USDA Natural Resources
Conservation Service

Ecological site R028AY136UT
Desert Sandy Loam (Four-Wing Saltbush)

Accessed: 05/09/2024

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.

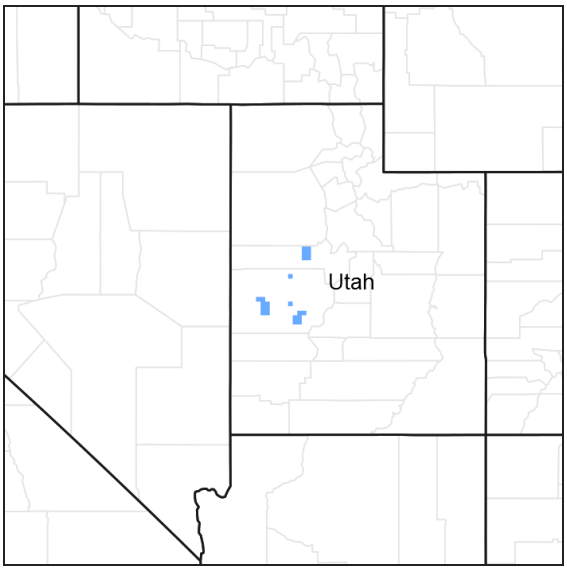


Figure 1. Mapped extent

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.

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 with some precipitation in the summer with convective thundstorms. Mean annual precipitation is between 4 to 8 inches. The south 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 present in the community.

Classification relationships

MLRA 28A, LRU E, southern desert ecological zone

Ecological site concept

This site is typically dominated by four-wing saltbush in reference condition. It is typically found on 2 to 8 percent slopes on lake terraces, alluvial fans and fan terraces with sandy loam textures.

Associated sites

R028AY119UT	**Desert Flat (Shadscale)**
R028AY226UT	**Semidesert Sandy Loam (Wyoming Big Sagebrush)**

Similar sites

R028AY011NV	**SODIC DUNE** Similar site in Nevada.
R028AY134UT	**Desert Sand (Four-Wing Saltbush)**

Table 1. Dominant plant species

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

Physiographic features

This site occurs on gently sloping fans and plains.

Table 2. Representative physiographic features

Landforms	(1) Fan (2) Plain
Elevation	1,463–1,585 m
Slope	1–5%

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: 54-58

Table 3. Representative climatic features

Frost-free period (average)	0 days
Freeze-free period (average)	130 days
Precipitation total (average)	178 mm

Influencing water features

Soil features

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

They formed in alluvium derived mainly from mixed parent materials. The surface horizon is loamy sand or fine sandy loam textures and 4 inches thick. Rock fragments are not found in or on this soil.

The subsoil or substratum is sandy loams or loams. Some soils will have carbonate accumulations in the substratum and are calcareous throughout the profile. Other soils will have some silica cementation in the substratum. The available water holding capacity is 4 to 6 inches.

The water supplying capacity is 3 to 5 inches. Natural geologic erosion in potential is approximately 0.1 tons/acre/year

Table 4. Representative soil features

Surface texture	(1) Gravelly sandy loam
Family particle size	(1) Sandy
Drainage class	Well drained
Permeability class	Moderately rapid
Soil depth	152 cm
Surface fragment cover <=3"	0–24%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	7.37–9.91 cm
Calcium carbonate equivalent (0-101.6cm)	10–20%
Electrical conductivity (0-101.6cm)	0–16 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	1–65
Soil reaction (1:1 water) (0-101.6cm)	7.9–9
Subsurface fragment volume <=3" (Depth not specified)	0–16%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

As ecological condition deteriorates due to overgrazing, Indian ricegrass, needleandthread, and fourwing saltbush decrease while rabbitbrush and threeawn increase.

