USDA Natural Resources
Conservation Service

Ecological site R030XB038NV
GRAVELLY 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 site is found on erosional fan remnants below 3100 feet elevation on alluvium derived from limestone or other sedimentary parent material. Slopes are less than 15 percent slope and have less than 15 percent cover of rock fragment over 3 inches diameter.

This is a group concept and provisional STM which also covers R030XB124CA, R030XB122CA.

Associated sites

R030XB005NV	**Arid Active Alluvial Fans**
R030XB019NV	**Eroded Fan Remnant Pavette 4-6 P.Z.**

Similar sites

R030XB003NV	**GYPSIC LOAM 5-7 P.Z.** ATHY absent; LEFR2 important shrub
R030XB116NV	**SHALLOW PEDIMENT 3-5 P.Z.** AMDU2 minor shrub; less productive site
R030XA060NV	**GYPSIC LOAM 3-5 P.Z.** SUAED and LYCIU codominant shrubs
R030XB113NV	**SANDSTONE HILL 3-5 P.Z.** PLRI3 major species; more productive site
R030XB079NV	**GYPSIC SLOPE 3-5 P.Z.** PSFR and PEPA13 codominant shrubs
R030XB005NV	**Arid Active Alluvial Fans** ATHY absent
R030XB019NV	**Eroded Fan Remnant Pavette 4-6 P.Z.** ATHY absent to rare
R030XB026NV	**GYPSIC LOAM 3-5 P.Z.** PSFR and PEPA13 codominant shrubs; less productive site
R030XB124CA	**Gravelly Loam 3-5" P.Z.** Conceptually the same ecological site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex hymenelytra* (2) *Ambrosia dumosa*
Herbaceous	Not specified

Physiographic features

This site occurs on pediments, fan remnants, and hills on all exposures. Slopes range from 2 to 50 percent, but slope gradients of 2 to 15 percent are most typical. Elevations are 1000 to 3000 feet.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Fan remnant (3) Pediment
Elevation	305–914 m
Slope	2–50%
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 56 to 63 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)	127 mm

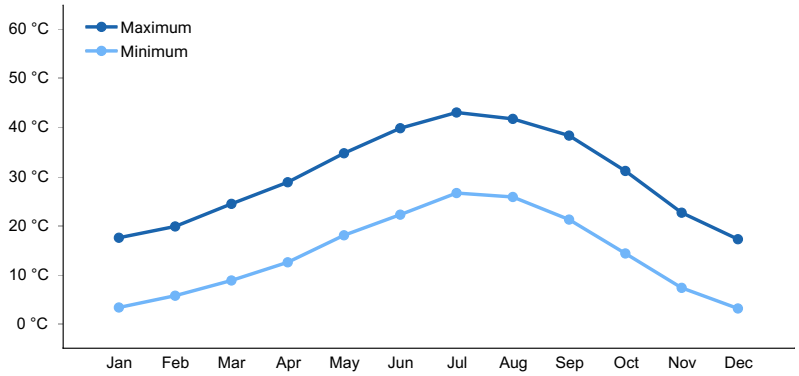


Figure 1. Monthly average minimum and maximum temperature

Influencing water features

There are no influencing water features associated with this site.

Soil features

The soils associated with this site are typically moderately deep to deep that are formed in gravelly pedisediment derived dominanty from limestone. The soils are well drained, permeability is moderately slow to moderately rapid, and runoff is medium to very high. The soil series associated with this site include: Baseline, Callville, Calwash, St. Thomas, and Upperline.

Table 4. Representative soil features

Parent material	(1) Colluvium–limestone
Surface texture	(1) Extremely gravelly fine sandy loam (2) Gravelly sandy loam (3) Extremely gravelly loam
Family particle size	(1) Loamy
Drainage class	Well drained

Permeability class	Moderately slow to moderately rapid
Soil depth	10–150 cm
Surface fragment cover <=3"	45–80%
Surface fragment cover >3"	1–73%
Available water capacity (0-101.6cm)	1.52–6.86 cm
Calcium carbonate equivalent (0-101.6cm)	0–60%
Electrical conductivity (0-101.6cm)	0–8 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–10
Soil reaction (1:1 water) (0-101.6cm)	7.4–9
Subsurface fragment volume <=3" (Depth not specified)	16–69%
Subsurface fragment volume >3" (Depth not specified)	1–45%

