USDA Natural Resources Conservation Service

Ecological site R028AY130UT
Desert Salt Flat (Sickle Saltbush)

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.

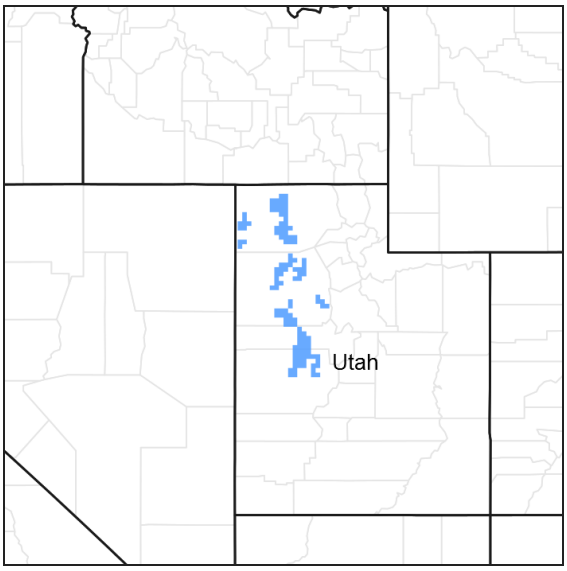

Figure 1. Mapped extent

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. 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 southern LRUs, there is typically very little if any galleta (Pleuraphis jamesii) grass.

Classification relationships

MRLA 28A, LRU A, northern desert ecological zone

Ecological site concept

This site is dominated by sickle saltbush in reference condition. It typically occurs in the northern portion of the MLRA on low slopes of lake terraces, lake plains or floodplains.

Associated sites

R028AY001UT	**Alkali Bottom (Alkali Sacaton)**
R028AY004UT	**Alkali Flat (Black Greasewood)**
R028AY119UT	**Desert Flat (Shadscale)**
R028AY124UT	**Desert Loam (Shadscale)**
R028AY140UT	**Desert Silt Flat (Winterfat)**

Similar sites

R028AY020NV	**ALKALI SILT FLAT** This site is similar in soils and vegetation but is found in Nevada.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex falcata*
Herbaceous	Not specified

Physiographic features

This site occurs on low, run-in valley bottoms and playa lakes, lake deltas, lake plains, and floodplains where extra moisture accumulates. This site can also occur on lake terraces where the water table is not apparent within 60 inches of the soil surface. Flooding and ponding typically do not occur on this site.

Table 2. Representative physiographic features

Landforms	(1) Lake terrace (2) Lake plain (3) Flood plain
Flooding frequency	None
Ponding frequency	None
Elevation	4,200–5,050 ft
Slope	0–3%

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.

Mean Annual Air Temperature: 45-50
Mean Annual Soil Temperature: 49-52

Table 3. Representative climatic features

Frost-free period (average)	127 days
Freeze-free period (average)	145 days
Precipitation total (average)	8 in

Climate stations used

- (1) KNOLLS 10 NE [USC00424748], Wendover, UT

Influencing water features

Soil features

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

They formed in alluvium and lake sediments derived mainly from mixed sedimentary and igneous parent materials. The surface horizon is silt loam textures and 5 inches thick. Rock fragments are not found in or on this soil.

These soils are medium textures, moderately alkaline or strongly alkaline and are slightly saline in the surface layer and strongly saline in the underlying material. Permeability is moderately slow. They are moderately or strongly calcareous. The available water capacity is reduced by salinity and ranges from 3 to 6 inches.

The water supplying capacity is 2 to 5 inches. Natural geologic erosion in potential is approximately 0.5 tons/acre/year.

Table 4. Representative soil features

Surface texture	(1) Silt loam (2) Silty clay loam
Drainage class	Well drained
Permeability class	Slow to moderately slow
Soil depth	60 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	0–7.1 in
Calcium carbonate equivalent (0-40in)	1–40%
Electrical conductivity (0-40in)	2–32 mmhos/cm
Sodium adsorption ratio (0-40in)	0–90
Soil reaction (1:1 water) (0-40in)	7.9–9
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

As ecological condition deteriorates due to overgrazing, sickle saltbush, greenmolly, and squirreltail decrease while greasewood and seepweed increase.

This site lacks quantity of fuel to carry a fire.

Annual forbs are most likely to invade this site.

This site is similar to Nevada's 028AY020NV site (Stringham et al. 2015). The STM developed for Nevada's site is used in this ESD.

