USDA Natural Resources
Conservation Service

Ecological site R028AY106UT
Desert Alkali Clay Loam (Alkali Sacaton)

Accessed: 05/11/2025

General information

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

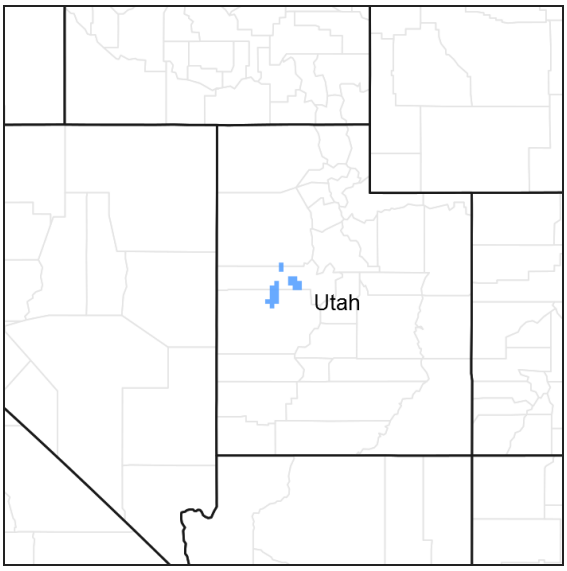

Figure 1. Mapped extent

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

MLRA notes

Major Land Resource Area (MLRA): 028A–Ancient Lake Bonneville

This site occurs in MLRA 28A, LRU A, the northern part of MLRA 28A. This LRU has a mesic soil temperature regime and a typic aridic soil moisture regime. Typically most precipitation occurs in the winter and then again in the summer with convective thunderstorms. Mean annual precipitation is between 4 to 8 inches. The north desert ecological zone typically has no big sagebrush (Artemisia tridentate spp.), but typically is dominated by shadscale (Atriplex confertifolia), winterfat (Krascheninnikovia lanata), saltbushes (Atriplex spp), Indian ricegrass (Achnatherum hymenoides), and bottlebrush squirreltail (Elymus elymoides). Unlike the northern LRUs, there is typically galleta (Pleuraphis jamesii) grass in the plant community.

Classification relationships

MLRA 28A, LRU E, southern portion of MLRA

Ecological site concept

This ecological site is dominated by grass in reference condition. It occurs on lake terraces on low slopes. This site occurs on fine textured soils, typically silty clay loams with few rocks on the surface or in the subsurface.

Associated sites

R028AY110UT	**Desert Alkali Sand (Fourwing Saltbush)** RO26AY110UT Desert Alkali Sand (Four-wing Saltbush) is also an associated site.
R028AY124UT	**Desert Loam (Shadscale)** RO26AY126UT Desert Clay Loam (Shadscale) is also an associated site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Sporobolus airoides*

Physiographic features

This site occurs on lacustrine plains above terraces on low slopes. It occurs between 4300 to 5800 feet. This site does not flood or pond during the year.

Table 2. Representative physiographic features

Landforms	(1) Plain (2) Terrace
Flooding frequency	None
Ponding frequency	None
Elevation	4,300–5,800 ft
Slope	0–5%

Climatic features

The climate is cold and snowy in the winter and warm and dry in the summer. The average annual precipitation is 5 to 8 inches. Approximately 70 percent comes as rain from March through October. On the average, June through September are the driest months and March through May are the wettest months.

Climate tables derived from PRISM model.

Mean Annual Air Temperature: 45-50
Mean Annual Soil Temperature: 50-53

Table 3. Representative climatic features

Frost-free period (average)	0 days
Freeze-free period (average)	130 days
Precipitation total (average)	7 in

Influencing water features

No water features in this site, no flooding or ponding occur.

Soil features

Characteristic soils in this site are 60 inches deep and well drained.

They formed in mixed lake sediments and alluvium derived mainly from mixed parent materials. The surface horizon is fine sandy loam or sandy loam textures and 4 to 10 inches thick. Rock fragments are not found in or on

this soil.

