USDA Natural Resources
Conservation Service

Ecological site R035XY121UT
Desert 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.

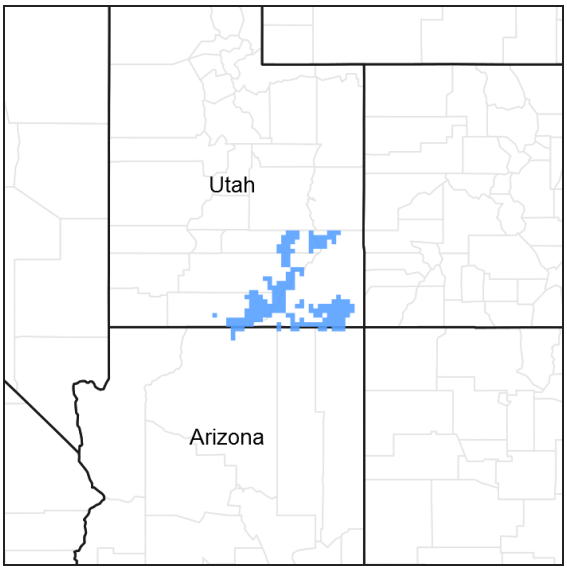


Figure 1. Mapped extent

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.

Classification relationships

Modal Soil: Moffat FSL, LFS — coarse-loamy, mixed, mesic Typic Calciorthids

Type Location: Gooseneck Park

Associated sites

R035XY115UT	**Desert Sand (Sand Sagebrush)**
R035XY118UT	**Desert Sandy Loam (Fourwing Saltbush)**
R035XY130UT	**Desert Shallow Sandy Loam (Shadscale)**
R035XY133UT	**Desert Shallow Sandy Loam (Blackbrush)**

Similar sites

R035XY210UT	**Semidesert Sand (Blackbrush)**

Table 1. Dominant plant species

Tree	Not specified

Shrub	(1) *Coleogyne ramosissima*
Herbaceous	(1) *Achnatherum hymenoides*

Physiographic features

This site occurs on structural benches, alluvial fans, valleys, basins, and dunes. Run off is low to very low (due to low slopes and high permeability). Slopes typically range from 1-12%. Elevations range from 3800-5000 ft but this site has been found as high as 5600 ft.

Table 2. Representative physiographic features

Landforms	(1) Structural bench (2) Alluvial fan (3) Valley
Flooding duration	Long (7 to 30 days)
Flooding frequency	None to occasional
Ponding frequency	None
Elevation	3,800–5,000 ft
Slope	1–12%
Aspect	Aspect is not a significant factor

Climatic features

The climate is characterized by hot summers and cool to warm winters, which can be slightly modified by local topographic conditions, such as aspect. Large fluctuations in daily temperatures are common. Mean annual high temperatures range from 67-71 degrees Fahrenheit and mean annual low temperatures range from 40-45 degrees Fahrenheit. Average annual precipitation is 5 to 10 inches. Approximately 77 percent occurs as rain from March through October. On the average, February, May, and June are the driest months and August, September, and October are the wettest months. Soil temperatures are in the mesic regime with mean annual soil temperatures ranging from 50 to 57. Precipitation is extremely variable from month to month and from year to year. Much of the summer precipitation occurs as convection thunderstorms.

Utah Climate Summaries. 2009. Available: http://www.wrcc.dri.edu/summary/climsmut.html. Accessed on February 25, 2008.

Table 3. Representative climatic features

Frost-free period (average)	190 days
Freeze-free period (average)	216 days
Precipitation total (average)	10 in

Influencing water features

Due to extreme distance from water, there are no water features influencing this site.

Soil features

Characteristic soils in this site are 20 to 60 inches deep over sandstone and well drained. Typically the dry surface is yellowish red to strong brown. Soils generally have high wind and water erosion potential. The soil temperature and moisture regimes are mesic and typic aridic respectively. They formed in eolian and alluvium deposits derived mainly from sandstone parent materials. Soils are in the coarse-loamy textural family and typically have a calcic horizon occuring at less than 24 inches. The water supplying capacity is 2 to 3 inches. Average annual soil loss in potential is approximately 0.1 tons/acre.