Information from 028AY020NV: This site is dominated by sickle saltbush and bottlebrush squirreltail. Indian ricegrass and green molly make up minor components on this site. Production ranges from 200 to 300 pounds per

acre. Historically, it is theorized green molly (*Bassia americana*) occupied monotypic stands in saline soils and declined in abundance from 1950-1970 following the increase in sheep numbers on desert ranges (Esplin et al. 1937). Green molly is not highly valued as a range plant but is palatable and nutritious as winter forage for sheep (Esplin et al. 1937). In a study in Utah by Cook and Stoddart (1953), green molly provided up to eight percent of the diet of range sheep, and was utilized at 95 percent. Green molly is also an important forage species for jackrabbits (Clark 1979).

State and transition model

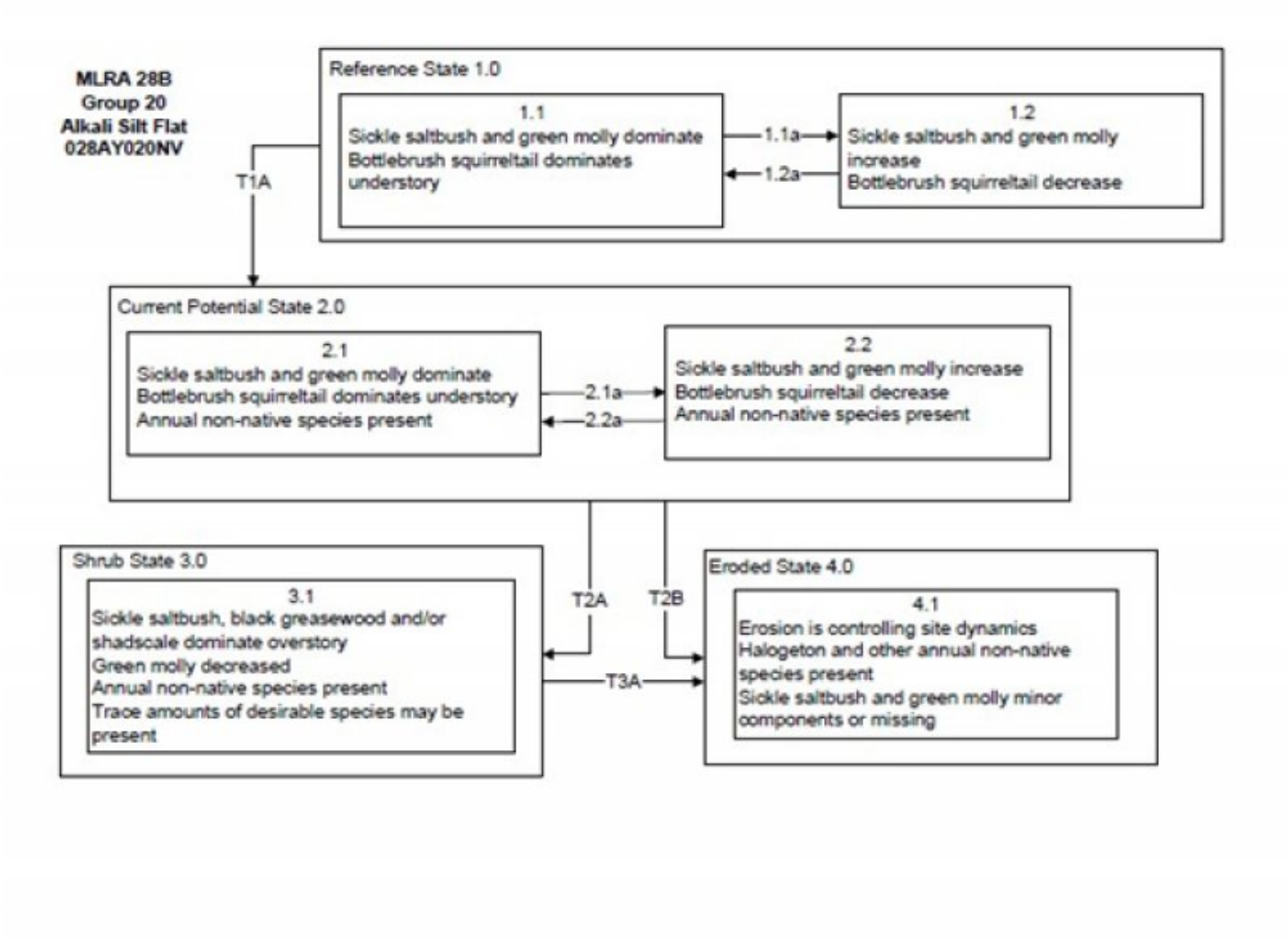

Figure 6. R028AA130UT STM

Reference State 1.0 Community Phase Pathways
1.1a: Drought and/or excessive herbivory would reduce some perennial grasses and some shrubs
1.2a: Release from drought and/or time and lack of disturbance

Transition T1A: Introduction of non-native annual species such as halogeton.

