Ecological site R024XY002NV
LOAMY 5-8 P.Z.

Accessed: 05/21/2024

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.

MLRA notes

Major Land Resource Area (MLRA): 024X–Humboldt Basin and Range Area

Major land resource area (MLRA) 24, the Humboldt Area, covers an area of approximately 8,115,200 acres (12,680 sq. mi.). It is found in the Great Basin Section of the Basin and Range Province of the Intermontane Plateaus. Elevations range from 3,950 to 5,900 feet (1,205 to 1,800 meters) in most of the area, some mountain peaks are more than 8,850 feet (2,700 meters).
A series of widely spaced north-south trending mountain ranges are separated by broad valleys filled with alluvium washed in from adjacent mountain ranges. Most valleys are drained by tributaries to the Humboldt River. However, playas occur in lower elevation valleys with closed drainage systems. Isolated ranges are dissected, uplifted fault-block mountains. Geology is comprised of Mesozoic and Paleozoic volcanic rock and marine and continental sediments. Occasional young andesite and basalt flows (6 to 17 million years old) occur at the margins of the mountains. Dominant soil orders include Aridisols, Entisols, Inceptisols and Mollisols. Soils of the basins are generally characterized by a mesic soil temperature regime, an aridic soil moisture regime and mixed geology. Approximately 75 percent of MLRA 24 is federally owned, the remainder is primarily used for farming, ranching and mining. Irrigated land makes up about 3 percent of the area; the majority of irrigation water is from surface water sources, such as the Humboldt River and Rye Patch Reservoir. Annual precipitation ranges from 6 to 12 inches (15 to 30 cm) for most of the area, but can be as much as 40 inches (101 cm) in the mountain ranges. The majority of annual precipitation occurs as snow in the winter. Rainfall occurs as high-intensity, convective thunderstorms in the spring and fall.
Nevada's climate is predominantly arid, with large daily ranges of temperature, infrequent severe storms and heavy snowfall in the higher mountains. Three basic geographical factors largely influence Nevada's climate: continentality, latitude, and elevation. 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, as a result 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 midlatitude 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 occasional thundershowers.

Ecological site concept

This ecological site occurs on fan remnants. The soils associated with this site are very deep, well drained and formed in alluvium derived from mixed parent material. Soils are characterized by an ochric epipedon, less than 25% rock fragments throughout the profile, a gravely surface and a horizon of salt accumulation (natric). The soil temperature regime is mesic and soil moisture regime is typic aridic.

Important abiotic factors include limited effective moisture, salt-affected soils, and low precipitation.

Associated sites

R024XY003NV	**SODIC TERRACE 6-8 P.Z.**
R024XY004NV	**SILTY 4-8 P.Z.**
R024XY020NV	**DROUGHTY LOAM 8-10 P.Z.**
R029XY025NV	**STREAMBANK 10-14 P.Z.**

Similar sites

R024XY003NV	**SODIC TERRACE 6-8 P.Z.** SAVE4-ATCO codominant; less productive site.
R024XY060NV	**SHALLOW SILTY 8-10 P.Z.** ATCO dominant plant; ARSP5 rare.
R024XY025NV	**LOAMY SLOPE 5-8 P.Z.** Less productive site.
R024XY065NV	**GRAVELLY LOAM 5-8 P.Z.** More productive site.
R024XY014NV	**COARSE SILTY 4-8 P.Z.** KRLA2 dominant shrub.
R024XY026NV	**STONY SLOPE 8-10 P.Z.** ARTRW major shrub.
R024XY067NV	**SHALLOW SILTY 5-8 P.Z.** ATCO dominant shrub; less productive site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex confertifolia* (2) *Picrothamnus desertorum*
Herbaceous	(1) *Achnatherum hymenoides*

Physiographic features

This site occurs on alluvial fans on all exposures. Slopes range from 2 to 30 percent, but slope gradients of 2 to 8 percent are most typical. Elevations are 3600 to 6500 feet.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Fan remnant
Elevation	1,097–1,981 m
Slope	2–8%
Aspect	Aspect is not a significant factor

Climatic features

The climate associated with this site is semiarid characterized by cool, moist winters and hot, dry summers. Over

70% of the precipitation occurs from November through May. Average annual precipitation is 5 to 8 inches. Some areas may receive up to 10 inches but effective moisture is reduced by surface runoff. Mean annual air temperature is 45 to 50 degrees F. At the Winnemucca Airport Climate Station (WACS) mean annual precipation is 8.28 inches and mean annual air temperature is 48.9 degrees F. The average growing season is about 90 to 130 days. Optimum growing season of the major plant species is March 15 to April 30.

Mean annual precipitation across the range in which this ecological site occurs in 7.02 inches. Jan 0.75; Feb 0.59; Mar 0.64; Apr 0.68; May 0.90; Jun 0.66; Jul 0.26; Aug 0.27; Sep 0.34; Oct 0.52; Nov 0.67; Dec 0.76. *The above data is averaged from the Golconda and Beowawe climate stations.

