USDA Natural Resources
Conservation Service

Ecological site R035XY224UT
Semidesert Shallow Sand (Blackbrush)

Accessed: 05/11/2025

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.

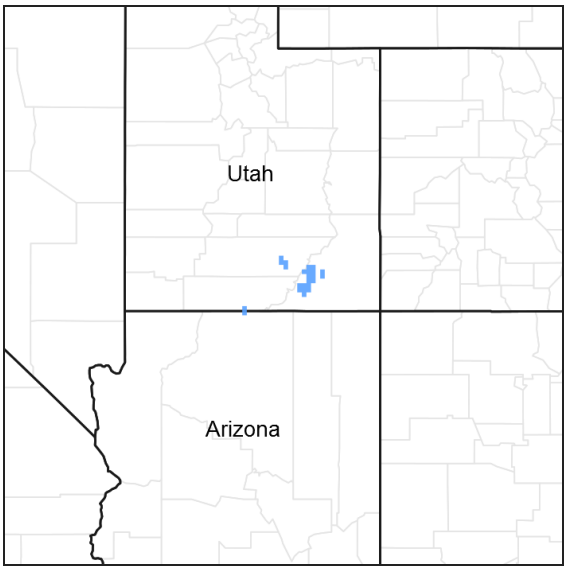


Figure 1. Mapped extent

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

Site Concept: This site developed on shallow sandy soils in the semidesert zone of the Colorado and Green River Plateaus region of southern Utah (MLRA 35). It is most commonly found on structural benches with 2-15% slopes, at elevations between 5,000 and 6,000 feet. Annual precipitation ranges from 7.5 to 10 inches, with 40% of the precipitation coming in the form of convective thunderstorms from July through October. Soils are shallow fine sands with few rock fragments on the soil surface and throughout the profile. The soil moisture regime is ustic aridic and the soil temperature regime is mesic. The reference plant community is dominated by blackbrush, with James' galleta, Indian ricegrass as the most common understory grass species.

Classification relationships

Modal Soil: Arches LS, Warm Hummocky — mixed, mesic Lithic Torripsamments

Similar sites

R035XY233UT	**Semidesert Shallow Sandy Loam (Blackbrush)** This site is very similar in terms of plant community composition and production. However, it has shallow sandy loam soils instead of shallow sand soils. As a result, perennial grasses are expected to be more resilient to disturbance, such as drought and grazing, on this site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Coleogyne ramosissima* (2) *Ephedra viridis*
Herbaceous	Not specified

Physiographic features

This site most commonly occurs on structural benches, but may sometimes be found on dipslopes of cuestas and hogbacks. Slopes are 2-15% and elevations range from 5000 to 6000 feet.

Table 2. Representative physiographic features

Landforms	(1) Structural bench (2) Dip slope (3) Hogback
Flooding frequency	None
Ponding frequency	None
Elevation	5,000–6,000 ft
Slope	2–15%

Climatic features

The climate of this site is characterized by hot summers and cool winters. Average annual precipitation ranges from 7.5 to 10 inches. About 40% of the annual precipitation comes as convective thunderstorms from July through October. June is typically the driest month during the growing season. In average years, plants begin growth around March 1 and end growth around October 15. Large fluctuations in daily temperatures are common, and precipitation can vary greatly from month to month and from year to year.

This section was developed using modeled climate data (PRISM) for soil map units correlated to this ecological site.

Table 3. Representative climatic features

Frost-free period (average)	155 days
Freeze-free period (average)	185 days
Precipitation total (average)	9 in

Influencing water features

Due to its landscape position, this site is not typically associated with streams or wetlands.

Soil features

The soils of this site are shallow fine sands derived from eolian deposits. There is typically some exposed bedrock, but rock fragments are not common on the soil surface or throughout the profile. These soils are poorly developed and have low water holding capacities ranging from 1.1 to 1.5 inches of water in the entire profile. The soil temperature regime is mesic and the soil moisture regime is ustic aridic. These soils typically have high wind and water erosion potential. Coppice mounds, water flow patterns, rills, and gullies are common. Biological crust cover is characterized as crustless or by isolated pinnacles of lichen and moss clumps with little continuity. Surface rock fragments, when present, typically have evidence of calcium deposits (small whiteish nodes).

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

UT638—San Juan County,Arches soil
UT642-Kane County, Arches soil
UT685-Capitol Reef, Moclom soil

Table 4. Representative soil features

Parent material	(1) Eolian sands–sandstone
Surface texture	(1) Fine sand (2) Loamy fine sand
Family particle size	(1) Sandy
Drainage class	Well drained to excessively drained
Permeability class	Rapid to very rapid
Soil depth	6–20 in
Surface fragment cover <=3"	0–15%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	1.1–1.5 in
Calcium carbonate equivalent (0-40in)	0–5%
Electrical conductivity (0-40in)	0–2 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)	0–15%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

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

There is no evidence to indicate that this site historically maintained a short burn frequency. Large gaps between plants (very discontinuous fuels)in relic areas indicate that this site may have historically rarely burned. Until further research indicates that fire played a significient role in the ecosystem processes of this site, this ecological site description will not include fire as a disturbance in the reference state. However, due to modern disturbances such as grazing and recreation, the resilience of the plant community can be reduced by the introduction of non-native invasive species. Disturbances that result in an opportunity for invasive annuals to enter the system and possibly produce sufficient fuel loads may allow fire to become a risk, but has not been observed on this site. Cheatgrass, red brome, and Russian thistle are most likely to invade this site.

