USDA Natural Resources Conservation Service

Ecological site R035XY136UT
Desert Stony Loam (Shadscale-Bud Sagebrush)

Accessed: 12/15/2025

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

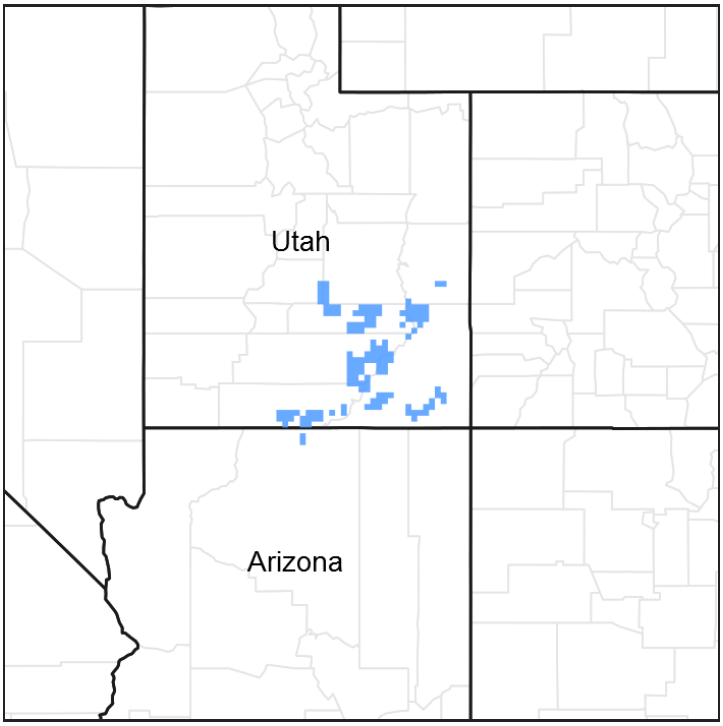


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 035X–Colorado Plateau

This ecological site occurs in the northern portion of MLRA 35, Colorado Plateau Province. It is found principally in the Canyon Lands and High Plateaus of Utah sections within that MLRA. This area has been stucturally uplifted over time while rivers flowing across it were

cutting down into its bedrock. Areas of shale, sandstone, limestone, dolomite, and volcanic rock outcrop are found throughout the region.

Classification relationships

Associated sites

R035XY018UT	**Talus Slope (Blackbrush-Shadscale)**
R035XY109UT	**Desert Loam (Shadscale)**
R035XY124UT	**Desert Shallow Clay (Mat Saltbush)**
R035XY139UT	**Desert Stony Loam (Blackbrush)**

Similar sites

R035XY243UT	**Semidesert Stony Loam (Blackbrush)**
R035XY122UT	**Desert Shallow Loam (Shadscale)**
R035XY139UT	**Desert Stony Loam (Blackbrush)**
R035XY130UT	**Desert Shallow Sandy Loam (Shadscale)**

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex confertifolia* (2) *Picrothamnus desertorum*
Herbaceous	(1) *Pleuraphis jamesii* (2) *Achnatherum hymenoides*

Physiographic features

This site occurs on stream terraces, hillslopes, pediments, fan terraces, and structural benches. Runoff potential is low to medium. Slopes typically range from 2-15%, but have been found as steep as 50% in some locations. Elevations range from 3700-6000 ft on all aspects.

Table 2. Representative physiographic features

Landforms	(1) Stream terrace (2) Pediment (3) Hill
Elevation	3,700–6,000 ft

Slope	2–50%
Aspect	Aspect is not a significant factor

Climatic features

The climate is characterized by hot, dry summers and cool winters. Average precipitation is 5-7 inches. Approximately 77% 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. The mean annual air temperature is 48 to 57 degrees Fahrenheit. The average freeze free period is 194 to 220 days per year. Precipitation is extremely variable from month to month and year to year. Much of the summer precipitation occurs as convection thunder storms.

Table 3. Representative climatic features

Frost-free period (average)	195 days
Freeze-free period (average)	220 days
Precipitation total (average)	7 in

Influencing water features

There are no influencing water features on this site.

Soil features

Characteristic soils in this site are very deep and well drained. Typically the dry surface is light red to brown. Bud sagebrush is considered an indicator of alkaline soils. The soil temperature and moisture regimes are mesic and typc aridic respectively. These soils formed in mixed alluvium derived mainly from sandstone shale. Soils are loamy-skeletal with more than 50 percent rock fragments throughout the soil profile. They are usually calcareous throughout. Available water capacity is 2-4 inches.

This site has been used in the following soil surveys and has been correlated to the following components:
UT631 – Henry Mountains Area – Blackston;
UT685 - Capitol Reef - Myton;
UT686 – Escalante Grand Staircase National Monument – Stent;
UT689 – Glen Canyon National Recreation Area – Myton;

Table 4. Representative soil features

Parent material	(1) Alluvium–diorite (2) Colluvium–sandstone and shale

Surface texture	(1) Very gravelly sandy loam (2) Gravelly fine sandy loam (3) Very gravelly fine sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderate to moderately rapid
Soil depth	60 in
Surface fragment cover <=3"	23–35%
Surface fragment cover >3"	2–3%
Available water capacity (0-40in)	1.8–4.5 in
Calcium carbonate equivalent (0-40in)	5–15%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0–4
Soil reaction (1:1 water) (0-40in)	7.9–8.8
Subsurface fragment volume <=3" (Depth not specified)	22–38%
Subsurface fragment volume >3" (Depth not specified)	4–32%

Ecological dynamics

This site developed under the Colorado Plateau ecological conditions and the natural influences of herbivory and climate. In average years, plants begin growth about February 20 and end growth around October 30.

