PSTH	*Psorothamnus thompsoniae*	0–8	–
	Mexican cliffrose	PUME	*Purshia mexicana*	0–8	–
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	0–7	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–5	–
	matted crinklemat	TILA6	*Tiquilia latior*	0–2	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–2	–
Grass/Grasslike					
0	**Dominant Grass**			30–50	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	20–30	–
	cheatgrass	BRTE	*Bromus tectorum*	5–20	–
	James' galleta	PLJA	*Pleuraphis jamesii*	10–20	–
1	**Sub-dominant Grass**			0–20	
	blue grama	BOGR2	*Bouteloua gracilis*	0–15	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–14	–
	squirreltail	ELEL5	*Elymus elymoides*	0–11	–
	Grass, annual	2GA	*Grass, annual*	0–10	–
	Grass, perennial	2GP	*Grass, perennial*	0–10	–
	arrowfeather threeawn	ARPU8	*Aristida purpurascens*	0–10	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–4	–
Forb					
2	**Forbs**			10–35	
	desert princesplume	STPI	*Stanleya pinnata*	0–30	–
	buckwheat	ERIOG	*Eriogonum*	0–15	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–13	–
	Shockley's buckwheat	ERSH	*Eriogonum shockleyi*	0–10	–
	Forb, annual	2FA	*Forb, annual*	0–10	–
	Forb, perennial	2FP	*Forb, perennial*	0–10	–

	pointed gumweed	GRFA	*Grindelia fastigiata*	0–10	–
	Jones' pepperweed	LEMOJ	*Lepidium montanum var. jonesii*	0–10	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–9	–
	cleftleaf wildheliotrope	PHCR	*Phacelia crenulata*	0–6	–
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	3–5	–
	canaigre dock	RUHY	*Rumex hymenosepalus*	0–4	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–4	–
	horned spurge	EUBR	*Euphorbia brachycera*	0–4	–
	shy gilia	GIIN2	*Gilia inconspicua*	0–4	–
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–4	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–4	–
	Pacific aster	SYCH4	*Symphyotrichum chilense*	0–4	–
	stemless four-nerve daisy	TEAC	*Tetraneuris acaulis*	0–4	–
	pale evening primrose	OEPA	*Oenothera pallida*	0–3	–
	plains springparsley	CYAC	*Cymopterus acaulis*	0–2	–
	bastard toadflax	COUM	*Comandra umbellata*	0–2	–
Tree					
4	**Trees**			0–20	
	Utah juniper	JUOS	*Juniperus osteosperma*	0–20	–

Table 20. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			80–160	
	blackbrush	CORA	*Coleogyne ramosissima*	80–160	–
3	**Sub-dominant Shrubs**			20–50	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–62	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–20	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–20	

	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–20	–
	mormon tea	EPVI	*Ephedra viridis*	0–20	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–18	–
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–15	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–10	–
	sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	0–8	–
	singleleaf ash	FRAN2	*Fraxinus anomala*	0–8	–
	spiny hopsage	GRSP	*Grayia spinosa*	0–8	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–8	–
	desert pepperweed	LEFR2	*Lepidium fremontii*	0–8	–
	Fremont's mahonia	MAFR3	*Mahonia fremontii*	0–8	–
	littleleaf mountain mahogany	CEIN7	*Cercocarpus intricatus*	0–8	–
	Nevada jointfir	EPNE	*Ephedra nevadensis*	0–8	–
	Thompson's dalea	PSTH	*Psorothamnus thompsoniae*	0–8	–
	Mexican cliffrose	PUME	*Purshia mexicana*	0–8	–
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	0–7	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–5	–
	matted crinklemat	TILA6	*Tiquilia latior*	0–2	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–2	–
Grass/Grasslike					
0	**Dominant Grass**			30–50	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–15	–
	cheatgrass	BRTE	*Bromus tectorum*	2–11	10–35
	James' galleta	PLJA	*Pleuraphis jamesii*	5–10	–
1	**Sub-dominant Grass**			0–20	
	blue grama	BOGR2	*Bouteloua gracilis*	0–15	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–14	–
	squirreltail	ELEL5	*Elymus elymoides*	0–11	–
	Grass, annual	2GA	*Grass, annual*	0–10	–
	Grass, perennial	2GP	*Grass, perennial*	0–10	–

