USDA Natural Resources
Conservation Service

Ecological site R024XY025NV
LOAMY SLOPE 5-8 P.Z.

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General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

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 area are generally characterized by a mesic soil temperature regime, an aridic soil moisture regime and mixed geology. They are generally well drained, loamy and very deep.
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.

Ecological site concept

This ecological site found on hills and low mountains. Soils are shallow to bedrock, well drained and formed in residuum/colluvium derived from volcanics. Soils are characterized by an ochric epipedon and greater than 35 percent rock fragments throughout. The plant community is dominated by shadscale, bud sagebrush and squireltail. Important abiotic factors include low AWC and low precipitation. Shallow depth and coarse fragments in the profile occupy plant growing space and reduce the available water capacity.

Associated sites

R024XY058NV	**SANDY LOAM 8-10 P.Z.** This site is found on fan remnants. Soils are moderately deep to a duripan, well drained and formed in alluvium derived from mixed alluvium. The soil profile was characterized by an ochric epipedon and a cambic horizon.

R024XY020NV	**DROUGHTY LOAM 8-10 P.Z.** The soils associated with this ecological site are deep, well drained, and formed in alluvium derived from mixed parent material. The soil profile is characterized by an ochric epipedon and high amounts of sand and gravel below 16 inches (40cm). Soil temperature regime is mesic. This site includes limited available soil moisture due to texture and precipitation zone. Plant available water is influenced by soil texture, presence and abundance of rock fragments, soil depth, aspect, elevation and landscape position.
R024XY030NV	**SHALLOW CALCAREOUS LOAM 8-10 P.Z.** The soils are shallow to a duripan, well drained and formed in loess with a component of volcanic ash and alluvium derived from mixed parent material. The soil profile is characterized by an ochric epipedon, effervescence throughout the profile and less than 35 percent rock fragments by volume.

Similar sites

R024XY005NV	**LOAMY 8-10 P.Z.** Moisture is important for deep-rooted perennial bunchgrasses, such as Thurber's needlegrass (ACTH7) found on this site. This contributes greatly to the higher herbaceous productivity on this ecological site than what the precipitation zone alone would indicate.
R024XY045NV	**ERODED SLOPE 6-10 P.Z.** Less productive site. Indian ricegrass (ACHY) is the dominant grass.
R024XY026NV	**STONY SLOPE 8-10 P.Z.** Wyoming big sabebrush (ARTRW8) major shrub.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex confertifolia* (2) *Picrothamnus desertorum*
Herbaceous	(1) *Achnatherum speciosum* (2) *Elymus elymoides*

Physiographic features

This site is on side slopes of low mountains and hills on all exposures. Slopes range from 4 to 50 percent, but slope gradients of 15 to 50 percent are typical. Elevations are 4000 to about 6000 feet (1219 to 1829 m).

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Mountain slope
Runoff class	Very high
Flooding frequency	None
Ponding frequency	None
Elevation	4,000–6,000 ft
Slope	15–50%
Water table depth	72 in
Aspect	Aspect is not a significant factor

Climatic features

The climate associated with this site is semiarid and characterized by cool, moist winters and warm, dry summers. Average annual precipitation is 5 to 8 inches (13 to 20cm). Mean annual air temperature is 45 to 53 degrees F. The average growing season is about 100 to 130 days.

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 (characteristic range)	85-92 days
Freeze-free period (characteristic range)	103-110 days
Precipitation total (characteristic range)	8-9 in
Frost-free period (actual range)	83-94 days
Freeze-free period (actual range)	101-112 days
Precipitation total (actual range)	7-9 in
Frost-free period (average)	89 days
Freeze-free period (average)	107 days
Precipitation total (average)	8 in