Sharp and Sanders' photo record indicates that insect herbivory coupled with climate fluctuations appear to drive some shadscale communities (Sharp and Sanders 2002). During periods of drought, perennial warm and cool season grasses decrease, while periods of normal and above average precipitation result in their increase. Shrub cover is generally lower under dryer climatic conditions, and annual production decreases during drought. Shadscale is also susceptible to diseases such as root rot, water mold, and vascular wilt fungi (USU.edu, 2009). There is little natural herbivory attributed to large herbivores on the site due to the lack of cover available to wildlife species. However, both

shadscale and bud sagebrush are highly palatable and are considered good forage for both livestock and wildlife on winter range (USU.edu, 2009).

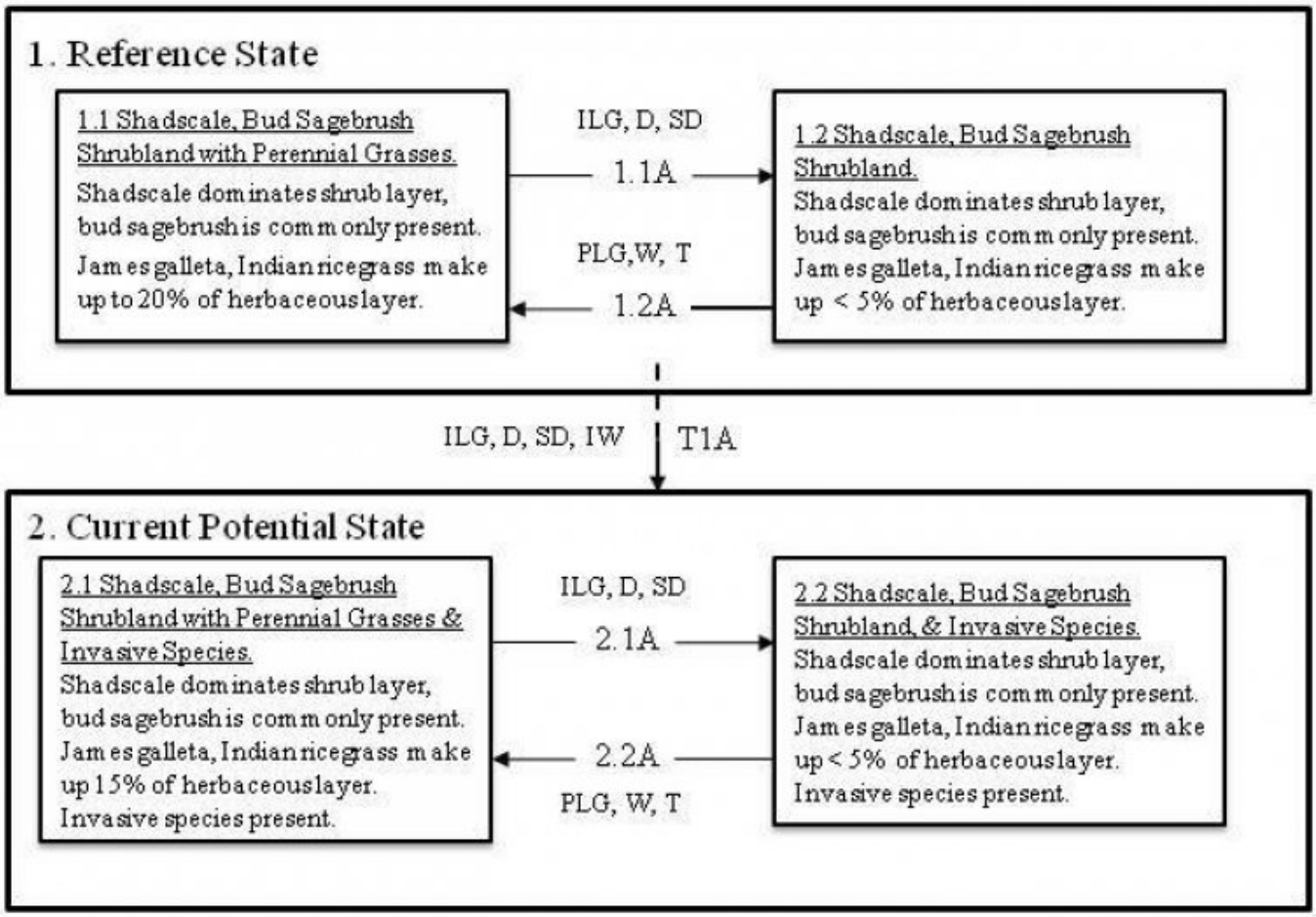
This ecological site has been grazed by domestic livestock since they were first introduced into the area around 1860. This livestock introduction, including the use of fencing, and the development of reliable water sources, have influenced the disturbance regime historically associated with this ecological site. This site often served as wintering pastures for sheep and cattle producers. Improperly managed livestock grazing (continuous season long grazing, heavy stocking rates, etc.) can cause this site to depart from it's reference plant community. Native perennial grasses can decrease while invasive forbs, annual grasses, rabbitbrush and broom snakeweed can increase. Shadscale, due to its spinescent nature, is resistant to moderate browsing pressures, however, improper grazing may stress this plant and allow nutrients to become available for invasive species to flourish (Simonin, 2001). Timing of grazing also affects the sites ecological dynamics, for example, spring grazing can result in a decline of cool season grasses, while heavy summer/early fall grazing can result in a decline of warm season grasses. Bud sagebrush can be eliminated from most sites through late winter and early spring grazing (USU.edu, 2009). Intense grazing of shadscale in the spring and early summer can be injurious to that species (USU.edu, 2009). The reduction of bud sagebrush and shadscale through grazing has not been documented on this particular site, but care should be taken to ensure that over grazing of these brush species does not become problematic in the future.

