USDA Natural Resources Conservation Service

Ecological site R035XY125UT
Desert Shallow Clay (Shadscale)

Accessed: 05/12/2025

General information

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

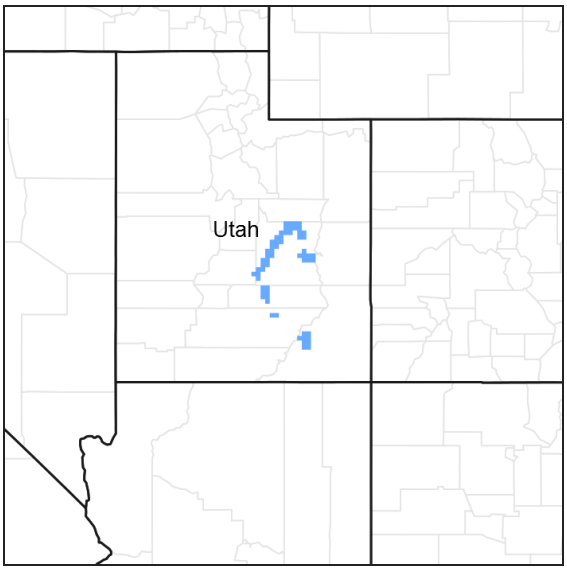

Figure 1. Mapped extent

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

MLRA notes

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

Site Concept: This site developed on shallow, clay loam soils in the desert zone of the Colorado and Green River Plateaus region of southern Utah (MLRA 35). It is found on shale hills and structural benches at elevations between 4,000 and 6,000 feet. Annual precipitation ranges from 7 to 9.5 inches, with about half occuring as convective thunderstorms from July through October. The soil moisture regime is aridic and the soil temperature regime is mesic. The plant community is dominated by shadscale, with James' galleta as the most common understory grass species. The reference plant community is resistant to change due to a harsh soil environment, the inability to carry fire, and the grazing resistance of shadscale.

Classification relationships

Modal Soil: Shalet CL, Eroded — loamy, mixed (calc.), mesic shallow Typic Torriorthents

Similar sites

R035XY122UT	**Desert Shallow Loam (Shadscale)** This site is also shallow, but has loamy soil textures rather than clay loams. Production is expected to be higher on this loamy site.

R035XY124UT	**Desert Shallow Clay (Mat Saltbush)** This site is also shallow, but has finer textures (clays instead of clay loams) and is dominated by mat saltbush or castle valley saltbush.

Table 1. Dominant plant species

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

Physiographic features

This site occurs on shale hills and structural benches at elevations between 4000 and 6000 feet. Runoff is high to very high, with slopes ranging from 3 to 60%.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Structural bench
Flooding frequency	None
Ponding frequency	None
Elevation	4,000–6,000 ft
Slope	3–60%

Climatic features

The climate of this site is characterized by hot summers and cool winters. Average annual precipitation ranges from 7 to 9.5 inches. About half of the precipitation occurs as convective thunderstorms from July through October. June is typically the driest month during the growing season. Large fluctuations in daily temperature are common, and precipitation varies greatly from month to month and from year to year. In average years, plant growth begins around February 20 and end growth around October 30.

This section was developed using modeled (PRISM) climate data.

Table 3. Representative climatic features

Frost-free period (average)	180 days
Freeze-free period (average)	220 days
Precipitation total (average)	10 in

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 clay loams over paralithic shale bedrock. These soils are well-drained clay loams or gravelly clay loams. Gravels are usually present on the soil surface but not necessarily in the profile. These soils are usually salt-affected and may be sodic. The soil moisture regime is aridic and the soil temperature regime is mesic. The available water-holding capacity ranges from 0.7 to 3.5 inches of water in the entire profile.

Soils correlated to this site are:
UT631 Henry Mtns. Area-Canyon family, Chipeta variant
UT623 Emery Area - Emco;

UT685 Capitol Reef National Park - Emco family;
UT638 San Juan County - Shalet;

Table 4. Representative soil features

Parent material	(1) Colluvium–calcareous shale (2) Residuum–shale
Surface texture	(1) Gravelly clay loam (2) Clay loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Slow to moderately slow
Soil depth	5–20 in
Surface fragment cover <=3"	20–50%
Surface fragment cover >3"	0–2%
Available water capacity (0-40in)	0.7–3.5 in
Calcium carbonate equivalent (0-40in)	1–40%
Electrical conductivity (0-40in)	0–16 mmhos/cm
Sodium adsorption ratio (0-40in)	0–45
Soil reaction (1:1 water) (0-40in)	7.9–9.2
Subsurface fragment volume <=3" (Depth not specified)	8–13%
Subsurface fragment volume >3" (Depth not specified)	1–2%

Ecological dynamics

This site developed under Colorado Plateau ecological conditions and the natural influences of herbivory and climate. This site’s plant species composition is generally dominated by shadscale and James' galleta.