Table 3. Representative climatic features

Frost-free period (average)	105 days
Freeze-free period (average)	135 days
Precipitation total (average)	178 mm

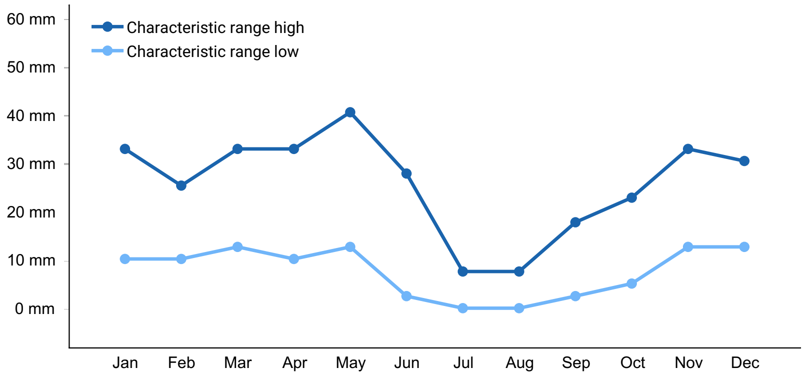


Figure 1. Monthly precipitation range

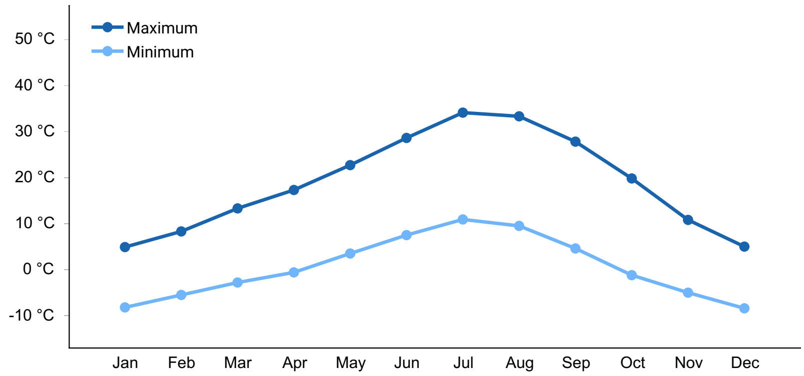


Figure 2. Monthly average minimum and maximum temperature

Influencing water features

Influencing water features are not associated with this site.

Soil features

Soils associated with this site are very deep, well drained and formed in alluvium derived mixed parent material with surficial deposits of loess. The typical soil profile is characterized by an ochric epipedon, a natric horizon with a SAR over 30, and a gravelly surface. These soils are fine in the particle size control section and have less than 25% rock fragments throughout the profile. Soil reaction ranges from moderately to strongly alkaline and the available water holding capacity is high.
The soil temperature regime is mesic and the soil moisture regime is typic aridic.

The typical soil series correlated to this is site is Oxcorel, classified as a fine, smectitic, mesic Durinodic Natrargids.

Other soils associated with this site include Antel, Batan, Beeox, Benin, Beoska, Beowawe, Bighat, Blacka, Blackhawk, Broyles, Bubus, Cleaver, Creemon, Cren, Deppy, Dun Glen, Ganaflan, Gitkaup, Glasshawk, Golconda, Granshaw, Hessing, Jenor, Jerval, Kingingham, Knott, Kortty, Kumiva, Malpais, Mazuma, Misad, Pumper, Raglan, Ragtown, Redflame, Rednik, Relley, Ricert, Sodhouse, Tenabo, Toulon, Trocken, Unsel variant, Weso, and Whirlo.

Where this site is correlated to series formed in residuum/colluvium such as Hoot, Stingdorn, Laped, Osoll, Perlor, McVegas, Koynik and Nopeg, components will be field checked for correlation to R024XY025NV or other appropriate ecological site. Where this site is correlated to Wholan, Rad, Puett var., Kodar var., Unsel var. will also be field checked and correlated as appropriate.

Table 4. Representative soil features

Surface texture	(1) Gravelly very fine sandy loam (2) Fine sandy loam (3) Loamy fine sand
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Slow to moderately slow
Soil depth	152–213 cm
Surface fragment cover <=3"	0–20%
Surface fragment cover >3"	0–5%
Available water capacity (0-101.6cm)	5.08–15.24 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%
Electrical conductivity (0-101.6cm)	0–8 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	13–45
Soil reaction (1:1 water) (0-101.6cm)	7.9–9
Subsurface fragment volume <=3" (Depth not specified)	0–25%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

An ecological site is the product of all the environmental factors responsible for its development and it 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 2013). Biotic factors that influence resilience include site productivity, species composition and structure, and population regulation and regeneration (Chambers et al. 2013).

The plant communities of this site are dynamic in response to changes in disturbance regimes and weather patterns. The reference plant community is dominated by shadscale, bud sagebrush and Indian ricegrass. Squirreltail, needleandthread and Sandberg's bluegrass are present in most areas. Community phase changes are primarily driven by long term drought, abnormally wet seasons, and insect/disease/dodder attack. Historically, wildfire was infrequent and patchy and had a minimal impact. This site likely experienced light grazing disturbance. This site inherently has low resistance to invasion by non-native species and low resilience following invasion by non-native species. In Great Basin ecosystems, inherent resilience typically increases with elevation due to higher levels of water, nutrients and biomass production (Chambers et al. 2012). Management activities should be prioritized based on relative resilience and resistance of a specific ecological site.

