USDA Natural Resources Conservation Service

Ecological site R028AY110UT
Desert Alkali Sand (Fourwing Saltbush)

Accessed: 05/16/2024

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.

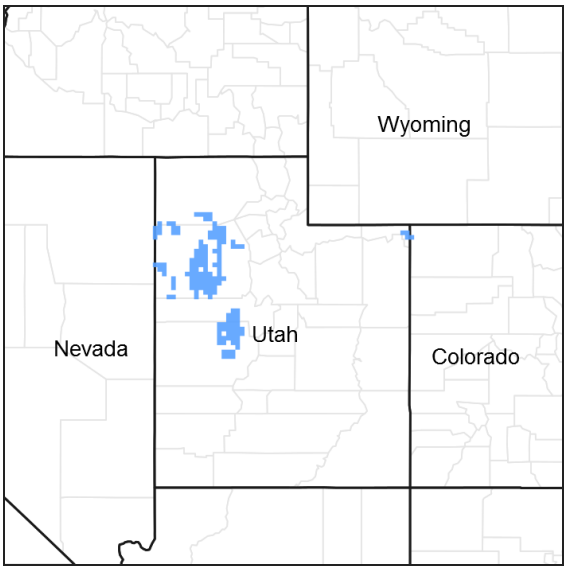


Figure 1. Mapped extent

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. 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, desert ecological zone in northern portion of MLRA

Ecological site concept

This ecological site occurs in the northern section of MLRA 28A. It is typically found on lake terraces, or dunes and is found on deep sandy soils. Fourwing saltbush is the dominant shrub in reference condition.

Associated sites

R028AY119UT	**Desert Flat (Shadscale)**
R028AY124UT	**Desert Loam (Shadscale)**

Similar sites

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 lake terraces, beach terraces, and lake planes. It is typically found at 0 to 15 percent slopes between 4200 to 5800 feet. Flooding and ponding do not occur on this site.

Table 2. Representative physiographic features

Landforms	(1) Lake terrace (2) Beach terrace (3) Lake plain
Flooding frequency	None
Ponding frequency	None
Elevation	1,280–1,768 m
Slope	0–15%
Aspect	Aspect is not a significant factor

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: 43-50
Mean Annual Soil Temperature: 51-54

Climate stations used:
Dugway (42225701)
Iosepa S. Ranch (42423302)

Table 3. Representative climatic features

Frost-free period (average)	121 days
Freeze-free period (average)	150 days
Precipitation total (average)	203 mm

Influencing water features

Water erosion hazard is slight.

Soil features

The characteristic soils in this site are more than 60 inches deep over bedrock and somewhat excessively drained. They formed in eolian derived mainly from mixed sedimentary parent materials. Rock fragments are not found in or on this site.

These soils have coarse textures throughout the profile. They are slightly to moderately saline, moderately alkaline to strongly alkaline, and are sodium affected. They are generally moderately to strongly calcareous. Permeability is rapid. Surface organic matter content is 0 - 1 percent. Runoff is slow and water erosion hazard is slight. The hazard of soil blowing is high.

The available water capacity is 2 to 3.2 inches. Natural geologic erosion in potential is approximately 0.5 tons/acre/year.

Table 4. Representative soil features

Surface texture	(1) Loamy fine sand (2) Fine sand (3) Sand
Family particle size	(1) Sandy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Rapid
Soil depth	152 cm
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	5.08–8.89 cm
Calcium carbonate equivalent (0-101.6cm)	3–30%
Electrical conductivity (0-101.6cm)	0–8 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–30
Soil reaction (1:1 water) (0-101.6cm)	7.9–9
Subsurface fragment volume <=3" (Depth not specified)	0–5%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

As ecological condition deteriorates due to overgrazing, Indian ricegrass, western wheatgrass, and fourwing saltbush decrease while rabbitbrush, snakeweed and annual forbs and annual grasses increase.

