

Ecological site R028BY112NV

Calcareous Mahogany Slope

Last updated: 2/19/2025
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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).

Classification relationships

US National Vegetation Classification (USNVC): 1. Forest and Woodland, 1.C.2. Cool Temperate Forest, 1.C.2.Nc. Western North American Cool Temperate Woodland and Scrub, M026. Intermountain Singleleaf Pinyon- Western Juniper Woodland, G249. Intermountain Basins Curl-leaf Mountain-mahogany Scrub and Woodland Group.

Ecological site concept

The Calcareous Mahogany Slope occurs upper mountain sideslopes. It can be found on all aspects, but is typically limited to mountains with limestone parent material. It is commonly associated with areas of rock outcrop. Slope gradients greater than 30 percent typical. Elevations are 7000 to 10,000 feet. Soils are very shallow or shallow, well drained and formed in residuum and colluvium derived from limestone and dolomite. The soil surface is covered with approximately 85 percent gravels. Coarse fragments at the surface provide a stabilizing affect on surface erosion conditions.

Associated sites

F028BY060NV	PIMO-JUOS/ARNO4/PSSPS-ACHY Pinyon-Juniper/black sagebrush/bluebunch wheatgrass-Indian ricegrass dominated.
R028BY059NV	SHALLOW CALCAREOUS HILL 8-12 P.Z. Shallow Calcareous Hill 10-14, not dominated by mountain mahogany

Similar sites

R028BY043NV	CALCAREOUS MAHOGANY SAVANNA More productive, mountain sagebrush dominant shrub
R028BY032NV	STONY MAHOGANY SAVANNA More productive, mountain sagebrush dominant shrub
R028BY042NV	MAHOGANY THICKET More productive, mountain sagebrush dominant shrub, overstory canopy of mountain mahogany greater than 50 percent

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Cercocarpus ledifolius</i> (2) <i>Artemisia nova</i>
Herbaceous	(1) <i>Poa fendleriana</i>

Physiographic features

This site occurs upper mountain sideslopes. It can be found on all aspects, but is typically limited to mountains with limestone parent material. This site is commonly associated with areas of rock outcrop. Slopes range from 15 to 75 percent, but slope gradients greater than 30 percent are most typical. Elevations are 7000 to 10,000 feet

Table 2. Representative physiographic features

Landforms	(1) Mountain (2) Mountain slope
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Runoff class	High to very high
Flooding frequency	None
Ponding frequency	None
Elevation	2,130 – 3,050 m
Slope	20 – 80 %
Water table depth	180 cm
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 16 to 25 inches. The majority of which comes as snow during the winter and early spring. Mean annual air temperature is about 30 to 55 degrees F. The average frost free season is 50 to 120 days.

Average monthly precipitation (inches):

Jan 2.19, Feb 2.29, March 2.36, April 1.18, May 1.3, June 0.66, July 1.18, Aug 1.45, Sep 1.5, Oct 1.46, Nov 1.27, Dec 1.42.

Table 3 Representative climatic features

Frost-free period (average)	90 days
Freeze-free period (average)	120 days
Precipitation total (average)	530 mm

Influencing water features

There are no influencing water features associated with this ecological site.

Soil features

Soils of this site are very shallow or shallow, well drained and formed in residuum and colluvium derived from limestone and dolomite. The soil surface is covered with approximately 85 percent gravels. Coarse fragments at the surface provide a stabilizing affect on surface erosion conditions. Runoff is high to very high and permeability is moderate. The soil profile is modified with 40 to 50 percent rock fragments, mostly gravels. Available water holding capacity is very low. The soils of this site are usually moist in the winter through mid-spring and dry late spring through the fall; a xeric soil moisture regime bordering on aridic. Soils are also characterized by a calcic horizon underlain by a lithic contact of hard fractured limestone and a mollic epipedon from the soil surface to 43 cm.

Official soil series associated with this site include Adobe, a loamy-skeletal, carbonatic Lithic Calcicryolls.

Table 4. Representative soil features

Parent material	(1) Residuum – dolomite (2) Colluvium – limestone
Surface texture	(1) Very gravelly silt loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow
Soil depth	40 – 50 cm
Surface fragment cover <=3"	80 – 90 %
Surface fragment cover >3"	0 – 10 %
Available water capacity (0-101.6cm)	3.05 – 5.31 cm
Calcium carbonate equivalent (0-101.6cm)	20 – 50 %
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	Not specified
Soil reaction (1:1 water) (0-101.6cm)	8.2 – 8.4
Subsurface fragment volume <=3" (Depth not specified)	40 – 50 %

Subsurface fragment volume >3" (Depth not specified)	0 – 10 %
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Ecological dynamics

The community phases of this ecological site are dynamic in response to changes in disturbance regimes and weather patterns. Natural disturbances affecting this community include infrequent or patchy wildfire, disease, insect attack, drought, and the possible rock slide or avalanche. Vegetation consists of widely spaced shrubs and scattered trees on steep slopes and typically lack enough fine fuels to readily carry fire. The best chances for wildfire on this ecological site are during summer lightning storms and under droughty conditions. Species of this plant community are long-lived and do not require establishment of new individuals every year for perpetuation of the stand, pulses of recruitment are infrequent and may be tied to climatic variables. Individual trees can reach 1,300 years in age (Schultz et al. 1990).

Curlleaf mountain mahogany stands are highly variable. The plant itself can range from a medium statured shrub, on harsh sites to a substantial tree where conditions permit. Trunk diameter of mature trees ranges from 30 to over a 100 centimeters (Kitchen 2008). Schultz and others (1990) estimated mean stand age of mature trees in central and western Nevada to be greater than 400 years. Because they are long lived and survive well on steep, dry slopes mountain mahogany plays an important role in soil stabilization (Kitchen 2008). Curlleaf mountain mahogany establishes solely from seed. Flowering occurs in spring and early summer and seeds are wind pollinated. Fruits disperse starting in late summer and continue through the fall (Kitchen 2008). Prior to germination, seeds require a period of moist chilling, approximately 4 to 12 weeks (Kitchen 2008).

Patterns of seedling establishment are sensitive to canopy density, depth of litter and soil moisture. Moderate levels of litter can encourage seedling establishment by decreasing soil temperature and increasing soil moisture. However, thick litter can reduce seedling establishment and survival by restricting contact between the soil and seed or the soil and root. Following germination, seedlings experience rapid root growth, enhancing chances of survival (Davis and Brotherson 1991 and Schultz et al. 1996). Curlleaf mountain mahogany stands with large canopy gaps had more established seedlings, juveniles and immature individuals than stands with small gaps or closed canopies (Schultz et al. 1996), indicating increasing shade intolerance with increasing maturity. Seedlings frequently establish under the canopy of other shrubs or shrub skeletons (Schultz et al. 1996). Nurse plants protect seedlings from herbivory and harsh weather conditions. Pests that may affect community dynamics include leaf defoliators and sap suckers, which can cause extensive mortality (Furniss et al. 1988 and Ross 1999). Outbreaks of leaf defoliators can impact entire watersheds, while sap sucker damage tends to be confined to stands near riparian areas.

Curlleaf mountain mahogany is considered to be a pioneer species which prefers sites that are steep, rocky, shallow, low in fertility and have little plant cover. Understory vegetation is commonly widespread perennials, often comprised of cushion plants, or those with basal rosettes and a high percentage of shrubs (Lepper and Fleschner 1977). Shrub species frequently have extensive root systems which increase uptake of nutrients and moisture on limiting sites. Researchers found soils supporting curlleaf mountain mahogany tend to have higher percentage of total nitrogen (N) than soils beneath similar communities without mahogany (Lepper and Fleschner 1977 and others). Nodules on the roots of curlleaf mountain mahogany are capable of fixing N and help this species occupy infertile sites. Nitrogen-fixing plant species have been found to be important in the modification of soil throughout the successional process. Lepper and Fleschner (1977) found curlleaf mountain mahogany was capable of adding 6.86kg/ha total N to the soil per year.

Mahogany maintains a relationship with actinorhizal N-fixing bacteria (Frankia), as well as, with vesicular-arbuscular ectomycorrhizal (EM) fungi. These mycorrhizal networks create linkages that provide pathways for carbon (C), nitrogen, phosphorus (P) and water to move among plants and aid in seedling establishment (McDonald et al. 2010). A diversity of EM relationships may be essential to survival by extracting nutrients from rocky soil. Ectomycorrhizal hyphae are able to penetrate rock and promote the weathering process. Development of the mycorrhizal network in rocky soil may be facilitated by this rock-penetrating ability (McDonald et al. 2010).

The fixed supply of N limits productivity, composition and diversity of most ecosystems. Nitrogen-fixing organisms can bring levels of N in balance with other limiting factors, increasing overall productivity. However, other biological factors limit the amount of N organisms are capable of fixing including; preferential grazing of nutrient-rich tissues of N-fixing plants, sensitivity of N-fixers to limitation of P or other nutrients and the shade intolerance of symbiotic fixers, such that they are unable to enter closed canopy systems (Vitousek et al. 2002).

