USDA Natural Resources Conservation Service

Ecological site R028BY013NV
SILTY 8-10 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): 028B–Central Nevada Basin and Range

MLRA 28B occurs entirely in Nevada and comprises about 23,555 square miles (61,035 square kilometers). More than nine-tenths of this MLRA is federally owned. This area is in the Great Basin Section of the Basin and Range Province of the Intermontane Plateaus. It is an area of nearly level, aggraded desert basins and valleys between a series of mountain ranges trending north to south. The basins are bordered by long, gently sloping to strongly sloping alluvial fans. The mountains are uplifted fault blocks with steep sideslopes. Many of the valleys are closed basins containing sinks or playas. Elevation ranges from 4,900 to 6,550 feet (1,495 to 1,995 meters) in the valleys and basins and from 6,550 to 11,900 feet (1,995 to 3,630 meters) in the mountains.
The mountains in the southern half are dominated by andesite and basalt rocks that were formed in the Miocene and Oligocene. Paleozoic and older carbonate rocks are prominent in the mountains to the north. Scattered outcrops of older Tertiary intrusives and very young tuffaceous sediments are throughout this area. The valleys consist mostly of alluvial fill, but lake deposits are at the lowest elevations in the closed basins. The alluvial valley fill consists of cobbles, gravel, and coarse sand near the mountains in the apex of the alluvial fans. Sands, silts, and clays are on the distal ends of the fans.
The average annual precipitation ranges from 4 to 12 inches (100 to 305 millimeters) in most areas on the valley floors. Average annual precipitation in the mountains ranges from 8 to 36 inches (205 to 915 millimeters) depending on elevation. The driest period is from midsummer to midautumn. The average annual temperature is 34 to 52 degrees F (1 to 11 degrees C). The freeze-free period averages 125 days and ranges from 80 to 170 days, decreasing in length with elevation.
The dominant soil orders in this MLRA are Aridisols, Entisols, and Mollisols. The soils in the area dominantly have a mesic soil temperature regime, an aridic or xeric soil moisture regime, and mixed or carbonatic mineralogy. They generally are well drained, loamy or loamyskeletal, and shallow to very deep.
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. The eastern portion of the state receives noteworthy summer thunderstorms generated

from monsoonal moisture pushed up from the Gulf of California, known as the North American monsoon. The monsoon system peaks in August and by October the monsoon high over the Western U.S. begins to weaken and the precipitation retreats southward towards the tropics (NOAA 2004).

Ecological site concept

This site occurs on inset fans and fan skirts. Slope gradients from 2 to 8 percent are typical. Elevations are 4700 to 6700 feet. The soils associated with this site are very deep, well drained and have silt loam or very fine sandy loam textures throughout. Soils correlated to this site have an ochric epipedon, no rock fragments on the surface and are modified with <15 percent rock fragments throughout the profile. The soil moisture regime is aridic bordering on xeric and the soil temperature regime is mesic.
The reference state is dominated by Indian ricegrass and winterfat. Other commonly associated plants are bud sagebrush, fourwing saltbrush and globemallow. Production ranges from 350 to 700 pounds per acre.

Associated sites

R028BY010NV	**LOAMY 8-10 P.Z.**
R028BY011NV	**SHALLOW CALCAREOUS LOAM 8-10 P.Z.**
R028BY014NV	**LOAMY PLAIN 8-10 P.Z.**
R028BY045NV	**LOAMY FAN 8-12 P.Z.**

Similar sites

R028BY071NV	**SILTY CLAY 8-10 P.Z.** ACHY-PASM codominant grasses.
R028BY084NV	**COARSE SILTY 6-8 P.Z.** More productive site; ACHY dominant plant.
R028BY075NV	**COARSE GRAVELLY LOAM 6-8 P.Z.** ATCO dominant shrub.
R028BY018NV	**SILTY 5-8 P.Z.** Less productive site; occurs on bolson floor landscapes.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Krascheninnikovia lanata*
Herbaceous	(1) *Achnatherum hymenoides* (2) *Elymus elymoides*

Physiographic features

This site occurs on inset fans and fan skirts on all exposures. Slopes range from 0 to 15 percent, but slope gradients of 2 to 8 percent are most typical. Elevations are typically between 4700 and 6700 feet, but may occur as low as 4000 feet in some areas.

Table 2. Representative physiographic features

Landforms	(1) Inset fan (2) Fan skirt
Flooding duration	Very brief (4 to 48 hours)
Flooding frequency	Rare to occasional
Ponding frequency	None
Elevation	4,700–6,700 ft

Slope	2–8%
Ponding depth	0 in
Aspect	Aspect is not a significant factor

Climatic features

The climate associated with this site is semiarid, characterized by cold, moist winters and warm, dry summers.

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

Mean annual precipitation across the range in which this ES occurs is 9.01". Monthly mean precipitation:
January 0.69; February 0.65; March 0.87; April 0.88; May 1.14; June 0.73; July 0.65; August 0.77; September 0.66; October 0.79; November 0.62; December 0.60.
*The above data is averaged from the Diamond Valley- Eureka and McGill WRCC climate stations.

