Ecological site R028BY084NV
COARSE SILTY 6-8 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): 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, barrier beaches and fan skirts. Slopes range from 0 to 15 percent, but slope gradients of 2 to 8 percent are most typical. Elevations are 4900 to 6800 feet.

The climate associated with this site is semiarid, characterized by cool, moist winters and warm, dry summers. Average annual precipitation is 6 to 8 inches. Mean annual air temperature is 45 to 50 degrees F. The average growing season is about 100 to 120 days.

The soils associated with this site are predominantly very deep and well drained. The soils are typically coarse textured throughout or at least in the upper profile. Permeability is moderately slow to moderately rapid with very low to moderate available water holding capacity.

The reference state is dominated by winterfat, bud sagebrush and Indian ricegrass. Production ranges from 400 to 900 pounds per acre.

Associated sites

R028BY013NV	**SILTY 8-10 P.Z.** 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.
R028BY045NV	**LOAMY FAN 8-12 P.Z.** This site occurs on inset fans. Slopes gradients of 2 to 4 percent are typical and elevations range from 5500 to 6700 feet. The soils are very deep, well drained, have an ochric epipedon and formed in alluvium derived from mixed rock sources. Surface textures are fine sandy loam or silt loam. The reference community phase is dominated by Wyoming big sagebrush, basin wildrye, Indian ricegrass and thickspike wheatgrass. Production ranges from 600 to 1000 pounds per acre. Run-on moisture and the fine sandy loam or silt loam surface texture result in increased annual production. This ecological site represents the wettest part of the landscape where Wyoming sagebrush occurs.
R028BY075NV	**COARSE GRAVELLY LOAM 6-8 P.Z.** This site occurs on beachplains, fan remnants and fan skirts. Slopes range from 0 to 15 percent, but slope gradients of 2 to 8 percent are most typical. Elevations range from 5600 to 7000 feet. The soils associated with this site are predominantly very deep and well drained to somewhat excessively drained. The soils are moderately to strongly alkaline and are calcareous throughout. These soils have a loamy surface texture that is generally modified by 15 percent or more gravel; however, the subsoils are loamy to sandy in texture and have more than 35 percent coarse fragments. The reference state is dominated by Indian ricegrass and shadscale. Bud sagebrush and winterfat are important associated plants. Production ranges from 300 to 700 pounds per acre.

Similar sites

R028BY013NV	**SILTY 8-10 P.Z.** Soils not coarse textured, typically silt loam or very fine sandy loam surfaces; less productive site
R028BY075NV	**COARSE GRAVELLY LOAM 6-8 P.Z.** ATCO dominant shrub
R028BY018NV	**SILTY 5-8 P.Z.** Droughtier growing environment; KRLA2 is dominant shrub; less shrub diversity; silt loam surface soils; less productive site

Table 1. Dominant plant species

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

Physiographic features

This site occurs on inset fans, barrier beaches and fan skirts. Slopes range from 0 to 15 percent, but slope gradients of 2 to 8 percent are most typical. Elevations range from 4900 to 6800 feet.

Table 2. Representative physiographic features

Landforms	(1) Fan skirt (2) Barrier beach (3) Inset fan
Runoff class	Low to high
Elevation	4,900–6,800 ft
Slope	0–15%
Water table depth	72 in
Aspect	Aspect is not a significant factor

Climatic features

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

Average annual precipitation ranges from 6 to 10 inches. Mean annual air temperature is about 45 to 50 degrees F. The average growing season is about 100 to 120 days.

Mean annual precipitation at the ELY WBO,NEVADA climate station (262631) is 9.72 inches. Monthly mean precipitation is:
January 0.77; February 0.78; March 1.01; April 1.03;
May 1.10; June 0.65; July 0.64; August 0.81;
September 0.75; October 0.82; November 0.68;
December 0.68.

