USDA Natural Resources
Conservation Service

Ecological site R028AY128UT
Desert Oolitic Dunes (Black Greasewood)

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.

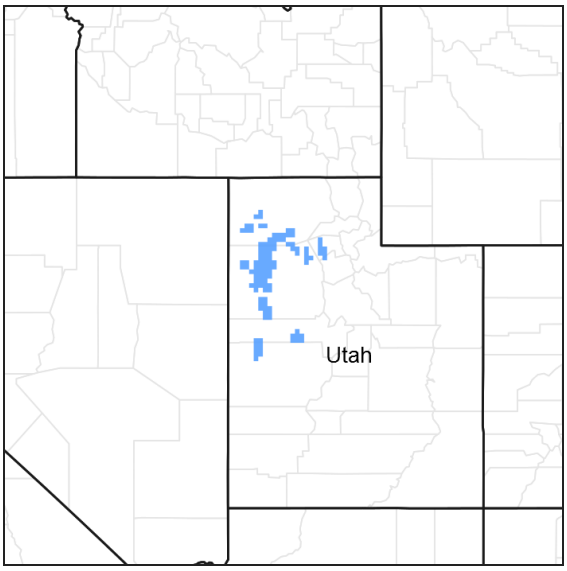


Figure 1. Mapped extent

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

MLRA 28A, LRU A, northern desert ecological zone

Ecological site concept

This ecological site is dominated by black greasewood. It typically occurs on dunes of old lake basins or the Great Salt Lake on sandy soils. The soils are dominantly make up of oolites, which are a rock consisting of small round grains usually calcium carbonated cemented together.

Associated sites

R028AY130UT	**Desert Salt Flat (Sickle Saltbush)** R028AY126UT Desert Clay Loam (Shadscale) is also an associated site. R028AY132UT is also a similar site with soil and vegetation defferentiae.
R028AY132UT	**Desert Salty Silt (Iodinebush)**

Similar sites

R028AY024NV	**SODIC TERRACE 5-8 P.Z.** This site located in Nevada is similar in vegetative composition and response to disturbance, however there is a difference in soils.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Sarcobatus vermiculatus* (2) *Atriplex canescens*
Herbaceous	Not specified

Physiographic features

This site occurs on semistable or stable dunelands on windblown lake sediments on basin floors adjacent to plazas or flats. It typically occurs on 2 to 15 percent slopes between 4200 and 4250 feet. There is no flooding or ponding on this site.

Table 2. Representative physiographic features

Landforms	(1) Dune (2) Lake plain
Flooding frequency	None
Ponding frequency	None
Elevation	4,200–4,250 ft
Slope	2–15%

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.

Mean Annual Air Temperature: 47-52
Mean Annual Soil Temperature: 49-54

Table 3. Representative climatic features

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

Influencing water features

Soil features

The characteristic soils in this site are 60 inches deep over sediments and well drained.

They formed in windblown materials derived mainly from lake sediment parent materials. The surface horizon is oolitic sand textures and 5 inches thick. Rock fragments are not found in or on this soil. The soils are dominantly made up of oolites "A rock consisting of small round grains usually calcium carbonate cemented together." Through the blowing action from the adjacent playas the soils are a mixture of oolites, sand, silt, clay and crystalline salts. The surface materials act as sandy materials when they initially receive moisture; but due to their nature, dissolve or partially dissolve and act more like clayey materials when they become wet.

The water supplying capacity is 0 to 2 inches. Natural geologic erosion in potential is approximately 1.0 ton/acre/year.

