

Ecological site R030XA055CA Calcareous Hill

Last updated: 2/18/2025 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 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

This ecological site is found on hill and mountain landforms predominantly below 3800 feet elevation. Higher elevations can exists when not adjacent to elevations above 5575 feet. Soils formed in colluvium and residuum weathered from rhyolite and are very shallow to shallow. Surface fragments larger than 10 inches cover less than 20 percent of the soil surface.

This is a group concept and provisional STM that also covers R030XB121CA.

Associated sites

R030XB139CA	Shallow Dry Hill 4-6 P.Z. Limy Hill 5-7
R030XB005NV	Arid Active Alluvial Fans Limy 5-7

Similar sites

R030XB122CA	Calcareous Loam 3-5" P.Z. Calcareous Loam 3-5
R030XB121CA	Calcareous Hill 5-7" P.Z. This is the same ecological site and was copied to R030XA055CA since the site is in the Western Mojave (XA LRU).
R030XB141CA	Loamy 5-7" P.Z. Loamy 5-7

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) Atriplex confertifolia(2) Larrea tridentata
Herbaceous	(1) Achnatherum speciosum

Physiographic features

This site occurs on summits and sideslopes of low hills and mountains. Elevations are 3000 to 4500 feet. Slopes range from 2 to 50 percent, but slopes of 15 to 50% are most typical.

Table 2.	Representative	physiographic	features
=-		P	

Landforms	(1) Mountain (2) Hill
Flooding duration	Extremely brief (0.1 to 4 hours)
Flooding frequency	None to rare
Ponding duration	Very brief (4 to 48 hours)
Ponding frequency	None to rare

Elevation	914–1,372 m	
Slope	2–50%	
Aspect	Aspect is not a significant factor	

Climatic features

The climate on this site is arid, characterized by warm, moist winters (30 to 60 degrees F) and hot, dry summers (70 to 100 degrees F). The average annual precipitation ranges from 4 to 7 inches with most falling as rain from November to March. Approximately 25% of the annual precipitation occurs from July to September as a result of summer convection storms. Mean annual air temperature is 61 to 66 degrees F.

"Maximum precipitation" data represents average precipitation by month from Goldstone Echo 2, CA, weather station ID 043498.

Available temperature data is taken from China Lake Armitage, CA, weather station ID 041733.

The average frost-free period is 240 to 300 days.

 Table 3. Representative climatic features

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



Figure 1. Monthly average minimum and maximum temperature

Influencing water features

There are no influencing water features.

Soil features

The soils that characterize this site are very shallow and shallow to bedrock. They are well drained to somewhat excessively drained. They are formed in residuum and colluvium mainly from volcanic sources. Surface textures are extremely cobbly loams and extremely gravelly sandy loams. Subsurface textures are gravelly loams to extremely gravelly sandy loams. Available water capacity is very low and permeability is moderate. Wind erosion hazard is negligible due to surface coarse fragments. Effective rooting depth is 0 to 15 inches to bedrock.

This ecosite is found on soil map units such as:

- 161 Marsite-Haleburu complex, 15-50% slopes
- 181 Stonegold extremely cobbly loam, 2-8% slopes

Surface texture	(1) Extremely cobbly loam(2) Extremely gravelly sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderate
Soil depth	0–51 cm
Surface fragment cover <=3"	40–75%
Surface fragment cover >3"	15–55%
Available water capacity (0-101.6cm)	0.61–3.71 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.6

Ecological dynamics

Successive years of below-average precipitation may result in considerable die-off of many species of native shrubs, especially shadscale (*Atriplex confertifolia*). Defoliation and death of branches of creosotebush (*Larrea tridentata*) may occur as a result of long periods of intense moisture stress. With a loss of perennial cover, non-native annual grasses and forbs such as red brome (*Bromus rubens*), schismus (*Schismus arabicus*), and redstem stork's bill (*Erodium cicutarium*) will readily invade this site. Burrobrush (*Hymenoclea salsola*) is also an invader on this site.