The underlying layers in these soils are mainly silty clay loam, and clay loam, stratified with thin layers of sand to sandy loam. Permeability is slow to very slow.

The available water capacity is 2.8 to 5.1 inches. Natural geologic erosion in potential is approximately 0.5 tons/acre/year.

Table 4. Representative soil features

Surface texture	(1) Silty clay loam (2) Loamy fine sand
Family particle size	(1) Sandy
Drainage class	Well drained
Permeability class	Slow to moderate
Soil depth	60 in
Surface fragment cover <=3"	0–11%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	2.8–5.1 in
Calcium carbonate equivalent (0-40in)	10–40%
Electrical conductivity (0-40in)	2–16 mmhos/cm
Sodium adsorption ratio (0-40in)	5–30
Soil reaction (1:1 water) (0-40in)	7.9–9
Subsurface fragment volume <=3" (Depth not specified)	0–29%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

As ecological condition deteriorates due to overgrazing, alkali sacaton, galleta, and Indian ricegrass decrease while greasewood, low rabbitbrush, and shadscale increases.

When the potential natural plant community is burned, alkali sacaton and Indian ricegrass decrease while low rabbitbrush and greasewood increases.

Annual forbs and annual grasses are most likely to invade this site.

R028AE106UT is similar to R028AY024NV. Nevada developed a state and transition model that is used for the 106UT site (see Stringham et al. 2015).

State and transition model

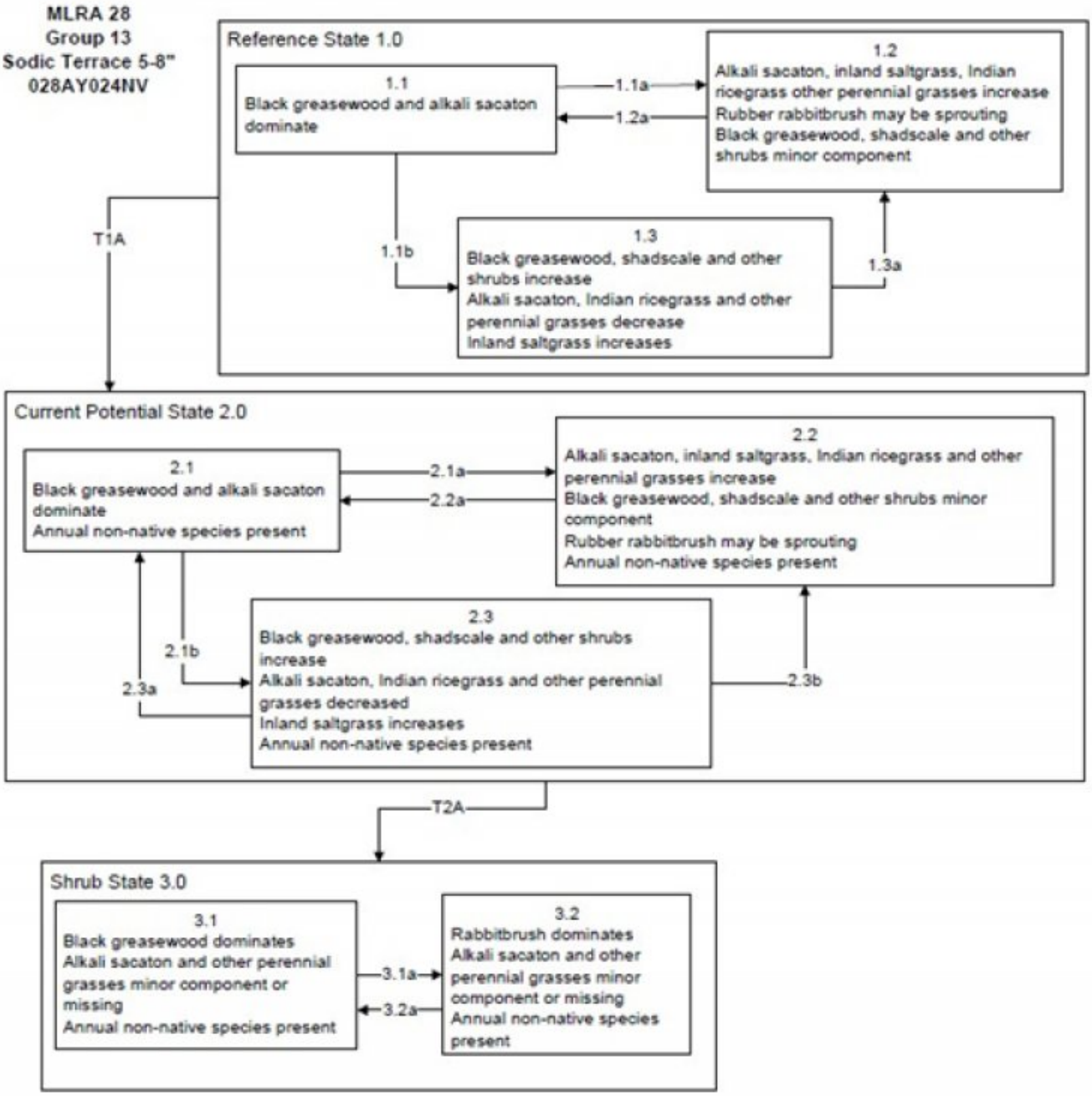

Figure 6. R028AE106UT STM

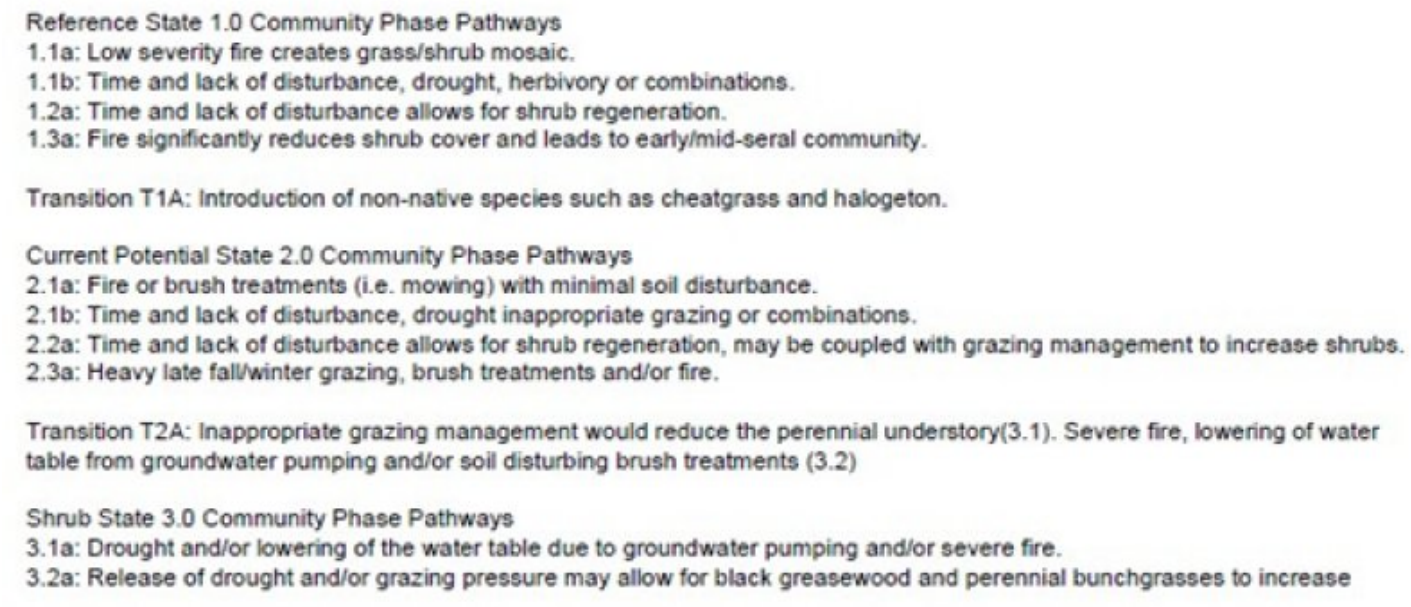

Figure 7. R028AE106UT Legend

State 1
Reference State

The dominant aspect of this state is alkali sacaton, black greasewood and shadscale. The community dynamics are driven by fire, drought, herbivory or other disturbances.