As vegetative communities respond to changes in management or natural influences that move them from one state to another, a return to previous states may not be possible. The amount of energy needed to affect these vegetative shifts depends on present biotic and abiotic features and the desired results.

The following state and transition model diagram depicts some of the most commonly occurring plant communities found on this ecological site. These 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 in 2006 and 2007 in Canyonlands National Park in Southeastern Utah as part of a national park soil survey update. Both ocular and measured data was collected and utilized. Range data collected by the NRCS since 1983 was also used.

State and transition model

State and Transition Model
State: Utah
Site Type: Rangeland
MLRA: D-35- Colorado Plateau
R035XY136UT – Desert Stony Loam (Shadscale, Bud Sagebrush).



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

State 1
Reference State

The reference state represents the historic plant communities and ecological dynamics of the desert stony loam, shadscale-bud sagebrush site. This state includes the biotic communities that become established on the ecological site if all successional sequences are completed under current climatic conditions; natural disturbances are inherent in its

development. This state is dominated by warm season perennial grasses, shadscale, and bud sagebrush. The primary disturbance mechanism is climate fluctuations. The reference state is self sustaining and resistant to change due to high resistance to natural disturbances and high resilience following natural disturbances. When natural disturbances occur, the rate of recovery is relatively rapid due to niches being filled with highly adapted native vegetation. The reference state was determined by study of rangeland relic areas, areas protected from excessive disturbance and outside influences, such as grazing and recreation. Literature reviews, trends in plant community dynamics, and historical accounts are also considered. Reference State: Community phases disturbed by climate fluctuations and insect herbivory. Indicators: A site dominated by shadscale and bud sagebrush where James galleta, Indian ricegrass and sand dropseed may or may not be present. Feedbacks: Extended periods of above average precipitation resulting in an increase in the native perennial plant vigor. Insect herbivory that reduces shrub vigor and allows grass production to increase. At-risk Community Phase: All communities are at risk when nutrients are available for invasive plants to establish. Plant community 1.2 is especially at risk due to limited production and cover of understory grasses. Trigger: Introduction of invasive plants to fill available niches.

Community 1.1
Shadscale, Bud Sagebrush Shrubland with Perennial Grasses.

Figure 4. Shadescale, bud sage with perennial grasses.

This plant community phase is dominated by shadscale, bud sagebrush, and perennial grasses. Grasses may include but are not limited to, Indian ricegrass and James galleta. James galleta is typically the dominant perennial grass species in this plant community phase. Other perennial grasses may or may not be present. Other perennial shrubs, and forbs may be present and cover is variable. Bare ground is 1-3% and biological crusts are 15-20%. Surface rock fragments (23-35%) can be very prevalent. The following tables provide an example of the typical vegetative floristics of a community phase 1.1 plant community.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	70	90	120
Shrub/Vine	60	80	100
Forb	15	20	30
Total	**145**	**190**	**250**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	10-15%
Grass/grasslike foliar cover	15-35%
Forb foliar cover	5-15%
Non-vascular plants	0%
Biological crusts	15-20%
Litter	3-8%
Surface fragments >0.25" and <=3"	23-35%
Surface fragments >3"	2-3%
Bedrock	30-60%
Water	0%
Bare ground	10-20%

Table 7. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	1-5%	10-20%	2-10%
>0.5 <= 1	–	4-10%	10-15%	0-5%
>1 <= 2	–	5-10%	5-10%	0-5%
>2 <= 4.5	–	–	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 1.2
Shadscale, Bud Sagebrush Shrubland.

Figure 6. Shadescale, bud sage shrubland.

This plant community phase is dominated by shadscale and bud sagebrush, where warm and cool season perennial grasses are minimally present. Grasses may include but are not limited to, Indian ricegrass and James galleta. James galleta is typically the dominant perennial grass species in this plant community phase. Other perennial grasses, shrubs, and forbs may or may not be present and cover is variable. Bare ground is 3-5% and biological crusts are 15-20%. Surface rock fragments (23-35%) can be very prevalent. The following tables provide an example of the typical vegetative floristics of a community phase 1.2 plant community.

