Ecological site F028BY072NV
Concave Mountain Slopes

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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 forest site occurs slightly concave mountain sideslopes with a north aspect. Slopes of 30 to 50 percent are typical. Elevations are 7500 to 11000 feet.

Soils associated with this site are moderately deep, well drained, and formed in residuum/colluvium derived from limestone parent material. Soil profile is modified by large volumes of gravel, cobbles and stones throughout.

The reference plant community is dominated by Engelmann's spruce. Overstory composition is about 80 to 90 percent Engelmann's spruce, 5 to 10 percent white fir and quaking aspen. Mountain gooseberry, western raspberry and snowberry are important understory shrubs. Columbia needlegrass, pinegrass, mountain brome and slender wheatgrass are the most prevalent understory grasses. Starwort, meadowrue, and erigeron are common understory forbs. An overstory canopy of 40 to 50 percent is assumed to be representative.

The site was formerly known as PIEN/RIMO2/BRMA4-ACNE9.

Associated sites

R028BY032NV	**STONY MAHOGANY SAVANNA** Occurs on shallow soils in the map unit.
R028BY070NV	**MOUNTAIN LOAM 16+ P.Z.** Occurs on deeper soil and is dominated by shrubs.

Similar sites

R028BY088NV	**CALCAREOUS LOAM 14-16 P.Z.** Also on concave mountain slopes, however not dominated by conifers.

Table 1. Dominant plant species

Tree	(1) *Picea engelmannii*
Shrub	(1) *Ribes montigenum*
Herbaceous	(1) *Bromus marginatus* (2) *Achnatherum nelsonii*

Physiographic features

This forestland site occurs on slightly concave mountain sideslopes with a northerly aspect. Slopes range from 15 to 75 percent, but are typically 30 to 75 percent. Elevations are 7500 to 11000 feet.

Table 2. Representative physiographic features

Landforms	(1) Mountain
Runoff class	Medium to high
Elevation	2,286–3,353 m
Slope	15–75%
Water table depth	183 cm
Aspect	Aspect is not a significant factor

Climatic features

The climate is semi-arid. In general it is characterized by cold, moist winters and warm, dry summers.

Average annual precipitation ranges from 25 to 35 inches. Mean annual air temperature is about 40 to 43 degrees F. The average growing season is 50 to 70 days.

There is no available climate station.

Table 3. Representative climatic features

Frost-free period (average)	60 days
Freeze-free period (average)	
Precipitation total (average)	762 mm

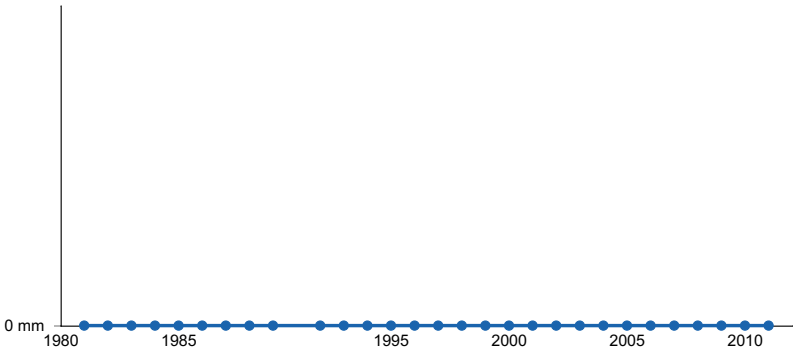


Figure 1. Annual precipitation pattern

Influencing water features

Influencing water features are not associated with this site.

Soil features

The soils are moderately deep, well drained, and formed in residuum/colluvium derived from limestone, dolomite, or calcareous siltstone. Soils are characterized by a light colored surface horizon called a ochric epipedon, a moderately acidic pH at the surface that increases with depth and large volumes of gravel, cobbles and stones throughout the profile.
The available water holding capacity is very low to low, but trees and shrubs extend their roots into fractures in the bedrock allowing them to utilize deep moisture. Snow accumulation persists into late spring when the soil is not frozen. Snow melt at this time adds to the soil moisture supply. The surface soil is normally greater than 10 inches deep. There is normally a 3 to 4 inch surface layer of decomposing organic matter present. This duff layer reduces moisture loss due to evaporation. Runoff is medium to high and the potential for sheet and rill erosion is moderate to severe depending on slope. The soil series associated with this site include: Jumble (minor component) and Muiral.

