USDA Natural Resources Conservation Service

Ecological site R028BY040NV
BARREN FAN 8-12 P.Z.

Accessed: 05/03/2024

General information

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

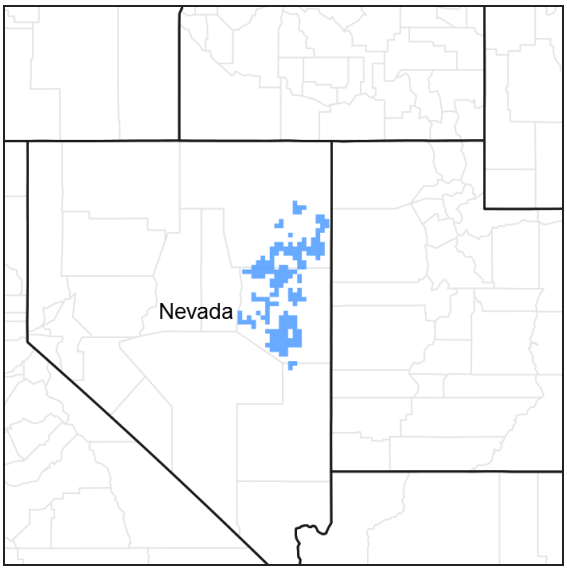

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 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 rock pediments. Slopes range from 2 to 30 percent, slopes <8 percent is typical. Elevations range from 6000 to 7000 feet.

Soils associated with this site are shallow or very shallow, well drained and formed in residuum derived from tuff and calcareous loess. Soil surface is covered with approximately 40 percent gravel and the textures are ashy sandy loams. Water intake rates are moderate to very slow. Available water holding capacity is very low. Runoff is very high and soils are well drained. The soil temperature regime is mesic and the soil moisture regime is aridic bordering on xeric.

The reference state is dominated by pygmy sagebrush. Indian ricegrass and needleandthread are common grasses. Average annual production ranges from 100 to 250 pounds per acre.

The primary abiotic factor contributing to the presence of this ecological site in the very low available water holding capacity of the soil. This site is found in areas with less than 10 inches precipitation and the soils are shallow, limiting the space available for soil moisture storage.

Associated sites

F028AY021NV	**JUOS/ARPY2/ACHY**
R028BY011NV	**SHALLOW CALCAREOUS LOAM 8-10 P.Z.**
R028BY059NV	**SHALLOW CALCAREOUS HILL 8-12 P.Z.**
R028BY075NV	**COARSE GRAVELLY LOAM 6-8 P.Z.**

Similar sites

F028AY021NV	**JUOS/ARPY2/ACHY** Has more than 10% tree canopy of JUOS over 150 years old

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia pygmaea*
Herbaceous	(1) *Achnatherum hymenoides* (2) *Hesperostipa comata*

Physiographic features

This site occurs on rock pediments. Slopes range from 2 to 30 percent, but <8 percent is typical. Elevations typically range from 6000 to 7000 feet, but occasionally this site occurs below 6000 feet.

Table 2. Representative physiographic features

Landforms	(1) Pediment (2) Hill
Flooding frequency	None
Ponding frequency	None
Elevation	1,829–2,134 m
Slope	2–8%
Aspect	Aspect is not a significant factor

Climatic features

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

Average annual precipitation ranges from 8 to 12 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 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)	229 mm

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 shallow, well drained, and formed in residuum derived from ash flow tuff and a mixture of calcareous loess. These soils have an ochric epipedon, the surface is covered with approximately 40 percent gravel, and textures are ashy sandy loams throughout. Available water holding capacity is very low to low. The soil moisture regime is aridic bordering on xeric and the soil temperature regime is mesic. Runoff is very high and soils are well drained. The soil series associated with this site include: Barfan and Mizpah.

The representative soil series is Barfan, an Ashy, glassy, calcareous, mesic Lithic Xeric Torriorthents. Diagnostic horizons include an ochric epipedon from the soil surface to 18 cm, and lithic contact at 28 cm to underlying fractured tuff. Clay content in the particle size control section averages 5 to 15 percent. Volcanic glass content ranges from 30 to 75 percent in coarse silt through fine sand fractions. Rock fragments range from 0 to 20 percent, dominantly fine gravel (2 to 5 mm diameter). Reaction is moderately alkaline or strongly alkaline. Soils are violently effervescent throughout. The parent material is ash flow tuff influenced by calcareous loess.