Current Potential State 2.0 Community Phase Pathways
2.1a: Prolonged drought and/or inappropriate grazing management
2.2a: Release from drought and/or lack of disturbance

Transition T2A: Inappropriate grazing management may be combined with drought.

Transition T2B: Soil disturbing treatments (drill seeding, roller chopper, Lawson aerator etc.), severe drought, and/or inappropriate grazing management

Transition T3A: Soil disturbing treatments (drill seeding, roller chopper, Lawson aerator etc.), severe drought, and/or inappropriate grazing management

Figure 7. R028AA130UT STM Legend

State 1
Reference State

The Reference State 1.0 is a representative of the natural range of variability under pristine conditions. This state has two community phases, one dominated by shrubs and grasses and the other dominated by shrubs. State dynamics are maintained by interactions between climatic patterns and disturbance regimes. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These include the presence of all structural and functional groups, low fine fuel loads, and retention of organic matter and nutrients. This site is very stable, with little variation in plant community composition. Plant community changes would be reflected in production in response to drought or abusive grazing. Wet years will increase grass production, while drought years will reduce production. Shrub production will also increase during wet years.

Community 1.1
Sickle saltbush, black greasewood, squirreltail

This community is dominated by sickle saltbush. Bottlebrush squirreltail is also an important species on this site. Black greasewood may be a significant component or dominant species. Community phase changes are primarily a function of long-term drought. Fire is infrequent and patchy due to low fuel loads. The dominant aspect of the plant community is sickle saltbush. The composition by air-dry weight is approximately 5 percent perennial grasses, 10 percent forbs, and 85 percent shrubs.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	43	234	340
Forb	5	28	40
Grass/Grasslike	3	14	20
Total	**51**	**276**	**400**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	10-25%
Grass/grasslike foliar cover	1-2%
Forb foliar cover	2-5%
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	–	20-30%	0-5%	0-10%
>1 <= 2	–	–	–	–
>2 <= 4.5	–	–	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Figure 9. Plant community growth curve (percent production by month). UT1301, 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
Sickle saltbush, greasewood

Drought will favor shrubs over perennial bunchgrasses. However, long-term drought will result in an overall decline in the plant community, regardless of functional group. Sickle saltbush and other shrubs dominate the overstory, squirreltail and other grasses are reduced to trace amounts.

Pathway 1.1a
Community 1.1 to 1.2

Long-term drought and/or herbivory would reduce the perennial grasses on this site.

Pathway 1.2a
Community 1.2 to 1.1

Time, lack of disturbance and recovery from drought would allow the vegetation to increase and bare ground would eventually decrease.

State 2
Current Potential State

This state is similar to the Reference State 1.0 with two similar community phases. Ecological function has not changed, however the resiliency of the state has been reduced by the presence of invasive weeds. Non-natives may increase in abundance but will not become dominant within this State. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These feedbacks include the presence of all structural and functional groups, low fine fuel loads, and retention of organic matter and nutrients. Positive feedbacks decrease ecosystem resilience and stability of the state. These include the non-natives' high seed output, persistent seed bank, rapid growth rate, ability to cross pollinate, and adaptations for seed dispersal.

Community 2.1
Sickle saltbush, greasewood, squirreltail, non-native annuals

This community is dominated by sickle saltbush. Bottlebrush squirreltail is also an important species on this site. Black greasewood may be a significant component of the plant community. Community phase changes are primarily a function of chronic drought. Fire is infrequent and patchy due to low fuel loads. Non-native annual species are present.

Community 2.2
Sickle saltbush, greasewood, non-native annuals

Drought will initially favor shrubs over bunchgrasses; however long-term drought will result in an overall decline in the plant community regardless of functional group. Unpalatable shrubs such as sickle saltbush increase with inappropriate grazing while squirreltail and shadscale decline. Bare ground increases along with annual weeds.

Pathway 2.1a
Community 2.1 to 2.2

Inappropriate grazing and/or drought would decrease the production on these sites.

