USDA Natural Resources Conservation Service

Ecological site R030XB067NV
BOULDERY HILL 5-7 P.Z.

Last updated: 3/11/2025
Accessed: 05/13/2025

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 northerly hill and mountain slopes between 2800 and 3525 feet west of the Colorado and Virgin Rivers; otherwise all aspects up to 3800 feet. Soils are formed in colluvium and residuum from extrusive igneous rock where more than 15 percent of the soil surface is covered with rock fragments larger than 10 inches.

This is a group concept and provisional STM that also covers the following ecological sites: R030XB069NV, R030XB080NV, R030XB081NV, R030XB085NV, R030XB089NV

Associated sites

R030XB001NV	**LIMY HILL 5-7 P.Z.**
R030XB005NV	**Arid Active Alluvial Fans**

Similar sites

R030XB201AZ	**Andesite Hills 6-9" p.z. Coarse** Conceptually the same ecological site.
R030XB060NV	**GRANITIC NORTH SLOPE 5-7 P.Z.** More productive site; soils from granitic PM
R030XB069NV	**BASALTIC HILL 5-7 P.Z.** Conceptually the same ecological site.
R030XB080NV	**STONY LOAM 5-7 P.Z.** Conceptually the same ecological site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Ephedra*
Herbaceous	(1) *Muhlenbergia porteri*

Physiographic features

This site occurs on extremely bouldery sideslopes and summits of hills and lower mountains. Slopes range from 4 to 75 percent, but slope gradients of 15 to 50 percent are most typical. Elevations are 4000 to 5500 feet.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Mountain
Elevation	1,219–1,676 m
Slope	4–75%

Climatic features

The climate is hot and arid, with mild winters and very hot summers. Precipitation is greatest in the winter with a lesser secondary peak in summer, typical of the Mojave Desert. Average annual precipitation is 5 to 7 inches. Mean annual air temperature is 51 to 57 degrees F. The average growing season is about 140 to 180 days.

Table 3. Representative climatic features

Frost-free period (average)	180 days
Freeze-free period (average)	
Precipitation total (average)	178 mm

Influencing water features

There are no influencing water features associated with this site.

Soil features

The soils associated with this site are coarse textured, shallow and formed in residuum and colluvium from volcanic rocks. These soils are well drained with moderately rapid permeability. The surface cover of boulders and stones is over 35 percent. The available water holding capacity is very low to low.

Table 4. Representative soil features

Drainage class	Well drained
Permeability class	Moderately rapid

Ecological dynamics

As ecological condition deteriorates, perennial grasses and forbs decrease as creosotebush increases. Introduced annual forbs and grasses readily invade this site.

Fire Ecology:
Mojave buckwheat is vulnerable to hot fires. Resprout success is low and most regeneration is from seeds. Frequent fires deplete the seed bank, making populations vulnerable to extinction. Most fires in the Mojave desert are infrequent and of low severity because production of annual and perennial herbs seldom provides a fuel load capable of sustaining fire.

Fires in creosotebush scrub were an infrequent event in pre-settlement desert habitats, because fine fuels from winter annual plants were probably sparse, only occurring in large amounts during exceptionally wet winters. Fire kills many creosotebush. Creosotebush is poorly adapted to fire because of its limited sprouting ability. Creosotebush survives some fires that burn patchily or are of low severity.