Occurrences of this ecological site correlated to the soil series Palinor will be field checked for recorrelation for the soil series and/or ecological site.

Table 4. Representative soil features

Parent material	(1) Residuum–tuff
Surface texture	(1) Gravelly sandy loam (2) Ashy
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Very slow to moderate
Soil depth	25–30 cm
Surface fragment cover <=3"	30–50%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	4.83–7.62 cm
Calcium carbonate equivalent (0-101.6cm)	1–5%
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	8–9
Subsurface fragment volume <=3" (Depth not specified)	0–20%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

An ecological site is the product of all the environmental factors responsible for its development and it has a set of key characteristics that influence a site's resilience to disturbance and resistance to invasives. Key characteristics include 1) climate (precipitation, temperature), 2) topography (aspect, slope, elevation, and landform), 3) hydrology (infiltration, runoff), 4) soils (depth, texture, structure, organic matter), 5) plant communities (functional groups, productivity), and 6) natural disturbance regime (fire, herbivory, etc.) (Caudle et. al 2013). Biotic factors that influence resilience include site productivity, species composition and structure, and population regulation and regeneration (Chambers et al. 2013).
This ecological site is dominated by deep-rooted cool season, perennial bunchgrasses and long-lived shrubs (50+ years) with high root to shoot ratios. The dominant shrubs usually root to the full depth of the winter-spring soil moisture recharge, which ranges from 1.0 and over 3.0 m (Comstock and Ehleringer 1992). The perennial bunchgrasses generally have somewhat shallower root systems than the shrubs, but root densities are often as high as or higher than those of shrubs in the upper 0.5 m but taper off more rapidly than shrubs. General differences in root depth distributions between grasses and shrubs results in resource partitioning in these shrub/grass systems.

In the Great Basin, the majority of annual precipitation is received during the winter and early spring. This continental semiarid climate regime favors growth and development of deep-rooted shrubs and herbaceous cool season plants using the C3 photosynthetic pathway (Comstock and Ehleringer 1992). Winter precipitation and slow melting of snow results in deeper percolation of moisture into the soil profile. Herbaceous plants, more shallow-rooted than shrubs, grow earlier in the growing season and thrive on spring rains, while the deeper rooted shrubs lag in phenological development because they draw from deeply infiltrating moisture from snowmelt the previous winter. Periodic drought regularly influences sagebrush ecosystems and drought duration and severity has increased throughout the 20th century in much of the Intermountain West. Major shifts away from historical precipitation patterns have the greatest potential to alter ecosystem function and productivity. Species composition and productivity can be altered by the timing of precipitation and water availability within the soil profile (Bates et al 2006). 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. The invasion of sagebrush communities by cheatgrass has been linked to disturbances (fire, abusive grazing) that have resulted in fluctuations in resources (Chambers et al 2007).

The introduction of annual weedy species, like cheatgrass, may cause an increase in fire frequency and eventually lead to an annual state. Conversely, as fire frequency decreases, sagebrush will increase and with inappropriate grazing management the perennial bunchgrasses and forbs may be reduced.

Variability in plant community composition and production depends on soil surface texture and depth. Needle and thread grass is adapted to coarser textured soils whereas Indian ricegrass will increase with sandy soil surfaces, and bottlebrush squirreltail will increase with silty soil surfaces.
Prolonged drought and/or abusive grazing will cause a decrease in Indian ricegrass and needle and thread grass while pygmy sagebrush and bare ground increases. Cheatgrass, halogeton, Russian thistle and other non-native annual weeds are likely to invade this site.
This ecological site may experience high wind erosion, especially with a decrease in vegetative cover. This can be caused by inappropriate grazing practices, drought, off-road vehicle use and/or fire.
This ecological site has low resilience to disturbance and resistance to invasion. Increased resilience increases with elevation, aspect, increased precipitation and increased nutrient availability. Three alternative states have been identified for this site.

