USDA Natural Resources
Conservation Service

Ecological site R035XY210UT
Semidesert Sand (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.

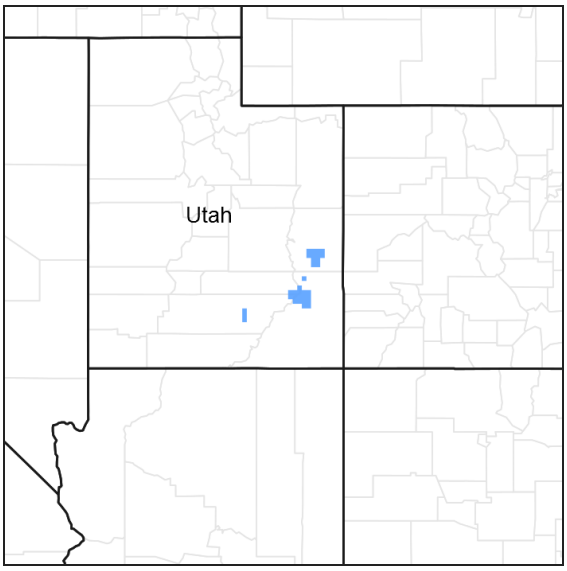


Figure 1. Mapped extent

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.

Associated sites

R035XY215UT	**Semidesert Sandy Loam (4-Wing Saltbush)**
R035XY233UT	**Semidesert Shallow Sandy Loam (Blackbrush)**

Similar sites

R035XY218UT	**Semidesert Sandy Loam (Blackbrush)**
R035XY121UT	**Desert Sandy Loam (Blackbrush)**
R035XY212UT	**Semidesert Sand (Fourwing Saltbush)**

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Coleogyne ramosissima* (2) *Ephedra cutleri*
Herbaceous	(1) *Achnatherum hymenoides* (2) *Hesperostipa comata*

Physiographic features

This site occurs on dunes on mesas and structural benches, interdunes, and shrub coppice dunes on sand sheets. Run off very low to low. Slopes typically range from 2-15%. Elevations are generally 4100 to 6860 ft.

Table 2. Representative physiographic features

Landforms	(1) Dune (2) Interdune (3) Sand sheet
Elevation	4,100–6,860 ft
Slope	2–15%
Aspect	Aspect is not a significant factor

Climatic features

Average annual precipitation is 9 to 13 inches. Approximately 77 percent occurs as rain from March through October. On the average, February, May, and June are the driest months and April, August, September, and October are the wettest months. The mean annual air temperature is 43-71 degrees Fahrenheit. The average frost-free period is 184 to 212 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)	212 days
Freeze-free period (average)	239 days
Precipitation total (average)	12 in

Influencing water features

There are no water features influencing this site.

Soil features

The soils are deep to very deep. The surface layer is typically reddish brown. Surface soil texture is fine sand. These soils are excessively well drained. The soil temperature and moisture regimes are mesic and ustic aridic respectively. Runoff is very low to low depending on slope and permeability—the coarser the soil the slower the runoff. 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:

UT - Capitol Reef National Park - Mido;
UT687—Arches National Park — Mido;
UT688—Canyonlands National Park - Mido;

Table 4. Representative soil features

Parent material	(1) Alluvium–sandstone

Surface texture	(1) Fine sand
Family particle size	(1) Sandy
Drainage class	Excessively drained
Permeability class	Rapid
Soil depth	40–70 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0–5%
Available water capacity (0-40in)	2–3.9 in
Calcium carbonate equivalent (0-40in)	0–5%
Electrical conductivity (0-40in)	0 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0–3%

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 Cutler's jointfir also commonly occurring. The amount of Indian ricegrass, needle-and-thread and other perennial grasses present is dependant on weather patterns (summer or winter precipitation)and the stability of the sites soil surface. The less structure in 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 historical evidence to indicate that this site maintained a short burn frequency. Large gaps between plants (discontinuous fuels)in relic areas indicate that this site may have 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 improper livestock grazing, brush treatments and harmful 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, can cause the site to become at risk to burn. 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.

Where this site is grazed, 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 may decrease while yellow cryptantha, locoweed, blackbrush, and snakeweed may increase. Improper grazing may also increase the chance for invasion by cheatgrass, red brome and invasive annual forbs. On the Colorado Plateau, however, these species are capable of establishing themselves on some sites even in the abscence of disturbance, but rarely increase to a point where they dominate in blackbrush communities.

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.

