USDA Natural Resources
Conservation Service

Ecological site R028BY066NV
LIMESTONE HILL

Accessed: 05/19/2024

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.

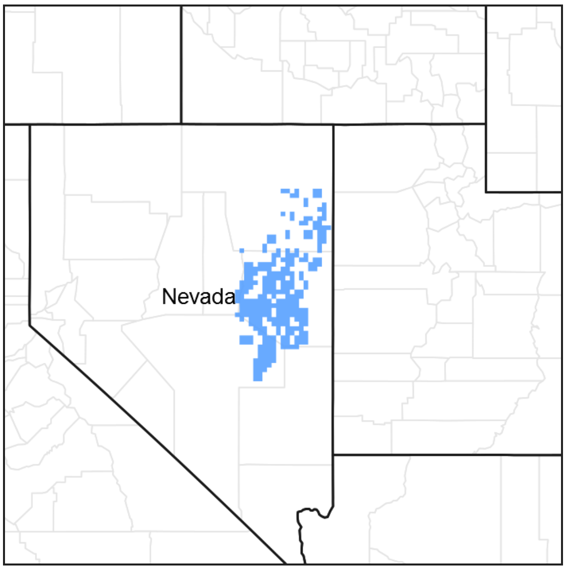


Figure 1. Mapped extent

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 mountains on all exposures. Slopes gradients of 15 to 50 percent are typical. Elevations are 6200 to 9500 feet.

Soils associated with this site are very shallow, well drained, and formed in residuum and colluvium derived from limestone and dolomite. The soil profile is modified with 60 to 75 percent rock fragments, dominated by cobbles and stones. Soils are characterized by a very low AWC due to shallow depth and carbonate minerology.

The reference state is dominated by littleleaf mountain mahogany. Black sagebrush, desert snowberry, Scribner needlegrass and Indian ricegrass are associated species. Average annual production ranges from 800 to 1300 pounds per acre.

Associated sites

F028BY060NV	**PIMO-JUOS/ARNO4/PSSPS-ACHY**
R028BY008NV	**SHALLOW CALCAREOUS SLOPE 10-12 P.Z.**

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Cercocarpus intricatus* (2) *Artemisia nova*
Herbaceous	(1) *Achnatherum scribneri*

Physiographic features

This site occurs on mountains, including sideslopes and shoulders on all exposures. Slopes range from 8 to 75 percent, but slope gradients of 15 to 50 percent are most typical. Elevations are 6200 to 9500 feet.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope (2) Mountain slope
Flooding frequency	None
Ponding frequency	None
Elevation	1,890–2,896 m
Slope	8–75%
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.

Average annual precipitation ranges from 10 to 14 inches. Mean annual air temperature is about 44 to 57 degrees F. The average growing season is approximately 100 to 140 days.

At the Ely climate station, the mean annual precipitation is approximately 10.09 inches and the mean annual air temperature is 44.7 degrees F. Mean precipitation by month (Ely 262631): Jan 0.77; Feb 0.78; Mar 1.01; Apr 1.03; May 1.10; Jun 0.65; Jul 0.64; Aug 0.81; Sept 0.75; Oct 0.82; Nov 0.68; Dec 0.68.

Table 3. Representative climatic features

Frost-free period (average)	66 days
Freeze-free period (average)	110 days
Precipitation total (average)	254 mm

Climate stations used

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

Influencing water features

Influencing water features are not associated with this site.

Soil features

Soils associated with this site are very shallow, well drained and formed in residuum and colluvium derived from limestone and dolomite. The soil profile is characterized by an ochric epipedon and is modified with 60 to 75 percent rock fragments, dominated by cobbles and stones. Runoff is high to very high. Available water holding capacity is very low. Soil temperature regime is frigid and the soil moisture regime is aridic bordering on xeric.
The soil series associated with this site include Hyzen and Mijoysee.

The representative soil series is Mijoysee, a Loamy-skeletal, carbonatic, frigid Lithic Xeric Torriorthents. Diagnostic horizons include an ochric epipedon from soil surface to 15cm. Identifiable secondary calcium carbonates occur from 7 to 15cm. Depth to bedrock is about 15cm. Clay content in the particle size control section averages 8 to 18 percent. Rock fragments range from 50 to 75 percent; includes gravel and cobbles. Reaction is slightly alkaline to moderately alkaline. Soils are violently effervescent throughout. Lithology consists of limestone and dolomite.