Table 3. Representative climatic features

Frost-free period (average)	90 days
Freeze-free period (average)	120 days
Precipitation total (average)	9 in

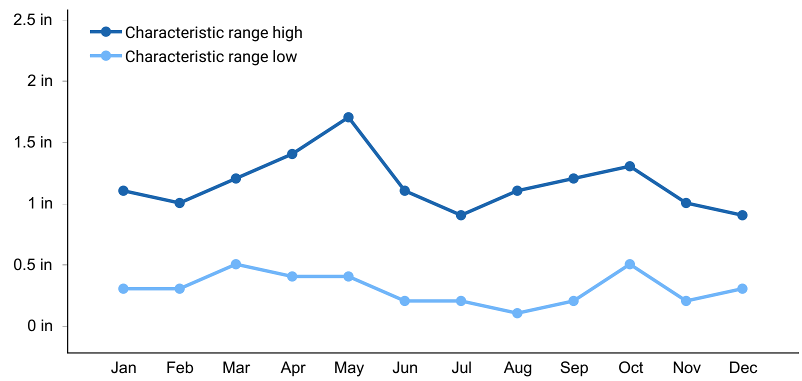

Figure 1. Monthly precipitation range

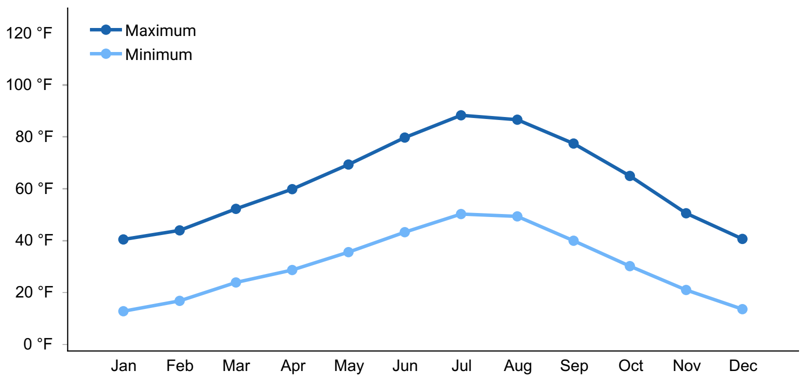

Figure 2. Monthly average minimum and maximum temperature

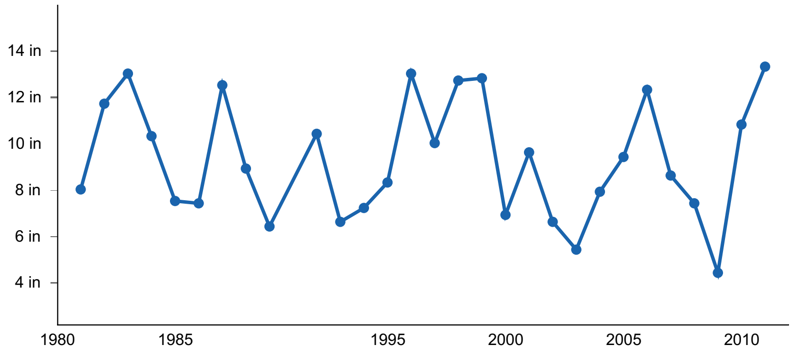

Figure 3. Annual precipitation pattern

Climate stations used

- (1) DIAMOND VALLEY - EUREKA 14NNW [USC00262296], Eureka, NV
- (2) MCGILL [USC00264950], Ely, NV

Influencing water features

Influencing water features are not associated with this site.

Soil features

The soils associated with this site are very deep, well drained and formed in alluvium derived from limestone and sandstone. Soils correlated to this site have very fine sandy loam, silt loam or silty clay loam textures, at least in the upper profile. A vesicular crust is common and the surface lacks rock fragments. Soil are characterized by an ochric epipedon, are typically calcareous, and may be modified with <15 percent rock fragments in the particle size control section. Permeability is moderately rapid and available water holding capacity is high. Additional moisture may be received on this site as overflow from adjacent ephemeral streams or as run-in from higher landscapes. The soil moisture regime is aridic bordering on xeric and the soil temperature regime is mesic. This soil has a potential to form gullies, especially in areas near shallow drainages. The soil series associated with this site are Bylo, Clowfin, Defler, Fenster, Geer, Linoyer, Maghills, Ricert, Shipley, Wholan, and Zimwala.
The representative soil series is Linoyer, classified as a Coarse-silty, mixed, superactive, calcareous, mesic Xeric Torriorthents. Diagnostic horizons include an ochric epipedon from the soil surface to 18cm. Clay content in the particle size control section averages 10 to 18 percent. Sand coarser than very fine sand ranges from 5 to 15 percent. Reaction is moderately alkaline or strongly alkaline. Soil profile is violently effervescent throughout.

Table 4. Representative soil features

Parent material	(1) Alluvium–limestone (2) Alluvium–sandstone
Surface texture	(1) Silt loam (2) Very fine sandy loam (3) Gravelly silty clay loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately rapid
Soil depth	60–84 in
Surface fragment cover <=3"	0–30%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	3–7 in
Calcium carbonate equivalent (0-40in)	1–40%

Electrical conductivity (0-40in)	0–16 mmhos/cm
Sodium adsorption ratio (0-40in)	0–12
Soil reaction (1:1 water) (0-40in)	8.2–8.8
Subsurface fragment volume <=3" (Depth not specified)	0–41%
Subsurface fragment volume >3" (Depth not specified)	0–10%

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.) (USDA-NRCS 2003). Biotic factors that influence resilience include site productivity, species composition and structure, and population regulation and regeneration (Chambers et al. 2013). This ecological site has low resilience to disturbance and resistance to invasion. Increased resilience increases with elevation, aspect, increased precipitation and increased nutrient availability. Five states have been identified for this site.

The Great Basin shrub communities have high spatial and temporal variability in precipitation, both among years and within growing seasons. Nutrient availability is typically low but increases with elevation and closely follows moisture availability. The moisture resource supporting the greatest amount of plant growth is usually the water stored in the soil profile during the winter. The invasibility of plant communities is often linked to resource availability. Disturbance can decrease resource uptake due to damage or mortality of the native species and depressed competition or can increase resource pools by the decomposition of dead plant material following disturbance.
These salt-desert shrub communities are dominated by plants belonging to the family Chenopodiaceae. Chenopods possess morphological and physiological traits that permit accommodation of both climatological drought resulting from low levels of precipitation, and physiological drought caused by high salt content of soils.
Winterfat is a long-lived, drought tolerant, native shrub typically about 30 cm tall (Mozingo 1987). It has a woody base from which annual branchlets grow (Welsh et al. 1987). The most common variety is a low growing dwarf form (less than 38.1 cm), which is most often found on desert valley floors (Stevens et al. 1977). Total winter precipitation is a primary growth driver and lower than average spring precipitation can reverse the impact of plentiful winter precipitation. While summer rainfall has a limited impact, heavy August-September rain can cause a second flowering in winterfat (West and Gasto 1978).
Winterfat reproduces from seed and primarily pollinates via wind (Stevens et al. 1977). Seed production, especially in desert regions, is dependent on precipitation (West and Gasto 1978) with good seed years occurring when there is appreciable summer precipitation and little browsing (Stevens et al. 1977). Winterfat has multiple dispersal mechanisms: diaspores are shed in the fall or winter, dispersed by wind, rodent-cached, or carried on animals (Majerus 2003). Diaspores take advantage of available moisture, tolerating freezing conditions as they progress from imbibed seeds to germinants to nonwoody seedlings (Booth 1989). Under some circumstances, the degree of reproduction may be dependent on mature plant density (Freeman and Emlen 1995).
These communities often exhibit the formation of microbiotic crusts within the interspaces between shrubs. These crusts influence the soils on these sites and their ability to reduce erosion and increase infiltration; they may also alter the soil structure and possibly increase soil fertility (Fletcher and Martin 1948, Williams 1993). Finer textured soils such as silts tend to support more microbiotic cover than coarse texture soils (Anderson 1982). Disturbance such as hoof action from inappropriate grazing and cheatgrass invasion can reduce biotic crust integrity (Anderson 1982, Ponzetti et al. 2007) and increase erosion.
Drought and/or inappropriate grazing management will initially favor shrubs but prolonged drought can cause a decrease in the winterfat, bud sagebrush and other shrubs, while bare ground increases. Squirreltail may maintain

or also decline within the community. Repeated spring and early summer grazing will have an especially detrimental effect on winterfat and bud sagebrush. Halogeton (*Halogeton glomeratus*) and other non-native annual weeds increase with excessive grazing. Abusive grazing during the winter may lead to soil compaction and reduced infiltration. Prolonged abusive grazing during any season leads to abundant bare ground, desert pavement and active wind and water erosion. Repeated, frequent fire will promote cheatgrass dominance and elimination of the native plant community. These sites frequently attract recreational use, primarily by off highway vehicles (OHV). Annual non-native species increase where surface soils have been disturbed.
The primary disturbance on these sites is drought, inappropriate grazing management and soil surface disturbance. Halogeton (*Halogeton glomeratus*), Russian thistle (*Salsola tragus*) and cheatgrass (*Bromus tectorum*) are most likely to invade disturbed sites.

Fire Ecology:
Historically, salt-desert shrub communities had sparse understories and bare soil in intershrub spaces, making these communities somewhat resistant to fire (Young 1983, Paysen et al. 2000). They may burn only during high fire hazard conditions; for example, years with high precipitation can result in almost continuous fine fuels from the herbaceous component, increasing the fire hazard (West 1994, Paysen et al. 2000).
Winterfat tolerates environmental stress, extremes of temperature and precipitation, and competition from other perennials but not the disturbance of fire or overgrazing (Ogle et al. 2001). Fire is rare within these communities due to low fuel loads. There are conflicting reports in the literature about the response of winterfat to fire. In one of the first published descriptions, Dwyer and Pieper (1967) reported that winterfat sprouts vigorously after fire. This observation was frequently cited in subsequent literature, but recent observations have suggested that winterfat can be completely killed by fire (Pellant and Reichert 1984). The response is apparently dependent on fire severity. Winterfat is able to sprout from buds near the base of the plant. However, if these buds are destroyed, winterfat will not sprout. Research has shown that winterfat seedling growth is depressed in growth by at least 90% when growing in the presence of cheatgrass (Hild et al. 2007). Repeated, frequent fires will increase the likelihood of conversion to a non-native, annual plant community with trace amounts of winterfat.
Bud sagebrush, a minor 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). Bud sagebrush is fire intolerant and must reestablish from seed (Banner 1992, West 1994).