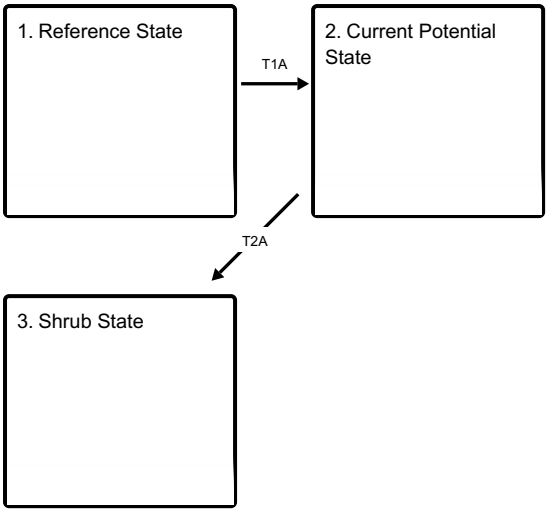
When the potential natural plant community is burned, Indian ricegrass and needleandthread decrease while rabbitbrush and annuals increase.

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

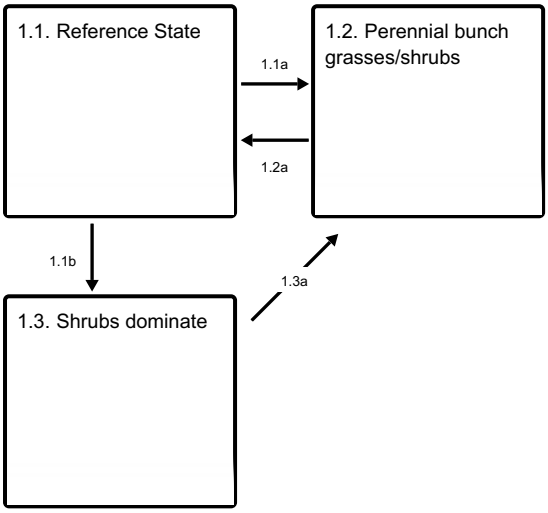
This site is similar to Nevada's 028AY011NV ecological site and the STM developed for 011NV is used below (Stringham et al. 2015).

State and transition model

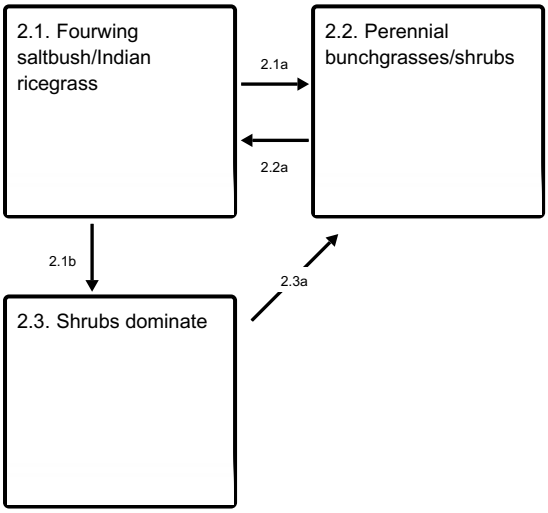
Ecosystem states



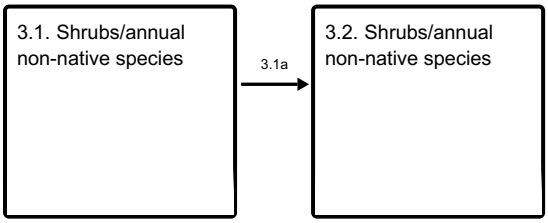
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Reference State

The Reference State 1.0 is a representative of the natural range of variability under pristine conditions. The reference state has three general community phases; a shrub-grass dominant phase, a perennial grass dominant phase and a shrub dominant phase. 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. Plant community phase changes are primarily driven by fire, periodic long term drought and/or insect or disease attack.

Community 1.1
Reference State

The dominant aspect of the plant community is fourwing saltbush and Indian ricegrass. The composition by air-dry weight is approximately 35 percent perennial grasses, 10 percent forbs, and 55 percent shrubs.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	123	340	493
Grass/Grasslike	78	216	314
Forb	22	62	90
Total	**223**	**618**	**897**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	15-30%
Grass/grasslike foliar cover	5-10%
Forb foliar cover	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 (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	–	–	–
>0.15 <= 0.3	–	–	–	0-10%
>0.3 <= 0.6	–	–	5-15%	–
>0.6 <= 1.4	–	25-35%	–	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Figure 7. Plant community growth curve (percent production by month). UT1361, 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
Perennial bunch grasses/shrubs

This community phase is characteristic of a post-disturbance, early-seral community phase. Indian ricegrass, and other perennial bunchgrasses dominate. Fourwing saltbush may sprout after fire depending on ecotype. Black greasewood, spiny hopsage and other sprouting shrubs may increase.

