USDA Natural Resources
Conservation Service

Ecological site R030XA045CA
Volcanic Hill

Last updated: 2/18/2025
Accessed: 05/12/2025

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 Western Mojave Land Resource Unit (XA)

LRU notes

The Mojave Desert is currently divided into 4 Land Resource Units (LRUs). This ecological site is within the arid portions of the Mojave where precipitation primarily occurs during the winter months (Hereford et. al 2004). The lack of summer precipitation as well as cooler temperatures allows cool season species to occupy sites at lower elevations than they do in the Eastern Mojave. For example, sandberg bluegrass, winterfat and spiny hopsage are common at lower elevations in the Western Mojave than they are in the Eastern Mojave. Warm season species like big galleta rarely occur in the Western Mojave. The Arid Western Mojave LRU is designated by the 'XA' symbol within the ecological site ID and is roughly equivalent to Western Mojave Basins and Western Mojave Low Ranges and Arid Footslopes of EPA Level IV Ecoregions.

Elevations range from 1650 to 4300 feet and precipitation is between 4 to 8 inches per year. The Arid Western Mojave LRU is distinguished from the Arid Eastern Mojave (XB) by the lack of summer precipitation which excludes many warm season plant species from occurring in this LRU. Vegetation includes creosote bush, rabbitbrush, shadscale saltbush, spiny hopsage, winterfat, Nevada jointfir, and Joshua tree. At the upper elevations of the LRU, plant production and diversity are greater and blackbrush is a common dominant shrub. The Arid Western Mojave LRU generally lacks the diversity of yucca, cacti and warm season species found in the Arid Eastern Mojave.

Ecological site concept

The Volcanic Hill ecological site is found among the mountains and hills landscape on extrusive igneous material such as basalt and rhyolite between 1600 and 3000 feet elevation. Soils are loamy and moderately deep to very deep with a very shallow to shallow argillic horizon. Fragments over 10 inches in diameter cover less than 20% of the soil surface.

The central concept for this ecological site is within the Mojave Desert Area, Northwest Part, California Soil Survey Area (CA682) on the Typic Haplargids components of the 3010 - Jawbone-Typic Haplargids-Rock outcrop association, 30 to 60 percent slopes map unit.

This is a group concept and provisional STM that also covers the following ecological sites: R030XA047CA, R030XA044NV, R030XA068NV.

Associated sites

R030XA054NV	**Limy Hill 5-7 P.Z.** R030XA054NV Limy Hill 5-7

Similar sites

R030XA050CA	**Volcanic Slope 5-7** R030XA045CA was copied from R030XA050CA in order to avoid duplicity with R030XA050NV (LOAMY 3-5 P.Z.) in the event the 'F', 'R', and state endings are dropped.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex polycarpa*
Herbaceous	(1) *Poa secunda*

Physiographic features

This ecological site occurs on hills. Slopes range from 30 to 60 percent.

Table 2. Representative physiographic features

Landforms	(1) Hill
Flooding frequency	None
Ponding frequency	None
Elevation	488–914 m
Slope	30–60%
Water table depth	152 cm

Climatic features

The Mojave Desert experiences clear, dry conditions for a majority of the year. Winter temperatures are mild,

summer temperatures are hot, and seasonal and diurnal temperature fluctuations are large. Monthly minimum temperature averages range from 30 to 80 degrees F (-1 to 27 degrees C). Monthly maximum temperature averages range from 60 to 110 degrees F (16 to 43 degrees C) (CSU 2002).

Average annual rainfall is between 2 and 8 inches (50 to 205 millimeters) (USDA 2006). Snowfall is more common at elevations above 4000 feet (1220 meters), but it may not occur every year (WRCC 2002). The Mojave Desert receives precipitation from two sources. Precipitation falls primarily in the winter as a result of storms originating in the northern Pacific Ocean. The Sierra Nevada and Transverse Ranges create a rain shadow effect, causing little precipitation to reach the Mojave Desert. Sporadic rainfall occurs during the summer as a result of convection storms formed when moisture from the Gulf of Mexico or Gulf of California moves into the region. Summer rainfall is more common and has a greater influence on soil moisture in the eastern Mojave Desert.

