USDA Natural Resources
Conservation Service

Ecological site R035XY133UT
Desert Shallow Sandy Loam (Blackbrush)

Accessed: 05/12/2025

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.

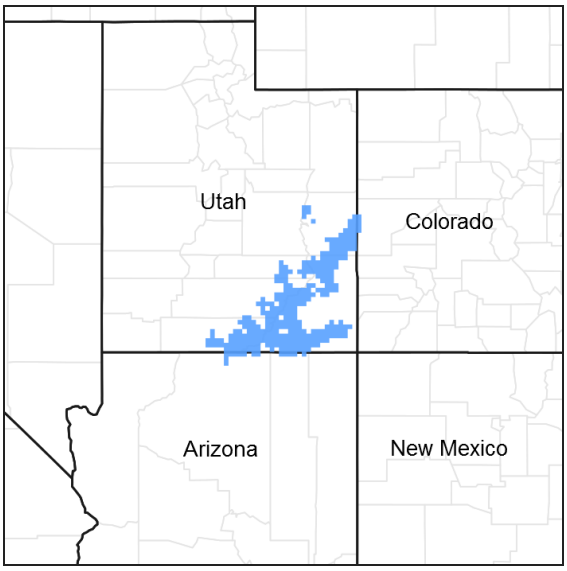


Figure 1. Mapped extent

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

Modal Soil: Moenkopie L, Extended Season — loamy, mixed (calcareous), mesic Lithic Calciorthids

Type Location: Gooseneck Park and Limeridge

Associated sites

R035XY115UT	**Desert Sand (Sand Sagebrush)**
R035XY118UT	**Desert Sandy Loam (Fourwing Saltbush)**
R035XY121UT	**Desert Sandy Loam (Blackbrush)**

R035XY130UT	**Desert Shallow Sandy Loam (Shadscale)**
R035XY139UT	**Desert Stony Loam (Blackbrush)**

Similar sites

R035XY233UT	**Semidesert Shallow Sandy Loam (Blackbrush)**
R035XY121UT	**Desert Sandy Loam (Blackbrush)**

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Coleogyne ramosissima*
Herbaceous	(1) *Pleuraphis jamesii*

Physiographic features

This site is located on dissected pediments, escarpments, ledges, hillslopes on structural benches, benches, rolling ridges, dissected cuestas, structural benches, top mesas, south facing hillslopes, and canyons. Runoff is high to very high. Slopes typically range from 1-20%, but in some areas, slopes are as steep as 60%. Elevations are generally 3700-6000 ft, but this site has been found on elevations as high as 7100 ft.

Table 2. Representative physiographic features

Landforms	(1) Escarpment (2) Ledge (3) Structural bench
Flooding frequency	None
Ponding frequency	None
Elevation	1,128–2,164 m
Slope	1–20%
Aspect	Aspect is not a significant factor

Climatic features

The climate is characterized by hot summers and cool to warm winters. Large fluctuations in daily temperatures are common. The mean annual air temperature ranges from 40 to 57 degrees Fahrenheit. Approximately 65–70% of precipitation occurs as rain from March through October. On the average, April, May, and June are the driest months and August, September, and October are the wettest months. Precipitation is extremely variable from month to month and from year to year. Much of the precipitation occurs as convection thunderstorms.

Table 3. Representative climatic features

Frost-free period (average)	191 days
Freeze-free period (average)	217 days
Precipitation total (average)	254 mm

Influencing water features

There are no water feature influencing this site.

Soil features

The soils are very shallow to shallow and well drained. Typically the dry surface is dark reddish brown to yellowish red. Typically soil surface fragments range from 0-40%. The soil temperature and moisture regimes are mesic and typic aridic respectively. Surface and subsurface textures are generally fine gravelly fine sandy loams, loamy fine sands, gravelly very fine sands, and sandy loams. These soils formed in eolian deposits derived mainly from eroded calcareous sandstone parent materials. Soils are calcareous to the surface and have a layer of carbonate accumulation just above the bedrock. This layer occurs as a hardpan in Limeridge & Deleco soils which are shallow (7-20") to calcium carbonate cemented hardpan with depth to limestone bedrock of 20 to 40". Pennell has a horizon with loamier textures (i.e. sandy clay loam) and the available water capacity is 1 to 4 inches, and moderate (0.6 to 2.0 in/hr) permeability. Walknolls Family has 30-80% rock fragments on the surface. Deleco and Walknolls family has 35-70% rock fragments in the control section. Runoff is rapid for slopes over 15%. Lithic Torripsamments (Needle and Suzipon) have somewhat excessive to excessive drainage classes and rapid (greater than 20 in/hr) permeability. Site is often associated with rock outcrops. The average annual soil loss in potential is approximately 0.5-1.5 tons/acre. The soil surface factor (SSF) in potential is 30. Available water holding capacity is 0.6 to 3.1 inches.

