USDA Natural Resources Conservation Service

Ecological site R028AY020NV
ALKALI SILT FLAT

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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.

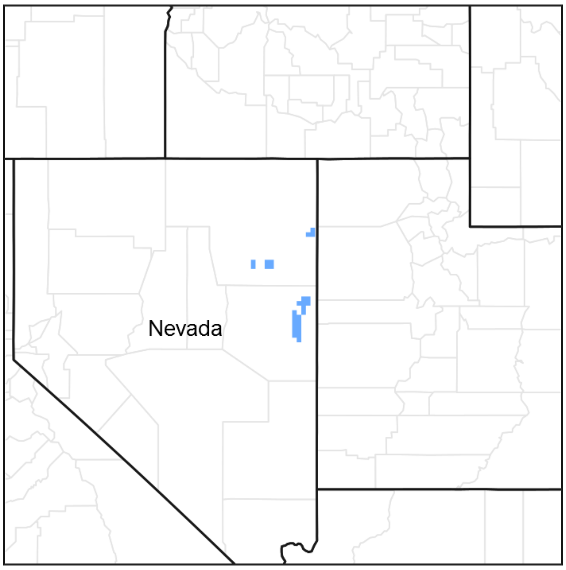

Figure 1. Mapped extent

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

MLRA 28A occurs in Utah (82%), Nevada (16%), and Idaho (2%). It makes up about 36,775 square miles. A large area west and southwest of Great Salt Lake is a salty playa. This area is the farthest eastern extent of the Great Basin Section of the Basin and Range Province of the Intermontane Plateaus. It is an area of nearly level basins between widely separated mountain ranges trending north to south. The basins are bordered by long, gently sloping alluvial fans. The mountains are uplifted fault blocks with steep side slopes. They are not well dissected because of low rainfall in the MLRA. Most of the valleys are closed basins containing sinks or playa lakes. Elevation ranges from 3,950 to 6,560 ft. in the basins and from 6,560 to 11,150 ft. in the mountains. Most of this area has alluvial valley fill and playa lakebed deposits at the surface. Great Salt Lake is all that remains of glacial Lake Bonneville. A level line on some mountain slopes indicates the former extent of this glacial lake. Most of the mountains in the interior of this area consist of tilted blocks of marine sediments from Cambrian to Mississippian age. Scattered outcrops of Tertiary continental sediments and volcanic rocks are throughout the area. The average annual precipitation is 5 to 12 ins. in the valleys and is as much as 49 ins. in the mountains. Most of the rainfall occurs as high-intensity, convective thunderstorms during the growing season. The driest period is from midsummer to early autumn. Precipitation in winter typically occurs as snow. The average annual temperature is 39 to 53 °F. The freeze-free period averages 165 days and ranges from 110 to 215 days, decreasing in length with elevation. The dominant soil orders in this MLRA are Aridisols, Entisols, and Mollisols. The soils in the area dominantly have a mesic or frigid soil temperature regime, an aridic or xeric soil moisture regime, and mixed mineralogy. They generally are well drained, loamy or loamy-skeletal, and very deep.

Ecological site concept

This site occurs on lake plains and basin floor remnants. Slopes range from 2 to 4 percent. Elevations are 4500 to 5500 feet.
Average annual precipitation is 5 to 8 inches. Mean annual air temperature is 46 to 54 degrees F. The average growing season is about 90 to 170 days.

The soils associated with this site are very deep, well drained soils that formed in alluvium derived from mixed rocks and loess high in volcanic ash over lacustrine deposits. These soils are typically moderately to strongly alkaline and moderately to strongly saline. Textures are silt loams and silty clays. Runoff is very or negligible. Water intake rates are low and these soils are often ponded in the early spring. Available water capacity is high but is reduced by salinity. The soil moisture regime is typic aridic and the soil temperature regime is mesic.

The reference state is dominated by sickle saltbush. Greenmolly kochia, shadscale, and black greasewood are important shrubs commonly associated with this site.
Production ranges from 200 to 500 pounds per acre.