Table 4. Representative soil features

Parent material	(1) Residuum–limestone (2) Colluvium–dolomite
Surface texture	(1) Extremely gravelly sandy loam (2) Very stony loam (3) Extremely stony

Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderate to moderately rapid
Soil depth	10–20 cm
Surface fragment cover <=3"	35–45%
Surface fragment cover >3"	30–35%
Available water capacity (0-101.6cm)	0.76–5.08 cm
Calcium carbonate equivalent (0-101.6cm)	20–60%
Electrical conductivity (0-101.6cm)	0–5 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–3
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	30–35%
Subsurface fragment volume >3" (Depth not specified)	25–30%

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).

The ecological site is dominated by the long-lived littleleaf mountain mahogany, deep-rooted cool season perennial bunchgrasses, and other long-lived shrubs (50+ years) with high root to shoot ratios. Littleleaf mountain mahogany occurs rooted in the cracks and crevices of exposed limestone and dolomite (Davis 1990). 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 meters. General differences in root depth distributions between grasses and shrubs results in resource partitioning in this system.

The Great Basin sagebrush 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. 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).

Littleleaf mountain mahogany (*Cercocarpus intricatus*) is a long-lived, intricately branched, and occasionally tree-like evergreen shrub. Its height may vary from 0.5 to 2.5m. Littleleaf mahogany is found throughout most of Nevada and Utah, and parts of California, Arizona and Colorado (Davis 1990). It is found mostly on rocky limestone slopes primarily within the pinyon woodland. Where it occurs near curl-leaf mountain mahogany (*Cercocarpus ledifolius*) the two may hybridize (Brayton and Mooney 1966).

Black sagebrush is generally long-lived; therefore it is not necessary for new individuals to recruit every year for perpetuation of the stand. Infrequent large recruitment events and simultaneous low, continuous recruitment is the foundation of population maintenance (Noy-Meir 1973). Survival of the seedlings is dependent on adequate moisture conditions.

The perennial bunchgrasses include Scribner needlegrass, Indian ricegrass, bluebunch wheatgrass, muttongrass and squirreltail. These species 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 of the soil profile. General differences in root depth distributions between grasses and shrubs results in resource partitioning in these shrub/grass systems.

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 Limestone Hill is a very stable ecological site. Fire is the main disturbance but will be rare and low severity due to low fuel loads. The majority of fires will be from lightning strikes and produce minor spot burns which create a mosaic of trees, shrubs, grasses, and forbs. Open areas will be dominated by shrubs and bunchgrasses such as bluebunch wheatgrass.
The ecological site has low to moderate resilience to disturbance and resistance to invasion. Resilience increases with elevation, aspect, precipitation, and nutrient availability. Long-term disturbance response may be influenced by small differences in landscape topography. Concave areas receive run-in from adjacent landscapes and consequently retain more moisture to support the growth of deep-rooted perennial grasses (i.e. bluebunch wheatgrass) whereas convex areas where runoff occurs are slightly less resilient and may have more shallow-rooted perennial grasses (i.e. Sandberg bluegrass). North slopes are also more resilient than south slopes because lower soil surface temperatures operate to keep moisture content higher on northern exposures. Two possible alternative stable states have been identified for this site.

Fire Ecology:

Literature on fire response in littleleaf mountain mahogany communities is scarce, however Kitchen (2012) studied historical fire regimes in the Wah Wah mountains in Utah where numerous forest and woodland openings are dominated by black sagebrush and littleleaf mountain mahogany. Point mean fire interval estimates for areas around these sites ranged from 13.8 to 138.4 years.
Black sagebrush plants have no morphological adaptations for surviving fire and must reestablish from seed following fire (Wright et al. 1979). The ability of black sagebrush to establish after fire is mostly dependent on the amount of seed deposited in the seed bank the year before the fire. Seeds typically do not persist in the soil for more than 1 growing season (Beetle 1960). A few seeds may remain viable in soil for 2 years (Meyer 2008); however, even in dry storage, black sagebrush seed viability has been found to drop rapidly over time, from 81% to 1% viability after 2 and 10 years of storage, respectively (Stevens et al. 1981). Thus, repeated frequent fires can eliminate black sagebrush from a site, however black sagebrush in zones receiving 12 to 16 inches of annual precipitation have been found to have greater fire survival (Boltz 1994). In lower precipitation zones rabbitbrush may become the dominant shrub species following fire, often with an understory of Sandberg bluegrass and/or cheatgrass and other weedy species.
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 also vary depending on post-fire soil moisture availability.
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.
Fire will remove aboveground biomass from bluebunch wheatgrass but plant mortality is generally low (Robberecht and Defossé 1995) because the buds are underground (Conrad and Poulton 1966) or protected by foliage. Uresk et al. (1976) reported burning increased vegetative and reproductive vigor of bluebunch wheatgrass. Thus, bluebunch wheatgrass is considered to experience slight damage to fire but is more susceptible in drought years (Young 1983). Plant response will vary depending on season, fire severity, fire intensity and post-fire soil moisture availability.