This site has been used in the following soil surveys and has been correlated to the following components:

UT624 – Grand County, Utah, Central – Pennell
UT631 – Henry Mountains Area – Pennell
UT633 – Canyonlands Area – Moenkopie; Arches; Lithic Toriothents; Arches
UT638 – San Juan County, Utah, Central – Moenkopie; Piute; Limeridge
UT643 – San Juan County, Utah, Navajo Indian Reservation – Deleco; Hoskinnini; Piute
UT685 – Capitol Reef National Park – Moenkopie; Needle;
UT686 – Escalante Grand Staircase National Monument – Moenkipie; Needle; Suzipon; Tsaya
UT688 – Canyonlands National Park – Tsaya; Needle

Table 4. Representative soil features

Parent material	(1) Alluvium–sandstone and shale (2) Residuum–sandstone (3) Eolian deposits–sandstone
Surface texture	(1) Gravelly fine sandy loam (2) Fine sandy loam (3) Loamy fine sand
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderate to moderately rapid
Soil depth	8–51 cm
Surface fragment cover <=3"	0–38%
Surface fragment cover >3"	0–6%
Available water capacity (0-101.6cm)	1.52–6.86 cm
Calcium carbonate equivalent (0-101.6cm)	0–45%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–5
Soil reaction (1:1 water) (0-101.6cm)	7.4–9
Subsurface fragment volume <=3" (Depth not specified)	0–48%

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 sites plant species composition is generally dominated by blackbrush. Some shadscale can occur on loamier textured soils. The amount of James galleta and Indian ricegrass present is dependant on weather patterns (summer or winter precipitation)and on soil depth to a caliche or other restrictive layer. The shallower the soil, the fewer herbaceous species. Blackbrush appears to act as a paleo-endenmic species on some sites in this MLRA and may not be able to reestablish itself after significant disturbance.

There is little 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 for fire to occur, can cause the site to become at 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 highly resistant to grazing due to the unpalatable nature of blackbrush and lack of forage plants. The introduction of domestic livestock and the use of fencing and reliable water sources have therefore 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 jointfir decrease while yellow cryptantha, locoweed, desert trumpet, blackbrush, and snakeweed 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 even in the abscence of grazing but rarely increase to a point where they dominate blackbrush communities.