Windy conditions are also common in the Mojave Desert, particularly in the west and central Mojave Desert. Spring is typically the windiest season, with winds averaging 10-15 miles per hour (WRCC 2002). Winds in excess of 25 miles per hour and gusts in excess of 50 miles per hour are not uncommon (CSU 2002).

Although half of the Jawbone-Butterbredt ACEC Soil Survey is in the Mojave Desert (MLRA 30), the western and northwestern areas of the survey transition into the Southern Nevada Basin and Range (MLRA 29). As the Mojave Desert transitions into the Southern Nevada Basin and Range, the temperature range generally becomes cooler (WRCC 2002). Precipitation as rain and as snow also increases (USDA 2006). This survey area has a wide range of precipitation due to its location. Where the Mojave Desert influences are stronger, average annual precipitation ranges from 5 to 7 inches (127 to 178 millimeters). Where the Southern Nevada Basin and Range influences are stronger, average annual precipitation commonly ranges from 7 to 9 inches (178 to 229 millimeters), and may range up to 12 inches (305 millimeters) annually (WRCC 2002). At elevations above 4000 feet (1370 meters), average annual snowfall may reach 20 inches (WRCC 2002).

The data from the following climate stations were used to describe the climate in the Jawbone-Butterbredt ACEC Soil Survey (station number in parentheses):
Cantil, CA (041488)
Inyokern, CA (044278)
Mojave, CA (045756)
Tehachapi, CA (048826)

"Maximum monthly precipitation" represents average monthly precipitation.

Table 3. Representative climatic features

Frost-free period (average)	270 days
Freeze-free period (average)	300 days
Precipitation total (average)	178 mm

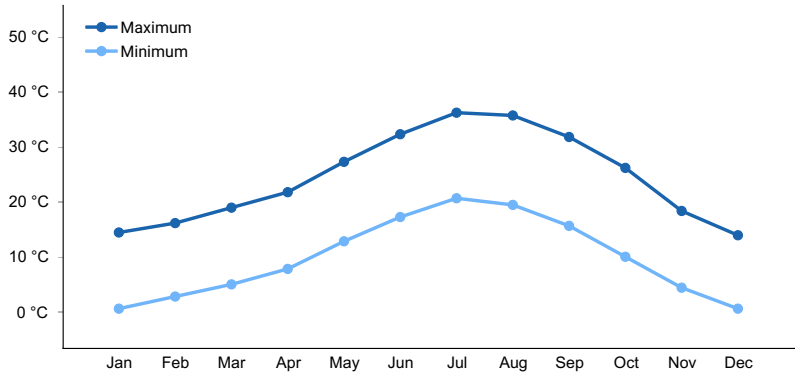


Figure 1. Monthly average minimum and maximum temperature

Influencing water features

Soil features

The soils on this ecological site are formed in residuum and colluvium from igneous extrusive rock. Soils are moderately deep to a lithic contact. Soil textures are loams, sandy loams, and sandy clay loams and are typically non-skeletal at the surface and very cobbly in the subsoil. They are well drained, permeability is slow, and runoff is high. Available water capacity ranges from very low to high depending on the rock fragment percentages and clay content. The soils are very shallow to an argillic horizon.

This ecological site is found on soils that classify as:
Typic Haplargids – Loamy-skeletal, mixed, superactive, thermic Typic Haplargids.
Garlock – Fine-loamy, mixed, superactive, thermic Typic Haplargids

Soil survey area - Map unit symbol - Component
CA682 – 3010 – Typic Haplargids (major)
CA682 – 3010 – Garlock

Table 4. Representative soil features

Surface texture	(1) Sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Slow
Soil depth	86–112 cm
Surface fragment cover <=3"	50–75%
Surface fragment cover >3"	5–15%
Available water capacity (0-101.6cm)	3.81–19.81 cm
Calcium carbonate equivalent (0-101.6cm)	0–1%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–5
Soil reaction (1:1 water) (0-101.6cm)	7.2–7.8
Subsurface fragment volume <=3" (Depth not specified)	5–30%
Subsurface fragment volume >3" (Depth not specified)	0–40%