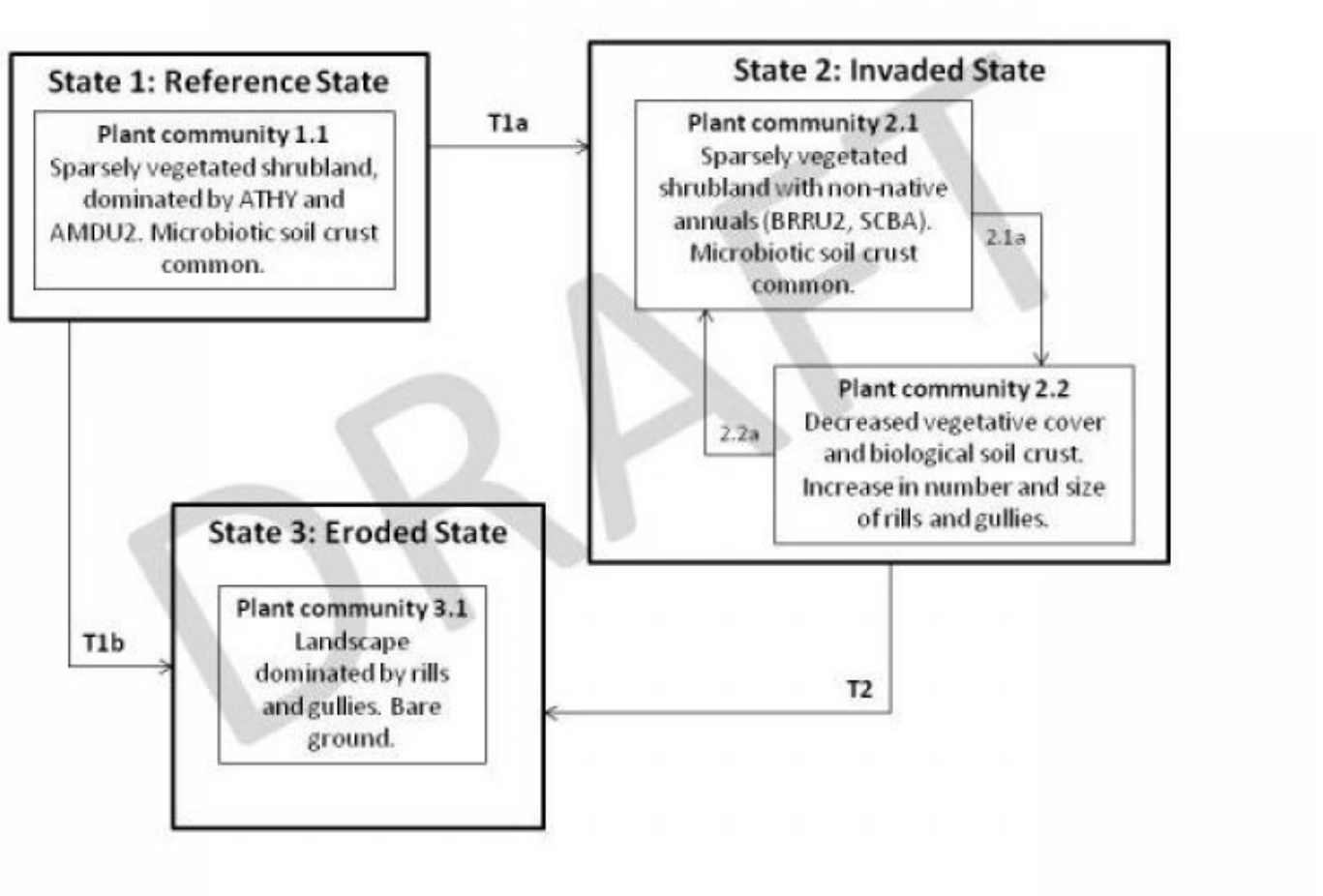
Ecological dynamics

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.

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.

Historically, this site would have rarely, if ever, experienced fire due to the sparse vegetative cover. Native annual plants usually break down rapidly during the summer and do not create a long-lived fuelbed. Fine fuels from non-native annual grasses currently represent the most important fuelbed component. Fire generally kills white bursage. Range ratany is top-killed by fire. Range ratany resprouts from the root crown after fire. Torrey’s ephedra has medium fire tolerance and is similar to Nevada ephedra. Fire kills many creosotebush. Creosotebush is poorly adapted to fire because of its limited sprouting ability. Creosotebush survives some fires that burn patchily or are of low severity.