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

UT631 – Henry Mountains Area – Moffat
UT643 – San Juan County, Navajo Indian Reservation – Mota; Neskahi; Oljeto; Moepitz; Nepalto
UT633 – Canyonlands Area – Cataract
UT638 – San Juan County, Central – Moffat; Blue Chief
UT685 - Capitol Reef - Moffat;
UT686 – Escalante Grand Staircase National Monument – Moffat; Ranion; Moepitz; Pagine; Spooky
UT688 – Canyonlands National Park – Sheppard; Sogzie; Nakai

Typical Profile:
A – 0-6 inches; loamy fine sand; moderately calcareous; slightly alkaline
Bk – 6-26 inches; fine sandy loam; strongly calcareous; strongly alkaline
C – 26-60 inches; fine sandy loam; moderately calcareous; strongly alkaline

Table 4. Representative soil features

Surface texture	(1) Fine sandy loam (2) Loamy fine sand (3) Very fine sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderately rapid to rapid
Soil depth	20–60 in
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0–4%
Available water capacity (0-40in)	3.9–5.2 in
Calcium carbonate equivalent (0-40in)	1–15%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0–5
Soil reaction (1:1 water) (0-40in)	7.9–9
Subsurface fragment volume <=3" (Depth not specified)	0–10%
Subsurface fragment volume >3" (Depth not specified)	0–4%

Ecological dynamics

This site developed under Colorado Plateau ecological conditions and the natural influences of herbivory and climate. In average years, plants begin growth around February 20 and end growth around October 30. This site's plant species composition is generally dominated by blackbrush. Shadscale is found on loamier textured soils. Galleta and Indian ricegrass are typically present; however, their dominance is dependant on the climate patterns. There is no evidence to indicate that this site historically maintained a short burn frequency. Large gaps between plants in relic areas indicate that this site may not have historically burned. Until further research indicates that fire played a 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, invasive species and OHV use, the resilience of the plant communities may be at risk. Disturbances that reduce the

presence of blackbrush result in an opportunity for invasive annuals to enter into the system and may produce a fuel load for fire to become an ecological driver in the current potential state. However the occurrence of this process has not been observed on this site and therefore is mentioned here only as a predicted occurrence. Cheatgrass, red brome 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 (~1860). It is highly resistant to grazing due to the unpalatable nature of blackbrush and lack of a significant grass component. Continuous season long grazing and/or heavy stocking rates may cause perennial grasses and Mormontea to decrease while yellow cryptantha, locoweed, desert trumpet, blackbrush, and snakeweed increase. This type of grazing may also increase the chance of invasion by cheatgrass and invasive annual forbs. On the Colorado Plateau these species can invade in the abscence of grazing, and rarely increase to a point where they dominate blackbrush communities.

Fluctuations in climate may influence the production of grasses and shrubs, however, plant community changes on the ecological site due to climate do not appear significant enough to warrant separate phases for wet and dry periods.

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

Suitability for rangeland seeding is very poor. It is not practical to revegetate large areas of this ecological site because of the low annual precipitation and very low available water capacity. Additionally, the soil has a high hazard of wind erosion because of its sandy textures. To control erosion in areas where the need is critical, small areas can be mechanically treated and seeded. Adapted native plants and forage kochia are suitable for seeding in these areas.

As vegetation communities respond to changes in management or natural influences, return to previous states may not be possible. The ability to affect vegetative shifts depends on present biotic and abiotic features and the desired results. The following diagram may not depict all the transitions and states that are possible, but it does show some of the most commonly occurring plant communities. 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 estimated and measured data was collected and utilized.

--Reference State (State 1)--
The reference state represents the plant community and ecological dynamics of the desert 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. Primary disturbance mechanisms include climate fluctuations and native herbivore grazing. Timing of these natural 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.

--Transition from Reference State (State 1) to Current Potential State (State 2)—
T1a – This transition is from the native perennial warm and cool season grass understory in the reference state to a state that contains some invasive species. Events may include season long continuous grazing of perennial grasses, prolonged drought, and surface disturbances, etc. 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.

