USDA Natural Resources Conservation Service

Ecological site R030XB116NV
SHALLOW PEDIMENT 3-5 P.Z.

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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

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 in the hills and mountains landscape below 3800 feet elevation with slopes greater than 15 percent slope. Soils are derived from clastic sedimentary parent material such as sandstone, mudstone and siltstone and are either gypsic, sodic, saline-sodic, saline or have a pH over 8.4. Between 2800 feet and 3800 feet this site is found on south facing aspects and below 2800 feet it is found on all aspects.

This is a group concept and provisional STM that also covers the following sites: R030XB126CA, R030XB152CA

Associated sites

R030XB001NV	**LIMY HILL 5-7 P.Z.**
R030XB017NV	**LIMY HILL 3-5 P.Z.**

Similar sites

R030XB079NV	**GYPSIC SLOPE 3-5 P.Z.** ATHY-SUMO codominant shrubs with wolfberry
R030XB038NV	**GRAVELLY PEDIMENT 3-5 P.Z.** AMDU2-ATHY codominant shrubs; more productive site
R030XB026NV	**GYPSIC LOAM 3-5 P.Z.** PSFR and PEPA13 codominant shrubs with ATHY
R030XY025NV	**SODIC FLAT** ATCO-ATHY codominant shrubs
R030XB113NV	**SANDSTONE HILL 3-5 P.Z.** More productive site; PLRI3 abundant
R030XA060NV	**GYPSIC LOAM 3-5 P.Z.** ATHY-SUAED codominant shrubs
R030XB126CA	**Saline Slope 3-5" P.Z.** Essentially the same ecological site.
R030XB152CA	**Saline Hill 3-5" P.Z.** Essentially the same ecological site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex hymenelytra*
Herbaceous	Not specified

Physiographic features

This site typically occurs on rock pediments and fan remnants. Slopes may range from 0 to over 50 percent (on short backslopes) but slope gradients of 8 to 30 percent are typical. Elevations are 1440 to about 3100 feet.

Table 2. Representative physiographic features

Landforms	(1) Fan remnant (2) Pediment

Elevation	439–945 m
Slope	0–50%
Aspect	Aspect is not a significant factor

Climatic features

The climate of the Mojave Desert has extreme fluctuations of daily temperatures, strong seasonal winds, and clear skies. The climate is arid and is characterized with cool, moist winters and hot, dry summers. Most of the rainfall falls between November and April. Summer convection storms from July to September may contribute up to 25 percent of the annual precipitation. Average annual precipitation is 3 to 5 inches. Mean annual air temperature is 64 to 73 degrees F. The average growing season is about 240 to 340 days.

Table 3. Representative climatic features

Frost-free period (average)	340 days
Freeze-free period (average)	
Precipitation total (average)	127 mm

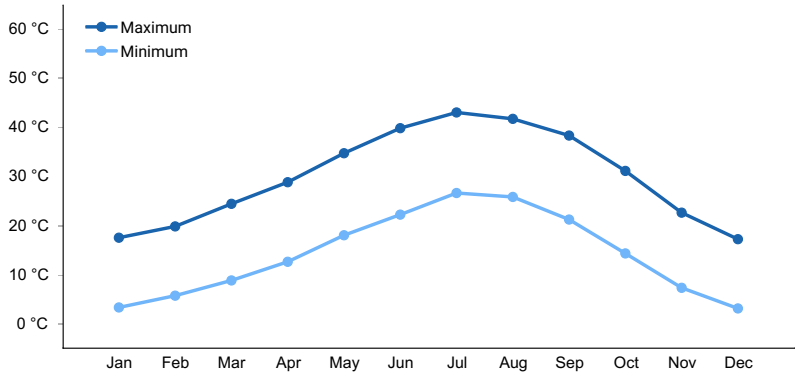


Figure 1. Monthly average minimum and maximum temperature

Influencing water features

There are no influencing water features associated with this site.