Table 3. Representative climatic features

Frost-free period (average)	66 days
Freeze-free period (average)	110 days
Precipitation total (average)	10 in

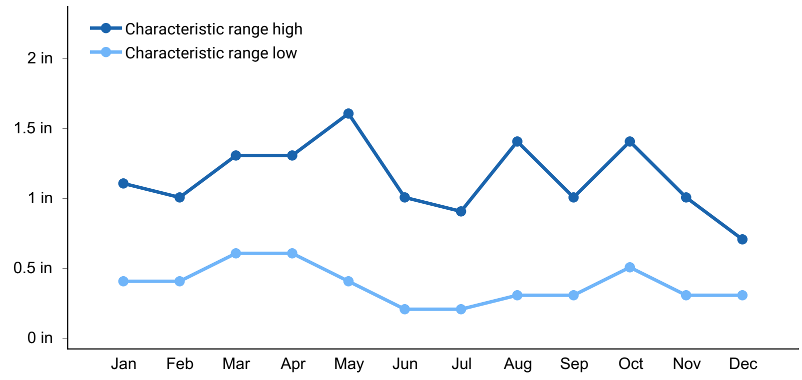

Figure 1. Monthly precipitation range

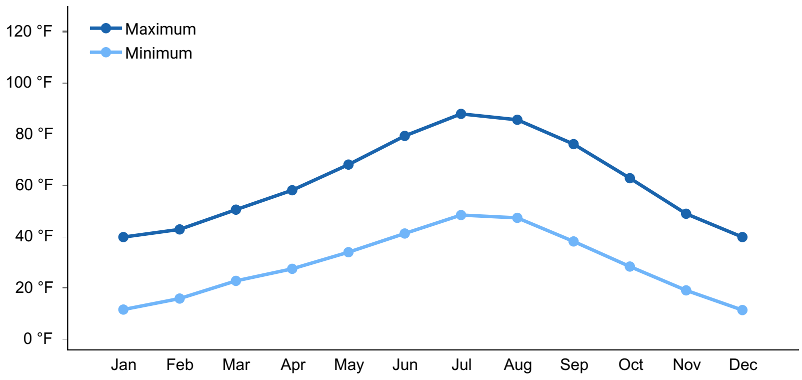

Figure 2. Monthly average minimum and maximum temperature

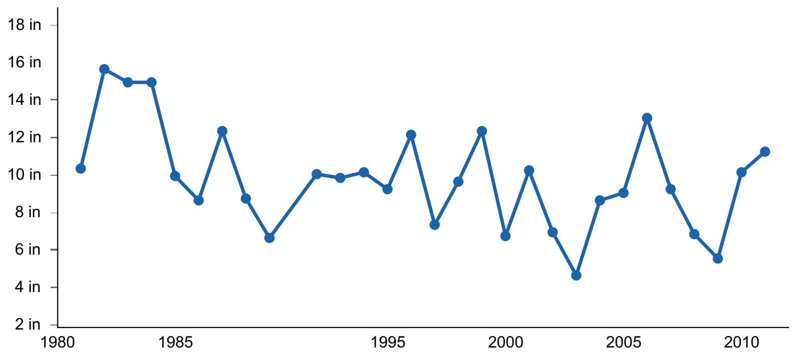

Figure 3. Annual precipitation pattern

Climate stations used

- (1) ELY YELLAND FLD AP [USW00023154], Ely, NV

Influencing water features

There are no influencing water features associated with this site.

Soil features

The soils associate with this site are predominantly very deep and well drained. The soils are typically coarse textured throughout or at least in the upper profile. Permeability is moderately slow to moderately rapid with very low to moderate available water holding capacity. Potential for sheet and rill erosion is slight. The soil moisture regime is aridic bordering on xeric and the soil temperature regime is mesic. The soil series associated with this site include Gravier, Heist, Linoyer, Sodhouse, Timpie, and Zerk.

The representative soil series is Sodhouse, classified as a Loamy, mixed, superactive, mesic, shallow Typic Haplodurids. Diagnostic horizons include an ochric epipedon from the soil surface to 7 inches and a cambic horizon from 6 to 19 inches. Clay content in the particle control sections average 8 to 15 percent. Rock fragments range from 0 to 25 percent, mainly gravel. Reaction is moderately alkaline or strongly alkaline, usually increasing with depth. Effervescence is strongly effervescent. Lithology consists of mixed rocks with some influence from loess and volcanic ash.