Table 4. Representative soil features

Surface texture	(1) Sand (2) Silty clay loam
Drainage class	Moderately well drained to somewhat poorly drained
Permeability class	Rapid
Soil depth	60 in
Surface fragment cover <=3"	0–2%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	1.6–2.8 in
Calcium carbonate equivalent (0-40in)	40–90%
Electrical conductivity (0-40in)	2–8 mmhos/cm
Soil reaction (1:1 water) (0-40in)	7.9–9
Subsurface fragment volume <=3" (Depth not specified)	0–2%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

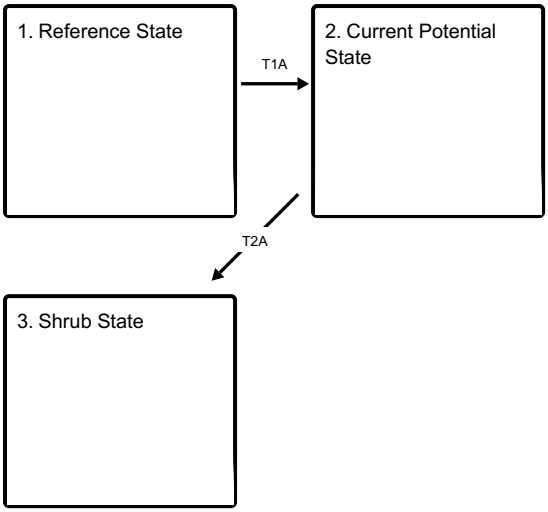
As ecological condition deteriorates due to grazing pressure, fourwing saltbush and perennial grasses decrease while greasewood, shrubby seepweed, and annual forbs increase.

When the potential natural plant community is burned, perennial grasses decrease while greasewood, seepweed, and rabbitbrush increase.

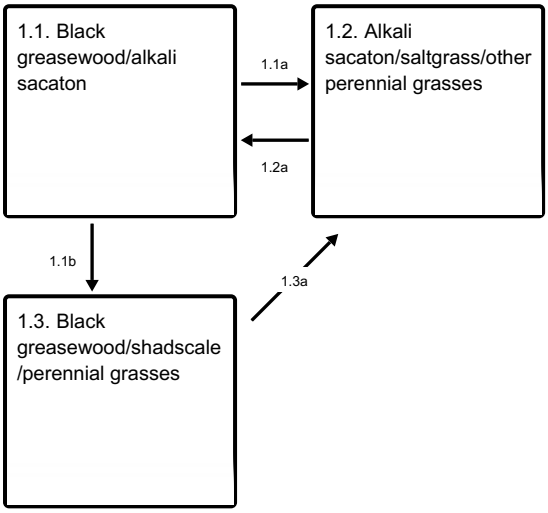
This site is similar to Nevada's R028AY024NV ecological site and the STM developed for that site are used (Stringham et. al 2015).

State and transition model

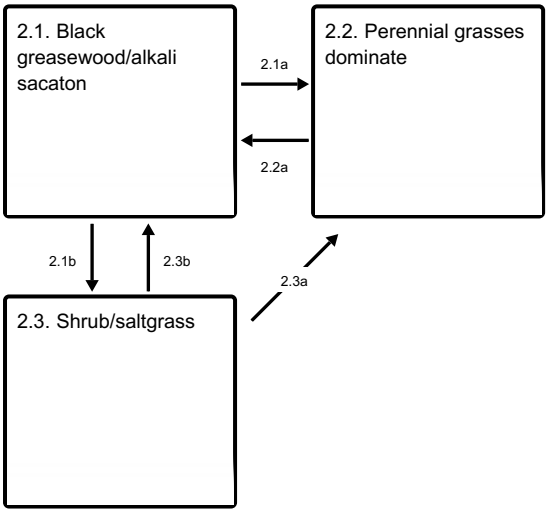
Ecosystem states



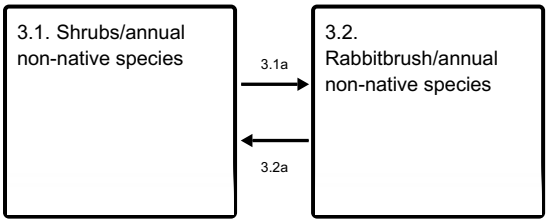
State 1 submodel, plant communities



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
Black greasewood/alkali sacaton

