USDA Natural Resources
Conservation Service

Ecological site R035XY109UT
Desert Loam (Shadscale)

Accessed: 05/03/2024

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.

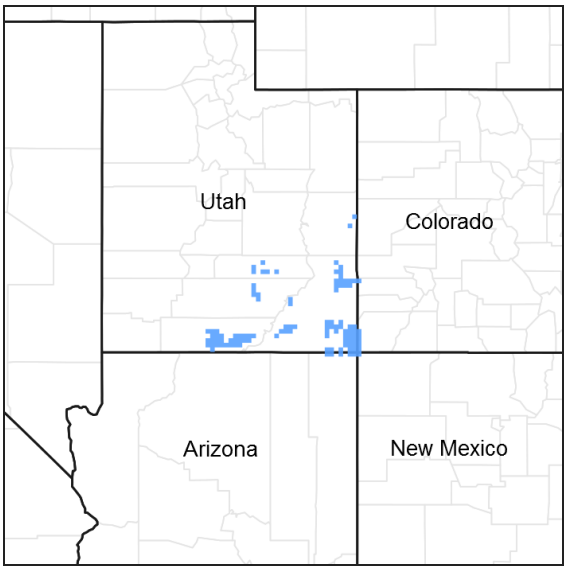


Figure 1. Mapped extent

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.

Associated sites

R035XY011UT	**Loamy Bottom (Basin Big Sagebrush)**
R035XY118UT	**Desert Sandy Loam (Fourwing Saltbush)**
R035XY121UT	**Desert Sandy Loam (Blackbrush)**
R035XY122UT	**Desert Shallow Loam (Shadscale)**
R035XY133UT	**Desert Shallow Sandy Loam (Blackbrush)**
R035XY136UT	**Desert Stony Loam (Shadscale-Bud Sagebrush)**
R035XY209UT	**Semidesert Loam (Wyoming Big Sagebrush)**
R035XY215UT	**Semidesert Sandy Loam (4-Wing Saltbush)**

Similar sites

R034BY106UT	**Desert Loam (Shadscale)**
R028AY124UT	**Desert Loam (Shadscale)**

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex confertifolia*
Herbaceous	(1) *Pleuraphis jamesii*

Physiographic features

This site occurs on drainageways, valley flats, structural benches, and stream terraces. Runoff is low to medium and the soil is well drained. Slopes are typically 0-10%. Elevations are generally from 4800-6000 ft.

Table 2. Representative physiographic features

Landforms	(1) Drainageway (2) Valley flat (3) Structural bench
Flooding duration	Very brief (4 to 48 hours)
Flooding frequency	None to very rare
Ponding frequency	None
Elevation	1,463–1,829 m
Slope	0–10%
Aspect	Aspect is not a significant factor

Climatic features

The climate is characterized by hot summers and cool to warm winters. Large fluctuations in daily temperatures are common. Mean annual high temperatures range from 51-70 degrees Fahrenheit and mean annual low temperatures range from 46-52 degrees Fahrenheit. Approximately 65–70% of moisture occurs as rain from March through October. On the average, April, May, and June are the driest months and August, September, and October are the wettest months. Precipitation is extremely variable from month to month and from year to year but averages between 6-12 inches. Much of the precipitation occurs as convection thunderstorms.

Table 3. Representative climatic features

Frost-free period (average)	174 days
Freeze-free period (average)	202 days
Precipitation total (average)	305 mm

Influencing water features

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

Soil features

The soils are moderately deep to very deep and well drained. Typically the dry surface is reddish brown to brown. Runoff is low to medium due to flatter slopes. The soil temperature and moisture regimes are mesic and typic aridic respectively. Surface and subsurface textures are generally fine sandy loams, loams, and silty clay loams. Soils are nonsaline to slightly saline. Average annual soil loss in potential is approximately 0.5 tons/acre. Pariette Family and Cerrillos variant are moderately deep soils; the other soils correlated with this site are very deep. Available water capacity for moderately deep soils is 5 to 7.5 inches.