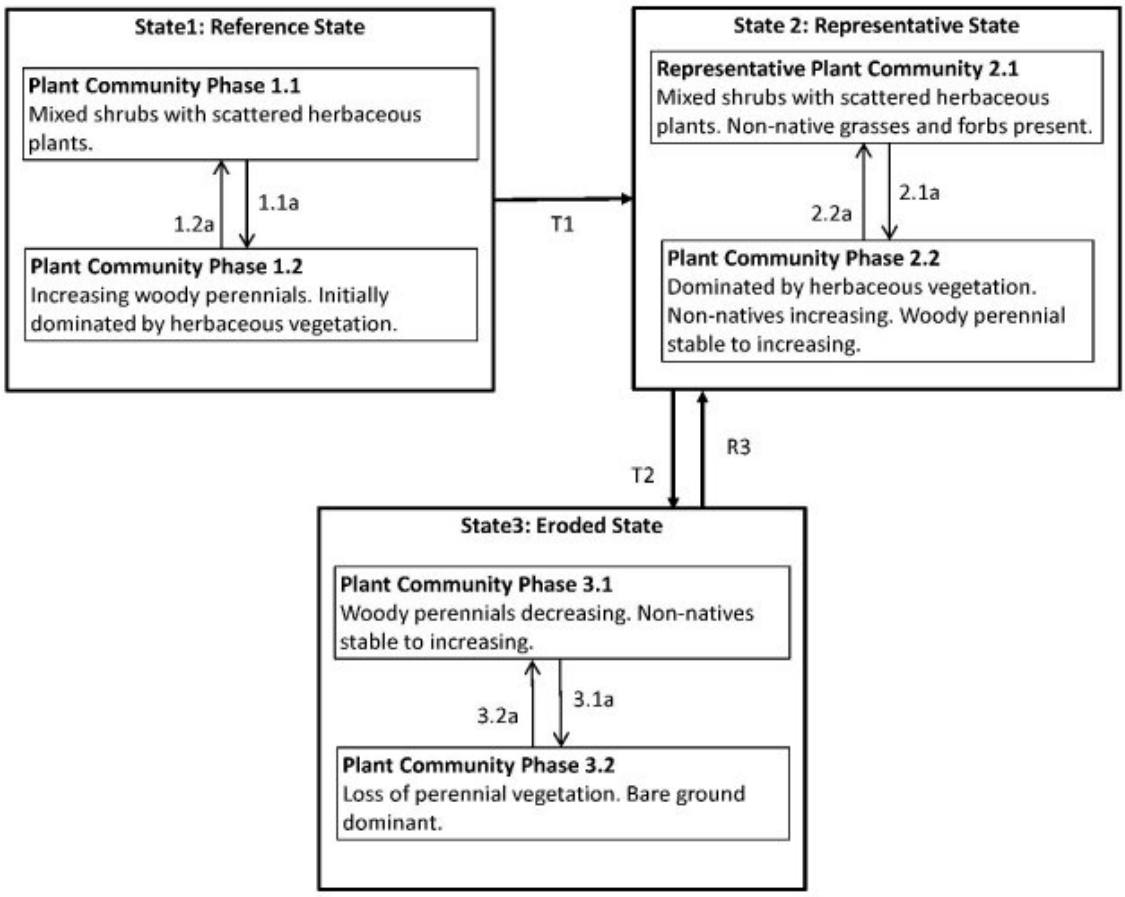
Winterfat is either killed or top-killed by fire, depending on fire severity. Severe fire can kill the perennating buds located several inches above the ground surface and thus kills the plant. In addition, severe fire usually destroys seed on the plant. Low-severity fire scorches or only partially consumes the aboveground portions of winterfat and thus does not cause high mortality.

Bush muhly regenerates following fire from soil-stored seed. Fire probably top-kills bush muhly. Burning causes at least short-term decline of bush muhly. Recovery time is thought to vary considerably and is probably dependent on postfire weather and competition.

Desert needlegrass has persistent dead leaf bases, which make it susceptible to burning. Fire removes the accumulation; a rapid, cool fire will not burn deep into the root crown and surviving tufts will resprout.

Fire most likely top-kills big galleta. Big galleta sprouts from rhizomes following fire. Damage to big galleta from fire varies, depending on whether big galleta is dormant when burned. If big galleta is dry, damage may be severe. However, when plants are green, fire will tend to be less severe and damage may be minimal, with big galleta recovering quickly.

State and transition model



State 1
Reference State

The reference state is representative of the natural range of variability under pristine conditions. It is maintained by periodic flooding in response to heavy rainfall events and has increased available moisture and nutrients. Fire is rare in this system. This ecological site experiences seasonal flooding and is important for redistributing moisture and nutrients throughout the landscape. Timing of disturbances combined with weather events determines plant community dynamics.