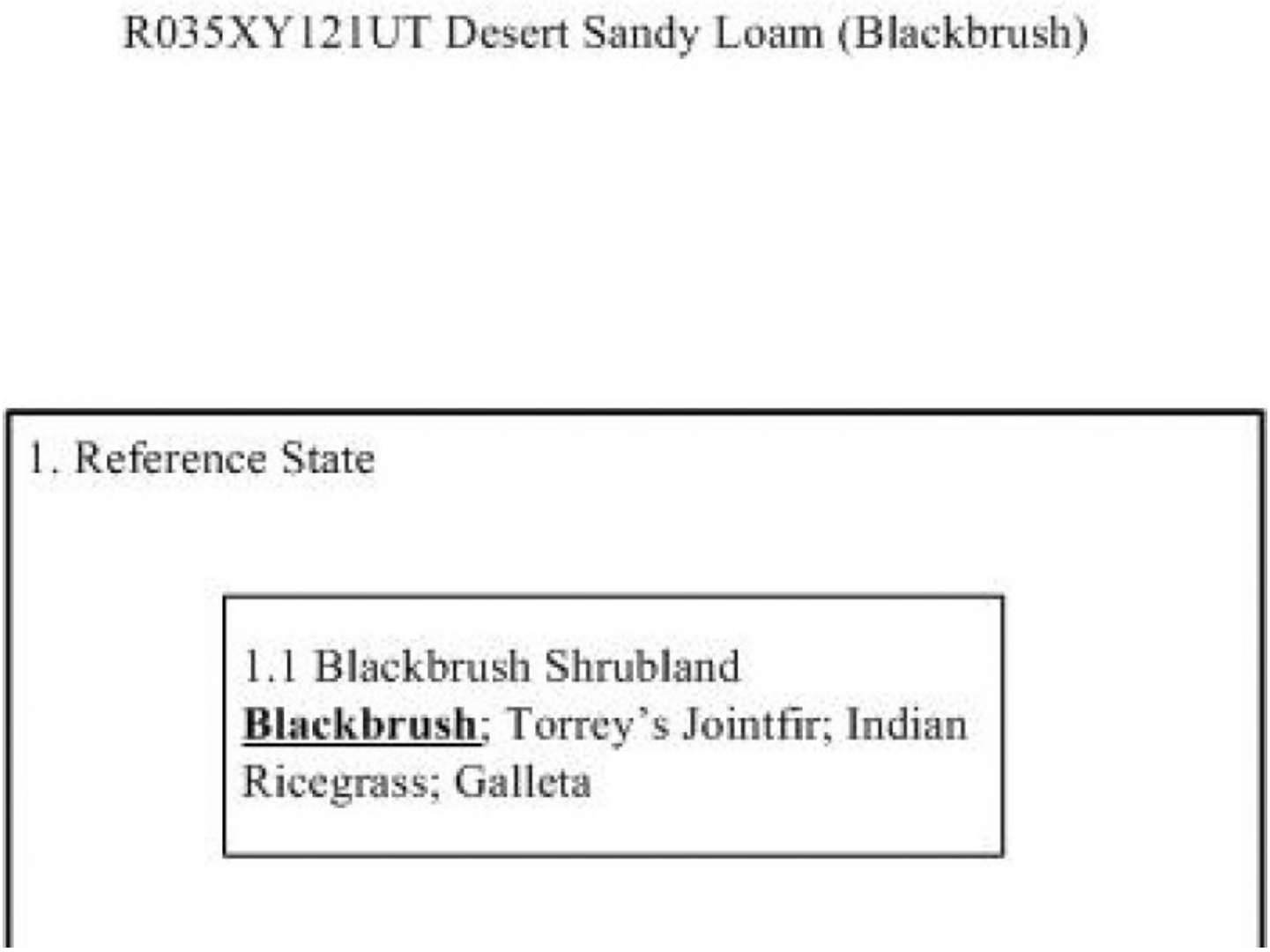
--Current Potential State (State 2)--
The current potential state is similar to the reference state, however invasive species are present. This state is generally dominated by blackbrush. Primary disturbance mechanisms include climate fluctuations, native herbivore grazing, domestic livestock grazing, 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.

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 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.