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). 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, another cool-season, native perennial bunchgrass is common to this ecological site. 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.
Sandberg bluegrass, a minor component of this ecological site, has been found to increase following fire likely due to its low stature and productivity (Daubenmire 1975). Sandberg bluegrass may retard reestablishment of deeper rooted bunchgrasses.

State and transition model

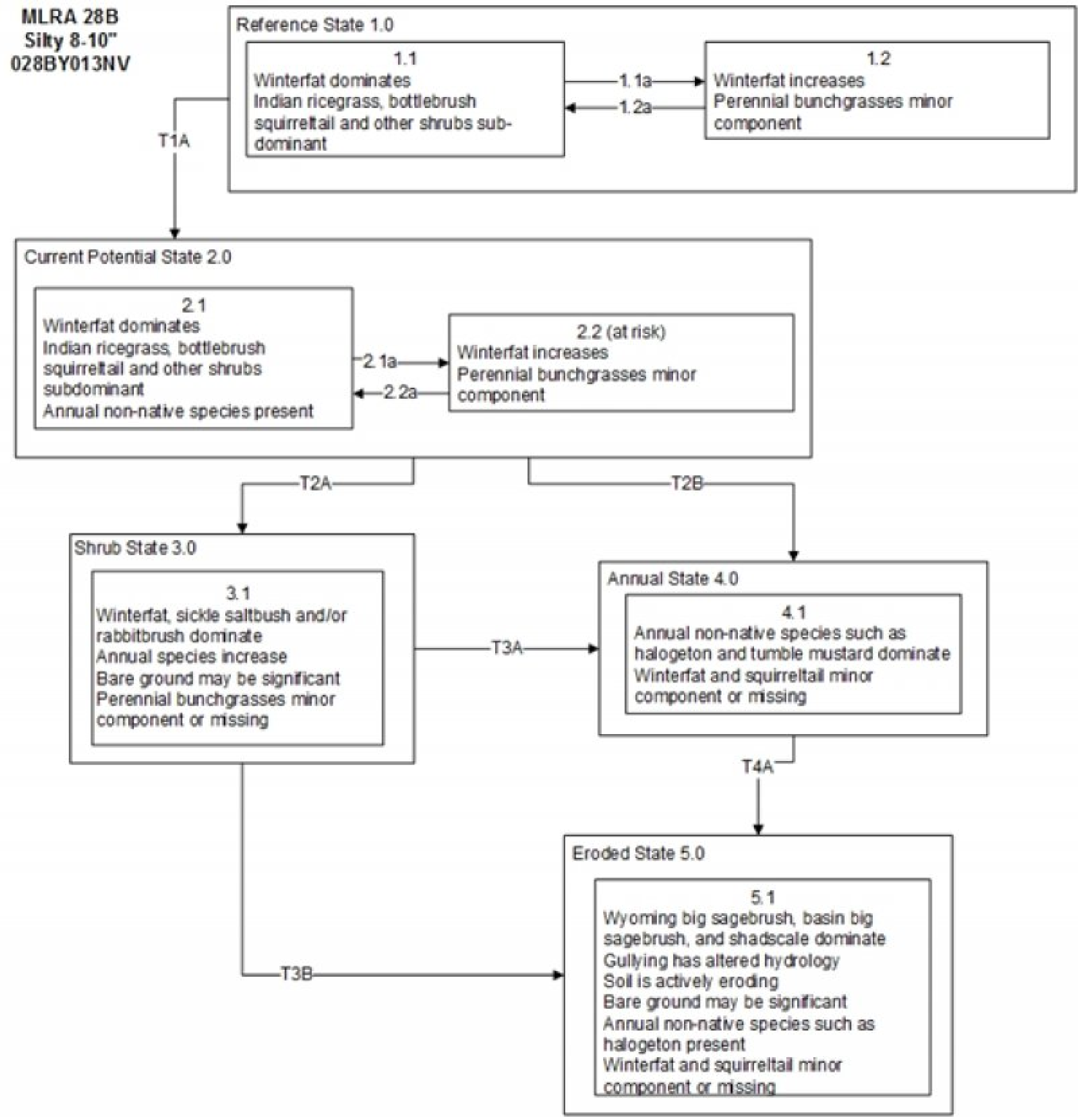

Figure 5. T. Stringham 12/2015

State 1
Reference State

The Reference State 1.0 is a representative of the natural range of variability under pristine conditions. This state has two community phases, one co-dominated by shrubs and grass, and the other dominated by shrubs. State dynamics are maintained by interactions between climatic patterns and disturbance regimes. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These include the presence of all structural and functional groups, low fine fuel loads, and retention of organic matter and nutrients. This site is very stable, with little variation in plant community composition. Plant community changes would be reflected in production in response to drought or wet years. Wet years will increase grass production, while drought years will reduce production. Shrub production will also increase during wet years; however, recruitment of winterfat is episodic.