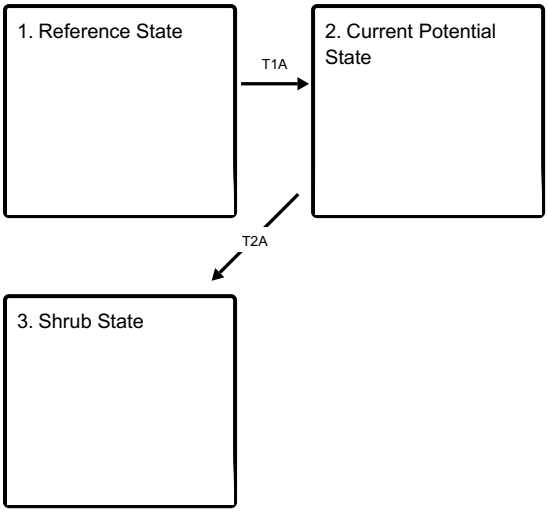
When the potential natural plant community is burned, alkali sacaton and Indian ricegrass decrease while rabbitbrush and annuals increases.

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

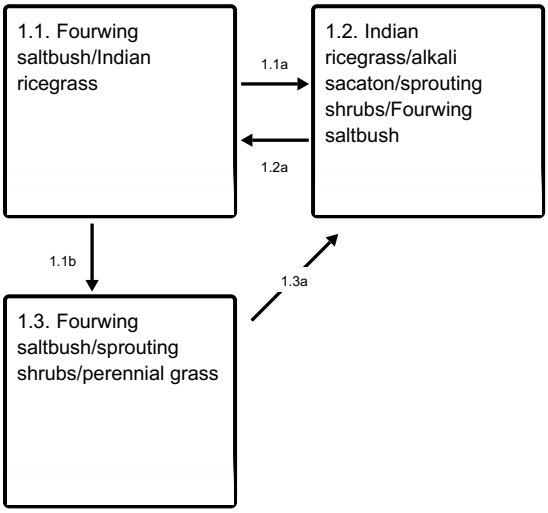
R028AA110UT is similar to R028AY011NV, which has a STM developed by Nevada (Stringham et al. 2015). This STM and narratives are used below.

State and transition model

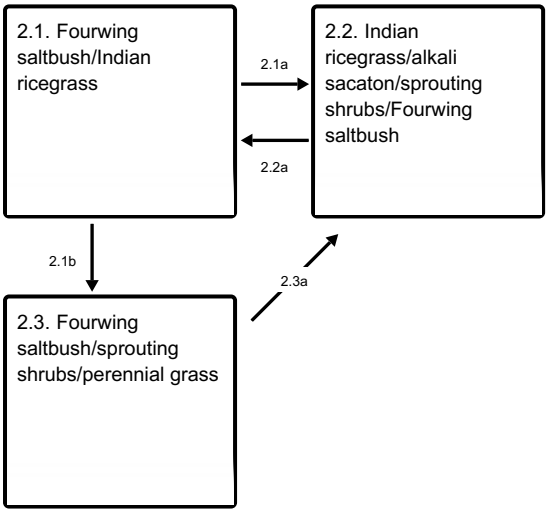
Ecosystem states



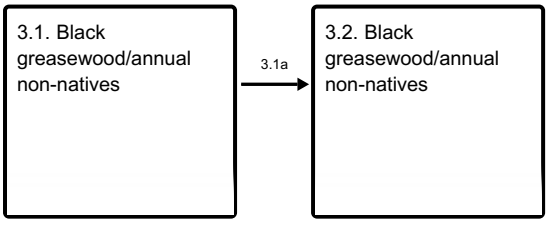
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Reference State

The Reference State 1.0 is 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
Fourwing saltbush/Indian ricegrass