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

UT631 – Henry Mountains Area – Cerrillos Variant

UT633 – Canyonlands Area – Barnum
UT638 – San Juan County, Central – Redhouse
UT643 – San Juan County, Navajo Indian Reservation – Typic Torrifluventes; Tohona Variant; Gotho
UT685 – Capital Reef National Park – Querecnia family, Begay family;
UT686 – Escalante Grand Staircase National Monument – Pariette; Minchey; Hanksville Family
UT688 – Canyonlands National Park – Myton

Table 4. Representative soil features

Surface texture	(1) Fine sandy loam (2) Loam (3) Silty clay loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Slow to moderate
Soil depth	51–180 cm
Surface fragment cover <=3"	0–35%
Surface fragment cover >3"	0–5%
Available water capacity (0-101.6cm)	11.68–19.05 cm
Calcium carbonate equivalent (0-101.6cm)	1–15%
Electrical conductivity (0-101.6cm)	0–8 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–13
Soil reaction (1:1 water) (0-101.6cm)	7.9–9
Subsurface fragment volume <=3" (Depth not specified)	0–9%
Subsurface fragment volume >3" (Depth not specified)	0–1%

Ecological dynamics

This site developed under the Colorado Plateau ecological conditions and the natural influences of herbivory and climate. This ecological site occurs on deep, well drained, ustic soils in Major Land Resource Area (MLRA) 35—The Colorado and Green River Plateaus. In average years plants begin to grow around 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 an increase in perennial warm and cool season grasses. Shrub cover is generally lower under dry climatic conditions, and annual production decreases during drought.

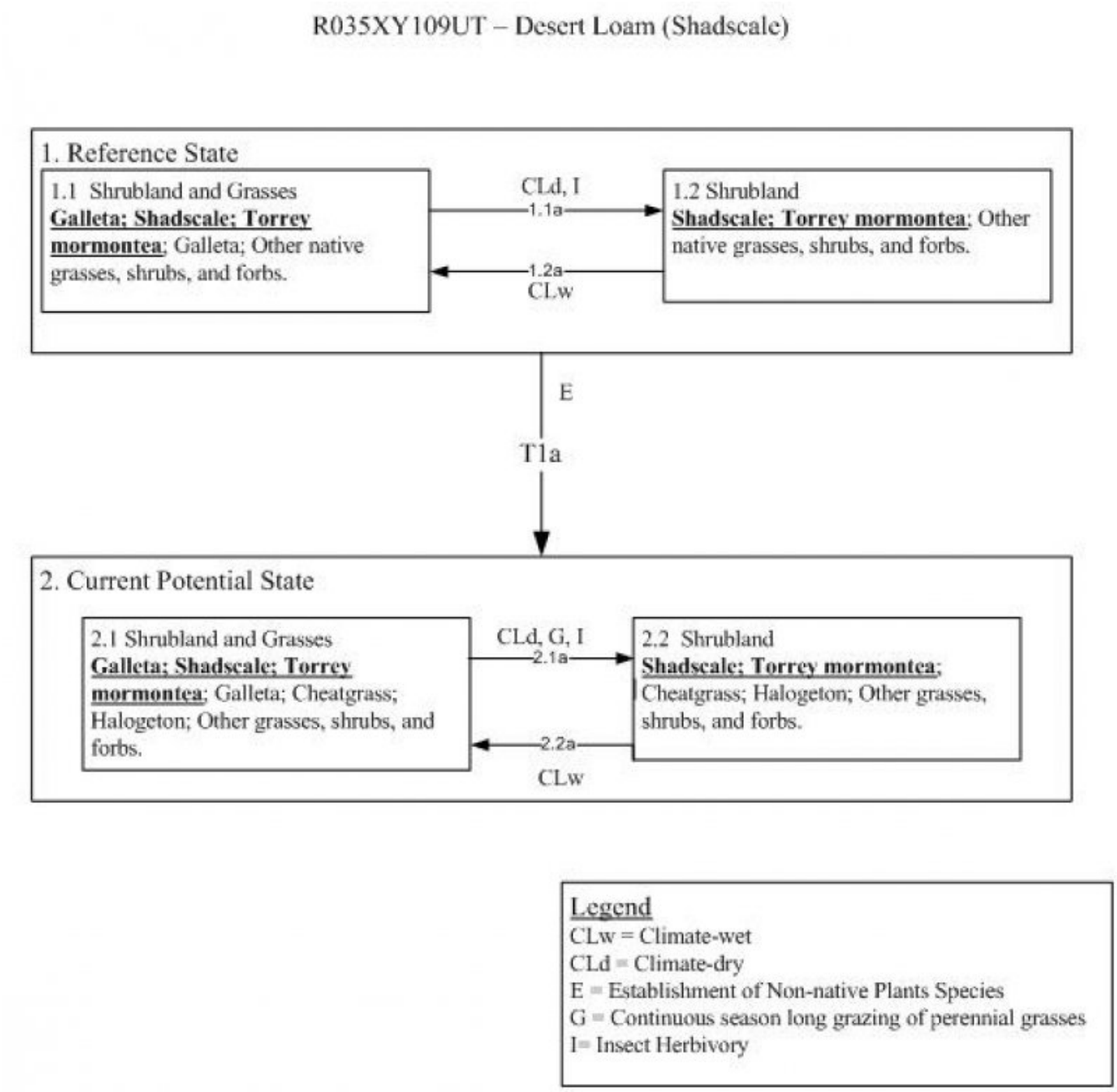
This ecological site has been grazed by domestic livestock since they were first introduced into the area (~1860). The introduction of domestic livestock and the use of fencing and reliable water sources have influenced the disturbance regime historically associated with this ecological site. This ecological site served as wintering pastures for sheep and cattle producers. Improperly managed livestock grazing (continuous season long grazing, heavy stocking rates, etc.) may cause this site to depart from the reference plant community. Native perennial grasses will decrease while invasive forbs, annual grasses, rabbitbrush and broom snakeweed will increase. While shadscale, due to its spinescent nature, is resistant to moderate browsing pressures, 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 ecological dynamics—spring grazing results in a decline of cool season grasses, while heavy summer/early fall grazing results in a decline of warm season grasses. Intense grazing of shadscale in the spring and early summer can damage shadscale (USU.edu, 2009). Shadscale is also susceptible to diseases such as root rot, water mold, and vascular wilt fungi (USU.edu, 2009).