Community 1.1
Black greasewood/alkali sacaton

The dominant aspect of the plant community is alkali sacaton. The composition by air dry weight is approximately 80 percent perennial grasses, 1 percent forbs, and 19 percent shrubs. Black greasewood and alkali sacaton dominate.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	200	320	480
Shrub/Vine	48	76	114
Forb	3	4	6
Total	**251**	**400**	**600**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	5-10%
Grass/grasslike foliar cover	15-40%
Forb foliar cover	1%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%

Bedrock	0%
Water	0%
Bare ground	0%

Table 7. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	–	–
>0.5 <= 1	–	–	–	0-2%
>1 <= 2	–	5-15%	35-45%	–
>2 <= 4.5	–	–	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Figure 9. Plant community growth curve (percent production by month). UT1061, PNC. Excellent Condition.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	25	50	10	0	0	5	5	0	0

Community 1.2
Alkali sacaton/perennial grasses/sprouting shrubs

The dominant aspect of the plant community is alkali sacaton. The composition by air dry weight is approximately 80 percent perennial grasses, 1 percent forbs, and 19 percent shrubs. Alkali sacaton, inland saltgrass, Indian ricegrass and other perennial shrubs increase. Rubber rabbitbrush my be sprouting. Black greasewood, shadscale and other shrubs are a minor component.

Community 1.3
Native shrubs/Inland saltgrass/other perennial grasses

The dominant aspect of the plant community is alkali sacaton. The composition by air dry weight is approximately 80 percent perennial grasses, 1 percent forbs, and 19 percent shrubs. Black greasewood, shadscale and other shrubs increase. Alkali sacaton, Indian ricegrass and other perennial grasses decrease. Inland saltgrass increases.

Pathway 1.1a
Community 1.1 to 1.2

Low severity fire creates grass/shrub mosaic.

Pathway 1.1b
Community 1.1 to 1.3

Time and lack of disturbance, drought, herbivory or combinations.

Pathway 1.2a
Community 1.2 to 1.1

Time and lack of disturbance allows for shrub regeneration.

Pathway 1.3a
Community 1.3 to 1.2

Fire significantly reduces shrub cover and leads to early/mid-seral community.

State 2
Current Potential State

Similar to State 1 with the presence of non-native species.

Community 2.1
Black greasewood/alkali sacaton

The dominant aspect of the plant community is alkali sacaton. The composition by air dry weight is approximately 80 percent perennial grasses, 1 percent forbs, and 19 percent shrubs. Black greasewood and alkali sacaton dominate. Annual non-native species present.

Community 2.2
Alkali sacaton/perennial grasses/native shrubs/annual non-native species

The dominant aspect of the plant community is alkali sacaton. Alkali sacaton, inland salgrass, Indian ricegrass and other perennial grasses increase. Black greasewood, shadscale and other shrubs minor component. Rubber rabbitbrush may be sprouting. Annual non-native species present.

Community 2.3
Native shrubs/Inland saltgrass/annual non-natives

The dominant aspect of the plant community is black greasewood. Black greasewood, shadscale and other shrubs increase. Alkali sacaton, Indian ricegrass and other perennial grasses decrease. Inland saltgrass increases. Annual non-native species present.

Pathway 2.1a
Community 2.1 to 2.2

Fire or brush treatments (i.e. mowing) with minimal soil disturbance.

Pathway 2.1b
Community 2.1 to 2.2

Time and lack of disturbance, drought inappropriate grazing or combinations.

Pathway 2.2a
Community 2.2 to 2.1

Time and lack of disturbance allows for shrub regeneration, may be coupled with grazing management to increase shrubs.

Pathway 2.3a
Community 2.3 to 2.1

Heavy late fall/winter grazing, brush treatments and/or fire.

