USDA Natural Resources
Conservation Service

Ecological site R028AY033NV
SALINE TERRACE 8-10 P.Z.

Accessed: 05/05/2024

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.

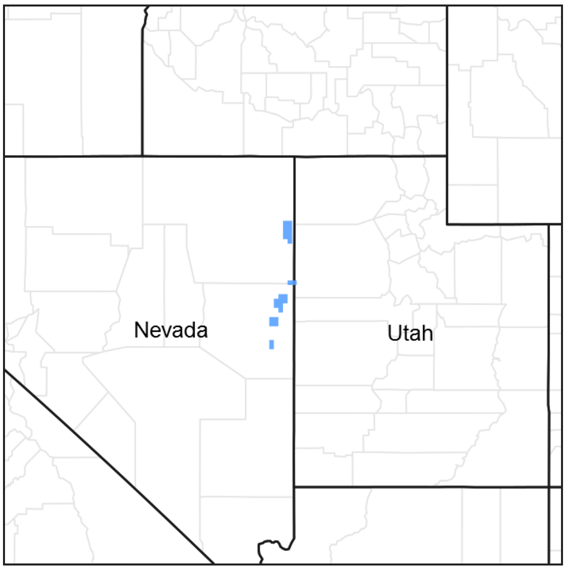

Figure 1. Mapped extent

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

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 inset fans and lake plains. Slope gradients of 0 to 4 percent are most typical. Elevations are 5300 to 5800 feet.

Average annual precipitation is 8 to 10 inches. Mean annual air temperature is 45 to 50 degrees F. The average growing season is about 100 to 120 days.

The soils associated with this site are very deep, well drained, and have formed in alluvium sediments overlain by mixed material. Textures are silt loams and silty clay loams. Soil reaction is strongly or very strongly saline-alkaline.

The reference state is dominated by sickle saltbush. Indian ricegrass and western wheatgrass are other important species.
Production ranges from 350 to 700 pounds per acre.

Associated sites

R028AY019NV	**SANDY 5-8 P.Z.**
R028AY030NV	**SILTY 8-10 P.Z.**
R028AY032NV	**DROUGHTY SODIC LOAM**

Similar sites

R028AY020NV	**ALKALI SILT FLAT** KOAM-ATCO-SAVE4 important shrubs; less productive site;lower elevations
R028BY047NV	**SALINE TERRACE 5-8 P.Z.** Less productive site; SPAI dominant grass; lower elevations

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex falcata*
Herbaceous	(1) *Achnatherum hymenoides* (2) *Pascopyrum smithii*

Physiographic features

This site occurs on inset fans and lake plains. Slope gradients of 0 to 4 percent are most typical. Elevations are 5300 to 5800 feet.

Table 2. Representative physiographic features

Landforms	(1) Inset fan (2) Lake plain
Elevation	1,615–1,768 m
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).

Average annual precipitation is 8 to 10 inches. Mean annual air temperature is 45 to 50 degrees F. The average growing season is about 100 to 120 days.

Mean annual preciptiation at OASIS, NEVADA (265722) Climate station 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)	229 mm

Influencing water features

Most areas receive additional moisture as run-in from higher landscapes.

Soil features

The soils associated with this site are very deep, well drained, and have formed in alluvium sediments overlain by mixed material. Textures are silt loams and silty clay loams. Soil reaction is strongly or very strongly saline. Salinity increases with depth. The soils are strongly alkaline and strongly effervescent. Runoff is low to medium and permeability is moderately slow. Most areas receive additional moisture as run-in from higher landscapes. The soil series associated with this site include: Timpie.

The representative soil component is Timpie (NV779, MU3130), classified as a Fine-silty, mixed, superactive, calcareous, mesic Typic Torriorthents. Diagnostic horizons include an ochric epipedon from the soil surface to a depth of 3 inches, and a Bw horizon of structural development with no evidence of either removal of carbonates or clay accumulation. Clay content in the particle control sections average 18 to 27 percent. Reaction is moderately to strongly alkaline. Effervescence is strongly effervescent and the soils are strongly saline. Lithology consists of limestone and quartzite.