Soil features

The soils associated with this site are very shallow to moderately deep and well drained. They are formed in residuum and colluvium derived from mudstone, or gypsiferous sandstone and siltstone. Reaction is moderately to strongly alkaline. The soils have a typic-aridic moisture regime and a thermic or hyperthermic temperature regime. Available water capacity is very low. Runoff is high to very high, permeability is slow to moderately rapid. Calville has a gypsic horizon from 2 to 25 inches. Soil series correlated to this site include Callville and Calwash.

Table 4. Representative soil features

Parent material	(1) Residuum–sandstone and siltstone (2) Colluvium–mudstone
Surface texture	(1) Very gravelly sandy loam (2) Fine sandy loam (3) Gravelly loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Slow to moderately rapid

Soil depth	15–152 cm
Surface fragment cover <=3"	5–55%
Surface fragment cover >3"	0–73%
Available water capacity (0-101.6cm)	2.79–7.11 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–5
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	4–40%
Subsurface fragment volume >3" (Depth not specified)	0–45%

Ecological dynamics

Desert holly is a long-lived evergreen desert shrub. This species is especially well adapted to the Mojave Desert environment. It has demonstrated some remarkable examples of drought resistance by surviving more than a week at -6Megapascals of water potential in the rooting zone. This phenomenon is aided by root association with endomycorrhizae (Cibils et al. 1998). Desert holly is most photosynethically active during the winter months, at this time leaves are displayed horizontally to ensure optimal C4 photosynthesis. During the summer months, the leaves are highly reflective and angled, which effectively lowers leaf temperature and transpiration (Mooney et al. 1977). A thick coating of white, salt-filled epidermal hairs also decrease the effects of the intense sun (Pavlik 2008). Salt accumulations on the surface of leaves can also act as an herbivore deterrent (Cibils et al. 1998). These special leaf characteristics allow desert holly to remain evergreen in an extremely hot and dry environment.

White bursage is a drought-deciduous, rhizomatous shrub with stiff branches forming dense crown (Marshall 1994). White bursage is a pioneering species due to its ability to reproduce vegetatively and sexually (Marshall 1994).

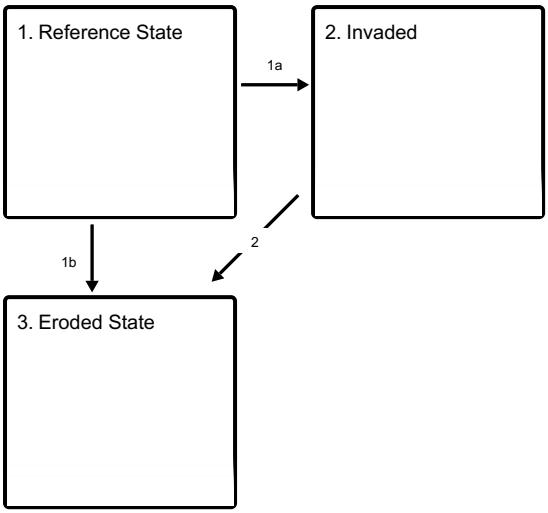
As ecological condition declines perennial grasses that may occur on this site are most often found in micro-topographical positions that receive extra moisture as run-in from adjacent landscapes. Invaders on this site include red brome and Mediterranean grass.

Disturbances associated with these sites consist of anthropogenic impacts. Historically, these sites would have rarely, if ever, experienced fires due to the sparse vegetative cover. Anthropogenic disturbances may cause soil compaction and disrupt the soil surface which decreases infiltration and overall stability of the soil. Reproduction and vigor of native plants suffer under these conditions. Rills are common, indicating water erosion is an important process. Biological soil crusts account for a significant portion of the ground cover. Once these crusts are disturbed, recovery is a slow process and may take decades for the crusts to recover to their pre-disturbance thickness (USGS 2006). Long-term degradation will lead to loss of site integrity.

