Ecological site R035XY239UT
Semidesert Shallow Clay (Shadscale-Utah Juniper)

Accessed: 05/18/2024

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.

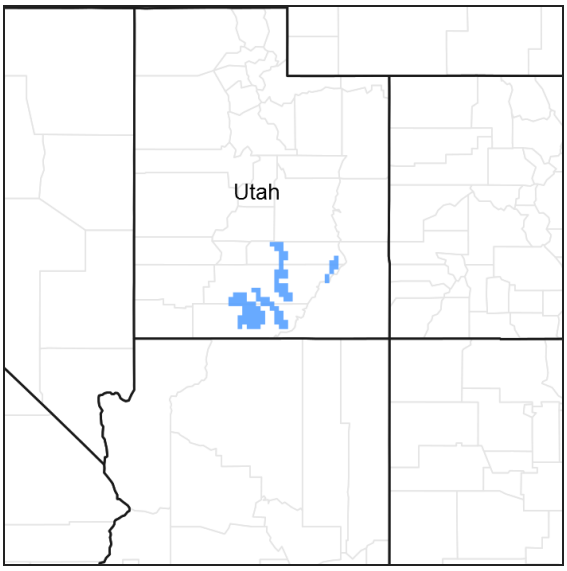

Figure 1. Mapped extent

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.

Ecological site concept

Site Concept: This site developed on shallow, clay soils in the semidesert zone of the Colorado and Green River Plateaus region of southern Utah (MLRA 35). It is found on shale hills, escarpments, and structural benches at elevations between 4,800 and 6,900 feet. Annual precipitation ranges from 9.5 to 13 inches, with about half occuring as convective thunderstorms from July through October. The soil moisture regime is ustic aridic and the soil temperature regime is mesic. The plant community is dominated by shadscale, James' galleta, and Utah juniper, though other shrubs, including snakeweed, yellow rabbitbrush, and Bigelow sagebrush may also be very abundant on the site.

Similar sites

R035XY125UT	**Desert Shallow Clay (Shadscale)** This site has similar soils, but recieves less than 9.5 inches of annual precipitation. As a result, it is unable to support Utah juniper in the plant community.

Table 1. Dominant plant species

Tree	(1) *Juniperus osteosperma*
Shrub	(1) *Atriplex confertifolia*
Herbaceous	(1) *Pleuraphis jamesii*

Physiographic features

This site occurs on hillslopes, structural benches, and escarpments. Slopes range from 15-50% and elevations range from 4800 to 6900 feet. Runoff potential is very high.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Structural bench (3) Escarpment
Flooding frequency	None
Ponding frequency	None
Elevation	1,463–2,103 m
Slope	15–50%
Aspect	Aspect is not a significant factor

Climatic features

The climate is characterized by hot summers and cool winters. Large fluctuations in daily temperatures are common, and precipitation can vary widely from month to month and from year to year. Average annual precipitation ranges from 9.5 to 13 inches, with about 45% of that precipitation in the form of convective thunderstorms from July through October. June is typically the driest month during the growing season, and April and May are very dry months as well.

This section was developed using modeled climate data (PRISM) due to the lack of climate stations near this site.

Table 3. Representative climatic features

Frost-free period (average)	122 days
Freeze-free period (average)	147 days
Precipitation total (average)	330 mm

Influencing water features

Due to its landscape position, this site is not typically influenced by streams or wetlands.

Soil features

The soils of this site are shallow clays that typically form on shale hills, or in areas where shale geology is exposed and weathered to form a shallow clay soil. In rare instances, this site occurs on deeper clay soils that exhibit the same plant community. The soil surface can have many rock fragments, but few rock fragments are found in the profile. These soils often have high salt and/or calcium carbonates throughout. Water-holding capacity ranges from 1.2 to 2.2 inches of water in the entire profile. The soil moisture regime is ustic aridic and the soil temperature regime is mesic.