Shadscale is a densely clumped, rounded, compact native shrub. It generally attains heights of 8 to 32 inches and widths of 12 to 68 inches (Blaisdell and Holmgren 1984). Shadscale is considered an evergreen to partially deciduous shrub, since a small percentage of leaves are dropped in the winter (Smith and Nobel 1986). Shadscale possesses wider ecological amplitude than most Atriplex species (Crofts and Van Epps 1975), and shows ploidy levels from diploid (2x) to decaploid (10x). The extensive polyploidy of shadscale is an important consideration when implementing revegetation projects because ploidy levels are usually associated with distinct habitats (Sanderson et al. 1990). Diploid individuals are unlikely to perform as well in areas where tetraploids are more common. Diploid individuals generally occur above Pleistocene lake levels, whereas lake floors are usually occupied by autotetraploids. Overall, tetraploids are the most widespread throughout its range (Carlson 1984). Thus, the shadscale most associated with this site is a tetraploid. Bud sagebrush, a common shrub to this ecological site, is a native, summer-deciduous shrub. It is low growing, spinescent, aromatic shrub with a height of 4 to 10 inches and a spread of 8 to 12 inches (Chambers and Norton 1993).

The root systems of desert shrubs generally have equal amounts of resources dedicated to lateral and tap root production (Osmond et al 1990). Extensive tap roots allows shrubs to extract water from deep in the soil profile, while shallow lateral roots can utilize water in the upper profile. Shadscale allocates considerable resources to root growth. Seasonal root growth is linked to soil moisture depletion and soil temperature changes. Production of herbaceous vegetation is relatively low, but is dominated by cool-season bunchgrasses and forbs.

The local patterns of nutrient and salt distribution in shadscale communities are closely associated with the distribution of the perennial vegetation and are the product of nutrient cycling processes, which depend in part on soil microbiological activity. Nutrient cycling processes are concentrated in litter at the soil surface, with most litter concentrated under the shrubs. There is a strong correlation between spring precipitation and plant growth in the shadscale communities. The lack of significant midsummer precipitation restricts growth to the cooler spring months when soil moisture is readily available. Shadscale prefers dry, well-drained, moderately saline soils, where groundwater is below the rooting zone. In general, shadscale inhabits a wide variety of soil textures, possessing no comprehensive edaphic restrictions.
Shadscale occurs in widespread genetically uniform populations on the edaphically consistent soil of the Pleistocene lake bottoms, setting the stage for extensive areas of plant death (Nelson et al. 1990a). Valley bottoms and upland depressions typically exhibit the greatest concentration of die back, due to ponding and run-in moisture. Soils found in this landscape position not course textures and typically have high available water holding capacity. Indian ricegrass, the dominant grass within this site, is a hardy, cool-season, densely tufted, native perennial bunchgrass that grows from 4 to 24 inches in height (Blaisdell and Holmgren 1984). Squirreltail, another native, cool-season perennial bunchgrass, is often a co-dominant with Indian ricegrass.

Shadscale has experienced widespread mortality during periods of above average precipitation (Nelson et al. 1990a). The roots of desert shrubs are sensitive to the level of soil oxygen, waterlogging reduces soil oxygen. Waterlogging causes physiological changes in plants increasing susceptibly to parasite and disease where prolonged period of high soil moisture occur (Nelson et al. 1990a). Periods of elevated precipitation result in increased soil moisture and salinity, which predisposes the roots of the shrubs to pathogenic root rot organisms (Weber et al. 1990). Shadscale is also susceptible to insect attack. Scale insects and mealy bugs have been found in the crown and upper root zone of shadscale plants during periods of dieoff (Nelson et al. 1990b).

Historically, shadscale dominant salt-desert shrub communities were free of exotic invaders; however, excessive grazing pressure during settlement and into the 20th century has increased the overall presence of cheatgrass, halogeton, Russian thistle and weedy mustard species (Peters and Bunting 1994). The lack of continuous fuels to carry fires made fire rare to non-existent in shadscale communities (Young and Tipton 1990), thus it is not surprising that shadscale and bud sagebrush are both fire intolerant (Banner 1992, West 1994). Shadscale does not readily recover from fire, except for establishment through seed (West 1994). The 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 vegetational 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). Grazing exclusion for 2 or more years is beneficial for revegetation of postfire shadscale communities as first year shadscale seedlings lack spines and are highly susceptible to browsing. Spines develop in the second year (Zielinski 1994).

Disturbance Ecology:
The historic fire return interval for shadscale communities is greater than 100 years. Shadscale does not readily recover from fire, except for establishment through seed (West 1994). The lack of continuous fuels to carry fires made fire rare to non-existent in shadscale communities (Young and Tipton 1990), thus it is not surprising that shadscale and bud sagebrush are both fire intolerant (Banner 1992, West 1994). The 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).

Budsage is killed by fire and regenerates from off site seed. Spiny hopsage is considered to be somewhat fire tolerant and often survives fires that kill sagebrush. Mature spiny hopsage generally sprout after being burned. Spiny hopsage is reported to be least susceptible to fire during summer dormancy. Winterfat is either killed or top-killed by fire, depending on fire severity. Severe fire can kill the perennating buds located several inches above the ground surface and thus kills the plant. In addition, severe fire usually destroys seed on the plant. Low-severity fire scorches or only partially consumes the aboveground portions of winterfat and thus does not cause high mortality.