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

Improper livestock grazing including, season long grazing and\or heavy stocking rates, may cause this site to depart from the reference plant community. As ecological condition deteriorates, perennial grasses and Torrey's jointfir may decrease while yellow cryptantha, locoweed, desert trumpet, blackbrush, and snakeweed may increase. Improper grazing may also increase the chance of invasion by cheatgrass, red brome and invasive annual forbs. On the Colorado Plateau, however, these species are capable of establishing themselves in blackbrush communities in the abscence of grazing, but they have not been observed to dominate this site.

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

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

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

The following State and Transition diagram shows some of the most commonly occurring plant communities found on this ecological site. These plant communities may not represent every possibility, but they are the most prevalent and repeatable. As more data are collected, some of these plant communities may be revised or removed, and new ones may be added. This model was developed using range data collected over the last 40 years in MLRA D35 in southeastern Utah. Both ocular and measured data was collected and utilized.

State and transition model

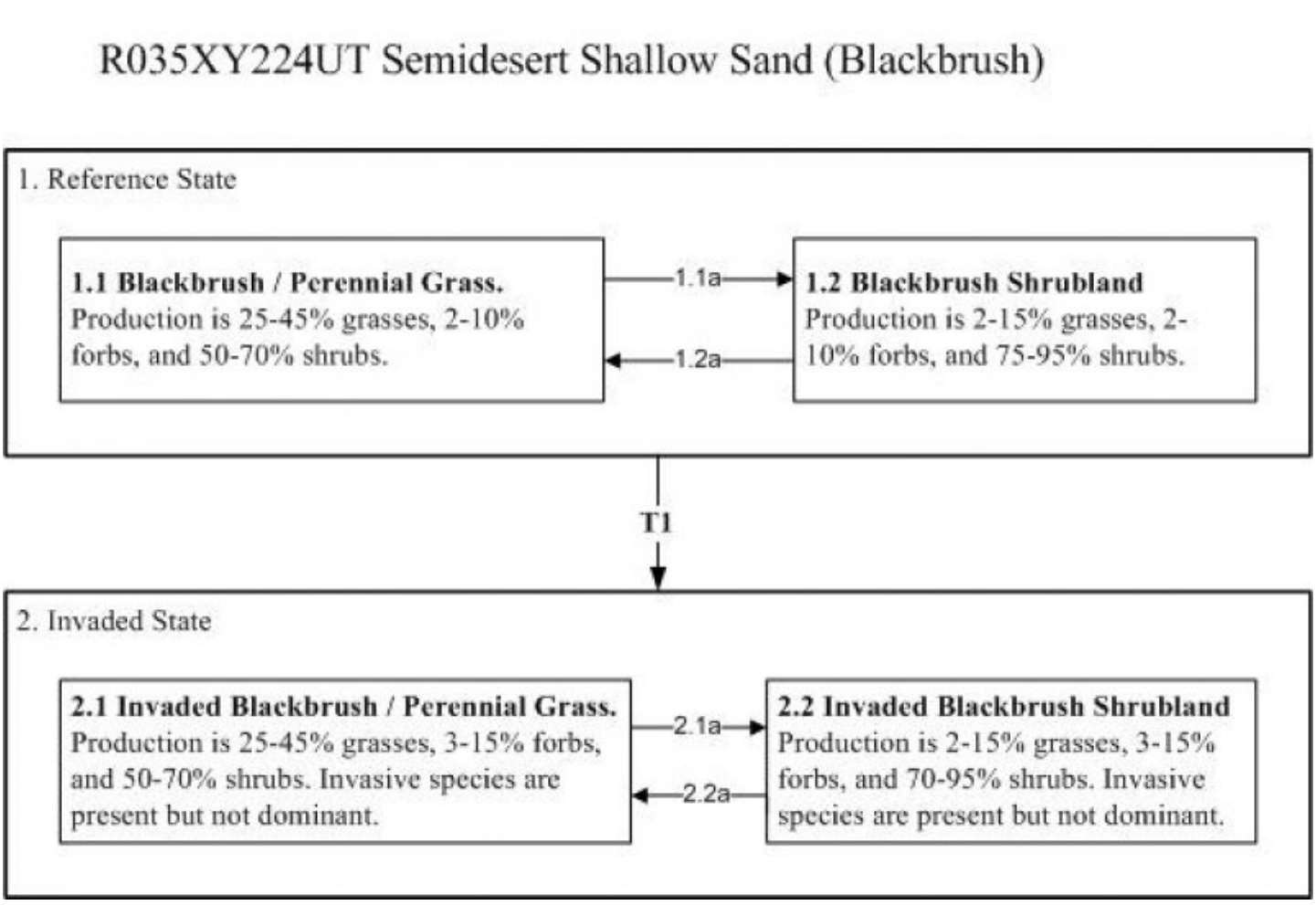


Figure 6. State-and-Transition Model

State 1
Reference State

The reference state represents the plant communities and ecological dynamics of the desert shallow sand (blackbrush) ecological 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 also be abundant in the plant community. Prolonged drought may result in a temporary loss of perennial grasses from the referenc state.