Pathway 2.2a
Community 2.2 to 2.1

Release from drought and/or growing season grazing pressure allows recovery of bunchgrasses.

State 3
Shrub State

This state consists of one community phase. This site has crossed a biotic threshold and site processes are being controlled by shrubs.

Community 3.1
Sickle saltbush, greasewood, shadscale, non-native annuals

Perennial grasses like bottlebrush squirreltail and western wheatgrass are reduced and the site is dominated by sickle saltbush, black greasewood, shadscale and other shrubs. Annual non-native species may be present to increasing. Bare ground is significant.

State 4
Eroded State

This site consists of one community phase. Abiotic factors including soil redistribution and erosion, soil temperature, soil crusting and sealing are primary drivers of ecological condition within this state. Soil moisture, soil nutrients and soil organic matter distribution and cycling are severely altered due to degraded soil surface conditions.

Community 4.1
Non-native annulas

Sickle saltbush and other shrubs may be the dominant species but are only present in patches, and are not contributing to site function. Regeneration of herbaceous species is not evident. Invasive plants (halogeton, Russian thistle) are sporadic and associated on mounds bordering playettes. Bare ground may be abundant, especially during low precipitation years. Soil erosion, soil temperature and wind are driving factors in site function.

Transition T1A
State 1 to 2

Trigger: This transition is caused by the introduction of non-native annual plants, such as halogeton and cheatgrass. Slow variables: Over time the annual non-native species will increase within the community. Threshold: Any amount of introduced non-native species causes an immediate decrease in the resilience of the site. Annual non-native species cannot be easily removed from the system and have the potential to significantly alter disturbance regimes from their historic range of variation.

Transition T2A

State 2 to 3

Trigger: Repeated, heavy, growing season grazing will decrease or eliminate deep rooted perennial bunchgrasses and decrease sickle saltbush. Slow variables: Long term decrease in deep-rooted perennial grass density. Threshold: Loss of deep-rooted perennial bunchgrasses changes nutrient cycling, nutrient redistribution, and reduces soil organic matter.

Transition T2B
State 2 to 4

Trigger: Contiguous inappropriate grazing management and/or soil disturbing treatments. Slow variables: Increased bare ground and/or increase amount of non-native annual species. Threshold: Loss of deep-rooted perennial bunchgrasses and shrubs truncates, spatially and temporally, nutrient capture and cycling within the community.

Transition T3A
State 3 to 4

Trigger: Contiguous inappropriate grazing management and/or soil disturbing treatments. Slow variables: Increase in bare ground, increased production and cover of non-native annual species. Threshold: Changes in plant community composition and spatial variability of vegetation due to the loss of perennial bunchgrasses and saltbush truncate energy capture spatially and temporally thus impacting nutrient cycling and distribution.

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**			195–240	
	sickle saltbush	ATFA	*Atriplex falcata*	150–180	–
	green molly	BAAM4	*Bassia americana*	45–60	–
3	**Secondary Shrubs**			15–30	
	iodinebush	ALOC2	*Allenrolfea occidentalis*	9–15	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	9–15	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	9–15	–
Grass/Grasslike					
0	**Primary Grasses**			9–15	
	squirreltail	ELEL5	*Elymus elymoides*	9–15	–
1	**Secondary Grasses**			9–15	
	saltgrass	DISP	*Distichlis spicata*	3–9	–
	James' galleta	PLJA	*Pleuraphis jamesii*	3–9	–
	Sandberg bluegrass	POSE	*Poa secunda*	3–9	–
	alkali sacaton	SPAI	*Sporobolus airoides*	3–9	–
Forb					
2	**Forbs**			15–30	
	fivehorn smotherweed	BAHY	*Bassia hyssopifolia*	9–15	–
	western tansymustard	DEPI	*Descurainia pinnata*	9–15	–
	clasping pepperweed	LEPE2	*Lepidium perfoliatum*	9–15	–
	Mojave seablite	SUMO	*Suaeda moquinii*	9–15	–

Animal community

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

Wildlife using this site include rabbit, coyote, fox, pronghorn antelope, and mule deer (seasonal).

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 with runoff curves ranging from 80 to 89 depending on hydrologic condition.

Recreational uses

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

Wood products

None

Other information

Threatened and endangered species include plants and animals.