Associated sites

R028AY012NV	**LOAMY 5-8 P.Z.**
R028BY015NV	**LOAMY SLOPE 12-16 P.Z.**
R028BY047NV	**SALINE TERRACE 5-8 P.Z.**
R028BY074NV	**SODIC TERRACE 5-8 P.Z.**

Similar sites

R028AY047NV	**DROUGHTY CALCAREOUS LOAM 8-10 P.Z. (burned phase)** PASM dominant grass; SAVE4 & KOAM minor species
R028AY033NV	**SALINE TERRACE 8-10 P.Z.** More productive site; SAVE4, ATCO & KOAM minor species

Table 1. Dominant plant species

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

Physiographic features

This site occurs on lake plains and basin floor remnants. Slopes range from 2 to 4 percent. Elevations are 4500 to 5500 feet.

Table 2. Representative physiographic features

Landforms	(1) Basin-floor remnant (2) Lake plain
Ponding duration	Very brief (4 to 48 hours)
Ponding frequency	Rare
Elevation	4,500–5,500 ft
Slope	0–4%
Aspect	Aspect is not a significant factor

Climatic features

Nevada's climate is predominantly arid, with large daily ranges of temperature, infrequent severe storms, heavy snowfall in the higher mountains, and great location variations with elevation. Three basic geographical factors largely influence Nevada's climate: continentality, latitude, and elevation. Continentality is the most important factor. The strong continental effect is expressed in the form of both dryness and large temperature variations. Nevada lies on the eastern, lee side of the Sierra Nevada Range, a massive mountain barrier that markedly influences the climate of the State. The prevailing winds are from the west, and as the warm moist air from the Pacific Ocean ascend the western slopes of the Sierra Range, the air cools, condensation occurs and most of the moisture falls as precipitation. As the air descends the eastern slope, it is warmed by compression, and very little precipitation occurs. The effects of this mountain barrier are felt not only in the West but throughout the state, with the result that the lowlands of Nevada are largely desert or steppes. The temperature regime is also affected by the blocking of the inland-moving maritime air. Nevada sheltered from maritime winds, has a continental climate with well-developed seasons and the terrain responds quickly to changes in solar heating.
Nevada lies within the mid-latitude belt of prevailing westerly winds which occur most of the year. These winds bring frequent changes in weather during the late fall, winter and spring months, when most of the precipitation occurs. To the south of the mid-latitude westerlies, lies a zone of high pressure in subtropical latitudes, with a center over the Pacific Ocean. In the summer, this high-pressure belt shifts northward over the latitudes of Nevada, blocking storms from the ocean. The resulting weather is mostly clear and dry during the summer and early fall, with scattered thundershowers. The eastern portion of the state receives significant summer thunderstorms generated from monsoonal moisture pushed up from the Gulf of California, known as the North American monsoon. The monsoon system peaks in August and by October the monsoon high over the Western U.S. begins to weaken and the precipitation retreats southward towards the tropics (NOAA 2004).
The climate associated with this site is semiarid, characterized by cool, moist winters and warm, dry summers. Average annual precipitation is 5 to 8 inches. Mean annual air temperature is 45 to 50 degrees F. The average growing season is about 100 to 120 days.

Mean annual precipitation at the OASIS, NEVADA climate station (265722) is 8.58 inches.

Monthly mean precipitation is:
January 0.65; February 0.58; March 0.69;
April 0.96; May 1.23; June 0.94; July 0.46;
August 0.62; September 0.47; October 0.76;
November 0.63; December 0.59.

Table 3. Representative climatic features

Frost-free period (average)	0 days
Freeze-free period (average)	110 days
Precipitation total (average)	7 in

Influencing water features

There are no influencing water features associated with this site.

Soil features

The soils associated with this site are very deep, well drained soils that formed in alluvium derived from mixed rocks and loess high in volcanic ash over lacustrine deposits. These soils are typically moderately to strongly alkaline and moderately to strongly saline. Textures are silt loams and silty clays. Runoff is very or negligible. Water intake rates are low and these soils are often ponded in the early spring. Available water capacity is high but is reduced by salinity. The soil moisture regime is typic aridic and the soil temperature regime is mesic. The soil series correlated with this site is Benin.