Fire Ecology:
Fire is a very rare disturbance in these plant communities likely occurring in years with above average rainfall and production. Historically, pygmy sagebrush communities had sparse understories and bare soil in shrub interspaces, making these communities very resistant to fire.
Pygmy sagebrush does not resprout from fire or other disturbance and only regenerates from seed (Arizona Game and Fish Department 2004; Walton et al 1986). Recovery time may require 50 to 120 or more years (Baker 2006). The effect of fire on bunchgrasses relates to culm density, culm-leaf morphology, and the size of the plant. The initial condition of bunchgrasses within the site along with seasonality and intensity of the fire all factor into the individual species response. For most forbs and grasses the growing points are located at or below the soil surface providing relative protection from disturbances which decrease above ground biomass, such as grazing or fire. Thus, fire mortality is more correlated to duration and intensity of heat which is related to culm density, culm-leaf morphology, size of plant and abundance of old growth (Wright 1971, Young 1983). However, season and severity of the fire will influence plant response. Plant response will vary depending on post-fire soil moisture availability. Indian ricegrass, a dominant grass on this site, 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.
Needleandthread is a fine leaf grass and is considered sensitive to fire (Akinsoji 1988, Bradley et al. 1992, Miller et al. 2013). In a study by Wright and Klemmedson (1965), season of burn rather than fire intensity seemed to be the crucial factor in mortality for needleandthread grass. Early spring season burning was seen to kill the plants while August burning had no effect. Thus, under wildfire scenarios needle and thread is often present in the post-burn community.

Squirreltail is considered more fire tolerant than Indian ricegrass due to its small size, coarse stems, broad leaves and generally sparse leafy material (Wright 1971, Britton et al. 1990). Postfire regeneration occurs from surviving root crowns and from on-and off-site seed sources. Bottlebrush squirreltail has the ability to produce large numbers of highly germinable seeds, with relatively rapid germination (Young and Evans 1977) when exposed to the correct environmental cues. Early spring growth and ability to grow at low temperatures contribute to the persistence of bottle brush squirreltail among cheatgrass dominated ranges (Hironaka and Tisdale 1972).