The dominant aspect of the plant community is greasewood and fourwing saltbush. The composition by air dry weight is approximately 5 percent perennial grasses, 25 percent forbs, and 70 percent shrubs.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	70	245	350
Forb	25	88	125
Grass/Grasslike	5	18	25
Total	**100**	**351**	**500**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	10-40%
Grass/grasslike foliar cover	2-5%
Forb foliar cover	5-15%
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	–	–	–	10-20%
>1 <= 2	–	–	0-10%	–
>2 <= 4.5	–	35-45%	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Figure 7. Plant community growth curve (percent production by month). UT1281, 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/saltgrass/other perennial grasses

This community phase is characteristic of a post-disturbance, early-seral community phase. Basin wildrye and alkali sacaton dominate the community. Black greasewood will decrease but will likely sprout and return to pre-burn levels within a few years. Early colonizers such as rabbitbrush and shadscale may increase.

Community 1.3
Black greasewood/shadscale/perennial grasses

Black greasewood and shadscale increase in the absence of disturbance. Decadent shrubs dominate the overstory and deep-rooted perennial bunchgrasses in the understory are reduced either from competition with shrubs, herbivory, drought or combinations of these.

Pathway 1.1a
Community 1.1 to 1.2

A low severity fire would decrease the overstory of black greasewood and allow for the understory perennial grasses to increase. Fires are typically low severity resulting in a mosaic pattern due to low fuel loads. A fire following an unusually wet spring facilitating an increase in fine fuels may be more severe and reduce black greasewood cover to trace amounts.

Pathway 1.1b
Community 1.1 to 1.3

Absence of disturbance over time, significant herbivory, long term drought or combinations of these would allow the black greasewood overstory to increase and dominate the site. This will generally cause a reduction in perennial bunchgrasses; however inland saltgrass may increase in the understory depending on the timing and intensity of herbivory. Heavy spring utilization will favor an increase in black greasewood.

Pathway 1.2a
Community 1.2 to 1.1

Time and lack of disturbance will allow shrubs to increase

Pathway 1.3a
Community 1.3 to 1.2

Fire will decrease the overstory of black greasewood and allow for the perennial bunchgrasses to dominate the site. Fires will typically by high intensity in this phase due to the dominance of greasewood resulting in removal of the overstory shrub community.

State 2
Current Potential State

This state is similar to the Reference State 1.0 with three 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. 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
Black greasewood/alkali sacaton

This community phase is similar to the Reference State Community Phase 1.1. This community is dominated by black greasewood. Shadscale and rubber rabbitbrush are also common. The herbaceous understory is dominated by alkali sacaton, inland saltgrass, basin wildrye and other perennial grasses are also common. Non-native annual species such as halogeton, Russian thistle and cheatgrass are present.

Community 2.2
Perennial grasses dominate

This community phase is characteristic of a post-disturbance, early-seral community where annual non-native species are present. Perennial bunchgrasses such as alkali sacaton, inland saltgrass and basin wildrye dominate the site. Depending on fire severity patches of intact shrubs may remain. Black greasewood and rabbitbrush may be sprouting. Annual non-native species are stable to increasing in the community.

Community 2.3
Shrub/saltgrass

Black greasewood dominates the overstory and perennial bunchgrasses in the understory are reduced, either from competition with shrubs or from inappropriate grazing, or from both. Rabbitbrush may be a significant component. Annual non-native species are stable or increasing. This community is at risk of crossing a threshold to State 3.0 (grazing or fire).

Pathway 2.1a
Community 2.1 to 2.2

A low severity fire would decrease the overstory of black greasewood and allow for the understory perennial grasses to increase. Fires are typically low severity resulting in a mosaic pattern due to low fuel loads. A fire following an unusually wet spring or a change in management favoring an increase in fine fuels may be more severe and reduce black greasewood cover to trace amounts. Brush treatments with minimal soil disturbance may also reduce black greasewood and allow for perennial bunchgrasses to increase. Annual non-native species are likely to increase after fire.