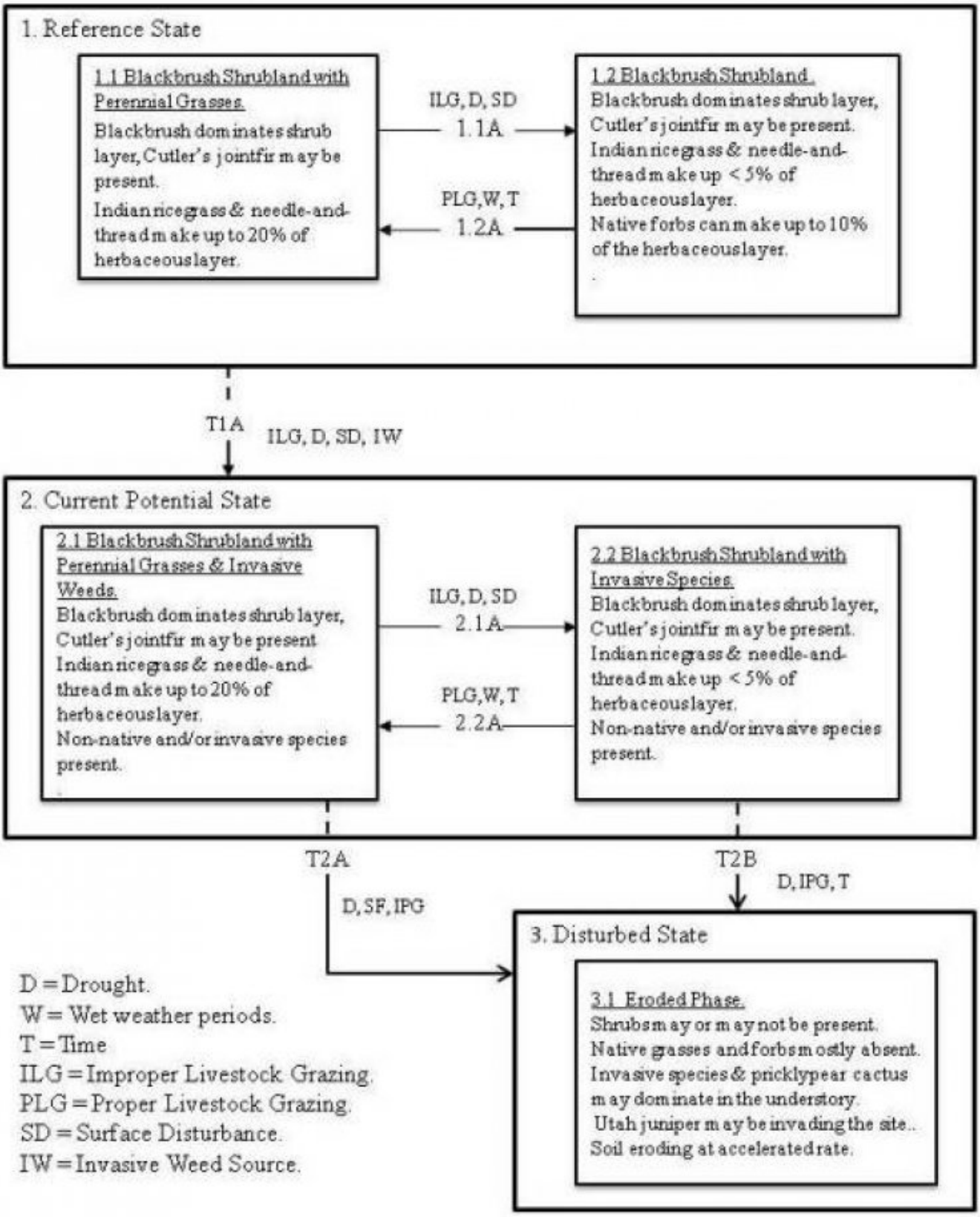
Suitability for rangeland seeding is very poor. It is not practical to revegetate large areas of this ecological site because of sandy soil textures, low annual precipitation, and very low available water capacity. To control erosion in areas where the need is critical, small areas can be mechanically treated and seeded.

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: D35 - Colorado Plateau.
R035XY210UT – Semidesert Sand (Blackbrush)



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 community and ecological dynamics of the Semidesert Sand, 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. Primary disturbance mechanisms include climate fluctuations and both native and domestic herbivore grazing. Timing of these disturbances dictates the ecological dynamics that occur. The reference state is self sustaining and resistant to change due to high resistance to natural disturbances and high resilience following natural disturbances. Once invasive plants establish, return to the reference state may not be possible. 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 4. Blackbrush with Perennial Grasses

This community phase is characterized by a blackbrush dominated shrub layer with Cutler's jointfir is also commonly present. Perennial grasses are also be present. Commonly occurring grasses include Indian ricegrass, needle-and-thread, Jamres galleta, six weeks fescue, and several dropseed species. These species are often concentrated near or within 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. The composition by air dry weight is approximately 10 percent forbs, 20 percent grasses, and 70 percent shrubs. Biological crust cover is also extremely variable on this site. The following tables provide an example of the typical vegetative floristics of a commumity 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	150	190	270
Grass/Grasslike	20	60	100
Forb	20	40	70
Tree	0	0	0
Total	**190**	**290**	**440**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	35-65%
Grass/grasslike foliar cover	10-25%
Forb foliar cover	5-15%
Non-vascular plants	0%
Biological crusts	0-30%
Litter	0-10%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0-5%
Bedrock	40-70%
Water	0%
Bare ground	20-65%

Table 7. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-10%	3-10%	0-10%
>0.5 <= 1	–	0-10%	0-10%	0-6%
>1 <= 2	–	5-15%	0-5%	0-5%
>2 <= 4.5	0-5%	5-15%	–	–
>4.5 <= 13	0-5%	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 1.2
Blackbrush Shrubland

Figure 6. Blackbrush Shrubland

This community phase is characterized by a shrub canopy dominated by blackbrush and Cutler's jointfir, a few perennial grasses may also be present. Where perennial grasses are present, Indian ricegrass, needle-and-thread, James galleta, 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 not 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. Biological crust cover is also extremely variable on this site. 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 (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	150	190	270
Forb	20	30	50
Grass/Grasslike	10	30	50
Total	**180**	**250**	**370**

Table 9. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	40-80%
Grass/grasslike foliar cover	0-20%
Forb foliar cover	0-15%
Non-vascular plants	0%
Biological crusts	0-30%
Litter	0-5%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0-5%
Bedrock	40-70%
Water	0%
Bare ground	25-65%

Table 10. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-10%	3-10%	0-10%
>0.5 <= 1	–	0-10%	0-10%	0-6%
>1 <= 2	–	5-15%	0-5%	0-5%
>2 <= 4.5	0-5%	5-15%	–	–
>4.5 <= 13	0-5%	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

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. This state is generally dominated by blackbrush. Disturbance mechanisms that may occur include climate fluctuations, native herbivore grazing, domestic livestock grazing, and surface disturbances such as road and pipeline development and off road vehicle (OHV) use. The current potential state is still self sustaining but is losing resistance to change due to a lower resistance to disturbances and lower a resilience following disturbances. New disturbances such as fire are now more likely to occur. Current Potential State: Plant communities resistant to climate fluctuations, herbivore grazing, and surface disturbance. 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 climate that allow for a self sustaining blackbrush and grass community. Trigger: Conditions which allow the sites soil to lose structure.

Community 2.1
Blackbrush Shrubland with Perennial Grasses & Invasive Species.