State and transition model

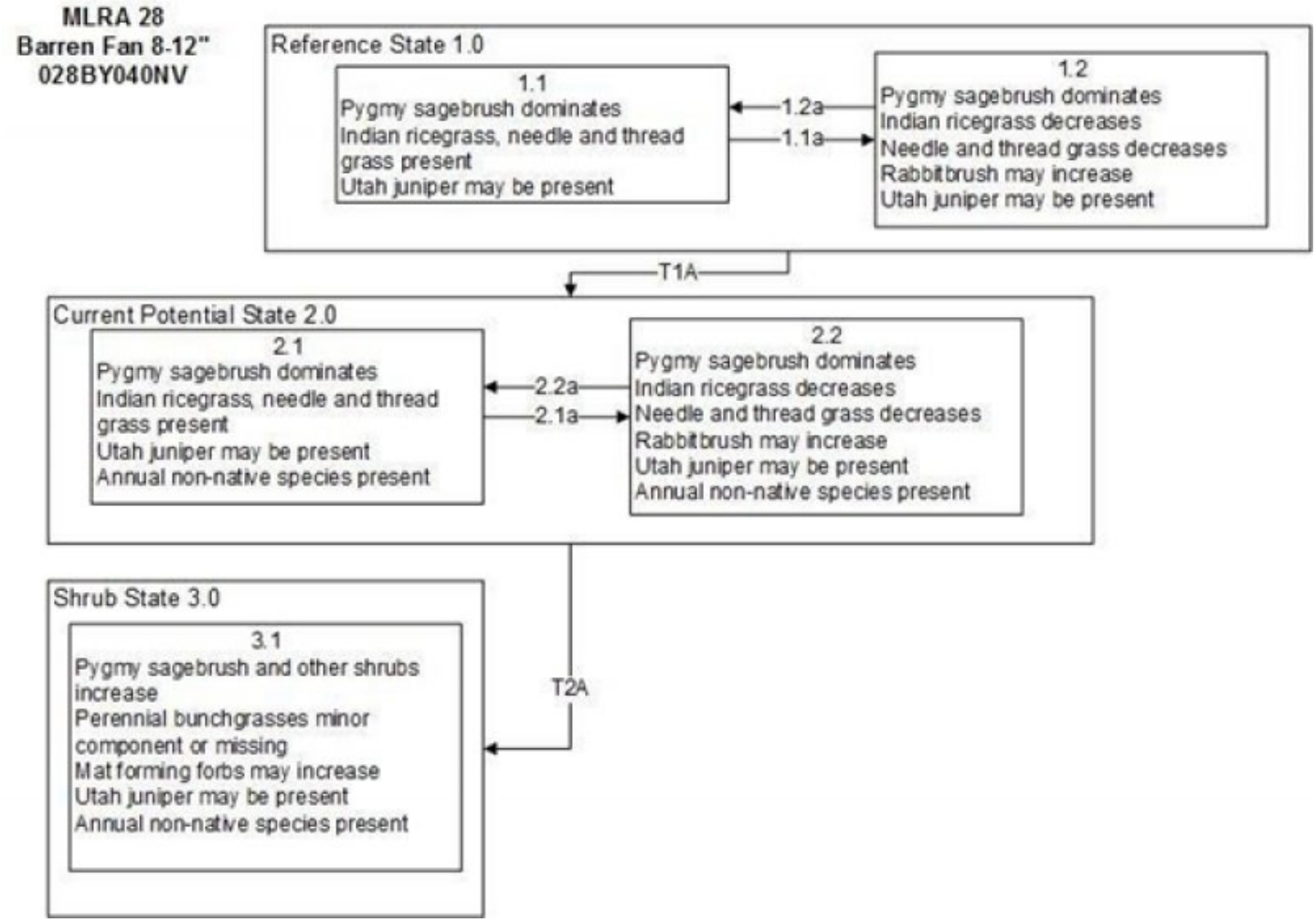

Figure 6. State and Transition Model

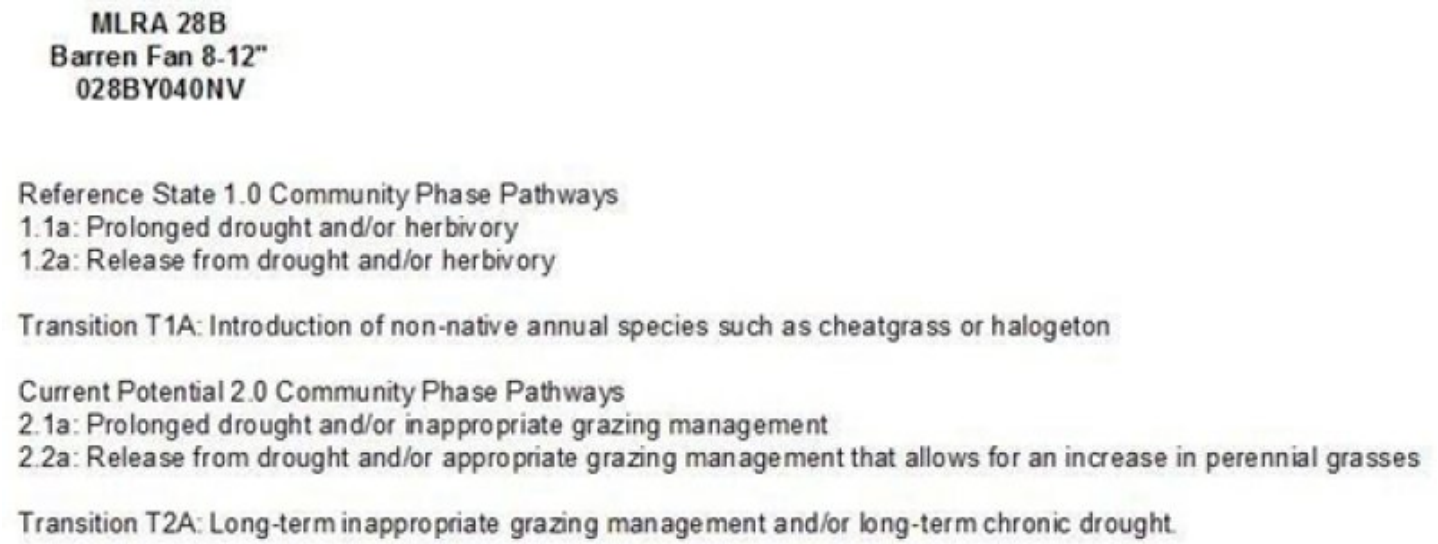

Figure 7. Legend

State 1

Reference State

The Reference State 1.0 is a representative of the natural range of variability under pristine conditions. The reference state has two general community phases; a shrub-grass dominant phase and a shrub dominant phase. State dynamics are maintained by interactions between climatic patterns and disturbance regimes. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These include the presence of all structural and functional groups, low fine fuel loads, and retention of organic matter and nutrients. Plant community phase changes are primarily driven by precipitation, periodic drought and/or insect or disease attack. This site is very stable, with little variation in plant community composition. Wet years will increase grass production, while drought years will reduce production. Shrub production will also increase during wet years.

