

Ecological site R030XB068NV LIMESTONE HILL 5-7 P.Z.

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General information

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

MLRA notes

Major Land Resource Area (MLRA): 030X–Mojave Basin and Range

The Mojave Desert Major Land Resource Area (MLRA 30) is found in southern California, southern Nevada, the extreme southwest corner of Utah and northwestern Arizona within the Basin and Range Province of the Intermontane Plateaus. The Mojave Desert is a transitional area between hot deserts and cold deserts where close proximity of these desert types exert enough influence on each other to distinguish these desert types from the hot and cold deserts beyond the Mojave. Kottek et. al 2006 defines hot deserts as areas where mean annual air temperatures are above 64 F (18 C) and cold deserts as areas where mean annual air temperatures are below 64 F (18 C). Steep elevation gradients within the Mojave create islands of low elevation hot desert areas surrounded by islands of high elevation cold desert areas. The Mojave Desert receives less than 10 inches of mean annual precipitation. Mojave Desert low elevation areas are often hyper-arid while high elevation cold deserts are often semi-arid with the majority of the Mojave being an arid climate. Hyper-arid areas receive less than 4 inches of mean annual precipitation and semi-arid areas receive more than 8 inches of precipitation (Salem 1989). The western Mojave receives very little precipitation during the summer months while the eastern Mojave experiences some summer monsoonal activity. In summary, the Mojave is a land of extremes. Elevation gradients contribute to extremely hot and dry summers and cold moist winters where temperature highs and lows can fluctuate greatly between day and night, from day to day and from winter to summer. Precipitation falls more consistently at higher elevations while lower elevations can experience long intervals without any precipitation. Lower elevations also experience a low frequency of precipitation events so that the majority of annual precipitation may come in only a couple precipitation events during the whole year. Hot desert areas influence cold desert areas by increasing the extreme highs and shortening the length of below freezing events. Cold desert areas influence hot desert areas by increasing the extreme lows and increasing the length of below freezing events. Average precipitation and temperature values contribute little understanding to the extremes which govern wildland plant communities across the Mojave. Arid Eastern Mojave Land Resource Unit (XB)

LRU notes

The Mojave Desert is currently divided into 4 Land Resource Units (LRUs). This ecological site is within the Arid Eastern Mojave LRU where precipitation is bi-modal, occurring during the winter months and summer months. The Arid Eastern Mojave LRU is designated by the 'XB' symbol within the ecological site ID. This LRU is found across the eastern half of California, much of the mid-elevations of Nevada, the southernmost portions of western Utah, and the mid-elevations of northwestern Arizona. This LRU is essentially equivalent to the Eastern Mojave Basins and Eastern Mojave Low Ranges and Arid Footslopes of EPA Level IV Ecoregions Elevations range from 1650 to 4000 feet and precipitation is between 4 to 8 inches per year. This LRU is distinguished from the Arid Western Mojave (XA) by the summer precipitation, falling between July and September, which tends to support more warm season plant species. The 'XB' LRU is generally east of the Mojave River and the 117 W meridian (Hereford et. al 2004). Vegetation includes creosote bush, burrobush, Nevada jointfir, ratany, Mojave yucca, Joshua tree, cacti, big galleta grass and several other warm season grasses. At the upper portions of the LRU, plant production and diversity are greater and blackbrush is a common dominant shrub.

Ecological site concept

This ecological site is found on hill and mountain slopes above 3800 feet. Soils formed in colluvium and residuum from limestone or dolomite where rock fragments larger than 3 inches diameter cover more than 15 percent of the soil surface. This is a group concept and provisional STM that also covers R030XB160CA and R030XB105NV.

Associated sites

R030XB030NV	SHALLOW LIMESTONE SLOPE 5-7 P.Z.
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Similar sites

R030XB160CA	Shallow Limestone Slope 5-7" p.z. Conceptually the same ecological site.
R030XB210AZ	Limestone Hills 6-9" p.z. Conceptually the same ecological site.
R030XB076NV	SHALLOW GRAVELLY SLOPE 6-8 P.Z. CORA dominant plant; less shrub diversity; AGUT absent
R030XB030NV	SHALLOW LIMESTONE SLOPE 5-7 P.Z. CORA dominant plant; less shrub diversity; AGUT rare to absent

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Coleogyne ramosissima</i>
Herbaceous	(1) <i>Achnatherum speciosum</i>

Physiographic features

This site occurs on the summits and sideslopes of hills and lower mountains on all aspects. Slopes range from 8 to 75 percent, but slope gradients of 15 to 50 percent are most typical. Elevations are 1600 to 6300 feet.