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

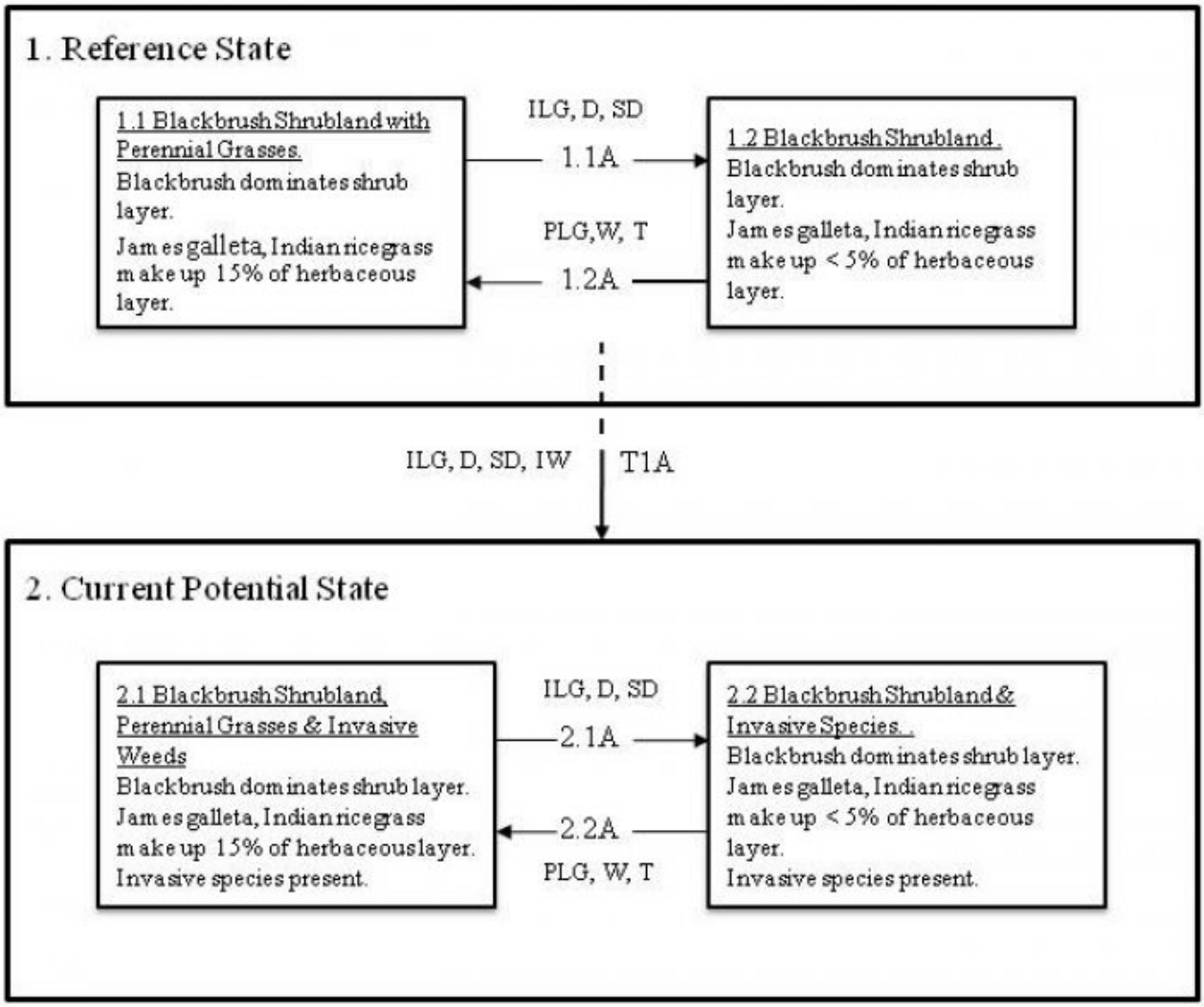
Suitability for rangeland seeding is very poor. It is not practical to revegetate large areas of this ecological site because of the shallow soil depth, low annual precipitation, and very low available water capacity. Additionally, the Piute soil has a high hazard of soil blowing because of its sandier 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 a different ecological state, 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 is 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
R035XY133UT – 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. Generally, as soil depth increases on these shallow sites, the herbaceous vegetative component of the site increases. 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 Grass

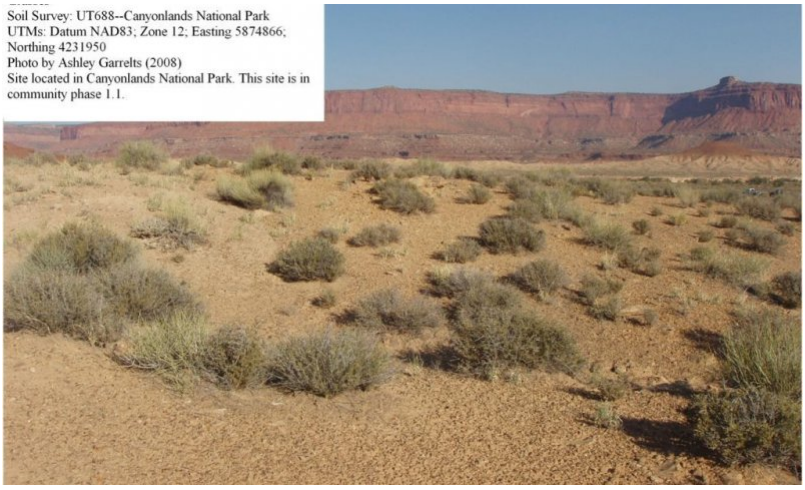


Figure 4. Blackbrush with Perennial Grasses.

This community phase is characterized by a blackbrush shrub canopy, where perennial grasses are also be present. Commonly seen grasses include Indian ricegrass, James galleta, needle-and-thread, six weeks fescue, and dropseeds, with many occurring solely in the shrub canopy. As grass cover increases, shrub interspaces are filled. Other perennial grasses, shrubs, and forbs may also be present and cover is variable. Composition by dry weight is approximately 10 percent forbs, 15 percent grasses, and 75 percent shrubs. Bare ground is variable (7-25%) depending on biological crust cover, which is also variable (13-30%) and surface rock fragments (0-44%). Biological crusts can be anywhere between sites dominated by light cyanobacteria in the plant interspaces, with occasional moss and lichen pinnacles under shrub canopies, to a dominance of lichen and moss pinnacles in the plant interspaces, with cyanobacteria 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 (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	146	140	213
Grass/Grasslike	56	84	112
Forb	17	22	28
Total	**219**	**246**	**353**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	15-20%
Grass/grasslike foliar cover	10-15%