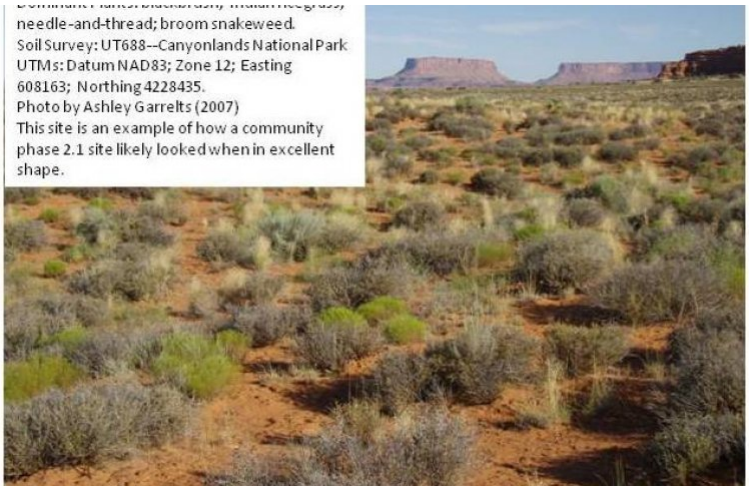


Figure 8. Blackbrush with Grasses & Weeds

This community phase is characterized by a blackbrush dominated shrub layer with Cutler's jointfir is also commonly present. Perennial and invasive grasses are also be present. Commonly occurring native grasses include Indian ricegrass, needle-and-thread, James galleta, six weeks fescue, and several dropseed species. Commonly occurring invasive species include cheatgrass, red brome and Russian thistle. These species are often concentrated near or within the shrub canopy. As both perennial and annual herbaceous cover increases, shrub interspaces are filled. Other perennial grasses, shrubs, and forbs may also be present and cover is variable. The composition by air dry weight is approximately 10 percent forbs, 20 percent grasses, 20-30 percent annual grasses and 70 percent shrubs. Biological crust cover is also extremely variable on this site. 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	150	190	270
Grass/Grasslike	20	60	100
Forb	20	40	70
Tree	0	0	20
Total	**190**	**290**	**460**

Table 12. Ground cover

Tree foliar cover	0-15%
Shrub/vine/liana foliar cover	0-52%
Grass/grasslike foliar cover	0-25%
Forb foliar cover	0-21%
Non-vascular plants	0%
Biological crusts	0-60%
Litter	0-10%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0-5%
Bedrock	40-71%
Water	0%
Bare ground	25-65%

Table 13. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-10%	3-10%	0-10%
>0.5 <= 1	–	0-10%	0-10%	0-6%
>1 <= 2	–	0-10%	0-5%	0-5%
>2 <= 4.5	0-5%	5-15%	–	–
>4.5 <= 13	0-5%	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 2.2
Blackbrush Shrubland with Invasive Species.

Figure 10. Blackbrush with Weeds.

This community phase is characterized by a shrub canopy dominated by blackbrush and Cutler's jointfir, a few perennial grasses may also be present. Where grasses are present, Indian ricegrass, needle-and-thread, James galleta, 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. Invasive annuals are now present with cheatgrass, red brome and Russian thistle being the most common. Other perennial grasses, shrubs, and forbs 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. Biological crust cover is also extremely variable on this site. 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	150	190	270
Forb	20	30	50
Grass/Grasslike	10	30	50
Total	**180**	**250**	**370**

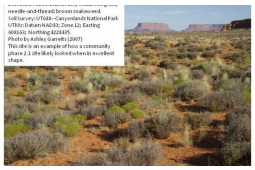
Table 15. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	40-80%
Grass/grasslike foliar cover	0-20%
Forb foliar cover	0-15%
Non-vascular plants	0%
Biological crusts	0-30%
Litter	0-5%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0-5%
Bedrock	40-70%
Water	0%
Bare ground	25-65%

Table 16. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-10%	3-10%	0-10%
>0.5 <= 1	–	0-10%	0-10%	0-6%
>1 <= 2	–	5-15%	0-5%	0-5%
>2 <= 4.5	0-5%	5-15%	–	–
>4.5 <= 13	0-5%	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Pathway 2.1A
Community 2.1 to 2.2

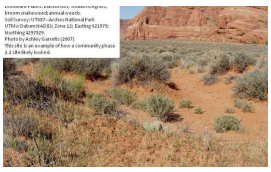


Blackbrush Shrubland with Perennial Grasses & Invasive Species.

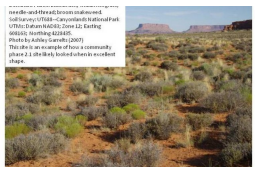
Blackbrush Shrubland with Invasive Species.

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

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.

State 3
Disturbed State

This phase of the ecological state is characterized as highly disturbed. Blackbrush and other shrubs may or may not be present in the community. Where other shrubs are present, Cutler's and Torrey's jointfir, are common species. Perennial grasses and forbs are mostly missing. Pricklypear cactus, cheatgrass, red brome, and Russian thistle may be present. Utah juniper may be invading this site if a seed source is present. The appearance of many forbs is episodic in nature and is closely tied to precipitation events.

Community 3.1
Eroded Phase.

Figure 12. Eroded Site.

Figure 13. Eroded Site.

This community phase is highly variable. Native shrubs and grasses are significantly reduced or missing. Where shrubs are present, some blackbrush and Cutler's jointfir may occur along with invasive species such as pricklypear cactus, broom snakeweed, and rubber rabbitbrush. A few perennial grasses may also be present. Where perennial grasses are present, Indian ricegrass, needle-and-thread, James galleta, six weeks fescue, and dropseed species are most common with many occurring solely in the shrub canopy. Invasive species such as Cheatgrass, rdr brome and Russian thistle may also be present. Cryptogamic crust, where present, may be holding the soil in place. As this biological crust is reduced, the soil takes on a "dimpled look". As deteration continues, soils lose structure and become loose sand. Air dry weight is approximately 5-20 percent forbs, 0-5 percent perennial grasses, 10 to 50 percent invasive annual grasses and forbs and 30-80 percent shrubs. Bare ground is variable (0-40%) depending on biological crust cover, which is also variable (5-35%) and surface rock fragments (3-60%). The following tables provide an example of the typical vegetative floristics of a commumity phase 3.1 plant community.

Table 17. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	150	190	270
Forb	20	30	50
Grass/Grasslike	10	30	50
Total	**180**	**250**	**370**

Table 18. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	40-80%
Grass/grasslike foliar cover	0-20%

Forb foliar cover	0-15%
Non-vascular plants	0%
Biological crusts	0-30%
Litter	0-5%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0-5%
Bedrock	40-70%
Water	0%
Bare ground	0-65%

Table 19. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-10%	3-10%	0-10%
>0.5 <= 1	–	0-10%	0-10%	0-6%
>1 <= 2	–	5-15%	0-5%	0-5%
>2 <= 4.5	0-5%	5-15%	–	–
>4.5 <= 13	0-5%	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

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 grass understory in the reference state to a state that contains invasive species. Events include season long continuous grazing of perennial grasses, prolonged drought, and surface disturbances, etc. 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.