Table 2. Representative physiographic features

Landforms	(1) Mountain (2) Hill
Elevation	490 – 1,920 m
Slope	10 – 80 %
Aspect	Aspect is not a significant factor

Climatic features

The climate of the Mojave Desert has extreme fluctuations of daily temperatures, strong seasonal winds, and clear skies. The climate is arid and is characterized with cool, moist winters and hot, dry summers. Most of the rainfall falls between November and April. Summer convection storms from July to September may contribute up to 25 percent of the annual precipitation. Average annual precipitation is 5 to 7 inches. Mean annual air temperature is 57 to 63 degrees F. The average growing season is about 180 to 240 days.

Table 3 Representative climatic features

Frost-free period (average)	240 days
Freeze-free period (average)	
Precipitation total (average)	180 mm

Influencing water features

There are no influencing water features associated with this site.

Soil features

The soils associated with this site are very shallow to shallow and are well drained. These soils have formed in residuum and colluvium from limestone and dolomite. The soil profile is modified with 50 to 75 percent rock fragments and more than half of these fragments are cobbles and stones. High amounts of rock fragments occur at the soil surface which occupy plant growing space yet help to reduce evaporation and conserve soil moisture. Coarse fragments on the surface provide a stabilizing affect of surface erosion conditions. Runoff is very high, available water capacity is very low and water intake rates are moderately rapid. The soil series associated with this site include Birdspring, a loamy-skeletal, carbonatic, thermic Lithic Torriorthent, Potosi a loamy-skeletal, carbonatic, mesic Lithic Torriorthen, and Zehme, a loamy-skeletal, carbonatic, thermic Lithic Haplocalcid.

Table 4. Representative soil features

Parent material	(1) Residuum – dolomite (2) Colluvium – limestone
Surface texture	(1) Extremely gravelly fine sandy loam (2) Very stony fine sandy loam (3) Extremely cobbly fine sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderate to moderately rapid
Soil depth	10 – 40 cm
Surface fragment cover <=3"	30 – 40 %

Surface fragment cover >3"	30 %
Available water capacity (0-101.6cm)	0.51 – 2.54 cm
Calcium carbonate equivalent (0-101.6cm)	20 – 40 %
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	0 – 10
Soil reaction (1:1 water) (0-101.6cm)	7.9 – 8.4
Subsurface fragment volume <=3" (Depth not specified)	20 – 60 %
Subsurface fragment volume >3" (Depth not specified)	10 – 40 %

Ecological dynamics

Blackbrush communities are most prevalent in the transitional zone between the Mojave Desert and Great Basin and are commonly associated with creosotebush. Blackbrush is a paleoendemic species as originally postulated by Stebbins and Major (1965). Blackbrush is a transitional species that occupies a boundary that has shifted in recent geologic time. Analysis of packrat middens suggests a 50–100-m downward movement of the blackbrush zone along elevational gradients in the Mojave (Cole and Webb, 1985; Hunter and McAuliffe, 1994). The plant communities of this site are dynamic in response to changes in disturbance regimes and weather patterns. Community phase changes are primarily driven by long term drought. Reproduction and recruitment are episodic, based on favorable environmental conditions (Pendleton and Meyer 2004). Very old stands of blackbrush may have established hundreds to thousands of years ago under very different climatic conditions and will take a considerable amount of time to recover following disturbances.

Blackbrush is a long-lived and generally considered a climax species. It is a non-sprouter; regeneration depends on wind pollinated seed and heavy winter precipitation, and is therefore slow to re-colonize burned areas (Anderson 2001). Blackbrush recruitment is episodic, like many shrubs in arid systems, when conditions are favorable large seed crops are produced and the rest of the time is characterized by minimal seed output (Pendleton and Meyer 2004). Blackbrush seeds are frequently cached away by rodents, until conditions are conducive for germination. Typically, germination occurs during the winter and early spring, given the proper moisture conditions and cool soil temperatures (Pendleton 2008). Seeds require cold stratification before germination and the survival of seedlings following germination is dependent on the availability of spring time moisture (Pendleton 2008).