Forb foliar cover	5-15%
Non-vascular plants	0%
Biological crusts	10-30%
Litter	0-3%
Surface fragments >0.25" and <=3"	0-40%
Surface fragments >3"	0-5%
Bedrock	3-20%
Water	0%
Bare ground	5-25%

Table 7. Canopy structure (% cover)

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

Community 1.2
Blackbrush Shrubland

Figure 6. Blackbrush Shrubland

This community phase is characterized by a blackbrush shrub canopy, where perennial grasses are mostly absent. Minor amounts of Indian ricegrass, James galleta, needle-and-thread, six weeks fescue, and dropseeds, may be present often solely located within the shrub canopy. Composition by dry weight is approximately 5 percent forbs, 10 percent grasses, and 85 percent shrubs. Bare ground is variable (7-25%) depending on biological crust cover, which is also variable (13-30%) and surface rock fragments (0-44%). Biological crusts can be anywhere between sites dominated by light cyanobacteria in the plant interspaces, with occasional moss and lichen pinnacles under shrub canopies, to a dominance of lichen and moss pinnacles in the plant interspaces, with cyanobacteria in the pinnacle 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	168	191	252
Grass/Grasslike	17	56	84
Forb	17	22	28
Total	**202**	**269**	**364**

Table 9. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	20-35%
Grass/grasslike foliar cover	5-10%
Forb foliar cover	5-15%
Non-vascular plants	0%
Biological crusts	0%
Litter	1-5%
Surface fragments >0.25" and <=3"	0-50%
Surface fragments >3"	0-10%
Bedrock	3-20%
Water	0%
Bare ground	5-25%

Pathway 1.1A
Community 1.1 to 1.2

Blackbrush Shrubland with Perennial Grass

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 Grass

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

--Current Potential State (State 2)-- The current potential state is similar to the reference state, however invasive species are present in all community phases of the current potential state. This state is generally dominated by blackbrush, however depending on disturbance history, native grasses, forbs, or other shrubs may dominate the site. Primary disturbance mechanisms include climate 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 documented, and are not currently included in the state and transition model. The current potential state is still self sustaining; but is losing resistance to change due to lower resistance to disturbances and lower resilience following disturbances, and new drastic disturbances such as fire being more likely to occur in the future. Current Potential State: Plant community is resistant to climate fluctuations. Indicators: A community dominated by blackbrush where native perennial grasses and forbs may or may not be present. Invasive grasses and forbs are present. Feedbacks: Natural fluctuations in climate that allow for a self sustaining blackbrush and grass community. Continuous, season-long grazing may result in a decrease of the perennial grasses.

Community 2.1
Blackbrush, Perennial Grasses & Invasive Weeds.

Figure 8. Blackbrush, Perennial Grasses, Invasive Weeds.

This community phase is characterized by a blackbrush shrub canopy, where perennial grasses are also present. Ivasive plants, primarily Cheatgrass, Red brome and Russian thistle are present. Commonly seen grasses include Indian ricegrass, galleta, needle-and-thread, six weeks fescue, purple threeawn, and cheatgrass. Other grasses, shrubs, and forbs may or may not be present and cover is variable. Bare ground, rock fragments, and biological crust cover are very similar to community phase 1.1 in their variability and responses to each other. The following tables provide an example of the typical vegetative floristics of a community phase 2.1 plant community.

Table 10. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	101	140	168
Grass/Grasslike	17	28	34
Forb	17	22	28
Total	**135**	**190**	**230**

Table 11. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	15-20%
Grass/grasslike foliar cover	10-15%
Forb foliar cover	5-13%
Non-vascular plants	0%

Biological crusts	13-30%
Litter	0-3%
Surface fragments >0.25" and <=3"	0-38%
Surface fragments >3"	0-6%
Bedrock	3-20%
Water	0%
Bare ground	7-25%

Table 12. Canopy structure (% cover)

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

Community 2.2
Blackbrush & Invasive Weeds.