State and transition model

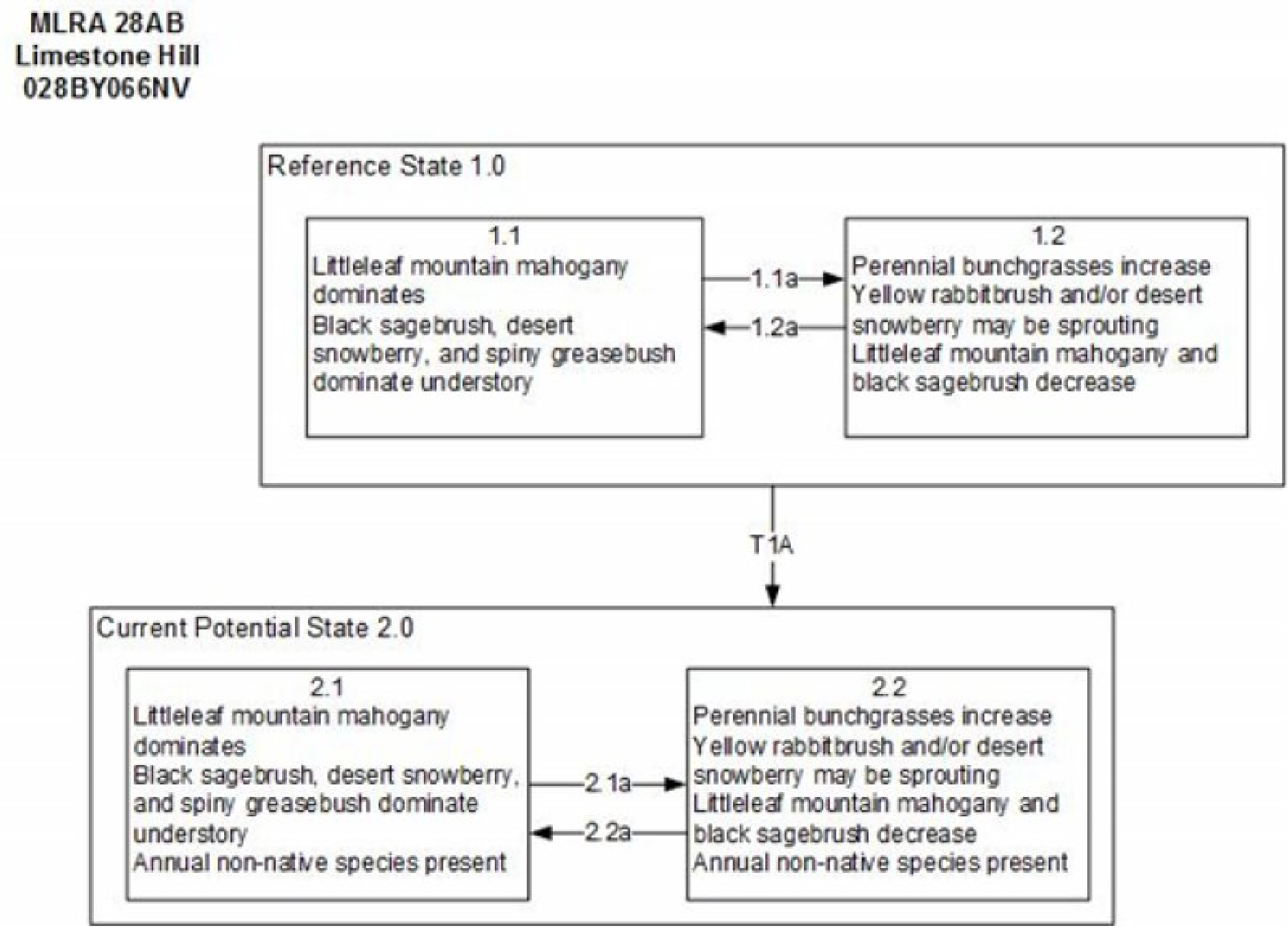
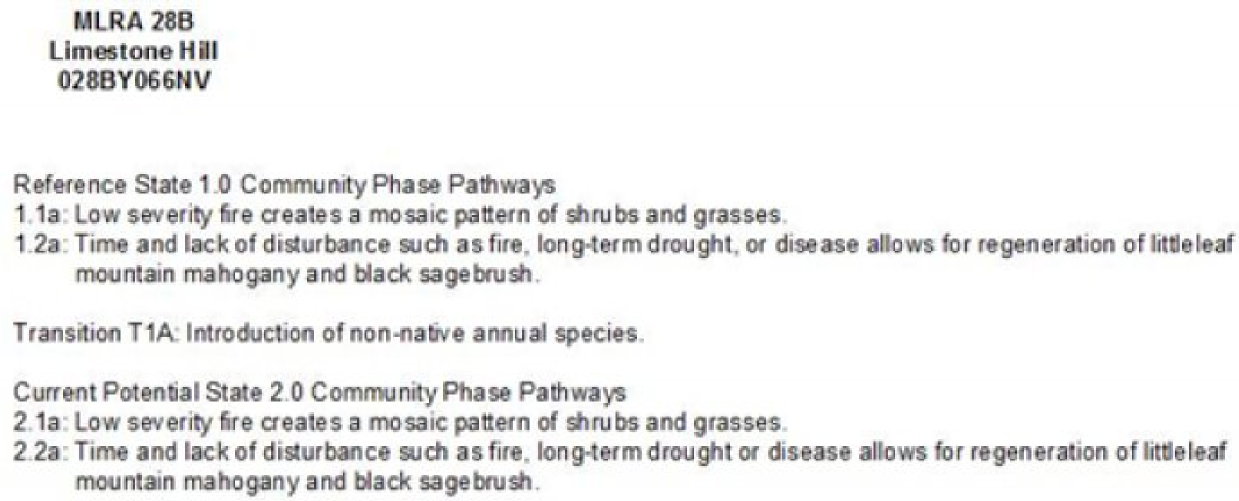