Community 1.1
Community Phase

This community is dominated by pygmy sagebrush. Indian ricegrass and needleandthread grass are co-dominants in the understory. Forbs and other grasses such as bottlebrush squirreltail and Sandberg bluegrass make up smaller components. Utah juniper is described in the site concept and may or may not be present. Community phase changes are primarily a function of chronic drought. Drought will favor shrubs over perennial bunchgrasses. However, long-term drought will result in an overall decline in plant community production, regardless of functional group. Fire is very infrequent to non-existent. Potential vegetative composition is about 20% grasses, 5% forbs and 75% shrubs and trees. Approximate ground cover (basal and crown) is 8 to 14 percent.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	83	143	206
Grass/Grasslike	22	39	56
Forb	6	10	13
Tree	1	3	4
Total	**112**	**195**	**279**

Community 1.2
Community Phase

Figure 9. Barren Fan 8-12" (R028BY040NV) P. Novak-Echenique 6/5/2014

This community is dominated by pygmy sagebrush. Perennial bunchgrasses such as Indian ricegrass and needleandthread are decreased. Rabbitbrush may increase.

Pathway a
Community 1.1 to 1.2

Long-term drought and/or herbivory. Drought will favor shrubs over perennial bunchgrasses.

Pathway a
Community 1.2 to 1.1

Release from drought and/or herbivory would allow the vegetation to increase and bare ground would eventually decrease.

State 2
Current Potential State

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

Community 2.1
Community Phase

This community is compositionally similar to Reference State Community Phase 1.1 with the presence of non-native species in trace amounts. This community is dominated by pygmy sagebrush. Indian ricegrass and needleandthread grass makeup the understory. Forbs and other grasses make up smaller components. Utah juniper is described in the site concept and may or may not be present. Community phase changes are primarily a function of chronic drought. Fire is very infrequent due to low fuel loads.

Community 2.2
Community Phase

Figure 10. Barren Fan 8-12" (R028BY040NV) T.Stringham May 2012

Pygmy sagebrush and other shrubs increase while Indian ricegrass and needleandthread grass decline. Bare ground increases along with annual weeds. Rabbitbrush may increase. Prolonged drought may lead to an overall decline in the plant community.

Pathway a
Community 2.1 to 2.2

Inappropriate growing season grazing favors unpalatable shrubs over bunchgrasses. Prolonged drought will also decrease the perennial bunchgrasses in the understory.

Pathway a

Community 2.2 to 2.1

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

State 3
Shrub State

This state has one community phase that is characterized by a pygmy sagebrush and rabbitbrush overstory with a mat forming forb understory. The site has crossed a biotic threshold and site processes are being controlled by shrubs. Shrub cover exceeds the site concept and may be decadent, reflecting stand maturity and lack of seedling establishment due to competition with mature plants. The shrub overstory dominates site resources such that soil water, nutrient capture, nutrient cycling and soil organic matter are temporally and spatially redistributed. Bareground has increased.

Community 3.1
Community Phase

Decadent pygmy sagebrush dominates the overstory. Rabbitbrush and/or other sprouting shrubs may be a significant component. Mat-forming forbs may be significant component. Deep-rooted perennial bunchgrasses may be present in trace amounts or absent from the community. Annual non-native species increase. Bare ground is significant. Utah juniper may be present.

Transition A
State 1 to 2

Trigger: This transition is caused by the introduction of non-native annual plants, such as cheatgrass, mustards, and Russian thistle. 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: Long-term inappropriate grazing and/or long-term chronic drought will decrease or eliminate deep rooted perennial bunchgrasses and favor shrub growth and establishment. Slow variables: Long term decrease in deep-rooted perennial grass density. Threshold: Loss of deep-rooted perennial bunchgrasses changes nutrient cycling, nutrient redistribution, and reduces soil organic matter.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Primary Perennial Grasses**			18–61	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	4–20	–
	needle and thread	HECO26	*Hesperostipa comata*	4–20	–
	Sandberg bluegrass	POSE	*Poa secunda*	4–10	–
	squirreltail	ELEL5	*Elymus elymoides*	4–10	–
2	**Secondary Perennial Grasses**			4–10	
Forb					
3	**Perennial**			4–20	
	buckwheat	ERIOG	*Eriogonum*	1–4	–
	phlox	PHLOX	*Phlox*	1–4	–
	globemallow	SPHAE	*Sphaeralcea*	1–4	–
Shrub/Vine					
4	**Primary Shrubs**			99–138	
	pygmy sagebrush	ARPY2	*Artemisia pygmaea*	99–138	–
5	**Secondary Shrubs**			10–29	
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	1–6	–
	horsebrush	TETRA3	*Tetradymia*	1–6	–
Tree					
6	**Evergreen**			1–4	
	Utah juniper	JUOS	*Juniperus osteosperma*	1–4	–