State and transition model



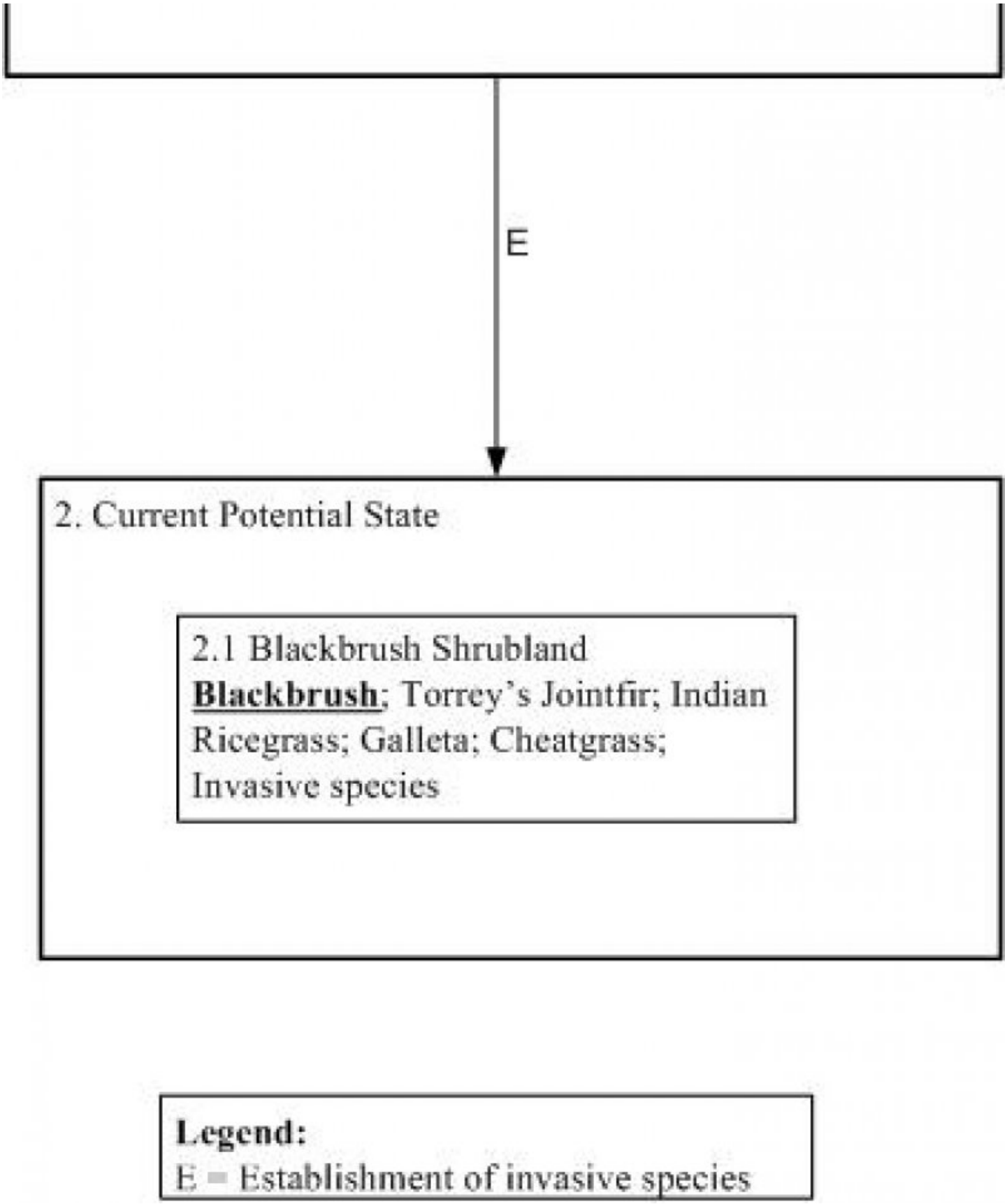


Figure 4. State and Transition Model

State 1
Reference State

Community 1.1
Reference State

This community phase is characterized by a blackbrush shrub canopy, where perennial native may or may not be present. Commonly seen grasses include Indian ricegrass, galleta, needleandthread, 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 or may not be present and cover is variable. The composition by air dry weight is approximately 10 percent forbs, 20 percent grasses, and 70 percent shrubs. Bare ground is variable (15-60%) depending on biological crust cover, which is also variable (0-40%) and surface rock fragments (0-50%). - Community Pathway- 1 (E,) = Establishement of invasive species.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	90	180	280
Grass/Grasslike	30	50	68
Forb	25	30	35
Tree	0	0	1
Total	**145**	**260**	**384**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	10-28%
Grass/grasslike foliar cover	3-20%
Forb foliar cover	0-16%
Non-vascular plants	0%
Biological crusts	0-40%
Litter	2-6%
Surface fragments >0.25" and <=3"	0-10%
Surface fragments >3"	0-4%
Bedrock	20-60%
Water	0%
Bare ground	15-60%

Table 7. Canopy structure (% cover)

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

State 2
Current Potential State

Community 2.1

Current Potential State

This community phase is characterized by a blackbrush shrub canopy, where perennial native may or may not be present. Some invasive plants are present. Commonly seen grasses include Indian ricegrass, galleta, needleandthread, 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 or may not be present and cover is variable. Bare ground is variable (15-60%) depending on biological crust cover, which is also variable (0-40%) and surface rock fragments (0-50%).

