USDA Natural Resources
Conservation Service

Ecological site R030XC189CA
Bi-Modal Semi-Arid Shallow Cool Hills

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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

MLRA Description:
Major Land Resource Area (MLRA) 30, Mojave Desert, 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 climate of the area is hot and dry with mostly hyperthermic and thermic soil temperature regimes. However, at higher elevations of this MLRA, generally above 5,000 feet, soil temperature regimes can be mesic, cryic and frigid. The most arid regimes of this MLRA can receive less than 4 inches (100 mm) Elevations range from below sea level to over 12,000 feet (3650 meters) in the higher mountain areas found within the MLRA. Due to the extreme elevational range found within this MLRA, land resource units (LRUs) were designated to group the MLRA into similar land units.

LRU Description:
The Bi-Modal Semi-Arid (XC) Land Resource Unit (LRU), represents a semi-arid zone as defined by the United Nations Food and Agriculture Organization and is a semi-arid region distinguished by other semi-arid regions of the Mojave by the amounts of summer precipitation it receives. Semi-arid regions in the western Mojave can experience hot and very dry summers whereas regions within the XC LRU can receive more than 2.5 inches (63.5 mm) of rain during the months of July, August and September. The Bi-Modal Semi-Arid LRU is found primarily in eastern Mojave such as in Nevada at the higher elevations, in California in the New York, Providence, Castle and Clark Mountain Ranges as well as the Cerbat and Virgin Mountains of Arizona. Elevations range from approximately 4000 to 12,000 feet (1500 to 3650 meters) and precipitation ranges 8 to 18 inches (200 – 450 mm) per year in the form of rain. Snow is not uncommon in this LRU with the chance of receiving 3 to 48 inches of snow per year.
Due to the relatively high volume of summer rainfall, soil moisture regimes may have been designated as ustic-aridic, however emerging soil moisture data suggests the xeric-aridic soil moisture regime may be more appropriate and is likely to dominate this LRU. Soils within this LRU also have a cool thermic or cooler soil temperature regime. The combination of cooler temperatures [mean annual air temperatures lower than 62 degrees F (17 degrees C)] with summer monsoonal rains help to create a unique climate within the Mojave Desert which may be more similar to the Southern Nevada Basin and Range (MLRA). Vegetation at the lower elevations of this LRU includes blackbrush, Joshua tree, juniper, pinyon pine, and mountain big sagebrush. At the higher elevations, vegetation includes oaks, Mojave sagebrush, Ponderosa pine, white fir, limber pine and the Great Basin bristlecone pine.

Ecological site concept

This site occurs on steep south facing mountain slopes with very shallow to moderately deep soils at elevations between 3300 and 5800 feet. Moderately deep soils typically have an argillic horizon. Soils have a cool thermic soil temperature regime and an ustic-aridic soil moisture regime. Production reference value (RV) for is about 400 pounds per acre. The site is dominated by blackbrush (Coleogyne ramosissima) and Utah juniper (Juniperus osteosperma). Shallow soils and a cool thermic temperature regime increases soil moisture availability allowing blackbrush and California juniper to dominate. Blackbrush is shallow-rooted, and most competitive on shallow soils. California juniper can thrive in both shallow and deep soils.

This is a group concept and provisional STM that also covers F030XC237NV.

Similar sites

R030XB189CA	**Shallow Cool Hills** This site has Juniperus californica rather than Juniperus osteosperma and does not have other warm season plant species such as black grama.

Table 1. Dominant plant species

Tree	(1) *Juniperus osteosperma*
Shrub	(1) *Coleogyne ramosissima*
Herbaceous	Not specified

Physiographic features

This site occurs on steep south facing mountain slopes with very shallow to moderately deep soils at elevations between 3300 and 5800 feet.

Climatic features

The Bi-Modal Semi-Arid (XC) Land Resource Unit (LRU), represents a semi-arid zone as defined by the United Nations Food and Agriculture Organization and is a semi-arid region distinguished by other semi-arid regions of the Mojave by the amounts of summer precipitation it receives. Semi-arid regions in the western Mojave can experience hot and very dry summers whereas regions within the XC LRU can receive more than 2.5 inches (63.5 mm) of rain during the months of July, August and September.