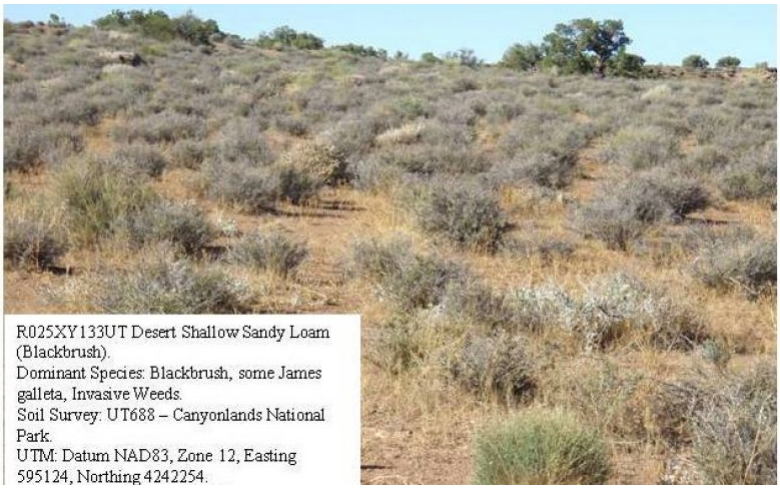


Figure 10. Blackbrush, some James galleta, Invasive Species

This community phase is characterized by a blackbrush shrub canopy, where perennial grasses are mostly absent. Minor amounts of Indian ricegrass, James galleta, needle-and-thread, six weeks fescue, and dropseeds, may be present often solely located within the shrub canopy. Ivasive plants, primarily Cheatgrass, Red brome and Russian thistle are present. Composition by dry weight is approximately 5 percent forbs, 10 percent grasses, and 85 percent shrubs. Bare ground is variable (7-25%) depending on biological crust cover, which is also variable (13-30%) and surface rock fragments (0-44%). Biological crusts can be anywhere between sites dominated by light cyanobacteria in the plant interspaces, with occasional moss and lichen pinnacles under shrub canopies, to a dominance of lichen and moss pinnacles in the plant interspaces, with cyanobacteria in the pinnacle interspaces. The following tables provide an example of the typical vegetative floristics of a community phase 2.2 plant community.

Table 13. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	168	191	247
Grass/Grasslike	34	101	135
Forb	22	45	67
Total	**224**	**337**	**449**

Table 14. Ground cover

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

Pathway 2.1A
Community 2.1 to 2.2

Blackbrush, Perennial Grasses & Invasive Weeds.

Blackbrush & Invasive Weeds.

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 which allows for an increase of invasive weeds.

Pathway 2.2A
Community 2.2 to 2.1

Blackbrush & Invasive Weeds.

Blackbrush, Perennial Grasses & Invasive Weeds.

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. Invasive species are still present.

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 include improper livestock grazing which reduces perennial grasses, prolonged drought, and surface disturbances, etc., where a seed source for invasive weed species is present. Invasive species such as cheatgrass, red brome, and Russian thistle, however, 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 15. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			78–101	
	blackbrush	CORA	*Coleogyne ramosissima*	78–101	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	3–11	–
3	**Sub-Dominant Shrubs**			22–67	
	mormon tea	EPVI	*Ephedra viridis*	6–67	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	7–15	–
	water jacket	LYAN	*Lycium andersonii*	0–11	–
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	0–9	–
	crispleaf buckwheat	ERCOA	*Eriogonum corymbosum var. aureum*	0–9	–
	slender buckwheat	ERMI4	*Eriogonum microthecum*	0–9	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–9	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–9	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–9	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–6	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–6	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–4	–
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–4	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–3	–
Grass/Grasslike					
0	**Dominant Grasses**			34–56	
	James' galleta	PLJA	*Pleuraphis jamesii*	11–45	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	6–22	–
1	**Sub-Dominant Grasses**			25–74	
	squirreltail	ELEL5	*Elymus elymoides*	0–9	–
	needle and thread	HECO26	*Hesperostipa comata*	0–9	–
	spike dropseed	SPCO4	*Sporobolus contractus*	0–9	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–9	–
	Grass, annual	2GA	*Grass, annual*	0–6	–
	Grass, perennial	2GP	*Grass, perennial*	0–6	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–2	–
	New Mexico feathergrass	HENE5	*Hesperostipa neomexicana*	0–2	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–1	–