Pathway 2.1b
Community 2.1 to 2.3

Absence of disturbance over time, chronic drought, inappropriate grazing management or combinations of these

would allow the black greasewood overstory to increase and dominate the site. Inappropriate grazing management reduces the perennial bunchgrass understory; conversely inland saltgrass may increase in the understory.

Pathway 2.2a
Community 2.2 to 2.1

Absence of disturbance over time and/or grazing management that favors the establishment and growth of black greasewood allows the shrub component to recover.

Pathway 2.3b
Community 2.3 to 2.1

Fire would reduce shrubs in the overstory and allow for the perennial bunchgrasses in the understory to increase.

Pathway 2.3a
Community 2.3 to 2.2

Grazing management that reduces shrubs will allow for the perennial bunchgrasses in the understory to increase. Heavy late-fall/winter grazing may cause mechanical damage to black greasewood promoting the perennial bunchgrass understory. Brush treatments with minimal soil disturbance will also decrease black greasewood and release the perennial understory. Annual non-native species are present and may increase in the community. A low severity fire would decrease the overstory of black greasewood and allow for the understory perennial grasses to increase.

State 3
Shrub State

This state has two community phases, one that is characterized by a dominance of a black greasewood overstory and the other with a rabbitbrush overstory. This site has crossed a biotic and abiotic threshold and site processes are being controlled by shrubs. Bare ground has increased and pedestalling of grasses may be excessive.

Community 3.1
Shrubs/annual non-native species

Black greasewood dominates the overstory. Rabbitbrush may be a significant component. Deep-rooted perennial bunchgrasses such as alkali sacaton have significantly declined. Annual non-native species increase. Bare ground is significant.

Community 3.2
Rabbitbrush/annual non-native species

Rabbitbrush dominates the site. Perennial bunchgrasses may be present but will be a minor component. Annual non-native species are present and may be increasing in the understory.

Pathway 3.1a
Community 3.1 to 3.2

Drought and/or lowering of water table by groundwater pumping would reduce black greasewood and allow for rabbitbrush and other shrubs on the site to dominate. Severe fire would also reduce black greasewood overstory and allow for an increase rabbitbrush.

Pathway 3.2a
Community 3.2 to 3.1

Release from drought and/or grazing pressure may allow for black greasewood, basin wildrye and other perennial bunchgrasses to increase.

Transition T1A
State 1 to 2

Trigger: This transition is caused by the introduction of non-native annual plants, such as cheatgrass, mustards, halogeton, 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 favor shrub growth and establishment. To Community Phase 3.2: Severe fire will reduce and/or eliminate black greasewood overstory and decrease perennial bunchgrasses. Soil disturbing brush treatments will reduce black greasewood and possibly increase non-native annual species. Lowering of the water table due to groundwater pumping will also decrease black greasewood and allow for rabbitbrush and other shrubs to increase. Slow variables: Long term decrease in deep-rooted perennial bunchgrasses density and/or black greasewood. Threshold: Loss of deep-rooted perennial bunchgrasses changes nutrient cycling, nutrient redistribution, and reduces soil organic matter. Loss of long-lived, black greasewood 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 (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Primary Shrubs**			260–320	
	greasewood	SAVE4	*Sarcobatus vermiculatus*	120–140	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	100–120	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	40–60	–
3	**Secondary Shruba**			12–20	
	iodinebush	ALOC2	*Allenrolfea occidentalis*	4–12	–
	sickle saltbush	ATFA	*Atriplex falcata*	4–12	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	4–12	–
	Nevada jointfir	EPNE	*Ephedra nevadensis*	4–12	–
	spiny hopsage	GRSP	*Grayia spinosa*	4–12	–
Forb					
0	**Primary Forb**			80–100	
	Mojave seablite	SUMO	*Suaeda moquinii*	80–100	–
2	**Secondary Forbs**			12–20	
Grass/Grasslike					
1	**Grasses**			12–20	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	4–12	–
	squirreltail	ELEL5	*Elymus elymoides*	4–12	–
	alkali sacaton	SPAI	*Sporobolus airoides*	4–12	–

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.