Table 4. Representative soil features

Parent material	(1) Alluvium–sandstone (2) Alluvium–limestone (3) Alluvium–welded tuff
Surface texture	(1) Very gravelly sandy loam (2) Fine sandy loam (3) Gravelly loam (4) Silt loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderately rapid
Soil depth	60–84 in
Surface fragment cover <=3"	15–57%
Surface fragment cover >3"	0–13%
Available water capacity (0-40in)	2.8–6.1 in
Calcium carbonate equivalent (0-40in)	1–40%
Electrical conductivity (0-40in)	0–32 mmhos/cm
Sodium adsorption ratio (0-40in)	0–50
Soil reaction (1:1 water) (0-40in)	8.2–8.8
Subsurface fragment volume <=3" (Depth not specified)	7–57%
Subsurface fragment volume >3" (Depth not specified)	3–13%

Ecological dynamics

An ecological site is the product of all the environmental factors responsible for its development and has a set of key characteristics that influence a site's resilience to disturbance and resistance to invasives. Key characteristics include 1) climate (precipitation, temperature), 2) topography (aspect, slope, elevation, and landform), 3) hydrology (infiltration, runoff), 4) soils (depth, texture, structure, organic matter), 5) plant communities (functional groups, productivity), and 6) natural disturbance regime (fire, herbivory, etc.) (USDA-NRCS 2003). Biotic factors that influence resilience include site productivity, species composition and structure, and population regulation and regeneration (Chambers et al. 2013).
The Great Basin shrub communities have high spatial and temporal variability in precipitation, both among years and within growing seasons. Nutrient availability is typically low but increases with elevation and closely follows moisture availability. The moisture resource supporting the greatest amount of plant growth is usually the water stored in the soil profile during the winter. The invasibility of plant communities is often linked to resource availability. Disturbance can decrease resource uptake due to damage or mortality of the native species and depressed competition or can increase resource pools by the decomposition of dead plant material following disturbance.

These salt-desert shrub communities are dominated by plants belonging to the family Chenopodiaceae. Chenopods possess morphological and physiological traits that permit accommodation of both climatological drought resulting

from low levels of precipitation, and physiological drought caused by high salt content of soils.
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 – silts, for example – 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 winterfat, bud sagebrush and other shrubs and an increase in bare ground. 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 ecological site has low resilience to disturbance and resistance to invasion. The primary disturbance on these sites is drought, inappropriate grazing and soil surface disturbance. Halogeton (*Halogeton glomeratus*), Russian thistle (*Salsola tragus*) and cheatgrass (*Bromus tectorum*) are most likely to invade disturbed sites. Four possible stable states have been identified for this site.

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

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, but if these buds are destroyed, the plant 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).

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 factor into individual species' responses. 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, 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