Animal community

Livestock/Wildlife Interpretations:
This site is suitable for livestock grazing. Considerations for grazing management including timing, intensity and duration of grazing. Targeted grazing could be used to decrease the density of non-natives.
Pygmy sagebrush is a small cushion-like evergreen shrub and has little to no value as browse for wildlife or livestock (Johnson 1987, McArthur and Stevens 2004). It does however provide important groundcover in the dry, alkaline areas where little else will grow (McArthur and Stevens 2004).
Indian ricegrass is a deep-rooted, cool season perennial bunchgrass that is adapted primarily to sandy soils. Indian ricegrass is a preferred forage species for livestock and wildlife (Cook 1962, Booth et al. 2006). This species is often heavily utilized in winter because it cures well (Booth et al. 2006). It is also readily utilized in early spring, being a source of green feed before most other perennial grasses have produced new growth (Quinones 1981). Booth et al. (2006) note that the plant does well when utilized in winter and spring. Cook and Child (1971) however, found that repeated heavy grazing reduced crown cover, which may reduce seed production, density, and basal area of these plants. Additionally, heavy early spring grazing reduces plant vigor and stand density (Stubbendieck 1985). In eastern Idaho, productivity of Indian ricegrass was at least 10 times greater in undisturbed plots than in heavily grazed ones (Pearson 1965). A study by Cook and Child (1971) found significant reduction in plant cover after seven 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. Indian ricegrass is eaten by pronghorn in "moderate" amounts whenever available. A number of heteromyid rodents inhabiting desert rangelands show preference for seed of Indian ricegrass. Indian ricegrass is an important component of jackrabbit diets in spring and summer. Indian ricegrass seed provides food for many species of birds. Doves, for example, eat large amounts of shattered Indian ricegrass seed lying on the ground.
Needleandthread grass is most commonly found on warm/dry soils (Miller et al. 2013). It is not grazing tolerant and will be one of the first grasses to decrease under heavy grazing pressure (Smoliak et al. 1972, Tueller and Blackburn 1974). Heavy grazing is likely to reduce basal area of these plants (Smoliak et al. 1972). With the

reduction in competition from deep rooted perennial bunchgrasses, shallower rooted grasses such as Sandberg bluegrass and forbs may increase (Smoliak et al. 1972). Needleandthread is moderately important spring forage for mule deer, but use declines considerably as more preferred forages become available. Bottlebrush squirreltail is a dietary component of several wildlife species. Bottlebrush squirreltail may provide forage for mule deer and pronghorn. Sandberg bluegrass is an important forage species for many wildlife species.
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.

Hydrological functions

Runoff is very high. Permeability is very slow to moderately high.

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.

Other products

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

Other information

Needleandthread is useful for stabilizing eroded or degraded sites. Bottlebrush squirreltail is tolerant of disturbance and is a suitable species for revegetation.

Type locality

Location 1: White Pine County, NV	
Township/Range/Section	T19N R63E S35
Latitude	39° 28′ 10″
Longitude	114° 51′ 7″
General legal description	SW¼ NE¼, Directly across road from Bassett Lake on northeast side of lake, about 6 miles northwest of McGill, White Pine County, Nevada. Also occurs in Elko County, Nevada.

Other references

Akinsoji, A. 1988. Postfire vegetation dynamics in a sagebrush steppe in southeastern Idaho, USA. Vegetation 78:151-155.

Arizona Game and Fish Department. 2004. Artemisia pygmaea. Unpublished abstract compiled and edited by Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ 5 pp.

Baker, W. L. 2006. Fire and restoration of sagebrush ecosystems. Wildlife Society Bulletin 34:177-185.