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 groups A and D with hydrologic curves ranging from 39 to 68 and 80 to 89 respectively depending on the hydrologic condition of the watershed.

Recreational uses

Recreation values 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	
General legal description	Southeast of Lucin, Utah in Box Elder County, 1 ½ Miles East of Little Pigeon Mountain.
Location 2: Millard County, UT	
General legal description	North of Delta, Utah in Millard County, 3 Miles East of Baker Hot Springs.

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	01/23/2009
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 may be evident in the reference community only following significant storm or snow melt events. Any rill development will be short (< 6') and widely spaced (5' – 7'). Evidence of rills on dune slopes will decrease in the months following major weather events due to the affects of wind on this sites Oolitic sands.

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2. **Presence of water flow patterns:** Slight evidence of water flow may be evident in the reference community only immediately following significant weather events. Flow patterns affect <3% of the site. High soil intake rates and excessive drainage limit water movement on soil surfaces. Any flow patterns present are normally <10 feet long, follow natural contours, and are typically spaced 10 to 15 feet apart.

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3. **Number and height of erosional pedestals or terracettes:** None. Pedestaling and terracette development is prevented from developing because of the nature of the soils associated with this site. Some depositional mounding around perennial vegetation is normal.

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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 40% - 60% in the reference community. Ground cover (the inverse of bare ground) typically includes: coarse fragments – 0% to 2%; plant canopy – 20% to 30%; litter – 15% to 20%

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5. **Number of gullies and erosion associated with gullies:** Very rare. Some gully channels are a normal component of desert environments. Gullies associated with this site are normally conveying runoff from higher elevation ecological sites. They will typically have unstable sides and bottoms as they travel through this sites Oolitic sands.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** Moderate evidence of wind generated soil movement is normal in reference state on this site. They typically have a mix of a few unstable dunes that are mixed with mostly stable ones that are healing. Evidence of wind generated blowouts may also be present; any blowouts present are being stabilized with perennial vegetation. Depositional mounding around perennial grass clumps is normal. Moderate coppice mounding under Four-wing saltbush and Black greasewood canopies is also normal.

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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 fine material (< ¼") may move (2' – 4') in the direction of prevailing winds or down slope if being transported by water. Some accumulation is observed behind obstructions. Larger woody litter (> ½") is mostly 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 2 to 4. Surface textures are typically coarse loamy sands containing few rock fragments. Where surface soil structure is lost, soil stability ratings may decrease to 1 – 2 in the

remaining soil.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface is approximately 5 inches deep and structure is very weak to loose, single grain. The A-horizon color is 10YR 6/2. Soils have an Ochric epipedon that extends 5 inches into the soil profile.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Healthy perennial grasses and shrubs in the reference community provides for the best infiltration and least runoff from storm events and snow melt. Soil movement is common even in healthy communities and is characteristic of the site.

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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.

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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. Black greasewood and Four-wing saltbush) 50 – 75%, >> cool season grasses (e.g. Indian ricegrass and Bottlebrush squirreltail) 3 – 6%.

    Sub-dominant: Sub-dominant: Perennial Forbs: (e.g. Shrubby seepweed) 20 - 25%,>> Sprouting shrubs (e.g. Shadscale and Spiny hopsage), 10 – 15%, > warm season grasses (e.g. Alkali sacaton) 1 – 3%.

    Other: Others: Shrubs (e.g. Iodinebush and Nevada jointfir 1-3%)

    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 15 to 20% with a spike when shrubs drop their leaves. Depth is typically about 1/4 inch.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 300 - 400 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: Russian thistle, Redstem storksbill, annual mustards and Halogeton are likely to 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.
