Ecological site R030XB097NV
SANDHILL 3-5 P.Z.

Last updated: 3/10/2025
Accessed: 08/31/2026

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 sand sheets and dunes below 1650 feet elevation. This is a group concept and provisional STM that also covers R030XB054NV.

Associated sites

R030XB017NV	**LIMY HILL 3-5 P.Z.**
R030XB019NV	**Eroded Fan Remnant Pavette 4-6 P.Z.**
R030XB096NV	**GRAVELLY SAND 3-5 P.Z.**

Similar sites

R030XB004NV	**SANDY 5-7 P.Z.** Less productive site; ACHY-PLRI3 codominant
R030XB121NV	**SANDY PLAIN 3-5 P.Z.** TIPA rare to absent; AMDU2 dominant shrub
R030XB096NV	**GRAVELLY SAND 3-5 P.Z.** AMDU2-TIPA codominant shrubs; less productive site
R030XB054NV	**SANDY 3-5 P.Z.** Less productive site; slopes less than 8%
R030XB065NV	**SODIC SAND** ATPO dominant shrub
R030XB063NV	**SANDHILL 5-7 P.Z.** ACHY-PLRI3 codominant
R030XB034NV	**SANDY PLAIN 5-7 P.Z.** Greater shrub diversity; slopes less than 8%

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Pleuraphis rigida*

Physiographic features

This site occurs on thick sand sheets. Slopes range from 2 to 50 percent, but slope gradients of 8 to 30 percent are typical. Elevations are 600 to about 1500 feet.

Table 2. Representative physiographic features

Landforms	(1) Sand sheet
Elevation	180 – 460 m
Slope	0 – 50 %

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 3 to 5 inches. Mean annual air temperature is greater than 69 degrees F. The average growing season is about 300 to 340 days.

Table 3 Representative climatic features

Frost-free period (average)	340 days
Freeze-free period (average)	
Precipitation total (average)	130 mm

Influencing water features

Because of rapid intake and deep percolation of water, the loss of soil moisture due to evaporation is reduced and runoff is negligible.

Soil features

The soil associated with this site are coarse textured aeolian deposits derived from mixed rock sources. These soils are deep to very deep and excessively drained. The coarse textured, single-grained, surface soils are at least 20 inches in depth. Surface cover of pebble-sized rock fragments is typically less than 2 percent. Because of rapid intake and deep percolation of water, the loss of soil moisture due to evaporation is reduced and runoff is negligible. The soils are extremely susceptible to wind erosion. Small "blow-out" spots are common and, collectively, may represent as much as 5 percent of the total surface area for the site. Potential for sheet and rill erosion is slight, but wind erosion potential is high.

Table 4. Representative soil features

Surface texture	(1) Fine sand
Family particle size	(1) Sandy
Drainage class	Somewhat excessively drained

Permeability class	Rapid
Soil depth	100 – 210 cm
Surface fragment cover <=3"	20 – 40 %
Calcium carbonate equivalent (0-101.6cm)	Not specified
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	0 – 10
Soil reaction (1:1 water) (0-101.6cm)	0 – 50
Subsurface fragment volume <=3" (Depth not specified)	0 – 50 %

Ecological dynamics

Potential natural vegetation is dominanted by perennial grasses.White bursage and winterfat are common shrubs on this site. Big galleta is a long-lived, rhizomatous, warm-season perennial grass and appears as a clumped growth form as a result of short rhizomes it produces. Big galleta typically undergoes two growth periods to correspond with the bimodal pattern of precipitation that typifies the eastern Mojave Desert. This species is the most drought-tolerant of all the Pleuraphis species. Indian ricegrass, a cool-season bunchgrass, depends on moisture in the early growing season to complete its growth cycle. Winterfat retains its leaves through the winter and are shed in the spring with the initiation of new growth (Carey 1995).

This site is characterized by sandy soils which contribute to higher productivity and cover of perennial grasses. The primary organizing principle, for these ecological sites, is the inverse-texture hypothesis, which predicts that plant communities on coarse textured soils should have higher above-ground net primary productivity than communities on fine textured soils. Sandy or coarse textured soils have greater rates of infiltration and precipitation is percolated deeper into the soil profile. On sandy sites, the surface horizon dries out quickly and forms a barrier to the conductance and evaporation of water held in the deeper soil horizons (Lane et al. 1998). This process protects moisture from being lost to evaporation, increasing the available water in the soil profile and positively contributing to the primary productivity of these sites.