Table 8. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	90	180	280
Grass/Grasslike	30	50	68
Forb	25	30	35
Tree	0	0	1
Total	**145**	**260**	**384**

Table 9. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	10-28%
Grass/grasslike foliar cover	3-20%
Forb foliar cover	0-16%
Non-vascular plants	0%
Biological crusts	0-40%
Litter	2-6%
Surface fragments >0.25" and <=3"	0-10%
Surface fragments >3"	0-4%
Bedrock	20-60%
Water	0%
Bare ground	15-60%

Table 10. Canopy structure (% cover)

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

Additional community tables

Table 11. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			38–220	
	blackbrush	CORA	*Coleogyne ramosissima*	38–220	–
	Forb, annual	2FA	*Forb, annual*	14–23	–
	Forb, perennial	2FP	*Forb, perennial*	14–23	–
	desert trumpet	ERIN4	*Eriogonum inflatum*	5–14	–
	manybranched ipomopsis	IPPO2	*Ipomopsis polycladon*	5–14	–
	mountain pepperweed	LEMO2	*Lepidium montanum*	5–14	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	5–14	–
3	**Sub-Dominant Shrubs**			54–135	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	10–45	–
	Cutler's jointfir	EPCU	*Ephedra cutleri*	1–35	–
	littleleaf horsebrush	TEGL	*Tetradymia glabrata*	0–20	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–17	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–15	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–15	–
	sand sagebrush	ARFI2	*Artemisia filifolia*	0–14	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–12	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–10	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–9	–
	crispleaf buckwheat	ERCO14	*Eriogonum corymbosum*	0–8	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–8	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–7	–
	Whipple's fishhook cactus	SCWH	*Sclerocactus whipplei*	0–1	–
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–1	–
Grass/Grasslike					
0	**Dominant Grass**			25–100	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–40	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	2–35	–
1	**Sub-Dominant Grasses**			5–88	
	spike dropseed	SPCO4	*Sporobolus contractus*	0–20	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	2–20	–
	Grass, annual	2GA	*Grass, annual*	0–15	–
	Grass, perennial	2GP	*Grass, perennial*	0–15	–
	purple threeawn	ARPU9	*Aristida purpurea*	5–14	–
	sandhill muhly	MUPU2	*Muhlenbergia pungens*	5–14	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	5–14	–
Forb					
2	**Forbs**			15–35	
	painted milkvetch	ASCE	*Astragalus ceramicus*	3–23	–
	globemallow	SPHAE	*Sphaeralcea*	3–18	–

	woodyaster	XYLOR	*Xylorhiza*	3–15	–
	desert trumpet	ERIN4	*Eriogonum inflatum*	0–13	–
	Forb, annual	2FA	*Forb, annual*	0–10	–
	Forb, perennial	2FP	*Forb, perennial*	0–10	–
	western blanketflower	GASP	*Gaillardia spathulata*	0–3	–
	larkspur	DELPH	*Delphinium*	0–3	–
	buckwheat	ERIOG	*Eriogonum*	0–1	–
	Townsend daisy	TOWNS	*Townsendia*	0–1	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–1	–
	cryptantha	CRYPT	*Cryptantha*	0–1	–
	plains springparsley	CYAC	*Cymopterus acaulis*	0–1	–
	shy gilia	GIIN2	*Gilia inconspicua*	0–1	–
	fineleaf hymenopappus	HYFI	*Hymenopappus filifolius*	0–1	–
	Jones' pepperweed	LEMOJ	*Lepidium montanum var. jonesii*	0–1	–
	bristle flax	LIAR3	*Linum aristatum*	0–1	–
	rusty lupine	LUPU	*Lupinus pusillus*	0–1	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–1	–
	whitest evening primrose	OEAL	*Oenothera albicaulis*	0–1	–
	tufted evening primrose	OECA10	*Oenothera caespitosa*	0–1	–
	pale evening primrose	OEPA	*Oenothera pallida*	0–1	–
	cleftleaf wildheliotrope	PHCR	*Phacelia crenulata*	0–1	–
	ragwort	SENEC	*Senecio*	0–1	–
	snowball sand verbena	ABFR2	*Abronia fragrans*	0–1	–
	onion	ALLIU	*Allium*	0–1	–
	woolly bluestar	AMTO2	*Amsonia tomentosa*	0–1	–

Table 12. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant**			38–220	
	blackbrush	CORA	*Coleogyne ramosissima*	38–220	–
3	**Sub-dominant**			10–60	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–45	–
	Cutler's jointfir	EPCU	*Ephedra cutleri*	1–35	–
	littleleaf horsebrush	TEGL	*Tetradymia glabrata*	0–20	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–17	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–15	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–15	–
	sand sagebrush	ARFI2	*Artemisia filifolia*	0–14	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–12	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–10	–
	crispleaf buckwheat	ERCO14	*Eriogonum corymbosum*	0–8	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–8	–

	Whipple's fishhook cactus	SCWH	*Sclerocactus whipplei*	0–1	–
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–1	–
Grass/Grasslike					
0	**Dominant Grass**			10–50	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–40	–
	James' galleta	PLJA	*Pleuraphis jamesii*	4–40	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	2–35	–
	cheatgrass	BRTE	*Bromus tectorum*	1–10	–
1	**Sub-Dominant**			2–22	
	spike dropseed	SPCO4	*Sporobolus contractus*	0–20	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	2–20	–
	Grass, perennial	2GP	*Grass, perennial*	0–5	–
	Grass, annual	2GA	*Grass, annual*	0–4	–
	threeawn	ARIST	*Aristida*	0–1	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–1	–
Forb					
2	**Forbs**			15–35	
	globemallow	SPHAE	*Sphaeralcea*	3–18	–
	woodyaster	XYLOR	*Xylorhiza*	5–15	–
	desert trumpet	ERIN4	*Eriogonum inflatum*	0–13	–
	western blanketflower	GASP	*Gaillardia spathulata*	0–3	–
	larkspur	DELPH	*Delphinium*	0–3	–
	shy gilia	GIIN2	*Gilia inconspicua*	0–1	–
	fineleaf hymenopappus	HYFI	*Hymenopappus filifolius*	0–1	–
	prickly lettuce	LASE	*Lactuca serriola*	0–1	–
	Jones' pepperweed	LEMOJ	*Lepidium montanum var. jonesii*	0–1	–
	bristle flax	LIAR3	*Linum aristatum*	0–1	–
	rusty lupine	LUPU	*Lupinus pusillus*	0–1	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–1	–
	blazingstar	MENTZ	*Mentzelia*	0–1	–
	whitest evening primrose	OEAL	*Oenothera albicaulis*	0–1	–
	pale evening primrose	OEPA	*Oenothera pallida*	0–1	–
	cleftleaf wildheliotrope	PHCR	*Phacelia crenulata*	0–1	–
	dock	RUMEX	*Rumex*	0–1	–
	Russian thistle	SALSO	*Salsola*	0–1	–
	ragwort	SENEC	*Senecio*	0–1	–
	buckwheat	ERIOG	*Eriogonum*	0–1	–
	Townsend daisy	TOWNS	*Townsendia*	0–1	–
	snowball sand verbena	ABFR2	*Abronia fragrans*	0–1	–
	onion	ALLIU	*Allium*	0–1	–
	madwort	ALYSS	*Alyssum*	0–1	–
	woolly bluestar	AMTO2	*Amsonia tomentosa*	0–1	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–1	–

	cryptantha	CRYPT	*Cryptantha*	0–1	–
	plains springparsley	CYAC	*Cymopterus acaulis*	0–1	–

Animal community

--Livestock and Wildlife Grazing--
Water scarcity and lack of cover limit the species richness and abundance of large mammals on this site; however 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)

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

The plant community is primarily shrubs, with the majority of canopy cover being attributed to blackbrush; sub dominants include mormontea, fourwing saltbush, and shadscale saltbush. These shrubs provide poor winter browse for cattle and sheep, as well as fair year round browse for goats. When present, grasses, primarily Indian ricegrass and galleta, provide good year round grazing forage for horses, cattle, and sheep; however many times these species are not abundant enough to support livestock. Forb composition and annual production depends primarily on precipitation amounts and thus is challenging to use in livestock grazing management decisions. However, forb composition should be monitored for species diversity, as well as poisonous or injurious plant communities which may be detrimental to livestock if grazed. Before making specific grazing management recommendations, an onsite evaluation must be made.

--References--
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Hydrological functions

The soil is in hydrologic groups b and c. The runoff curve numbers are 61 through 86 depending on the condition of the watershed.
Hydrological groups are used in equations that estimate runoff from rainfall. These estimates are needed for solving hydrologic problems that arise in planning watershed-protection and flood-prevention projects and for designing structures for the use, control and disposal of water. Heavy grazing can alter the hydrology by decreasing plant cover and increasing bare ground. Fire can also affect hydrology, but 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).

National Engineering Handbook. US Department of Agriculture, Natural Resources Conservation Service. Available: http://www.info.usda.gov/CED/Default.cfm#National%20Engineering%20Handbook. Accessed February 25, 2008.
NRCS Grazing Lands Technology Institute. 2003. National Range and Pasture Handbook. Fort Worth, TX, USA: US Department of Agriculture, Natural Resources Conservation Service, 190-VI-NRPH.

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

Potentially toxic plants associated with this site include four-wing 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. Horses tend to develop what is called a “bob” tail or “roached” main due to breakage of the long hairs.

Russian thistle is an invasive toxic plant, causing nitrate and to a lesser extent oxalate poisoning, which affects all classes of livestock. The buildup of nitrates in these plants is highly dependent upon environmental factors, such as after a rain storm during a drought, cool/cloudy days, and soils high in nitrogen and low in sulfur and phosphorus, all which cause increased nitrate accumulation. Nitrate collects in the stems and can persist throughout the growing season. Clinical signs of nitrate poisoning include drowsiness, weakness, muscular tremors, increased heart and respiratory rates, staggering gait, and death. Conversely, oxalate poisoning causes kidney failure; clinical signs include muscle tremors, tetany, weakness, and depression. Poisoning generally occurs when livestock consume and are not accustomed to grazing oxalate-containing plants. Animals with prior exposure to oxalates have increased numbers of oxalate-degrading rumen microflora and thus are able to degrade the toxin before clinical poisoning can occur (Knight and Walter, 2001).

--Invasive Plant Communities--

Generally as ecological conditions deteriorate and perennial vegetation decreases due to disturbance (fire, over grazing, drought, off road vehicle overuse, erosion, etc.) annual forbs and grasses will invade the site. Of particular concern in semi-arid environments are invaders including cheatgrass, Russian thistle, kochia, halogeton, and annual mustards. The presence of these species will depend on soil properties and moisture availability; however, these invaders are highly adaptive and can flourish in many locations. Once established, complete removal is difficult but suppression may be possible. At this time, in most of the Colorado Plateau area, cheatgrass is not known to invade blackbrush associations as it does in areas of southwest Utah and the Mojave.

--Fire Ecology--

The ability for an ecological site to carry fire depends primarily on the present fuel load and plant moisture content—sites with small fuel loads will burn more slowly and less intensely than sites with large fuel loads. Many semi-desert communities in the Colorado Plateau may have evolved without the influence of fire. However a year of exceptionally heavy winter rains can generate fuels by producing heavy stands of annual forbs and grasses. When fires do occur, the effect on the plant community may be extreme due to the harsh environment and slow rate of recovery.

There is no evidence that this site historically maintained a short burn frequency. Only a few species in the association show fire scars and can be aged. This ecological site is comprised of scatterd shrubs with bare interspaces to patchy occurrence of grasses, which is unlikely to carry a fire unless under high winds, 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 burning within that time frame. This ecological site is comprised of dense to scattered low stature blackbrush plants with bare interspaces to patchy occurrence of grasses, which is unlikely to carry a fire unless under high winds, high temperature, and low humidity. Blackbrush is a non-sprouter and is slow to re-establish on burned sites. Studies indicate that blackbrush sites do not recover well in Utah. So currently burning is not a recommended brush management tool. Because of the apical dominance trait, removal through grazing or mechanical treatment will increase sprouting/new growth. If at sometime there are species that can be used successfully to re-vegetate the community, then mechanical treatment could be used. Of caution, blackbrush is thought to be very flammable due to the dense spacing of the brush and the tinder-like nature, and resinous foliage. So, if annual grasses or forbs dominate the area after disturbance, re-vegetating efforts could be hampered due to several factors including an increase in fire frequency.

--References--
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Callison, J., J.D. Brotherson, and J.E. Bowns. 1985. The effects of fire on the blackbrush [Coleogyne ramosissima] community of Southwestern Utah. Journal of Range Management. 38:535-538.

Knight, A.P. and R.G. Walter. 2001. A guide to plant poisoning of animals in North America. Teton NewMedia. Jackson, WY.

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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	4236407
UTM easting	587201
General legal description	Canyonlands National Park-The Maze --Field Office Site Location-- Panguitch, Utah Monticello, Utah Richfield, Utah Price, Utah

Other references

Anderson, M. D. 2001. Coleogyne ramosissima. In: Fire Effects Information System. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis. Accessed August 11, 2008.

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Contributors

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Jacob Owens

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)	Paul Curtis (BLM), Randy Beckstrand (BLM), Dana Truman (NRCS), Robert Stager (BLM), Shane A. Green (NRCS)_
Contact for lead author	shane.green@ut.usda.gov
Date	09/11/2008
Approved by	Shane A. Green
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Very minor rill development, increasing as slope steepens. Rill development will increase following large storm events, but rills heal within a few months due to the very sandy soil textures

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2. **Presence of water flow patterns:** Flow patterns will occur more often on soils with more structure (fine sandy loams), and less often on soils with less structure (sands). Flow patterns are usually sinuous and wind around perennial plant bases and show very minor evidence of erosion due to sandy texture of soil. They are expected to be short (3 to 6 feet), narrow (less tha 1 foot), and somewhat widely spaced (> 15 feet). They are typically stable with only minor evidence of deposition. Evidence of flow will increase somewhat with greater slopes.