Transition T2A
State 2 to 3

Transition from Community Phase 2.1 to Disturbed State (State 3). This transition is from a mix of native shrubs and grasses along with invasive annual species found in community phase 2.1 to a state that is dominated by pricklypear cactus, broon snakeweed and/or a mix other non-native, invasive species. Events include season long continuous grazing of perennial grasses, prolonged drought, surface disturbances, etc. Once invasive species dominate the plant community a threshold has been crossed.

Transition T2B
State 2 to 3

Transition from Community Phase 2.2 to Disturbed State (State 3). This transition is from a mix of native shrubs and grasses along with invasive annual species found in community phase 2.2 to a state that is dominated by pricklypear cactus, broon snakeweed and/or a mix other non-native, invasive species. Events include long periods of season long continuous grazing of perennial grasses, and/or prolonged drought. Once invasive species dominate the plant community a threshold has been crossed.

Additional community tables

Table 20. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrub**			90–200	
	blackbrush	CORA	*Coleogyne ramosissima*	90–200	–
3	**Sub-dominant Shrubs**			35–90	
	Cutler's jointfir	EPCU	*Ephedra cutleri*	5–75	–
	sand sagebrush	ARFI2	*Artemisia filifolia*	5–70	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	2–45	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	5–40	–
	mormon tea	EPVI	*Ephedra viridis*	2–40	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–30	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	4–30	–
	Fremont's mahonia	MAFR3	*Mahonia fremontii*	0–25	–
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	3–25	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–25	–
	common dunebroom	PAFI4	*Parryella filifolia*	0–20	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–15	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	2–15	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	8–15	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–10	–
	Whipple's fishhook cactus	SCWH	*Sclerocactus whipplei*	0–3	–
	singleleaf ash	FRAN2	*Fraxinus anomala*	0–2	–
Grass/Grasslike					
0	**Dominant Grass**			20–50	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	10–40	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	5–40	–
	James' galleta	PLJA	*Pleuraphis jamesii*	5–25	–
1	**Sub-dominant Grass**			0–25	
	blue grama	BOGR2	*Bouteloua gracilis*	0–20	–
	New Mexico feathergrass	HENE5	*Hesperostipa neomexicana*	0–20	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–20	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–10	–
	spike dropseed	SPCO4	*Sporobolus contractus*	0–10	–
	Grass, annual	2GA	*Grass, annual*	0–10	–
	Grass, perennial	2GP	*Grass, perennial*	0–10	–
	threeawn	ARIST	*Aristida*	0–10	–
	squirreltail	ELEL5	*Elymus elymoides*	0–2	–
Forb					
2	**Forbs**			20–70	
	cryptantha	CRYPT	*Cryptantha*	2–30	–
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–30	–

	Wright's bird's beak	CORWR2	*Cordylanthus wrightii*	0–30	–
	frosted mint	POIN3	*Poliomintha incana*	5–30	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	2–25	–
	Jones' pepperweed	LEMOJ	*Lepidium montanum var. jonesii*	1–25	–
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–20	–
	sand buckwheat	ERLE9	*Eriogonum leptocladon*	5–20	–
	pointed gumweed	GRFA	*Grindelia fastigiata*	0–20	–
	Utah juniper	JUOS	*Juniperus osteosperma*	0–20	–
	pale evening primrose	OEPA	*Oenothera pallida*	0–15	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–15	–
	woodyaster	XYLOR	*Xylorhiza*	5–15	–
	lobeleaf groundsel	PAMU11	*Packera multilobata*	3–10	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–8	–
	desert princesplume	STPI	*Stanleya pinnata*	0–8	–
	basindaisy	PLIN7	*Platyschkuhria integrifolia*	0–7	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–5	–
	Esteve's pincushion	CHST	*Chaenactis stevioides*	0–5	–
	red dome blanketflower	GAPI	*Gaillardia pinnatifida*	0–5	–
	stickseed	LAPPU	*Lappula*	0–4	–
	bristle flax	LIAR3	*Linum aristatum*	1–4	–
	rusty lupine	LUPU	*Lupinus pusillus*	0–2	–
	cleftleaf wildheliotrope	PHCR	*Phacelia crenulata*	0–2	–
	gilia	GILIA	*Gilia*	0–2	–
	pinkthroat morning-glory	IPLO	*Ipomoea longifolia*	0–2	–
	spider milkweed	ASAS	*Asclepias asperula*	0–2	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–2	–
	Fendler's sandmat	CHFE3	*Chamaesyce fendleri*	0–2	–
	Parry's sandmat	CHPA28	*Chamaesyce parryi*	0–2	–
	Townsend daisy	TOWNS	*Townsendia*	0–2	–
	pillar false gumweed	VAST3	*Vanclevea stylosa*	0–2	–
	prairie clover	DALEA	*Dalea*	0–1	–
	larkspur	DELPH	*Delphinium*	0–1	–
	buckwheat	ERIOG	*Eriogonum*	0–1	–
	Wetherill's buckwheat	ERWE	*Eriogonum wetherillii*	0–1	–
	Newberry's twinpod	PHNE5	*Physaria newberryi*	0–1	–
	dock	RUMEX	*Rumex*	0–1	–
	ragwort	SENEC	*Senecio*	0–1	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–1	–
	small wirelettuce	STEX	*Stephanomeria exigua*	0–1	–
	longbeak streptanthella	STLO4	*Streptanthella longirostris*	0–1	–

Table 21. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)