This site has been used in the following soil surveys and has been correlated to the following components:
UT685 – Capitol Reef National Park – Cannonville, chinchin, Lybrook family, and Quezcan soils;
UT686 – Escalante Grand Staircase National Monument – Cannonville; Chinchin; Gerst; Stent

Table 4. Representative soil features

Parent material	(1) Residuum–shale

Surface texture	(1) Clay (2) Loam (3) Silty clay loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Slow to moderate
Soil depth	10–51 cm
Surface fragment cover <=3"	0–14%
Surface fragment cover >3"	0–8%
Available water capacity (0-101.6cm)	3.05–5.59 cm
Calcium carbonate equivalent (0-101.6cm)	5–30%
Electrical conductivity (0-101.6cm)	0–8 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–5
Soil reaction (1:1 water) (0-101.6cm)	7.9–9
Subsurface fragment volume <=3" (Depth not specified)	0–5%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

This site developed under the Colorado Plateau ecological conditions and included natural influences of herbivory and climate.

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. 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, shadscale is highly palatable and are considered good forage for both livestock and wildlife on winter range (USU.edu, 2009). No herbivory (insect or otherwise) has been documented to be severe enough to reduce vegetation and cause either a phase or a state shift within this ecological site.

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. 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). Continuous grazing of shadscale in the spring and early summer can be injurious to shadscale (USU.edu, 2009). 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. The reduction of shadscale through grazing has not been documented as having occurred 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 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 over the past 30 years Southeastern Utah. Both ocular and measured data was collected and utilized.

State and transition model

R035XY239UT – Semidesert Shallow Clay (Shadscale-Utah Juniper)

1. Reference State

1.1 Shadscale / Galleta / Utah Juniper
Production is 35-50% grasses, 0-10% forbs, 25-60% shrubs, and 5-30% trees.

T1

2. Invaded State

2.1 Shadscale / Galleta / Utah Juniper
Production is 35-50% grasses, 0-10% forbs, 25-60% shrubs, and 5-30% trees. Non-native invasive species are present but not dominant.

Figure 4. State-and-Transition Model

State 1
Reference State

The reference state is dominated by shadscale, James' galleta, and Utah juniper. Other shrubs can are opportunistic on this site and can be more abundant than shadscale; including Bigelow sagebrush, Torrey's jointfir, snakeweed, and yellow rabbitbrush. These shrubs are not always found in the reference plant community, as opposed to shadscale which is always present. The harsh soil environment of this site makes it reistant to invasion and wildfire. Not only is it difficult for invasive species to establish on the heavy shale soils, but the sparse native vegetation does not produce enough fuel to carry fires on a recurring basis. As a result, the reference state currently has but one documented plant community.

Community 1.1
Shadscale / Galleta / Utah Juniper

14% rock, and 50% bare ground. James' galleta dominates, with shadscale and Utah juniper also abundant in the community. Capitol Reef soil survey. NAD 83 Zone 12 0493380 E. 4206926 N. Photo by Jake Owens, April 5, 2010.

Figure 5. Phase 1.1

This plant community phase is dominated by shadscale, Utah juniper, and James' galleta. Composition by air-dry weight is 35-50% grasses, 0-10% forbs, 25-60% shrubs, and 5-30% trees.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	56	112	224
Grass/Grasslike	67	123	179
Tree	22	56	90
Forb	–	17	34
Total	**145**	**308**	**527**

Table 6. Ground cover

Tree foliar cover	2-6%
Shrub/vine/liana foliar cover	4-20%
Grass/grasslike foliar cover	4-20%
Forb foliar cover	0-6%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%
Surface fragments >0.25" and <=3"	0-15%

Surface fragments >3"	0-10%
Bedrock	4-20%
Water	0%
Bare ground	30-70%

Table 7. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-10%	2-12%	0-5%
>0.15 <= 0.3	–	5-10%	0-5%	0-3%
>0.3 <= 0.6	–	0-10%	0-5%	0-3%
>0.6 <= 1.4	0-5%	–	–	–
>1.4 <= 4	0-5%	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

State 2
Invaded State

The invaded state is similar to the Reference state in community structure and ecological function, but non-native invasive species are present. Russian thistle and cheatgrass have been documented to establish on this site in the absence of major disturbance, but they constitute only a minor component of the plant community.