Other disturbances to this site include livestock grazing, off-highway vehicle use, and military operations. Consequences of these activities may include a reduction in native species abundance and cover, and increased erosion.

Desert communities are usually unaffected by fire because of low fuel loads, though a year of exceptionally heavy winter rains can generate fuels by producing a heavy stand of annual forbs and grasses. When fires do occur, the effect on the ecosystem may be extreme due to the harsh environment and the slow rate of recovery. White bursage (*Ambrosia dumosa*) and creosotebush possess limited sprouting ability, thus, can be killed by fire. White bursage, however, can rapidly re-establish from seed. Saltbush species are generally resistant to fire because of a low volatilization rate.

State and transition model

Ecosystem states



State 1 submodel, plant communities



State 2 submodel, plant communities



State 1 Reference State

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. Historically, this state experienced an extended fire return interval due to low fuel loading, which resulted in long-lived stable plant communities.

Community 1.1 Reference State- Plant Community 1.1

The historic site potential is dominated by creosotebush, white bursage and shadscale. Perennial grasses and annual forbs and grasses comprise a small percentage of the cover. The composition of the annual vegetation differs from year to year, depending on the time and amount of rainfall. This site is stable in this condition. The representative natural plant community is Mojave Creosotebush Scrub or Creosotebush Series. This community is dominated by shadscale, creosotebush, white bursage and desert needlegrass. Potential vegetative composition is about 15% grasses, 10% forbs, and 75% shrubs. This community is dominated by shadscale, creosotebush, white bursage, and desert needlegrass (Achnatherum speciosum). Other perennial grasses and annual forbs and grasses comprise a small percentage of the cover. Potential vegetative composition by production (pounds of air-dry weight per acre in an average year) is about 15% grasses, 10% forbs, and 75% shrubs. Fluctuations in species composition and relative production may change from year to year due to abnormal precipitation or other climatic factors. The following table lists the major species and the percentage of the total plant community production (airdry weight) that each species contributes in an average year. SHRUBS and TREES (75%): shadscale = 15-25% creosotebush = 10-20% white bursage = 5-15% Other shrubs = 5-15%** -Nevada ephedra (Ephedra nevadensis) -Anderson wolfberry (Lycium andersonii) -littleleaf ratany (Krameria erecta) -winterfat (Krascheninnikovia lanata) -Mojave woodyaster (Xylorhiza tortifolia) -Desert alyssum (Lepidium fremontii) -Spiny hopsage (Grayia spinosa) -Hedgehog barrel cactus (Echinocactus polycephalus) -Beavertail pricklypear (Opuntia basilaris) -Mojave cottonthorn (Tetradymia stenolepis) - Joshua tree (Yucca brevifolia) ** Allow no more than 5% of each species of this group, and no more than 15% in aggregate GRASSES and GRASS-LIKE PLANTS (15%): Desert needlegrass = 5-10% Other perennial grasses = 2-8%** - Indian ricegrass (Achnatherum hymenoides) - Big galleta (Pleuraphis rigida) -Sandberg bluegrass (Poa secunda) Annual grasses = Trace-5% ** Allow no more than 2% of each species of this group, and no more than 8% in aggregate FORBS (10%): Perennial forbs = 5-10%** -Wirelettuce (Stephanomeria pauciflora) -Desert globemallow (Sphaeralcea ambigua) -Desert trumpet (Eriogonum inflatum) -

Wishbone herb (Mirabilis bigelovii) Annual forbs = Trace-10% -Desert Indianwheat (*Plantago ovata*) -Wallace eriophyllum (*Antheropeas wallacei*) -Sagebrush spineflower (*Chorizanthe brevicornu*) -Little gold poppy (*Eschscholzia minutiflora*) ** Allow no more than 2% of each species of this group, and no more than 10% in aggregate Approximate ground cover (basal and crown) is 5 to 15 percent.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	420	291	123
Grass/Grasslike	84	62	28
Forb	56	39	17
Total	560	392	168



Figure 3. Plant community growth curve (percent production by month). CA3003, Shadscale. Growth starts in early spring. Flowering and seed set occur by July. Seeds stay on the shrub for several months. Dormancy occurs during the hot summer months..