As vegetation communities respond to changes in management or natural influences, return to previous states may not be possible. 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 model diagram does not necessarily depict all the transitions and states that are possible, but it does show some of the most commonly occurring plant communities. These plant communities may not represent every possibility, but they are the most prevalent and repeatable. As more data is collected, some of these plant communities may be revised or removed, and new ones may be added. This model was developed using range data collected 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.

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

State and transition model



State 1
Reference State

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. The reference state represents the historic plant communities and ecological dynamics of the desert loam, shadscale 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 and shadscale. 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. Reference State: Community phases disturbed by climate fluctuations and insect herbivory. Indicators: A site dominated by shadscale with 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
Shrubland with Grasses

This plant community phase is dominated by shadscale, Torrey mormontea, and perennial grasses. Grasses may include but are not limited to, Indian ricegrass and galleta. 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 2-19% and biological crusts are 0-30%. Surface rock fragments (0-35%) can be very prevalent.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	139	262	324
Grass/Grasslike	89	170	206
Forb	26	48	59
Total	**254**	**480**	**589**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	20-25%
Grass/grasslike foliar cover	10-20%
Forb foliar cover	5-13%
Non-vascular plants	0%
Biological crusts	0-28%
Litter	3-8%
Surface fragments >0.25" and <=3"	0-35%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	2-19%

Table 7. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-5%	2-8%	2-5%
>0.15 <= 0.3	–	2-10%	2-8%	0-5%
>0.3 <= 0.6	–	10-20%	2-5%	0-5%
>0.6 <= 1.4	–	–	–	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Community 1.2
Shrubland

This plant community phase is dominated by shadscale and Torrey mormontea, where warm and cool season perennial grasses are minimally present. Grasses may include but are not limited to, Indian ricegrass and galleta. 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 2-19% and biological crusts are 0-30%. Surface rock fragments 0-35%.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	96	135	157
Grass/Grasslike	11	45	62
Forb	28	34	39
Total	**135**	**214**	**258**

Table 9. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	20-25%
Grass/grasslike foliar cover	5-10%
Forb foliar cover	5-10%
Non-vascular plants	0%
Biological crusts	0-28%
Litter	3-8%
Surface fragments >0.25" and <=3"	0-35%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	2-19%

Table 10. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-5%	2-8%	2-5%
>0.15 <= 0.3	–	5-10%	2-8%	0-5%
>0.3 <= 0.6	–	10-20%	2-5%	0-5%
>0.6 <= 1.4	–	–	–	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Pathway 1.1a
Community 1.1 to 1.2

This pathway occurs when climatic events, such as drought disfavor the establishment and persistence of perennial grasses.

Pathway 1.2a
Community 1.2 to 1.1

This pathway occurs when climatic events, such as years with normal to above average precipitation favor the establishment of perennial grasses.

State 2
Current Potential State

This 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 galleta, 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
Shrubland with grasses

This plant community phase is dominated by shadscale, Torrey mormontea, and perennial grasses. Grasses may include but are not limited to, Indian ricegrass and galleta. Galleta is typically the dominant perennial grass species in this plant community phase. Other perennial or invasive grasses, shrubs, and forbs my or may not be present and cover is variable. 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. Bare ground is 2-19% and biological crusts are 0-30%. Surface rock fragments (0-35%) can be very prevalent.