Forb					
2	**Forbs**			17–28	
	Forb, annual	2FA	*Forb, annual*	6–28	–
	Forb, perennial	2FP	*Forb, perennial*	6–28	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–22	–
	snowball sand verbena	ABFR2	*Abronia fragrans*	0–9	–
	twisted cleomella	CLPL2	*Cleomella plocasperma*	0–9	–
	manybranched ipomopsis	IPPO2	*Ipomopsis polycladon*	0–9	–
	James' buckwheat	ERJA	*Eriogonum jamesii*	0–9	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–4	–
	desert trumpet	ERIN4	*Eriogonum inflatum*	0–3	–
	skyblue phacelia	PHCO	*Phacelia coerulea*	0–3	–
	basindaisy	PLIN7	*Platyschkuhria integrifolia*	0–3	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–3	–
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–3	–
	Crescent milkvetch	ASAM5	*Astragalus amphioxys*	0–3	–
	plains springparsley	CYAC	*Cymopterus acaulis*	0–2	–
	golden spiderflower	CLPL	*Cleome platycarpa*	0–1	–
	woolly bluestar	AMTO2	*Amsonia tomentosa*	0–1	–
	gilia	GILIA	*Gilia*	0–1	–
	rusty lupine	LUPU	*Lupinus pusillus*	0–1	–
	tufted evening primrose	OECA10	*Oenothera caespitosa*	0–1	–
	pale evening primrose	OEPA	*Oenothera pallida*	0–1	–

Table 16. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			140–224	
	blackbrush	CORA	*Coleogyne ramosissima*	112–224	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	6–11	–
3	**Sub-Dominant Shrubs**			22–101	
	mormon tea	EPVI	*Ephedra viridis*	6–67	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	6–17	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–11	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–11	–
	crispleaf buckwheat	ERCOA	*Eriogonum corymbosum var. aureum*	0–11	–
	slender buckwheat	ERMI4	*Eriogonum microthecum*	0–11	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–11	–
	water jacket	LYAN	*Lycium andersonii*	0–11	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–11	–
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	0–11	–

	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–6	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–6	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–6	–
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–6	–
Grass/Grasslike					
0	**Dominant Grasses**			22–56	
	James' galleta	PLJA	*Pleuraphis jamesii*	6–22	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	2–11	–
1	**Sub-Dominant Grasses**			11–45	
	Grass, annual	2GA	*Grass, annual*	0–6	–
	Grass, perennial	2GP	*Grass, perennial*	0–6	–
	squirreltail	ELEL5	*Elymus elymoides*	0–6	–
	needle and thread	HECO26	*Hesperostipa comata*	0–6	–
	spike dropseed	SPCO4	*Sporobolus contractus*	0–6	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–6	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–2	–
	New Mexico feathergrass	HENE5	*Hesperostipa neomexicana*	0–2	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–2	–
Forb					
2	**Forbs**			11–22	
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–22	–
	Forb, annual	2FA	*Forb, annual*	6–11	–
	Forb, perennial	2FP	*Forb, perennial*	6–11	–
	snowball sand verbena	ABFR2	*Abronia fragrans*	0–6	–
	twisted cleomella	CLPL2	*Cleomella plocasperma*	0–6	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–6	–
	James' buckwheat	ERJA	*Eriogonum jamesii*	0–6	–
	manybranched ipomopsis	IPPO2	*Ipomopsis polycladon*	0–6	–
	rusty lupine	LUPU	*Lupinus pusillus*	0–2	–
	tufted evening primrose	OECA10	*Oenothera caespitosa*	0–2	–
	pale evening primrose	OEPA	*Oenothera pallida*	0–2	–
	skyblue phacelia	PHCO	*Phacelia coerulea*	0–2	–
	basindaisy	PLIN7	*Platyschkuhria integrifolia*	0–2	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–2	–
	gilia	GILIA	*Gilia*	0–2	–
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–2	–
	plains springparsley	CYAC	*Cymopterus acaulis*	0–2	–
	desert trumpet	ERIN4	*Eriogonum inflatum*	0–2	–
	woolly bluestar	AMTO2	*Amsonia tomentosa*	0–2	–
	Crescent milkvetch	ASAM5	*Astragalus amphioxys*	0–2	–
	golden spiderflower	CLPL	*Cleome platycarpa*	0–2	–

Table 17. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrub**			78–101	
	blackbrush	CORA	*Coleogyne ramosissima*	78–101	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	3–11	–
3	**Sub-dominant Shrubs**			22–67	
	water jacket	LYAN	*Lycium andersonii*	0–11	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–9	–
	villous lipfern	CHVI	*Cheilanthes villosa*	0–9	–
	crispleaf buckwheat	ERCO14	*Eriogonum corymbosum*	0–9	–
	slender buckwheat	ERMI4	*Eriogonum microthecum*	0–9	–
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	0–9	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–9	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–6	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–6	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–4	–
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–4	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–3	–
Grass/Grasslike					
0	**Dominant Grasses**			11–34	
	James' galleta	PLJA	*Pleuraphis jamesii*	3–34	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–22	–
	cheatgrass	BRTE	*Bromus tectorum*	0–6	–
1	**Sub-dominant Grassea**			6–11	
	squirreltail	ELEL5	*Elymus elymoides*	0–9	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–9	–
	spike dropseed	SPCO4	*Sporobolus contractus*	0–9	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–9	–
	Grass, annual	2GA	*Grass, annual*	0–6	–
	Grass, perennial	2GP	*Grass, perennial*	0–6	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–2	–
	New Mexico feathergrass	HENE5	*Hesperostipa neomexicana*	0–2	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–1	–
	low woollygrass	DAPU7	*Dasyochloa pulchella*	0–1	–
Forb					
2	**Forbs**			17–28	
	Forb, annual	2FA	*Forb, annual*	6–28	–
	Forb, perennial	2FP	*Forb, perennial*	6–28	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–22	–
	snowball sand verbena	ABFR2	*Abronia fragrans*	0–9	–
	twisted cleomella	CLPL2	*Cleomella plocasperma*	0–9	–
	Pagosa ipomopsis	IPPO	*Ipomopsis polyantha*	0–9	–