Community 1.1
Reference Plant Community

The reference plant community is dominated by ephedra and bush muhly. Other important species are Mojave buckwheat and creosotebush. Potential vegetative composition is about 35% grasses, 10% annual and perennial forbs and 55% shrubs. Approximate ground cover (basal and crown) is 10 to 15 percent.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	53	109	211
Forb	3	3	13
Total	**56**	**112**	**224**

Table 6. Ground cover

Tree foliar cover	0%

Shrub/vine/liana foliar cover	15-20%
Grass/grasslike foliar cover	0%
Forb foliar cover	2-3%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

Table 7. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	7-10%
Grass/grasslike basal cover	0%
Forb basal cover	1-2%
Non-vascular plants	0%
Biological crusts	0%
Litter	1-2%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

Table 8. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	–	–	1-3%
>0.15 <= 0.3	–	1-2%	–	–
>0.3 <= 0.6	–	3-5%	–	–
>0.6 <= 1.4	–	3-5%	–	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Community 1.2
Plant Community 1.2

This plant community is characteristic of a post-disturbance plant community phase. Initially, it is heavily dominated

by herbaceous vegetation and short-lived perennials. Sprouting shrubs quickly recover and provide a favorable environment for establishment of shrub seedlings. This plant community is ‘at-risk’ of invasion by non-natives. Non-native species are able to take advantage of increased availability of critical resources following disturbances.

Pathway 1.1a
Community 1.1 to 1.2

Drought, wildfire, disease or insect attack or other event which reduces vegetation cover

Pathway 1.2a
Community 1.2 to 1.1

Absence from disturbance and natural regeneration over time.

State 2
Representative Plant Community

The Representative Plant Community is characterized by the presence of non-native species in the understory. A biotic threshold is crossed with the introduction of non-natives that are difficult to remove from the system and have they potential to significantly alter disturbance regimes from their historic range of variation. Non-native annuals will persist once introduced into the plant community, due to their annual growth form, abundant seed production and long term seed viability. Non-native annuals such as red brome and cheatgrass are potential invaders on this ecological site. These non-native annuals are highly flammable and promote wildfires where fires historically have been infrequent.

Community 2.1
Representative Plant Community 2.1

Species composition is similar to the reference plant community. Ecological processes have not been compromised at this time, however, ecological resilience is reduced by the presence of non-natives. This plant community phase will respond differently following disturbance, when compared to the reference plant community. Management focused on decreasing the amount of anthropogenic disturbance is important for maintaining the health of perennial native species that protect the site against erosion.

Community 2.2
Plant Community Phase 2.2

This plant community is characteristic of a post-disturbance plant community. It is dominated by herbaceous vegetation, which may or may not be non-native, woody perennials are increasing. Nevada ephedra, desert almond and desert willow commonly sprout from rhizomes following disturbance. Sprouting species provide favorable sites for germination of species such as brittlebush, ratany, and bursage which reproduce sexually and are prolific seed producers. This plant community is ‘at-risk’ of increased erosion due to reduction of deep rooted perennials and increased non-native annuals.

State 3
Eroded State

This state is characterized by reduced cover of woody perennials. Bare ground is increasing, leading to increased erosion, decreased infiltration and loosening of the soil surface causing channeling. An abiotic threshold has been crossed preventing the natural repair of this plant community. Feedbacks keeping this state stable include reduced perennial vegetative cover causing increased runoff and decreased infiltration preventing the establishment of desirable perennial vegetation.

Community 3.1
Plant Community Phase 3.1

This plant community is characteristic of a short disturbance return interval. Long-lived woody perennials are

decreasing. The ability of this site to dissipate energy during large flow events is severely reduced contributing to ecological damage downstream.

Community 3.2
Plant Community Phase 3.2

This plant community is characterized by the loss of long-lived woody perennials. Ecological processes have been altered including connectivity within the watershed, ground water recharge and habitat quality. Soil and soil nutrients are being redistributed down stream, leading to down cutting and channel widening.

Pathway 3.1a
Community 3.1 to 3.2

Seasonal flooding, drought, wildfire, disease, insect attack or other mechanism which reduces vegetation cover.

Pathway 3.2a
Community 3.2 to 3.1

Absence from disturbance and natural regeneration over time, allow some perennials to return to the system increasing stability.

Transition T1
State 1 to 2

Introduction of non-native species due to a combination of factors including: 1) surface disturbance, 2) changes in the kinds of animals and their grazing patterns, 3) drought and/or 4) changes in fire history.

Transition T2
State 2 to 3

Large scale reoccurring disturbance, natural or anthropogenic.