Community 2.1
Invaded Shadscale / Galleta / Utah Juniper

8% litter, 30% rock, and 20% bare ground. James' galleta and snakeweed dominate, with shadscale and Utah juniper, as well as cheatgrass and Russian thistle present. Capitol Reef soil survey, Cannonville soil. NAD 83 zone 12 04189174 E. 4296755 N. Photo by Jamin Johanson, May 12, 2011.

Figure 7. Phase 2.1

This plant community phase is dominated by shadscale, Utah juniper, and James' galleta. Composition by air-dry weight is 35-50% grasses, 0-10% forbs, 25-60% shrubs, and 5-30% trees. Russian thistle and/or cheatgrass are present but not dominant.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	56	112	224
Grass/Grasslike	67	123	179
Tree	22	56	90
Forb	–	17	34
Total	**145**	**308**	**527**

Table 9. Ground cover

Tree foliar cover	2-6%
Shrub/vine/liana foliar cover	4-20%
Grass/grasslike foliar cover	4-20%
Forb foliar cover	0-6%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%
Surface fragments >0.25" and <=3"	0-15%
Surface fragments >3"	0-10%
Bedrock	4-20%
Water	0%
Bare ground	40-70%

Table 10. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-10%	2-12%	0-5%
>0.15 <= 0.3	–	5-10%	0-5%	0-3%
>0.3 <= 0.6	–	0-10%	0-5%	0-3%
>0.6 <= 1.4	0-5%	–	–	–
>1.4 <= 4	0-5%	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Transition T1
State 1 to 2

This transition occurs when non-native invasive species establish in the community. Once a seed source and germination sites allow Russian thistle, cheatgrass, and/or other non-native invasive species to establish, they will persist in the community. Russian thistle and cheatgrass have been documented to establish on this site in the absence of major disturbance.

Additional community tables

Table 11. Community 1.1 plant community composition

				Annual Production	Foliar Cover

Group	Common Name	Symbol	Scientific Name	(Kg/Hectare)	(%)
Tree					
0	**Trees**			22–90	
	Utah juniper	JUOS	*Juniperus osteosperma*	22–90	1–5
Shrub/Vine					
0	**Dominant Shrubs**			56–224	
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–168	0–10
	shadscale saltbush	ATCO	*Atriplex confertifolia*	11–112	1–8
3	**Subdominant Shrubs**			0–112	
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–50	0–3
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–50	0–3
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–34	0–2
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–22	0–2
	mat saltbush	ATCO4	*Atriplex corrugata*	0–6	0–1
	mormon tea	EPVI	*Ephedra viridis*	0–6	0–1
	crispleaf buckwheat	ERCO14	*Eriogonum corymbosum*	0–6	0–1
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–6	0–1
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–6	0–1
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–6	0–1
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	0–6	0–1
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–6	0–1
Grass/Grasslike					
0	**Dominant Grasses**			56–146	
	James' galleta	PLJA	*Pleuraphis jamesii*	56–146	5–10
1	**Subdominant Grasses**			0–67	
	blue grama	BOGR2	*Bouteloua gracilis*	0–34	0–2
	Grass, perennial	2GP	*Grass, perennial*	0–34	0–2
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–34	0–2
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–17	0–1
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–11	0–1
	mesa dropseed	SPFL2	*Sporobolus flexuosus*	0–11	0–1
	desert needlegrass	ACSP12	*Achnatherum speciosum*	0–11	0–1
	squirreltail	ELEL5	*Elymus elymoides*	0–11	0–1
	Grass, annual	2GA	*Grass, annual*	0–11	0–1
	twoneedle pinyon	PIED	*Pinus edulis*	1–7	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–6	0–1
	saline wildrye	LESAS	*Leymus salinus ssp. salinus*	0–6	0–1
Forb					
2	**Forbs**			0–34	
	Forb, annual	2FA	*Forb, annual*	0–11	0–1
	Forb, perennial	2FP	*Forb, perennial*	0–11	0–1
	aster	ASTER	*Aster*	0–11	0–1
	desert trumpet	ERIN4	*Eriogonum inflatum*	0–11	0–1