Table 11. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	99	135	191
Grass/Grasslike	56	101	90
Forb	28	28	43
Total	**183**	**264**	**324**

Table 12. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	20-25%
Grass/grasslike foliar cover	10-20%
Forb foliar cover	5-15%
Non-vascular plants	0%
Biological crusts	0-28%
Litter	3-8%
Surface fragments >0.25" and <=3"	0-35%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	2-19%

Table 13. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-5%	2-8%	2-5%
>0.15 <= 0.3	–	5-10%	2-8%	0-5%
>0.3 <= 0.6	–	10-20%	2-5%	0-5%
>0.6 <= 1.4	–	–	–	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Community 2.2
Shrubland

This plant community phase is dominated by shadscale and Torrey mormontea, where warm and cool season perennial grasses are minimally present. Grasses may include but are not limited to, Indian ricegrass and galleta. Galleta is typically the dominant perennial grass species in this plant community phase. Other perennial or invasive grasses, shrubs, and forbs my or may not be present and cover is variable. 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. Bare ground is 2-19% and biological crusts are 0-30%. Surface rock fragments (0-35%) can be very prevalent.

Table 14. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	96	135	157
Grass/Grasslike	11	45	62
Forb	28	34	39
Total	**135**	**214**	**258**

Table 15. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	20-25%
Grass/grasslike foliar cover	5-10%
Forb foliar cover	5-10%
Non-vascular plants	0%
Biological crusts	0-28%
Litter	3-8%
Surface fragments >0.25" and <=3"	0-35%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	2-19%

Table 16. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-5%	2-8%	2-5%
>0.15 <= 0.3	–	2-10%	2-8%	0-5%
>0.3 <= 0.6	–	10-20%	2-5%	0-5%
>0.6 <= 1.4	–	–	–	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Pathway 2.1a
Community 2.1 to 2.2

This pathway occurs when events, such as drought or continuous season long grazing of perennial grasses, disfavor the persistence of perennial grasses.

Pathway 2.2a
Community 2.2 to 2.1

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

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 and extended drought. Invasive species such as cheatgrass have also been known to invade intact perennial plant community where no disturbance has occurred.

Additional community tables

Table 17. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Sub-dominant Shrub**			57–90	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	50–90	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	7–13	–
3	**Sub-Dominant Shrubs**			47–101	
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	6–56	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–45	–
	littleleaf horsebrush	TEGL	*Tetradymia glabrata*	0–34	–
	blackbrush	CORA	*Coleogyne ramosissima*	0–22	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–17	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	0–17	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–15	–

	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–11	–
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–1	–
	Whipple's fishhook cactus	SCWH	*Sclerocactus whipplei*	0–1	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–1	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–1	–
Grass/Grasslike					
0	**Dominant Grasses**			45–67	
	James' galleta	PLJA	*Pleuraphis jamesii*	45–67	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–22	–
1	**Sub-Dominant Grasses**			40–114	
	Grass, annual	2GA	*Grass, annual*	0–11	–
	Grass, perennial	2GP	*Grass, perennial*	0–11	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–10	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–2	–
	low woollygrass	DAPU7	*Dasyochloa pulchella*	0–2	–
	squirreltail	ELEL5	*Elymus elymoides*	0–2	–
Forb					
2	**Forbs**			28–43	
	Crescent milkvetch	ASAM5	*Astragalus amphioxys*	0–34	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–28	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	4–26	–
	Forb, annual	2FA	*Forb, annual*	0–22	–
	Forb, perennial	2FP	*Forb, perennial*	0–22	–
	desert trumpet	ERIN4	*Eriogonum inflatum*	0–17	–
	Utah fleabane	ERUT	*Erigeron utahensis*	0–11	–
	woodyaster	XYLOR	*Xylorhiza*	0–7	–
	western blanketflower	GASP	*Gaillardia spathulata*	0–3	–
	redroot buckwheat	ERRA3	*Eriogonum racemosum*	0–3	–
	Rocky Mountain beeplant	CLSE	*Cleome serrulata*	0–2	–
	fineleaf hymenopappus	HYFI	*Hymenopappus filifolius*	0–2	–
	tufted evening primrose	OECA10	*Oenothera caespitosa*	0–2	–
	basindaisy	PLIN7	*Platyschkuhria integrifolia*	0–2	–
	woolly bluestar	AMTO2	*Amsonia tomentosa*	0–2	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–2	–
	mustard	BRASS2	*Brassica*	0–2	–
	northwestern Indian paintbrush	CAAN7	*Castilleja angustifolia*	0–2	–
	Pacific aster	SYCHC	*Symphyotrichum chilense var. chilense*	0–2	–
	Townsend daisy	TOWNS	*Townsendia*	0–1	–
	desert princesplume	STPI	*Stanleya pinnata*	0–1	–
	Fendler's sandmat	CHFE3	*Chamaesyce fendleri*	0–1	–
	cryptantha	CRYPT	*Cryptantha*	0–1	–
	plains springparsley	CYAC	*Cymopterus acaulis*	0–1	–

Table 18. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			45–67	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	45–67	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	7–11	–
3	**Sub-Dominant Shrub**			45–90	
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	6–45	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–39	–
	littleleaf horsebrush	TEGL	*Tetradymia glabrata*	0–28	–
	blackbrush	CORA	*Coleogyne ramosissima*	0–22	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–11	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–11	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	0–11	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–6	–
	Whipple's fishhook cactus	SCWH	*Sclerocactus whipplei*	0–1	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–1	–
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–1	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–1	–
Grass/Grasslike					
0	**Dominant Grass**			6–45	
	James' galleta	PLJA	*Pleuraphis jamesii*	6–45	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–11	–
1	**Sub-Dominant**			6–17	
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–17	–
	low woollygrass	DAPU7	*Dasyochloa pulchella*	0–2	–
	squirreltail	ELEL5	*Elymus elymoides*	0–2	–
	threeawn	ARIST	*Aristida*	0–1	–
Forb					
2	**Forbs**			28–39	
	Crescent milkvetch	ASAM5	*Astragalus amphioxys*	0–28	–
	Forb, annual	2FA	*Forb, annual*	0–22	–
	Forb, perennial	2FP	*Forb, perennial*	0–22	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–22	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–22	–
	desert trumpet	ERIN4	*Eriogonum inflatum*	0–11	–
	delta eryngo	ERRA5	*Eryngium racemosum*	0–3	–
	western blanketflower	GASP	*Gaillardia spathulata*	0–3	–
	woodyaster	XYLOR	*Xylorhiza*	0–3	–
	fineleaf hymenopappus	HYFI	*Hymenopappus filifolius*	0–2	–
	basindaisy	PLIN7	*Platyschkuhria integrifolia*	0–2	–

	Pacific aster	SYCH4	*Symphyotrichum chilense*	0–2	–
	skeletonleaf bur ragweed	AMTO3	*Ambrosia tomentosa*	0–2	–
	Rocky Mountain beeplant	CLSE	*Cleome serrulata*	0–2	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–2	–
	mustard	BRASS2	*Brassica*	0–2	–
	northwestern Indian paintbrush	CAAN7	*Castilleja angustifolia*	0–2	–
	Fendler's sandmat	CHFE3	*Chamaesyce fendleri*	0–1	–
	cryptantha	CRYPT	*Cryptantha*	0–1	–
	plains springparsley	CYAC	*Cymopterus acaulis*	0–1	–
	Townsend daisy	TOWNS	*Townsendia*	0–1	–
	desert princesplume	STPI	*Stanleya pinnata*	0–1	–

Table 19. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			57–90	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	50–90	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	7–13	–
3	**Sub-Dominant Shrubs**			47–101	
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	6–56	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–45	–
	littleleaf horsebrush	TEGL	*Tetradymia glabrata*	0–34	–
	blackbrush	CORA	*Coleogyne ramosissima*	0–22	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–17	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	0–17	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–15	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–11	–
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–1	–
	Whipple's fishhook cactus	SCWH	*Sclerocactus whipplei*	0–1	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–1	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–1	–
Grass/Grasslike					
0	**Dominant Grass**			46–67	
	James' galleta	PLJA	*Pleuraphis jamesii*	45–67	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–22	–
	cheatgrass	BRTE	*Bromus tectorum*	1–11	–
1	**Sub-Dominant Grass**			11–22	
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–10	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–2	–
	low woollygrass	DAPU7	*Dasyochloa pulchella*	0–2	–
	squirreltail	ELEL5	*Elymus elymoides*	0–2	–
Forb					