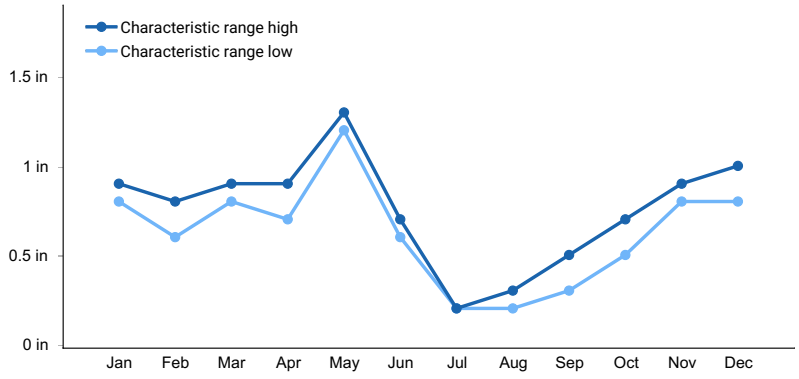

Figure 1. Monthly precipitation range

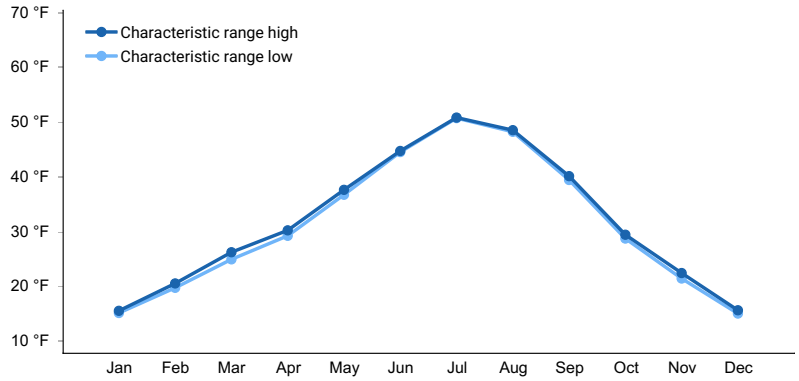

Figure 2. Monthly minimum temperature range

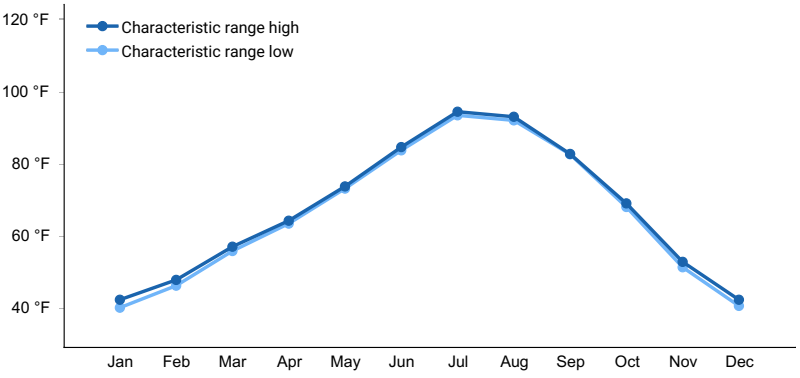

Figure 3. Monthly maximum temperature range

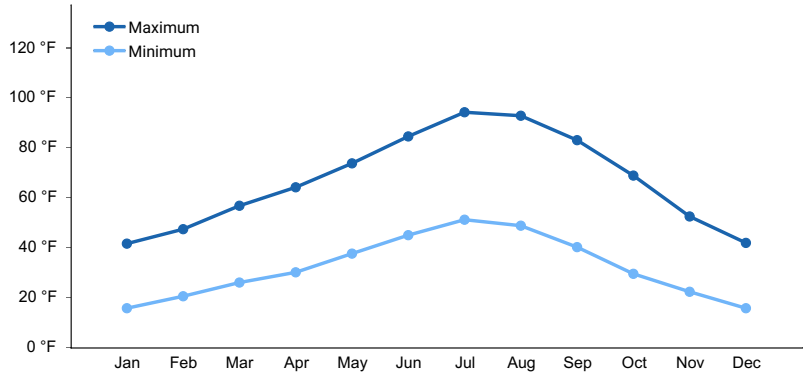

Figure 4. Monthly average minimum and maximum temperature

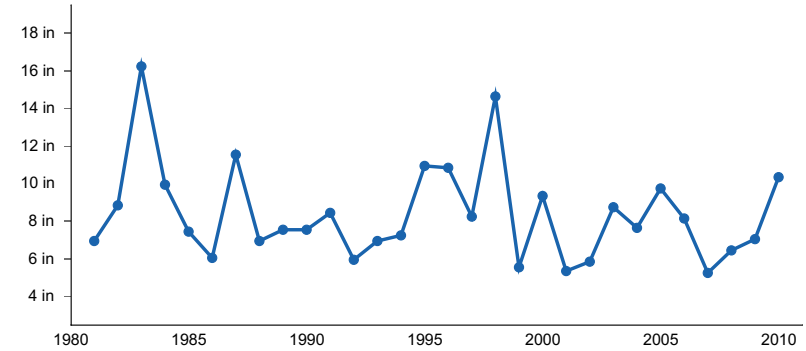

Figure 5. Annual precipitation pattern

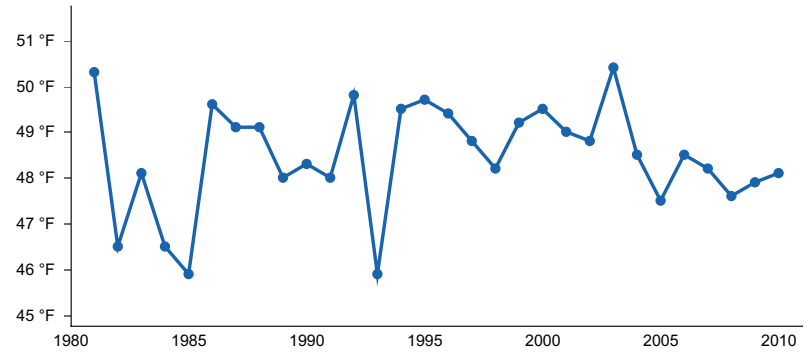

Figure 6. Annual average temperature pattern

Climate stations used

- (1) BEOWAWE [USC00260795], Crescent Valley, NV
- (2) GOLCONDA [USC00263245], Golconda, NV

Influencing water features

Influencing water features are not associated with this site.

Soil features

The soils associated with this site are shallow, well drained and formed in colluvium/residuum derived from metamorphic and volcanic parent material. The soil profile is characterized by and ochric epipedon and greater than 35 percent rock fragments distributed throughout the profile. Soil reaction is slightly to moderately alkaline. Available water capacity is very low, and soils are subject to very high runoff. Potential for sheet and rill erosion is moderate to severe depending on slope and surface rock fragments.
The representative soil associated with this site is Hoot, classified as a loamy-skeletal, mixed, superactive, mesic Lithic Haplargids.
Additional soil series associated with this site include Blackhawk and Koynik.

Table 4. Representative soil features

Parent material	(1) Colluvium–volcanic breccia (2) Residuum–metasedimentary rock
Surface texture	(1) Very cobbly loam (2) Gravelly loam (3) Very gravelly loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Soil depth	10–20 in
Surface fragment cover <=3"	15–54%
Surface fragment cover >3"	2–23%
Available water capacity (0-40in)	0.6–2.9 in
Calcium carbonate equivalent (0-40in)	0–5%
Electrical conductivity (0-40in)	0–4 mmhos/cm
Sodium adsorption ratio (0-40in)	1–12
Soil reaction (1:1 water) (0-40in)	7.4–9
Subsurface fragment volume <=3" (Depth not specified)	16–69%
Subsurface fragment volume >3" (Depth not specified)	2–9%

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).

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). 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 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).
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).

Fire Ecology:
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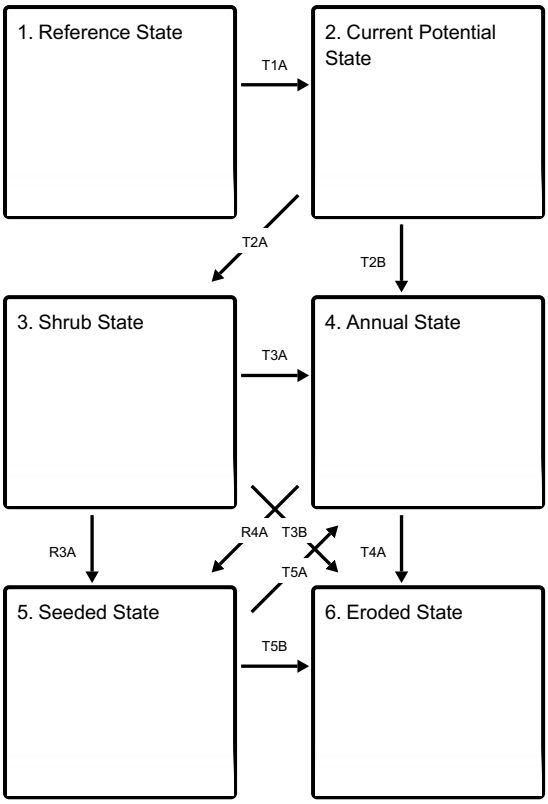
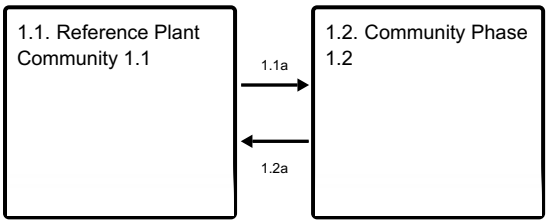
The effect of fire on bunchgrasses relates to culm density, culm-leaf morphology, and the size of the plant. The initial condition of bunchgrasses within the site along with seasonality and intensity of the fire all factor into the individual species response. For most forbs and grasses the growing points 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.

State and transition model

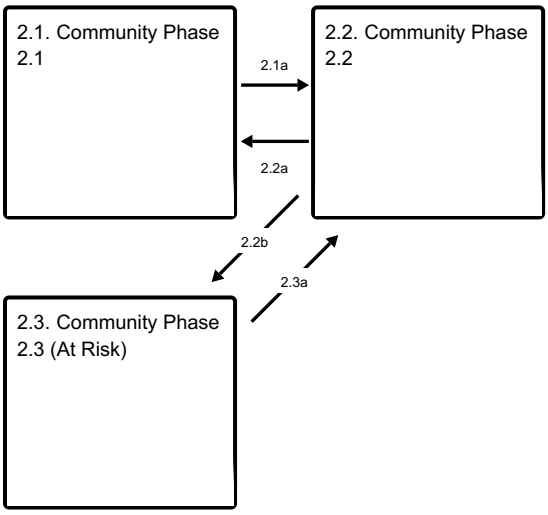
Ecosystem states



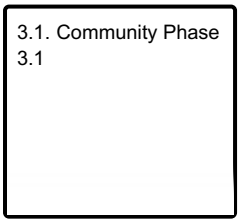
State 1 submodel, plant communities



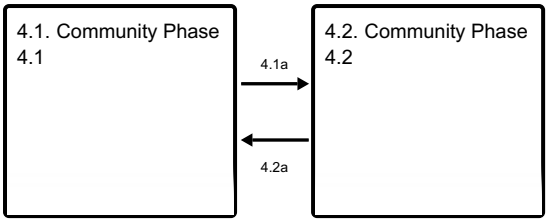
State 2 submodel, plant communities



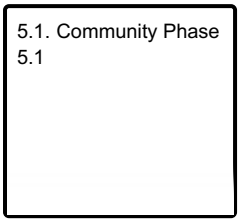
State 3 submodel, plant communities



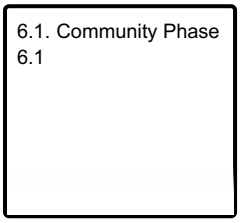
State 4 submodel, plant communities



State 5 submodel, plant communities



State 6 submodel, plant communities



State 1
Reference State

The Reference State 1.0 is a representative of the natural range of variability under pristine conditions. The Reference State has two general community phases: a shrub-grass dominant phase and a shrub dominant phase. State dynamics are maintained by interactions between climatic patterns and disturbance regimes. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These include the presence of all structural and functional groups, low fine fuel loads, and retention of organic matter and nutrients. 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 1.1

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 (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	56	113	188
Grass/Grasslike	15	30	50
Forb	4	7	12
Total	**75**	**150**	**250**

Community 1.2

Community Phase 1.2

Shadscale dominates overstory. Bud sagebrush may be co-dominate. Perennial bunchgrasses decrease with drought and are a minor component. If present, Sandberg bluegrass dominates understory.

Pathway 1.1a
Community 1.1 to 1.2

Long-term drought, extreme wet periods and/or herbivory. Drought will favor shrubs over perennial bunchgrasses. Extreme wet periods will reduce the shadscale component.

Pathway 1.2a
Community 1.2 to 1.1

Release from drought and/or herbivory would allow the vegetation to increase and bare ground would eventually decrease. Extreme growing season wet period may reduce shadscale.

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 will not become dominant within this State. These non-natives can be highly flammable and can promote fire where historically fire had been infrequent. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These feedbacks include the presence of all structural and functional groups, low fine fuel loads, and retention of organic matter and nutrients. Positive feedbacks decrease ecosystem resilience and stability of the state. These include the non-natives' high seed output, persistent seed bank, rapid growth rate, ability to cross pollinate, and adaptations for seed dispersal.

Community 2.1
Community Phase 2.1

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 phase changes are primarily a function of chronic drought or extreme wet periods. Fire is infrequent and patchy due to low fuel loads.

Community 2.2
Community Phase 2.2

Shadscale dominates overstory while rabbitbrush may become sub-dominate. 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. Wet periods may decrease the shadscale component, if present.