The representative soil component is Benin, sodic (NV779, MU3271), classified as a Fine, smectitic, calcareous, mesic Vertic Torriorthents. Diagnostic horizons include an ochric epipedon from the soil surface to 7 inches.

Identifiable secondary carbonates occur from 8 to 23 inches. Reaction is moderately alkaline through very strongly alkaline. Effervescence is noneffervescent through violently effervescent. Lithology consists of mixed rocks and loess high in volcanic ash over lacustrine deposits.

Table 4. Representative soil features

Surface texture	(1) Silt loam (2) Silt loam (3) Silt loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Slow
Soil depth	60–84 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	9–9.3 in
Calcium carbonate equivalent (0-40in)	0–10%
Electrical conductivity (0-40in)	4–32 mmhos/cm
Sodium adsorption ratio (0-40in)	13–440
Soil reaction (1:1 water) (0-40in)	8.6–9.2
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

An ecological site is the product of all the environmental factors responsible for its development and has a set of key characteristics that influence a site's resilience to disturbance and resistance to invasives. Key characteristics include 1) climate (precipitation, temperature), 2) topography (aspect, slope, elevation, and landform), 3) hydrology (infiltration, runoff), 4) soils (depth, texture, structure, organic matter), 5) plant communities (functional groups, productivity), and 6) natural disturbance regime (fire, herbivory, etc.) (Caudle et al. 2013). Biotic factors that influence resilience include site productivity, species composition and structure, and population regulation and regeneration (Chambers et al. 2013).

The Great Basin shrub communities have high spatial and temporal variability in precipitation, both among years and within growing seasons. Nutrient availability is typically low but increases with elevation and closely follows moisture availability. The moisture resource supporting the greatest amount of plant growth is usually the water stored in the soil profile during the winter. The invasibility of plant communities is often linked to resource availability. Disturbance can decrease resource uptake due to damage or mortality of the native species and depressed competition or can increase resource pools by the decomposition of dead plant material following disturbance.

These salt-desert shrub communities are dominated by plants belonging to the family Chenopodiaceae. Chenopods possess morphological and physiological traits that permit accommodation of both climatological drought resulting from low levels of precipitation, and physiological drought caused by high salt content of soils.

Atriplex species are considered medium to short-lived shrubs and possess a number of morphological and physiological traits that enable them to cope with drought. Some of these traits include: a) photosynthesis through the C4 carboxylation pathway; b) production of leaf trichomes and accumulation of salt crystals on the leaf surface to increase reflectance; c) accumulation and synthesis of inorganic and organic solutes to maintain turgor; and 4) root association with endomycorrhizae that allows absorption of soil moisture at very low water potentials (Cibils, et al. 1998, Dobrowolski 1990, Newton and Goodin 1989). Two Atriplex species occur on this site: sickle saltbush (*Atriplex falcata*) and shadscale (*Atriplex confertifolia*). Sickle saltbush – the dominant plant on this ecological site – is a low-growing, evergreen, subshrub which is woody at the base and herbaceous above (Mozingo 1987). Shadscale is an evergreen, rigidly branched, spiny, compact rounded shrub (Perryman 2014).

Black greasewood is a deciduous, intricately branched, spreading or erect shrub (Mozingo 1987). It is classified as a phreatophyte (Eddleman 2002), and its distribution is well correlated with the distribution of groundwater (Mozingo 1987). Meinzer (1927) discovered that the taproots of black greasewood could penetrate from 20 to 57 feet below the surface. Romo (1984) found water tables ranging from 3.5-15 m under black greasewood dominated communities in Oregon. Black greasewood stands develop best where moisture is readily available, either from surface or subsurface runoff (Brown 1965). It is commonly found on floodplains that are either subject to periodic flooding, have a high water table at least part of the year, or have a water table less than 34 feet deep (Harr and Price 1972, Blauer et al. 1976, Branson et al. 1976, Blaisdell and Holmgren 1984, Eddleman 2002). Ganskopp (1986) reported that water tables within 9.8 to 11.8 inches of the surface had no effect on black greasewood in Oregon. However, a study, conducted in California, found that black greasewood did not survive six months of continuous flooding (Groeneveld and Crowley 1988, Groeneveld 1990). Black greasewood is usually a deep rooted shrub but has some shallow roots near the soil surface; the maximum rooting depth can be determined by the depth to a saturated zone (Harr and Price 1972).