Ecological dynamics

This ecological site is dominated by cattle saltbush (*Atriplex polycarpa*) and Sandberg bluegrass (*Poa secunda*). Cattle saltbush is a long-lived shrub commonly found in alkali sinks which may receive ponding, but it may also be found in areas that are very rarely to occasionally flooded. Cattle saltbush establishes easily when adequate moisture is present (Garner and Munda 2003). This ecological site is not affected by flooding or ponding, but the clay content of the soil increases its available water capacity. This may increase the soil's ability to support cattle saltbush. Cattle saltbush also spreads easily via seed. In many areas of Soil Survey Area CA682, cattle saltbush is present in adjacent, lower elevation plant communities into which water drains. Because the soil of this ecological site holds more moisture, individuals may have been able to migrate up the hill from these lower elevation communities.

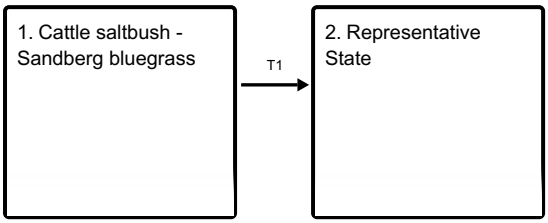
Sandberg bluegrass is a common species found in a variety of habitats. Although it is often found on shallow, rocky, and coarse-textured soils, the finer textures and the well-drained characteristic of the soils may be encouraging its

presence in this community (Howard 1997).

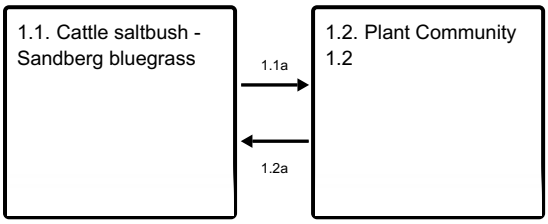
Areas of this ecological site have been affected by invasive annual species. Red brome (*Bromus rubens*) is the most common species. It is present both as a canopy species and as an understory species of other shrubs. Where it is present it may account for approximately 30 to 35 percent of the vegetation cover. An increase in invasive species cover may lead to increased risk of wildfire in this plant community by creating a more continuous, easily ignitable fuel source. In turn higher fire frequencies will encourage the spread of invasive species.

State and transition model

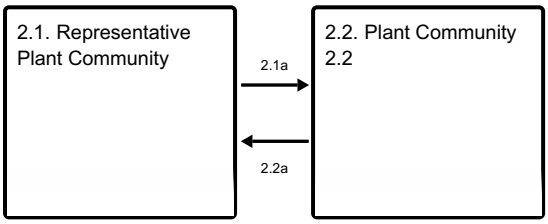
Ecosystem states



State 1 submodel, plant communities



State 2 submodel, plant communities



State 1
Cattle saltbush - Sandberg bluegrass

The reference state is representative of the natural range of variability under pristine conditions. The plant community is shrub dominated with a minor component of perennial grasses. Plant community dynamics are primarily driven by long-term drought, insect outbreaks, and infrequent wildfire.

Community 1.1
Cattle saltbush - Sandberg bluegrass

The major species in this plant community are cattle saltbush (*Atriplex polycarpa*) and Sandberg bluegrass (*Poa secunda*). Burrobrush (*Hymenoclea salsola*) is also a common species. Several plant species are present throughout the ecological site but are more common in localized areas. These include Mexican bladdersage (*Salazaria mexicana*), white burrobush (*Ambrosia dumosa*), and winterfat (*Krascheninnikovia lanata*). Other minor species include Nevada jointfir (*Ephedra nevadensis*), California buckwheat (*Eriogonum fasciculatum*), spiny hopsage (*Grayia spinosa*), creosote bush (*Larrea tridentata*), water jacket (*Lycium andersonii*), and longspine horsebrush (*Tetradymia axillaris*). This community has a predominantly one-tier structure. The tope vegetation canopy typically covers litter or gravel. Lower tiers of grasses and other shrubs are scattered. In a below average rainfall year, approximately 30 to 60 percent of the ground surface had native perennial vegetation cover. Contributions of native annual species were minimal but may be more so during average or above average rainfall years.