The dominant aspect of the plant community is fourwing saltbush and Indian ricegrass. 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. The composition by air dry weight is approximately 40 percent perennial grasses, 10 percent forbs, and 50 percent shrubs.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	140	252	504
Grass/Grasslike	112	202	404
Forb	28	50	101
Total	**280**	**504**	**1009**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	15-30%
Grass/grasslike foliar cover	10-25%
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 (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	–	–	–
>0.15 <= 0.3	–	–	–	0-10%
>0.3 <= 0.6	–	–	20-30%	–
>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). UT1101, 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
Indian ricegrass/alkali sacaton/sprouting shrubs/Fourwing saltbush

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
Fourwing saltbush/sprouting shrubs/perennial grass

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.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	140	252	504
Grass/Grasslike	112	202	404
Forb	28	50	101
Total	**280**	**504**	**1009**

Table 9. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	15-30%
Grass/grasslike foliar cover	10-25%
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 10. 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	–	–	20-30%	–
>0.6 <= 1.4	–	25-35%	–	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Figure 9. Plant community growth curve (percent production by month). UT1101, 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 2.2
Indian ricegrass/alkali sacaton/sprouting shrubs/Fourwing saltbush

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
Fourwing saltbush/sprouting shrubs/perennial grass

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 long term 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
Black greasewood/annual non-natives

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 nonnative species increase. Bare ground is significant.

Community 3.2
Black greasewood/annual non-natives

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 possiblyincrease 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 11. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Primary Shrubs**			112–196	
	fourwing saltbush	ATCA2	*Atriplex canescens*	56–84	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	56–84	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	56–84	–
3	**Secondary Shrubs**			28–56	
	burrobush	AMDU2	*Ambrosia dumosa*	6–17	–
	basin big sagebrush	ARTRT	*Artemisia tridentata ssp. tridentata*	6–17	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	6–17	–
	mormon tea	EPVI	*Ephedra viridis*	6–17	–
	spiny hopsage	GRSP	*Grayia spinosa*	6–17	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	6–17	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	6–17	–
	littleleaf horsebrush	TEGL	*Tetradymia glabrata*	6–17	–
Grass/Grasslike					
0	**Primary Grasses**			168–224	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	140–168	–
	alkali sacaton	SPAI	*Sporobolus airoides*	28–56	–
1	**Seconary Grasses**			28–56	
	purple threeawn	ARPU9	*Aristida purpurea*	6–17	–
	squirreltail	ELEL5	*Elymus elymoides*	6–17	–
	needle and thread	HECO26	*Hesperostipa comata*	6–17	–
	western wheatgrass	PASM	*Pascopyrum smithii*	6–17	–
	James' galleta	PLJA	*Pleuraphis jamesii*	6–17	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	6–17	–
Forb					
2	**Forbs**			56–84	
	flatspine bur ragweed	AMAC2	*Ambrosia acanthicarpa*	6–17	–
	spotted buckwheat	ERMA2	*Eriogonum maculatum*	6–17	–
	rusty lupine	LUPU	*Lupinus pusillus*	6–17	–
	whitestem blazingstar	MEAL6	*Mentzelia albicaulis*	6–17	–
	lemon scurfpea	PSLA3	*Psoralidium lanceolatum*	6–17	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	6–17	–
	Mojave seablite	SUMO	*Suaeda moquinii*	6–17	–