Shrub/Vine					
0	**Dominant Shrub**			90–200	
	blackbrush	CORA	*Coleogyne ramosissima*	90–200	–
3	**Sub-dominant Shrubs**			35–90	
	Cutler's jointfir	EPCU	*Ephedra cutleri*	4–75	–
	sand sagebrush	ARFI2	*Artemisia filifolia*	6–70	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	2–45	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	4–40	–
	mormon tea	EPVI	*Ephedra viridis*	2–40	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–30	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	4–30	–
	Fremont's mahonia	MAFR3	*Mahonia fremontii*	0–25	–
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	3–25	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–25	–
	common dunebroom	PAFI4	*Parryella filifolia*	0–20	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–15	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	2–15	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	8–15	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–10	–
	Whipple's fishhook cactus	SCWH	*Sclerocactus whipplei*	0–3	–
	singleleaf ash	FRAN2	*Fraxinus anomala*	0–2	–
Grass/Grasslike					
0	**Dominant Grass**			5–15	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	2–15	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–15	–
	James' galleta	PLJA	*Pleuraphis jamesii*	2–10	–
1	**Sub-dominant Grass**			0–15	
	blue grama	BOGR2	*Bouteloua gracilis*	0–20	–
	New Mexico feathergrass	HENE5	*Hesperostipa neomexicana*	0–15	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–15	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–10	–
	spike dropseed	SPCO4	*Sporobolus contractus*	0–10	–
	Grass, annual	2GA	*Grass, annual*	0–10	–
	Grass, perennial	2GP	*Grass, perennial*	0–10	–
	threeawn	ARIST	*Aristida*	0–10	–
	squirreltail	ELEL5	*Elymus elymoides*	0–2	–
Forb					
2	**Forbs**			20–70	
	cryptantha	CRYPT	*Cryptantha*	2–30	–
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–30	–
	frosted mint	POIN3	*Poliomintha incana*	5–30	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	2–25	–
	Jones' pepperweed	LEMOJ	*Lepidium montanum var. jonesii*	1–24	–

	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–21	–
	pointed gumweed	GRFA	*Grindelia fastigiata*	0–20	–
	sand buckwheat	ERLE9	*Eriogonum leptocladon*	6–19	–
	pale evening primrose	OEPA	*Oenothera pallida*	0–15	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–15	–
	woodyaster	XYLOR	*Xylorhiza*	5–15	–
	lobeleaf groundsel	PAMU11	*Packera multilobata*	3–10	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–8	–
	desert princesplume	STPI	*Stanleya pinnata*	0–8	–
	basindaisy	PLIN7	*Platyschkuhria integrifolia*	0–7	–
	Esteve's pincushion	CHST	*Chaenactis stevioides*	0–5	–
	red dome blanketflower	GAPI	*Gaillardia pinnatifida*	0–5	–
	stickseed	LAPPU	*Lappula*	0–4	–
	bristle flax	LIAR3	*Linum aristatum*	1–4	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–4	–
	Townsend daisy	TOWNS	*Townsendia*	0–2	–
	pillar false gumweed	VAST3	*Vanclevea stylosa*	0–2	–
	rusty lupine	LUPU	*Lupinus pusillus*	0–2	–
	cleftleaf wildheliotrope	PHCR	*Phacelia crenulata*	0–2	–
	gilia	GILIA	*Gilia*	0–2	–
	pinkthroat morning-glory	IPLO	*Ipomoea longifolia*	0–2	–
	spider milkweed	ASAS	*Asclepias asperula*	0–2	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–2	–
	Fendler's sandmat	CHFE3	*Chamaesyce fendleri*	0–2	–
	Parry's sandmat	CHPA28	*Chamaesyce parryi*	0–2	–
	prairie clover	DALEA	*Dalea*	0–1	–
	larkspur	DELPH	*Delphinium*	0–1	–
	buckwheat	ERIOG	*Eriogonum*	0–1	–
	Wetherill's buckwheat	ERWE	*Eriogonum wetherillii*	0–1	–
	Newberry's twinpod	PHNE5	*Physaria newberryi*	0–1	–
	dock	RUMEX	*Rumex*	0–1	–
	ragwort	SENEC	*Senecio*	0–1	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–1	–
	small wirelettuce	STEX	*Stephanomeria exigua*	0–1	–
	longbeak streptanthella	STLO4	*Streptanthella longirostris*	0–1	–
Tree					
4	**Trees**			0–20	
	Utah juniper	JUOS	*Juniperus osteosperma*	0–20	–

Table 22. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrub**			90–200	

	blackbrush	CORA	*Coleogyne ramosissima*	90–200	–
3	**Sub-dominant Shrubs**			35–90	
	Cutler's jointfir	EPCU	*Ephedra cutleri*	4–76	–
	sand sagebrush	ARFI2	*Artemisia filifolia*	6–70	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	2–45	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	4–40	–
	mormon tea	EPVI	*Ephedra viridis*	2–40	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	4–30	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–30	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–28	–
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	3–25	–
	Fremont's mahonia	MAFR3	*Mahonia fremontii*	0–25	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–24	–
	common dunebroom	PAFI4	*Parryella filifolia*	0–19	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	8–15	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	2–14	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–10	–
	Whipple's fishhook cactus	SCWH	*Sclerocactus whipplei*	0–3	–
	singleleaf ash	FRAN2	*Fraxinus anomala*	0–2	–
	spiny hopsage	GRSP	*Grayia spinosa*	0–2	–
Grass/Grasslike					
0	**Dominant Grass**			20–90	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	5–35	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	5–30	–
	James' galleta	PLJA	*Pleuraphis jamesii*	2–25	–
	cheatgrass	BRTE	*Bromus tectorum*	5–15	–
1	**Sub-dominant Grass**			0–22	
	New Mexico feathergrass	HENE5	*Hesperostipa neomexicana*	0–22	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–20	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–18	–
	spike dropseed	SPCO4	*Sporobolus contractus*	0–12	–
	threeawn	ARIST	*Aristida*	0–12	–
	Grass, annual	2GA	*Grass, annual*	0–10	–
	Grass, perennial	2GP	*Grass, perennial*	0–10	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–8	–
	squirreltail	ELEL5	*Elymus elymoides*	0–2	–
Forb					
2	**Forbs**			20–70	
	cryptantha	CRYPT	*Cryptantha*	2–30	–
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–30	–
	frosted mint	POIN3	*Poliomintha incana*	5–30	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	2–25	–
	Jones' pepperweed	LEMOJ	*Lepidium montanum var. jonesii*	1–24	–