Figure 6. State and Transition Model



MLRA 28B
Limestone Hill
028BY066NV

Reference State 1.0 Community Phase Pathways
1.1a: Low severity fire creates a mosaic pattern of shrubs and grasses.
1.2a: Time and lack of disturbance such as fire, long-term drought, or disease allows for regeneration of littleleaf mountain mahogany and black sagebrush.

Transition T1A: Introduction of non-native annual species.

Current Potential State 2.0 Community Phase Pathways
2.1a: Low severity fire creates a mosaic pattern of shrubs and grasses.
2.2a: Time and lack of disturbance such as fire, long-term drought or disease allows for regeneration of littleleaf mountain mahogany and black sagebrush.

Figure 7. Legend

State 1
Reference State

The Reference State 1.0 is representative of the natural range of variability under pristine conditions. The

Reference State has two general community phases: a dominant tree/shrub phase and a dominant tree/grass 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 fire, periodic drought and/or insect or disease attack. Management should focus on maintaining high species diversity of desired species to promote site resiliency.

Community 1.1
Community Phase

This community phase is characterized by the dominance of littleleaf mountain mahogany. Black sagebrush and desert snowberry are other common shrubs. Scribner needlegrass and Indian ricegrass are the dominant bunchgrasses in the understory. Bottlebrush squirreltail, bluebunch wheatgrass and Sandberg bluegrass are also present. Perennial forbs such as mock goldenweed (*Stenotus acaulis*), beardtongue (Penstemon spp.), fineleaf hymenopappus (*Hymenopappus filifolius*) make up minor components. Utah juniper may be present in small amounts. The plant community is dominated by littleleaf mountain mahogany. Black sagebrush, desert snowberry, Scribner needlegrass and Indian ricegrass are important species associated with this site. Potential vegetative composition is about 15% grasses, 10% forbs and 75% shrubs and trees. Approximate ground cover (basal and crown) is 25 to 35 percent.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	661	813	1048
Grass/Grasslike	135	168	219
Forb	90	112	146
Tree	11	28	45
Total	**897**	**1121**	**1458**

Community 1.2
Community Phase

Littleleaf mountain mahogany is reduced but remains as a major component of the overstory. Black sagebrush is reduced. Yellow rabbitbrush and desert snowberry may be sprouting. Perennial bunchgrasses may be reduced the first season after fire but will likely increase in cover and density due to the reduced competition from shrubs and trees. Forbs may increase the first season after fire, but continue to decline as grasses and shrubs return to pre-burn densities.

Pathway a
Community 1.1 to 1.2

A low severity fire would reduce cover of a few shrubs and allow the perennial bunchgrasses to increase.

Pathway a
Community 1.2 to 1.1

Time without disturbance such as fire, extended drought, or disease will allow for the trees and shrubs to increase in height and density.

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. 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 9. Limestone Hill (R028BY066NV) T.Stringham June 2013

This community phase is characterized by a dominance of littleleaf mountain mahogany. Black sagebrush and desert snowberry are common associated shrubs. Scribner needlegrass and Indian ricegrass are the dominant bunchgrasses in the understory. Bottlebrush squirreltail, bluebunch wheatgrass and Sandberg bluegrass are also present. Perennial forbs comprise a minor component in the understory. Annual non-native species are present in the understory. Utah juniper may be present in small amounts.

Community 2.2
Community Phase

Littleleaf mountain mahogany is reduced but remains as a major component of the overstory. Black sagebrush is reduced and desert snowberry may be sprouting. Perennial bunchgrasses may be reduced the first season after fire but will likely increase in cover and density due to the reduced competition from shrubs and trees. Annual non-native species respond well to fire and may increase.

Pathway a
Community 2.1 to 2.2

A low severity fire would reduce the canopy of the shrubs and allow the perennial bunchgrasses to increase.

Pathway a
Community 2.2 to 2.1

Time without disturbance such as fire, extended drought, or disease will allow for the trees and shrubs to increase in height and density.

Transition A
State 1 to 2

Trigger: This transition is caused by the introduction of non-native annual plants, such as cheatgrass and annual mustards. 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.

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**			45–168	
	Scribner needlegrass	ACSC11	*Achnatherum scribneri*	22–112	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	22–56	–
2	**Secondary Perennial Grasses**			56–112	
	squirreltail	ELEL5	*Elymus elymoides*	6–22	–
	muttongrass	POFE	*Poa fendleriana*	6–22	–
	Sandberg bluegrass	POSE	*Poa secunda*	6–22	–
	bluebunch wheatgrass	PSSPS	*Pseudoroegneria spicata ssp. spicata*	6–22	–
Forb					
3	**Perennial**			78–168	
	goldenweed	PYRRO	*Pyrrocoma*	22–56	–
	milkvetch	ASTRA	*Astragalus*	6–22	–
	buckwheat	ERIOG	*Eriogonum*	6–22	–
	mat rockspirea	PECA12	*Petrophytum caespitosum*	6–22	–
	phlox	PHLOX	*Phlox*	6–22	–
Shrub/Vine					
4	**Primary Shrubs**			717–964	
	littleleaf mountain mahogany	CEIN7	*Cercocarpus intricatus*	673–785	–
	desert snowberry	SYLO	*Symphoricarpos longiflorus*	22–90	–
	black sagebrush	ARNO4	*Artemisia nova*	22–90	–
5	**Secondary Shrubs**			11–45	
	spiny greasebush	GLSPA	*Glossopetalon spinescens var. aridum*	6–22	–
	Stansbury cliffrose	PUST	*Purshia stansburiana*	6–22	–
	wax currant	RICE	*Ribes cereum*	6–22	–
Tree					
6	**Evergreen**			11–45	
	Utah juniper	JUOS	*Juniperus osteosperma*	6–22	–
	singleleaf pinyon	PIMO	*Pinus monophylla*	6–22	–

Animal community

Livestock Interpretations:
This site has limited value for livestock grazing due to low amounts of palatable forage and steep slopes. Grazing considerations include timing, intensity and duration of grazing.
Cattle and sheep will feed on littleleaf mountain mahogany slightly in the winter, and is generally of minor significance to livestock. Domestic sheep will browse black sagebrush during all seasons of the year depending on the availability of other forage species with greater amounts being consumed in fall and winter. Black sagebrush is generally less palatable to cattle than to domestic sheep and wild ungulates (McArthur et al. 1982); however, cattle use of black sagebrush has also been shown to be greatest in fall and winter (Schultz and McAdoo 2002), with only

trace amounts being consumed in summer (Van Vuren 1984).
Bluebunch wheatgrass is moderately grazing tolerant and is very sensitive to defoliation during the active growth period (Blaisdell and Pechanec 1949, Laycock 1967, Anderson and Scherzinger 1975, Britton et al. 1990). Herbage and flower stalk production was reduced with clipping at all times during the growing season; however, clipping was most harmful during the boot stage (Blaisdell and Pechanec 1949)). Tiller production and growth of bluebunch was greatly reduced when clipping was coupled with drought (Busso and Richards 1995). Mueggler (1975) estimated that low vigor bluebunch wheatgrass may need up to 8 years rest to recover. Although an important forage species, it is not always the preferred species by livestock and wildlife.
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 feed before most other perennial grasses have produced new growth (Quinones 1981). Booth et al. (2006) note that bluebunch wheatgrass 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). 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.
Scribner’s needlegrass is palatable to livestock and is grazed during the spring. Indian ricegrass is highly palatable to all classes of livestock in both green and cured condition. It supplies a source of green feed before most other native grasses have produced much new growth. Since desert snowberry leafs out in early spring it is utilized by all browsing animals at that time but, in general, use is very limited.
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 wildlife habitat for several species of wildlife. Littleleaf mountain mahogany is browsed by wild ungulates and domestic sheep where it is within reach (Francis 2004), however Clary and Beale (1983) noted that pronghorn appeared to make little use of this plant when other forage, such as black sagebrush, was available, even in winter.
Littleleaf mountain mahogany is good winter browse for deer and elk. Black sagebrush palatability has been rated as moderate to high depending on the ungulate and the season of use (Horton 1989, Wambolt 1996). The palatability of black sagebrush increase the potential negative impacts on remaining black sagebrush plants from grazing or browsing pressure following fire (Wambolt 1996). Pronghorn utilize black sagebrush heavily (Beale and Smith 1970). It is especially important on low elevation winter ranges in the southern Great Basin, where extended snow free periods allow animal’s access to plants throughout most of the winter. In these areas it is heavily utilized by pronghorn and mule deer. Desert snowberry is browsed by deer and livestock and the seeds are eaten by birds, especially the gallinaceous birds such as ring-necked pheasants, grouse, and quail. Sage-grouse in Nevada utilize desert snowberry as both juveniles and adults. The American pika and various ground squirrels also eat the seeds. Desert snowberry is used "lightly" in all seasons but winter, when it is not utilized by mule deer. Limited summer use of desert snowberry by pronghorns in has been observed. Cover value of desert snowberry for big game is limited by its size. However, it provides fair cover for both upland game birds and small nongame birds and good cover for small mammals. Scribner’s needlegrass is palatable to wildlife and is grazed during the spring. 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.

Hydrological functions

Permeability is moderate to moderately rapid. Runoff is high to very 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. 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 Americans. The Paiutes used seed as a reserve food source.

Other information

Black sagebrush is an excellent species to establish on sites where management objectives include restoration or improvement of domestic sheep, pronghorn, or mule deer winter range.

Type locality

Location 1: White Pine County, NV	
Township/Range/Section	T18N R54E S26
Latitude	39° 24′ 15″
Longitude	115° 51′ 39″
General legal description	About 8 miles southeast of Eureka (south end of Diamond Mountains) and about 2 miles north of Highway 50, White Pine County, 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)	P NOVAK-ECHENIQUE
Contact for lead author	State Rangeland Management Specialist.
Date	04/02/2014
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. Rock fragments armor the surface.

2. **Presence of water flow patterns:** Water flow patterns are none to rare. A few may occur after summer convection storms or rapid snow melt. These will be short (<2m), meandering and not connected. They are interrupted by rock fragments and plant bases.

3. **Number and height of erosional pedestals or terracettes:** Pedestals are none to rare. A few may occur in flow paths.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare Ground to 5-15%. Surface rock fragments up to 85%.

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

6. **Extent of wind scoured, blowouts and/or depositional areas:** None - rock fragments protect soil surface.

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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 4 to 6 on most soil textures found on this site. (To be field tested.)

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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 medium platy. Soil surface colors are browns and soils are typified by an ochric epipedon. Surface textures are loams. Organic matter of the surface 2 to 3 inches is 1 to 3 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 allow for snow capture on the site. Deep-rooted perennial grasses increase 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):** None. The soil is very shallow to bedrock. Subsurface subangular blocky structure should not be mistaken for 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: evergreen tall shrubs (littleleaf mountain mahogany)

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

    Other: evergreen trees

    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; mature bunchgrasses commonly (<20%) have dead centers.

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14. **Average percent litter cover (%) and depth (in):** Between plant interspaces 25-35% and depth <¼-inch.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** For normal or average growing season ± 1000 lbs/ac. Favorable years ± 1300 lbs/ac and unfavorable

years ± 800 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 on this site include cheatgrass and annual mustards.

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