Variation in the timing and amount of rainfall is particularly important in favoring species with different physiological characteristics: there is strong relationship between summer rainfall patterns and desert grasslands (McClaran and Van Devender 1995). Perennial grass recruitment occurs from seeds, rihizomes and stolons. Rainfall and runoff is unevenly distributed across the landscape, contributing to the spatial distribution of functional and structural groups. Desert grasses are intensive exploiters, which mean the extract a large proportion of their moisture from shallow soil horizons (Burgess 1995). Intensive exploiters are very effective competitors for limited moisture and tend to be very resilient. Long-term drought greatly influences plant community dynamics. Drought induced canopy die-back and mortality, is common during periods of below average precipitation, especially among juveniles (Hamerlynck and McAuliffe 2008).

Historically, these sites would have experienced infrequent, stand replacing fires, carried by a relatively high cover of perennial grasses and shrubs (Brooks and Minnich 2006). Degree of fire damage is largely dependent on the seasonality of the burn. Plants in dormancy or

during drought years may be adversely affected. Fire generally top-kills big galleta and resprouting occurs from the rhizomes (Matthews 2000). Fire damage to Indian ricegrass is variable, however, it readily reestablishes on burned sites through seed dispersed from adjacent unburned areas (Tirmenstein 1999). Severe fires generally kill mature white bursage and winterfat plants. White bursage will not sprout from the root crown, but has been observed to readily establish from seed several years post fire (Marshall 1994). Winterfat is able to re-sprout from the root crown following low intensity fires. More intense fires generally result in high mortality (Carey 1995).

Big galleta has coarse, rigid stems that make it relatively resistant to heavy grazing and trampling and is considered fair forage for cattle, horses and domestic sheep (Matthews 2000). Heavy grazing pressure can result in decreased abundance of big galleta. If heavy to moderate utilization occurs during time of increased water stress, growth and survival of this species may be significantly affected (Robberecht 1988).

Indian ricegrass is highly palatable to all classes of livestock and benefits from grazing use if it is moderately grazed in winter and early spring. Heavy early spring grazing may reduce the vigor of Indian ricegrass and decrease abundance (Tirmenstein 1999). White bursage is a moderately important forage species, but can experience increased grazing pressure during years of low precipitation when production of winter annuals is low (Marshall 1994). Extended periods of heavy grazing can be detrimental to white bursage plants (Pavlik 2008). Winterfat is an extremely important winter forage species. It is considered to be palatable throughout the year, but browsers prefer it during periods of active growth (Carey 1995). Although winterfat is fairly resistant to grazing disturbance, seasonality of the grazing pressure is very important.

Recreation impacts, such as trampling and OHV use can decrease the abundance and vigor of these native species, increase the nutrient availability, and provide pathways for propagule introduction (Webb et al. 2009). Loss of vegetative cover from natural or anthropogenic disturbances will result in establishment of non-native annual species (Sahara mustard, red brome, Mediterranean grass, red-stem filaree). The transition from natives to non-natives will result in increased erosion, increased susceptibility to fire and decreased habitat quality.

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**			841-1009	
	big galleta	PLRI3	*Pleuraphis rigida*	841-1009	–
2	**Secondary Perennial Grasses**			22-90	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	6-22	–
	threeawn	ARIST	*Aristida*	6-22	–
	low woollygrass	DAPU7	*Dasyochloa pulchella*	6-22	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	6-22	–
3	**Annual Grasses**			1-22	
Forb					
4	**Perennial forbs**			22-90	
5	**Annual forbs**			1-112	
Shrub/Vine					
6	**Primary shrubs**			90-224	
	burrobush	AMDU2	*Ambrosia dumosa*	22-56	–
	California croton	CRCA5	*Croton californicus*	22-56	–
	Palmer's crinklemat	TIPA	*Tiquilia palmeri*	22-56	–
	white ratany	KRGR	*Krameria grayi*	11-28	–
7	**Secondary shrubs**			22-112	
	catclaw acacia	ACGR	*Acacia greggii*	11-34	–
	button brittlebush	ENFR	*Encelia frutescens*	11-34	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	11-34	–
	beavertail pricklypear	OPBA2	*Opuntia basilaris*	11-34	–

Table 6. Community 2.1 plant community composition

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

Table 7. Community 2.2 plant community composition

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

Table 8. Community 2.3 plant community composition

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

Table 9. Community 2.4 plant community composition

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

Animal community

Livestock Interpretations: This site is suitable for livestock grazing. 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. White bursage is of intermediate forage value. It is fair to good forage for horses and fair to poor for cattle and sheep. However, because there is often little other forage where white bursage grows, it is often highly valuable to browsing animals and is sensitive to browsing. Range ratany is an important forage species for all classes of livestock. Palatability of range ratany is rated fair to good for cattle and sheep. White ratany is important forage for all classes of livestock. White ratany decreases in response to grazing. Under heavy grazing pressure white ratany produces phenolic acids to reduce herbivory by reducing the palatability. 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: White bursage is an important browse species for wildlife. Range ratany is an important forage species for deer. Mule deer browse range ratany year-long with seasonal peaks. Mule deer peak use is from February to April and from August to October. It is one of the most important browse species for mule deer and desert bighorn sheep. Black-tailed jack rabbits rely almost exclusively on white ratany during the winter.