	arrowfeather threeawn	ARPU8	*Aristida purpurascens*	0–10	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–4	–
Forb					
2	**Forbs**			10–35	
	desert princesplume	STPI	*Stanleya pinnata*	0–30	–
	buckwheat	ERIOG	*Eriogonum*	0–15	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–13	–
	Shockley's buckwheat	ERSH	*Eriogonum shockleyi*	0–10	–
	Forb, annual	2FA	*Forb, annual*	0–10	–
	Forb, perennial	2FP	*Forb, perennial*	0–10	–
	pointed gumweed	GRFA	*Grindelia fastigiata*	0–10	–
	Jones' pepperweed	LEMOJ	*Lepidium montanum var. jonesii*	0–10	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–9	–
	cleftleaf wildheliotrope	PHCR	*Phacelia crenulata*	0–6	–
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	3–5	–
	canaigre dock	RUHY	*Rumex hymenosepalus*	0–4	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–4	–
	horned spurge	EUBR	*Euphorbia brachycera*	0–4	–
	shy gilia	GIIN2	*Gilia inconspicua*	0–4	–
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–4	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–4	–
	Pacific aster	SYCH4	*Symphyotrichum chilense*	0–4	–
	stemless four-nerve daisy	TEAC	*Tetraneuris acaulis*	0–4	–
	pale evening primrose	OEPA	*Oenothera pallida*	0–3	–
	plains springparsley	CYAC	*Cymopterus acaulis*	0–2	–
	bastard toadflax	COUM	*Comandra umbellata*	0–2	–
Tree					
4	**Trees**			0–20	

	Utah juniper	JUOS	*Juniperus osteosperma*	0–20	–

Animal community

--Threatened, Endangered and Sensitive Species-
This site provides foraging opportunities for Eagles, Peregrine Falcons and Ferruginous Hawks. Roosting opportunities are scarce due to the small amount of trees. This site can occur away from cliffs so available nests sites are scarce. Desert bighorn sheep will use this site for foraging mainly during the winter and spring. And Fringed Myotis could potential use this site for foraging.

--Wildlife Interpretations—
Small herds of mule deer, pronghorn antelope, and desert bighorn sheep can be seen grazing/browsing on these sites, especially when near water sources and in the winter. These sites are also important winter areas for bighorn sheep, in many places, however, populations are small and will have little impact on the site.
The hot climate and lack of water favors small mammals, which have an easier time finding shelter, food, and water. Many species of rats, mice, squirrels, bats, and chipmunks can be observed, along with coyotes and foxes. On sites where Utah juniper is invading, or where Utah juniper sites are adjacent, birds are the most visible wildlife species that can be observed, sightings may be rare however, due to the sparseness of tree canopies. Species may include juniper titmice, scrub jays, pinyon jays, and black throated gray warblers, and sparrows. Lizards are the most visible and can be observed during the day. Species may include the northern whiptail, desert spiny, and the colorful western collard lizard. (NPS.gov, 2008)

--Grazing Interpretations--
This site provides very limited grazing for livestock. Blackbrush contains high levels of tannins, and has low available nutrition. When present, grasses, primarily Indian ricegrass and James galleta, provide good forage for livestock, however, these species are not always abundant enough to support many livestock. The site does provide fairly good browse for goats. Forage composition and annual production depend largely on yearly precipitation amounts and thus provide challenges for those making livestock grazing management decisions. Regardless of class of livestock, this sites carrying capacity is always low. A lack of available drinking water, can also influence its suitability for livestock grazing. Care should be taken to maintain the native perennial grasses and shrubs present on this site because they are hard to restore once gone.

Livestock grazing should be based on a science based management plan that includes an onsite resource inventory.

Hydrological functions

Soils associated with this ecological site are generally in Hydrologic Soil Group D due to the shallow depth (NRCS National Engineering Handbook). The hydrologic curve numbers

are 80 to 90 depending on watershed condition. Hydrologic 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.

The following runoff and soil loss data were generated using the Rangeland Hydrology and Erosion Model Web Tool. Hydrology and erosion are approximately the same for both State 1 and State 2. Soil textures range from loams to sandy loams and slope ranges from 2-30 percent on this site. Loam soils have greater runoff and soil loss potential than sandy loam soils. Slope does not affect the runoff on this site, but does have an impact on soil loss. Average runoff is typically about 0.8 inches per year, but may be as high as 1.5 inches in a single 100-year storm event. Soil loss ranges from 0.16(about 2% slope) to 0.7 (about 30% slope) tons per acre on an average year, and from 0.4 (about 2% slope) to 1.4 (about 30% slope) tons per acre during a 100-year storm event. Long-term soil loss is not the only concern on this site, storm events (i.e. 25, 50 or 100 year storms) that result in significant soil loss are more likely to impact the soil resource. Average rainfall ranges from 9-12 inches per year, but a single 100-year storm event can generate 2 inches of precipitation in a 24-hour period.