	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–11	0–1
	cryptantha	CRYPT	*Cryptantha*	0–11	0–1
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–11	0–1
	buckwheat	ERIOG	*Eriogonum*	0–7	0–1
	mountain pepperweed	LEMO2	*Lepidium montanum*	0–6	0–1
	tufted evening primrose	OECA10	*Oenothera caespitosa*	0–6	0–1
	owl's-clover	ORTHO	*Orthocarpus*	0–6	0–1
	beardtongue	PENST	*Penstemon*	0–6	0–1
	desert princesplume	STPI	*Stanleya pinnata*	0–6	0–1
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	0–6	0–1
	Navajo fleabane	ERCOC3	*Erigeron concinnus var. concinnus*	0–6	0–1
	cleftleaf wildheliotrope	PHCR	*Phacelia crenulata*	0–6	0–1
	spiny phlox	PHHO	*Phlox hoodii*	0–6	0–1
	woolly plantain	PLPA2	*Plantago patagonica*	0–6	0–1
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–6	0–1
	rock goldenrod	PEPU7	*Petradoria pumila*	0–4	0–1
	sego lily	CANU3	*Calochortus nuttallii*	0–2	0–1
	pink funnel lily	ANBR4	*Androstephium breviflorum*	0–2	0–1

Table 12. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Tree					
0	**Trees**			22–90	
	Utah juniper	JUOS	*Juniperus osteosperma*	22–90	1–5
Shrub/Vine					
0	**Dominant Shrubs**			56–224	
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–168	0–10
	shadscale saltbush	ATCO	*Atriplex confertifolia*	11–112	1–8
3	**Subdominant Shrubs**			0–112	
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–50	0–3
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–50	0–3
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–34	0–2
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–22	0–2
	mat saltbush	ATCO4	*Atriplex corrugata*	0–6	0–1
	mormon tea	EPVI	*Ephedra viridis*	0–6	0–1
	crispleaf buckwheat	ERCO14	*Eriogonum corymbosum*	0–6	0–1
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–6	0–1
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–6	0–1
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–6	0–1
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	0–6	0–1
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–6	0–1
Grass/Grasslike					

0	**Dominant Grasses**			56–146	
	James' galleta	PLJA	*Pleuraphis jamesii*	56–146	5–10
1	**Subdominant Grasses**			1–67	
	blue grama	BOGR2	*Bouteloua gracilis*	0–34	0–2
	Grass, perennial	2GP	*Grass, perennial*	0–34	0–2
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–34	0–2
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–17	0–1
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–11	0–1
	mesa dropseed	SPFL2	*Sporobolus flexuosus*	0–11	0–1
	desert needlegrass	ACSP12	*Achnatherum speciosum*	0–11	0–1
	cheatgrass	BRTE	*Bromus tectorum*	0–11	0–1
	squirreltail	ELEL5	*Elymus elymoides*	0–11	0–1
	Grass, annual	2GA	*Grass, annual*	0–11	0–1
	twoneedle pinyon	PIED	*Pinus edulis*	1–7	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–6	0–1
	saline wildrye	LESAS	*Leymus salinus ssp. salinus*	0–6	0–1
Forb					
2	**Forbs**			0–34	
	Forb, annual	2FA	*Forb, annual*	0–11	0–1
	Forb, perennial	2FP	*Forb, perennial*	0–11	0–1
	aster	ASTER	*Aster*	0–11	0–1
	desert trumpet	ERIN4	*Eriogonum inflatum*	0–11	0–1
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–11	0–1
	cryptantha	CRYPT	*Cryptantha*	0–11	0–1
	prickly Russian thistle	SATR12	*Salsola tragus*	0–11	0–1
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–11	0–1
	buckwheat	ERIOG	*Eriogonum*	0–7	0–1
	mountain pepperweed	LEMO2	*Lepidium montanum*	0–6	0–1
	tufted evening primrose	OECA10	*Oenothera caespitosa*	0–6	0–1
	owl's-clover	ORTHO	*Orthocarpus*	0–6	0–1
	beardtongue	PENST	*Penstemon*	0–6	0–1
	desert princesplume	STPI	*Stanleya pinnata*	0–6	0–1
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	0–6	0–1
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–6	0–1
	Navajo fleabane	ERCOC3	*Erigeron concinnus var. concinnus*	0–6	0–1
	cleftleaf wildheliotrope	PHCR	*Phacelia crenulata*	0–6	0–1
	spiny phlox	PHHO	*Phlox hoodii*	0–6	0–1
	woolly plantain	PLPA2	*Plantago patagonica*	0–6	0–1
	rock goldenrod	PEPU7	*Petradoria pumila*	0–4	0–1
	sego lily	CANU3	*Calochortus nuttallii*	0–2	0–1
	pink funnel lily	ANBR4	*Androstephium breviflorum*	0–2	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--
Shadescale is a highly palatable shrub and good winter forage for livestock and wildlife. Indian ricegrass is good forage for grazing animals whenever it is 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. 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 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 shrubs and grasses. The dominant shrub species provide good browse for mule deer and domestic sheep and goats in the winter, spring, and fall. The presence of grasses including galleta and Indian ricegrass, provide good grazing forage 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.