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 and post-fire soil moisture availability will influence plant response.
Indian ricegrass is a deep-rooted, cool season perennial bunchgrass that is adapted primarily to sandy soils. A prominent grass on this site, 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). 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). 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 1972).

Rehabilitation following fire will have limited success. Observations from one hundred and seven separate plantings within the shadscale zone in Utah and Nevada indicate a very low success rate (Bleak et al. 1965). Seed from 148 native and non-native grasses, forbs and shrubs were planted from 1937 to 1962 across ten locations. Good seedling stands were obtained with introduced wheatgrasses, but most perished during the first summer. A few plantings of crested wheatgrass (*Agropyron cristatum*), fairway and Siberian wheatgrass (*Agropyron fragile*) along with Russian wildrye (*Psathyrostachys juncea*) maintained stands for 10 or more years but eventually declined to very few plants (Bleak et al. 1965). The primary cause of seeding failures appeared to be the arid climate.

Shadscale has experienced widespread mortality during periods of drought (Vest 1962) and also periods of above average precipitation (Nelson et al. 1990a). The roots of desert shrubs are sensitive to the level of soil oxygen, waterlogging reduces soil oxygen. Waterlogging causes physiological changes in plants increasing susceptibly to parasite and disease where prolonged periods of high soil moisture occur (Nelson et al. 1990a). Periods of elevated precipitation result in increased soil moisture and salinity, which predisposes the roots of the shrubs to pathogenic root rot organisms (Weber et al. 1990). Shadscale occurs in widespread genetically uniform populations on the edaphically consistent soil of the Pleistocene lake bottoms, setting the stage for extensive areas of plant death (Nelson et al. 1990a). Valley bottoms and upland depressions typically exhibit the greatest concentration of die back, due to ponding and run-in moisture. Shadscale is also susceptible to insect attack. Scale insects and mealy bugs have been found in the crown and upper root zone of shadscale plants during periods of dieoff (Nelson et al. 1990b).

In summary, overgrazing causes a decrease in Indian ricegrass along with bud sagebrush, while shadscale and squirreltail initially increase. 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 1972).

Spring grazing year after year can be detrimental to bud sagebrush and bunchgrasses. Grazing exclusion for 2 or more years is beneficial for revegetation of postfire shadscale communities as first year shadscale seedlings lack spines and are highly susceptible to browsing. Spines develop in the second year (Zielinski 1994). Continued abusive grazing leads to increased bare ground and invasion by annual weeds (e.g., cheatgrass, halogeton, and tansy mustard). Shadscale may become dominant with an annual understory. With further deterioration, shadscale and squirreltail decline, bare ground increases, erosion accelerates and site productivity decreases. On some soils, erosion can result in increased surface salts and development of desert pavement.

Reestablishment of perennials is limited in areas of extensive desert pavement. Fire is a very infrequent and patchy event in these salt desert shrub communities; however, where it has occurred the shrub community is greatly reduced and annual weeds will increase if present.

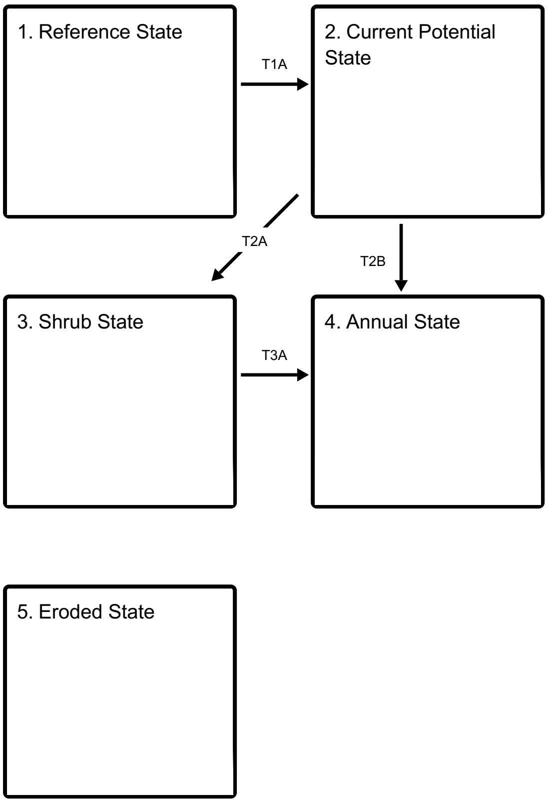
Indian ricegrass has been found to reestablish on burned sites through seed dispersed from adjacent unburned areas (Young 1983). Thus the presence of surviving, seed producing plants is necessary for reestablishment of Indian ricegrass. Grazing management following fire to promote seed production and establishment of seedlings is important.

Bottlebrush squirreltail is moderately tolerant of fire. Post fire regeneration occurs from surving root crown and from on and off site seed sources. Frequency of disturbance largely determines post fire response of squirreltail. Undisturbed plants with in a 6 to 9 year age class generally contain large amounts of dead material, increasing its susceptibly to fire.

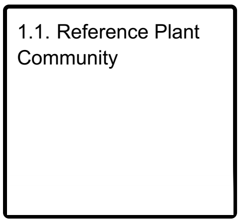
Repeated fire within a 10 to 20 year timeframe has the potential to convert this site to an annual weed dominated system. Knowledge of rehabilitation strategies in these droughty plant communities is limited.

State and transition model

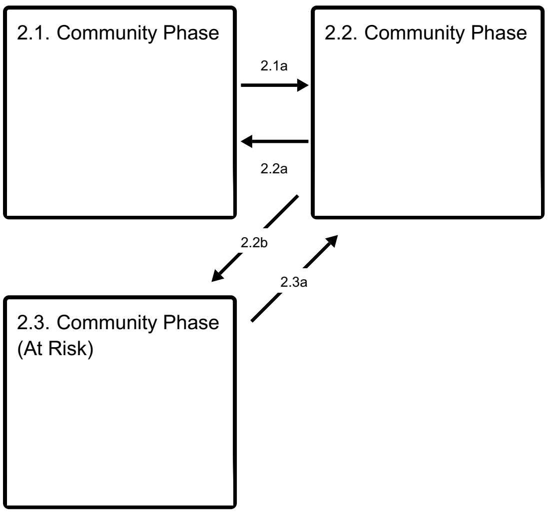
Ecosystem states



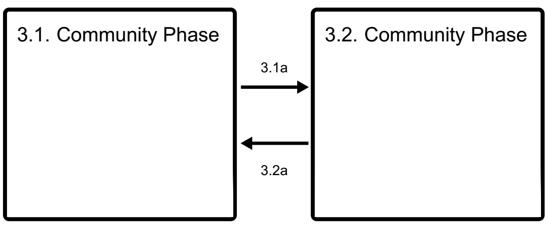
State 1 submodel, plant communities



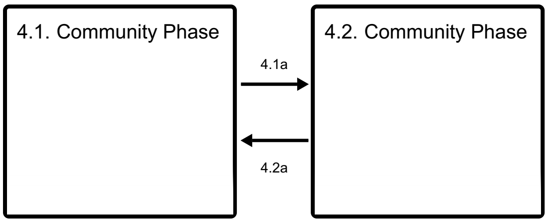
State 2 submodel, plant communities



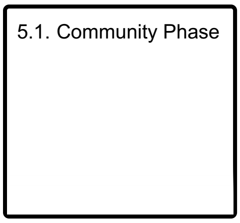
State 3 submodel, plant communities



State 4 submodel, plant communities



State 5 submodel, plant communities



State 1
Reference State

The Reference State 1.0 is a representative of the natural range of variability under pristine conditions. 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 response to long term drought or herbivory. Wet years will increase grass production, while drought years will reduce production. Shrub production will also increase during wet years; however, extreme growing season wet periods has been shown to cause shadscale death.

Community 1.1
Reference Plant Community

This community is dominated by shadscale, bud sagebrush, and Indian ricegrass. Bottlebrush squirreltail, spiny hopsage, and winterfat are important, but minor components within this community. Community phase changes are primarily a function of chronic drought. Drought will favor shrubs over perennial bunchgrasses. However, long-term drought will result in an overall decline in plant community production, regardless of functional group. Extreme growing season wet periods may also reduce the shadscale component. Fire is very infrequent to non-existent.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	235	353	588
Grass/Grasslike	84	127	211
Forb	17	25	41
Total	**336**	**505**	**840**

State 2
Current Potential State

This state is similar to the Reference State 1.0 with the addition of a shadscale and sprouting shrub dominated community phase. 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 do not dominate or control ecological function. 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 phase changes are primarily a function of chronic drought or extreme wet periods. Fire is infrequent and patchy due to low fuel loads.

Community 2.1
Community Phase

Figure 4. Loamy 5-8 Community Phase 2.1 Whirlo Soil T. Stringham June 2010

Figure 5. Loamy 5-8 Community Phase 2.1 Whirlo Soil T. Stringham June 2010

This community is compositionally similar to the reference plant community with a trace of annual non-natives, primarily cheatgrass, halogeton and tansy mustard. Non-native species may also include seeded perennials and parasitic plants like dodder. Ecological resilience is reduced by the presence of non-native species.

Community 2.2
Community Phase

Figure 6. Loamy 5-8 Community Phase 2.2 NV769 MU663 T. Stringham June 2010

Shadscale dominates overstory while rabbitbrush may become sub-dominate and Indian ricegrass and winterfat decrease. Bud sagebrush may become minor component if spring grazed. Sandberg bluegrass may dominate the understory whereas Indian ricegrass becomes a minor component. Bare ground interspaces increase in size and connectivity. Annual non-native weeds such as bur buttercup and halogeton increase. Prolonged drought may lead to an overall decline in the plant community. Extreme wet periods may result in shadscale dieoff.

Community 2.3
Community Phase (At Risk)

Figure 7. Loamy 5-8 Community Phase 2.3 NV 769 MU663 T. Stringham June 2010

Figure 8. Loamy 5-8 Community Phase 2.3 NV 769 MU663 T. Stringham June 2010

This community phase results from the long term reduction of perennial bunchgrasses from competition with shrubs, inappropriate grazing, chronic drought or a combination. Shadscale and rabbitbrush dominate the overstory and perennial bunchgrasses and bud sagebrush are reduced. Annual non-native species may be stable or increasing due to a lack of competition with perennial bunchgrasses. Bare ground may be significant. This community is at risk of crossing a threshold to either State 3.0 (shrub) or State 4.0 (annual).

Pathway 2.1a
Community 2.1 to 2.2

Community Phase

Community Phase

Inappropriate growing season grazing favors unpalatable shrubs over bunchgrasses, winterfat and bud sagebrush. Long term drought will also decrease the perennial bunchgrasses in the understory.

Pathway 2.2a
Community 2.2 to 2.1

Community Phase

Community Phase

Release from drought and/or grazing management that facilitates an increase in perennial grasses and bud sagebrush.

Pathway 2.2b
Community 2.2 to 2.3

Community Phase

Community Phase (At Risk)

Long term drought and/or inappropriate grazing management will significantly reduce perennial grasses, winterfat and bud sagebrush in favor of shadscale and rabbitbrush.

Pathway 2.3a
Community 2.3 to 2.2

Community Phase (At Risk)

Community Phase

Release from drought and/or introduction of grazing management allows for bud sagebrush and perennial grasses to increase.

State 3
Shrub State

This state has one community phase that is characterized by shadscale, bud sagebrush or a sprouting shrub overstory with very little to no understory. The site has crossed a biotic threshold and site processes are being controlled by shrubs. Shrub cover exceeds the 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. Bare ground has increased.

Community 3.1
Community Phase

Figure 9. Loamy 5-8 Community Phase 3.1 NV777 MU615 Weso Soil T. Stringham June 2010

Figure 10. Loamy 5-8 Community Phase 3.1 NV777 MU615 Weso Soil T. Stringham June 2010

Decadent shadscale and bud sagebrush dominate the overstory. Rabbitbrush, spiny hopsage and other sprouting shrubs may be a significant component of the shrub overstory. Native perennial bunchgrasses may be present in trace amounts. Annual non-native species are common and increasing. Bare ground is significant.

Community 3.2
Community Phase

Rabbitbrush, spiny hopsage and other sprouting shrubs increasing. Shadscale and bud sagebrush may be present. Seeded perennial bunchgrasses may be present in trace amounts. Annual non-native species are common and increasing. Bare ground is significant.

Pathway 3.1a
Community 3.1 to 3.2

Failed attempt at shrub management and seeding of desired species using minimal soil disturbing practices.

Pathway 3.2a
Community 3.2 to 3.1

Absence of disturbance and natural regeneration over time allows shadscale to increase and dominate the overstory.

State 4
Annual State

This state consists of two community phases; an annual species dominant state and a shadscale/rabbitbrush dominant state with an annual understory. In this state, a biotic threshold has been crossed and state dynamics are driven by the dominance and persistence of the annual plant community which is perpetuated by a shortened fire return interval. The herbaceous understory is dominated by annual non-native species such as cheatgrass and halogeton. Bare ground may be abundant. Resiliency has declined and further degradation from fire facilitates a cheatgrass and sprouting shrub plant community. The fire return interval has shortened due to the dominance of cheatgrass in the understory and is a driver in site dynamics.

Community 4.1
Community Phase

Figure 11. Loamy 5-8 P.Z. Community Phase 4.1 NV769 MU663 T. Stringham June 2010

Figure 12. Loamy 5-8 P.Z. Community Phase 4.1 NV769 MU663 T. Stringham June 2010

Figure 13. Loamy 5-8 P.Z. Community Phase 4.1 NV769 MU663 T. Stringham June 2010

This plant community phase is dominated by non-native annual species. Desert pavement and salt affected areas are present on some soils. This plant community is at-risk of increased erosion and soil loss or redistribution and reoccurring fire driven by fine fuels. Prescribed grazing may be used to reduce fuel loading and the cheatgrass seedbank. However, caution should be exercised; inappropriate grazing management resulting in the complete defoliation of the site will lead to a more degraded state, resulting in and Eroded state 5.0.

Community 4.2
Community Phase

Figure 14. Loamy 5-8 Community Phase 4.2 NV777 MU663 P. Novak-E June 2010

Figure 15. Loamy 5-8 Community Phase 4.2 NV777 MU663 P. Novak-E June 2010

This community is dominated by annual non-native forbs. Forage kochia, shadscale and/or rabbitbrush along with other seeded species may be present in the community. This site is at risk of increased erosion and soil loss and an increase risk of fire due to fine fuel loads.

Pathway 4.1a
Community 4.1 to 4.2

Community Phase

Community Phase

Seeding of shrub species may result in an increase in shadscale, forage kochia and other species on this site (probability of success is very low).

Pathway 4.2a
Community 4.2 to 4.1

Community Phase

Community Phase

Fire

State 5
Eroded State

Community 5.1
Community Phase

This community is the result of extreme soil loss and redistribution. The vegetative cover is minimal, but is dominated by introduced non-native grasses and/or forbs. Desert pavement is extensive. Ecological function is controlled by soil erosion, wind and warm soil temperatures. Rehabilitation technologies for this community phase are unknown.