Where individual blackbrush plants are uniformly distributed resulting in high tortuosity, overland flow slows down and promotes on-site infiltration. Grasses and forbs in the shrub interspaces often have a minimal impact on water flow patterns due to their low production.

Improper livestock grazing does not seem to significantly alter the sites hydrology since blackbrush is not typically grazed. Interspaces are often protected by biological soil crusts, rock fragments, or a weak physical soil crust. Soil physical crusts and weak biological crusts (light cyanobacteria) are the most susceptible to water erosion.

Recreational uses

Recreation activities include aesthetic value and good opportunities for hiking, horseback riding, and off-road vehicle use. Campsites are usually limited due to lack of sheltering trees or rock outcrops.

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) which is poisonous at all stages of growth. Poisoning will become evident after 2-3 weeks of continuous grazing. Clinical signs include neurological damage, emaciation, reproductive failure and abortion, and 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 sustained drought, during periods of cool/cloudy weather, and 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. (Knight and Walter, 2001)

--Invasive Plant Communities--
As ecological conditions deteriorate and native vegetation decreases due to disturbance (i.e., fire, improper livestock grazing, drought, off road vehicle overuse, erosion, etc.) invasive species can establish on this site. Of particular concern in semi-arid environments are the non-native annual invaders including cheatgrass, Russian thistle, kochia, halogeton, and mustards. The presence of these species will depend on soil properties and moisture availability, however, these species are highly adaptive and can flourish in many locations. Once established, complete removal is difficult, suppression however, may be possible.

--Fire Ecology--
The ability for this ecological site to carry fire depends primarily on it's present fuel load and plants fine fuel 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 sufficient fuels by producing heavy stands of forbs and grasses for fire to carry. When fires do occur, the effect on the plant community may be extreme due to the harsh environment and slow rate of recovery.

There is little evidence to indicate that this site historically mainained a short burn frequency. Few species in the association show fire scars and can be aged. This ecological site is comprised of scattered shrubs with large bare or patchy interspaces occupied by grasses. These site are unlikely to carry fire except during periods with high winds, high temperature, and/or low humidity.

Research has shown 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 to be 35-100 years (Anderson, 2001). However, communities in southeastern Utah do not show evidence of burning within that time frame.

Studies have shown that because of the apical stem dominance trait of blackbrush, twig removal through grazing or mechanical treatment may increase sprouting and/or new growth. In disturbed area where annual grasses or forbs dominate, re-vegetation efforts could be hampered due to the potential for an increase in fire frequency.

Inventory data references

Data for the revision was collected during 2005-2007 during the update of the soil surveys within Arches National Park and Canyonlands National Park. For most locations, there is an associated soil pit and GPS location. Data is all electronic, contact the State Range specialist for more information.

Type locality

Location 1: San Juan County, UT	
UTM zone	N
UTM northing	4258599
UTM easting	603774
General legal description	Canyonlands National Park

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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.

Author(s)/participant(s)	Robert Stager (BLM), Randy Beckstrand (BLM), V. Keith Wadman (NRCS Ret.), Dana Truman (NRCS), Paul Curtis (BLM), Shane A. Green (NRCS). Contributors to 2/2008 revisions included Shane Green and Dana Truman (NRCS); Kim Allison, Ann Marie Aubrey, Lynn Jackson, Pam Riddle, Daryl Trotter and David Williams (BLM); and Mike Duniway and Jeff Herrick (ARS).
Contact for lead author	shane.green@ut.usda.gov
Date	02/07/2008
Approved by	Shane A. Green
Approval date	
Composition (Indicators 10 and 12) based on	Foliar Cover

Indicators

1. **Number and extent of rills:** Rills increase immediately following large storm events but should not persist more than one or two winters due to frost-heave recovery. There should be very few on slopes < 6%. On slopes >6%, rills may be 5-10 feet in length. Rills are most likely to form below adjacent exposed bedrock or water flow patterns where sufficient water accumulates to cause erosion.

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2. **Presence of water flow patterns:** There should be few and short (3-6') water flow patterns on low slopes (< 6%), increasing in frequency and length (up to 5-10') with slope. Waterflow patterns may increase on steeper slopes following large storm events, dissipating where the slope flattens. Interspaces between vegetation and/or well developed biological soil crusts

appear to be depression water storage areas but actually serve as somewhat stable water flow patterns during precipitation events.

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3. **Number and height of erosional pedestals or terracettes:** Blackbrush plants that occur on the edge of water flow patterns and rills on steeper slopes (>6%) may be pedestalled, but there should be no exposed roots.
   Terracettes are few. Well developed biological crusts may appear pedestalled, but are actually a characteristic of the crust formation.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 25-35%. Most bare ground is associated with water flow patterns. Areas with well developed biological soil crusts should not be counted as bare ground. Areas with 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. This site can have up to 35% surface rock cover. Ground cover is based on first raindrop impact, and bare ground is the opposite of ground cover. Ground cover + bare ground = 100%.

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5. **Number of gullies and erosion associated with gullies:** No active gullies. Some stable 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 slopes exceeding 15% and adjacent to sites where runoff accumulation occurs. Any gullies present should show little sign of accelerated erosion and should be stabilized with perennial vegetation and biological soil crusts.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** There should be very little evidence of active wind scoured, blowout or depositional areas. Wind caused deposition at the base of shrubs is stabilized by biological soil crusts.

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7. **Amount of litter movement (describe size and distance expected to travel):** There may be movement of fine litter on low slopes (< 6%) of up 2-4’. On steeper slopes, fine litter may be redistributed in waterflow patterns following large storm events, depositing where the slope flattens or behind obstructions. Woody litter (if present) should not move from beneath the plant.

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 5-6 throughout the site. Surface texture varies from fine sand to gravelly fine sandy loam to channery loam.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface varies from 2 to 2 ½ inches thick. Structure is medium platy. Color is strong brown (7.5YR4/6) to red (2.5YR4/6). 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:** Distribution of vascular plants and/or biological soil crusts (where present) intercept raindrops preventing, but not eliminating, reduction of infiltration due to physical crusting. Plants and/or biological soil crusts usually have sufficient cover to slow runoff allowing time for infiltration (except on clay loam soils where biological soil crust development is minimal). Shrubs and bunchgrasses and associated plant litter provide barriers to flow.

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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, although bedrock is found within 20 inches of soil surface. In addition, there may be layers of calcium carbonate 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: Non-resprouting shrub (e.g. Blackbrush) and biological soil crusts*

Sub-dominant: Cool-season bunchgrasses (e.g. Indian ricegrass), Warm-season bunchgrasses (e.g. Galleta)

Other: Forbs, trees (e.g. Utah juniper), other shrubs.
Perennial and annual forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions.

Additional: *Biological soil crusts are an important component on many soils of this ecological site except on very fine textured surfaces (clay loams) and where rock fragment cover is high. At least 1/5 to 1/3 of the soil surface not protected by plant litter or rock should support lichens, mosses or dark cyanobacterial crusts.
Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species in 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):** During years with average to above-average precipitation, there should be very little recent mortality or decadence apparent in either the shrubs or grasses. During severe (multi-year) drought up to 20% of the blackbrush stems may die. Some mortality of bunchgrass and other shrubs may also occur during severe droughts, particularly on the shallower and coarser soils associated with this site. There may be partial mortality of individual bunchgrasses and other shrubs during less severe drought. Because woody stems may persist for many years, blackbrush will normally have dead stems within the plant canopy. Blackbrush will drop its leaves when water stressed.

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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 leaf thickness in the interspaces and up to ¼" under canopies. Litter cover may increase up to 20% immediately following leaf drop. Litter redistribution following natural extreme runoff events can reduce litter cover by concentrating it in low-lying areas. Litter cover may increase to 15-20% followings seasons with above average production due to a high production of annuals.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 250-300 #/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: None currently known; however cheatgrass, Russian thistle, and other introduced annual forbs have future potential. This reference should be revised if any of these species become invasive in this ecological site.

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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. Blackbrush reproduction is naturally very episodic and no young plants may be apparent.

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18. **Supporting Data:** USGS (Mark Miller) 2006-2007 data from Canyonlands and Dugout Ranch, including some higher elevation Desert Shallow Sandy Loam (Blackbrush) sites (R035XY133UT). NRCS (Dana Truman) 2006-2007 ESD data from Canyonlands and Arches.