	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–21	–
	pointed gumweed	GRFA	*Grindelia fastigiata*	0–20	–
	Utah juniper	JUOS	*Juniperus osteosperma*	0–20	–
	sand buckwheat	ERLE9	*Eriogonum leptocladon*	6–19	–
	pale evening primrose	OEPA	*Oenothera pallida*	0–15	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–15	–
	woodyaster	XYLOR	*Xylorhiza*	5–15	–
	lobeleaf groundsel	PAMU11	*Packera multilobata*	3–10	–
	prickly Russian thistle	SATR12	*Salsola tragus*	1–8	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–8	–
	desert princesplume	STPI	*Stanleya pinnata*	0–8	–
	basindaisy	PLIN7	*Platyschkuhria integrifolia*	0–7	–
	Esteve's pincushion	CHST	*Chaenactis stevioides*	0–5	–
	red dome blanketflower	GAPI	*Gaillardia pinnatifida*	0–5	–
	plains springparsley	CYAC	*Cymopterus acaulis*	2–5	–
	tansymustard	DESCU	*Descurainia*	0–4	–
	stickseed	LAPPU	*Lappula*	0–4	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–4	–
	bristle flax	LIAR3	*Linum aristatum*	0–4	–
	rusty lupine	LUPU	*Lupinus pusillus*	0–2	–
	flaxflowered ipomopsis	IPLO2	*Ipomopsis longiflora*	0–2	–
	cleftleaf wildheliotrope	PHCR	*Phacelia crenulata*	0–2	–
	Newberry's twinpod	PHNE5	*Physaria newberryi*	0–2	–
	spider milkweed	ASAS	*Asclepias asperula*	0–2	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–2	–
	Fendler's sandmat	CHFE3	*Chamaesyce fendleri*	0–2	–
	Parry's sandmat	CHPA28	*Chamaesyce parryi*	0–2	–
	prairie clover	DALEA	*Dalea*	0–1	–
	larkspur	DELPH	*Delphinium*	0–1	–
	fleabane	ERIGE2	*Erigeron*	0–1	–
	buckwheat	ERIOG	*Eriogonum*	0–1	–
	shy gilia	GIIN2	*Gilia inconspicua*	0–1	–
	Wetherill's buckwheat	ERWE	*Eriogonum wetherillii*	0–1	–
	ragwort	SENEC	*Senecio*	0–1	–
	dock	RUMEX	*Rumex*	0–1	–
	Townsend daisy	TOWNS	*Townsendia*	0–1	–
	pillar false gumweed	VAST3	*Vanclevea stylosa*	0–1	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–1	–
	longbeak streptanthella	STLO4	*Streptanthella longirostris*	0–1	–

Table 23. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					

0	**Dominant Shrub**			90–200	
	blackbrush	CORA	*Coleogyne ramosissima*	90–200	–
3	**Sub-dominant Shrubs**			35–90	
	Cutler's jointfir	EPCU	*Ephedra cutleri*	4–75	–
	sand sagebrush	ARFI2	*Artemisia filifolia*	6–70	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	2–45	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	4–40	–
	mormon tea	EPVI	*Ephedra viridis*	2–40	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–30	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	4–30	–
	Fremont's mahonia	MAFR3	*Mahonia fremontii*	0–25	–
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	3–25	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–25	–
	common dunebroom	PAFI4	*Parryella filifolia*	0–20	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–15	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	2–15	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	8–15	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–10	–
	Whipple's fishhook cactus	SCWH	*Sclerocactus whipplei*	0–3	–
	singleleaf ash	FRAN2	*Fraxinus anomala*	0–2	–
Grass/Grasslike					
0	**Dominant Grass**			5–15	
	cheatgrass	BRTE	*Bromus tectorum*	5–30	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–15	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	2–15	–
	James' galleta	PLJA	*Pleuraphis jamesii*	2–10	–
1	**Sub-dominant Grass**			0–15	
	blue grama	BOGR2	*Bouteloua gracilis*	0–20	–
	New Mexico feathergrass	HENE5	*Hesperostipa neomexicana*	0–15	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–15	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–10	–
	spike dropseed	SPCO4	*Sporobolus contractus*	0–10	–
	Grass, annual	2GA	*Grass, annual*	0–10	–
	Grass, perennial	2GP	*Grass, perennial*	0–10	–
	threeawn	ARIST	*Aristida*	0–10	–
	squirreltail	ELEL5	*Elymus elymoides*	0–2	–
Forb					
2	**Forbs**			20–70	
	cryptantha	CRYPT	*Cryptantha*	2–30	–
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–30	–
	frosted mint	POIN3	*Poliomintha incana*	5–30	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	2–25	–
	Jones' pepperweed	LEMOJ	*Lepidium montanum var. jonesii*	1–24	–

	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–21	–
	pointed gumweed	GRFA	*Grindelia fastigiata*	0–20	–
	sand buckwheat	ERLE9	*Eriogonum leptocladon*	6–19	–
	pale evening primrose	OEPA	*Oenothera pallida*	0–15	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–15	–
	woodyaster	XYLOR	*Xylorhiza*	5–15	–
	lobeleaf groundsel	PAMU11	*Packera multilobata*	3–10	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–8	–
	desert princesplume	STPI	*Stanleya pinnata*	0–8	–
	basindaisy	PLIN7	*Platyschkuhria integrifolia*	0–7	–
	Esteve's pincushion	CHST	*Chaenactis stevioides*	0–5	–
	red dome blanketflower	GAPI	*Gaillardia pinnatifida*	0–5	–
	stickseed	LAPPU	*Lappula*	0–4	–
	bristle flax	LIAR3	*Linum aristatum*	1–4	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–4	–
	Townsend daisy	TOWNS	*Townsendia*	0–2	–
	pillar false gumweed	VAST3	*Vanclevea stylosa*	0–2	–
	rusty lupine	LUPU	*Lupinus pusillus*	0–2	–
	cleftleaf wildheliotrope	PHCR	*Phacelia crenulata*	0–2	–
	gilia	GILIA	*Gilia*	0–2	–
	pinkthroat morning-glory	IPLO	*Ipomoea longifolia*	0–2	–
	spider milkweed	ASAS	*Asclepias asperula*	0–2	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–2	–
	Fendler's sandmat	CHFE3	*Chamaesyce fendleri*	0–2	–
	Parry's sandmat	CHPA28	*Chamaesyce parryi*	0–2	–
	prairie clover	DALEA	*Dalea*	0–1	–
	larkspur	DELPH	*Delphinium*	0–1	–
	buckwheat	ERIOG	*Eriogonum*	0–1	–
	Wetherill's buckwheat	ERWE	*Eriogonum wetherillii*	0–1	–
	Newberry's twinpod	PHNE5	*Physaria newberryi*	0–1	–
	dock	RUMEX	*Rumex*	0–1	–
	ragwort	SENEC	*Senecio*	0–1	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–1	–
	small wirelettuce	STEX	*Stephanomeria exigua*	0–1	–
	longbeak streptanthella	STLO4	*Streptanthella longirostris*	0–1	–
Tree					
4	**Trees**			0–20	
	Utah juniper	JUOS	*Juniperus osteosperma*	0–20	–