	James' buckwheat	ERJA	*Eriogonum jamesii*	0–9	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–4	–
	skyblue phacelia	PHCO	*Phacelia coerulea*	0–3	–
	basindaisy	PLIN7	*Platyschkuhria integrifolia*	0–3	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–3	–
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–3	–
	Crescent milkvetch	ASAM5	*Astragalus amphioxys*	0–3	–
	desert trumpet	ERIN4	*Eriogonum inflatum*	0–3	–
	plains springparsley	CYAC	*Cymopterus acaulis*	0–2	–
	golden spiderflower	CLPL	*Cleome platycarpa*	0–1	–
	woolly bluestar	AMTO2	*Amsonia tomentosa*	0–1	–
	gilia	GILIA	*Gilia*	0–1	–
	rusty lupine	LUPU	*Lupinus pusillus*	0–1	–
	tufted evening primrose	OECA10	*Oenothera caespitosa*	0–1	–
	pale evening primrose	OEPA	*Oenothera pallida*	0–1	–

Table 18. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			140–224	
	blackbrush	CORA	*Coleogyne ramosissima*	112–196	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	28–84	–
	mormon tea	EPVI	*Ephedra viridis*	17–67	–
2	**Sub-Dominant Shrubs**			22–56	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	6–17	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–11	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–11	–
	crispleaf buckwheat	ERCOA	*Eriogonum corymbosum var. aureum*	0–11	–
	slender buckwheat	ERMI4	*Eriogonum microthecum*	0–11	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–11	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–11	–
	water jacket	LYAN	*Lycium andersonii*	0–11	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–11	–
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	0–11	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–6	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–6	–
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–6	–
Grass/Grasslike					
0	**Dominant Grasses**			56–101	
	red brome	BRRU2	*Bromus rubens*	22–56	–
	cheatgrass	BRTE	*Bromus tectorum*	22–56	–
	James' galleta	PLJA	*Pleuraphis jamesii*	6–11	–

	Indian ricegrass	ACHY	*Achnatherum hymenoides*	2–11	–
1	**Sub-Dominant Grasses**			11–45	
	Grass, annual	2GA	*Grass, annual*	0–6	–
	Grass, perennial	2GP	*Grass, perennial*	0–6	–
	squirreltail	ELEL5	*Elymus elymoides*	0–6	–
	needle and thread	HECO26	*Hesperostipa comata*	0–6	–
	spike dropseed	SPCO4	*Sporobolus contractus*	0–6	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–6	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–6	–
	New Mexico feathergrass	HENE5	*Hesperostipa neomexicana*	0–2	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–2	–
Forb					
2	**Forbs**			22–34	
	Russian thistle	SAKA	*Salsola kali*	11–22	–
	Forb, annual	2FA	*Forb, annual*	6–11	–
	Forb, perennial	2FP	*Forb, perennial*	6–11	–
	snowball sand verbena	ABFR2	*Abronia fragrans*	0–6	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–6	–
	James' buckwheat	ERJA	*Eriogonum jamesii*	0–6	–
	manybranched ipomopsis	IPPO2	*Ipomopsis polycladon*	0–6	–
	rusty lupine	LUPU	*Lupinus pusillus*	0–2	–
	tufted evening primrose	OECA10	*Oenothera caespitosa*	0–2	–
	pale evening primrose	OEPA	*Oenothera pallida*	0–2	–
	skyblue phacelia	PHCO	*Phacelia coerulea*	0–2	–
	basindaisy	PLIN7	*Platyschkuhria integrifolia*	0–2	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–2	–
	gilia	GILIA	*Gilia*	0–2	–
	woolly bluestar	AMTO2	*Amsonia tomentosa*	0–2	–
	Crescent milkvetch	ASAM5	*Astragalus amphioxys*	0–2	–
	golden spiderflower	CLPL	*Cleome platycarpa*	0–2	–
	twisted cleomella	CLPL2	*Cleomella plocasperma*	0–2	–
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–2	–
	plains springparsley	CYAC	*Cymopterus acaulis*	0–2	–
	desert trumpet	ERIN4	*Eriogonum inflatum*	0–2	–