Table 4. Representative soil features

Parent material	(1) Alluvium–limestone (2) Lacustrine deposits–quartzite
Surface texture	(1) Silt loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow
Soil depth	152–183 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	10.16–13.72 cm
Calcium carbonate equivalent (0-101.6cm)	23–28%
Electrical conductivity (0-101.6cm)	6–12 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	11–78
Soil reaction (1:1 water) (0-101.6cm)	8.4–9
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). Three Atriplex species occur on this site: sickle saltbush

(*Atriplex falcata*), shadscale (*Atriplex confertifolia*) and fourwing saltbush (*Atriplex canescens*). Sickle saltbush – the dominant plant on this 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. Fourwing saltbush is an evergreen or deciduous, tall, diffusely branched shrub (Perryman 2014).

The herbaceous component includes both perennial deep-rooted and shallow-rooted bunchgrasses, perennial rhizomatous grasses and perennial forbs. The soils have low to medium 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. Primary disturbances include drought, inappropriate grazing and soil disturbances (off-road vehicles, etc). Halogeton (*Halogeton glomeratus*), Russian thistle (*Salsola tragus*) and cheatgrass (*Bromus tectorum*) are most likely to invade disturbed sites. Three 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 shows an 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 on its response to wildfire.

Winterfat – a minor component on this ecological site – tolerates environmental stress, extremes of temperature and precipitation, and competition from other perennials but not the disturbance of fire or overgrazing (Ogle et al. 2001). There are conflicting reports in the literature about the response of winterfat to fire. In one of the first published descriptions, Dwyer and Pieper (1967) reported that winterfat sprouts vigorously after fire. This observation was frequently cited in subsequent literature, but recent observations have suggested that winterfat can be completely killed by fire (Pellant and Reichert 1984). The response is apparently dependent on fire severity. Winterfat is able to sprout from buds near the base of the plant; if these buds are destroyed, however, winterfat will not sprout. Research has shown that winterfat seedling growth is depressed in growth by at least 90% when growing in the presence of cheatgrass (Hild et al. 2007). Repeated, frequent fires will increase the likelihood of conversion to a non-native, annual plant community with trace amounts of winterfat.

Western wheatgrass 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. For most forbs and grasses the growing points 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 will influence plant response. Plant response will also vary depending on post-fire soil moisture availability.

Indian ricegrass, the dominant grass on this site, is fairly fire tolerant (Wright 1985), which is likely due to its low culm density and below-ground root 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); thus, 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.

Bottlebrush squirreltail is considered more fire tolerant than Indian ricegrass due to its small size, coarse stems, and sparse leafy material (Britton et al. 1990). Post fire 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).