Community 2.3
Community Phase 2.3 (At Risk)

Shadscale and rabbitbrush dominates the overstory and perennial bunchgrasses and bud sagebrush are reduced, either from competition with shrubs, inappropriate grazing, chronic drought or a combination. 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

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

Release from drought and/or grazing management that facilitates an increase in perennial grasses and bud sagebrush. Extreme growing season wet period may reduce shadscale.

Pathway 2.2b
Community 2.2 to 2.3

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

Pathway 2.3a
Community 2.3 to 2.2

Release from drought and/or inappropriate grazing allows for bud sagebrush and perennial grasses to increase. Extreme growing season wet period may reduce shadscale.

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 3.1

Decadent shadscale and bud sagebrush dominate the overstory. Rabbitbrush and/or other sprouting shrubs may be a significant component or dominant shrub. Deep-rooted perennial bunchgrasses may be present in trace amounts or absent from the community. Annual non-native species increase. Bare ground is significant.

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 4.1

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 4.2

This community is dominated by shadscale and/or rabbitbrush with annual non-native species dominating the understory. Forage kochia and 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 the fine fuel loads.

Pathway 4.1a
Community 4.1 to 4.2

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

Fire

State 5
Seeded State

This state has one community phase which is characterized by a dominance of seeded species most commonly forage kochia. Other seeded species such as crested wheatgrass and Russian wildrye may be present on the site. Annual non-native species are present to increasing.

Community 5.1
Community Phase 5.1

This phase is dominated by seeded species such as forage kochia. Other seeded species may be present. Native species such as shadscale and squirreltail may be present. Annual non-native species are present and may be increasing.

State 6
Eroded State

This state consists of one community phase. This state is characterized by the loss of vegetative cover, redistribution and loss of the soil surface, as well as, increasing cover of desert pavement. Feedbacks contributing to the stability of this state include soil loss, nutrient loss, soil surface degradation and increased area, distribution and connectivity between patches of bare soil. This state has only one community phase, described below.

Community 6.1
Community Phase 6.1

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. Site function is controlled by soil erosion, wind and soil temperature. Rehabilitation of this community is 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.

Restoration pathway R3A
State 3 to 5

Shrub management and seeding of desired species with minimal soil disturbance. This pathway has a low probability of success due to the arid climate of these sites (see Ecological Dynamics and Disturbance Response, Fire Ecology).

Transition T3B
State 3 to 6

Trigger: Multiple fires and/or failed seeding and other soil disturbing treatments such as drill seeding, roller chopper, Lawson aerator etc. Slow variables: Increased, continuous fine fuels modify the fire regime by changing intensity, size and spatial variability of fires. Threshold: Increased wind erosion resulting in soil loss preventing the establishment of native perennials. 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.

Restoration pathway R4A
State 4 to 5

Seeding of perennial species. This pathway has a low probability of success due to the arid climate of these sites (see Ecological Dynamics and Disturbance Response, Fire Ecology).

Transition T4A
State 4 to 6

Trigger: Severe drought, multiple fires (typically occurring within 15 years) or inadequate rest and recovery from defoliation, coupled with soil loss and redistribution caused by an intense rain or wind event. Slow variables: Long term decrease in grass density and reduced native species (shrub and grass) recruitment rates. Long term soil movement and soil loss. Threshold: Increased overland flow and reduced soil moisture due to extensive bare ground.

Transition T5A
State 5 to 4

Trigger: Catastrophic fire Slow variable: Increased production and cover of non-native annual species. Threshold: Cheatgrass or other non-native annuals dominate the understory.

Transition T5B
State 5 to 6

Not in narrative

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Primary Perennial Grasses**			16–30	
	desert needlegrass	ACSP12	*Achnatherum speciosum*	8–15	–
	squirreltail	ELEL5	*Elymus elymoides*	8–15	–
2	**Secondary Perennial Grasses**			3–15	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	1–8	–
	needle and thread	HECO26	*Hesperostipa comata*	1–8	–
	Sandberg bluegrass	POSE	*Poa secunda*	1–8	–
Forb					
3	**Perennial Forbs**			3–12	
	globemallow	SPHAE	*Sphaeralcea*	1–3	–
4	**Annual Forbs**			1–5	
Shrub/Vine					
5	**Primary Shrubs**			68–120	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	45–75	–
6	**Secondary Shrubs**			8–23	
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	2–8	–
	spiny hopsage	GRSP	*Grayia spinosa*	2–8	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	2–8	–