State and transition model



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 dominated by desert holly and white bursage. Torreys ephedra and range ratany are other important species associated with this site. Annuals are common in wet years. Potential vegetative composition is about 5% grasses, 5% forbs and 90% shrubs. Approximate ground cover (basal and crown) is less than 15 percent (~10%).

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	101	228	353
Grass/Grasslike	6	12	20
Forb	6	12	19
Total	**113**	**252**	**392**

State 2
Invaded

Introduced annuals such as red brome, schismus and redstem stork's bill have invaded the reference plant community and have become a dominant component of the herbaceous cover. 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. ATHY and AMDU would persist after invasion by non-native annuals, but other species may be unsuccessful in competing with the non-natives and could be removed from the system.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.

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.

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**			1–20	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	1–6	–
	desert needlegrass	ACSP12	*Achnatherum speciosum*	1–6	–
	threeawn	ARIST	*Aristida*	1–6	–
	big galleta	PLRI3	*Pleuraphis rigida*	1–6	–
2	**Annual Grasses**			1–12	
Forb					
3	**Perennial Forbs**			1–20	
	globemallow	SPHAE	*Sphaeralcea*	1–6	–
4	**Annual Forbs**			1–12	
Shrub/Vine					
5	**Primary Shrubs**			161–280	
	desertholly	ATHY	*Atriplex hymenelytra*	123–177	–
	burrobush	AMDU2	*Ambrosia dumosa*	25–50	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	4–20	–
	creosote bush	LATR2	*Larrea tridentata*	4–12	–
6	**Secondary Shrubs**			12–38	
	burrobrush	HYSA	*Hymenoclea salsola*	2–8	–
	desert pepperweed	LEFR2	*Lepidium fremontii*	2–8	–
	desert-thorn	LYCIU	*Lycium*	2–8	–
	pricklypear	OPUNT	*Opuntia*	2–8	–
	Fremont's dalea	PSFR	*Psorothamnus fremontii*	2–8	–
	Mojave woodyaster	XYTO2	*Xylorhiza tortifolia*	2–8	–

Animal community

Livestock Interpretations:
This site has limited value for livestock grazing, due to the low forage production. Grazing management should be keyed to palatable shrub production. White bursage is an important browse species. Browsing pressure on white bursage is particularly heavy during years of low precipitation, when production of winter annuals is low. 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. 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 because it 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.

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. Torrey's ephedra is an important browse species for big game. Torrey's ephedra is moderately palatable to many big game species, especially as winter browse. Many small mammals browse creosotebush or consume its seeds. Desert reptiles and amphibians use creosotebush as a food source and perch site and hibernate or estivate in burrows under creosotebush, avoiding predators and excessive daytime temperatures.

Hydrological functions

Runoff is medium to very high. Permeability is moderately slow to moderately rapid.

Other products

White bursage is a host for sandfood, a parasitic plant with a sweet, succulent, subterranean flowerstalk. Sandfood was a valuable food supply for desert peoples. Creosotebush has been highly valued for its medicinal properties by desert peoples. It has been used to treat at least 14 illnesses. Twigs and leaves may be boiled as tea, steamed, pounded into a powder, pressed into a poultice, or heated into an infusion.

Other information

White bursage may be used to revegetate disturbed sites in southwestern deserts. Creosotebush may be used to rehabilitate disturbed environments in southwestern deserts. Once established, creosotebush may improve sites for annuals that grow under its canopy by trapping fine soil, organic matter, and symbiont propagules. It may also increase water infiltration and storage.

Type locality

Location 1: Clark County, NV	
Township/Range/Section	T20S R66E S23
UTM zone	N
UTM northing	4008954
UTM easting	716977
Latitude	36° 12′ 4″
Longitude	114° 35′ 11″
General legal description	Lake Mead National Recreation Area about 3.5 miles north of Coyote Cove in Pinto Valley, Clark County, Nevada.

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Contributors

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Approval

Kendra Moseley, 3/11/2025

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	04/19/2010
Approved by	Kendra Moseley
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.

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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:** Gullies are none to rare.

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 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. (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 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 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 and big galleta] slow runoff and increase infiltration. Shrub canopy and associated litter break 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: Reference Plant Community: Mojave desert shrubs

    Sub-dominant: deep-rooted, warm season, perennial bunchgrasses > deep-rooted, cool 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 ±225 lbs/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, and filaree.

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