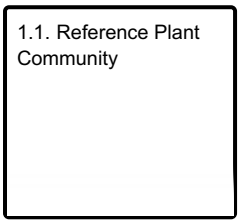
Presettlement fire regimes in Mojave Desert shrub communities are characterized by relatively infrequent, stand-replacement fires with return intervals in the range of 35 years to several centuries. Mojave Desert communities are usually unaffected by fire because of low fuel loads, although a year of 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 generally reproduces by seed and is not known to have special fire adaptations. However, it is well adapted to harsh environments and will reestablish quickly provided there is a nearby seed source. White bursage commonly facilitates colonization of other species by acting as a nurse plant providing improved microhabitat and protection from herbivory (Marshall 1994). Little is known about desert holly’s response to disturbances. However, other Atriplex species show decreased abundance, even decades after surface disturbances (Webb et al. 2009).

State and transition model

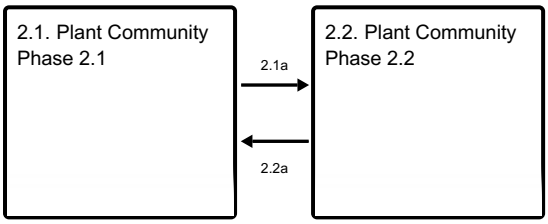
Ecosystem states



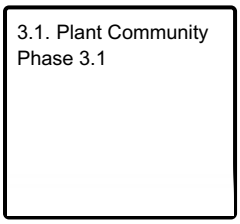
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Reference State

This state represents the natural range of variability under pristine conditions and is dominated by drought tolerant native shrubs. Primary natural disturbance mechanisms affecting this ecological site are long-term drought and insect attack. Historically, wildfire was infrequent and patchy due to low fuel loading, resulting in long-lived stable plant communities. Timing of disturbance combined with weather events determines plant community dynamics.

Community 1.1
Reference Plant Community

The reference plant community is characterized by widely spaced shrubs with a trace of bunchgrasses and perennial forbs. Dominant species include desert holly and white bursage. Torrey’s ephedra and range ratany are other important species associated with this site. Microbiotic soil crusts are common. Potential vegetative composition is about 5% perennial grasses and forbs and 95% shrubs. Approximate ground cover (basal and

crown) is less than 5 percent (~3%).

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	26	80	160
Grass/Grasslike	1	2	4
Forb	1	2	3
Total	**28**	**84**	**167**

State 2
Invaded

The Invaded State is characterized by the presence of non-natives in the understory. A biotic threshold has been crossed, with the introduction of non-natives that cannot be removed from the system. The presence of non-natives has reduced the ecological resilience of the site. Following a disturbance this state relies on the availability of an offsite seed source. These non-natives have the potential to significantly alter disturbance regimes from their historic range or variability. This invasion of non-natives is attributed to a combination of factors including: 1) surface disturbances, 2) changes in the kinds of animals and their grazing patterns, 3) drought, and 4) changes in fire history. These non-natives annuals are highly flammable and promote wildfires where fires historically have been infrequent.

Community 2.1
Plant Community Phase 2.1

The plant community is similar to the Reference Plant Community with a trace of non-natives in the understory. At this time the ecological processes on this site have not changed, although ecological resilience is compromised by the presence of non-natives.Dominant shrubs persist after invasion by non-native annuals, but the other shrubs and desirable grasses may be unsuccessful in competing with the non-natives.

Community 2.2
Plant Community Phase 2.2

The plant community is characterized by loss of vegetation and soil crust. Relatively steep slopes and very high surface runoff make this site susceptible to erosion. Presence of rills and gullies has increased. This plant community is identified as “at risk”. If disturbances are not controlled, site integrity will be lost and an irreversible threshold will be crossed.

Pathway 2.1a
Community 2.1 to 2.2

Continued disturbance reduces cover of native shrubs and microbiotic soil crust.

Pathway 2.2a
Community 2.2 to 2.1

Removing disturbances allows microbiotic soil crust to recover and native species to regenerate from seed.

State 3
Eroded State

The Eroded State is characterized by severely decreased soil stabilization and increased rills and gullies. A biotic threshold has been crossed, with the loss of long-lived native vegetation and microbiotic soil crust leading to active soil erosion. This state is characterized by a new ecological equilibrium, one that includes reduced nutrient cycling and infiltration.