Animal community

Livestock Interpretations:
This site has limited value for livestock grazing, due to the low forage production and steep slopes. Grazing management should be keyed to dominant grasses and palatable shrubs production. Shadscale is a valuable browse species, providing a source of palatable, nutritious forage for a wide variety of livestock. Shadscale provides good browse for domestic sheep. Shadscale leaves and seeds are an important component of domestic sheep and cattle winter diets. Budsage is palatable and nutritious forage for domestic sheep in the winter and spring although it is known to cause mouth sores in lambs. Budsage can be poisonous or fatal to calves when eaten in

quantity. Budsage, while desired by cattle in spring, is poisonous to cattle when consumed alone. 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. Desert needlegrass produces considerable basal foliage and is good forage while young. Young desert needlegrass is palatable to all classes of livestock. Mature herbage is moderately grazed by horses and cattle but rarely grazed by sheep.

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. Bud sage 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. Bottlebrush squirreltail is a dietary component of several wildlife species. Bottlebrush squirreltail may provide forage for mule deer and pronghorn. Desert bighorn sheep and feral horses and burros will graze desert needlegrass.

Hydrological functions

Runoff is very high. Permeability is moderately slow to moderate. Hydrologic soil group is D. Rills are none to rare. Rock fragments armor the soil surface. Water flow patterns are none to rare. Pedestals are none to rare. Occurrence is usually limited to areas of water flow patterns. Frost heaving of shallow rooted plants should not be considered a "normal" condition. Gullies are none. Perennial herbaceous plants slow runoff and increase infiltration. Shrub canopy and associated litter break raindrop impact and provide opportunity for snow catch and accumulation on 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 bird and big game hunting.

Other products

Seeds of shadscale were used by Native Americans for bread and mush.

Other information

Bottlebrush squirreltail is tolerant of disturbance and is a suitable species for revegetation. Desert needlegrass may be used for groundcover in areas of light disturbance, but it is susceptible to excessive trampling.

Inventory data references

NASIS soil component data.

Type locality

Location 1: Humboldt County, NV	
Township/Range/Section	T35N R34E S20
UTM zone	N

UTM northing	4527565
UTM easting	400229
Latitude	40° 53′ 35″
Longitude	118° 11′ 3″
General legal description	SE¼ About ¼ mile southwest of the Golden Eagle Mine, Eugene Mountains, Humboldt County, Nevada.

Other references

Fire Effects Information System (Online; http://www.fs.fed.us/database/feis/plants/).

USDA-NRCS Plants Database (Online; http://www.plants.usda.gov).

Contributors

CP/GKB

Approval

Kendra Moseley, 3/07/2025

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	02/05/2010
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills are none to rare. Rock fragments armor the soil surface.

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2. **Presence of water flow patterns:** Water flow patterns are none to rare.

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3. **Number and height of erosional pedestals or terracettes:** Pedestals are none to rare. Occurrence is usually limited to areas of water flow patterns. Frost heaving of shallow rooted plants should not be considered a "normal" condition.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is ± 20-30%.

5. **Number of gullies and erosion associated with gullies:** Gullies are 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 catastrophic 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 3 to 6 on most soil textures found on this site. Areas of this site occurring on soils that have a physical crust will probably have stability values less than 3. (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 fine to thick platy. Soil surface colors are dark and soils are typified by an ochric epipedon. Organic matter of the surface 2 to 3 inches is typically 0.1 to 1.5 percent dropping off quickly below. Organic matter content can be more or less depending on micro-topography.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Perennial herbaceous plants slow runoff and increase infiltration. Shrub canopy and associated litter break raindrop impact and provide opportunity for snow catch and accumulation on site.

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 not typical. Subangular blocky, platy, or massive sub-surface horizons or subsoil argillic horizons 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: Short statured shrubs (i.e., shadscale)

    Sub-dominant: Deep-rooted, cool season, perennial bunchgrasses > associated shrubs > shallow-rooted, cool season, perennial bunchgrasses > deep-rooted, cool season, perennial forbs = fibrous, shallow-rooted, cool season, perennial and annual 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 25% of total woody canopy; some of the mature bunchgrasses (<20%) have dead centers.

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14. **Average percent litter cover (%) and depth (in):** Within plant interspaces (± 20%) and depth of litter is <½ inch.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** For normal or average growing season (end of May) ± 150 lbs/ac; Spring moisture significantly affects total production.

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** Increasers include Douglas rabbitbrush and shadscale. Invaders include halogeton, Russian thistle, bassia, annual mustards, and cheatgrass.

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17. **Perennial plant reproductive capability:** All functional groups should reproduce in average (or normal) and above average growing season years.