Restoration pathway R3
State 3 to 2

Ecological processes can be restored to the site, but non-natives remain. Possible restoration techniques include stabilizing the site by reestablishing native perennials and the use of artificial rip-rap to dissipate energy and reestablish the flood plain.

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
1	**Shrubs**			53–211	
	California broomsage	LESQ	*Lepidospartum squamatum*	45–179	–
	Eastern Mojave buckwheat	ERFA2	*Eriogonum fasciculatum*	3–16	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	2–4	–
	burrobrush	HYSA	*Hymenoclea salsola*	1–4	–
	desertsenna	SEAR8	*Senna armata*	1–2	–
	burrobush	AMDU2	*Ambrosia dumosa*	0–2	–
Forb					
2	**Annual forbs**			3–13	
	flatspine bur ragweed	AMAC2	*Ambrosia acanthicarpa*	1–2	–
	brittle spineflower	CHBR	*Chorizanthe brevicornu*	1–2	–
	pincushion flower	CHFR	*Chaenactis fremontii*	1–2	–
	common pussypaws	CIMO4	*Cistanthe monandra*	0–1	–
	Bigelow's tickseed	COBI	*Coreopsis bigelovii*	0–1	–
	flatcrown buckwheat	ERDE6	*Eriogonum deflexum*	0–1	–
	pygmy poppy	ESMI	*Eschscholzia minutiflora*	0–1	–
	chia	SACO6	*Salvia columbariae*	0–1	–
	Booth's evening primrose	CABO7	*Camissonia boothii*	0–1	–

Animal community

Livestock Interpretations:
This site has limited value for livestock grazing, due to the low forage production, steep slopes and stony surfaces. Bush muhly is readily eaten by livestock throughout the year when available; however, it is usually not abundant enough to provide much forage. It is grazed heavily in winter when other species become scarce. Because of its branching habit, it is extremely susceptible to heavy grazing. Bush muhly is damaged when continuously grazed to a stubble height of less than 4 inches (10 cm). Desert needlegrass produces considerable basal foliage and is good forage while young. Young desert needlegrass is palatable to all classes of livestock. Mature herbage is moderately grazed by horses and cattle but rarely grazed by sheep. Big galleta is considered a valuable forage plant for cattle and domestic sheep. Its coarse, rigid culms make it relatively resistant to heavy grazing and trampling. Mojave buckwheat has a browse rating of fair to poor for cattle. Creosotebush is unpalatable to livestock. Consumption of creosotebush may be fatal to sheep. Winterfat is an important forage plant for livestock in salt-desert shrub rangeland and subalkaline flats. Winterfat palatability is rated as good for sheep, good to fair for horses, and fair for cattle. Abusive grazing practices have reduced or eliminated winterfat on some areas even though it is fairly resistant to browsing. Grazing season has more influence on winterfat than grazing intensity. Early winter grazing may actually be beneficial.

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:
Creosotebush is unpalatable to most browsing wildlife. Winterfat is an important forage plant for wildlife in salt-desert shrub rangeland and subalkaline flats. Animals that browse winterfat include mule deer, Rocky Mountain elk, desert bighorn sheep, and pronghorn antelope. The palatability of bush muhly for wildlife species is rated fair to poor. Desert bighorn sheep and feral horses and burros will graze desert needlegrass.

Hydrological functions

These soils are well drained with moderately rapid permeability.

Other products

Creosotebush has been highly valued for its medicinal properties by Native Americans. It has been used to treat at least 14 illnesses. Twigs and leaves may be boiled as tea, steamed, pounded into a powder, pressed into a poultice, or heated into an infusion.

Other information

Desert needlegrass may be used for groundcover in areas of light disturbance, but it is susceptible to excessive trampling. Big galleta's clumped growth form stabilizes blowing sand. Once established, creosotebush may improve sites for annuals that grow under its canopy by trapping fine soil, organic matter, and symbiont propagules. It may also increase water infiltration and storage.

Other references

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Salem, B. B. (1989). Arid zone forestry: a guide for field technicians (No. 20). Food and Agriculture Organization (FAO).

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Contributors

RWA/GKB
Dustin Detweiler

Approval

Kendra Moseley, 3/11/2025

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	Sarah Quistberg
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:**

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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:

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

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

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

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:**

17. **Perennial plant reproductive capability:**