2	**Forbs**			28–43	
	Crescent milkvetch	ASAM5	*Astragalus amphioxys*	0–34	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–28	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–26	–
	Forb, annual	2FA	*Forb, annual*	0–22	–
	Forb, perennial	2FP	*Forb, perennial*	0–22	–
	desert trumpet	ERIN4	*Eriogonum inflatum*	0–17	–
	Utah fleabane	ERUT	*Erigeron utahensis*	0–11	–
	woodyaster	XYLOR	*Xylorhiza*	0–7	–
	western blanketflower	GASP	*Gaillardia spathulata*	0–3	–
	redroot buckwheat	ERRA3	*Eriogonum racemosum*	0–3	–
	fineleaf hymenopappus	HYFI	*Hymenopappus filifolius*	0–2	–
	tufted evening primrose	OECA10	*Oenothera caespitosa*	0–2	–
	basindaisy	PLIN7	*Platyschkuhria integrifolia*	0–2	–
	woolly bluestar	AMTO2	*Amsonia tomentosa*	0–2	–
	Rocky Mountain beeplant	CLSE	*Cleome serrulata*	0–2	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–2	–
	mustard	BRASS2	*Brassica*	0–2	–
	northwestern Indian paintbrush	CAAN7	*Castilleja angustifolia*	0–2	–
	Pacific aster	SYCH4	*Symphyotrichum chilense*	0–2	–
	Townsend daisy	TOWNS	*Townsendia*	0–1	–
	Fendler's sandmat	CHFE3	*Chamaesyce fendleri*	0–1	–
	cryptantha	CRYPT	*Cryptantha*	0–1	–
	plains springparsley	CYAC	*Cymopterus acaulis*	0–1	–
	desert princesplume	STPI	*Stanleya pinnata*	0–1	–

Table 20. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			52–67	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	34–67	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	7–11	–
3	**Sub-Dominant Shrubs**			45–90	
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	6–45	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–39	–
	littleleaf horsebrush	TEGL	*Tetradymia glabrata*	0–28	–
	blackbrush	CORA	*Coleogyne ramosissima*	0–22	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–11	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–11	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	0–11	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–6	–

	Whipple's fishhook cactus	SCWH	*Sclerocactus whipplei*	0–1	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–1	–
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–1	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–1	–
Grass/Grasslike					
0	**Dominant Grass**			7–45	
	James' galleta	PLJA	*Pleuraphis jamesii*	6–45	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–11	–
	cheatgrass	BRTE	*Bromus tectorum*	1–11	–
1	**Sub-Dominant Grass**			6–17	
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–6	–
	threeawn	ARIST	*Aristida*	0–1	–
	low woollygrass	DAPU7	*Dasyochloa pulchella*	0–1	–
	squirreltail	ELEL5	*Elymus elymoides*	0–1	–
Forb					
2	**Forbs**			28–39	
	Crescent milkvetch	ASAM5	*Astragalus amphioxys*	0–28	–
	Forb, annual	2FA	*Forb, annual*	0–22	–
	Forb, perennial	2FP	*Forb, perennial*	0–22	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–22	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–22	–
	desert trumpet	ERIN4	*Eriogonum inflatum*	0–11	–
	redroot buckwheat	ERRA3	*Eriogonum racemosum*	0–3	–
	western blanketflower	GASP	*Gaillardia spathulata*	0–3	–
	woodyaster	XYLOR	*Xylorhiza*	0–3	–
	Rocky Mountain beeplant	CLSE	*Cleome serrulata*	0–2	–
	Pacific aster	SYCH4	*Symphyotrichum chilense*	0–2	–
	skeletonleaf bur ragweed	AMTO3	*Ambrosia tomentosa*	0–2	–
	fineleaf hymenopappus	HYFI	*Hymenopappus filifolius*	0–2	–
	basindaisy	PLIN7	*Platyschkuhria integrifolia*	0–2	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–2	–
	mustard	BRASS2	*Brassica*	0–2	–
	northwestern Indian paintbrush	CAAN7	*Castilleja angustifolia*	0–2	–
	Fendler's sandmat	CHFE3	*Chamaesyce fendleri*	0–1	–
	desert princesplume	STPI	*Stanleya pinnata*	0–1	–
	Townsend daisy	TOWNS	*Townsendia*	0–1	–

Animal community

--Wildlife Interpretation--
Water scarcity and lack of cover limit the species richness and abundance of large mammals on this site; however small herds of mule deer and pronghorn antelope can be seen grazing/browsing on these sites, especially when near water sources and in the winter. Desert bighorn sheep may utilize this site, when occurring on steeper slopes. The hot climate and lack of water favors small mammals, which have an easier time finding shelter, food, and water to live. Many species of rats, mice, squirrels, bats, and chipmunks can be observed, along with coyotes and foxes.