Table 8. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	55	80	90
Grass/Grasslike	25	60	80
Forb	10	15	25
Total	**90**	**155**	**195**

Table 9. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	5-15%
Grass/grasslike foliar cover	5-25%
Forb foliar cover	3-10%

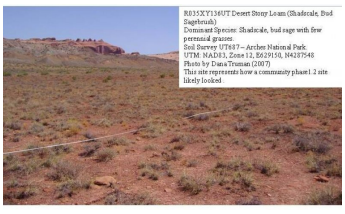
Non-vascular plants	0%
Biological crusts	15-20%
Litter	3-8%
Surface fragments >0.25" and <=3"	23-35%
Surface fragments >3"	2-3%
Bedrock	30-60%
Water	0%
Bare ground	10-20%

Table 10. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	1-5%	5-20%	2-10%
>0.5 <= 1	–	2-10%	0-15%	0-5%
>1 <= 2	–	2-10%	0-10%	0-5%
>2 <= 4.5	–	–	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Pathway 1.1A
Community 1.1 to 1.2

Shadscale, Bud Sagebrush Shrubland with Perennial Grasses.

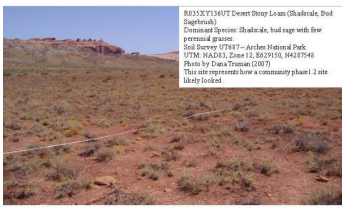


Shadscale, Bud Sagebrush Shrubland.

This pathway occurs when climatic events, such as drought disfavor the establishment and persistence of perennial grasses. Improper livestock grazing and/or surface disturbance may accelerate this transition.

Pathway 1.2A

Community 1.2 to 1.1



Shadscale, Bud Sagebrush Shrubland.

Shadscale, Bud Sagebrush Shrubland with Perennial Grasses.

This pathway occurs when climatic events, such as years with normal to above average precipitation favor the establishment and persistence of perennial grasses. Carefully managed livestock grazing, where present can accelerate this transition.

State 2
Current Potential State

The current potential state is similar to state one, however there are invasive species established in the understory—cheatgrass and halogeton being the most common. The primary disturbance mechanism is climate fluctuations; however livestock grazing may influence the ecological dynamics of the site. Current Potential State: Plant communities disturbed by fluctuating climatic conditions insect herbivory, and livestock grazing. Indicators: A site dominated by shadscale and bud sagebrush, where Indian ricegrass and sand dropseed may or may not be present. Invasive species are present. Feedbacks: Fluctuations in climate allow for the maintenance of both shrubs and perennial grasses.

Community 2.1
Shadscale, Bud Sagebrush Shrubland with Perennial Grassses & Invasive Annuals.


R035XY136UT Desert Stony Loam (Shadscale, Bud Sagebrush)
Dominant Species: Shadscale, bud sage, Torrey's jointfir with perennial grasses.
Soil Survey UT687 – Arches National Park.
UTM: NAD83, Zone 12, E586606, N4259141
Photo by Dana Truman (2008)

This plant community phase is dominated by shadscale, bud sagebrush, and perennial grasses. Grasses may include but are not limited to, Indian ricegrass and James galleta.

James galleta is typically the dominant perennial grass species in this plant community phase. Other perennial grasses may also be present. Other perennial shrubs, and forbs may be present and cover is variable. Bare ground is 1-3% and biological crusts are 15-20%. Surface rock fragments (23-35%) can be very prevalent. This plant community is very similar to plant community 1.1 in production and cover. The main difference is that invasive species are present in this phase. The following tables provide an example of the typical vegetative floristics of a community phase 2.1 plant community.

Table 11. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	70	90	120
Shrub/Vine	60	80	100
Forb	15	20	30
Total	**145**	**190**	**250**

Table 12. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	10-15%
Grass/grasslike foliar cover	15-35%
Forb foliar cover	5-15%
Non-vascular plants	0%
Biological crusts	15-20%
Litter	3-8%
Surface fragments >0.25" and <=3"	23-35%
Surface fragments >3"	2-3%
Bedrock	30-60%
Water	0%
Bare ground	10-20%

Table 13. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	1-5%	10-20%	2-10%
>0.5 <= 1	–	4-10%	10-15%	0-5%
>1 <= 2	–	5-10%	5-10%	0-5%
>2 <= 4.5	–	–	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 2.2
Shadscale, Bud Sagebrush Shrubland with Invasive Annuals.

Figure 9. Shadescale, bud sage with invasive grasses.

This plant community phase is dominated by shadscale and bud sagebrush, where warm and cool season perennial grasses are minimally present. Grasses may include but are not limited to, Indian ricegrass and James galleta. James galleta is typically the dominant perennial grass species in this plant community phase. Other perennial grasses, shrubs, and forbs may also be present and cover is variable. Bare ground is 3-5% and biological crusts are 15-20%. Surface rock fragments (23-35%) can be very prevalent. This plant community is very similar to plant community 1.2 in production and cover. The main difference is that invasive species are present in this phase. The following tables provide an example of the typical vegetative floristics of a community phase 2.2 plant community.

Table 14. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	55	80	90
Grass/Grasslike	25	60	80
Forb	10	15	25
Total	**90**	**155**	**195**

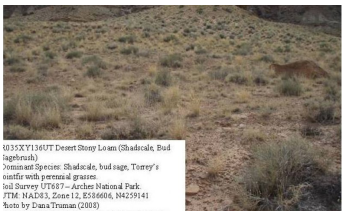
Table 15. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	5-15%
Grass/grasslike foliar cover	5-25%
Forb foliar cover	3-10%
Non-vascular plants	0%
Biological crusts	15-20%
Litter	3-8%
Surface fragments >0.25" and <=3"	23-35%
Surface fragments >3"	2-3%
Bedrock	30-60%
Water	0%
Bare ground	10-20%

Table 16. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	1-5%	5-20%	2-10%
>0.5 <= 1	–	2-10%	0-15%	0-5%
>1 <= 2	–	2-10%	0-10%	0-5%
>2 <= 4.5	–	–	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Pathway 2.1A
Community 2.1 to 2.2



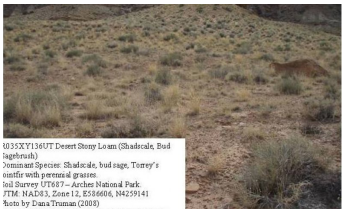
Shadscale, Bud Sagebrush Shrubland with Perennial Grassses & Invasive Annuals.