The herbaceous component is sparse and depends on annual precipitation. This component includes both perennial deep-rooted and shallow-rooted bunchgrasses, perennial rhizomatous grasses and perennial forbs. The soils have low to negligible surface runoff and typically have a well-developed vesicular crust, thus vegetation productivity is enhanced in wet years when flooding and ponding can occur.

This ecological site has low resilience to disturbance and resistance to invasion. The primary disturbance on these sites is drought, inappropriate grazing management and soil disturbance (off-road vehicles, etc). Halogeton (*Halogeton glomeratus*), Russian thistle (*Salsola tragus*) and cheatgrass (*Bromus tectorum*) are most likely to invade disturbed sites. Four possible stable states have been identified for this site.

Fire Ecology:
Historically, salt-desert shrub communities had sparse understories and bare soil in intershrub spaces, making these communities somewhat resistant to fire (Young 1983, Paysen et al. 2000). They may burn only during high fire hazard conditions; for example, years with high precipitation can result in almost continuous fine fuels from the herbaceous component, increasing the fire hazard (West 1994, Paysen et al. 2000).

Sickle saltbush sprouts from the root and exhibits the ability to reproduce by root sprouts where soil is loose and friable (Nord et al. 1969) which may allow it to sprout after fire. Sickle saltbush has also been observed to have stem layering where branches are partially covered by soil (Nord et al. 1969, Blaisdell and Holmgren 1984) and the conditions are favorable. These plants have been observed to recover quickly after roadside burning (Nord et al. 1969), but the research is inconclusive as to its response to wildfire.

Shadscale does not readily recover from fire, except for establishment through seed (West 1994). Slow reestablishment allows for easy invasion by cheatgrass and other non-native weedy species (Sanderson et al. 1990). The increased presence of exotic annual grasses has greatly altered fire regimes in areas of the Intermountain West where shadscale is a major vegetation component. Exotic annuals increase fire frequency under wet to near-normal summer moisture conditions and repeated, frequent fire has converted large expanses of shadscale rangeland to annual non-native plant communities (Knapp 1998).

Black greasewood may be killed by severe fires, but can resprout after low to moderate severity fires (Robertson 1983, West 1994). Sheeter (1968) reported that following a Nevada wildfire, black greasewood sprouts reached approximately 2.5 feet within 3 years. Grazing and other disturbance may result in increased biomass production due to sprouting and increased seed production, also leading to greater fuel loads (Sanderson and Stutz 1994, Paysen et al. 2000).

Western wheatgrass, a minor component of this community, is a coarse-leaved, sod forming perennial grass

(Wasser and Shoemaker 1982). It has good fire tolerance, likely due to its coarse leaves and rhizomatous growing structure (Wasser and Shoemaker 1982). In a study by White and Currie (1983), fall burning increased western wheatgrass but clipping and spring burning basal cover was similar to the untreated control plot.

The effect of fire on bunchgrasses relates to culm density, culm-leaf morphology, and the size of the plant. The initial condition of bunchgrasses within the site along with seasonality and intensity of the fire all factor into the individual species response. The growing points for most forbs and grasses are located at or below the soil surface, providing relative protection from disturbances which decrease above ground biomass, such as grazing or fire. Thus, fire mortality is more correlated to duration and intensity of heat which is related to culm density, culm-leaf morphology, size of plant and abundance of old growth (Wright 1971, Young 1983). However, season and severity of the fire and post-fire soil moisture availability will influence plant response.