Community 1.1

Community Phase

This community is dominated by winterfat and Indian ricegrass. Bottlebrush squirreltail and bud sagebrush are also important species on this site. Community phase changes are primarily a function of chronic drought. Fire is infrequent and patchy due to low fuel loads. Potential vegetative composition is about 30% grasses, 5% forbs, and 65% shrubs. Approximate ground cover (basal and crown) is 10 to 20 percent.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	227	325	455
Grass/Grasslike	105	150	210
Forb	18	25	35
Total	**350**	**500**	**700**

Community 1.2
Community Phase

Drought will favor shrubs over perennial bunchgrasses. However, long-term drought will result in an overall decline in the plant community, regardless of functional group.

Pathway a
Community 1.1 to 1.2

Drought and/or herbivory. Fires would also decrease vegetation on these sites but would be infrequent and patchy due to low fuel loads.

Pathway a
Community 1.2 to 1.1

Time, lack of disturbance and recovery from drought would allow the vegetation to increase and bare ground would eventually decrease.

State 2
Current Potential State

This state is similar to the Reference State 1.0. This state has the same two general community phases. Ecological function has not changed, however the resiliency of the state has been reduced by the presence of invasive weeds. Non-natives may increase in abundance but will not become dominant within this State. These non-natives can be highly flammable and can promote fire where historically fire had been infrequent. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These feedbacks include the presence of all structural and functional groups, low fine fuel loads, and retention of organic matter and nutrients. Positive feedbacks decrease ecosystem resilience and stability of the state. These include the non-natives' high seed output, persistent seed bank, rapid growth rate, ability to cross pollinate, and adaptations for seed dispersal.

Community 2.1
Community Phase

Figure 7. T.Stringham, 7/2014, NV776, MU351, Linoyer series

This community is dominated by winterfat and Indian ricegrass. Bottlebrush squirreltail and bud sagebrush are also important species on this site. Sandberg bluegrass is a dominant grass on silt loam surfaces. Community phase changes are primarily a function of chronic drought. Fire is infrequent and patchy due to low fuel loads. Non-native annual species are present in minor amounts. Potential vegetative composition is approximately 30% grasses, 5% forbs and 65% shrubs.

Community 2.2
Community Phase (At Risk)

Drought will favor shrubs over perennial bunchgrasses. However, long-term drought will result in an overall decline in the plant community, regardless of functional group. Inappropriate grazing management may cause an increase the less palatable shrubs such as rabbitbrush and cause a decrease in winterfat and bud sagebrush.

Pathway a
Community 2.1 to 2.2

Inappropriate grazing management and/or drought.

Pathway a
Community 2.2 to 2.1

Release from drought and/or changes in grazing management allows recovery of bunchgrasses, winterfat, and bud sagebrush.

State 3
Shrub State

This state consists of one community phase. This site has crossed a biotic threshold and site processes are being controlled by shrubs. Bare ground and runoff has increased. Infiltration has decreased due to loss of deep-rooted perennial bunchgrasses.

Community 3.1
Community Phase

Figure 8. T.Stringham, 7/2014, NV776, MU351, Linoyer series

Perennial bunchgrasses, like Indian ricegrass are reduced and the site is dominated by winterfat. Rabbitbrush (Chrysothamnus spp.) and shadscale may be significant components or co-dominant shrubs. Annual non-native species increase. Bare ground has increased, infiltration is reduced and runoff has increased.

State 4
Annual State

This state consists of one community phase. This community is characterized by the dominance of annual non-native species such as halogeton and cheatgrass. Rabbitbrush and other sprouting shrubs may dominate the overstory.

Community 4.1
Community Phase

Figure 9. T.Stringham April 2013, NV766 MU1480, Linyoer series

This community is dominated by annual non-native species. Trace amounts of winterfat and other shrubs may be present, but are not contributing to site function. Bare ground may be abundant, especially during low precipitation years. Wind erosion and extreme soil temperatures are driving factors in site function.

State 5
Eroded State

This state consists of one community phase. Abiotic factors including soil redistribution and erosion, soil temperature, soil crusting and sealing are primary drivers of ecological condition within this state. Soil moisture, soil nutrients and soil organic matter distribution and cycling are severely altered due to degraded soil surface conditions.

Community 5.1
Community Phase

Figure 10. T. Stringham, 7/2014 NV766, MU351, Typic torriorth

Wyoming big sagebrush, basin big sagebrush, and shadscale dominate this phase. Winterfat and squirreltail are only a minor component and may be entirely missing from the site. Gullying and active soil erosion are occurring. Bare ground may be significant. Hydrology has been altered at this site due to significant soil loss. Annual non-native species such as halogeton and annual mustards may be present.

Transition A
State 1 to 2

Trigger: This transition is caused by the introduction of non-native annual plants, such as halogeton and cheatgrass. Slow variables: Over time, the annual non-native species will increase within the community. Threshold: Any amount of introduced non-native species causes an immediate decrease in the resilience of the site. Annual non-native species cannot be easily removed from the system and have the potential to significantly alter disturbance regimes from their historic range of variation.

Transition A
State 2 to 3

Trigger: Inappropriate, long-term grazing of perennial bunchgrasses during the growing season and/or long term drought will favor shrubs and initiate a transition to Community phase 3.1. Slow variables: Long term decrease in deep-rooted perennial grass density. Threshold: Loss of deep-rooted perennial bunchgrasses changes nutrient cycling, nutrient redistribution, and reduces soil organic matter.