Shadscale, Bud Sagebrush Shrubland with Invasive Annuals.

This pathway occurs when climatic events, such as drought disfavor the establishment and persistence of perennial grasses. Improper livestock grazing and/or surface disturbance may accelerate this transition.

Pathway 2.2A
Community 2.2 to 2.1

Shadscale, Bud Sagebrush Shrubland with Invasive Annuals.



Shadscale, Bud Sagebrush Shrubland with Perennial Grassses & Invasive Annuals.

This pathway occurs when events, such as years with normal to above average precipitation favor the establishment of perennial grasses, and when grazing regimes are used that promote the establishment and persistence of perennial grasses.

Transition T1A
State 1 to 2

Transition from Reference State (State 1) to Current Potential State (State 2). This transition occurs as invasive species become established in the plant community. Common invasive species include cheatgrass, halogeton, and Russian thistle. Disturbances that may accelerate this transition include improper livestock grazing, surface disturbance and extended drought. Invasive species such as cheatgrass have also been known to invade an intact perennial plant community where no disturbance has occurred. Short wet spells when annuals are germinating can significiently increase their annual production.

Additional community tables

Table 17. Community 1.1 plant community composition

				Annual Production	Foliar

Group	Common Name	Symbol	Scientific Name	(Lb/Acre)	Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			60–80	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	50–75	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	10–30	–
3	**Sub-Dominant Shrubs**			20–40	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	25–50	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–15	–
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–12	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	5–10	–
	valley saltbush	ATCU	*Atriplex cuneata*	0–8	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–7	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–7	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–6	–
	crispleaf buckwheat	ERCOA	*Eriogonum corymbosum var. aureum*	0–5	–
	desert pepperweed	LEFR2	*Lepidium fremontii*	0–4	–
	Nevada jointfir	EPNE	*Ephedra nevadensis*	0–4	–
	Fremont's dalea	PSFR	*Psorothamnus fremontii*	0–3	–
	Whipple's fishhook cactus	SCWH	*Sclerocactus whipplei*	0–2	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–2	–
Grass/Grasslike					
0	**Dominant Grass**			30–60	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	10–25	–
1	**Sub-Dominant Grasses**			15–50	
	alkali sacaton	SPAI	*Sporobolus airoides*	0–50	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–25	–
	Grass, annual	2GA	*Grass, annual*	0–10	–
	Grass, perennial	2GP	*Grass, perennial*	0–10	–
	squirreltail	ELEL5	*Elymus elymoides*	0–5	–
	bluegrass	POA	*Poa*	0–3	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–3	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–3	–
Forb					

Forb					
2	**Forbs**			15–30	
	woolly locoweed	ASMO7	*Astragalus mollissimus*	2–10	–
	woolly plantain	PLPA2	*Plantago patagonica*	5–10	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–7	–
	flatcrown buckwheat	ERDE6	*Eriogonum deflexum*	0–7	–
	matted crinklemat	TILA6	*Tiquilia latior*	0–6	–
	Forb, annual	2FA	*Forb, annual*	0–5	–
	Forb, perennial	2FP	*Forb, perennial*	0–5	–
	onion	ALLIU	*Allium*	0–3	–
	Pacific aster	SYCHC	*Symphyotrichum chilense var. chilense*	0–3	–
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	0–3	–
	flatspine stickseed	LAOC3	*Lappula occidentalis*	0–2	–
	redroot buckwheat	ERRA3	*Eriogonum racemosum*	0–2	–
	tansymustard	DESCU	*Descurainia*	0–2	–
	woodyaster	XYLOR	*Xylorhiza*	0–2	–
	manybranched ipomopsis	IPPO2	*Ipomopsis polycladon*	0–1	–
	rusty lupine	LUPU	*Lupinus pusillus*	0–1	–
	Townsend daisy	TOWNS	*Townsendia*	0–1	–

Table 18. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrub**			40–60	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	30–45	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	10–15	–
3	**Sub-Dominant Shrubs**			15–30	
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–12	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	5–10	–
	valley saltbush	ATCU	*Atriplex cuneata*	0–8	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus*	0–7	–