Bottlebrush squirreltail, the dominant grass on this site, is considered more fire tolerant than other bunchgrasses due to its small size, coarse stems, and sparse leafy material (Britton et al. 1990). Postfire regeneration occurs from surviving root crowns and from on- and off-site seed sources. Bottlebrush squirreltail has the ability to produce large numbers of highly germinable seeds, with relatively rapid germination (Young and Evans 1977) when exposed to the correct environmental cues. Early spring growth and ability to grow at low temperatures contribute to the persistence of bottlebrush squirreltail among cheatgrass dominated ranges (Hironaka and Tisdale 1973).

Indian ricegrass is a deep-rooted, cool season perennial bunchgrass that is adapted primarily to sandy soils. It is fairly fire tolerant (Wright 1985), which is likely due to its low culm density and below ground plant crowns. Vallentine (1989) cites several studies in the sagebrush zone that classified Indian ricegrass as being slightly damaged from late summer burning. Indian ricegrass has also been found to reestablish on burned sites through seed dispersed from adjacent unburned areas (Young 1983, West 1994); therefore, the presence of surviving, seed producing plants facilitates the reestablishment of Indian ricegrass. Grazing management following fire to promote seed production and establishment of seedlings is important.

State and transition model

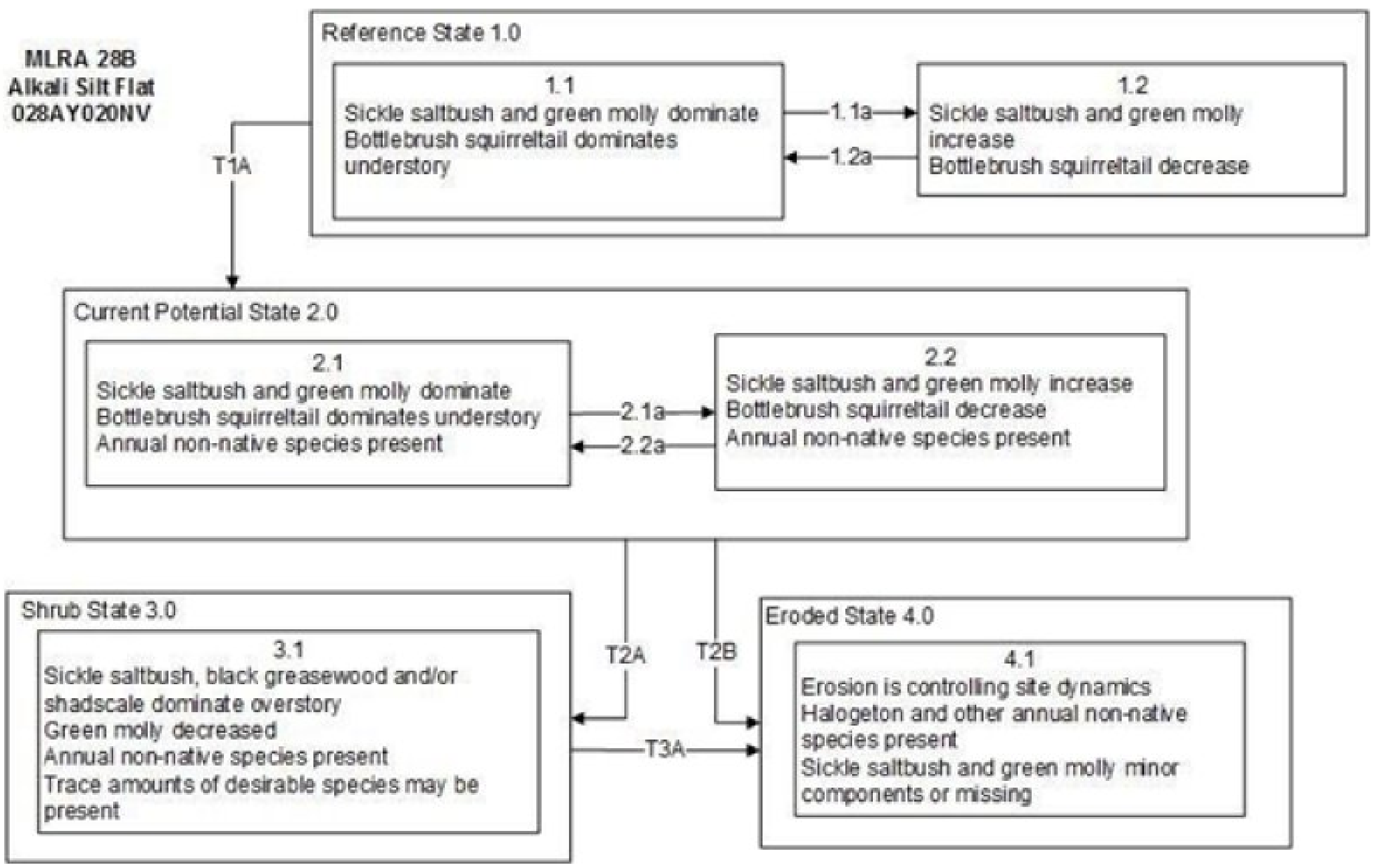

Figure 6. State and Transition Model

MLRA 28B
Alkali Silt Flat
028AY020NV

Reference State 1.0 Community Phase Pathways
1.1a: Long-term 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: Long-term 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. 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
Community Phase

This community is dominated by sickle saltbush and greem molly. Shadscale, black greasewood, Indian ricegrass, bottlebrush squirreltail are also common species on this site. Community phase changes are primarily a function of chronic drought. Fire is infrequent and patchy due to low fuel loads. Potential vegetative composition is about 15% grasses, 5% forbs and 80% shrubs. Approximate ground cover (basal and crown) is 10 to 15 percent.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	160	280	400
Grass/Grasslike	30	53	75
Forb	10	18	25
Total	**200**	**351**	**500**

Community 1.2
Community Phase

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 a
Community 1.1 to 1.2