Community 1.1
Blackbrush / Perennial Grass

Ashley Garrelts, June 20, 2008.

Figure 7. Phase 1.1

This phase is dominated by blackbrush, with diverse shrubs and perennial grasses also present in the plant community. Composition by air dry weight is approximately 2-10% forbs, 25-45 % grasses, and 50-70% shrubs. Bare ground is variable (5-35%) depending on biological crust cover (15-45%) and surface rock fragments.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	100	200	300
Grass/Grasslike	65	100	135
Forb	5	20	35
Tree	5	15	30
Total	**175**	**335**	**500**

Table 6. Ground cover

Tree foliar cover	0-5%
Shrub/vine/liana foliar cover	15-25%
Grass/grasslike foliar cover	5-15%
Forb foliar cover	0-10%
Non-vascular plants	0%
Biological crusts	15-45%
Litter	5-15%
Surface fragments >0.25" and <=3"	0-15%

Surface fragments >3"	0%
Bedrock	0-5%
Water	0%
Bare ground	5-35%

Table 7. Canopy structure (% cover)

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

Community 1.2
Blackbrush Shrubland


Russian thistle and is phase 2.2. Canyonlands National Park Soil Survey. Photo by A. Garrelts, June 18, 2008.

Figure 9. Phase 1.2

This phase is dominated by blackbrush, with few perennial grasses in the understory. Composition by air dry weight is approximately 2-10% forbs, 2-15 % grasses, and 75-95% shrubs. Bare ground is variable (30-45%) depending on biological crust cover (15-35%) and surface rock fragments.

Table 8. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	100	200	300
Grass/Grasslike	0	25	50
Forb	5	20	35
Tree	5	15	30
Total	**110**	**260**	**415**

Table 9. Ground cover

Tree foliar cover	0-5%
Shrub/vine/liana foliar cover	15-30%
Grass/grasslike foliar cover	0-6%
Forb foliar cover	0-5%
Non-vascular plants	0%
Biological crusts	15-30%
Litter	5-10%
Surface fragments >0.25" and <=3"	0-15%
Surface fragments >3"	0%
Bedrock	0-5%
Water	0%
Bare ground	30-45%

Table 10. Canopy structure (% cover)

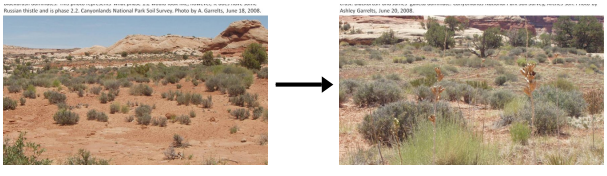
Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	0-5%	0-5%
>0.5 <= 1	–	0-5%	0-5%	0-5%
>1 <= 2	–	0-10%	0-5%	0-5%
>2 <= 4.5	0-5%	0-10%	–	–
>4.5 <= 13	0-5%	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Pathway 1.1a
Community 1.1 to 1.2

Blackbrush / Perennial Grass **Blackbrush Shrubland**

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

Pathway 1.2a
Community 1.2 to 1.1



Blackbrush Shrubland **Blackbrush / Perennial Grass**

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

State 2
Invaded State

The invaded state is similar to the reference state in plant community structure and function, however invasive species are now present in all community phases. As a result, the resistance and resillience of the site to further degradation are reduced. This state is generally dominated by blackbrush, with diverse shrubs and perennial grasses also abundant. Primary disturbance mechanisms include weather fluctuations, native herbivore grazing, domestic livestock grazing, recreation,and surface disturbances such as road and pipeline development. Due to lack of disturbed areas, the community responses to such disturbances are not well documented.

Community 2.1
Invaded Blackbrush / Perennial Grass

This phase is dominated by blackbrush, with diverse shrubs and perennial grasses also present in the plant community. Invasive annual species are present but not dominant. Composition by air dry weight is approximately 2-10% forbs, 25-45 % grasses, and 50-70% shrubs. Bare ground is variable (5-35%) depending on biological crust cover (15-45%) and surface rock fragments.