There is no evidence that this site historically burned on a regular basis due to very large and persistent gaps between plants. However, modern disturbances such as recreation and livestock grazing, may result in an opportunity for invasive annuals to enter the system. However, non-native invasive species have not been documented on this site to date.

This ecological site has been grazed by domestic livestock since they were first introduced into the area around 1860. The introduction of domestic livestock and the use of fencing and reliable water sources have apparrently only minimally influenced the historic disturbance regime associated with this ecological site.

Suitability for rangeland seeding is very poor because of low annual precipitation, and very low available water capacity.

The following State and Transition diagram shows the reference plant community. No other plant communities have been documented on this site to date. As more data are collected, new plant communities or states may be added. This model was developed using range data collected over the last 40 years in MLRA D35 in southeastern Utah. Both ocular and measured data was collected and utilized.

State and transition model

R035XY125UT Desert Shallow Clay (Shadscale)

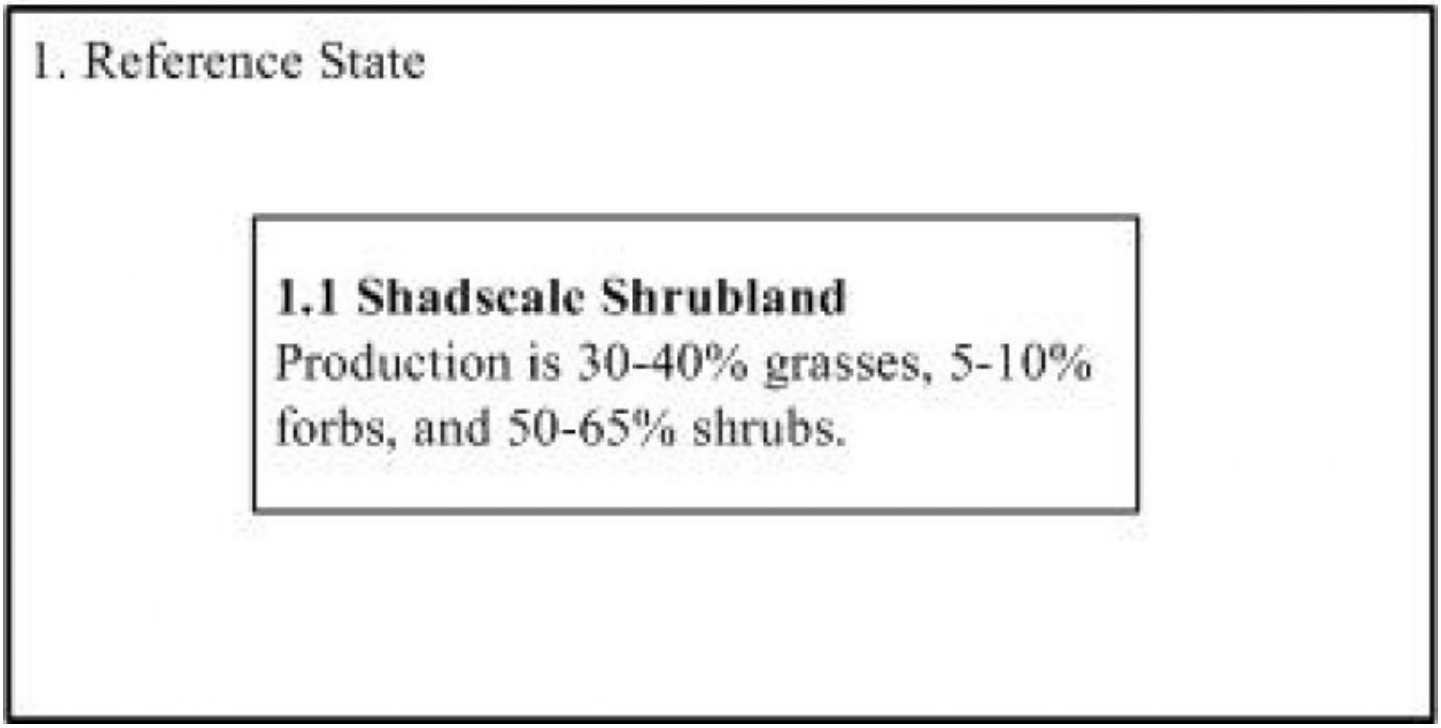

Figure 4. State-and-Transition Model

State 1
Reference State

The reference state is highly resistant to change due to the harsh soil environment of this site. Few species can readily establish and dominate on a shallow, clay, salt-affected soil with only 7-9.5 inches of annual precipitaion. The fuel loads are too sparse to carry a fire, and insect or disease impacts have not been documented to have a major impact on the plant community of the site. The resulting condition is a reference state that perpetuates itself on the site indefinately under natural historical conditions. To this point, no non-native invasive species have been documented on this site, however, it is expected that cheatgrass, Russian thistle, and/or annual mustards may be able to establish as a result of disturbance.

Community 1.1
Shadscale Shrubland

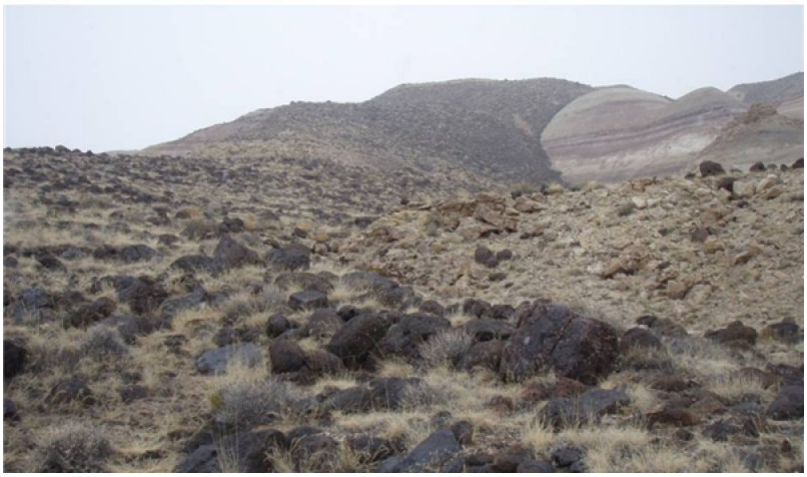

Figure 5. Phase 1.1

The dominant aspect of the plant community is shadscale. The composition by air-dry weight is approximately 30-40 percent perennial grasses, 5-10 percent forbs and 50-65 percent shrubs.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	50	85	120