The representative soil series is Muiral, a Loamy-skeletal, mixed, superactive Calcic Haplocryepts.

Table 4. Representative soil features

Parent material	(1) Residuum–dolomite (2) Colluvium–limestone (3) Residuum–calcareous siltstone
Surface texture	(1) Gravelly loam (2) Gravelly loam (3) Gravelly loam

Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderate to moderately rapid
Soil depth	51–183 cm
Surface fragment cover <=3"	5–45%
Surface fragment cover >3"	0–25%
Available water capacity (0-101.6cm)	4.83–12.7 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	5.4–6.4
Subsurface fragment volume <=3" (Depth not specified)	40–70%
Subsurface fragment volume >3" (Depth not specified)	0–40%

Ecological dynamics

Major Successional Stages of Forestland Development:

Fire Ecology:
Engelmann spruce is very fire sensitive and is generally killed even by low-intensity fires. Postfire reestablishment is via wind-dispersed seeds which readily germinate on fire-prepared seedbeds. The occasional mature tree which survives fire, those escaping fire in small, unburned pockets, and trees adjacent to burned areas provide seeds to colonize burned sites. Large trees occasionally survive light fires. Young white fir is highly susceptible to fire, and mature trees are only moderately fire tolerant. White fir is an aggressive, shade-tolerant species that will seed into the understory. Fire kills gooseberry, however, regeneration is favored by fire because scarification of soil-stored seed generally enhances germination in gooseberry. The life cycle of western raspberry is integrally associated with disturbances such as fire. In many areas of vigorous fire suppression, both plant vigor and abundance have decreased. Western raspberry typically flourishes, completes its life cycle and declines within the early years after disturbance. As shade levels increase in the postfire community and soil nitrate levels drop (generally during the first 5 years after fire), western raspberry shifts resource allocation from vegetative growth to seed production although the plants themselves soon senesce and die, viable seed persists for decades, germinating in great numbers after the next fire creates favorable conditions for growth and establishment. Seed is effectively scarified by heat, and exposed mineral soil serves as a favorable substrate for early growth and development. Underground regenerative structures appear to be well protected from the damaging effects of heat, and reestablishment is typically rapid where plants were present in the preburn community. Western raspberry is described as resistant to fire. However, foliage is extremely susceptible to fire-induced mortality. Common snowberry is classified as a sprouter and has high resistance to fire. It is a rhizomatous species with rhizomes buried 2 to 5 inches (5-12.5 cm) deep in mineral soil. After fire has killed the top of the plant, new growth sprouts from these rhizomes. This rhizomatous growth response is highly variable and depends on conditions at specific sites. Regeneration from buried seed is favored by fires of low severity and short duration that remove little of the soil organic level. Mountain brome is likely to be top-killed by fire, although the coarse stems and broad leaves may be more fire-resistant than fine-leaved bunchgrasses. Mountain brome is most susceptible to fire damage when it is actively growing in spring and early summer. Columbia needlegrass is only slightly to moderately damaged by fire, because it has relatively few culms per clump which may help to minimize the amount of subsurface heat transfer and subsequent damage. Little specific information is available on adaptations of Letterman's needlegrass to fire. It is morphologically similar to Columbia needlegrass, which is only slightly to moderately damaged by fire. Season of burn affects the plant's ability to survive a fire. Post-fire regeneration is through seeding and tillering. The effects of fire on slender

wheatgrass are dependent on its growth form. Tall, decadent plants with many leaves sustain the most fire damage, while those with short, sparse growth form, is the least likely to sustain damage to the root system during a fire.

Plant Community 1.1 -

The plant community is dominated by Engelmann's spruce with white fir and quaking aspen occurring sporadically in the tree canopy. Overstory tree canopy composition is about 80 to 90 percent Engelmann's spruce, 5 to 10 percent white fir and 5 to 10 percent quaking aspen. Mountain gooseberry is the principal understory shrub. Western raspberry and snowberry are other important shrubs in the understory community. Columbia needlegrass, pinegrass, mountain brome and slender wheatgrass are the most prevalent understory grasses. Starwort, Fendler meadowrue, dandelion and daisy are common understory forbs. An overstory canopy of 40 to 50 percent is assumed to be representative of tree dominance on this site in the pristine environment. This site is dominated by Engelmann's spruce with white fir and quaking aspen occurring sporadically in the tree canopy. Overstory tree canopy composition is about 80 to 90 percent Engelmann's spruce, 5 to 10 percent white fir and 5 to 10 percent quaking aspen.