Table 5. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	35-55%
Grass/grasslike foliar cover	5-10%
Forb foliar cover	1-3%
Non-vascular plants	0%
Biological crusts	0%
Litter	5-10%
Surface fragments >0.25" and <=3"	25-50%
Surface fragments >3"	1-20%
Bedrock	0%
Water	0%
Bare ground	1-5%

Table 6. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	1-5%
Grass/grasslike basal cover	1-3%
Forb basal cover	1-2%
Non-vascular plants	0%
Biological crusts	0%
Litter	25-35%
Surface fragments >0.25" and <=3"	50-70%
Surface fragments >3"	1-5%
Bedrock	0%
Water	0%
Bare ground	1-7%

Community 1.2
Plant Community 1.2

This plant community is characteristic of an early seral, post- disturbance plant community. Initially, this plant community phase is heavily dominated by herbaceous vegetation. Perennial grasses provide favorable sites for the establishment of shrub seedlings. This plant community is considered at risk of invasion by non-native annuals. Non-natives take advantage of increased availability of critical resources following a fire or other disturbance.

Pathway 1.1a
Community 1.1 to 1.2

Wildfire, disease, prolonged drought, insect attack or any other type of incomplete vegetation removal.

Pathway 1.2a
Community 1.2 to 1.1

Absence from disturbance and natural regeneration over time.

State 2

Representative State

The Representative State is characterized by the presence of non-native annuals in the understory. Plant communities in this state function very similarly to the reference state, however, ecological resilience may be reduced by the presence of the non-natives. Introduced annuals such as red brome, Mediterranean grass and redstem filaree have invaded the reference plant community and have become a component of the herbaceous cover. These non-native annuals are highly flammable and promote wildfires where fires historically have been infrequent. Mature shrubs persists after this invasion by non-native annuals, however shrubs seedling and desirable grasses suffer reduced vigor and limited reproductive capability due to increased competition from non-natives.

Community 2.1
Representative Plant Community

This plant community is similar to the reference plant community with a trace of non-natives in the understory. Ecological function has been not compromised at this time. Ecological resilience is reduced by the presence of non-native species and this plant community phase will respond differently following a disturbance when compared to non-invaded plant communities.

Community 2.2
Plant Community 2.2

This plant community is characteristic of a post-disturbance plant community. It is initially dominated by herbaceous vegetation, woody perennials are increasing.

Pathway 2.1a
Community 2.1 to 2.2

Frequent and repeated surface disturbances, wildfire, disease, insect attack, or any other type of incomplete vegetation removal.

Pathway 2.2a
Community 2.2 to 2.1

Absence from disturbance and natural regeneration over time.

Transition T1
State 1 to 2

Introduction of non-native species due to a combination of factors including; surface disturbance, changes in the kinds of animals and their grazing patterns, drought, changes in fire history or any other type of vegetation removal. Non-natives can alter disturbance regimes significantly from their natural or historic range and change ecological processes therefore creating an unlikely scenario to restore the site back to reference.

Additional community tables

Animal community

Cattle saltbush (*Atriplex polycarpa*) and Sandberg bluegrass (*Poa secunda*) are important forage species for wildlife. The shrubs on this ecosite also provide cover for many animals.

Cattle saltbush and Sandberg bluegrass are also valuable as livestock forage (Sampson and Jesperson 1963). However, use of this ecological site for that purpose would be limited by the steep, rocky slopes on which it is found.

Recreational uses

This ecological site is located in an off-highway vehicle recreation area. Parts of this ecological site are located in close proximity to areas where travel is not restricted to established trails. Such activity may aid the transport of invasive species seeds to this community.

Inventory data references

3 Line-point intercept transects (2007)

Annual production was not sampled due to a poor growing season in 2007. Total production estimated with assistance from Leon J. Lato, Soil Scientist (Las Vegas, NV).

Other references

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Contributors

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Approval

Kendra Moseley, 2/18/2025

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	05/12/2025
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:**

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:

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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:**