Table 11. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	100	200	300
Grass/Grasslike	65	100	135
Forb	5	20	35
Tree	5	15	30
Total	**175**	**335**	**500**

Table 12. Ground cover

Tree foliar cover	0-5%
Shrub/vine/liana foliar cover	15-25%
Grass/grasslike foliar cover	5-15%
Forb foliar cover	0-10%
Non-vascular plants	0%
Biological crusts	15-45%
Litter	5-15%
Surface fragments >0.25" and <=3"	0-15%
Surface fragments >3"	0%
Bedrock	0-5%
Water	0%
Bare ground	5-35%

Table 13. Canopy structure (% cover)

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

Community 2.2
Invaded Blackbrush Shrubland

Park Soil Survey. Ashley Garrelts, Photo, June 18, 2008.

Figure 12. Phase 2.2

This phase is dominated by blackbrush, with few perennial grasses in the understory. Annual invasive species are present but not dominant. Composition by air dry weight is approximately 3-15% forbs, 2-15 % grasses, and 70-95% shrubs. Bare ground is variable (30-45%) depending on biological crust cover (15-35%) and surface rock fragments.

Table 14. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	100	200	300
Grass/Grasslike	0	25	50
Forb	5	20	35
Tree	5	15	30
Total	**110**	**260**	**415**

Table 15. Ground cover

Tree foliar cover	0-5%
Shrub/vine/liana foliar cover	15-30%
Grass/grasslike foliar cover	0-6%
Forb foliar cover	0-5%
Non-vascular plants	0%

Biological crusts	15-30%
Litter	5-10%
Surface fragments >0.25" and <=3"	0-15%
Surface fragments >3"	0%
Bedrock	0-5%
Water	0%
Bare ground	30-45%

Table 16. Canopy structure (% cover)

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

Pathway 2.1a
Community 2.1 to 2.2

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

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.

Transition T1
State 1 to 2

This transition occurs when a seed source and germination sites are available for non-native plant establishment. Common invaders of this site are Russian thistle, cheatgrass and red brome. Recreation, grazing, or other soil surface disturbances may facilitate this transition, but these species are capable of establishing on this site without major disturbances.

Additional community tables

Table 17. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			100–300	
	blackbrush	CORA	*Coleogyne ramosissima*	100–300	8–24
2	**Sub-dominant Shrubs**			10–75	

	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–30	0–2
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	5–25	0–2
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–20	0–1
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–15	0–1
	frosted mint	POIN3	*Poliomintha incana*	0–15	0–1
	Havard oak	QUHA3	*Quercus havardii*	0–10	0–1
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	0–10	0–1
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–10	0–1
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–10	0–1
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–10	0–1
	Cutler's jointfir	EPCU	*Ephedra cutleri*	0–10	0–1
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–10	0–1
	mormon tea	EPVI	*Ephedra viridis*	0–10	0–1
	crispleaf buckwheat	ERCOA	*Eriogonum corymbosum var. aureum*	0–10	0–1
	sand buckwheat	ERLE9	*Eriogonum leptocladon*	0–10	0–1
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–10	0–1
	spiny hopsage	GRSP	*Grayia spinosa*	0–5	0–1
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–5	0–1
	shortspine horsebrush	TESP2	*Tetradymia spinosa*	0–5	0–1
Grass/Grasslike					
0	**Dominant Grasses**			65–135	
	James' galleta	PLJA	*Pleuraphis jamesii*	15–80	1–6
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	10–75	1–5
1	**Sub-dominant Grasses**			0–35	
	Grass, perennial	2GP	*Grass, perennial*	0–30	0–2
	black grama	BOER4	*Bouteloua eriopoda*	0–30	0–2
	needle and thread	HECO26	*Hesperostipa comata*	0–25	0–2
	sandhill muhly	MUPU2	*Muhlenbergia pungens*	0–25	0–2
	Grass, annual	2GA	*Grass, annual*	0–20	0–2
	squirreltail	ELEL5	*Elymus elymoides*	0–10	0–1
	spike dropseed	SPCO4	*Sporobolus contractus*	0–10	0–1
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–10	0–1
	mesa dropseed	SPFL2	*Sporobolus flexuosus*	0–10	0–1
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–5	0–1
	Sandberg bluegrass	POSE	*Poa secunda*	0–5	0–1
	desert needlegrass	ACSP12	*Achnatherum speciosum*	0–5	0–1
	purple threeawn	ARPU9	*Aristida purpurea*	0–5	0–1
Forb					
3	**Forbs**			5–35	
	Forb, perennial	2FP	*Forb, perennial*	0–30	0–2
	Forb, annual	2FA	*Forb, annual*	0–25	0–2
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–20	0–2