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3. **Number and height of erosional pedestals or terracettes:** Rare. If they occur, pedestalled plants show very minor pedestalling caused by wind erosion, but there should never be any exposed roots. Terracettes should be very few and stable, occurring behind pieces of woody litter blocking water flow patterns.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 40 – 50% bare ground. Ground cover is based on the first raindrop impact, and bare ground is the opposite of ground cover. Any well developed biological crusts present should not be recorded as bare ground. Poorly developed biological soil crusts that are interpreted as functioning as bare ground (therefore they would be susceptible to raindrop splash erosion) should be recorded as bare ground.

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5. **Number of gullies and erosion associated with gullies:** None to very few. Some gullies may be present in landscape settings where increased runoff may accumulate (such as areas below exposed bedrock). Such gully development is expected to be limited to steeper slopes 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:** Slight wind generated soil movement is normal. Wind

caused blowouts and deposition are mostly stable or have healed over. Coppice mounding around perennial vegetation is common, especially around blackbrush plants.

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7. **Amount of litter movement (describe size and distance expected to travel):** Most litter resides in place, accumulating at the base of plants. Some redistribution of fine litter caused by water movement. Very minor fine litter removal may occur in flow patterns or rills with deposition occurring at points of obstruction. Some grass leaves and small twigs (grass stems) may accumulate in soil depressions adjacent to plants. Woody litter is not likely to move.

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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 4 or 5 under plant canopies and a rating of 3 to 4 in the interspaces using the soil stability kit test. The average should be a 4. Surface texture is fine sandy loam to gravelly loam. Surface texture is gravelly fine sand to fine sand loamy fine sand. Vegetation cover, litter, biological soil crusts and surface rock reduce erosion.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface horizon is typically 2 to 6 inches deep. Structure is typically weak platy. Color is typically yellowish red (5YR5/6-8). 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:** Vascular plants and/or any well developed biological soil crusts will break raindrop impact and splash erosion. Spatial distribution of vascular plants and interspaces between well developed biological soil crusts (where present) provide detention storage and surface roughness that slows runoff allowing time for infiltration. Where present, interspaces between plants and any well developed biological soil crusts may serve as water flow patterns during episodic runoff events, with natural erosion expected in severe storms. When perennial grasses decrease, reducing ground cover and increasing bare ground, runoff is expected to increase and any associated infiltration 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. A few soils have bedrock at about 20+ inches. Naturally occurring soil horizons may be harder than the surface because of an accumulation of clay or calcium carbonate and should not be considered as compaction layers

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant: Cool season Perennial grasses (Indian ricegrass) = non-sprouting shrubs (Blackbrush)

    Sub-dominant: Warm season perennial grasses (Spike dropseed, Sand dropseed) sprouting shrubs (Mormontea) > forbs > Biological soil crusts

    Other: Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species in the reference state (e.g. Siberian Wheatgrass, Forage kochia etc.)
    Biological soil crust is variable in its expression where present on this site and is measured as a component of ground

cover.
Forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions.

Additional: Temporal variability is caused by drought, insects, and very infrequent fire. Spatial variability is caused by differing soil textures, etc.
Following a recent disturbance such as drought or insects that removes the blackbrush, forbs, perennial grasses (herbaceous species) and sprouting shrubs may dominate the community. If a disturbance has not occurred for an extended period of time, woody species may continue to increase crowding out the perennial herbaceous understory species. In either case, these conditions reflect a community phase within the reference state.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** 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) droughts, up to 20% of the blackrush stems may die. Some mortality of bunchgrass and other shrubs may occur during very severe (long term) droughts. There may be partial mortality of individual bunchgrasses and other shrus during less severe droughts. Because woody stems may persist for many years, blackbrush will normally have dead stems within the plant canopy. Blackbrush will drop it's leaves when water stressed.

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14. **Average percent litter cover (%) and depth (in):** Litter cover (including under plants) Depth should be 1-2 leaf thickness in the interspaces and up to 1/4" under canopies. Litter cover may increase up to 20% immediately following leaf drop. Litter redistribution following natural extreme runoff events can reduce litter cover by concentrating it in low lying areas. Litter cover may increase to 10-15% following seasons with above average production with 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):** 400 - 450 #/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, Broom snakeweed & introduced annual forbs (Filarie, Russian thistle).

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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.