On undisturbed sites, blackbrush dominates the landscape and species diversity is generally low. Undisturbed blackbrush communities are fairly resistant to invasion by non-natives (Brooks and Matchett 2003). Mature blackbrush plants are well adapted to persist under less than optimal conditions, and individuals' may live as long as 400 years (Pendleton and Meyer 2004). Communities are characterized

by a flammable shrub architecture allowing fire to easily spread, thus these communities experience stand replacing fire regimes. The short-lived seed of blackbrush is readily destroyed by fire and it may take upwards of 60 years for blackbrush to reestablish. There is frequently 100 percent mortality of blackbrush following fire (Brooks and Matchett 2003).

Fire Ecology:

Plant succession varies widely following fire and blackbrush communities can be replaced by undesirable species, like redstem filaree, snakeweed (*Gutierrezia* spp), and *Bromus* spp. (Anderson 2001). The response of woody vegetation post-fire largely depends on site history, species present prior to the fire, as well as, fire severity and frequency. Common plant species include those that are known to sprout, are fire resistant, and/or prolific seed producers. Mojave buckwheat, creosotebush, *Ephedra* spp., *Encelia* spp., and saltbush are all found on burned blackbrush sites. However, it is uncommon to see blackbrush recruitment under the current climatic conditions, especially at the lower extent of its elevational range. The traits that allow established blackbrush communities to persist for centuries, even after environmental conditions have changed are now precluding seedling establishment under the current climatic regime (Pendleton and Meyer 2004).

Under current environmental conditions in the Mojave Desert it is common to see disturbed blackbrush sites dominated by the semi-erect, evergreen, Mojave buckwheat. *Eriogonum* species are frequently pioneering species following natural disturbance (Meyer 2008). Following severe fires, resprout success of Mojave buckwheat is limited. Most regeneration is from seed (Montalvo 2010). The seedbank of Mojave buckwheat will not persist under a frequent fire regime. Under an unnaturally high fire frequency, herbaceous communities are favored over woody-dominated plant communities, which cause habitat degradation.

Desert needlegrass is a facultative seral species and is often one of the first perennials to appear following a disturbance. It is highly susceptible to top kill by fire due to the persistent leaf bases. The root crown will resprout following low to moderate intensity fires. The majority of its vegetative growth occurs in the spring and early summer. Senescence begins in late summer, making the seasonality of disturbance very important. Desert needlegrass will likely survive disturbances and fires that occur in the late summer and fall, but early summer fires cause high mortality (Pavek 1993). Fire effects on Utah agave vary depending on season and frequency of burn. Fire can minimize competition for water and nutrients, but also exposes young agave to harsh conditions.

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Grass/Grasslike					
1	Primary perennial grasses			9-26	
	Mormon needlegrass	ACAR14	<i>Achnatherum aridum</i>	4-13	–
	desert needlegrass	ACSP12	<i>Achnatherum speciosum</i>	4-12	–
2	Secondary Perennial Grasses			3-26	
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	1-6	–
	threeawn	ARIST	<i>Aristida</i>	1-6	–
	low woollygrass	DAPU7	<i>Dasyochloa pulchella</i>	1-6	–
	bush muhly	MUPO2	<i>Muhlenbergia porteri</i>	1-6	–
	big galleta	PLRI3	<i>Pleuraphis rigida</i>	1-6	–
	slim tridens	TRMU	<i>Tridens muticus</i>	1-6	–
3	Annual Grasses			1-9	
Forb					
4	Perennial forbs			3-13	
5	Annual forbs			1-17	
Shrub/Vine					
6	Primary shrubs			12-39	
	blackbrush	CORA	<i>Coleogyne ramosissima</i>	9-26	–
	Utah agave	AGUT	<i>Agave utahensis</i>	3-13	–
7	Secondary shrubs			16-63	