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Hydrological functions

Runoff and Soil Loss
The following runoff and soil loss data was generated using the Rangeland Hydrology and Erosion Model Web Tool (See citation below).

Soil textures are clayey and slope ranges from 15-30 percent on this site. Slope does not affect the runoff on this site, but does have an impact on soil loss. Average runoff is typically about 2.3 inches per year, but may be as high as 3.2 inches in a single 100-year storm event. Soil loss ranges from 0.8(about 15% slope) to 1.5 (about 30% slope) tons per acre on an average year, and from 1.7 (about 15% slope) to 2.6(about 30% slope) tons per acre during a 100-year storm event. Average rainfall ranges from 8-12 inches per year, but a single 100-year storm event

can generate 3.8 inches of precipitation in a 24-hour period.
Individual shrubs plants are uniformly distributed, resulting in high tortuosity which slows down overland flow and promotes on-site infiltration. The grasses and forbs in the shrub interspaces have a minimal impact on water flow patterns due to low production. Heavy grazing does not significantly alter the hydrology since this site is not typically affected by livestock. Interspaces are typically protected by rock fragments or a weak physical soil crust. Soil physical crusts and weak biological crusts (light cyanobacteria) are the most susceptible to water erosion.

Soil Group
The soils associated with this ecological site are generally in Hydrologic Soil Group D due to the shallow depth (NRCS National Engineering Handbook). Hydrologic 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.

--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.

Rangeland Hydrology and Erosion Model Web Tool. Available http://apps.tucson.ars.ag.gov/rhem/e: Accessed on December 16, 2010.

Recreational uses

Recreation activities include aesthetic value; and limited opportunities for hiking and hunting.

Wood products

Firewood. Trees are typically too short to produce juniper posts.

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 the 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.

Type locality

Location 1: Wayne County, UT	
UTM zone	N
UTM northing	4185182
UTM easting	0497747

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.

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) Randy Beckstrand (BLM).
Contact for lead author	
Date	03/21/2007
Approved by	Shane A. Green
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Present. A. On more gentle slopes (< 10 %): While not common may occur in the site. Rills may be 10 or more feet in length. Sides of rills may be up to 4 inches high. Rills are most likely to form below adjacent exposed bedrock or water flow patterns where sufficient water accumulates to cause erosion. B. On steep slopes (> 20 %): More common. May 0ccur throughout the site. Where they occur, rills may extend down entire slope.

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2. **Presence of water flow patterns:** Common and occur throughout area on gentle slopes (<10 %). Some sinuous flow around perennial plants. Interspaces between well developed biological soil crusts appear to be water depression storage areas but actually serve as water flow patterns across areas covered with biological soil crust during episodic precipitation events. Evidence of flow patterns is expected to increase somewhat with slopes greater than 20 percent.