Black sagebrush is an evergreen, aromatic shrub that is low-growing and decumbent. Black sagebrush has a taproot and wide-spreading lateral roots. Roots can be deep on favorable sites, but shallow soils prevent deep root development on most sites where black sagebrush is dominant. Soils supporting black sagebrush typically have large quantities of carbonates (Zamora and Tueller 1793). Black sagebrush is highly drought tolerant; it is more likely to endure drought than most sagebrush taxa. It is slightly salt tolerant and flood intolerant. Black sagebrush occurs throughout the successional process, it is highly light tolerant and shade intolerant (Fryer 2009).

Plant community structure is controlled in part by infrequent, patchy wildfire and in part by pulses of seedling recruitment. Scattered trees found on this ecological site include Utah juniper, singleleaf pinyon pine, limber pine and Great Basin bristlecone pine. Trees growing on this site can easily attain an age of 150 years or older. However, total canopy cover does not meet the requirements of a forest ecological site. This community has an overall low frequency of disturbance, providing extended periods of time for recovery before the next disturbance event, contributing to increased resiliency. Vegetative cover on this site is relatively low, but the soil surface is covered with approximately 80% rock fragments (mostly gravels), protecting the site from excessive soil erosion. Potential invasive species on this site include cheatgrass.

Fire ecology:

The naturally stable, presettlement fire regime of curlleaf mountain mahogany communities probably varied with fire intensity, as well as, community type and structure. The fire return interval is highly variable, ranging from 13 to 1000 years. Some curlleaf mountain mahogany stands occupy sites with very low fuel levels that rarely burn. Curlleaf mountain mahogany can readily burn, trees have

persistent dead branches in the crown and leaves are slightly resinous. It can easily be removed from a site. Following fire, curlleaf mountain mahogany reestablishes solely from seed and recovery can be extremely slow. There has only been one documented case of sprouting following fire.

However, this ecological site is not susceptible to frequent fire, due to low and discontinuous fuels. Black sagebrush is readily killed by fires of all intensities and regeneration occurs solely from seed. Recovery of sagebrush is dependent of pulses of seedling establishment, controlled in large part by periods of favorable weather. Desert snowberry is top killed but sprouts from the root crown and rhizomes following fire. Muttongrass tends to be unharmed by light-severity fall fire. It can be damaged and slow to recover from severe fire. Ross's sedge easily survives fire of various intensities. Its seeds readily germinate after heat treatment and its rhizomes easily survive low- to moderate- severity fire.

The reference plant community is considered to be representative of this ecological site under naturally stable, pre-European settlement conditions. This community is stable and long lived but periodically experiences localized disturbances. Vegetative cover and herbaceous biomass is not sufficient to readily carry fire across this site. The soil surface is covered with approximately 85% rock fragments that protect the soil from accelerated erosion, even on steep slopes, increasing ecological resistance. Potential vegetative composition is about 15% grasses, 30% forbs and 50% shrubs and about 5% trees. The plant community is dominated by curlleaf mountain mahogany. Black sagebrush, desert snowberry, muttongrass and Ross' sedge are important species associated with this site. Approximate ground cover (basal and crown) is 20 to 30 percent.

State and transition model

Additional community tables

Animal community

Livestock: This ecological site is not suitable for livestock grazing due to excessive slopes and low forage production. The leaves of curlleaf mountain mahogany are generally persistent and stems are unarmed, making it a desirable forage plant when available to livestock. Black sagebrush is desirable to domestic sheep, but is less palatable to cattle. Excessive evidence of browsing on black sagebrush should be considered a downward trend in grazing condition. Desert snowberry is not preferred forage by domestic livestock. However, it leafs out early in the spring and is used by all browsing animals at that time. Muttongrass provided excellent forage for cattle, horses and domestic sheep. Ross' sedge provides good to fair forage for domestic grazers. **Wildlife:** Mature or old growth trees available on this site are valuable to wildlife because they provide an abundance of insect infected snags or dying trees. Trees with heart rot provide the essential substrate for cavity excavation which is important for wildlife nesting or denning, and dying trees provide an insect prey base for foraging. Wildlife species feed on limber and bristlecone pine seeds, and the trees provide structure in an otherwise sparsely vegetated environment. The overstory created by mountain-mahogany tends to be sparse and diffuse light tends to reach the ground. In young-to-middle aged stands of mountain-mahogany the understory often supports a variety of forbs, grasses, and shrubs, all of which offer foraging opportunities for birds, small mammals, and reptiles. Curlleaf mountain mahogany is high palatable to wildlife and is a preferred browse species of mountain sheep, mountain goats, deer and elk. Its nutritive value (about 12% protein) and digestibility ratings (around 50%) in the winter are high when compared to other winter browse species (Davis and Brotherson 1991). Black sagebrush is an important source of fall and winter forage for wildlife, especially mule deer, pronghorn and sage-grouse. Desert snowberry is moderately desirable to wildlife. However, it leafs out early in the spring and is used by all browsing animals at that time. Utah serviceberry is an associated species on this site. The serviceberry fruit is an excellent source of nutrition for wildlife, and the young growth is excellent browse for deer (Stubbendieck et al. 1992). Muttongrass is preferred forage for sheep, elk and deer. Wildlife species readily use Ross's sedge when available.