Transition B
State 2 to 4

Trigger: Severe fire/ multiple fires, long term inappropriate grazing and/or soil disturbing treatments such as plowing. 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 A
State 3 to 4

Trigger: Severe fire/ multiple fires, long term inappropriate grazing, and/or soil disturbing treatments such as 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 shrubs truncate energy capture spatially and temporally thus impacting nutrient cycling and distribution.

Transition B
State 3 to 5

Trigger: Contiguous inappropriate grazing management on site and in the watershed and/or soil disturbance that concentrates runoff of water. Slow variables: Increased bare ground, increased runoff. Threshold: Headcutting and subsequent gullies alter the hydrology of the site. Loss of hydraulic connectivity alters the potential vegetation and truncates, spatially and temporally, nutrient capture and cycling within the community.

Transition A
State 4 to 5

Trigger: Contiguous inappropriate grazing management on site and in the watershed and/or soil disturbance that concentrates runoff of water. Slow variables: Increased bare ground. Reduced infiltration and increased runoff. Threshold: Headcutting and subsequent gullies alter the hydrology of the site. Loss of hydraulic connectivity alters the potential vegetation and truncates, spatially and temporally, nutrient capture and cycling within the community.

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**			100–175	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	75–125	–
	squirreltail	ELEL5	*Elymus elymoides*	25–50	–
2	**Secondary Perennial Grasses**			10–50	
	western wheatgrass	PASM	*Pascopyrum smithii*	3–10	–
	Sandberg bluegrass	POSE	*Poa secunda*	3–10	–
Forb					
3	**Perennial**			20–50	
	globemallow	SPHAE	*Sphaeralcea*	10–25	–
	buckwheat	ERIOG	*Eriogonum*	3–5	–
	beardtongue	PENST	*Penstemon*	3–5	–
	phlox	PHLOX	*Phlox*	3–5	–
Shrub/Vine					
4	**Primary Shrubs**			220–315	
	winterfat	KRLA2	*Krascheninnikovia lanata*	200–250	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	10–40	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	10–25	–
5	**Secondary Shrubs**			10–50	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	3–10	–
	sickle saltbush	ATFA	*Atriplex falcata*	3–10	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	3–10	–

Animal community

Livestock Interpretations:
This site is suited for livestock grazing. Grazing management considerations include timing, intensity, frequency, and duration of grazing. Productivity and grazing capacities are typically low for salt-desert shrub communities and these sites are typically used for winter range. Winterfat is a valuable forage species with an average of 10 percent

crude protein during winter when there are few nutritious options for livestock and wildlife (Welch 1989). However, excessive grazing throughout the West has negatively impacted survival of winterfat stands (Hilton 1941, Statler 1967, Stevens et al. 1977). Time of grazing is critical for winterfat with the active growing period being most critical (Romo 1995). Stevens et al. (1977) found that both vigor and reproduction of winterfat were reduced in Steptoe Valley, Nevada by improper season of use, and he recommended no more than 25% utilization during periods of active growth and up to 75% utilization during dormant season use. Rasmussen and Brotherson (1986) found significantly greater foliar cover and density of winterfat in areas ungrazed for 26 years versus winter grazed areas in Utah. In exclosures protected from grazing for between 5 and 16 years, Rice and Westoby (1978) found that winterfat increased in foliar cover but not in density where it was dominant, and in both foliar cover and density in shadscale-perennial grass communities where it was not dominant.

Bud sagebrush is also a palatable, nutritious forage for upland game birds, small game, big game and 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). 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 (Chambers and Norton 1993). Heavy browsing (>50%) may kill budsage rapidly (Wood and Brotherson 1986). Fourwing saltbush is one of the most palatable shrubs in the West. Its protein, fat, and carbohydrate levels are comparable to alfalfa. It provides nutritious forage for all classes of livestock. Palatability is rated as good for domestic sheep and domestic goats; fair for cattle; fair to good for horses in winter, poor for horses in other seasons.

Indian ricegrass has good forage value for domestic sheep, cattle, and horses. It can be important cattle forage in winter, particularly in salt desert communities. Indian ricegrass is often used most heavily in late winter, when succulent and nutritious new green leaves are produced. It supplies a source of green feed before most other native grasses have produced much new growth. Indian ricegrass is often heavily grazed before animals leave winter ranges. Indian ricegrass also produces abundant foliage in spring and early summer when it is readily eaten. It cures well and provides excellent winter forage for cattle, domestic sheep, and horses. Domestic sheep grazing on Indian ricegrass may be heavy in the spring. 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 1965). Cook and Child (1971) found significant reduction in plant cover after 7 years of rest from heavy (90%) and moderate (60%) spring use. The seed crop may be reduced where grazing is heavy (Bich et al. 1995). Tolerance to grazing increases after May thus spring deferment may be necessary for stand enhancement (Pearson 1964, Cook and Child 1971); however, utilization of less than 60% is recommended.