Influencing water features

Soil features

Moderately deep soils typically have an argillic horizon. Soils have a cool thermic soil temperature regime and an ustic-aridic soil moisture regime.

Ecological dynamics

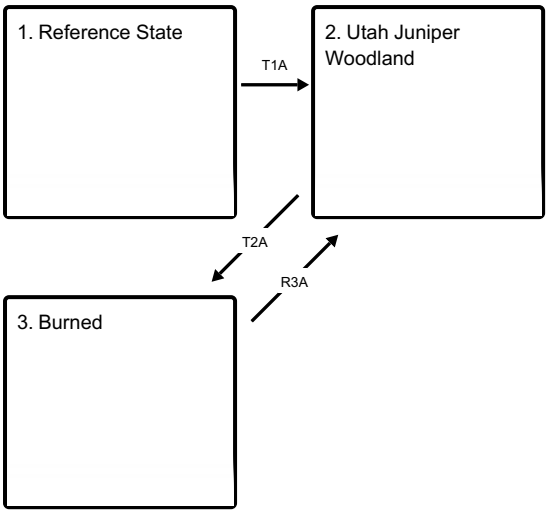
Prediction of postfire succession is affected by prefire vegetation and its fire survivability, soil seedbank, immigrating propagules, and postfire precipitation [46,48,49,51]. Succession following fire in a climax pinyon-juniper woodland often proceeds as follows: skeleton forest and bare soil; annual stage (2-3 years); annual-perennial forb stage (3-4 years); perennial forb-grass-half-shrub phase (4-6 years); shrub stage or perennial grass stage; eventual pinyon-juniper climax [4,10,41]. However, Everett and Ward [51] studied 6 burned sites to determine successional pathways, and they concluded that succession starts from multiple points along a hypothetical pathway, and that early postfire communities vary considerably.

Singleleaf pinyon may be present in early to mid-succession, but slow growth and establishment preclude early dominance [69,112].

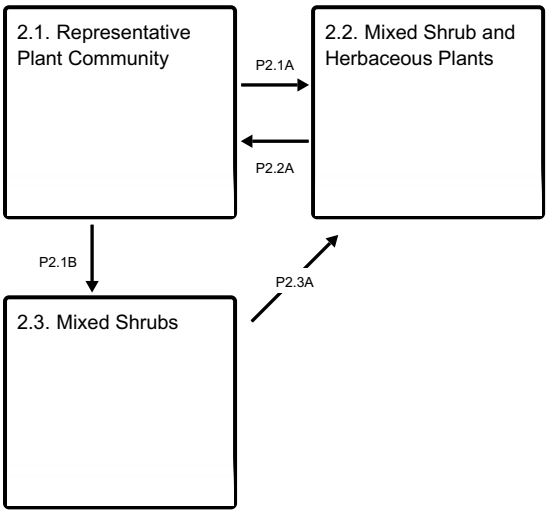
Summerfield and others [191] found that soils supporting singleleaf pinyon stands in western Nevada commonly had mollic epipedons, argillic horizons, shallow depth to bedrock, mesic temperature regimes, and low available water capacities. These soils are well suited for producing woodlands, but have low potential for forage production. A study in the Great Basin in Nevada found that singleleaf pinyon was absent from sites with hydrothermally altered andesite parent material. Researchers concluded that the absence of singleleaf pinyon was more likely due to the absence of big sagebrush nurse plants than to substrate-induced nutrient limitations, since it was able to grow on this soil in the greenhouse [32,45,177].

State and transition model

Ecosystem states



State 2 submodel, plant communities



State 1
Reference State

The community phase pathways for this state were probably similar to State 2. The only difference between States 1 and 2 is the assumption that non-native species were absent from State 1. The widespread presence of non-native annual species makes a reference state devoid of these species unrealistic. Although some areas, at times may seem to be in reference condition, non-native annuals are likely to be present at some times of year and/or following certain years with the right combination of precipitation amounts, timing and temperatures.