Grass/Grasslike	25	50	75
Forb	5	15	25
Total	**80**	**150**	**220**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	10-20%
Grass/grasslike foliar cover	2-8%
Forb foliar cover	1-4%
Non-vascular plants	0%
Biological crusts	0%
Litter	0-4%
Surface fragments >0.25" and <=3"	20-50%
Surface fragments >3"	0-5%
Bedrock	0%
Water	0%
Bare ground	30-50%

Table 7. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	0-2%	0-4%
>0.5 <= 1	–	5-15%	2-8%	1-4%
>1 <= 2	–	5-15%	0-2%	–
>2 <= 4.5	–	–	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			30–70	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	25–50	2–5
	Torrey's jointfir	EPTO	*Ephedra torreyana*	5–20	0–2
3	**Sub-Dominant Shrubs**			10–40	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	5–25	0–2
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	0–15	0–1
	littleleaf horsebrush	TEGL	*Tetradymia glabrata*	0–10	0–1
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–10	0–1
	valley saltbush	ATCU	*Atriplex cuneata*	0–10	0–1
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–10	0–1
	blackbrush	CORA	*Coleogyne ramosissima*	0–10	0–1
	Nevada jointfir	EPNE	*Ephedra nevadensis*	0–10	0–1
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–10	0–1
Grass/Grasslike					
0	**Dominant Grasses**			25–75	
1	**Sub-Dominant Grasses**			0–50	
	Grass, perennial	2GP	*Grass, perennial*	0–20	0–2
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–20	0–2
	Grass, annual	2GA	*Grass, annual*	0–10	0–1
	squirreltail	ELEL5	*Elymus elymoides*	0–10	0–1
	alkali sacaton	SPAI	*Sporobolus airoides*	0–6	0–1
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–6	0–1
	mesa dropseed	SPFL2	*Sporobolus flexuosus*	0–6	0–1
	purple threeawn	ARPU9	*Aristida purpurea*	0–6	0–1
	black grama	BOER4	*Bouteloua eriopoda*	0–5	0–1
	blue grama	BOGR2	*Bouteloua gracilis*	0–5	0–1
Forb					
2	**Forbs**			5–25	
	Forb, annual	2FA	*Forb, annual*	0–15	0–1
	Forb, perennial	2FP	*Forb, perennial*	0–15	0–1
	desert trumpet	ERIN4	*Eriogonum inflatum*	2–10	0–1
	redroot buckwheat	ERRA3	*Eriogonum racemosum*	0–6	0–1
	rusty lupine	LUPUP	*Lupinus pusillus ssp. pusillus*	0–6	0–1
	tufted evening primrose	OECA10	*Oenothera caespitosa*	0–6	0–1
	woolly plantain	PLPA2	*Plantago patagonica*	0–6	0–1
	Munro's globemallow	SPMU2	*Sphaeralcea munroana*	0–6	0–1
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	0–6	0–1
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–6	0–1
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–6	0–1