	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–15	0–1
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–10	0–1
	Paria spurge	EUNE2	*Euphorbia nephradenia*	0–10	0–1
	Pacific aster	SYCHC	*Symphyotrichum chilense var. chilense*	0–10	0–1
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	0–10	0–1
	tawny cryptantha	CRFU	*Cryptantha fulvocanescens*	0–10	0–1
	cushion buckwheat	EROV	*Eriogonum ovalifolium*	0–10	0–1
	Wetherill's buckwheat	ERWE	*Eriogonum wetherillii*	0–5	0–1
	Canyonlands prairie clover	DAFL	*Dalea flavescens*	0–5	0–1
	matted crinklemat	TILA6	*Tiquilia latior*	0–5	0–1
	longbeak streptanthella	STLO4	*Streptanthella longirostris*	0–5	0–1
	common sunflower	HEAN3	*Helianthus annuus*	0–5	0–1
	mountain pepperweed	LEMOT	*Lepidium montanum var. tenellum*	0–5	0–1
	rusty lupine	LUPU	*Lupinus pusillus*	0–5	0–1
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–5	0–1
	pale evening primrose	OEPA	*Oenothera pallida*	0–5	0–1
	basindaisy	PLIN7	*Platyschkuhria integrifolia*	0–5	0–1
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–5	0–1
	mustard	BRASS2	*Brassica*	0–5	0–1
	Esteve's pincushion	CHST	*Chaenactis stevioides*	0–5	0–1
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–5	0–1
	sand verbena	ABRON	*Abronia*	0–5	0–1
	Bicknell's milkvetch	ASCO16	*Astragalus consobrinus*	0–5	0–1
Tree					
4	**Trees**			5–30	
	Utah juniper	JUOS	*Juniperus osteosperma*	5–30	0–2

Table 18. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			100–300	
	blackbrush	CORA	*Coleogyne ramosissima*	100–300	8–24
	James' galleta	PLJA	*Pleuraphis jamesii*	15–80	1–6
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	10–75	1–5
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	11–18	–
2	**Sub-dominant Shrubs**			10–75	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–30	0–2
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	5–25	0–2
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–20	0–1
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–15	0–1
	frosted mint	POIN3	*Poliomintha incana*	0–15	0–1

	Havard oak	QUHA3	*Quercus havardii*	0–10	0–1
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	0–10	0–1
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–10	0–1
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–10	0–1
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–10	0–1
	Cutler's jointfir	EPCU	*Ephedra cutleri*	0–10	0–1
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–10	0–1
	mormon tea	EPVI	*Ephedra viridis*	0–10	0–1
	crispleaf buckwheat	ERCOA	*Eriogonum corymbosum var. aureum*	0–10	0–1
	sand buckwheat	ERLE9	*Eriogonum leptocladon*	0–10	0–1
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–10	0–1
	spiny hopsage	GRSP	*Grayia spinosa*	0–5	0–1
	shortspine horsebrush	TESP2	*Tetradymia spinosa*	0–5	0–1
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–5	0–1
Grass/Grasslike					
1	**Grasses**			0–50	
	Grass, annual	2GA	*Grass, annual*	0–20	0–2
	Grass, perennial	2GP	*Grass, perennial*	0–20	0–1
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–20	0–1
	James' galleta	PLJA	*Pleuraphis jamesii*	0–20	0–1
	needle and thread	HECO26	*Hesperostipa comata*	0–15	0–1
	sandhill muhly	MUPU2	*Muhlenbergia pungens*	0–10	0–1
	black grama	BOER4	*Bouteloua eriopoda*	0–10	0–1
	squirreltail	ELEL5	*Elymus elymoides*	0–10	0–1
	spike dropseed	SPCO4	*Sporobolus contractus*	0–10	0–1
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–10	0–1
	mesa dropseed	SPFL2	*Sporobolus flexuosus*	0–10	0–1
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–5	0–1
	Sandberg bluegrass	POSE	*Poa secunda*	0–5	0–1
	desert needlegrass	ACSP12	*Achnatherum speciosum*	0–5	0–1
	purple threeawn	ARPU9	*Aristida purpurea*	0–5	0–1
Forb					
3	**Forbs**			5–35	
	Forb, perennial	2FP	*Forb, perennial*	0–30	0–2
	Forb, annual	2FA	*Forb, annual*	0–25	0–2
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–20	0–2
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–15	0–1
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–10	0–1
	Paria spurge	EUNE2	*Euphorbia nephradenia*	0–10	0–1
	Pacific aster	SYCHC	*Symphyotrichum chilense var. chilense*	0–10	0–1
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	0–10	0–1
	tawny cryptantha	CRFU	*Cryptantha fulvocanescens*	0–10	0–1

	cushion buckwheat	EROV	*Eriogonum ovalifolium*	0–10	0–1
	Wetherill's buckwheat	ERWE	*Eriogonum wetherillii*	0–5	0–1
	Canyonlands prairie clover	DAFL	*Dalea flavescens*	0–5	0–1
	matted crinklemat	TILA6	*Tiquilia latior*	0–5	0–1
	longbeak streptanthella	STLO4	*Streptanthella longirostris*	0–5	0–1
	common sunflower	HEAN3	*Helianthus annuus*	0–5	0–1
	mountain pepperweed	LEMOT	*Lepidium montanum var. tenellum*	0–5	0–1
	rusty lupine	LUPU	*Lupinus pusillus*	0–5	0–1
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–5	0–1
	pale evening primrose	OEPA	*Oenothera pallida*	0–5	0–1
	basindaisy	PLIN7	*Platyschkuhria integrifolia*	0–5	0–1
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–5	0–1
	mustard	BRASS2	*Brassica*	0–5	0–1
	Esteve's pincushion	CHST	*Chaenactis stevioides*	0–5	0–1
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–5	0–1
	sand verbena	ABRON	*Abronia*	0–5	0–1
	Bicknell's milkvetch	ASCO16	*Astragalus consobrinus*	0–5	0–1
Tree					
4	**Trees**			5–30	
	Utah juniper	JUOS	*Juniperus osteosperma*	5–30	0–2