Drought and/or herbivory would reduce the perennial grasses on this site.

Pathway a
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
Community Phase

This community is dominated by sickle saltbush and green molly. Bottlebrush squirreltail is also an important species on this site. 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 in minor amounts. Potential vegetative composition is approximately 10% grasses, 10% forbs and 80% shrubs.

Community 2.2
Community Phase

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 management while Indian ricegrass and other perennial grasses decrease. Bare ground increases along with annual weeds.

Pathway a
Community 2.1 to 2.2

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

Pathway a
Community 2.2 to 2.1

Release from drought and/or change in grazing management allows recovery of perennial grasses.

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
Community Phase

Perennial grasses like Indian ricegrass, 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, excessive soil temperatures, 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
Community Phase

Figure 9. Alkali Silt Flat, T.Stringham April 2013, NV779 MU3271

Figure 10. Alkali Silt Flat, T.Stringham April 2013, NV779, MU3271

Figure 11. Alkali Silt Flat, T.Stringham April 2013, NV779 MU3271

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. Wind erosion and extreme soil temperatures are driving factors in site function.

Transition A
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 A
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 B
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 A
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 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Primary Perennial Grasses**			25–53	
	squirreltail	ELEL5	*Elymus elymoides*	18–35	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	7–18	–
2	**Secondary Perennial Grasses**			0–28	
	saltgrass	DISP	*Distichlis spicata*	2–11	–
	western wheatgrass	PASM	*Pascopyrum smithii*	2–11	–
	Sandberg bluegrass	POSE	*Poa secunda*	2–11	–
	alkali sacaton	SPAI	*Sporobolus airoides*	2–11	–
Forb					
3	**Perennial**			7–28	
	globemallow	SPHAE	*Sphaeralcea*	2–7	–
Shrub/Vine					
4	**Primary Shrubs**			245–379	
	sickle saltbush	ATFA	*Atriplex falcata*	175–228	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	18–35	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	7–28	–
5	**Secondary Shrubs**			7–18	
	seepweed	SUAED	*Suaeda*	4–11	–