	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	2-6	–
	littleleaf mountain mahogany	CEIN7	<i>Cercocarpus intricatus</i>	2-6	–
	jointfir	EPHED	<i>Ephedra</i>	2-6	–
	Eastern Mojave buckwheat	ERFAP	<i>Eriogonum fasciculatum</i> var. <i>polifolium</i>	2-6	–
	Apache plume	FAPA	<i>Fallugia paradoxa</i>	2-6	–
	California barrel cactus	FECY	<i>Ferocactus cylindraceus</i>	2-6	–
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	2-6	–
	creosote bush	LATR2	<i>Larrea tridentata</i>	2-6	–
	water jacket	LYAN	<i>Lycium andersonii</i>	2-6	–
	desert apricot	PRFR	<i>Prunus fremontii</i>	2-6	–
	Mexican cliffrose	PUME	<i>Purshia mexicana</i>	2-6	–
	woody crinklemat	TICA3	<i>Tiquilia canescens</i>	2-6	–
	Joshua tree	YUBR	<i>Yucca brevifolia</i>	2-6	–

Table 6. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 7. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 8. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 9. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 10. Community 3.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Animal community

Livestock Interpretations: This site has limited value for livestock grazing, due to the low forage production, steep slopes and stony surfaces. Grazing management should be keyed to perennial grass or palatable shrub production. Arid needlegrass is preferred by horses year round and desired by cattle and sheep in the spring. Young desert needlegrass is palatable to all classes of livestock. Mature herbage is moderately grazed by horses and cattle, but rarely grazed by sheep. Blackbrush is not preferred as forage by domestic livestock, but does provide some forage during the spring, summer and fall. 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: Mule deer and pronghorn prefer to graze on arid needlegrass during the spring, however it is undesirable during the winter. Young desert needlegrass is palatable to many species of wildlife. Desert needlegrass produces considerable basal foliage and is good forage while young. Desert bighorn sheep graze desert needlegrass. Blackbrush is a valuable browse species for bighorn sheep. It may also comprise up to 25% of the mule deer winter diet. Blackbrush provides cover for upland game birds, nongame birds and small mammals.

Hydrological functions

Runoff is very high. Permeability is moderate to moderately rapid. Rills and waterflow patterns are none to rare. Shrub canopy and associated litter provide some protection from raindrop impact.

Recreational uses

Aesthetic value is derived from the diverse floral and faunal composition and the colorful flowering of wildflowers and shrubs during the spring and early summer. This site offers rewarding opportunities to photographers and for nature study. This site is used for hiking and has potential for upland and big game hunting.

Other information

Blackbrush contributes to desert fertility by 1) protecting the soil against wind erosion through retarding the movement of soil and increasing the accumulation of fine soil particles around its base; 2) protecting understory vegetation from the effects of high temperatures, thereby helping to retain surface nitrogen and adding organic matter to the soil; and 3) serving as a nitrogen reservoir through the storage of nitrogen in roots, leaves, and stems.

Type locality

Location 1: Clark County, NV	
Township/Range/Section	T26S R58E S36
General legal description	NE1/4 Section 36, T26S. R58E. MDBM. About 2 miles northwest of State Line, on steep mountain slopes, south end of Spring Mountains, Clark County, Nevada.

Other references

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Contributors

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Approval

Sarah Quistberg, 2/24/2025

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 Novak-Echenique
Contact for lead author	State Rangeland Management Specialist
Date	04/26/2010
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. Rock fragments armor the surface.

3. **Number and height of erosional pedestals or terracettes:** Pedestals are none.

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

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

9. Soil surface structure and SOM content (include type of structure and A-horizon color and thickness): Surface structure is typically moderate fine and medium subangular blocky or moderate thick to weak thin platy structure. Soil surface colors are light and soils are typified by an ochric epipedon. Organic matter of the surface horizon is typically <1 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: Shrub canopy and associated litter break raindrop impact.

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. Subsoil calcic horizons are not to be interpreted as compacted.

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: Mojave Desert shrubs

Sub-dominant: deep-rooted, cool-season, bunchgrasses > deep-rooted, warm-season, bunchgrasses > annual forbs > perennial forbs > annual grasses

Other: succulents

Additional:

13. Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence): Dead branches within individual shrubs common and standing dead shrub canopy material may be as much as 25% of total woody canopy; some of the mature bunchgrasses (<10%) have dead centers.

14. Average percent litter cover (%) and depth (in): Between plant interspaces up to 5-10%.

15. Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production): For normal or average growing season ± 150 lbs/ac. Favorable years 250 lb/ac and unfavorable years <100 lbs/ac.

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

and Mediterranean grass are potential invaders on this site.

17. **Perennial plant reproductive capability:** All functional groups should reproduce in average (or normal) and above average growing season years. Little growth or reproduction occurs in below-average years.
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