Bich, B. S., J. L. Butler, and C. A. Schmidt. 1995. Effects of Differential Livestock Use on Key Plant Species and Rodent Populations within Selected Oryzopsis hymenoides/Hilaria jamesii Communities of Glen Canyon National Recreation Area. The Southwestern Naturalist 40:281-287.

Blaisdell, J. P., R. B. Murray, and E. D. McArthur. 1982. Managing intermountain rangelands-sagebrush-grass ranges. Gen. Tech. Rep. INT-134. U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station, Ogden, UT.

Booth, D. T., C. G. Howard, and C. E. Mowry. 2006. 'Nezpar' Indian ricegrass: description, justification for release, and recommendations for use. Rangelands Archives 2:53-54.

Bradley, A. F., N. V. Noste, and W. C. Fischer. 1992. Gen. Tech. Rep. INT-287: Fire ecology of forests and woodlands in Utah. . U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Ogden, UT.

Britton, C. M., G. R. McPherson, and F. A. Sneva. 1990. Effects of burning and clipping on five bunchgrasses in eastern Oregon. Great Basin Naturalist 50:115-120.

Caudle, D., J. DiBenedetto, M. Karl, H. Sanchez, and C. Talbot. 2013. Interagency ecological site handbook for rangelands. Available at: http://jornada.nmsu.edu/sites/jornada.nmsu.edu/files/InteragencyEcolSiteHandbook.pdf. Accessed 4 October 2013.

Chambers, J., B. Bradley, C. Brown, C. D'Antonio, M. Germino, J. Grace, S. Hardegree, R. Miller, and D. Pyke. 2013. Resilience to Stress and Disturbance, and Resistance to Bromus tectorum L. Invasion in Cold Desert Shrublands of Western North America. Ecosystems:1-16.

Cook, C. W. 1962. An Evaluation of Some Common Factors Affecting Utilization of Desert Range Species. Journal of Range Management 15:333-338.

Cook, C. W. and R. D. Child. 1971. Recovery of Desert Plants in Various States of Vigor. Journal of Range Management 24:339-343.

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

Hironaka, M. and E.W. Tisdale. 1972. Growth and development of Sitanion hystrix and Poa sandbergii. Research Memorandum RM 72-124. U.S. International Biological Program, Desert Biome 15 p.

Houghton, J.G., C.M. Sakamoto, and R.O. Gifford. 1975. Nevada's Weather and Climate, Special Publication 2. Nevada Bureau of Mines and Geology, Mackay School of Mines, University of Nevada, Reno, NV.

Johnson, K. L. 1987. Sagebrush types as ecological indicators to integrated pest management (IPM) in the sagebrush ecosystem of western North America. Pages 1-10 in Integrated pest management on rangland: state of the art in the sagebrush ecosystem. ARS-50. USDA, Agricultural Research Service, Washington DC.

McArthur, E. D. 1994. Ecology, distribution, and values of sagebrush within the Intermountain Region. Pages 347-351 in Proceedings--ecology and mangement of annual rangelands. Gen. Tech. Rep. INT-GTR-313. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Boise, ID.

McArthur, E. D. and R. Stevens. 2004. Composite shrubs. Restoring western ranges and wildlands: 2004:493-437.

Miller, R. F., J. C. Chambers, D. A. Pyke, F. B. Pierson, and C. J. Williams. 2013. A review of fire effects on vegetation and soils in the Great Basin Region: response and ecological site characteristics.

National Oceanic and Atmospheric Administration. 2004. The North American Monsoon. Reports to the Nation. National Weather Service, Climate Prediction Center. Available online: http://www.weather.gov/.

Pearson, L. 1964. Effect of harvest date on recovery of range grasses and shrubs. Agronomy Journal 56:80-82.

Pearson, L. C. 1965. Primary Production in Grazed and Ungrazed Desert Communities of Eastern Idaho. Ecology 46:278-285.

Quinones, F. A. 1981. Indian ricegrass evaluation and breeding. Bulletin 681. Page 19. New Mexico State University, Agricultural Experiment Station, Las Cruces, NM.

Robberecht, R. and G. Defossé. 1995. The relative sensitivity of two bunchgrass species to fire. International Journal of Wildland Fire 5:127-134.

Smoliak, S., J. F. Dormaar, and A. Johnston. 1972. Long-Term Grazing Effects on Stipa-Bouteloua Prairie Soils. Journal of Range Management 25:246-250.