Hydrological functions

Runoff associated with this site is high to very high even under reference conditions. Rills are none to rare. Occurrence of rills may be more frequent as canopy cover increase on steeper slopes. Changes in plant community structure and composition, including reduced perennial grasses and native shrubs, can lead to increase surface runoff and accelerate soil movement down slope. Pedestals are none to rare, usually limited to areas of water flow patterns. Curlleaf mountain mahogany and understory shrubs break raindrop impact and provide opportunity for snow accumulation on site.

Recreational uses

This ecological site has potential for upland game and bird hunting. The diverse floral and faunal composition provides a suitable environment for hiking, photography and bird watching. Great Basin bristlecone pine can be found at the upper elevations of this ecological site which is of particular dendrochronological interest.

Wood products

This site does not have significant cover of species considered to have commercial value.

Other information

Curleaf mountain mahogany may be planted to help stabilize soil in disturbed area such as roadcuts and mine spoils. Mountain snowberry is useful for establishing cover on bare site and has done well when planted onto roadcuts. Needleandthread grass is useful for stabilizing eroded or degraded sites.

Inventory data references

NASIS soil component data.

Type locality

Location 1: Nye County, NV	
Township/Range/Section	T4N R57E S19
UTM zone	N
UTM northing	622117
UTM easting	4227449
General legal description	Approximately 400 m from Cherry Creek Summit Grant-Quinn Range, Nye County; Nevada. Mt. Diablo Meridian. USGS Adaven 7.5 minute topographic quadrangle.

Other references

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Contributors

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)	P.N. Echenique/ E.V. Hourihan
Contact for lead author	State Rangeland Management Specialist
Date	10/30/2012
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. Occurrence of rills may be more frequent as canopy cover increases and on steeper slopes.

- 2. Presence of water flow patterns:** Water flow patterns are none to rare with occurrence increasing as canopy cover increases.

- 3. Number and height of erosional pedestals or terracettes:** Pedestals are none to rare. Occurrence is usually limited to areas of water flow patterns.

- 4. Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**
Bare Ground $\pm$ 5-10%.

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

6. Extent of wind scoured, blowouts and/or depositional areas: None

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 catastrophic events. Mat of accumulating leaf or needle litter under mature trees is very stable and shows no obvious movement.

8. Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values): Soil stability values should be 3 to 4 on most soil textures found on this site.

9. Soil surface structure and SOM content (include type of structure and A-horizon color and thickness): Surface structure is thick platy. Soil surface colors are grays and soils are typified by a mollic epipedon. Organic matter of the surface 2 to 4 inches is typically 2 to 4 percent, dropping off quickly below. Organic matter content can be more or less depending on micro-topography.

10. Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff: Perennial herbaceous plants (especially deep-rooted bunchgrasses [i.e., needlegrasses] slow runoff and increase infiltration. Curlleaf mountain mahogany and understory shrubs break raindrop impact and provide opportunity for snow catch and accumulation 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 calcic horizons are not to be interpreted as compacted layers.

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: Curlleaf mountain mahogany

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

Other:

Additional:

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

14. Average percent litter cover (%) and depth (in): Herbaceous, or non-persistent, litter within curleaff mountainmahogany canopy interspaces ($\pm 25\%$) and litter depth is $\pm \frac{1}{2}$ inch. Leaf litter forms a mat 1 to 2 inches thick under the drip line of mature mountain mahogany. Large, persistent, litter from trees (limbs, etc.) variable to 5%.

15. Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production): Total for all trees, shrubs and herbaceous plants, irrespective of plant height for normal or average growing season (through June) = ± 500 lbs/ac. For understory vegetation to $4\frac{1}{2}$ feet and normal or average growing season (through June) = ± 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.

17. Perennial plant reproductive capability: All functional groups should reproduce in average (or normal) and above average growing season years.