State 2
Utah Juniper Woodland

Non-native annuals, including red brome (*Bromus rubens*) and red-stem storks bill (*Erodium cicutarium*) are naturalized in this state. Their abundance varies with precipitation but they are, at a minimum, sparsely present. Non-native annuals may be present in current year's growth or in the soil seedbank. This ecological state has a long history of livestock grazing which is likely to have obscured our understanding of state and community pathways as well as vegetation composition. Given that this ecological site is at higher elevations and can support perennial bunch grasses, unlike the more harsh and arid Mojave Desert environments, this ecological site would have been attractive to early livestock operations in the Mojave Desert.

Community 2.1
Representative Plant Community

This monospecific blackbrush stand often exists with few other species scattered throughout the stand and under blackbrush canopies. Blackbrush as a climax species is supported by West (1969), Provenza and Urness (1981) and Jeffries and Klopatek (1987) but solid stands may have developed as livestock grazing removed more palatable grasses and shrubs (Bowns and West 1976b, Plummer et. al 1968).

Community 2.2
Mixed Shrub and Herbaceous Plants

This site has a mosaic of shrubs and grasses where fire has opened the shrub canopy and has allowed colonization to grasses.

Community 2.3
Mixed Shrubs

This community is heavier on blackbrush and juniper and has less grasses than the reference community.

Pathway P2.1A
Community 2.1 to 2.2

A mosaic of spot fires will reduce blackbrush and juniper creating more open patches of grass cover.

Pathway P2.1B
Community 2.1 to 2.3

Over time blackbrush and juniper increase due to resistance to grazing pressure and a competitive root system.

Pathway P2.2A
Community 2.2 to 2.1

Over time shrubs such as blacbrush gain a competitive advantage and begin to fill in the interspaces.

Pathway P2.3A
Community 2.3 to 2.2

Low impact fire creating a mosaic of shrubs and grasses.

State 3
Burned

This state exists when blackbrush is lost from the community as a result of large-scale and high intensity fires, where blackbrush seed source is not available to recolonize, and/or recurrent fire does not provide intervals long enough for blackbrush recovery. Evidence suggests that Indigenous land management practices were employed in and around this ecological site for several reasons, which include increasing the number of individual Mojave yucca (*Yucca schidigera*) and banana yucca (*Yucca baccata*) plants. Several bands of Chemehuevi (Hokwaits, Kauyaichits, and the Timpashauwagotsits) spent time in and around the Providence and New York Mountains and are reported to have employed fire as a hunting technique to capture rabbits and deer (Miller and Miller 1967). Laird (1984) also describes Chemehuevi tales where fire was used to improve the growth and quality of basketry materials as well as to char seeds to be eaten. Whether intentional or not, the greatest differences recorded between pre- and post-fire vegetation demographics, aside from the blackbrush removal, is an increase in *Yucca schidigera* and *Yucca baccata* individuals. S.R. Abella (2009) found Mojave yucca (*Yucca schidigera*) to exhibit the highest post-fire sprouting rate than any other plant species in a study of post-fire recovery in the Mojave and Sonoran Deserts. Abella et al (2009) also described vigorous *Yucca baccata* and schidigera resprouting following a Mojave Desert burn. In yet another study of post-fire effects, a similar yucca (*Yucca glauca*) increased the number of rosettes, from pre-burn, by 17% two years following the experimental fire (Parmenter 2008). Many tribes such as the Chemehuevi used Yucca species for food, soap, baskets, bowstrings, sandals and many other items (Bean and Saubel 1972).

Transition T1A
State 1 to 2

This introduction and proliferation of introduced species. Once this happens it is unlikely the site will return to reference conditions.

Transition T2A
State 2 to 3

An intense wildfire taking out blackbrush and juniper.

Restoration pathway R3A
State 3 to 2

It is uncertain whether blackbrush will come back but juniper will begin to re-establish itself over time.

Additional community tables

Inventory data references

F030XC237NV is the same ecological site concept as R030XC189CA.

Approval

Sarah Quistberg, 2/25/2025

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):**

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5. **Number of gullies and erosion associated with gullies:**

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6. **Extent of wind scoured, blowouts and/or depositional areas:**

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7. **Amount of litter movement (describe size and distance expected to travel):**

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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

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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):**

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:**