Pathway 2.3b
Community 2.3 to 2.2

Fire significantly reduces shrub cover and leads to grass dominance.

State 3
Shrub State

Native grasses have largely been depleted through excessive grazing over a number of years. Presence and dominance of non-native species lowers the resiliency of this state to return to State 2.

Community 3.1
Black greasewood/annual non-natives

The dominant aspect of the plant community is black greasewood and annual non-native species. Black greasewood dominates. Alkali sacaton and other perennial grasses are minor components or missing. Annual non-natives species are present and may dominate the understory.

Community 3.2
Rabbitbrush/Annual non-natives

The dominant aspect of the plant community is rabbitbrush and annual non-native species. Rabbitbrush dominates the shrub community after a drought or severe fire. Alkali sacaton and other perennial grasses are a minor component in the understory or are altogether absent. Annual non-native species are present and dominate the understory.

Pathway 3.1a
Community 3.1 to 3.2

Heavy late fall/winter grazing, brush treatments and/or fire.

Pathway 3.2a
Community 3.2 to 3.1

Release of drought and/or grazing pressure may allow for black greasewood and perennial bunchgrasses to increase

Transition T1A
State 1 to 2

Introduction of non-native species such as cheatgrass and halogeton.

Transition T2A
State 2 to 3

Inappropriate grazing management would reduce the perennial understory(3.1). Severe fire, lowering of watertable from groundwater pumping and/or soil disturbing brush treatments (3.2)

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	**Primary Shrubs**			59–90	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	45–68	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	14–23	–
3	**Secondary Shrubs**			5–14	
	green molly	BAAM4	*Bassia americana*	0–5	–
	yellow rabbitbrush	CHVIS5	*Chrysothamnus viscidiflorus ssp. viscidiflorus var. stenophyllus*	0–5	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–5	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–5	–
Grass/Grasslike					
0	**Primary Grasses**			293–405	
	alkali sacaton	SPAI	*Sporobolus airoides*	180–225	–
	James' galleta	PLJA	*Pleuraphis jamesii*	90–135	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	23–45	–
1	**Seconary Grasses**			5–14	
	saltgrass	DISP	*Distichlis spicata*	0–5	–
	squirreltail	ELEL5	*Elymus elymoides*	0–5	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–5	–
Forb					
2	**Forbs**			5–14	
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–5	–

Animal community

This site is suited for sheep and cattle grazing during fall, winter, and spring.

Wildlife using this site include rabbit, coyote, fox, and pronghorn antelope.

This is a short list of the more common species found. Many other species are present as well and migratory birds are present at times.

Hydrological functions

The soils are in hydrologic group D. The runoff curve ranges from 80 to 89 depending on condition of the vegetation.

Recreational uses

Resources that have special aesthetic and landscape value are wildflowers. Some recreation of this site are hiking and hunting.

Wood products

None

Other information

Threatened and endangered species include plants and animals.

Type locality

Location 1: Juab County, UT

Other references

Stringham, T.K., P. Novak-Echenique, P. Blackburn, C. Coombs, D. Synder, and A. Wartgow. 2015. Final Report for USDA Ecological Site Description State-and-Transition Models, Major Land Resource Area 28A and 28B Nevada. University of Nevada Reno, Nevada Agricultural Experiment Station Research Report 2015-01. p. 1524.

Contributors

David J. Somorville
DJS
Patti NovakEchenique
Tamzen Stringham

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)	V. Keith Wadman (NRCS Ret.), Shane A. Green (NRCS)
Contact for lead author	shane.green@ut.usda.gov
Date	01/26/2009
Approved by	Shane A. Green
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Very minor rill development will be evident in reference communities on this site. Development will be more pronounced following significant storm or snow melt events. The presence of rills may also be more apparent where run-on from adjacent upland sites or exposed bedrock concentrate flows. Rill development will be moderately short (< 8') and widely spaced (8' – 10'). Evidence of rills will decrease in the months following major weather events.