Community 1.3
Shrubs dominate

Fourwing saltbush and other shrubs increase in the absence of disturbance. Excessive herbivory may cause an increase in black greasewood and other unpalatable shrubs. Fourwing saltbush and other shrubs dominate the overstory and the deep-rooted perennial bunchgrasses in the understory are reduced either from competition with shrubs and/or from herbivory.

Pathway 1.1a
Community 1.1 to 1.2

Fire will decrease or eliminate the overstory of fourwing saltbush and allow for the perennial bunchgrasses to dominate the site. Fires will typically be low severity due to dispersed fuel loads. A fire following an unusually wet spring facilitating an increase in fine fuels may be more severe and reduce fourwing saltbush cover to trace amounts.

Pathway 1.1b
Community 1.1 to 1.3

Time and lack of disturbance such as fire allows for fourwing saltbush to increase. Long term drought will cause a decline in perennial bunchgrasses allowing shrubs to increase. Herbivory may cause a decrease in perennial bunchgrasses and fourwing saltbush allowing other shrubs such as black greasewood and shadscale to increase.

Pathway 1.2a
Community 1.2 to 1.1

Absence of disturbance over time allows fourwing saltbush and other shrubs to recover.

Pathway 1.3a
Community 1.3 to 1.2

A low severity fire, herbivory or combinations will reduce the fourwing saltbush overstory and create a fourwing saltbush/grass mosaic.

State 2
Current Potential State

This state is similar to the Reference State 1.0. This state has the same three general 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. These non-natives can be highly flammable and can promote fire where historically fire had been infrequent. 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
Fourwing saltbush/Indian ricegrass

Fourwing saltbush and Indian ricegrass dominate the site. Black greasewood, spiny hopsage and other shrubs are also common. Alkali sacaton, thickspike wheatgrass and bottlebrush squirreltail are also present in the understory. Forbs are present but not abundant. Non-native annual species are present.

Community 2.2
Perennial bunchgrasses/shrubs

This community phase is characteristic of a post-disturbance, early seral community phase. Indian ricegrass and other perennial grasses dominate. Fourwing saltbush may be killed by fire depending on ecotype, therefore it may decrease in the burned community. Depending on fire severity patches of intact fourwing saltbush may remain. Sprouting shrubs such as black greasewood, spiny hopsage and rabbitbrush may dominate the aspect for a number of years following fire. Annual non-native species generally respond well after fire and may be stable to increasing within the community.

Community 2.3
Shrubs dominate

Fourwing saltbush increases in the community and may become the dominant with lack of disturbance. Inappropriate grazing may cause a decrease in fourwing saltbush and allow other shrubs such as black greasewood, spiny hopsage and shadscale to increase.

Pathway 2.1a
Community 2.1 to 2.2

Fire would decrease or eliminate the overstory of fourwing saltbush and allow for the perennial bunchgrasses to dominate the site. Fires would typically be small and patchy due to low fuel loads. A fire following an unusually wet spring or a change in management facilitating an increase in fuel loads may be more severe and reduce shrub cover to trace amounts. Annual non-native species generally respond well after fire and may be stable or increasing in within the community.

Pathway 2.1b
Community 2.1 to 2.3

Time and lack of disturbance and/or chronic drought allows for fourwing saltbush to increase and dominate the site, causing a reduction in the perennial bunchgrasses. Inappropriate grazing may cause a decrease in perennial bunchgrasses and fourwing saltbush allowing other shrubs such as black greasewood and spiny hopsage to

increase. However bottlebrush squirreltail and thickspike wheatgrass may increase in the understory depending on the grazing management.

Pathway 2.2a
Community 2.2 to 2.1

Time and lack of disturbance may allow for fourwing saltbush and other shrubs to establish and increase in community.