Community 3.1
Plant Community Phase 3.1

This plant community is characterized by active erosion. Heavy and continued disturbance has removed vegetation and microbiotic soil crust. Bare ground is dominant.

Transition 1a
State 1 to 2

Introduction of non-native species through anthropogenic disturbances, including OHV use, dry land farming, grazing, linear corridors, mining, military training operations, and settlements.

Transition 1b
State 1 to 3

Anthropogenic disturbance removes vegetation and soil crust leading to increased erosion.

Transition 2
State 2 to 3

Continued disturbance removes existing vegetation and remaining soil crust, leading to severe erosion.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Perennial grasses**			1–7	
	purple threeawn	ARPU9	*Aristida purpurea*	0–2	–
	big galleta	PLRI3	*Pleuraphis rigida*	0–2	–
2	**Annual grasses**			1–2	
Forb					
3	**Perennial forbs**			1–7	
	featherplume	DAFO	*Dalea formosa*	0–2	–
	desert globemallow	SPAM2	*Sphaeralcea ambigua*	0–2	–
4	**Annual forbs**			1–4	
	desert trumpet	ERIN4	*Eriogonum inflatum*	0–2	–
Shrub/Vine					
5	**Primary shrubs**			67–80	
	desertholly	ATHY	*Atriplex hymenelytra*	67–80	–
6	**Secondary shrubs**			1–17	
	burrobush	AMDU2	*Ambrosia dumosa*	1–7	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	1–7	–
	creosote bush	LATR2	*Larrea tridentata*	1–7	–
	Mojave woodyaster	XYTO2	*Xylorhiza tortifolia*	1–7	–

Animal community

Livestock Interpretations:
This site has limited value for livestock grazing, due to the very low forage production and steep slopes.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. Torrey's ephedra is important winter forage for cattle and sheep. Torrey's ephedra is moderately palatable to all domestic livestock especially as winter browse. Many animals bed in or under creosotebush. Domestic sheep dig shallow beds under creosotebush becauseit provides the only shade in the desert scrub community. Creosotebush is unpalatable to livestock. Consumption of creosotebush may be fatal to sheep.

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.

Hydrological functions

Runoff is high to very high. Permeability is slow to moderately rapid. Hydrologic soil groups are C and D.

Type locality

Location 1: Clark County, NV	
Location 2: Clark County, NV	
Township/Range/Section	T17S R67 S26
UTM zone	N
UTM northing	4034040
UTM easting	727088
Latitude	36° 25′ 36″
Longitude	114° 28′ 1″
General legal description	Approximately 0.4 miles west of Elephant Rock along Nevada State Route 169 in the Valley of Fire State Park. Clark Co., Nevada.

Other references

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

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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.

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

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Contributors

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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)	P Novak-Echenique
Contact for lead author	State Rangland Management Specialist
Date	07/15/2010
Approved by	Sarah Quistberg
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills are none to rare. Rock fragments armor the soil surface.

2. **Presence of water flow patterns:** Water flow patterns none to rare. Waterflow patterns only expected on steeper slopes in areas recently subjected to summer convection storms.

3. **Number and height of erosional pedestals or terracettes:** Pedestals are none to rare.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare Ground to 10-20%.

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

6. **Extent of wind scoured, blowouts and/or depositional areas:** None

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 large rainfall 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 3. (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 moderate medium to thick platy. Soil surface colors are light and soils are typified by an ochric epipedon. Organic matter of the surface 2 to 3 inches is typically less than 1 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:** Sparse shrub canopy and associated litter provide some protection from raindrop impact.

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: salt-desert shrubs

    Sub-dominant: associated shrubs > deep-rooted, warm season, perennial bunchgrasses = perennial forbs > annual forbs > annual grasses

    Other:

    Additional:

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 (<20%) have dead centers.

14. **Average percent litter cover (%) and depth (in):** Between plant interspaces (<5%) and depth of litter is <¼ inch.

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** For normal or average growing season ±75 lbs/ac. Favorable production 150 lb/ac and unfavorable years =25 lb/ac.

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:** Invaders on this site include Mediterranean grass, red brome, mustards, and redstem filaree.

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