Lizards are the most visible and can be observed during the day. Species may include the northern whiptail, desert spiny, and the colorful western collard lizard. (NPS.gov, 2008)

--Grazing Interpretations--
This site provides fair/poor grazing conditions for livestock and wildlife during fall, winter, and spring due to low availability of nutritious forage. This site also often lacks natural perennial water sources, which can influence the suitability for livestock and wildlife grazing. Intense late spring or summer grazing of shadscale can result in reduction of shadscale (USU.edu, 2009). However, shadscale can be utilized as browse on livestock and wildlife winter ranges. 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 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, shadscale, provides good browse for mule deer and domestic sheep and goats in the winter, spring, and fall. It is a minor component of bighorn sheep and pronghorn antelope diets in the winter. Cattle will only utilize the fruits/seeds due to the spiny nature of the plant. Sub-dominant shrubs include winterfat, bud sagebrush, 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 galleta and Indian ricegrass, provide good grazing conditions for all classes of livestock and wildlife. Forb composition and annual production depends primarily on precipitation amounts and thus is challenging to use in livestock grazing management decisions. However, forb composition should be monitored for species diversity, as well as poisonous or injurious plant communities which may be detrimental to livestock if grazed. Before making specific grazing management recommendations, an onsite evaluation must be made.

--References--

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.

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.

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Hydrological functions

The soil in this site is in hydrologic group b (NRCS National Engineering Handbook). These soils are typically 10 to 20 percent clay and have moderately low runoff potential. 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 the hydrology by decreasing plant cover and increasing bare ground. Fire can also affect hydrology, but it is variable. Fire intensity, fuel type, soil, climate, and topography can each have different influences. Fires can increase areas of bare ground and hydrophobic layers that reduce infiltration and increase runoff (National Range and Pasture Handbook, 2003).

--References--

National Engineering Handbook. US Department of Agriculture, Natural Resources Conservation Service. Available: http://www.info.usda.gov/CED/Default.cfm#National%20Engineering%20Handbook. Accessed February 25, 2008.

NRCS Grazing Lands Technology Institute. 2003. National Range and Pasture Handbook. Fort Worth, TX, USA: US Department of Agriculture, Natural Resources Conservation Service, 190-VI-NRPH.

Recreational uses

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

Wood products

There are no wood products on this site.

Other information

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

Potentially toxic plants associated with this site include four-wing saltbush and buckwheat species, which may accumulate selenium, but only when growing on selenium enriched soils. These plants, when consumed will cause alkali disease or chronic selenosis, which affects all classes of livestock (excluding goats). Typically animals consuming 5-50 ppm selenium will develop chronic selenosis and animals consuming greater than 50 ppm selenium will develop acute selenosis. Clinical signs include lameness, soughing of the hoof, hair loss, blindness, and aimless wondering. Horses tend to develop what is called a “bob” tail or “roached” main due to breakage of the long hairs.

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

--Invasive Plant Communities--
Generally as ecological conditions deteriorate and 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 semi-arid environments are the non-native annual invaders including cheatgrass, Russian thistle, kochia, halogeton, and mustards. The presence of these species will depend on soil properties and moisture availability; however, these invaders are highly adaptive and can flourish in many locations. Once established, complete removal is difficult but suppression may be possible.

--Fire Ecology--
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 plant 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.
Due to the sparse plant cover and lack of fine fuels on this ecological site, historically shadscale dominated shrub communities were not influenced by fire. Fires were rare and non-existent; however increased presence of exotic annual grasses can greatly alter fire regimes due to the increase in fine fuels. The slow recovery period allows for cheatgrass invasions which can subsequently increase the fire regime. When fire does occur shadscale plants are killed and do 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

--References--

Knight, A. P. and R. G. Walter. 2001. A guide to plant poisoning of animals in North America. Jackson, WY: Teton NewMedia. 367p.

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.

Inventory data references

This 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: San Juan County, UT	
UTM zone	N
UTM northing	4231826
UTM easting	585018
General legal description	Canyonlands National Park; Maze District; Maze Overlook Rd.

Other references

Modal Soil: Hostage GR-FSL — fine-loamy, mixed (calcareous), mesic Typic Torriorthents
Type Location: Combwash, along Hwy. 95 between White Canyon and Hite.