Pathway 2.3a
Community 2.3 to 2.2

Low severity fire, grazing management or combinations may decrease fourwing saltbush allowing for the perennial understory to increase. Late fall/winter grazing may cause mechanical damage to other shrubs such as black greasewood and spiny hopsage promoting the perennial bunchgrass understory.

State 3
Shrub State

This state has two community phases and is a product of many years of heavy grazing during time periods harmful to perennial bunchgrasses. Black greasewood, spiny hopsage and rabbitbrush dominate the overstory. Shrub cover exceeds site concept and may be decadent, reflecting stand maturity and lack of seedling establishment due to competition with mature plants. The shrub overstory dominates site resources such that soil water, nutrient capture, nutrient cycling and soil organic matter are temporally and spatially redistributed. With a decrease in understory species the soils on these sites may become unstable and wind erosion may increase.

Community 3.1
Shrubs/annual non-native species

Black greasewood dominates the overstory. Rabbitbrush and spiny hopsage may be significant components. Fourwing saltbush is still present but declining. Deep-rooted perennial bunchgrasses may be present in trace amounts or absent from the community. Annual non-native species increase. Bare ground is significant.

Community 3.2
Shrubs/annual non-native species

Black greasewood, rabbitbrush and spiny hopsage dominate the site. Fourwing saltbush may be found in trace amounts or may be absent from the site. Annual non-native species dominate the understory. Perennial bunchgrasses make up a minor component.

Pathway 3.1a
Community 3.1 to 3.2

Heavy grazing in winter and early spring decreases fourwing saltbush and perennial bunchgrasses, and may promote other shrubs such as rabbitbrush and black greasewood.

Transition T1A
State 1 to 2

Trigger: This transition is caused by the introduction of non-native annual weeds, such as cheatgrass, mustards, and Russian thistle. 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: To Community Phase 3.1: Inappropriate cattle/horse grazing will decrease or eliminate deep rooted perennial bunchgrasses and fourwing saltbush and favor other shrub growth and establishment. Soil disturbing brush treatments will reduce fourwing saltbush and possibly increase non-native annual species and rabbitbrush. Slow variables: Long term decrease in deep-rooted perennial grass density and/or fourwing saltbush. Threshold: Loss of deep-rooted perennial bunchgrasses changes nutrient cycling, nutrient redistribution, and reduces soil organic matter. Loss of long-lived, fourwing saltbush changes the temporal and depending on the replacement shrub, the spatial distribution of nutrient cycling.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Primary Shrubs**			235–370	
	fourwing saltbush	ATCA2	*Atriplex canescens*	135–202	–
	Nevada jointfir	EPNE	*Ephedra nevadensis*	67–101	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	34–67	–
3	**Secondary Shrubs**			20–34	
	yellow rabbitbrush	CHVIS5	*Chrysothamnus viscidiflorus ssp. viscidiflorus var. stenophyllus*	7–20	–
	granite prickly phlox	LIPU11	*Linanthus pungens*	7–20	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	7–20	–
Grass/Grasslike					
0	**Primary Grasses**			155–202	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	135–168	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	20–34	–
1	**Secondary Grasses**			20–34	
	blue grama	BOGR2	*Bouteloua gracilis*	7–20	–
	squirreltail	ELEL5	*Elymus elymoides*	7–20	–
	needle and thread	HECO26	*Hesperostipa comata*	7–20	–
	James' galleta	PLJA	*Pleuraphis jamesii*	7–20	–
Forb					
0	**Primary Forbs**			20–34	
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	20–34	–
2	**Secondary Forbs**			20–34	
	Utah milkvetch	ASUT	*Astragalus utahensis*	7–20	–
	roundspike cryptantha	CRHU2	*Cryptantha humilis*	7–20	–
	Shockley's buckwheat	ERSH	*Eriogonum shockleyi*	7–20	–
	tufted evening primrose	OECA10	*Oenothera caespitosa*	7–20	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	7–20	–
	Mojave woodyaster	XYTO2	*Xylorhiza tortifolia*	7–20	–

Animal community

This site is suited for sheep and cattle grazing during 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

Soils are in hydrologic groups B and C with runoff curves ranging from 61 to 79 and 74 to 76 respectively depending on hydrologic condition.