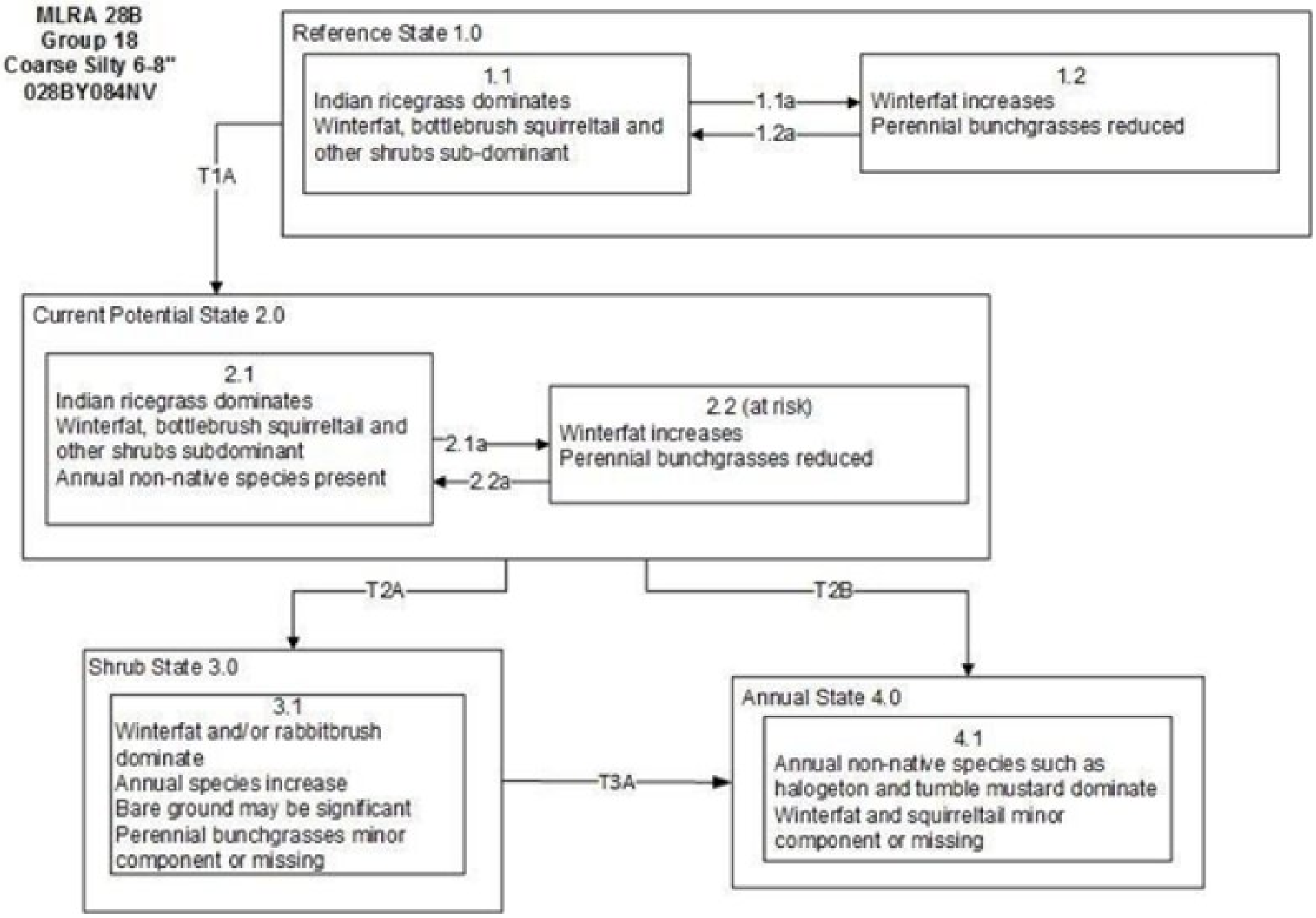

Figure 5. State and Transition Model

MLRA 28B
Coarse Silty 6-8"
028BY084NV

Reference State 1.0 Community Phase Pathways
1.1a: Long-term drought and/or excessive herbivory favors as decrease in perennial bunchgrasses. Fire was infrequent but would be patchy due to low fuel loads.
1.2a: Time and lack of disturbance and/or release from drought

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

Current Potential State 2.0 Community Phase Pathways
2.1a: Long-term drought and/or inappropriate grazing management
2.2a: Time and lack of disturbance and/or release from drought

Transition T2A: Inappropriate grazing management in the presence of non-native species (3.1)

Transition T2B: Catastrophic fire and/or multiple fires, inappropriate grazing management and/or soil disturbing treatments (4.1)

Transition T3A: Catastrophic fire and/or multiple fires, inappropriate grazing management and/or soil disturbing treatments (4.1)

Figure 6. Legend

Animal community

Livestock Interpretations:
This site is suitable for livestock grazing. Grazing management considerations include timing, duration, frequency, and intensity 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 an important forage plant for livestock in salt-desert shrub rangeland and subalkaline flats, especially during winter when forage is scarce. 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 palatable, nutritious forage for domestic sheep in winter, particularly late winter (Johnson 1978), however it can be poisonous or fatal to calves when eaten in quantity (Stubbendieck et al. 1992). Bud sagebrush is highly susceptible to effects of browsing. It decreases under browsing due to year-long palatability of its buds and is particularly susceptible to browsing in the spring when it is physiologically most active (Chambers and Norton 1993). Heavy browsing (>50%) may kill bud sagebrush rapidly (Wood and Brotherson 1986).