--Other References--
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Contributors

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Rangeland health reference sheet

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

Author(s)/participant(s)	Shane A. Green (NRCS), Robert D. Stager (BLM), Dana Truman (NRCS), Paul Curtis (BLM) and Randy Beckstrand (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:** A few rills occur throughout the site. Rills may be 8 or more feet in length but may become longer as slope increases. Rills are most likely to form below adjacent exposed bedrock or where water flow patterns converge and sufficient water accumulates to cause erosion. Rills will be more apparent immediately following large storm events.

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2. **Presence of water flow patterns:** Frequent and occur throughout the site. Interspaces between well developed biological soil crusts appear to be depression water storage areas but actually direct the water flow patterns across areas covered with biological soil crust during high intensity precipitation events. Evidence of flow will increase somewhat with slope. Water flow patterns are somewhat sinuous and wind around perennial plant bases. They are long (>20 feet), narrow (<6 inches), and not widely spaced (5-10 feet), and often converge creating drainage networks.

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3. **Number and height of erosional pedestals or terracettes:** Minor pedestalling may form at the base of plants as a result of natural wind or water erosion, occurring more frequently near water flow patterns. Exposed roots are very rare. Terracettes are rare and occur behind debris dams in water flow patterns. Well developed biological crusts may appear pedastalled, but this is actually a characteristic of the crust formation.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 2-195%. Bare ground is often associated with water flow patterns and rills. Areas with well developed biological soil crusts should not be counted as bare ground. Areas with poorly developed biological soil crusts that are interpreted as functioning as bare ground (therefore they would be susceptible to raindrop splash erosion) should be recorded as bare ground. 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:** Few. Any gullies present should show little sign of accelerated erosion and should be stabilized with perennial vegetation on the slopes, gully bottoms may be active, especially following a large storm event. Gullies may show slightly more indication of erosion as slope increases, or as the site occurs adjacent to other sites where runoff accumulation occurs (i.e. exposed bedrock, small watersheds, etc.).

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6. **Extent of wind scoured, blowouts and/or depositional areas:** Slight wind generated soil movement is normal. Any wind caused blowouts and deposition are mostly stable or have healed over. Fresh wind generated deposition may be common following severe wind events.

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7. **Amount of litter movement (describe size and distance expected to travel):** Most litter accumulates under or adjacent to plant bases. Some litter (leaves, small stems) may accumulate in soil depressions located near plants. Woody litter is usually not expected to be moved from the base of shrubs. Some redistribution of fine litter is caused by both wind and water. Minor fine litter removal may occur in flow patterns or rills with deposition occurring at points of obstruction. Fine litter may be removed from the site by wind action. Litter movement is expected to 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 underneath plant canopies and a rating of 3 in the interspaces using the soil stability test kit. The average should be a 3. Vegetation cover, litter, biological soil crusts and surface rock reduce erosion. Surface texture is loam to very fine sandy loam.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface horizon is typically 4 to 12 inches deep. Structure is typically moderate very fine granular to weak thin platy parting to weak fine granular. Color is typically reddish brown (5YR5/4) to (2.5YR5/4) to pale brown (10YR6/3). 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 and biological soil crusts are expected to intercept raindrops reducing splash erosion. Plants and biological soil crusts are usually distributed in sufficient density to slow runoff allowing time for infiltration. Natural erosion would be expected in severe thunder storms or heavy spring runoff.

When perennial grasses decrease, reducing ground cover and increasing bare ground, runoff is expected to increase and any associated infiltration reduced.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. Due to this site's lower placement on gently sloping mesas, benches, floodplains, alluvial fans, fan and stream terraces, pediments and valley floors, it tends to accumulate fine particles such as very fine sands, silts and clays. The associated structure is moderate very fine granular to weak thin platy parting to weak fine granular. 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, winterfat, brigham tea, bud sagebrush) > warm season perennial sod forming grasses (Galleta) > = cool season perennial bunchgrasses (Indian ricegrass)

    Sub-dominant: perennial and native annual forbs (globemallow) > sprouting shrubs (rabbitbrush)> Biological soil crusts

    Other: Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species in the reference state (e.g. Siberian Wheatgrass, Forage kochia etc.)
    Biological soil crust is variable in its expression where present on this site and is measured as a component of ground cover.
    Forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions.

    Additional: Temporal variability is caused by very infrequent fires, droughts, insects and other pathogens, or large precipitation events. Sparial variability is caused by variation in rock fragments contained in the soils, topography, 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 reflect a community phase within the reference state.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** During years with 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 3-10% 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):** 226-526 #/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, Halogeton and Russian thistle.

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