Recreational uses

Some recreational uses of this site are hiking and hunting.

Wood products

None

Other information

Threatened and endangered species include plants and animals.

Other references

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.

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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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Date	01/12/2009
Approved by	Shane A. Green
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Minor rill development may be evident in the reference community only following significant storm or snow melt events. The presence of rills may be more evident where run-on from adjacent upland sites or exposed bedrock concentrate flows. Any rill development will be short (< 5') and spaced 6' – 8'. Evidence of rills will decrease in the months following major weather events due to coarse textured surface soils.

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2. **Presence of water flow patterns:** Evidence of water flow is not evident in the reference community except slight flow activity may be observed following significant weather events. Any flow patterns present are normally <15 feet long, follow natural contours, and are typically spaced 15 to 20 feet apart. Healthy vascular plant communities and biological soil crusts reduce runoff and improve infiltration on this site.

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3. **Number and height of erosional pedestals or terracettes:** Pedestals or terracettes caused by accelerated water erosion are not typically evident in the reference community. 1 – 2 inches of depositional mounding in perennial grass clumps and Four-wing saltbush canopies is normal. There are no exposed roots around perennial grass bunches and little evidence of soil or litter accumulating behind obstructions.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground ranges from 20% - 40% in the reference community. Ground cover (the inverse of bare ground) typically includes: coarse fragments – 5% to 15%; plant canopy – 20% to 30%; litter – 20% to 30%, and cryptogamic crusts – 2% to 5%.

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5. **Number of gullies and erosion associated with gullies:** Developed 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 eroding areas.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** Some minor evidence of wind generated soil movement is present in reference communities. Slight depositional mounding around Indian ricegrass and Sand dropseed bunches is a normal characteristic of this site. Slight coppice mounding under Four-wing canopies is normal. Evidence of increased soil saltation may be present during severe drought periods or wind storms.

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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") may move (1' – 2') in the direction of prevailing winds or down slope if being transported by water. Little accumulation is observed behind obstructions. Larger woody litter (> ¼") is found under or near shrubs.

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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 to 5. Surface textures are typically sandy loams containing 10% to 15% coarse fragments.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface is 3 - 4 inches deep and structure varies from granular to weak thick platy. The A-horizon color varies from 5YR 6/8 to 10YR 6/3. Soils have an Ochric epipedon that extends 4 – 10 inches into the soil profile. The A horizon is normally deeper and better developed under plant canopies.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** The presence of rhizomatous grasses combined with healthy perennial bunchgrasses and Four-wing saltbush 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.

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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. Soils are deep to very deep. Increases in clay or silt content in subsoil layers could be mistaken for compaction in some soils.

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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: Dominant: Sprouting shrubs (e.g. Four-wing saltbush and Winterfat) 20 – 40%, > cool season grasses (e.g. Indian ricegrass and Bottlebrush squirreltail) 20 – 25%.

    Sub-dominant: Sub-dominant: Sprouting shrubs (e.g. Nevada jointfir and Low rabbitbrush) 10 – 15%, > warm season grasses (e.g. Galleta) 2 – 5%, > Short Cool season grasses (e.g. Sandberg and Nevada bluegrasses) 1-3%.

    Other: Others: Shrubs (e.g. Bud sage 1-3%), perennial forbs (e.g. Gooseberryleaf globemallow and wild buckwheat) 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.

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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 average to above-average precipitation, there should be very little recent mortality or decadence apparent in either the shrubs or grasses. There may be partial (<30%) mortality of individual bunchgrasses and other shrubs during severe drought.

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14. **Average percent litter cover (%) and depth (in):** Litter cover ranges from 20 to 30% with a spike when shrubs drop their leaves. Depth varies from ¾ to 1/2 inch with depth increasing near plant canopies.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 500 - 600 pounds 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:** Broom snakeweed, Russian thistle, Redstem storksbill, annual bromes and Halogeton are likely to increase in or invade this site.

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