	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–4	
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–7	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–6	–
	crispleaf buckwheat	ERCO14	*Eriogonum corymbosum*	0–5	–
	desert pepperweed	LEFR2	*Lepidium fremontii*	0–4	–
	Nevada jointfir	EPNE	*Ephedra nevadensis*	0–4	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–2	–
	Whipple's fishhook cactus	SCWH	*Sclerocactus whipplei*	0–2	–
Grass/Grasslike					
0	**Dominant Grass**			20–50	
	James' galleta	PLJA	*Pleuraphis jamesii*	15–40	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	5–20	–
1	**Sub-Dominant Grass**			5–30	
	alkali sacaton	SPAI	*Sporobolus airoides*	0–30	–
	Grass, annual	2GA	*Grass, annual*	0–10	–
	Grass, perennial	2GP	*Grass, perennial*	0–10	–
	squirreltail	ELEL5	*Elymus elymoides*	0–5	–
	bluegrass	POA	*Poa*	0–3	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–3	–
	threeawn	ARIST	*Aristida*	0–3	–
Forb					
2	**Forbs**			10–25	
	woolly plantain	PLPA2	*Plantago patagonica*	5–10	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	2–10	–
	flatcrown buckwheat	ERDE6	*Eriogonum deflexum*	0–7	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–7	–
	matted crinklemat	TILA6	*Tiquilia latior*	0–6	–
	Forb, annual	2FA	*Forb, annual*	0–5	–
	Forb, perennial	2FP	*Forb, perennial*	0–5	–
	onion	ALLIU	*Allium*	0–3	–

	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	0–3	–
	tansymustard	DESCU	*Descurainia*	0–2	–
	redroot buckwheat	ERRA3	*Eriogonum racemosum*	0–2	–
	flatspine stickseed	LAOC3	*Lappula occidentalis*	0–2	–
	woodyaster	XYLOR	*Xylorhiza*	0–2	–
	rusty lupine	LUPU	*Lupinus pusillus*	0–1	–
	manybranched ipomopsis	IPPO2	*Ipomopsis polycladon*	0–1	–
	Townsend daisy	TOWNS	*Townsendia*	0–1	–

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**			60–80	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	50–75	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	10–30	–
3	**Sub-Dominant Shrubs**			20–40	
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–12	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	5–10	–
	valley saltbush	ATCU	*Atriplex cuneata*	0–8	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–7	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–7	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–6	–
	crispleaf buckwheat	ERCO14	*Eriogonum corymbosum*	0–5	–
	desert pepperweed	LEFR2	*Lepidium fremontii*	0–4	–
	Nevada jointfir	EPNE	*Ephedra nevadensis*	0–4	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–2	–
	Whipple's fishhook cactus	SCWH	*Sclerocactus whipplei*	0–2	–
Grass/Grasslike					
0	**Dominant Grass**			30–60	

	James' galleta	PLJA	*Pleuraphis jamesii*	20–50	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	10–25	–
	cheatgrass	BRTE	*Bromus tectorum*	1–25	–
1	**Sub-Dominant Grass**			15–50	
	alkali sacaton	SPAI	*Sporobolus airoides*	0–50	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–25	–
	Grass, annual	2GA	*Grass, annual*	0–10	–
	Grass, perennial	2GP	*Grass, perennial*	0–10	–
	squirreltail	ELEL5	*Elymus elymoides*	0–5	–
	bluegrass	POA	*Poa*	0–3	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–3	–
	threeawn	ARIST	*Aristida*	0–3	–
Forb					
2	**Forbs**			15–30	
	woolly locoweed	ASMO7	*Astragalus mollissimus*	2–10	–
	woolly plantain	PLPA2	*Plantago patagonica*	5–10	–
	saltlover	HAGL	*Halogeton glomeratus*	1–8	–
	flatcrown buckwheat	ERDE6	*Eriogonum deflexum*	0–7	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–7	–
	matted crinklemat	TILA6	*Tiquilia latior*	0–6	–
	prickly Russian thistle	SATR12	*Salsola tragus*	1–5	–
	Forb, annual	2FA	*Forb, annual*	0–5	–
	onion	ALLIU	*Allium*	0–3	–
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	0–3	–
	flatspine stickseed	LAOC3	*Lappula occidentalis*	0–2	–
	tansymustard	DESCU	*Descurainia*	0–2	–
	redroot buckwheat	ERRA3	*Eriogonum racemosum*	0–2	–
	woodyaster	XYLOR	*Xylorhiza*	0–2	–
	manybranched ipomopsis	IPPO2	*Ipomopsis polycladon*	0–1	–

	rusty lupine	LUPU	*Lupinus pusillus*	0–1	–
	Townsend daisy	TOWNS	*Townsendia*	0–1	–

Table 20. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrub**			40–60	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	30–45	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	10–15	–
3	**Sub-Dominant Shrubs**			15–30	
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–12	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	5–10	–
	valley saltbush	ATCU	*Atriplex cuneata*	0–8	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–7	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–7	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–6	–
	crispleaf buckwheat	ERCO14	*Eriogonum corymbosum*	0–5	–
	desert pepperweed	LEFR2	*Lepidium fremontii*	0–4	–
	Nevada jointfir	EPNE	*Ephedra nevadensis*	0–4	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–2	–
	Whipple's fishhook cactus	SCWH	*Sclerocactus whipplei*	0–2	–
Grass/Grasslike					
0	**Dominant Grass**			20–50	
	James' galleta	PLJA	*Pleuraphis jamesii*	15–40	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	5–20	–
	cheatgrass	BRTE	*Bromus tectorum*	1–13	–
1	**Sub-Dominant Grass**			5–30	
	alkali sacaton	SPAI	*Sporobolus airoides*	0–30	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–25	–
	Grass, annual	2GA	*Grass, annual*	0–10	