State and transition model

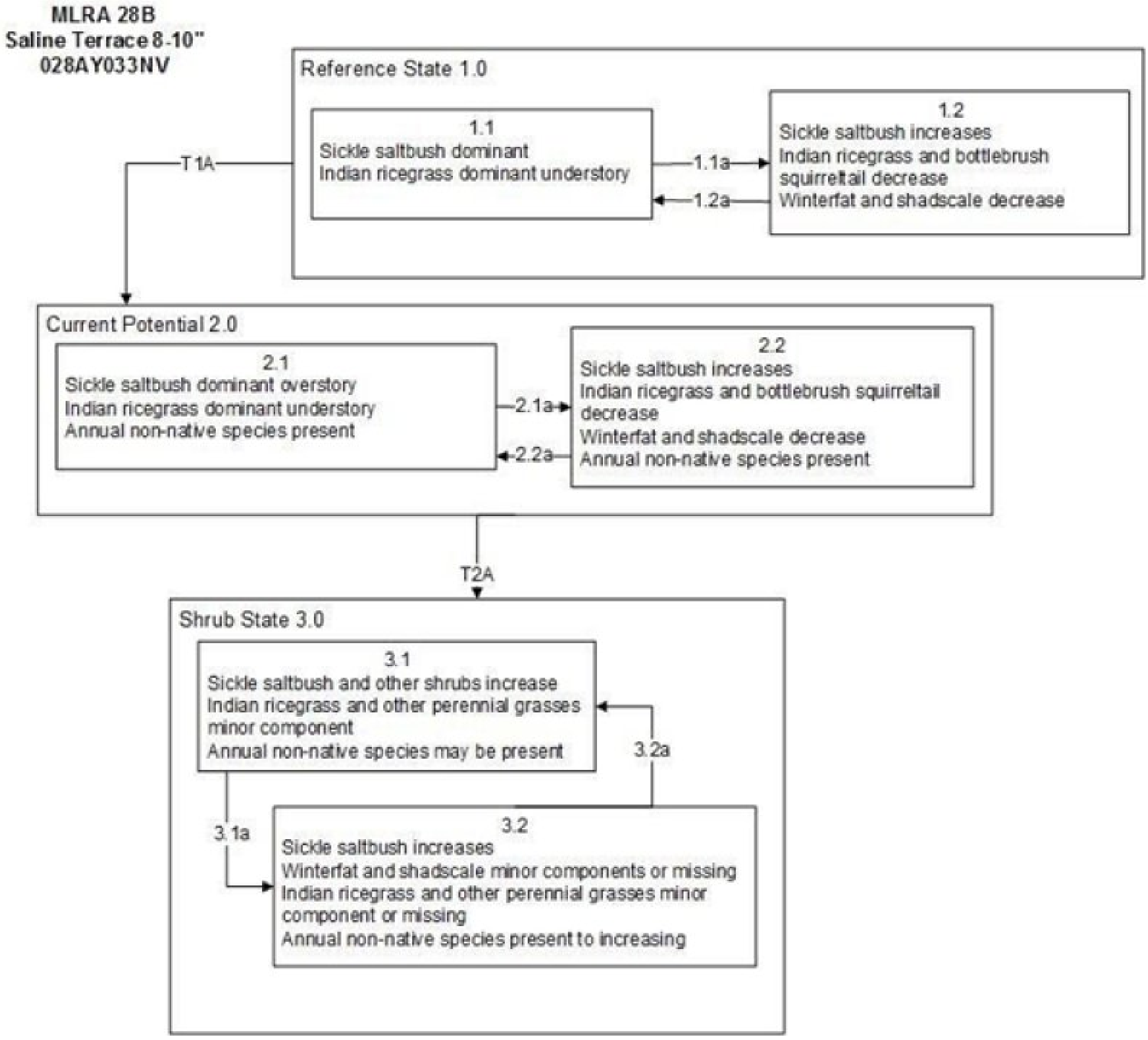

Figure 6. State and Transition Model

MLRA 28B
Saline Terrace 8-10"
028AY033NV

Reference 1.0 Community Phase Pathways
1.1a: Long-term drought and/or excessive herbivory may reduce both shrubs and perennial bunchgrasses
1.2a: Time and lack of disturbance and/or release from drought

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

Current Potential State 2.0 Community Phase Pathways
2.1a: Long-term drought and/or inappropriate grazing management; non-native species present
2.1b: Time and lack of disturbance and/or release from drought

T2A: Inappropriate grazing management

Shrub State 3.0 Community Phase Pathways
3.1a: Long-term drought and/or Inappropriate grazing management
3.2a: Time and lack of disturbance

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 co-dominated by shrubs and grass 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; however, recruitment of sickle saltbush is episodic.

Community 1.1
Community Phase

This community is dominated by sickle saltbush and western wheatgrass. Indian ricegrass, bottlebrush squirreltail and winterfat are also 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. Potential vegetative composition is about 35% grasses, 5% forbs and 60% shrubs. Approximate ground cover (basal and crown) is 15 to 25 percent.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	235	336	471
Grass/Grasslike	138	196	275
Forb	20	28	39
Total	**393**	**560**	**785**

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.

Pathway a
Community 1.1 to 1.2

Drought and/or herbivory would reduce the perennial grasses and winterfat on this site. Fires would also decrease vegetation on these sites but would be infrequent and patchy due to low fuel loads.