Table 24. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					

0	**Dominant Shrub**			10–100	
	blackbrush	CORA	*Coleogyne ramosissima*	10–100	–
3	**Sub-dominant Shrubs**			35–90	
	Cutler's jointfir	EPCU	*Ephedra cutleri*	4–75	–
	sand sagebrush	ARFI2	*Artemisia filifolia*	6–70	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–60	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	2–45	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	4–40	–
	mormon tea	EPVI	*Ephedra viridis*	2–40	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–30	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	4–30	–
	Fremont's mahonia	MAFR3	*Mahonia fremontii*	0–25	–
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	3–25	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–25	–
	common dunebroom	PAFI4	*Parryella filifolia*	0–20	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	2–15	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	8–15	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–10	–
	Whipple's fishhook cactus	SCWH	*Sclerocactus whipplei*	0–3	–
	singleleaf ash	FRAN2	*Fraxinus anomala*	0–2	–
Grass/Grasslike					
0	**Dominant Grass**			5–15	
	cheatgrass	BRTE	*Bromus tectorum*	10–50	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–15	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–15	–
	James' galleta	PLJA	*Pleuraphis jamesii*	0–10	–
1	**Sub-dominant Grass**			5–15	
	Grass, annual	2GA	*Grass, annual*	10–30	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–20	–
	New Mexico feathergrass	HENE5	*Hesperostipa neomexicana*	0–15	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–15	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–10	–
	spike dropseed	SPCO4	*Sporobolus contractus*	0–10	–
	Grass, perennial	2GP	*Grass, perennial*	0–10	–
	threeawn	ARIST	*Aristida*	0–10	–
	squirreltail	ELEL5	*Elymus elymoides*	0–2	–
Forb					
2	**Forbs**			20–70	
	cryptantha	CRYPT	*Cryptantha*	2–30	–
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–30	–
	frosted mint	POIN3	*Poliomintha incana*	5–30	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	2–25	–
	Jones' pepperweed	LEMOJ	*Lepidium montanum var. jonesii*	1–25	–

	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–20	–
	pointed gumweed	GRFA	*Grindelia fastigiata*	0–20	–
	sand buckwheat	ERLE9	*Eriogonum leptocladon*	6–19	–
	pale evening primrose	OEPA	*Oenothera pallida*	0–15	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–15	–
	woodyaster	XYLOR	*Xylorhiza*	5–15	–
	lobeleaf groundsel	PAMU11	*Packera multilobata*	3–10	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–8	–
	desert princesplume	STPI	*Stanleya pinnata*	0–8	–
	basindaisy	PLIN7	*Platyschkuhria integrifolia*	0–7	–
	Esteve's pincushion	CHST	*Chaenactis stevioides*	0–5	–
	red dome blanketflower	GAPI	*Gaillardia pinnatifida*	0–5	–
	stickseed	LAPPU	*Lappula*	0–4	–
	bristle flax	LIAR3	*Linum aristatum*	1–4	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–4	–
	Townsend daisy	TOWNS	*Townsendia*	0–2	–
	pillar false gumweed	VAST3	*Vanclevea stylosa*	0–2	–
	rusty lupine	LUPU	*Lupinus pusillus*	0–2	–
	cleftleaf wildheliotrope	PHCR	*Phacelia crenulata*	0–2	–
	gilia	GILIA	*Gilia*	0–2	–
	pinkthroat morning-glory	IPLO	*Ipomoea longifolia*	0–2	–
	spider milkweed	ASAS	*Asclepias asperula*	0–2	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–2	–
	Fendler's sandmat	CHFE3	*Chamaesyce fendleri*	0–2	–
	Parry's sandmat	CHPA28	*Chamaesyce parryi*	0–2	–
	prairie clover	DALEA	*Dalea*	0–1	–
	larkspur	DELPH	*Delphinium*	0–1	–
	buckwheat	ERIOG	*Eriogonum*	0–1	–
	Wetherill's buckwheat	ERWE	*Eriogonum wetherillii*	0–1	–
	Newberry's twinpod	PHNE5	*Physaria newberryi*	0–1	–
	dock	RUMEX	*Rumex*	0–1	–
	ragwort	SENEC	*Senecio*	0–1	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–1	–
	small wirelettuce	STEX	*Stephanomeria exigua*	0–1	–
	longbeak streptanthella	STLO4	*Streptanthella longirostris*	0–1	–
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

The soil in this site is in hydrologic group A (NRCS National Engineering Handbook). These soils are well to excessively drained and have low runoff potential. Hydrological groups are used in equations that estimate runoff from rainfall. These estimates are needed for solving hydrologic problems that arise in planning watershed-protection and flood-prevention projects and for designing structures for the use, control and disposal of water. Improper livestock grazing can alter the sites hydrology by decreasing plant cover and increasing bare ground. Fire can also affect hydrology, but it is variable. Fire intensity, fuel type, soil, climate, and topography can each have different influences. Fires can increase areas of bare ground and hydrophobic layers that reduce infiltration and increase runoff (National Range and Pasture Handbook, 2003).

Recreational uses

Recreation activities include aesthetic value and 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

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

Woolly locoweed is toxic to all classes of livestock and wildlife. This plant is palatable and has similar nutrient value to alfalfa which may cause animals to consume it even when other forage is available. Locoweed contains swainsonine (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 graze broom snakeweed when other forage is unavailable, typically in winter when toxicity levels are at their lowest. (Knight and Walter, 2001).

Sand sagebrush is toxic to horses, but not to other livestock and wildlife ruminants. This plant contains sesquiterpene lactones and monoterpenes, where toxic concentrations are greatest in the late fall and winter. Horses develop neurological signs and exhibit abnormal behavior, such as ataxia and the tendency to fall down, after eating sand sagebrush for several days.