Hydrological functions

Because of rapid intake and deep percolation of water, the loss of soil moisture due to evaporation is reduced and runoff is negligible.

Other products

White bursage is a host for sandfood, a parasitic plant. Sandfood was a valuable food supply for Native Americans. The Papago Indians used an infusion of range ratany twigs externally for treating sore eyes and internally for dysentery. The roots provided them with a red dye for wool and other materials. The dye was also used as an ink.

Other information

Big galleta's clumped growth form stabilizes blowing sand. White bursage may be used to revegetate disturbed sites in southwestern deserts.

Type locality

Location 1: Clark County, NV	
Township/Range/Section	T32S R66E S13
General legal description	About two miles south of Laughlin, on river terraces along west side of Colorado River, Clark County, Nevada.

Other references

Brooks M. L. and R.A Minnich. 2006. Southeastern deserts bioregion. In: Sugihara, N.G., van Wagtendonk, J.W., Shaffer, K.E., Fites-Kaufman, J.Thode, A.E. (Eds.). Fire in California's Ecosystems. The University of California Press, Berkeley, 576 pp.

Fire Effects Information System (Online; http://www.fs.fed.us/database/feis/plants/).

Hereford, R., R.H. Webb and C. I. Longpre. 2004. Precipitation history of the Mojave Desert region, 1893-2001 (No. 117-03).

Kottek, M., Grieser, J., Beck, C., Rudolf, B., & Rubel, F. (2006). World map of the Köppen-Geiger climate classification updated. Meteorologische Zeitschrift, 15(3), 259-263.

Lane, D.R., D.P. Coffin and W. K. Lauenroth. 1998. Effects of soil texture and precipitation on above-ground net primary productivity and vegetation structure across the Central Grassland region of the United States. J. of Vegetation Science. 9: 239-250.

Pavlik, B.M. 2008. The California Deserts: an ecological rediscovery. University of California Press.

Robberecht, R. 1988. Big galleta grass - a warm-season bunchgrass in the Sonoran and Mojave Deserts. Rangelands 10.2: 58-60.

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

USDA-NRCS Plants Database (Online; http://www.plants.usda.gov).

Contributors

BLS/GKB
Dustin Detweiler

Approval

Kendra Moseley, 3/10/2025

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)	GK BRACKLEY
Contact for lead author	STATE RANGE MANAGEMENT SPECIALIST
Date	09/16/2011
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills are rare. A few can be expected on steeper slopes in areas recently subjected to summer convection storms or rapid spring snowmelt.

2. **Presence of water flow patterns:** Water flow patterns none to rare.

3. **Number and height of erosional pedestals or terracettes:** Pedestals are rare with occurrence typically limited to areas affected by wind scouring.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare Ground to 80%; surface rock fragments absent; shrub canopy to 5%; basal area for perennial herbaceous plants ±15%.

5. **Number of gullies and erosion associated with gullies:** None

6. **Extent of wind scoured, blowouts and/or depositional areas:** A few wind-scoured spots may occur, but will be isolated and small in aerial extent

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 storms. Persistent litter (large woody material) will remain in place except during catastrophic 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 the sandy 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 single grain. Soil surface colors are light and are typified by an ochric epipedon. Organic matter of the surface 2 to 3 inches is typically 1 to 1.5 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:** Perennial herbaceous plants (especially deep-rooted bunchgrasses [i.e., Indian ricegrass] slow runoff and increase infiltration.

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

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: Deep-rooted, cool season, perennial bunchgrasses >> low-statured shrubs > perennial forbs = annual forbs

---

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 (±25%) have dead centers.**

---

14. **Average percent litter cover (%) and depth (in): Between plant interspaces (± 10%) and depth of litter is ±½ inch.**

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production): For normal or average growing season (February thru April) ± 1000lbs/ac; Late winter moisture significantly affects total 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: Red brome; filaree; Russian thistle;**

---

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