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 western wheatgrass. Indian ricegrass, bottlebrush squirreltail and winterfat are also 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. Halogeton and Russian thistle are the species most likely to invade this site. Potential vegetative composition is approximately 30% grasses, 10% forbs and 60% shrubs.

Community 2.2
Community Phase

Drought will 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 managemetn while Indian ricegrass, winterfat and shadscale decline. Bare ground increases along with annual weeds.

Pathway a
Community 2.1 to 2.2

Inappropriate grazing management and/or drought

Pathway a
Community 2.2 to 2.1

Release from drought and/or growing season grazing pressure allows recovery of bunchgrasses, sickle saltbush, and winterfat.

State 3
Shrub State

This state consists of two community phases, one phase with sickle saltbush and other shrubs dominating the overstory, and the other dominated by sickle saltbush. This site has crossed a biotic threshold and site processes are being controlled by shrubs.

Community 3.1
Community Phase

Figure 9. Saline Terrace 8-10", T.Stringham April 2013, NV779 MU3130

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

Community 3.2
Community Phase

Sickle saltbush dominates the overstory. Black greasewood may be a significant component. Winterfat, shadscale and other palatable shrubs are reduced in the community. Deep-rooted perennial bunchgrasses may be present in trace amounts or absent from the community. Bare ground increases, non-native annual species may be present to increasing.

Pathway a
Community 3.1 to 3.2

Drought and/or inappropriate grazing management would reduce the winterfat component of the overstory.

Pathway a
Community 3.2 to 3.1

Release from drought and appropriate grazing management would allow for the winterfat, shadscale and perennial grasses to increase within the community.

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: Inappropriate, long-term grazing will decrease or eliminate deep rooted perennial bunchgrasses and increase 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.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Primary Perennial Grasses**			95–224	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	56–112	–
	western wheatgrass	PASM	*Pascopyrum smithii*	28–84	–
	squirreltail	ELEL5	*Elymus elymoides*	11–28	–
2	**Secondary Perennial Grasses**			11–45	
	saltgrass	DISP	*Distichlis spicata*	3–17	–
	basin wildrye	LECI4	*Leymus cinereus*	3–17	–
	alkali sacaton	SPAI	*Sporobolus airoides*	3–17	–
Forb					
3	**Perennial**			11–45	
	globemallow	SPHAE	*Sphaeralcea*	3–11	–
	thelypody	THELY	*Thelypodium*	3–11	–
Shrub/Vine					
4	**Primary Shrubs**			275–381	
	sickle saltbush	ATFA	*Atriplex falcata*	252–308	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	11–45	–
5	**Secondary Shrubs**			11–45	
	fourwing saltbush	ATCA2	*Atriplex canescens*	6–17	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	6–17	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	6–17	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	6–17	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	6–17	–

Animal community

Livestock Interpretations:
This site is suited for livestock production. Grazing management considerations include timing, intensity and duration of grazing.
Sickle saltbush provides valuable winter forage for livestock and wildlife in areas where it is it the predominant shrub such as rangelands and disturbed sites (Ansley and Abernethy 1983). With grazing saltbush will initially increase in the community and native perennial bunchgrasses will decrease. Overgrazing may reduce plant vigor. 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. Greenmolly provides excellent forage for sheep and cattle, and is often used as a winter forage, when it is high in protein. Winterfat is an important forage plant for livestock, especially during winter when forage is scarce. Abusive grazing practices have reduced or eliminated winterfat on some areas even though it is fairly resistant to browsing. Effects depend on severity and season of grazing.
Indian ricegrass is highly palatable to all classes of livestock in both green and cured condition. It supplies a source