Bottlebrush squirreltail is very palatable winter forage for domestic sheep of Intermountain ranges. Domestic sheep relish the green foliage. Overall, bottlebrush squirreltail is considered moderately palatable to livestock. Bottlebrush squirreltail has the ability to produce large numbers of highly germinable seeds, with relatively rapid germination (Young and Evans 1977) when exposed to the correct environmental cues. Early spring growth and ability to grow at low temperatures contribute to the persistence of bottlebrush squirreltail among cheatgrass dominated ranges (Hironaka and Tisdale 1973). 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. Reduced bunchgrass vigor or density provides an opportunity for Sandberg bluegrass expansion and/or cheatgrass and other invasive species to occupy interspaces, leading to increased fire frequency and potentially an annual plant community. Sandberg bluegrass increases under grazing pressure (Tisdale and Hironaka 1981) and is capable of co-existing with cheatgrass. Excessive sheep grazing favors Sandberg bluegrass; however, where cattle are the dominant grazers, cheatgrass often dominates (Daubenmire 1970). Thus, depending on the season of use, the grazer and site conditions, either Sandberg bluegrass or cheatgrass may become the dominant understory with inappropriate grazing management.

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:

This site provides valuable habitat for several species of wildlife. Winterfat is important to wildlife for feed and cover in salt-desert shrub rangelands and sub-alkaline flats (Blaisdell and Holmgren 1984). In fact, during late winter months when other forage is scarce, winterfat is heavily grazed (Carey 1995). Winterfat is browsed by rabbits, antelope, and other wildlife species (Stevens et al. 1977, Ogle et al. 2001). Winterfat and perennial grasses average 80% of jackrabbits' diet in southeastern Idaho, with shrubs being grazed in fall and winter particularly

(Johnson and Anderson 1984). Pronghorn and rabbits browse stems, leaves, and seed stalks of winterfat year round, especially during periods of active growth (Stevens et al. 1977). Management of wildlife browse is difficult and browse may be harmful to winterfat reestablishment as seed production and regrowth are curtailed if grazing occurs as the plant begins to grow (Eckert 1954). Ungulates that occur in Nevada feed on winterfat as well. Winterfat has been identified as important forage for mule deer (Odocoileus hemionus) and elk diet especially in winter (Hansen and Reed 1979, Hubbard and Hansen 1976, Wildlife Action Plan Team 2012).
Indian ricegrass is eaten by pronghorn and mule deer in moderate amounts whenever available. Bottlebrush squirreltail is a dietary component of several wildlife species. Bottlebrush squirreltail may provide forage for mule deer and pronghorn. Bud sagebrush is palatable, nutritious forage for upland game birds, small game and big game in winter. Bud sagebrush is rated as "regularly, frequently, or moderately taken" 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 sagebrush comprises 18 – 35% of a pronghorn’s diet during the spring where it is available. Chukar will utilize the leaves and seeds of bud sagebrush. 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. Fourwing saltbush provides valuable habitat and year-round browse for wildlife. Fourwing saltbush also provides browse and shelter for small mammals. Additionally, the browse provides a source of water for black-tailed jackrabbits in arid environments. Granivorous birds consume the fruits. Wild ungulates, rodent and lagomorphs readily consume all aboveground portions of the plant. Palatability is rated good for deer, elk, pronghorn and bighorn sheep.
Lagamorphs such as black-tailed jackrabbits (Lepus californicus) will feed selectively on winterfat, which comprises a majority of their diet (Johnson and Anderson 1984). Similarly, although Nuttall’s cottontail (Sylvilagus nuttallii) consumed mostly grasses and forbs, winterfat made up a large component of their diet as well (Johnson and Hansen 1979).
Rodents also utilize winterfat habitat. The diet of Townsend's ground squirrel (Urocitellus townsendii) consisted on average of 47 percent winterfat and three other native plant species (Yensen et al 1992). Great Basin pocket mice (Perognathus parvus) can be found sporadically in winterfat communities (Dobkin and Sauder 2004). Piute ground squirrels (Urocitellus mollis), little pocket mice (Perognathus longimembris), dark kangaroo mice (Microdipodops megacephalus), chisel-toothed kangaroo rats (Dipodomys microps) and desert woodrats (Neotoma lepida) are found invariably in various shrubsteppe communities especially where winterfat occurs (Dobkin and Sauder 2004).
Several passerine species occur in winterfat-dominated communities; these include horned lark (Eremophila alpestris), Brewer's sparrow (Spizella breweri), and sage thrasher (Oreoscoptes montanus) in east-central Nevada; however, they are not dependent on these species as their range extend well beyond the distribution of winterfat (Carey 1995, Bradford et al. 1996, Dobkin and Sauder 2004). Furthermore, the sandy soils found in winterfat communities can be important to burrowing owls (Athene cunicularia) and short-eared owls (Asio flammeus) (Wildlife Action Plan Team 2012).
Reptiles and amphibians have been documented to utilize habitat associated with winterfat. The use of winterfat by other reptiles and amphibians has not been well documented. However, several species of reptiles and amphibians are found where winterfat occurs (intermountain cold desert shrub habitat and semi-desert grasslands). The long-nosed leopard lizard (Gambelia wislizenii) and desert horned lizard (Phrynosoma platyrhinos), both species of conservation priority occur in habitats where winterfat grows as well as the western rattlesnake (Crotalus viridis) and sidewinder (Crotalus cerastes) (Ernst and Ernst 2012, Wildlife Action Plan Team 2012). Amphibians have not been documented to use winterfat communities; however, winterfat will occur in areas of the Intermountain cold desert shrub habitat where washes are common. These washes can be used for migration routes and are important for metapopulation maintenance. Thus these areas should be managed for within the Intermountain cold desert shrub habitat where winterfat occurs (Wildlife Action Plan Team 2012).
Notably, several wildlife species will prey on animals that inhabit winterfat communities such as the prairie falcon (Falco mexicanus), the ferruginous hawk (Buteo regalis), the long-nosed leopard lizard and the desert horned lizard (Wildlife Action Plan Team 2012).
Changes in plant community composition caused by human activity, invasive weeds, fire and frequency associated with this ecological site could affect the distribution and presence of wildlife species and it is important to maintain the community for optimal productivity and species diversity (Wildlife Action Plan 2012).