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3. **Number and height of erosional pedestals or terracettes:** Pedestals may form at the base of plants that occur on the edge of rills. On steep slopes (>20 %), gullies may remove soil from the base of shrubs and/or trees exposing roots that resemble pedestals. Interspaces between well developed biological soil crusts resemble pedestals and may be up to 2 inches high. Terracettes are rare. Debris dams of small to medium sized litter (up to 2 inches in diameter) may form in water flow patterns, rills, and gullies. These debris dams may accumulate smaller litter (leaves, grass and forb stems).

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 30 – 40%. (Soil surface is typically covered by 30 to 60 percent surface fragments). Ground cover is based on the first raindrop impact, and bare ground is the inverse of ground cover. Ground cover + bare ground = 100%. Any well developed biological crusts present should not be recorded as bare ground. Poorly developed biological soil crusts that are interpreted as functioning as bare ground (therefore they would be susceptible to raindrop splash erosion) should be recorded as bare ground.

5. **Number of gullies and erosion associated with gullies:** None to few on gentle slopes (< 10 %). On steep slopes and areas below adjacent exposed bedrock, gullies may be numerous. Length often extends from exposed bedrock until gully reaches a stream or an area where water and sediment accumulate. Gullies may remove soil from base of shrubs and/or trees exposing roots. Gullies may show slightly more indication of erosion as slope increases, or as the site occurs adjacent to steep sites/watershed with concentrated flow patterns.

6. **Extent of wind scoured, blowouts and/or depositional areas:** None. The channery soil surface armors and reduces the potential for wind erosion.

7. **Amount of litter movement (describe size and distance expected to travel):** On gentle slopes (< 10 %) most litter accumulates at base of plants. Woody stems from shrubs and/or trees is usually not moved unless present in water flow patterns, rills, or gullies. On steep slopes (> 20 %), woody stems may be washed from site.

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 an soil stability rating of 4 or 5 under plant canopies and a rating of 2 to 4 in the interspaces using the soil stability test kit. The average rating should be a 4. Surface texture is very channery clay loam. Vegetation cover, litter accumulation, surface rock and biological soil crusts reduce erosion.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface horizon is 5 inches deep. Structure is moderate fine granular. Color is light brownish gray to (2.5Y6/2). Use the specific information for the soil you are assessing found in the published soil survey to supplement this description.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Vascular plants and/or any well developed biological soil crusts (where present) will break raindrop impact and splash erosion. Spatial distribution of vascular plants and interspaces between well developed biological soil crusts (where present) provide detention storage and surface roughness that slows runoff allowing time for infiltration. Interspaces between plants and any well developed biological soil crusts (where present) may serve as water flow patterns during episodic runoff events, with natural erosion expected in severe storms. When perennial grasses decrease, reducing ground cover and increasing bare ground, runoff is expected to increase and any associated infiltration reduced.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. Bedrock is found within 20 inches of soil surface. This should not be considered as compaction.

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

    Dominant: Dominance is based on average annual production, air dry weight: Sprouting shrubs > perennial grasses > Non-sprouting shrubs > perennial and annual native forbs. Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species in the reference state (e.g. Crested wheatgrass, Smooth brome, Intermediate wheatgrass, Siberian wheatgrass and/or forage kochia etc.)

Sub-dominant:

Other:

Additional: Biological soil crust is variable in it's expression where present on this site and is measured as a component of ground cover.
Following a recent disturbance such as fire, drought or insects that may remove the woody vegetation, forbs and perennial grasses (herbaceous species) may become more dominate in the community. These conditions would reflect a functional community phase within the reference state.
Dominants: Torrey Mormon tea, galleta, Indian ricegrass, broom snakeweed. Sub-dominants: Other perennial grasses and shrubs. Perennial and annual forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** All age classes of perennial grasses should be present under average to above average growing conditions with age class expression likely subdued during below average growing conditions or on sites with high (usually greater than 65 percent) similarity index (late seral to historic climax). In general, a mix of age classes may be expected with some dead and decadent plants present.

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

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 85-220 #/acre

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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.

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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.