of green feed before most other native grasses have produced much new growth. Indian ricegrass is a deep-rooted, cool season perennial bunchgrass that is adapted primarily to sandy soils. Indian ricegrass is a preferred forage species for livestock and wildlife (Cook 1962, Booth et al. 2006). This species is often heavily utilized in winter because it cures well (Booth et al. 2006). It is also readily utilized in early spring, being a source of green feed before most other perennial grasses have produced new growth (Quinones 1981). Booth et al. (2006) note that the plant does well when utilized in winter and spring. Cook and Child (1971) however, found that repeated heavy grazing reduced crown cover, which may reduce seed production, density, and basal area of these plants. Additionally, heavy early spring grazing reduces plant vigor and stand density (Stubbendieck 1985). In eastern Idaho, productivity of Indian ricegrass was at least 10 times greater in undisturbed plots than in heavily grazed ones (Pearson 1965). Cook and Child (1971) found significant reduction in plant cover after 7 years of rest from heavy (90%) and moderate (60%) spring use. The seed crop may be reduced where grazing is heavy (Bich et al. 1995). Tolerance to grazing increases after May, thus spring deferment may be necessary for stand enhancement (Pearson 1964, Cook and Child 1971); however, utilization of less than 60% is recommended.

Western wheatgrass provides important forage for domestic sheep. Fall regrowth cures well on the stem, so western wheatgrass is good winter forage for domestic livestock. This site has limited value for livestock grazing, due to the low forage production. Western wheatgrass provides important forage for domestic sheep. Fall regrowth cures well on the stem, so western wheatgrass is good winter forage for domestic livestock. 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).

Bottlebrush squirreltail is very palatable winter forage for domestic sheep of Intermountain ranges. Domestic sheep relish the green foliage. Overall, bottlebrush squirreltail is considered moderately palatable to livestock. 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 Indian ricegrass but all bunchgrasses are sensitive to over utilization within the growing season.

Prolonged drought and/or inappropriate grazing will cause a decrease in the palatable shrubs and Indian ricegrass, while sickle saltbush increases. Repeated spring and early summer grazing will decrease sickle saltbush and increase bare ground. Halogeton and other non-native annuals increase with excessive grazing. Inappropriate grazing management during the winter while soils are wet may lead to soil compaction and reduced infiltration. Prolonged grazing during any season leads to abundant bare ground, desert pavement and active wind and water erosion.

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).

For example, salt-desert shrub communities provide important forage plants, such as winterfat and sickle saltbush, for wildlife especially during winter when forage is scarce. Winterfat seeds are eaten by rodents. Winterfat is a staple food for black-tailed jackrabbit (Lepus californicus). Winterfat and perennial grasses average 80% of jackrabbits' diet in southeastern Idaho, with shrubs being grazed in fall and winter particularly (Johnson and Anderson 1984). Similarly, although Nuttall's cottontail (Sylvilagus nuttallii) consumed mostly grasses and forbs, winterfat made up a large component of their diet as well (Johnson and Hansen 1979).

Mule deer (Odocoileus hemionus) and pronghorn antelope (Antilocapra americana) browse winterfat (Stevens et al. 1977, Ogle et al. 2001). Pronghorn and rabbits browse stems, leaves, and seed stalks of winterfat year round, especially during periods of active growth (Stevens et al. 1977). Winterfat is used for cover by rodents. It is potential nesting cover for upland game birds, especially when grasses grow up through its crown. Management of wildlife browse is difficult and browse may be harmful to winterfat reestablishment as seed production and regrowth are curtailed if grazing occurs as the plant begins to grow (Eckert 1954).

Rodents also utilize winterfat and sickle saltbush habitat. The diet of Townsend's ground squirrel (Urocitellus townsendii) consisted on average of 47% winterfat and three other native plant species (Yensen and Quinny 1992). Great Basin pocket mice can be found sporadically in winterfat communities (Dobkin and Sauder 2004).Piute ground squirrels (Urocitellus mollis), little pocket mice (Perognathus longimembris), dark kangaroo mice

(Microdipodops megacephalus), chisel-toothed kangaroo rats (Dipodomys microps) and desert woodrats (Neotoma lepida) are found invariably in various shrubsteppe communities especially where winterfat occurs (Dobkin and Sauder 2004). Greenmolly, a minor component of this site, is an excellent forage for deer.
Elk consume western wheatgrass during the fall, winter, spring, and summer. Western wheatgrass is used by various small mammals. Indian ricegrass is eaten by pronghorn in moderate amounts whenever available. 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. 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. Bottlebrush squirreltail is a dietary component of several wildlife species.
Changes in plant community composition caused by human activity, invasive weeds, fire and frequency associated with this ecological site could affect the distribution and presence of wildlife species and it is important to maintain the community for optimal productivity and species diversity (Nevada Wildlife Action Plan 2012).