	Grass, annual	2GA	*Grass, annual*	0–10	–
	Grass, perennial	2GP	*Grass, perennial*	0–10	–
	squirreltail	ELEL5	*Elymus elymoides*	0–5	–
	bluegrass	POA	*Poa*	0–3	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–3	–
	threeawn	ARIST	*Aristida*	0–3	–
Forb					
2	**Forbs**			10–25	
	woolly locoweed	ASMO7	*Astragalus mollissimus*	2–10	–
	woolly plantain	PLPA2	*Plantago patagonica*	5–10	–
	saltlover	HAGL	*Halogeton glomeratus*	1–8	–
	flatcrown buckwheat	ERDE6	*Eriogonum deflexum*	0–7	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–7	–
	matted crinklemat	TILA6	*Tiquilia latior*	0–6	–
	prickly Russian thistle	SATR12	*Salsola tragus*	1–5	–
	Forb, annual	2FA	*Forb, annual*	0–5	–
	Forb, perennial	2FP	*Forb, perennial*	0–5	–
	onion	ALLIU	*Allium*	0–3	–
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	0–3	–
	flatspine stickseed	LAOC3	*Lappula occidentalis*	0–2	–
	tansymustard	DESCU	*Descurainia*	0–2	–
	redroot buckwheat	ERRA3	*Eriogonum racemosum*	0–2	–
	woodyaster	XYLOR	*Xylorhiza*	0–2	–
	manybranched ipomopsis	IPPO2	*Ipomopsis polycladon*	0–1	–
	rusty lupine	LUPU	*Lupinus pusillus*	0–1	–
	Townsend daisy	TOWNS	*Townsendia*	0–1	–

Animal community

--Wildlife Interpretation--
Small herds of mule deer and pronghorn antelope can be seen grazing/browsing on these sites, especially when near water sources and in the winter. Desert bighorn sheep may

utilize this site, when occurring on steeper slopes. The hot climate and lack of water favors small mammals, which have an easier time finding shelter, food, and water to live. Many species of rats, mice, squirrels, bats, and chipmunks can be observed, along with coyotes and foxes. Lizards are the most visible and can be observed during the day. Species may include the northern whiptail, desert spiny, and the colorful western collard lizard. (NPS.gov, 2008)

--Grazing Interpretations--
Shadescale and bud sagebrush are highly palatable shrubs and are good winter forage for livestock and wildlife. Indian ricegrass and James galleta are good forage for grazing animals whenever they are available. Timing of grazing affects the ecological dynamics of this site. Spring grazing results in a decline of cool season grasses, while heavy summer/early fall grazing results in a decline of warm season grasses. Bud sagebrush can be eliminated from most sites through late winter and early spring grazing (USU.edu, 2009). Intense grazing of shadscale in the spring and early summer can reduce the presence of shadscale (USU.edu, 2009). 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 this sites poor suitability for reseeding or restoration. These treatments are difficult due to the sites extreme temperatures, unpredictability in time required for recovery, and variable amounts of precipitation. This site may occur in mule deer, desert bighorn sheep, and pronghorn antelope, habitat; however in many places the populations will be small and have little grazing impact on the site.

The plant community is generally an equal mixture shrubs and grasses. The dominant shrub species provide good browse for mule deer and domestic sheep and goats in the winter, spring, and fall. Subdominant shrubs include winterfat and Torrey’s jointfir, which provide good winter browse for cattle, sheep, goats, mule deer, bighorn sheep, and pronghorn antelope. The presence of grasses including James galleta and Indian ricegrass, provide good grazing conditions for all classes of livestock and wildlife. Forb composition and total annual production depends primarily on precipitation amounts and thus creates challenges fot those making livestock grazing management decisions. 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.

Hydrological functions

The soil in this site is in hydrologic group B. (NRCS National Engineering Handbook. The runoff curve numbers are 61 through 79 depending on watershed condition. 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 a sites hydrology by decreasing plant cover and increasing bare ground. Fire can also affect hydrology, but it is variable. Fire intensity, fuel type, soil,

climate, and topography can each have different influences. Fires can increase areas of bare ground and hydrophobic layers that reduce infiltration and increase runoff (National Range and Pasture Handbook, 2003).

Recreational uses

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

Wood products

None

Other information

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

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

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

Russian thistle 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)

Potentially toxic plants associated with this site can include four-wing saltbush and buckwheat species, which may accumulate selenium when 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.

--Invasive Plant Communities--
As ecological conditions deteriorate and native vegetation decreases due to disturbance (fire, improper livestock grazing, drought, off road vehicle overuse, erosion, etc.) invasive species can establish on the site. Of particular concern in arid environments are the non-native annual invaders including cheatgrass, Red brome, Russian thistle, kochia, halogeton, and mustards. The presence of these species will depend on soil properties and moisture availability; however, these invaders are highly adaptive and can flourish in many locations. Once established, complete removal is difficult but suppression may be possible. Shadscale ecological sites occur on a wide variety of saline soils and thus invading plants must be tolerant of such conditions.

--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 desert plant communities in the Colorado Plateau may have evolved without a significient influence of fire. However, a year of exceptionally heavy winter rains can generate sufficient fuels to carry fire 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.

This ecological site was not historically heavily influenced by fire. However, the increased presence of exotic annual grasses can greatly alter it's fire regimes due to the increase in fine fuels. It's slow recovery period after disturbance allows for cheatgrass invasions which can subsequently increase the fire cycle. When fire does occur, shadscale plants are often killed and can not readily recover except through re-establishment by seeds from adjacent unburned stands. Because shadscale seedlings lack spines, they are highly susceptible to browsing and thus grazing should be excluded for at least two years post fire.