Animal community

--Wildlife Interpretation--
Small herds of mule deer and pronghorn antelope can be seen grazing/browsing on these sites, especially when near water sources and in the winter. Desert bighorn sheep may utilize this site, when occurring on steeper slopes. The hot climate and lack of water favors small mammals, which have an easier time finding shelter, food, and water to live. Many species of rats, mice, squirrels, bats, and chipmunks can be observed, along with coyotes and foxes. 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 galleta, provide good forage for livestock, however, these species are often not abundant enough to support many livestock. 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 one gone.

This site may serve a duel purpose by also being important habitat for wildlife species such as pronghorn antelope, mule deer, and desert bighorn sheep, and can be important for wintering areas for bighorn sheep. In many places, however, wildlife populations are small and thus have little grazing/beowsing impact on the site.

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

Hydrological functions

The soils associated with this ecological site are generally in Hydrologic Soil Group D due to the shallow depth (NRCS National Engineering Handbook). The runoff curve numbers are 80 through 89 depending on the condition of the watershed. These soils are saturated quickly due to high infiltration rates and shallow depth; once soils are saturated run off potential is high.

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. Improper livestock grazing can alter the sites hydrology by decreasing plant cover and increasing bare ground. Fire, when it occurs, can also affect soil hydrology. Fire intensity, fuel type, soil, climate, and topography can each have different influences. Fires can increase areas of bare ground and hydrophobic layers that reduce infiltration and increase runoff. (National Range and Pasture Handbook, 2003).

Recreational uses

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

Wood products

None

Other information

--Poisonous/Toxic Plant Communities--

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

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

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

Russian thistle can cause 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 an exrended drought, during periods with cool, cloudy days, 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 (improper grazing, drought, off road vehicle overuse, erosion, etc.,) invasive species can establish on the site. Of particular concern in 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 invaders are highly adaptive and can flourish in many locations. Once established, complete removal is difficult but suppression may be possible.

--Fire Ecology--
There is little evidence that this site historically maintained a short burn frequency. It is comprised of scattered shrubs with bare interspaces and a patchy occurrence of grasses, which are unlikely to carry a fire except under extreme conditions such as high wind, high temperature, and low humidity.

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 reburning within those time frames.

Blackbrush is a non-sprouter and is slow to re-establish on burned sites in Utah. Because of its apical dominance trait, twig removal through browsing or mechanical treatment can increase sprouting and new growth.

Blackbrush, because of its tinder-like nature, and resinous foliage, is a very flammable species and in areas with dense spacing can burn. Where annual grasses or forbs are alos present on a site fire frequencies could become shorter.

Inventory data references

The data collected in 2005-2009 were in conjunction with the soil survey update for Arches and Canyonlands National Park. The vegetation data was collected in associated with a soil pit and geo-referenced. All the data is stored as hard copy files in the NRCS Utah State Office.

Type locality

Location 1: San Juan County, UT	
UTM zone	N
UTM northing	4247566
UTM easting	602080
General legal description	Canyonlands National Park

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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). 9/11/08 adapted from Semidesert version of the site by Beckstrand and Green
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, occurring behind litter obstructions in water flow patterns. 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):** 20-60%. 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 and limited in depth by bedrock.

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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 4-5 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 horizon is typically 2 to 8 inches deep. Structure is typically weak medium platy and weak fine granular to weak medium subangular blocky. Color is typically reddish brown (5YR4/3) to yellowish red (5YR5-6/6). 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) = biological soil crusts*.*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.

    Sub-dominant: Cool-season bunchgrasses (e.g. Indian ricegrass) > Warm-season bunchgrasses (e.g. Galleta) > Forbs > trees (e.g. Utah juniper) > other shrubs

    Other: Perennial and annual forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions.
    Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species in the reference state.

    Additional: Factors contributing to temporal variability include wildlife (deer) use; drought and insects (though these have minimal direct impacts on the dominant plant (blackbrush)).
    Factors contributing to spatial variability include texture, depth and coarse fragment (rock/gravel) content, slope and aspect

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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 15% 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 10-15% 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):** 200-250 #/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. **References::** 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.