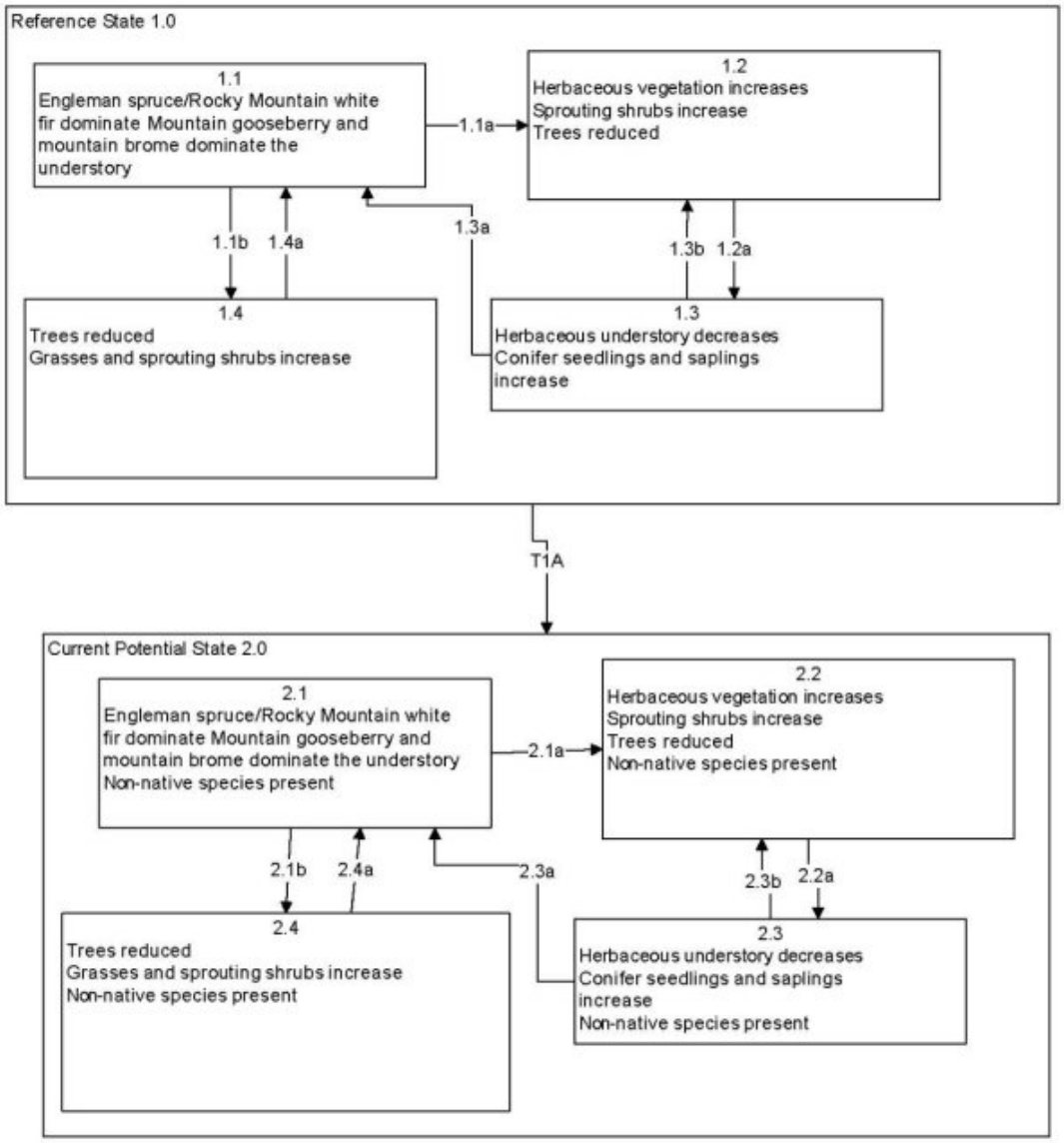
See the STM image and legend for the full model.

State and transition model

Reference State 1.0 Community Phase Pathways
1.1a: High severity, stand replacing fire
1.1b: Lightning strike, low severity fire and/or disease and insects creates shrub/grass mosaic in the understory 1.2a: Time and lack of disturbance
1.3a: Time and lack of disturbance
1.3b: Low severity fire
1.4a: Time and lack of disturbance

Transition T1A: Introduction of non-native species

Current Potential 2.0 Community Phase Pathways
2.1a: High severity, stand replacing fire
2.1b: Lightning strike, low severity fire and/or disease and insects.
2.2a: Time and lack of disturbance
2.3a: Time and lack of disturbance
2.3b: Low severity fire
2.4a: Time and lack of disturbance



Animal community

Livestock Interpretations:
Livestock may concentrate on this site in order to take advantage of the shade and shelter offered by the tree overstory. Many areas may not be used because of steep slopes or lack of adequate water. Attentive grazing

management is required where this site is used due to steep slopes and erosion hazards, and during the earlier stages of succession such as the shrub-herbaceous and sapling stages. During these early stages the young trees are most susceptible to damage from livestock, so grazing should be monitored closely. Harvesting trees on this site would have to be considered very carefully since this site provides important shelter for livestock, wildlife and reforestation, and helps hold the fragile soil in place.

Stocking rates vary with such factors as kind and class of grazing animal, season of use and fluctuations in climate. Actual use records for individual sites, a determination of the degree to which the sites have been grazed, and an evaluation of trend in site condition offer the most reliable basis for developing initial stocking rates.

The forage value rating is not an ecological evaluation of the understory as is the range condition rating for rangeland. The forage value rating is a utilitarian rating of the existing understory plants for use by specific kinds of grazing animals.

Wildlife Interpretations:
Open to sparse tree canopies provide forage and browse, and medium to dense tree canopies provide shelter and protection for mule deer and elk. It also may be used be by a variety of upland game species including rabbits and blue and ruffed grouse. This site is used by various songbirds, rodents, reptiles and associated predators natural to the area. This site's main value is for providing cover when it occurs adjacent to open areas. In areas where this site is found to any extent, some of the earlier stages, such as the herbaceous and shrub-herbaceous, may also provide important habitat elements.

Hydrological functions

Runoff is medium to high. Permeability is very slow to moderate. Hydrologic soil groups is C.

Recreational uses

This site has high aesthetic value and provides a variety of recreational opportunities such as hiking, camping and deer and upland game bird hunting. Steep slopes and the fragile soil-vegetation complex, however, inhibit many other forms of recreation such as the use of off-road vehicles.

Wood products

Engelmann's spruce has been and is an important lumber source. Saw lumber from this species sometimes has numerous knots because trees shed their lower limbs rather slowly. The wood has good strength qualities because of long wood fibers. Since it is found most abundantly at high elevations, it is rather difficult to harvest. In addition to saw timber, this species is used for poles, railroad ties, and mine props. It can also be used for fuelwood and pulp.

PRODUCTIVE CAPACITY

This site has a low to moderate site quality for tree production. Site index ranges from about 80 to 90 (Alexander, 1967).

Productivity Class: 6
CMAI*: 80 to 92 cu ft/ac/yr;
5.6 to 6.4 cu m/hr/yr.
Culmination is estimated to be at 100 years.
*CMAI: is the culmination of mean annual increment or highest average growth rate of the stand in the units specified.

Timber Production: 19,900 bd ft/ac.

Fuelwood Production: 10 to 20 cords per acre for stands averaging 10 inches in diameter at breast height. There are about 188,000 British Thermal Units (BTUs) of heat energy per cubic foot of Englemann's spruce wood. Firewood is commonly measured in cords, or a stacked unit equivalent to 128 cubic feet. Solid wood volume in a cord ranges from 65 to 90 cubic feet. Assuming an average of 75 cubic feet of solid wood per cord, there are about 15 million BTUs of heat value in a cord of Englemann's spruce.

Spacing: D+4

MANAGEMENT GUIDES AND INTERPRETATIONS

1. LIMITATIONS AND CONSIDERATIONS
a. Potential for sheet and rill erosion is moderate to severe depending on slope.
b. Severe equipment limitations on steeper slopes because of traction loss on wet soils; unsafe operating conditions due to slope and on sites having extreme surface stoniness.
c. Potential for wind throw is moderate to severe depending on wind conditions and soil depth.
d. Adequately protect from uncontrolled burning to protect woodland resources and reduce potential erosion hazards.
e. Protect soils from accelerated erosion by using water bars at designed spacing and insloping, outsloping or crowning of roads (with necessary ditching and reliable culverts).

2. ESSENTIAL REQUIREMENTS
a. Adequately protect from uncontrolled burning.
b. Protect soils from accelerated erosion.
c. Apply proper grazing management practices.

3. SILVICULTURAL PRACTICES
a. Harvest cut selectively or in small patches size dependent upon site conditions) to enhance forage production.
1) Harvest cutting - Selectively harvest surplus trees to achieve desired spacing, D+4 (in stands greater than 8 inch diameter at breast height). Rotation time for cutting should be geared to the desired products and extent of the previous harvest. Save large, healthy, full-crowned trees for a seed source and cover for wildlife and livestock. Do not select only "high grade" trees during harvest, or harvest to such an extent as to create a windthrow hazard.
2) Thinning and improvement cutting - Removal of poorly formed, diseased and low vigor trees for fuelwood. D+4 is the optimum spacing. As the spacing approaches D+1, thinning should be done to maintain the vigor of the stand. Thinning and improvement cutting would be of particular importance during the immature woodland stage. Proper spacing will improve the health and development of the trees as well as the overall health of the stand.

b. Wind throw hazard - Wind throw can be a problem in the mature and over-mature community. The shallow rooted nature of Engelmann's spruce and white fir make them prone to windfall. Such things as harvesting trees in patterns that tend to concentrate or tunnel the wind, or thinning to such an extent that the wind strikes individual trees directly should be avoided. Other precautions should be taken, where possible, to reduce the wind throw hazard.

c. Pest control - Control pests (such as spruce bud worm) as the need arises to maintain the vigor of the stand. Using pesticides or harvesting of over-mature trees can be used as a pest control.

d. Fire hazard - Fire can be a problem in the mature community. Precautions should be taken, where possible, to reduce the fire hazard (such as firebreaks, slash treatment and controlled burning). As a silvicultural tool, fire is desirable for a few purposes. Prescribed fires can be used to reduce available food supply for the spruce beetle, which may occupy cull logs or wind thrown trees, and expose mineral soil which is the best seedbed for Engelmann's spruce because soil moisture is more stable. Hot fires are not desirable because they sterilize the mineral soil and leave it unprotected.

Other products

Native Americans used Engelmann spruce for numerous purposes. The bark was often peeled into sheets and used for making canoes, baskets, and roofing. The fibrous roots were used to make rope, and the boughs and needles to make incense, body scents, and cleansing agents. Various teas and poultices were made from Engelmann spruce for medicinal purposes. Native Americans occasionally ate the inner bark. Currants (Ribes spp.) can be used for making jam, jelly, or pie. Some western Indian tribes used currants for making pemmican. The red raspberry was traditionally an important food of many Native American peoples. It was eaten fresh or preserved for winter use. The fruit, bark of roots, and stems of raspberries have been used to make various medicinal preparations.

Other information

Engelmann spruce is sometimes used as an ornamental landscape plant. It has been used for screenings, windbreaks, and as a specimen tree. Some ecotypes of red raspberry have value in reclamation. Suitable ecotypes are rated as having low to moderate value for short-term revegetation, and at least moderate value for long-term revegetation projects. Red raspberry exhibits good potential for erosion control on some sites. Mountain brome is an excellent native bunchgrass for seeding alone or in mixtures in disturbed areas, including depleted rangelands, burned areas, roadways, mined lands, and degraded riparian zones.

Table 5. Representative site productivity

Common Name	Symbol	Site Index Low	Site Index High	CMAI Low	CMAI High	Age Of CMAI	Site Index Curve Code	Site Index Curve Basis	Citation
Engelmann spruce	*PIEN*	80	90	80	92	–	–	–	

Inventory data references

NASIS soil component data.

Type locality

Location 1: Elko County, NV	
Township/Range/Section	T26N R63E S16
Latitude	40° 7′ 50″
Longitude	114° 52′ 23″
General legal description	SE ¼ NW ¼, Approximately 5 miles east of the Straton Ranch on east side of Butte Valley, Cherry Creek Range, Elko County, Nevada. This site also occurs in White Pine County, Nevada.

Other references

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Contributors

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Approval

Kendra Moseley, 2/19/2025

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	05/13/2025
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

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

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

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

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and 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):**

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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:

    Sub-dominant:

    Other:

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth (in):**

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

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17. **Perennial plant reproductive capability:**