Transition T1A
State 1 to 2

Trigger: This transition is caused by the introduction of non-native annual plants, such as halogeton, mustards 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 T2A
State 2 to 3

Trigger: Inappropriate grazing management and/or prolonged drought will decrease or eliminate deep rooted perennial bunchgrasses and favor shrub growth and establishment. Slow variables: Long term decrease in grass density and reduced native species (shrub and grass) recruitment rates. Increased reproduction of non-native invasive species. Threshold: Loss of deep-rooted perennial bunchgrasses changes nutrient cycling, nutrient redistribution, and reduces soil organic matter.

Transition T2B

State 2 to 4

Trigger: Fire and/or soil disturbing treatments such as drill seeding and plowing. An unusually wet spring may facilitate the increased germination and production of cheatgrass leading to its dominance within the community. Slow variables: Increased production and cover 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. Increased, continuous fine fuels from annual non-native plants modify the fire regime by changing intensity, size and spatial variability of fires.

Transition T3A
State 3 to 4

Trigger: Fire and/or soil disturbing treatments such as drill seeding and plowing. Slow variables: Increased production and cover of non-native annual species. Threshold: Increased, continuous fine fuels modify the fire regime by changing intensity, size and spatial variability of fires. Changes in plant community composition and spatial variability of vegetation due to the loss of perennial bunchgrasses and sagebrush 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 (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Primary Perennial Grasses**			36–151	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	26–101	–
	squirreltail	ELEL5	*Elymus elymoides*	10–50	–
2	**Secondary Perennial Grasses**			10–26	
	needle and thread	HECO26	*Hesperostipa comata*	2–16	–
	Sandberg bluegrass	POSE	*Poa secunda*	2–16	–
Forb					
3	**Perennial Forbs**			10–40	
	globemallow	SPHAE	*Sphaeralcea*	2–10	–
	Indian paintbrush	CASTI2	*Castilleja*	1–3	–
4	**Annual Forbs**			1–16	
	slender phlox	MIGRG4	*Microsteris gracilis var. gracilis*	0–6	–
Shrub/Vine					
5	**Primary Shrubs**			272–405	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	151–202	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	101–151	–
	spiny hopsage	GRSP	*Grayia spinosa*	10–26	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	10–26	–
6	**Secondary Shrubs**			10–50	
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	6–16	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	6–16	–
	horsebrush	TETRA3	*Tetradymia*	6–16	–

Animal community

Livestock Interpretations:
This site has value for livestock grazing. Grazing management should be keyed to dominant grasses and palatable

shrubs.

Historically, shadscale plant communities provided good winter forage for the expanding sheep and cattle industry in the arid West. Shadscale is a valuable browse species for a wide variety of wildlife and livestock (Blaisdell and Holmgren 1984). The spinescent growth habit of shadscale lends to its browsing tolerance with no more than 15 to 20% utilization by sheep being reported (Blaisdell and Holmgren 1984) and significantly less utilization by cattle. Increased presence of shadscale within grazed versus ungrazed areas is generally a result of the decreased competition from more heavily browsed associates (Cibils et al. 1998). Reduced competition from more palatable species in heavily grazed areas may increase shadscale germination and establishment. Chambers and Norton (1993) found shadscale establishment higher under spring than winter browsing as well as heavy compared to light browsing ($p<0.01$). During years of below average precipitation, shadscale is very susceptible to grazing pressure regardless of season (Chambers and Norton 1993).

Bud sagebrush is also a palatable, nutritious forage for domestic sheep in winter, particularly late winter (Johnson 1978), however, it can be poisonous or fatal to calves when eaten in quantity (Stubbendieck et al. 1992). Bud sagebrush is highly susceptible to effects of browsing. It decreases under browsing due to year-long palatability of its buds and is particularly susceptible to browsing in the spring when it is physiologically most active (Chambers and Norton 1993). Heavy browsing (>50%) may kill bud sagebrush rapidly (Wood and Brotherson 1986). Spiny hopsage provides a palatable and nutritious food source for livestock, particularly during late winter through spring. Domestic sheep browse the succulent new growth of spiny hopsage in late winter and early spring. 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. Heavy spring grazing has been found to sharply reduce the vigor of Indian ricegrass and decrease the stand (Cook and Child 1971). In eastern Idaho, productivity of Indian ricegrass was at least 10 times greater in undisturbed plots than in heavily grazed ones (Pearson 1976). 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.

Bottlebrush squirreltail is very palatable winter forage for domestic sheep of Intermountain ranges. Domestic sheep relish the green foliage. 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.
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:
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. Budsage is palatable, nutritious forage for upland game birds, small game and big game in winter. Budsage is browsed by mule deer in Nevada in winter and is utilized by bighorn sheep in summer, but the importance of budsage in the diet of bighorns is not known. Budsage comprises 18 – 35% of a pronghorn’s diet during the spring where it is available. Chukar will utilize the leaves and seeds of bud sage. Budsage is highly susceptible to effects of browsing. It decreases under browsing due to year-long palatability of its buds and is particularly susceptible to browsing in the spring when it is physiologically most active. Spiny hopsage provides a palatable and nutritious food source for big game animals. Spiny hopsage is used as forage to at least some extent by domestic goats, deer, pronghorn, and rabbits. Winterfat is an important forage plant for wildlife, especially during winter when forage is scarce. Winterfat seeds are eaten by rodents and are a staple food for black-tailed jackrabbits. Mule deer and pronghorn antelope browse winterfat. Winterfat is used for cover by rodents. It is potential nesting cover for upland game birds, especially when grasses grow up through its

crown. 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. Bottlebrush squirreltail is a dietary component of several wildlife species. Bottlebrush squirreltail may provide forage for mule deer and pronghorn.