Indian ricegrass is often heavily utilized in winter because it cures well (Booth et al. 2006). It is also readily utilized in early spring, being a source of green forage before most other perennial grasses have produced new growth (Quinones 1981).
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). Heavy trampling 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. In summary, overgrazing causes a decrease in Indian ricegrass along with winterfat, bud sagebrush, while shadscale may initially increase. Spring grazing year after year can be detrimental to winterfat, bud sagebrush and bunchgrasses. Continued abusive grazing leads to increased bare ground and invasion by annual weeds (e.g., cheatgrass, halogeton, and annual mustards). Shadscale may become dominant with an annual understory. With further deterioration, shadscale declines, bare ground increases, soil redistribution accelerates and site productivity decreases. On some soils, erosion can result in increased surface salts and development of desert pavement. Reestablishment of perennials is limited in areas of extensive desert pavement. Fire is a very infrequent and patchy event in these salt desert shrub communities; however, where it has occurred the shrub community is greatly reduced and annual exotic weeds will increase if present. Repeated fire within a 10 to 20 year timeframe has the potential to convert this site to an annual weed dominated system. Knowledge of successful rehabilitation strategies in these droughty plant communities is limited grass 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 even 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. Adaptive management is required to manage this bunchgrass well.
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 wildlife species. Winterfat is important to wildlife for feed and cover in salt-desert shrub rangeland 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 seeds are eaten by rodents. Winterfat is a staple food for black-tailed jackrabbit (Lepus californicus). Winterfat and perennial grasses average 80% of jackrabbits' diet in southeastern Idaho, with shrubs being grazed in fall and winter particularly (Johnson and Anderson 1984). Mule deer (Odocoileus hemionus) and pronghorn antelope (Antilocapra americana) browse winterfat (Stevens et al. 1977, Ogle et al. 2001). Pronghorn and rabbits browse stems, leaves, and seed stalks of winterfat year round, especially during periods of active growth (Stevens et al. 1977). Winterfat is used for cover by rodents. It is potential nesting cover for upland game birds, especially when grasses grow up through its crown. Management of wildlife browse is difficult and browse may be harmful to winterfat reestablishment as seed production and regrowth are curtailed if grazing occurs as the plant begins to grow (Eckert 1954).
Lagamorphs such as the Black-tailed jackrabbits will feed selectively on Winterfat, as previously mentioned, 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% winterfat and three other native plant species (Yensen and Quinny 1992). Great Basin pocket mice can be found sporadically in winterfat communities (Dobkin and Sauder 2004).Piute ground squirrels (Urocitellus mollis), little pocket mice (Perognathus longimembris), dark kangaroo mice (Microdipodops megacephalus), chisel-toothed kangaroo rats (Dipodomys microps) and desert woodrats (Neotoma lepida) are found invariably in various shrubsteppe communities especially where winterfat occurs (Dobkin and Sauder 2004).
Ungulates that occur in Nevada feed on winterfat as well. Winterfat has been documented as a substantial forage item for bighorn sheep (Ovis canadensis nelsoni) occurring in Yellow Stone National Park, Arizona and North Dakota badlands throughout winter months (Keating et al. 1985, Fairaizl 1978, Morgart 1990). Winterfat has been identified as important forage for mule deer and makes up the majority of elk (Cervus canadensis) diet in winter (Hansen and Reed 1979, Hubbard and Hansen 1976, Nevada Wildlife Action Plan Team 2012).
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) (Nevada Wildlife Action Plan Team 2012)
Reptiles and amphibians have been documented to utilize habitat associated with winterfat. McArthur et al. (1994) suggested desert tortoises, a species of conservation priority in Nevada, eat 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). It should be noted that habitats within the Great Basin, intermountain cold desert shrub communities are also the primary habitat of the long-nosed leopard lizard (Nevada Wildlife Action Plan 2012).
Bottlebrush squirreltail is a dietary component of several wildlife species. Bottlebrush squirreltail may provide forage for mule deer and pronghorn.
Indian ricegrass is eaten by pronghorn in "moderate" amounts whenever available. A number of heteromyid rodents inhabiting desert rangelands show preference for seed of Indian ricegrass. Indian ricegrass is an important component of jackrabbit diets in spring and summer. In Nevada, Indian ricegrass may even dominate jackrabbit diets during the spring through early summer months. Indian ricegrass seed provides food for many species of birds. Doves, for example, eat large amounts of shattered Indian ricegrass seed lying on the ground.
Changes in plant community composition caused by human activity, invasive weeds, fire and frequency associated with this ecological site could affect the distribution and presence of wildlife species and it is important to maintain the community for optimal productivity and species diversity (Nevada Wildlife Action Plan 2012).