Type locality

Location 1: Box Elder County, UT	
Township/Range/Section	T10N R14W S20
General legal description	Box Elder County, Western, Soil Survey - Section 20, Township 10N, Range 14W.
Location 2: Box Elder County, UT	
Township/Range/Section	T11N R15W S26
General legal description	Section 26, Township 11N, Range 15W

Other references

Clark, W.R. 1979. Population Limitation of Jackrabbits: an Examination of the Food Hypothesis. All Graduate Thesis and Dissertations. Paper 3502. Available at: http://digitalcommons.usu.edu/etd/3502

Cook, C. W. and L.A. Stoddart, L. A. 1953. Bulletin No. 364 - The Halogeton Problem in Utah. UAES Bulletins. Paper 322. Available at: http://digitalcommons.usu.edu/uaes_bulletins/322

Esplin, A. C., J.E. Greaves, and L.A. Stoddart. 1937. Bulletin No. 277 - A Study of Utah's Winter Range: Composition of Forage Plants and Use of Supplements. UAES Bulletins. Paper 239. http://digitalcommons.usu.edu/uaes_bulletins/239

Stringham, T.K., P. Novak-Echenique, P. Blackburn, C. Coombs, D. Snyder, 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 Novak Echenique
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	01/31/2009
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 shallow rill development may be apparent in reference communities. Development will be more pronounced following significant storm or snow melt events. Rills should be somewhat short (< 4') and fairly widely spaced (6' – 8') and less tha 1" deep. Evidence of rills will slowly decrease in the months following major weather events. Rills development may also be more pronounced on the edges of this site where run-on from adjacent upland sites or exposed bedrock concentrate flows.

---

2. **Presence of water flow patterns:** Evidence of stable overland water flow is apparent in the reference community. Flow patterns follow site micro-contours, are sinuous and may have standing water after storm events. There are no exposed roots around perennial grass bunches and cryptogamic crusts, where present, show little sign of disturbance. Flow patterns are normally <20 feet long, flow around shrub mounds, and are typically spaced 10 to 12 feet apart.

---

3. **Number and height of erosional pedestals or terracettes:** None. 1 – 2 inches of depositional mounding around Sickle saltbush canopies and within biological soil crusts, when present, is normal and may not be water erosion caused.

---

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground ranges from 50% - 60% in the reference community. Ground cover (the inverse of bare ground) typically includes: rock fragments – < 1%; plant canopy – 20% to 30%; litter – 15% to 20%, and biological soil crusts – 2% to 5%.

---

5. **Number of gullies and erosion associated with gullies:** None. Some gully channels are a normal component of desert environments. Gullies associated with this site will typically have stable, partially vegetated sides and bottoms with no evidence of head-cutting, and be a result of runoff from higher elevation rocky or naturally runoff producing areas.

---

6. **Extent of wind scoured, blowouts and/or depositional areas:** Very minor evidence of wind generated soil movement is present in reference communities. Wind caused blowouts are not present. Slight depositional mounding in perennial

grass bunches, around Sickle saltbush canopies and within cryptogamic 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 3 to 4 under plant canopies and 2 to 3 in interspaces. Surface textures are typically silt loams or fine loams containing very few rock fragments.

---

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface is 1 - 3 inches deep and structure varies from weak, medium to strong, thick platy. The A-horizon color varies from 10YR 7/2 to 7.5YR 8/2. Soils have an Ochric epipedon that extends 3 – 5 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 healthy perennial bunchgrasses and Sickle saltbush in the reference state 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.

---

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: Sprouting shrubs (e.g. Sickle saltbush and Black greasewood) 55 – 65%, > > cool season grasses (e.g. Bottlebrush squirreltail and Saltgrass) 5 – 10%.

    Sub-dominant: Sub-dominant: Non-sprouting shrubs (e.g. Greenmolly and Iodinebush) 15 - 20% > Warm season grasses (e.g. Alkali sacaton and James galleta) 1 - 3%.

    Other: Others: Shrubs (e.g. Shadscale) 1-3%, perennial forbs (e.g. Clasping pepperweed Shrubby seepweed) 3-5%, biological crusts (e.g. lichens, mosses, cyanobacteria) trace%.

    Additional: Moss and lichen communities will normally be found under plant canopies while the cyanobacteria will be found throughout the site. Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species in the reference state. Perennial and annual forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions.

---

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 shrubs may die (or appear dead). There may be partial mortality of individual bunchgrasses and other shrubs during severe drought.

---

14. **Average percent litter cover (%) and depth (in):** Litter cover ranges from 15 to 20%. Depth is typically ¾ inch with depth increasing near plant canopies.

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 250 – 300 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:** Russian thistle, annual bromes and Halogeton are likely to invade this site.

---

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