Table 19. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			100–300	
	blackbrush	CORA	*Coleogyne ramosissima*	100–300	8–24
2	**Sub-dominant Shrubs**			10–75	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–30	0–2
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	5–25	0–2
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–20	0–1
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–15	0–1
	frosted mint	POIN3	*Poliomintha incana*	0–15	0–1
	Havard oak	QUHA3	*Quercus havardii*	0–10	0–1
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	0–10	0–1
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–10	0–1
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–10	0–1
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–10	0–1
	Cutler's jointfir	EPCU	*Ephedra cutleri*	0–10	0–1
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–10	0–1
	mormon tea	EPVI	*Ephedra viridis*	0–10	0–1
	crispleaf buckwheat	ERCOA	*Eriogonum corymbosum var. aureum*	0–10	0–1

	sand buckwheat	ERLE9	*Eriogonum leptocladon*	0–10	0–1
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–10	0–1
	spiny hopsage	GRSP	*Grayia spinosa*	0–5	0–1
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–5	0–1
	shortspine horsebrush	TESP2	*Tetradymia spinosa*	0–5	0–1
Grass/Grasslike					
0	**Dominant Grasses**			65–135	
	James' galleta	PLJA	*Pleuraphis jamesii*	15–80	1–6
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	10–75	1–5
1	**Sub-dominant Grasses**			1–35	
	black grama	BOER4	*Bouteloua eriopoda*	0–30	0–2
	Grass, perennial	2GP	*Grass, perennial*	0–30	0–2
	needle and thread	HECO26	*Hesperostipa comata*	0–25	0–2
	sandhill muhly	MUPU2	*Muhlenbergia pungens*	0–25	0–2
	Grass, annual	2GA	*Grass, annual*	0–20	0–2
	red brome	BRRU2	*Bromus rubens*	0–10	0–1
	cheatgrass	BRTE	*Bromus tectorum*	0–10	0–1
	squirreltail	ELEL5	*Elymus elymoides*	0–10	0–1
	spike dropseed	SPCO4	*Sporobolus contractus*	0–10	0–1
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–10	0–1
	mesa dropseed	SPFL2	*Sporobolus flexuosus*	0–10	0–1
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–5	0–1
	Sandberg bluegrass	POSE	*Poa secunda*	0–5	0–1
	desert needlegrass	ACSP12	*Achnatherum speciosum*	0–5	0–1
	purple threeawn	ARPU9	*Aristida purpurea*	0–5	0–1
Forb					
3	**Forbs**			5–35	
	Forb, perennial	2FP	*Forb, perennial*	0–30	0–2
	Forb, annual	2FA	*Forb, annual*	0–25	0–2
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–20	0–2
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–15	0–1
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–10	0–1
	Paria spurge	EUNE2	*Euphorbia nephradenia*	0–10	0–1
	Pacific aster	SYCHC	*Symphyotrichum chilense var. chilense*	0–10	0–1
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	0–10	0–1
	tawny cryptantha	CRFU	*Cryptantha fulvocanescens*	0–10	0–1
	cushion buckwheat	EROV	*Eriogonum ovalifolium*	0–10	0–1
	prickly Russian thistle	SATR12	*Salsola tragus*	0–10	0–1
	Wetherill's buckwheat	ERWE	*Eriogonum wetherillii*	0–5	0–1
	Canyonlands prairie clover	DAFL	*Dalea flavescens*	0–5	0–1
	matted crinklemat	TILA6	*Tiquilia latior*	0–5	0–1
	longbeak streptanthella	STLO4	*Streptanthella longirostris*	0–5	0–1

	common sunflower	HEAN3	*Helianthus annuus*	0–5	0–1
	mountain pepperweed	LEMOT	*Lepidium montanum var. tenellum*	0–5	0–1
	rusty lupine	LUPU	*Lupinus pusillus*	0–5	0–1
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–5	0–1
	pale evening primrose	OEPA	*Oenothera pallida*	0–5	0–1
	basindaisy	PLIN7	*Platyschkuhria integrifolia*	0–5	0–1
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–5	0–1
	mustard	BRASS2	*Brassica*	0–5	0–1
	Esteve's pincushion	CHST	*Chaenactis stevioides*	0–5	0–1
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–5	0–1
	sand verbena	ABRON	*Abronia*	0–5	0–1
	Bicknell's milkvetch	ASCO16	*Astragalus consobrinus*	0–5	0–1
Tree					
4	**Trees**			5–30	
	Utah juniper	JUOS	*Juniperus osteosperma*	5–30	0–2

Table 20. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			100–300	
	blackbrush	CORA	*Coleogyne ramosissima*	100–300	8–24
	James' galleta	PLJA	*Pleuraphis jamesii*	15–80	1–6
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	10–75	1–5
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	11–18	–
2	**Sub-dominant Shrubs**			10–75	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–30	0–2
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	5–25	0–2
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–20	0–1
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–15	0–1
	frosted mint	POIN3	*Poliomintha incana*	0–15	0–1
	Havard oak	QUHA3	*Quercus havardii*	0–10	0–1
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	0–10	0–1
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–10	0–1
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–10	0–1
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–10	0–1
	Cutler's jointfir	EPCU	*Ephedra cutleri*	0–10	0–1
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–10	0–1
	mormon tea	EPVI	*Ephedra viridis*	0–10	0–1
	crispleaf buckwheat	ERCOA	*Eriogonum corymbosum var. aureum*	0–10	0–1
	sand buckwheat	ERLE9	*Eriogonum leptocladon*	0–10	0–1
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–10	0–1
	spiny hopsage	GRSP	*Gravia spinosa*	0–5	0–1

	spiny hopsage	GRSP	*Grayia spinosa*	0–5	0–1
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–5	0–1
	shortspine horsebrush	TESP2	*Tetradymia spinosa*	0–5	0–1
Grass/Grasslike					
1	**Grasses**			1–50	
	Grass, annual	2GA	*Grass, annual*	0–20	0–2
	Grass, perennial	2GP	*Grass, perennial*	0–20	0–1
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–20	0–1
	James' galleta	PLJA	*Pleuraphis jamesii*	0–20	0–1
	needle and thread	HECO26	*Hesperostipa comata*	0–15	0–1
	sandhill muhly	MUPU2	*Muhlenbergia pungens*	0–10	0–1
	spike dropseed	SPCO4	*Sporobolus contractus*	0–10	0–1
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–10	0–1
	mesa dropseed	SPFL2	*Sporobolus flexuosus*	0–10	0–1
	black grama	BOER4	*Bouteloua eriopoda*	0–10	0–1
	red brome	BRRU2	*Bromus rubens*	0–10	0–1
	cheatgrass	BRTE	*Bromus tectorum*	0–10	0–1
	squirreltail	ELEL5	*Elymus elymoides*	0–10	0–1
	desert needlegrass	ACSP12	*Achnatherum speciosum*	0–5	0–1
	purple threeawn	ARPU9	*Aristida purpurea*	0–5	0–1
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–5	0–1
	Sandberg bluegrass	POSE	*Poa secunda*	0–5	0–1
Forb					
3	**Forbs**			5–35	
	Forb, perennial	2FP	*Forb, perennial*	0–30	0–2
	Forb, annual	2FA	*Forb, annual*	0–25	0–2
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–20	0–2
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–15	0–1
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–10	0–1
	Paria spurge	EUNE2	*Euphorbia nephradenia*	0–10	0–1
	Pacific aster	SYCHC	*Symphyotrichum chilense var. chilense*	0–10	0–1
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	0–10	0–1
	tawny cryptantha	CRFU	*Cryptantha fulvocanescens*	0–10	0–1
	cushion buckwheat	EROV	*Eriogonum ovalifolium*	0–10	0–1
	prickly Russian thistle	SATR12	*Salsola tragus*	0–10	0–1
	Wetherill's buckwheat	ERWE	*Eriogonum wetherillii*	0–5	0–1
	Canyonlands prairie clover	DAFL	*Dalea flavescens*	0–5	0–1
	matted crinklemat	TILA6	*Tiquilia latior*	0–5	0–1
	longbeak streptanthella	STLO4	*Streptanthella longirostris*	0–5	0–1
	common sunflower	HEAN3	*Helianthus annuus*	0–5	0–1
	mountain pepperweed	LEMOT	*Lepidium montanum var. tenellum*	0–5	0–1
	rusty lupine	LUPU	*Lupinus pusillus*	0–5	0–1

	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–5	0–1
	pale evening primrose	OEPA	*Oenothera pallida*	0–5	0–1
	basindaisy	PLIN7	*Platyschkuhria integrifolia*	0–5	0–1
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–5	0–1
	mustard	BRASS2	*Brassica*	0–5	0–1
	Esteve's pincushion	CHST	*Chaenactis stevioides*	0–5	0–1
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–5	0–1
	sand verbena	ABRON	*Abronia*	0–5	0–1
	Bicknell's milkvetch	ASCO16	*Astragalus consobrinus*	0–5	0–1
Tree					
4	**Trees**			5–30	
	Utah juniper	JUOS	*Juniperus osteosperma*	5–30	0–2

Animal community

--Livestock and Wildlife Grazing--

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

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

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Hydrological functions

The soil is in hydrologic group d. The runoff curve numbers are 80 through 89 depending on the condition of the watershed.

Recreational uses

Recreation values are hiking and hunting.

Wood products

None

Other information

--Poisonous/Toxic Plant Communities--

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

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

--Invasive Plant Communities--

Generally as ecological conditions deteriorate and perennial vegetation decreases due to disturbance (fire, over grazing, drought, off road vehicle overuse, erosion, etc.) annual forbs and grasses will invade the site. Of particular concern in semi-arid environments are annual invaders including cheatgrass, Russian thistle, kochia, halogeton, and annual mustards. The presence of these species will depend on soil properties and moisture availability; however, these invaders are highly adaptive and can flourish in many locations. Once established, complete removal is difficult but suppression may be possible. At this time, in most of the Colorado Plateau area, cheatgrass

is not known to invade blackbrush associations as it does in areas of southwest Utah and the Mojave.

--Fire Ecology--

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

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

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

Contributors

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Jamin Johanson

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

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Contact for lead author	shane.green@ut.usda.gov
Date	09/12/2008
Approved by	Shane A. Green
Approval date	
Composition (Indicators 10 and 12) based on	Foliar Cover

Indicators

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

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2. **Presence of water flow patterns:** Small, indistinct water flow patterns should be few and short (3-6') water flow patterns on low slopes (< 6%), increasing in frequency and length (up to 5-10') with slope. Waterflow patterns may increase on steeper slopes following large storm events, dissipating where the slope flattens. Micro topography typically found on this site creates widely spaced (30-60 yards) larger water flow patterns. Interspaces between vegetation and/or well developed biological soil crusts appear to be depression water storage areas but actually serve as somewhat stable water flow patterns during precipitation events.

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3. **Number and height of erosional pedestals or terracettes:** Blackbrush plants that occur on the edge of water flow patterns and rills on steeper slopes (>6%) may be pedestalled, but there should be no exposed roots. Well developed (pinnacled) biological crusts may appear pedestalled, but are actually a characteristic of the crust formation. Terracettes are rare to none, occurring if woody litter obstructs 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):** 20 – 35%. Most bare ground is associated with water flow patterns, rills, and gullies. Any areas with well developed biological soil crusts should not be counted 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. This site has 20-50% surface rock cover. Ground cover is based on first raindrop impact, and bare ground is the opposite of ground cover. Ground cover + Bare ground = 100%.

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5. **Number of gullies and erosion associated with gullies:** No active gullies. Some stable gullies may be present in landscape settings where increased runoff may accumulate (such as areas below exposed bedrock). Such gully development is expected to be limited to slopes exceeding 15% and adjacent to sites where runoff accumulation occurs. Any gullies present should show little sign of accelerated erosion and should be stabilized with perennial vegetation and biological soil crusts.

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 the Blackbrush. Increased wind generated soil movement can occur after severe wind events.

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

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** This site should have a soil stability rating of 4 under the plant canopies, and a rating of 2 to 3 in the interspaces. The average should be a 3. Surface texture is fine sand. Vegetation cover, litter, biological soil crusts and surface rock reduce erosion.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface is typically 4 inches deep. Structure is typically very weak. Color is typically light reddish brown (5YR6/4). 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.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Distribution of vascular plants and/or biological soil crusts (where present) intercept raindrops preventing, but not eliminating, reduction of infiltration due to physical crusting. Plants and/or biological soil crusts usually have sufficient cover to slow runoff allowing time for infiltration. Shrubs and bunchgrasses and associated plant litter provide barriers to flow.

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.

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

    Dominant: Non-resprouting shrub (e.g. Blackbrush) > Cool-season bunchgrasses (e.g. Indian ricegrass) = biological soil crusts

    Sub-dominant: sprouting shrubs (Mormontea) > forbs (Globemallow) > warm-season bunchgrasses (e.g. Galleta)

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

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

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** During years with average to above-average precipitation, there should be very little recent mortality or decadence apparent in either the shrubs or grasses. During severe (multi-year) drought up to 20% of the blackbrush stems may die. Some mortality of bunchgrass and other shrubs may also occur during severe droughts, particularly on the shallower and coarser soils associated with this site. There may be partial mortality of individual bunchgrasses and other shrubs during less severe drought. Because woody stems may persist for many years, blackbrush will normally have dead stems within the plant canopy. Blackbrush will drop its leaves when water stressed.

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14. **Average percent litter cover (%) and depth (in):** Litter cover (including under plants) nearly all of which should be fine litter. Depth should be 1 leaf thickness in the interspaces and up to ¼" under canopies. Litter cover may increase up to 20% immediately following leaf drop. Litter redistribution following natural extreme runoff events can reduce litter cover by concentrating it in low-lying areas. Litter cover may increase to 15-20% followings seasons with above average production due to a high production of annuals.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 300-350 #/acre on an average year

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** None currently known; however cheatgrass, Russian thistle, and other introduced annual forbs have future potential. This reference should be revised if any of these species become invasive in this ecological site.

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17. **Perennial plant reproductive capability:** All perennial plants should have the ability to reproduce sexually or asexually in most years, except in drought years. Blackbrush reproduction is naturally very episodic and no young plants may be apparent.

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