Hydrological functions

Permeability is moderately slow to moderately rapid. Runoff is very low to very high. Rills are none to rare. Water flow patterns are rare. A few waterflow patterns may be evident in areas subjected to summer convection storms. Where flow patterns are observed, they are short in length and stable. Water flow patterns are rare. A few waterflow patterns may be evident in areas subjected to summer convection storms. Where flow patterns are observed, they are short in length and stable. Pedestals are rare with occurrence typically limited to areas within water flow patterns. Gullies are rare in areas of this site that occur on stable landforms. Where this site occurs on inset fans, gullies and head-cuts associated with ephemeral channel entrenchment may occur. If observed, gullies and head-cuts should be healing or stable. Shrub canopy and associated litter break raindrop impact. Medium to coarse textured surface soils have moderate to rapid infiltration and medium to slow runoff.

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 for camping and hiking and has potential for upland and big game hunting.

Other products

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

Other information

Winterfat adapts well to most site conditions, and its extensive root system stabilizes soil. However, winterfat is intolerant of flooding, excess water, and acidic soils. Indian ricegrass is well-suited for surface erosion control and desert revegetation although it is not highly effective in controlling sand movement. Bottlebrush squirreltail is tolerant of disturbance and is a suitable species for revegetation.

Inventory data references

NASIS soil component data.

Type locality

Location 1: White Pine County, NV	
Township/Range/Section	T17N R63E S28
Latitude	39° 18′ 34″
Longitude	114° 53′ 21″

General legal description	About 3½ miles north of Ely, White Pine County, Nevada. This site also occurs in Elko and Eureka Counties, Nevada.

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Approval

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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	11/01/2006
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.

2. **Presence of water flow patterns:** Water flow patterns are none to rare. A few waterflow patterns may be evident in areas subjected to summer convection storms. Where flow patterns are observed, they are short (< 2m), meandering and stable.

3. **Number and height of erosional pedestals or terracettes:** Pedestals are rare with occurrence typically limited to areas within water flow paths. There are no terracettes.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare Ground 40-60%; surface rock fragments up to ±15%; shrub canopy 15 to 25%; basal area for perennial herbaceous plants ±10%.

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

6. **Extent of wind scoured, blowouts and/or depositional areas:** None to rare. If observed, wind scoured spots are isolated and very small in areal extent (<50ft2).

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

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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 should be 3 to 6 on most soil textures found on this site. Soils having thin surface sand sheet have lower stability values.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Surface soil structure is typically single grained to medium platy. Soil surface colors are light grays or yellowish browns and the soils are typified by an ochric epipedon. Surface textures are sandy loams, fine sandy loams, loams or silt loams. A soft vesicular crust is present on the surface. Organic carbon of the surface 2 to 3 inches is typically 1 or less percent.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Shrub canopy and associated litter break raindrop impact and provide for snow capture on this site. Deep-rooted perennial bunchgrasses promote infiltration and reduce runoff.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** Compacted layers are none. Platy or massive sub-surface horizons are not to be interpreted as compacted layers.

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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 & bud sagebrush) = deep-rooted, cool season, perennial bunchgrasses (Indian ricegrass)(by above ground production).

    Sub-dominant: >> shallow-rooted and/or rhizomatous, perennial, grasses = deep-rooted, perennial, forbs = fibrous, shallow-rooted, annual and perennial forbs (by above ground production).

    Other: 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 are common and standing dead shrub canopy material may be as much as 25% of total woody canopy; mature bunchgrasses commonly (±15%) have dead centers.

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14. **Average percent litter cover (%) and depth (in):** Between plant interspaces (10-20%) and depth (± ¼ in.)

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-**

production): For normal or average growing season (thru May) ± 700lbs/ac; Favorable years ±900lbs/ac and unfavorable years ± 400lbs/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:** Potential invaders include halogeton, Russian thistle, bur buttercup, annual mustards, and cheatgrass.

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