---

2. **Presence of water flow patterns:** Evidence of stable overland water flow is apparent in the reference community; increased flow activity may be observed immediately following significant weather events. Flow patterns are normally <15 feet long, follow natural contours, and are typically spaced 8 to 10 feet apart.

---

3. **Number and height of erosional pedestals or terracettes:** Very slight evidence of pedestals or terracettes caused by

accelerated water erosion may be evident in the reference community. 1 – 2 inches of elevational mounding around perennial grass clumps and within biological soil crusts is normal and may not be water erosion caused. Some pedestalling around Indian ricegrass plants may indicate past water erosion. There should be no exposed roots.

---

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground ranges from 10% - 20% in the reference community. Ground cover (the inverse of bare ground) typically includes: coarse fragments – 1% to 3%; plant canopy – 35% to 50%; litter – 20% to 30%, and biological soil crusts – 2% to 5%.

---

5. **Number of gullies and erosion associated with gullies:** Some gully channels are a normal component of desert environments. Gullies associated with reference areas will typically have stable, partially vegetated sides and bottoms with no evidence of head-cutting. Some evidence of disturbance may be evident following significant weather events or when gullies convey runoff from higher elevation rocky or naturally runoff producing areas.

---

6. **Extent of wind scoured, blowouts and/or depositional areas:** No evidence of wind generated soil movement is present in reference communities. Slight depositional mounding within perennial grass plants, Shadscale canopies and biological soil crusts is a normal characteristic of this site.

---

7. **Amount of litter movement (describe size and distance expected to travel):** Most litter resides in place within or under plant canopies. Some movement of the finest material (< 1/8” or less) may move (1’ – 2’) in the direction of prevailing winds or down slope if being transported by water. Little accumulation is observed behind obstructions.

---

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 to 5. Surface textures are typically silty clay loams containing few coarse fragments.

---

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface is 4 inches deep and structure is moderate, coarse subangular blocky. The A-horizon color is 2.5YR 7/2. Soils have a salic (natric) horizon that extends 40 inches into the soil profile. Where surface soil is lost, increased clay and silt percentages are common in the remaining soil material.

---

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** The presence of perennial grasses combined with Shadscale in the reference community provides for the best infiltration and least runoff from storm events and snow melt. As perennial vegetation decreases and bare ground increases, runoff increases and soil loss is accelerated. Biological soil crusts provide for added soil stability when present.

---

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. Soils are deep to very deep. Increases in clay or silt content in subsoil layers could be mistaken for 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: Dominant: Warm season grasses (e.g. Alkali sacaton and/or James galleta) 60 – 80%, >> Non-sprouting shrubs (e.g. Shadscale and Bud sagebrush) 10 – 20%.

    Sub-dominant: Sub-dominant: Cool season grasses (e.g. Indian ricegrass and Bottlebrush squirreltail) 5-10% > sprouting shrubs (e.g. Black Greasewood and Winterfat).

    Other: Others: Shrubs (e.g. Low rabbitbrush and Greenmolly) 1-3%, perennial forbs (e.g. Scarlet globemallow and Slender seepweed) 1 - 3%

    Additional: Moss and lichen communities will normally be found under plant canopies while the cyanobacteria may be found throughout the site.

---

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** During years with average to above-average precipitation, there should be very little recent mortality or decadence apparent in either the shrubs or grasses. During severe (multi-year) drought or insect infestations up to 80% of the Shadscale plants may die. Some mortality of bunchgrass and other shrubs may also occur during severe droughts. There may be partial mortality of individual bunchgrasses and other shrubs during less severe drought. During drought years principle shrubs may experience early and prolonged leaf drop.

---

14. **Average percent litter cover (%) and depth (in):** Litter cover ranges from 10 to 20%. Depth varies from ¾ - 1/2 inch with depth increasing near plant canopies.

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 350 – 450 pounds on an average year.

---

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:** Broom snakeweed, Russian thistle, Redstem storksbill, annual bromes and Halogeton are likely to increase in or invade this site.

---

17. **Perennial plant reproductive capability:** All perennial plant species have the ability to reproduce in most years except drought years.