Hydrological functions

Rills, erosional pedestals or terracettes are none to rare. Water flow patterns are rare to common dependent on site location relative to major inflow areas. Water flow patterns are typically short, ending in depressional areas where water ponds. Moderately fine to fine surface textures and physical crusts result in limited infiltration rates. The available water holding capacity is very low to high. Runoff is very low to high. This site is may be ponded for short periods in the late winter. Deep-rooted bunchgrasses (i.e., Indian ricegrass) increase infiltration.

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 is used has potential for upland and big game hunting.

Other products

Indian ricegrass was traditionally eaten by some Native Americans. The Paiutes used seed as a reserve food source. The large-seeded panicle is often used in dry floral arrangements. Fourwing saltbush is traditionally important to Native Americans. They ground the seeds for flour. The leaves, placed on coals, impart a salty flavor to corn and other roasted food. Top-growth produces a yellow dye. Young leaves and shoots were used to dye wool and other materials. The roots and flowers were ground to soothe insect bites.

Other information

Winterfat is a useful shrub for reclamation of mines and revegetation of disturbed sites in arid climates. 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. Winterfat can be seeded or propagated by stem cuttings. Indian ricegrass is well-suited for surface erosion control and desert revegetation although it is not highly effective in controlling sand movement. Certain native ecotypes exhibit desirable characteristics such as drought and salinity tolerance, low seed dormancy, and good nutritional qualities. However, Indian ricegrass can be difficult to establish. Indian ricegrass can be useful in the reclamation of many arid and semiarid areas in the western United States. Typical sites include those in which vegetation has been removed due to surface mining, construction activity, brush control, heavy grazing, or fire. Indian ricegrass can be used for revegetating degraded rangelands in areas of low precipitation and has naturally revegetated overgrazed ranges. Bottlebrush squirreltail is tolerant of disturbance and is a suitable species for revegetation. Fourwing saltbush is widely used in rangeland and riparian improvement and reclamation projects, including burned area recovery. It is probably the most widely used shrub for restoration of winter ranges and mined land reclamation.

Type locality

Location 1: White Pine County, NV	
Township/Range/Section	T17 N R63 E S35
General legal description	Ely Airport, Steptoe Valley, White Pine County, Nevada. This site also occurs in Churchill, Elko, Eureka, Lander, Lincoln, and Nye 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)	GK BRACKLEY/P.NOVAK-ECHENIQUE
Contact for lead author	State Rangeland Management Specialist
Date	06/20/2006
Approved by	P.Novak-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 may occur on steeper slopes after summer convection storms. These are short (<5ft) and stable.

2. **Presence of water flow patterns:** Water flow patterns are rare to common dependent on site location relative to major inflow areas. Flow patterns are relatively short <10 ft) and meandering.

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

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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 40-60% depending on amount of surface rock fragments.

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

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None - some wind scouring may occur after a severe wildfire.

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7. **Amount of litter movement (describe size and distance expected to travel):** Fine litter (foliage of grasses and annual & perennial forbs) only expected to move during periods of flooding by adjacent streams. Persistent litter (large woody material) will remain in place except during major flooding events.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil stability values will range from 3 to 6.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Structure of soil surface is moderate medium thick platy. Soil surface colors are light brownish grays or yellowish browns and soils are typified by an ochric epipedon. Surface textures are silts, fine sandy loams, or very fine sandy loams. A vesicular crust is common. Organic matter is less than 1 percent.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Deep-rooted perennial grasses and/or rhizomatous grasses slow runoff and increase infiltration. Litter and shrub canopy offer some opportunity for snow capture on this site. Moderately fine to fine surface textures and physical crusts result in limited infiltration rates. The surface layer will normally crust and bake upon drying, inhibiting water infiltration and seedling emergence.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** Compacted layers are none. Subangular blocky or massive subsoil structure is normal for this site and is not to be interpreted as compaction.

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant: Reference State: salt-desert shrubs (winterfat) >>

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

Other: cool-season rhizomatous grasses, microbiotic crusts

Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Dead branches within individual shrubs common and standing dead shrub canopy material may be as much as 25% of total woody canopy.

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14. **Average percent litter cover (%) and depth (in):** Within plant interspaces (15-25%) and depth of litter < 0.25 inches.

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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 (through end of May) ±500 lbs/ac; Favorable years: ±700 lbs/ac; Unfavorable years: ±350 lbs/ac

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

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