Figure 4. Plant community growth curve (percent production by month). CA3004, Burrobush XB. Growth starts in early spring, flowering and seed set occur by July. Dormancy occurs during the hot summer months. With sufficient summer/fall precipitation, some vegetation may break dormancy and produce a flush of new growth..



Figure 5. Plant community growth curve (percent production by month). CA3015, Creosote bush XB. Growth starts in early spring with flowering and seed set occurring by July. Dormancy occurs during the hot summer

months. With sufficient summer/fall precipitation, some vegetation may break dormancy and produce a flush of growth..



Figure 6. Plant community growth curve (percent production by month). CA3087, Desert needlegrass. Growth begins in mid-winter and continues through summer, setting seed in late summer.

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 shrub seedlings 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. Short lived and pioneering shrubs such as cattle saltbush, rabbit brush, California buckwheat, spiny hopsage, and burrobrush provide favorable microsites for the establishment of long lived shrub seedlings.

Community 2.3 Plant Community 2.3

This plant community is characterized by a short disturbance return interval. Non-native annuals take advantage of the increased availability of resources. This plant community is identified as "at risk". The loss of vegetative cover has reduced the ecological resistance and resilience. Management should be focused on limiting disturbances and protecting remnants of mature vegetation to ensure a seed source is available in the future.

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.

Pathway 2.2b Community 2.2 to 2.3

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

Pathway 2.3a Community 2.3 to 2.2

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.

Restoration pathway NR State 2 to 1

No Recovery (NR) - Recovery within our lifetime is extremely difficult and challenging without an infinite amount of resources to achieve restoration.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
1	Shrubs			123–420	
	shadscale saltbush	ATCO	Atriplex confertifolia	56–101	
	creosote bush	LATR2	Larrea tridentata	39–78	
	burrobush	AMDU2	Ambrosia dumosa	17–62	-
	desert pepperweed	LEFR2	Lepidium fremontii	0–22	-
	water jacket	LYAN	Lycium andersonii	0–22	-
	beavertail pricklypear	OPBA2	Opuntia basilaris	0–22	-
	Mojave cottonthorn	TEST2	Tetradymia stenolepis	0–22	-
	Mojave woodyaster	XYTO2	Xylorhiza tortifolia	0–22	
	Joshua tree	YUBR	Yucca brevifolia	0–22	
	cottontop cactus	ECPO2	Echinocactus polycephalus	0–22	-
	Nevada jointfir	EPNE	Ephedra nevadensis	0–22	-
	spiny hopsage	GRSP	Grayia spinosa	0–22	-
	littleleaf ratany	KRER	Krameria erecta	0–22	-
	winterfat	KRLA2	Krascheninnikovia lanata	0–22	
Grass	/Grasslike		·	· · · · · · · · · · · · · · · · · · ·	
2	Grasses			28–84	
	desert needlegrass	ACSP12	Achnatherum speciosum	17–39	-
	Grass, annual	2GA	Grass, annual	0–22	
	Indian ricegrass	ACHY	Achnatherum hymenoides	0–11	
	big galleta	PLRI3	Pleuraphis rigida	0–11	
	Sandberg bluegrass	POSE	Poa secunda	0–11	-
Forb			·		
3	Forbs			17–56	
	brittle spineflower	CHBR	Chorizanthe brevicornu	0–11	-
	desert trumpet	ERIN4	Eriogonum inflatum	0–11	-
	pygmy poppy	ESMI	Eschscholzia minutiflora	0–11	-
	desert Indianwheat	PLOV	Plantago ovata	0–11	-
	desert globemallow	SPAM2	Sphaeralcea ambigua	0–11	
	brownplume wirelettuce	STPA4	Stephanomeria pauciflora	0–11	

Animal community

This site provides habitat for small mammals such as antelope ground squirrels; pocket mice; Merriam and Great Basin kangaroo rats; and black-tailed jackrabbits and coyotes. Shadscale seeds are used by several species of small mammals. The twigs and foliage provide forage for jackrabbits and some small mammals. Feral burros also occur on this site.