Animal community

Livestock Interpretations:
This site is suitable for livestock grazing. Grazing management considerations include timing, intensity, frequency, and duration of grazing.
Productivity and grazing capacities are typically low for salt-desert shrub communities and these sites are typically used for winter range. Sickle saltbush and shadscale provide valuable winter forage for livestock and wildlife on salt-desert rangelands (Ansley and Abernethy 1983). Green molly is considered fair to good forage for sheep, cattle and goats. Black greasewood is browsed by cattle when green, but contains soluble oxalates that may cause poisoning and death if large quantities are consumed in a short time period (Blaisdell and Holmgren).
Bottlebrush squirreltail generally increases in abundance when moderately grazed or protected (Hutchings and Stewart 1953). In addition, moderate trampling by livestock in big sagebrush rangelands of central Nevada enhanced bottlebrush squirreltail seedling emergence compared to untrampled conditions. Heavy trampling however was found to significantly reduce germination sites (Eckert et al. 1987). Squirreltail is more tolerant of grazing than other perennial bunchgrasses but all bunchgrasses are sensitive to over utilization within the growing season.
Western wheatgrass is considered one of the most valuable wheatgrasses on rangelands. It often inhabits sites with high salinity and few other grass species (Dayton 1937). It is valuable forage for sheep, especially as a winter feed; it is also rated as a choice forage for elk and deer (Dayton 1937).
Repeated spring and early summer grazing will decrease the cover of the more palatable species and increase the potential for serious soil erosion. Undesirable perennial species will increase and non-native annuals such as halogeton, Russian thistle and cheatgrass will invade. With grazing, saltbush will initially increase in the community and native perennial bunchgrasses will decrease. In a study by Fisser and Joyce (1983), saltbush remained the dominant vegetation in an exclosure protected from grazing for seven years. After sixteen years of protection from grazing the same exclosures exhibited an increase in perennial bunchgrasses and a subsequent decrease in sickle saltbush which was significantly correlated with precipitation combined with protection from grazing. They also found that 35 percent shrub removal during winter was acceptable for maintenance of the population, but severe overuse can cause a decrease in sickle saltbush and allow an increase in halogeton.
Inappropriate grazing during the winter while soils are wet may lead to soil compaction and reduced infiltration. Prolonged inappropriate grazing during any season leads to abundant bare ground, destruction of microbiotic

crusts, and active wind and water erosion (Blaisdell and Holmgren 1984).
Stocking rates vary over time depending upon season of use, climate variations, site, and previous and current management goals. A safe starting stocking rate is an estimated stocking rate that is fine tuned by the client by adaptive management through the year and from year to year.
Wildlife Interpretations:
Salt-desert shrub communities are relatively simple in terms of structure and species diversity but they serve as habitat for several wildlife species including reptiles, small mammals, birds and large herbivores (Blaisdell and Holmgren 1984).
Sickle saltbush provides nutritious forage for wildlife. Shadscale is a valuable browse species, providing a source of palatable, nutritious forage for a wide variety of wildlife particularly during spring and summer before the hardening of spiny twigs. It supplies browse, seed, and cover for birds, small mammals, rabbits, deer, and pronghorn antelope. Black greasewood is an important winter browse plant for big game animals and a food source for many other wildlife species. It also receives light to moderate use by mule deer and pronghorn during spring and summer months. Bottlebrush squirreltail is a dietary component of several wildlife species. Bottlebrush squirreltail may provide forage for mule deer and pronghorn. Indian ricegrass is eaten by pronghorn in "moderate" amounts whenever available. In Nevada it is consumed by desert bighorns. A number of heteromyid rodents inhabiting desert rangelands show preference for seed of Indian ricegrass. Indian ricegrass is an important component of jackrabbit diets in spring and summer. In Nevada, Indian ricegrass may even dominate jackrabbit diets during the spring through early summer months. Indian ricegrass seed provides food for many species of birds. Doves, for example, eat large amounts of shattered Indian ricegrass seed lying on the ground.

Hydrological functions

Runoff is very low or negligible. Permeability is slow. These soils may have brief periods of flooding between November and June. Rills are typically non-existent. Water flow patterns are rare to common dependent on site location relative to major inflow areas. Water flow patterns are typically short, ending in depressional areas where water ponds. Moderately fine to fine surface textures and physical crusts result in limited infiltration rates. The surface layer will normally crust and bake upon drying, inhibiting water infiltration and seedling emergence. Ponding occurs in late winter/early spring in many areas. Ponding may also occur after heavy summer convection storms.

Recreational uses

Aesthetic value is derived from the diverse floral and faunal composition. This site offers rewarding opportunities to photographers and for nature study. This site has potential for upland and big game hunting.

Other products

Seeds of shadscale were used by Native Americans of Arizona, Utah, and Nevada for bread and mush. The leaves, seeds and stems of black greasewood are edible. Indian ricegrass was traditionally eaten by some Native Americans. The Paiutes used seed as a reserve food source.

Other information

Black greasewood is useful for stabilizing soil on wind-blown areas. It successfully revegetates eroded areas and sites too saline for most plant species. Bottlebrush squirreltail is tolerant of disturbance and is a suitable species for revegetation.

Type locality

Location 1: White Pine County, NV	
Township/Range/Section	T23N R68E S18
General legal description	E½ Section 18, T23N. R68E. MDBM. About 1 mile east of Tippet Ranch, Antelope Valley area, White Pine County, Nevada. This site also occurs in Elko County, Nevada.

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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.

Author(s)/participant(s)	P NOVAK-ECHENIQUE
Contact for lead author	State Rangeland Management Specialist
Date	05/14/2013
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** This site is nearly flat so rills are not expected.

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2. **Presence of water flow patterns:** Water flow patterns are rare to common dependent on site location relative to major inflow areas. Water flow patterns are typically short, ending in depressional areas where water ponds. Moderately fine to fine surface textures and physical crusts result in limited infiltration rates. The surface layer will normally crust and bake upon drying, inhibiting water infiltration and seedling emergence. Ponding occurs in late winter/early spring in many areas. Ponding may also occur after heavy summer convection storms.

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3. **Number and height of erosional pedestals or terracettes:** Pedestals are none to rare and mainly occur in water flow paths. Terracettes are typically non-existent.

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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 70-80%

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5. **Number of gullies and erosion associated with gullies:** None - small gullies may form at inflow areas where run-in occurs from adjacent landscapes.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None

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7. **Amount of litter movement (describe size and distance expected to travel):** Fine litter (foliage of grasses and annual & perennial forbs) expected to move distance of slope length during periods of intense summer convection

storms or run in of early spring snow melt flows. Persistent litter (large woody material) will remain in place except during unusual flooding (ponding) events.

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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):** Soil stability values will range from 3 to 6.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Structure of soil surface will be weak and thin platy. Soil surface colors are light grays and soils are typified by an ochric epipedon. Surface textures are silt loams. Organic matter is typically less than 1 percent.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** This site is typically ponded for short periods in the late winter/early spring and runoff is not significant. In areas, with herbaceous cover (sparse) of deep-rooted perennial herbaceous bunchgrasses and/or rhizomatous grasses (western wheatgrass), these plants can aid in infiltration.

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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):** Compacted layers are none. Platy, prismatic, or massive subsurface layers are normal for this site and are not to be interpreted as compaction.

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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: Reference State: salt-desert shrubs (sickle saltbush)

    Sub-dominant: shallow-rooted cool season, perennial bunchgrasses (bottlebrush squirreltail & Sandberg bluegrass) > low-stature shrubs (kochia, shadscale, etc.) > deep-rooted, cool season, perennial bunchgrasses = cool season, rhizomatous grasses = deep-rooted, cool season, perennial forbs = fibrous, shallow-rooted, cool season, perennial and annual forbs.

    Other:

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Dead branches within individual shrubs common and standing dead shrub canopy material may be as much as 35% of total woody canopy

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14. **Average percent litter cover (%) and depth (in):** Between plant interspaces (10-15%) and depth (<¼ in.)

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** For normal or average growing season (March thru May) ± 350 lbs/ac; Favorable years ± 500 lbs/ac and unfavorable years ± 200 lbs/ac

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:** Potential invaders include annual mustards, annual kochia, Russian thistle, halogeton, and cheatgrass.

17. **Perennial plant reproductive capability:** All functional groups should reproduce in average (or normal) and above average growing season years. Reduced growth and reproduction occurs during extended or extreme drought conditions.