Table 12. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Primary Shrubs**			112–196	
	fourwing saltbush	ATCA2	*Atriplex canescens*	56–84	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	56–84	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	56–84	–
3	**Secondary Shrubs**			28–56	
	burrobush	AMDU2	*Ambrosia dumosa*	6–17	–
	basin big sagebrush	ARTRT	*Artemisia tridentata ssp. tridentata*	6–17	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	6–17	–
	mormon tea	EPVI	*Ephedra viridis*	6–17	–
	spiny hopsage	GRSP	*Grayia spinosa*	6–17	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	6–17	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	6–17	–
	littleleaf horsebrush	TEGL	*Tetradymia glabrata*	6–17	–
Grass/Grasslike					
0	**Primary Grasses**			168–224	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	140–168	–
	alkali sacaton	SPAI	*Sporobolus airoides*	28–56	–
1	**Seconary Grasses**			28–56	
	purple threeawn	ARPU9	*Aristida purpurea*	6–17	–
	squirreltail	ELEL5	*Elymus elymoides*	6–17	–
	needle and thread	HECO26	*Hesperostipa comata*	6–17	–
	western wheatgrass	PASM	*Pascopyrum smithii*	6–17	–
	James' galleta	PLJA	*Pleuraphis jamesii*	6–17	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	6–17	–
Forb					
2	**Forbs**			56–84	
	flatspine bur ragweed	AMAC2	*Ambrosia acanthicarpa*	6–17	–
	spotted buckwheat	ERMA2	*Eriogonum maculatum*	6–17	–
	rusty lupine	LUPU	*Lupinus pusillus*	6–17	–
	whitestem blazingstar	MEAL6	*Mentzelia albicaulis*	6–17	–
	lemon scurfpea	PSLA3	*Psoralidium lanceolatum*	6–17	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	6–17	–
	Mojave seablite	SUMO	*Suaeda moquinii*	6–17	–

Animal community

This site is suited for sheep and cattle grazing during 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 A with runoff curve numbers ranging from 39 to 68 depending on hydrologic condition.

Recreational uses

This site has value for natural beauty. Recreation use is 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.

Contributors

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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	01/17/2009
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. Rill presence may be more apparent where run-on from adjacent upland sites or exposed bedrock concentrate flows. Any rill development will be short (< 5 feet) and widely spaced (10 – 20 feet). Slopes >10% may exhibit increased rill lengths (5 to 10 feet) with more narrow spacings (8 to 15 feet). Evidence of rills will decrease in the months following major weather events due to the very coarse textured surface soil.

2. **Presence of water flow patterns:** Only very slight evidence of water flow may be evident in the reference community only following significant weather events. Flow patterns affect <5% of the site and may increase to 10% on slopes >10%. Flow patterns are normally <20 feet long, follow natural contours, and are typically spaced 10 to 15 feet apart.

3. **Number and height of erosional pedestals or terracettes:** Ver minor pedestal and/or terracette development is evident in the reference community. 1 – 2 inches of elevational mounding in Indian ricegrass bunches and Four-wing saltbush canopies are normal and should not be mistaken for erosional pedestals.

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 – 2% to 5%; plant canopy – 20% to 30%; litter – 20% to 30%.

5. **Number of gullies and erosion associated with gullies:** Some gully channels are a normal component of desert environments, but only where natural circumstances allow for concentrated runoff from adjacent sites. 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.

6. **Extent of wind scoured, blowouts and/or depositional areas:** Some evidence of wind generated soil movement is normal in reference communities on this site. Evidence of wind generated blowouts may also be present; any blowout areas present appear stable and are small and being stabilized with perennial vegetation. Some depositional mounding around plants is a normal characteristic of this site. Moderate coppice mounding under Four-wing canopies is also normal.

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 slight accumulation is observed behind obstructions. Larger woody litter (> ½") is mostly found under or near shrubs.

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 0% to 5% coarse fragments.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface is 12 inches deep and structure is very weak. The A-horizon color is 10YR 6/3. It is normally deeper and better developed under plant canopies.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** The presence of perennial grasses 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.

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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: cool season bunch grasses (e.g. Indian ricegrass and Bottlebrush squirreltail) 30 – 40%, >> Sprouting shrubs (e.g. Four-wing saltbush) 10 – 25%.

    Sub-dominant: Sub-dominant: perennial forbs (e.g. Gooseberryleaf globemallow and wild buckwheat) 3-5% > Warm season grasses 2 – 5% > Shrubs (e.g. Spiny hopsage and Bud sage 1-3%) = Cool season rhizomotous grasses (e.g. Western wheatgrass) 1-3%.

    Other: Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species in the reference state.

    Additional: 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. During severe (multi-year) drought up to 20% of the shrubs may die. There may be partial 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):** 400 - 500 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, and annual bromes 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.