Inventory data references

This model was developed using range data collected in 2006 and 2007 in Canyonlands

National Park in Southeastern Utah as part of a national park soil survey update. Both ocular and measured data was collected and utilized. Range data collected by the NRCS since 1983 was also used.

Type locality

Location 1: Grand County, UT	
UTM zone	N
UTM northing	4587548
UTM easting	629159
General legal description	Arches National Park

Other references

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

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.

NPS.gov. 2008. Canyonlands National Park. Nature and Science. Available: http://www.nps.gov/cany/naturescience/. Accessed on January 4, 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.

USU.edu, 2009. Range Plants of Utah. Available: http://extension.usu.edu/rangeplants/. Accessed on December 1, 2009.

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

Relative Forage Preference of Plants for Grazing Use by Season: Plants commonly found in Major Land Resource Area D35 --The Colorado Plateau. 2007

Stubbendieck, J., S. L. Hatch, and C. H. Butterfield. 1997. North American range plants. Lincoln, NE: University of Nebraska Press. 501p.

USU.edu, 2009. Range Plants of Utah. Available: http://extension.usu.edu/rangeplants/. Accessed on December 1, 2009.

USDA, Forest Service. 2007. Fire effects information: plant species life form. Available at http://www.fs.fed.us/database/feis/plants/index.html. Accessed 7 August 2007.

Contributors

George Cook
V.Keith Wadman, 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)	Robert D. Stager (BLM), Shane A. Green (NRCS), Dana Truman (NRCS), Randy Beckstrand (BLM), Paul Curtis (BLM)
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 rare. Any rills should be 6 to 10 feet in length. Rills are most likely to form below adjacent exposed bedrock or where water flow patterns converge where sufficient water accumulates to cause erosion. Overall, rills are not active.

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2. **Presence of water flow patterns:** Frequent and occur throughout area. Flow patterns are short and sinuous and wind between the surface rocks and plant bases. They are short (up to 8 feet), narrow (under 6 inches wide), and spaced 7 to 15 feet apart.

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3. **Number and height of erosional pedestals or terracettes:** Rare. Any pedestalled plants may show very minor (<.5 inch) pedestalling on their down slope side, or adjacent to water flow patterns. Terracettes should be few where debris and 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):** 10 – 20%. (Soil surface is typically covered by up to 60% rock). Ground cover is measured as first raindrop impact, bare ground is the inverse of cover. Ground cover + bare ground = 100%. 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:** Very few gullies may be present. If present, their length often extends from exposed bedrock or other areas of water flow accumulation until gully reaches a stream or an area where water and sediment accumulate. They may be wide and shallow and armored with very large rocks.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** No evidence of wind generated soil movement. Wind caused blowouts and deposition are not present.

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7. **Amount of litter movement (describe size and distance expected to travel):** Some relocation by wind, and some down slope redistribution caused by water. Fine litter removal may occur in flow patterns with deposition occurring at points of obstruction, accumulating at plant or rock bases, especially following large storm events. Litter movement will increase with slope.

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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 very cobbly sandy loam to very gravelly sandy clay loam. 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 is approximately 3 inches deep. Structure is typically massive to weak medium platy to moderate medium granular. Color is typically light red (2.5YR6/6) to very pale brown (10YR7/3). The A horizon would be expected to be more strongly developed under plant canopies. It is important if you are sampling to observe the A horizon under plant canopies as well as the interspaces. Use the specific information for the soil you are assessing found in the published soil survey to supplement this description.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Distribution of vascular plants are expected to intercept raindrops reducing splash erosion. Vegetation distribution helps create sinuous water flow patterns along with any surface rock to reduce or eliminate runoff and erosion in all but the most extreme storm events. Plants have even distribution across the site. Spatial distribution of well developed biological soil crusts intercept raindrops reducing splash erosion and provide areas of surface detention to store water allowing additional time for infiltration. When perennial grasses and shrubs 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. There may be layers of calcium carbonate or other naturally occurring hard layers found in the soil subsurface. These should not be considered to be compaction layers.

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

    Dominant: Non-sprouting shrubs (Shadscale, Bud sage) > Warm season perennial grasses (Galleta)

    Sub-dominant: Cool season perennial bunchgrasses (Indian ricegrass) >= sprouting shrubs (Torrey Mormontea, Bigelow sage) > native perennial and annual forbs (Wooly milkvetch) > 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 factors include drought, insects, wildlife browsing, and very infrequent fire. Spatial variability factors include soil depth, texture, rock fragment size and amounts, elevation, etc.
Following a recent disturbance such as drought or insects that removes the woody vegetation, forbs and perennial grasses (herbaceous species) may dominate the community. These conditions could reflect a functional community phase within the reference state.

---

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** During years with near average or above average precipitation, there should be very little recent plant mortality and decadence in either the shrubs or grasses. During severe (multi year) drought, many of the Shadscale plants will die. Some mortality of perennial grass and other shrubs may also occur during severe droughts. There may be partial mortality of individual grasses and shrubs during less severe drought. Shadscale may appear dead during droughts, but is actually in a dormant stage with partial leaf shedding.

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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 to 7-15% on some years due to increased production of plants.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 450-500 #/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, Russian thistle, and other introduced annual forbs are most likely to invade this site.

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17. **Perennial plant reproductive capability:** All perennial plants should have the ability to reproduce sexually or asexually in all years, except in drought years.