Animal community

--Livestock and Wildlife Grazing--

This site provides fair to 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. 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 and desert bighorn sheep, habitat; however in many places the populations will be small and have little grazing impact on the site.

The plant community is primarily shrubs with dominant canopy cover being made up of shadscale. This shrub provides good browse for mule deer, domestic sheep, and goats in the winter, spring, and fall. It is a minor component of bighorn sheep diets in the winter. Cattle will only utilize the fruits/seeds due to the spiny nature of the plant. Sub-dominant shrubs include Torrey jointfir, castlevalley saltbush, and bud sagebrush, which provide good winter browse for cattle, sheep, goats, mule deer, and bighorn sheep. Grasses include galleta, and bottlebrush squirreltail and provide poor 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.

Hydrological functions

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

Recreational uses

Recreation values are hiking and hunting.

Wood products

None

Other information

--Poisonous/Toxic Plant Communities--

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

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

Potentially toxic plants associated with this site include some 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.

--Invasive Plant Communities--

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

Other references

Modal Soil: Shalet CL, Eroded — loamy, mixed (calc.), mesic shallow Typic Torriorthents

Contributors

George Cook
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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.

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Contact for lead author	shane.green@ut.usda.gov This site is in the early stages of soil formation
Date	09/10/2008
Approved by	Shane A. Green
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Very common. Rills present should be 15 or more feet long. They should be 2-3 inches deep.

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2. **Presence of water flow patterns:** Very common throughout the site. They are expected to be long and connected into drainage networks. Evidence of flow will increase with slope.

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3. **Number and height of erosional pedestals or terracettes:** Plants may show some pedestalling (up to .5 inch) on their down slope side. Terracettes should be few and stable. Interspaces between well developed biological soil crusts may resemble pedestals but they are 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):** 30 – 50%. Ground cover is based on the first raindrop impact, and bare ground is the inverse of ground 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:** Few. May be found where adjacent sites/watershed provide

concentrated flows into the site. Gullies should show only minor signs of active erosion and should be mostly stabilized with perennial vegetation. Gullies may show slightly more indication of erosion as slope steepens, or as the site occurs adjacent to sites where runoff accumulation occurs.

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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 expected to be present.

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7. **Amount of litter movement (describe size and distance expected to travel):** Some down slope redistribution caused by water. Some litter removal may occur in flow patterns or rills with deposition occurring at points of obstruction, especially following major 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 under plant canopies and a rating of 2 to 3 in the interspaces using the soil stability kit test. The average should be a 3. Surface texture is 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 horizon is typically 4 inches deep. Structure is typically moderate fine granular. Color is typically reddish brown (5YR5/4). The A horizon would be expected to be more strongly developed under plant canopies. It is important if you are sampling to observe the A horizon under plant canopies as well as the interspaces. Use the specific information for the soil you are assessing found in the published soil survey to supplement this description.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Vascular plants are expected to break raindrop impact and splash erosion reducing the amount of splash erosion but not eliminating it. Spatial distribution of vascular plants slows runoff somewhat by obstructing surface flows to help create sinuous flow patterns that dissipate energy and allow time for some infiltration. Natural erosion would be expected in most storms and spring runoff.

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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. The higher clay content and platy structure on this site should not be confused with 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)

    Sub-dominant: Warm season perennial grasses (Galleta) > Perennial bunchgrasses (Indian ricegrass) > perennial and annual native forbs (Indian pipeweed) > 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 it’s 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: Factors that cause temporal variability include drought and insects. Factors that cause spatial variability include slope and aspect, 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):** Mostly shadscale leaves. Litter cover (including under plants) 5-10% nearly all of which should be fine litter. Depth should be 1 leaf thickness in the interspaces and 1/8 inch under shadscale canopies.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 150-200 #/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:** Russian thistle, halogeton, 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.