Hydrological functions

Runoff is very low to very high. Permeability is very slow to moderately rapid. Hydrologic soil groups are A, B, and C. Rills are none to rare. A few can be expected on steeper slopes in areas subjected to summer convection storms or rapid spring snowmelt. Waterflow patterns are often numerous in areas subjected to summer convection storms. Flow patterns short and stable. Pedestals are none to rare with occurrence typically limited to areas within water flow patterns. Gullies are none. Sparse shrub canopy and associated litter break raindrop impact. Medium to coarse textured surface soils have moderate to rapid infiltration and medium runoff.

Recreational uses

In average and above average precipitation years, this site produces minor amounts of flowering forbs. This site has some potential for upland bird and big game hunting.

Other products

Seeds of shadscale were used by Native Americans for bread and mush. Some Native American peoples traditionally ground parched seeds of spiny hopsage to make pinole flour. Indian ricegrass was traditionally eaten by some Native Americans. The Paiutes used seed as a reserve food source.

Other information

Spiny hopsage has moderate potential for erosion control and low to high potential for long-term revegetation projects. It can improve forage, control wind erosion, and increase soil stability on gentle to moderate slopes. Spiny hopsage is suitable for highway plantings on dry sites in Nevada. 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. Bottlebrush squirreltail is tolerant of disturbance and is a suitable species for revegetation.

Type locality

Location 1: Lander County, NV	
Township/Range/Section	T24N R41E S12
UTM zone	N
UTM northing	4412890
UTM easting	473276
Latitude	39° 57′ 53″
Longitude	117° 18′ 46″
General legal description	About 1 mile south of Red Butte, Antelope Valley area, Lander County, Nevada. This site also occurs in Eureka, Humboldt, and Pershing counties, Nevada.

Location 2: Eureka County, NV	
Township/Range/Section	T20N R53E S16
UTM zone	N
UTM northing	4384629
UTM easting	584991

Latitude	39° 36′ 25″
Longitude	116° 0′ 35″
General legal description	SW¼NE¼ About 7 miles northeast of Eureka at Eureka airport, Eureka County, Nevada. This site also occurs in Humboldt, Lander, and Pershing Counties, 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)	Patti Novak-Echenique
Contact for lead author	State Rangeland Management Specialist
Date	12/02/2009
Approved by	PNovak-Echenique
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills are none to rare. A few can be expected on steeper slopes in areas subjected to summer convection storms or rapid spring snowmelt.

2. **Presence of water flow patterns:** Waterflow patterns are often numerous in areas subjected to summer convection storms. Flow patterns short (<2 m) and stable.

3. **Number and height of erosional pedestals or terracettes:** Pedestals are none to rare with occurrence typically limitec to areas within water flow patterns.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare Ground 50-80% depending on amount of rock fragments.

5. **Number of gullies and erosion associated with gullies:** None

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

7. **Amount of litter movement (describe size and distance expected to travel):** Fine litter (foliage from grasses and annual & perennial forbs) expected to move distance of slope length during intense summer convection storms or rapid snowmelt events. Persistent litter (large woody material) will remain in place except during large rainfall events.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil stability values should be 2 to 4 on most soil textures found on this site.(To be field tested.)

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Surface structure is very thin to thick platy or prismatic. Soil surface colors are light and soils are typified by an ochric epipedon. Organic matter of the surface 2 to 3 inches is less than 1 percent.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Sparse shrub canopy and associated litter provide some protection from raindrop impact. Shrub cover and perennial bunchgrasses enhance infiltration and reduce runoff.

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, platy, prismatic, calcic, or massive sub-surface horizons or duripans are not to be interpreted as compacted layers.

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 Plant Community: Salt desert shrubs (shadscale & bud sagebrush)

    Sub-dominant: deep-rooted, cool season, perennial bunchgrasses > shallow-rooted, cool season, perennial bunchgrasses > associated shrubs > deep-rooted, cool season, perennial forbs = fibrous, shallow-rooted, cool season, annual and perennial forbs

    Other:

    Additional:

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; mature bunchgrasses commonly (±25%) have dead centers.

14. **Average percent litter cover (%) and depth (in):** Between plant interspaces (± 5%) 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 (through May) ± 450 lbs/ac; Spring moisture significantly affects total production. Favorable years ± 750 lbs/ac and unfavorable years ± 300 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 bur buttercup, halogeton, Russian thistle, annual mustards, and cheatgrass.

17. **Perennial plant reproductive capability:** All functional groups should reproduce in average and above average growing season years. Little to know growth occurs during extended drought periods.