Stringham, T.K., P. Novak-Echenique, P. Blackburn, C. Coombs, D. Snyder and A. Wartgow. 2015. Final Report for USDA Ecological Site Description State-and-Transition Models, Major Land Resource Area 28A and 28B Nevada. University of Nevada Reno, Nevada Agricultural Experiment Station Research Report 2015-01. p. 1524.

Stubbendieck, J. L. 1985. Nebraska Range and Pasture Grasses: (including Grass-like Plants). University of Nebraska, Department of Agriculture, Cooperative Extension Service, Lincoln, NE.

Tueller, P. T. and W. H. Blackburn. 1974. Condition and Trend of the Big Sagebrush/Needleandthread Habitat Type in Nevada. Journal of Range Management 27:36-40.
USDA-NRCS Plants Database (Online; http://www.plants.usda.gov).

Vallentine, J. F. 1989. Range development and improvements. Academic Press, Inc.

Walton, Todd P, R.S. White, and C.L. Wambolt. 1986. Artemisia reproductive strategies: a review with emphasis on plains silver sagebrush. In: McArthur, E. Durant; Welch, Bruce L., compilers. Proceedings--symposium on the biology of Artemisia and Chrysothamnus; 1984 July 9-13; Provo, UT. Gen. Tech. Rep. INT-200. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 67-74.

West, N. E. 1994. Effects of fire on salt-desert shrub rangelands.in Proceedings--Ecology and Management of Annual Rangelands, General Technical Report INT-313. USDA Forest Service, Intermountain Research Station, Boise, ID.

Wright, H. A. 1971. Why Squirreltail Is More Tolerant to Burning than Needle-and-Thread. Journal of Range Management 24:277-284.

Wright, H. A. 1985. Effects of fire on grasses and forbs in sagebrush-grass communities. Pages 12-21 in Rangeland Fire Effects; A Symposium: Boise, ID, USDI-BLM.

Wright, H. A. and J. O. Klemmedson. 1965. Effect of Fire on Bunchgrasses of the Sagebrush-Grass Region in Southern Idaho. Ecology 46:680-688.

Young, J. A. and R. A. Evans. 1977. Squirreltail Seed Germination. Journal of Range Management 30:33-36.

Young, R. P. 1983. Fire as a vegetation management tool in rangelands of the intermountain region. Pages 18-31 in Managing intermountain rangelands - improvement of range and wildlife habitats. USDA, Forest Service.

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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)	P. NOVAK-ECHENIQUE
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Date	03/17/2015

Approved by	
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 rills can be expected particularly in areas subjected to summer convection storms or rapid spring snowmelt.

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2. **Presence of water flow patterns:** Water flow patterns are none to rare. A few may occur after summer convection storms or rapid snowmelt. These are short (<1m), meandering and not connected.

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3. **Number and height of erosional pedestals or terracettes:** Pedestals are rare and are limited to water flow patterns.

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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 50%; surface cover of rock fragments up to 20%

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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:** Minor evidence of wind-scouring with slight depositional mounding at base of shrubs and grasses. This site is subject to severe wind erosion if the vegetative cover is lost.

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

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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 2 to 4 on most soil textures found on this site. Areas of this site occurring on soils that have a vesicular crust will probably have stability values less than 3.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Surface structure is typically subangular blocky or fine to medium platy. Soil surface colors are light grays or brownish grays and the soils are typified by an ochric epipedon. Surface textures are gravelly ashy sandy loams or sandy loams. Organic matter of the surface 2 to 3 inches 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:** Sparse shrub canopy and associated litter break raindrop impact and provide for some snow capture on site.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** Compacted layers are none. Subangular blocky or prismatic structure or subsurface argillic or calcic horizons should not be mistaken for compaction.

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: Low-statured shrubs (pygmy sagebrush)

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

    Other: microbiotic crusts

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Dead branches within individual shrubs common and standing dead shrub canopy material may be as much as 35% of total woody canopy; mature bunchgrasses commonly (±25%) have dead centers.

14. **Average percent litter cover (%) and depth (in):** Between plant interspaces 5-10%; depth <1/4 inch

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** For normal or average growing season (February thru June) ±175 lbs/ac; Favorable years: 250 lbs/ ac; Unfavorable years: 100 lbs/ac

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

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.