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 quick rain storm during a long drought, during periods with cool/cloudy days, and on soils high in nitrogen and low in sulfur and phosphorus. Nitrate collects in the plants 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.

Potentially toxic plants associated with this site include fourwing saltbush and buckwheat species, which may accumulate selenium, but only when growing on selenium enriched soils. These plants, when consumed will cause alkali disease or chronic selenosis, which affects all classes of livestock (excluding goats). Typically animals consuming 5-50 ppm selenium will develop chronic selenosis and animals consuming greater than 50 ppm selenium will develop acute selenosis. Clinical signs include lameness, soughing of the hoof, hair loss, blindness, and aimless wondering.

--Invasive Plant Communities--
As ecological condition deteriorates and perennial vegetation decreases due to disturbance (i.e., fire, over grazing, drought, off road vehicle overuse, erosion, etc.) annual forbs and grasses can invade this site. Of particular concern in semi-arid environments are annual invaders including cheatgrass, Russian thistle, kochia, halogeton, and annual mustards. The presence of these species will depend on soil properties and moisture availability, however, these invaders are highly adaptive and can flourish in many locations. Once established, complete removal of these species is difficult but suppression may be possible. In most of the Colorado Plateau area, cheatgrass is not known to invade blackbrush associations to the degree that it does on other sites in southwestern Utah and the Mojave Desert.

--Fire Ecology--
The ability for this ecological site to carry fire depends primarily on it's present fuel load and fine fuel moisture content. Sites with small fuel loads will burn more slowly and less intensely than sites with large fuel loads. A year of exceptionally heavy winter moisture can, however, generate sufficient fuels for fire to carry on this site by producing heavy stands of both perennial and annual forbs and grasses. When fires do occur, their effect on plant communities can be extreme due to the sites harsh environment and slow rate of recovery.

This ecological site is typically comprised of a dense or somwtimes scattered stand of low stature blackbrush with mostly bare interspaces. Blackbrush, because of its tinder-like nature, and resinous foliage, is a very flammable species and in areas with dense spacing can burn. Where either perennial or annual grasses or forbs are also present, fire frequencies could become shorter. Periods with high winds, high temperature and low humidity can increase the chances for fire to occur. (Callison, 1985). 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.

The fire regime for blackbrush communities in Utah is not well understood. 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. On some sites, blackbrush act act as a paleo-endemic species.

The use of fire as a brush management tool is not recommended on this ecological sites at the present time. Where revetation is desired, other treatment methods could be used.

Inventory data references

The data collected in 2006-2008 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 and in electronic format in the NRCS Utah State Office.

Type locality

Location 1: Grand County, UT	
UTM zone	N
UTM northing	4283347
UTM easting	620730
General legal description	Arches 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)	Jake Owens (NRCS)
Contact for lead author	shane.green@ut.usda.gov
Date	12/11/2009
Approved by	Shane A. Green
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Very few. Rills may be 6 or more feet in length. Rills are most likely to form below adjacent exposed bedrock or water flow patterns where sufficient water accumulates to cause erosion. Rills increase immediately following episodic storm events.

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2. **Presence of water flow patterns:** Frequent and often continuous. Occur throughout the site, but are often masked by wind blown sand. 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 across areas covered with biological soil crust during episodic precipitation events. Evidence of flow will increase somewhat with slope.

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3. **Number and height of erosional pedestals or terracettes:** None to few. Pedestals form at base of plants that occur on the edge of rills. Terracettes are few. Interspaces between well developed biological crusts may resemble pedestals, but they 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 – 65 %. 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 has about 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:** None. Some gullies may be present in landscape settings where increased runoff may accumulate. 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.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** Wind generated soil movement is common. Wind caused blowouts and depositions are somewhat stable or have healed over. Coppice mounding around perennial vegetation is common, especially the Blackbrush. Wind caused blowouts are most common around junipers.

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7. **Amount of litter movement (describe size and distance expected to travel):** Most litter accumulates under or adjacent to plant bases. Litter ¼" in diameter moves 3' or less from origin. Some litter (leaves, small stems) may accumulate in soil depressions located near plants. Woody stems are usually not expected to be moved from base of shrubs. Minor litter removal may occur in flow patterns and rills with deposition occurring at points of obstruction. A small amount of fine litter may be removed from the site by wind action.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** This site should have a soil stability rating of 3 or 4 under the plant canopies, and a rating of 1 to 3 in the interspaces. The average should be a 3. Surface texture varies from fine sand to sand. Vegetation cover, litter, biological and soil crusts help reduce erosion.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface varies from 0 to 2 inches. Color is reddish brown (5YR5/4). The A horizon would be expected to be more strongly developed under plant canopies. It is important if you are sampling to observe the A horizon under plant canopies as well as the interspaces. Use the specific information for the soil you are assessing found in the published soil survey to supplement this description.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Distribution of vascular plants and/or biological soil crusts (where present) intercept raindrops preventing splash erosion. Plants and biological soil crusts (where present) are usually distributed in sufficient density to slow runoff allowing time for infiltration. When perennial grasses and shrubs decrease, reducing ground cover and increasing bare ground, runoff can increase and infiltration would be reduced.

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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: Dominance by average annual production: Non-sprouting Shrubs >> Cool season perennial grasses > Warm season perennial grasses > forbs > sprouting shrubs. Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species in the reference state (e.g. Crested wheatgrass and

Russian wildrye etc.)

Sub-dominant:

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

Additional: Following a recent disturbance such as fire drought that removes the woody vegetation, forbs and perennial grasses (herbaceous species) may dominate the community. These conditions would reflect a functional community phase within the reference state. However, these types of disturbances are uncommon and are not expected to occur. Dominants — Blackbrush, Indian ricegrass, Galleta. Sub Dominants — Torrey jointfir, Bigelow sagebrush, other perennial grasses. Perennial and annual forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** All age classes of perennial grasses should be present under average growing conditions with age class expression likely subdued during below average years, or on sites with high (usually greater than 65%) similarity index (late seral to historic climax). Reference state includes mix of plants of various ages with some plants being dead or showing characteristics of decadence.

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14. **Average percent litter cover (%) and depth (in):** Variability may occur due to weather.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 200-400 #/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:** Cheatgrass and introduced annual forbs are most likely to invade this 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.