Hydrological functions

Runoff is low to medium. Permeability is moderately slow. This site is nearly flat, thus rills are not expected. Water flow patterns and terracettes are rare to common depending on site location relative to major inflow areas. 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. Shrubs and deep-rooted perennial herbaceous bunchgrasses and/or rhizomatous grasses (western wheatgrass) aid in infiltration and reduce runoff. The low statured shrubs and associated litter provide some protection from raindrop impact and provide opportunity for snow capture on the site.

Recreational uses

Aesthetic value is derived from the diverse floral and faunal composition and the colorful flowering of wild flowers and shrubs during the spring and early summer. This site offers rewarding opportunities to photographers and for nature study. This site has potential for upland and big game hunting.

Other products

Indian ricegrass was traditionally eaten by some Native Americans. The Paiutes used seed as a reserve food source.

Other information

Winterfat adapts well to most site conditions, and its extensive root system stabilizes soil. However, winterfat is intolerant of flooding, excess water, and acidic soils. Western wheatgrass is a good soil binder and is well suited for reclamation of disturbed sites such as erosion control and soil stabilization. Bottlebrush squirreltail is tolerant of disturbance and is a suitable species for revegetation.

Type locality

Location 1: White Pine County, NV	
Township/Range/Section	T22N R68E S19
UTM zone	N
UTM northing	4404992
UTM easting	0728928
Latitude	39° 45′ 50″
Longitude	114° 19′ 38″
General legal description	White Pine County, SS 779, MU 3130

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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.

Author(s)/participant(s)	PATTI NOVAK-ECHENIQUE
Contact for lead author	State Rangeland Management Specialist.
Date	04/02/2014
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, thus rills are not expected.

2. **Presence of water flow patterns:** Water flow patterns are rare to common depending on site location relative to major inflow areas. 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.

3. **Number and height of erosional pedestals or terracettes:** Pedestals and terracettes are none to rare.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare Ground ± 80%. Surface rock fragments < 5%

5. **Number of gullies and erosion associated with gullies:** Small gullies may form along major inflow areas where run-in occurs from adjacent landforms.

6. **Extent of wind scoured, blowouts and/or depositional areas:** Very minor wind-scouring with slight depositional

mounds under shrub canopies.

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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 is weak, thin platy. Soil surface colors are pale browns and soils are typified by an ochric epipedon. Soil surface textures are silt loams. Organic matter of the surface 2 to 3 inches is typically less than 3 percent (OM values taken from lab characterization data).

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Shrubs and deep-rooted perennial herbaceous bunchgrasses and/or rhizomatous grasses (western wheatgrass) aid in infiltration and reduce runoff. The low statured shrubs and associated litter provide some protection from raindrop impact and provide opportunity for snow capture on 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):** Compacted layers are none. Subangular blocky, 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: Sprouting shrubs (sickle saltbush)

    Sub-dominant: deep-rooted, cool season, perennial bunchgrasses > low-stature shrubs or half-shrubs (winterfat, shadscale, etc.) > cool season, rhizomatous grasses (western wheatgrass) > shallow-rooted cool season, perennial bunchgrasses (bottlebrush squirreltail) > deep-rooted, cool season, perennial forbs = fibrous, shallow-rooted, cool season, perennial and annual forbs

    Other: warm season grasses, microbiotic crusts

    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 (15-25%) and depth (± ¼ in.)

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** For normal or average growing season (thru June) ± 500 lbs/ac. Favorable years ± 700 lbs/ac and unfavorable years ± 350 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, 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. Little growth or reproduction occurs during extreme drought or extended drought periods.