This site provides habitat for lizards such as the western whiptail, side-blotched lizard, chuckwalla and desert horned lizard. The depth of bedrock may be a limiting factor for burrowing reptiles such as desert tortoise.

Birds common to this site include common ravens, black-throated and sage sparrows, and rock wrens.(Brown and Nagy 1995: Brydolf 1996; Recht 1995)

Management for this site would be to protect it from excessive disturbance and maintain existing plant cover. Close roads and trails no longer being used and revegetate using native species indigenous to this site. Vehicle activity off of designated roads and tank trails can result in destruction of desert tortoise and small mammal burrows. Water developments would increase the species diversity of this site.

Shadscale, white bursage and creosotebush are effective shrubs for revegetation of disturbed sites. Transplanting seedlings is more effective than direct seeding. Planting in late fall or early spring allows for acclimation to summer conditions. Transplants that are dormant during the hot, dry season are best maintained that way rather than attempting to force them to break dormancy and undergo new vegetative growth out of season. Supplemental irrigation is recommended for the first growing season, especially if winter rainfall has been sparse. Protection from rodents is also recommended.

LIVESTOCK GRAZING:

Shadscale is considered valuable browse for cattle and sheep. Shadscale is often eaten during the early spring before spines mature. The seeds are also readily eaten by livestock. White bursage is fair browse for cattle and horses, and fair to good browse for goats. Sheep also use this shrub, feeding primarily on new growth and seeds. White bursage is one of the major forage species of feral burros, especially in winter. Feral burros can eliminate this shrub through browsing and trampling. Creosotebush is unpalatable to livestock. Domestic sheep use creosotebush primarily for shade. During favorable years, perennial and annual forbs and grasses provide additional forage.

General guide to initial stocking rate. Before making specific recommendations, an on-site evaluation must be made.

Production in an average year: 350 lbs/acre

Hydrological functions

Runoff is medium to very high.

Hydrologic group D (Haleburu, Marsite, Stonegold) - soils having very slow infiltration rates when thoroughly wetted and consisting chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material.

Hydrologic conditions: good - >70% ground cover (includes litter, grass and brush overstory) fair - 30 to 70% ground cover poor <30% ground cover.

Soil group D hydrologic conditions and runoff curves for Haleburu, Marsite, and Stonegold: Good-Fair-Poor = 84-86-88

Recreational uses

This site is highly valued for open space and those interested in desert ecology. Flowering wildflowers and shrubs may also attract visitors during the spring.

Wood products

There are no wood products derived from this ecosite.

Other information

MILITARY OPERATIONS

The steep rocky slopes restrict extensive vehicle and foot traffic. Management for this site would be to protect it from excessive disturbance and maintain existing plant cover. Land clearing or other disturbances that destroy the vegetation and the soil crust and structure can result in soil compaction, reduced infiltration rates, accelerated erosion, soil blowing and barren areas. Rest or protect sites from further disturbance.

POISONOUS PLANTS and/or NON-NATIVE PLANTS:

There are no poisonous plants found on this ecosite. Non-native plants occurring on this site include schismus, red brome, and redstem stork's bill.

Inventory data references

This ecological site description is based on the following documentation:

Sampling technique: _3_NV-ECS-1 _2_SCS-Range 417

1 Other

Other references

This ecosite was developed in cooperation with: Directorate of Public Works, National Training Center, Fort Irwin, and the Mojave Desert Resource Conservation District

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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	05/13/2025
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

- 1. Number and extent of rills:
- 2. Presence of water flow patterns:
- 3. Number and height of erosional pedestals or terracettes:
- 4. Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):
- 5. Number of gullies and erosion associated with gullies:
- 6. Extent of wind scoured, blowouts and/or depositional areas:
- 7. Amount of litter movement (describe size and distance expected to travel):
- 8. Soil surface (top few mm) resistance to erosion (stability values are averages most sites will show a range of values):
- 9. Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):
- 10. Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:
- 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 annualproduction):
- 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: