USDA Natural Resources
Conservation Service

Ecological site R030XB115NV
GYPSIC SODIC LOAM 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.

Ecological site concept

This site occurs on shoulders and backslopes of eroded pediments hills, and fan remnants. Slopes may range from 2 to 30 percent (on short backslopes) but slope gradients of 2 to 8 percent are typical. Elevations are 1450 to about 2400 feet. The soil associated with this site are shallow to very shallow and somewhat excessively drained. The soils formed in residuum derived from gypsiferous sedimentary rocks.

This is a group concept and provisional STM that also covers the following ecological sites: R030XB109NV and R030XB117NV.

Similar sites

R030XY013NV	**SHALLOW SILTY** ATCO dominant plant on site
R030XB131NV	**CALCAREOUS PEDIMENT 3-5 P.Z.** ATCO-AMDU2 codominant shrubs; soils not significantly affected by gypsum
R030XB006NV	**LOAMY 5-7 P.Z.** ATCO-AMDU2 codominant
R030XY025NV	**SODIC FLAT** ATCO-ATHY codominant shrubs
R030XY040NV	**SODIC TERRACE** ATCO-LYCIU codominant; ATPO and ATCA2 important shrubs
R030XB114NV	**SODIC LOAM 3-5 P.Z.** ATCO-SUMO codominant shrubs

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex confertifolia* (2) *Petalonyx parryi*
Herbaceous	(1) *Enceliopsis argophylla*

Physiographic features

This site occurs on shoulders and backslopes of eroded pediments hills, and fan remnants. Slopes may range from 2 to 30 percent (on short backslopes) but slope gradients of 2 to 8 percent are typical. Elevations are 1450 to about 2400 feet.

Table 2. Representative physiographic features

Landforms	(1) Pediment (2) Hill (3) Fan remnant
Elevation	1,450–2,400 ft
Slope	2–30%

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 70 to 75 degrees F. The average growing season is about 300 to 360 days.

Table 3. Representative climatic features

Frost-free period (average)	360 days
Freeze-free period (average)	
Precipitation total (average)	5 in

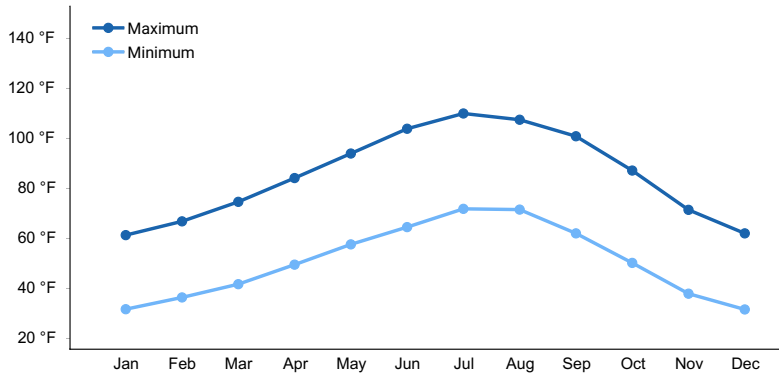


Figure 1. Monthly average minimum and maximum temperature

Influencing water features

There are no influencing water features associated with this site.

Soil features

The soil associated with this site are shallow to very shallow and somewhat excessively drained. The soils formed in residuum derived from gypsiferous sedimentary rocks. Soil series associated with this site include Drygyp and Guardian. Drygyp has a petrogypsic horizon 7 to 65 inches. Guardian has a gypsic horizon from 2 to 19 inches.

Table 4. Representative soil features

Parent material	(1) Residuum–rock gypsum
Surface texture	(1) Gypsiferous fine sandy loam (2) Gypsiferous sandy loam
Family particle size	(1) Loamy
Drainage class	Somewhat excessively drained
Permeability class	Very slow to moderately rapid
Soil depth	4–20 in
Surface fragment cover <=3"	0–5%

Surface fragment cover >3"	0%
Available water capacity (0-40in)	1–2.6 in
Calcium carbonate equivalent (0-40in)	0–10%
Electrical conductivity (0-40in)	0–4 mmhos/cm
Sodium adsorption ratio (0-40in)	0–2
Soil reaction (1:1 water) (0-40in)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	3–6%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

Although shadscale is typically the dominant plant on this site, Parry sandpaper plant and Fremont dalea are also important shrubs. Silverleaf sunray is abundant. California bearpoppy may be present but it is relatively uncommon.

Gypsic soils are generally weakly aggregated which can result in serious erosion. The severity of the erosion is dependent on the gypsum content (FAO 1990). Gypsiferous soils are generally structureless, low in organic matter, and may become unstable in water making them a poor medium for plant growth. Gypsic horizons, however, can also be strongly aggregated and form hard crusts that control erosion and sometimes impede the downward movement of water and extension of roots (FAO 1990). The continuous petrogypsic horizon plays a significant role in plant community dynamics by increasing the available water holding capacity of the soil. These soils are high in sodium and have approximately 50% ground cover of microbiotic crusts.

Gypsic crusts formed from sulfate minerals are common across this ecological site. Crusts form in the soils due to the lack of sufficient water to remove soluble salts (Dong et al. 2007). Microtopography created by crusts can form microcatchments for water, positively influencing soil moisture, causing suspended sediment to settle out, as well as, reinforcing the formation of soil crusts. Interactions between microboitic crusts and vascular plants are complex. They can be mutualistic, competitive, or neutral (Williams 1994). Soil crusts can encourage seedling establishment and survival, due to increased water holding capacity and availability of macronutrients (Belnap 1995). Crusts can also act as a competitor. Seeds may require morphological adaptations in order to penetrate and establish in well developed microbiotic crusts (Williams 1994). This relationship will help keep non-natives out of the system, under undisturbed conditions, while native plants will thrive because they have evolutionary adaptations to persist in this environment.

Development of microbiotic crusts are successful increasers of soil stability because they are an accretionary phenomenon in an otherwise erosional setting (Williams 1994). Litter and microbiotic crusts increase infiltration and protect the soil surface from wind and water erosion (Belnap 1995). The micro-environment created by microbiotic crusts facilitate an increase in macronutrients and is associated with increased plant vigor and productivity (Williams 1994). Microbiotic crusts are also important for facilitating symbiotic plant-fungi-soil interactions, including the fixation of carbon and nitrogen.

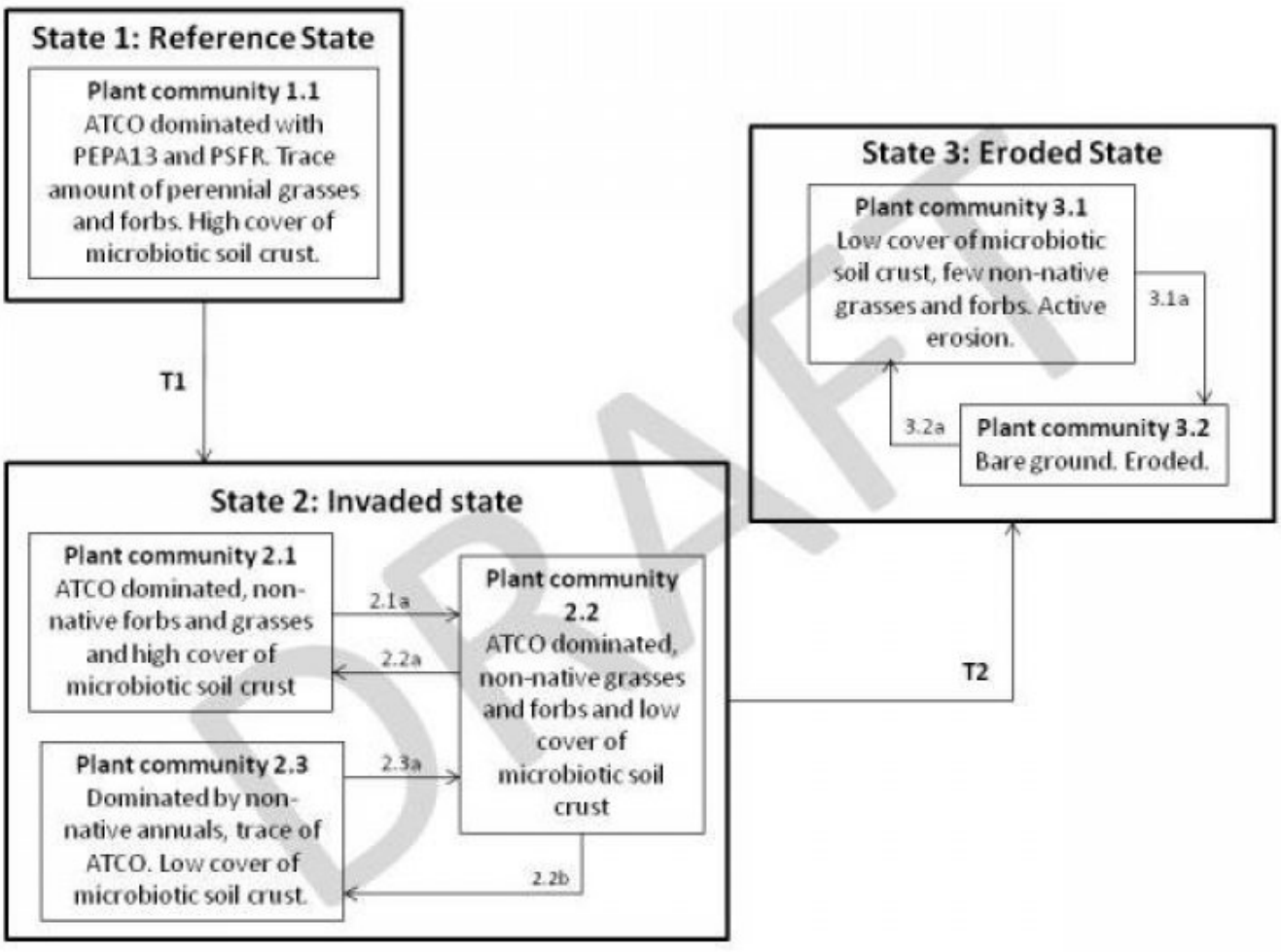
Anthropogenic impacts including OHV’s are the primary disturbance impacting the vegetation on this site. Microbiotic soil crusts are well adapted to growing in severely limited environments, but are poorly adapted to compressional disturbances such as recreational activities including biking and hiking (USGS 2006). Recreational activities disturb the soil and break up microbiotic surfaces leading to increased wind and water erosion, decreased infiltration, soil stability, nutrient availability and changes in the plant community composition. In addition to damaging the microbiotic soil crust, increased anthropogenic disturbance results in soil compaction. Soil compaction reduces soil aggregates and pore spaces which are important for soil stability and infiltration (Belnap 1995). Vigor and reproduction of native plants, including shadscale, will suffer under these conditions. Anthropogenic disturbances are vectors or propagule introduction of non-native species. Potential invasive species

on this site include redstem stork's bill, African mustard and red brome.

Recreational impacts can be particularly devastating to these sites due to the presence of sensitive plant species like the Las Vegas bearpoppy and the silverleaf sunray. Recent surveys of the Las Vegas bearpoppy, have reported approximately 120 populations growing in the Mojave Desert region. It has been previously suggested that this species is restricted to soils with high gypsum content (Mistretta et al. 1996). However, the Las Vegas bearpoppy is not a true gypsophile, but actually a gypsovage (a species that can occur on soil with or without gypsum) (Drohan and Merkler 2009). Distribution of this rare plant is more likely constrained by aridity and available soil moisture. The Las Vegas bearpoppy is commonly found on sites susceptible to erosion with high risk of runoff and low aggregate stability, these factors combined with soil chemistry results suggest that this species is highly adapted to survive in extremely limiting environments less tolerable to other species (Drohan and Merkler 2009). Approximately 27 percent of the known populations are experiencing significant impacts due to recreational activities. The Las Vegas bearpoppy is able to colonize disturbed sites. However, recruitment of this species may be episodic controlled by timing of precipitation events. Colonization and emergence of new individuals is likely explained by multiple factors related to soil moisture (Drohan and Merkler 2009). Silverleaf sunray is also commonly found growing on gypsiferious soils. Management decisions must be carefully considered in order to protect sensitive species that are uniquely adapted to gypsic soil conditions.

The mean fire return interval for shadscale communities ranges from 35 to 100 years. Shadscale 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. Increased presence of non-native annual grasses, such as cheatgrass, can alter fire regimes in shadscale communities by increasing fire frequency under wet to near-normal summer moisture conditions. When fire does occur, the effect on the ecosystem may be extreme. Shadscale is fire intolerant and it does not readily recover from fire, except for establishment through seed.

State and transition model



State 1
Reference State

This state represents the natural range of variability under pristine conditions. The plant communities of this site are dynamic in response to changes in disturbance regimes and weather patterns. Primary natural disturbance mechanisms affecting this ecological site are long-term drought and insect attack. Historically wildfire was infrequent and patchy and had a minimal impact due to low fuel loading. The extended fire return interval resulted in long-lived stable shadscale dominated plant communities. The state is sparsely vegetated and soil stability is primarily provided by microbiotic soil crust.

Community 1.1
Reference Plant Community

The reference plant community is dominated by shadscale. Parry sandpaper plant, Fremont dalea and silverleaf sunray are other important plant species in this community. Potential vegetative composition is about 15% forbs, 80% shrubs and up to 5% grasses. Approximate ground cover (basal and crown) is less than 10 percent (˜6%).

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	80	160	280
Forb	15	30	52
Grass/Grasslike	5	10	18
Total	**100**	**200**	**350**

State 2
Invaded

The Invaded State is characterized by the presence of non-native species in the understory. Ecological function has not changed at this time, however, the resiliency of the state has been reduced. A biotic threshold has been crossed with the introduction of non-native species that cannot be removed from the system and have the potential to alter disturbance regimes significantly from their historic range of variability. 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.

Community 2.1
Plant Community Phase 2.1

This plant community is similar to the Reference Plant Community with a trace of non-natives in the understory. Ecological function is reduced by the presence of non-native species. ATCO and SUMO persist after invasion by non-native annuals, but other shrubs and desirable grasses may be unsuccessful in competing with non-natives.

Community 2.2
Plant Community Phase 2.2

This plant community is characterized by a reduction of microbiotic soil crust. Disturbances resulting in soil trampling, remove microbiotic soil crust, decrease soil stability and reduce ecological resilience. Non-native species are common in the plant community.

Community 2.3
Plant Community Phase 2.3

This plant community is characterized by the loss of deep-rooted perennial vegetation. The soil surface is

continually disturbed decreasing the cover of microbiotic crust and increasing the potential for severe erosion. Non-native annuals take advantage of the increased availability of resources. This plant community is identified as “at risk”. The loss of microbiotic soil crust and vegetative cover has reduced the ecological resistance and resilience. Management of this plant community should focus on eliminating surface disturbances and protecting remaining native vegetation.

Pathway 2.1a
Community 2.1 to 2.2

Further anthropogenic disturbance removes shrubs and microbiotic soil crust reducing soil stability.

Pathway 2.2a
Community 2.2 to 2.1

Management decisions that decrease disturbance over the long term allow microbiotic crust to recover.

Pathway 2.2b
Community 2.2 to 2.3

Continued disturbance removes shadscale and other shrubby vegetation. Non-native annuals increase and microbiotic crusts are unable to recover.

Pathway 2.3a
Community 2.3 to 2.2

Removing anthropogenic disturbance allows shrubby vegetation to reestablish on the site.

State 3
Eroded State

The Eroded State is characterized by reduced soil stabilization due to loss of vegetative cover and microbiotic soil crust. A biotic threshold has been crossed, with the loss of 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 dominated by non-native annuals. Soil stability is severely reduced and active erosion easily occurs, even during typical rainfall events.

Community 3.2
Plant Community Phase 3.2

This plant community is characterized by a total loss of vegetation and soil crust. Gullies and rills are common to severe. Ecological processes such as, infiltration and nutrient cycling have been greatly altered.

Pathway 3.1a
Community 3.1 to 3.2

Continued disturbance or large rainfall events increase the amount of erosion.

Pathway 3.2a
Community 3.2 to 3.1

Non-native annuals germinate and establish even on a severely eroded site.

Transition 1
State 1 to 2

Introduction of non-natives due to anthropogenic impacts, including OHV use, dry land farming, grazing, linear corridors, mining, military training operations and settlements.

Transition 2
State 2 to 3

Repeated disturbance further decreases microbiotic soil crust and vegetative cover.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Perennial grasses**			1–10	
Forb					
2	**Primary Perennial forbs**			4–30	
	silverleaf sunray	ENAR	*Enceliopsis argophylla*	4–30	–
3	**Secondary Perennial forbs**			1–16	
	California bearpoppy	ARCA4	*Arctomecon californica*	1–6	–
	Palmer's phacelia	PHPA13	*Phacelia palmeri*	1–6	–
	desert globemallow	SPAM2	*Sphaeralcea ambigua*	1–6	–
4	**Annual forbs**			1–10	
Shrub/Vine					
5	**Primary shrubs**			110–180	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	70–100	–
	Parry's sandpaper plant	PEPA13	*Petalonyx parryi*	20–40	–
	Fremont's dalea	PSFR	*Psorothamnus fremontii*	20–40	–
6	**Secondary shrubs**			1–20	
	catclaw acacia	ACGR	*Acacia greggii*	2–6	–
	burrobush	AMDU2	*Ambrosia dumosa*	2–6	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	2–6	–
	ratany	KRAME	*Krameria*	2–6	–
	creosote bush	LATR2	*Larrea tridentata*	2–6	–
	desert pepperweed	LEFR2	*Lepidium fremontii*	2–6	–
	water jacket	LYAN	*Lycium andersonii*	2–6	–
	Schott's pygmycedar	PESC4	*Peucephyllum schottii*	2–6	–
	Mojave seablite	SUMO	*Suaeda moquinii*	2–6	–

Animal community

Livestock Interpretations:
This site has limited value for livestock grazing, due to the low forage production and steep slopes. Shadscale tends to be browse tolerant. Heavy grazing during the winter and/or spring reduces shadscale. Die-off can also occur during extended periods of high precipitation. Shadscale is tolerant of early spring light-intensity browsing.

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:
Shadscale is a valuable browse species, providing a source of palatable, nutritious forage for a wide variety of wildlife particularly during spring and summer before the hardening of spiny twigs. It supplies browse, seed, and cover for birds, small mammals, rabbits, deer, and pronghorn antelope.

Hydrological functions

Runoff is medium to very high. Permeability is moderately rapid. Hydrologic soil group D.

Recreational uses

Aesthetic value is derived from the diverse floral and faunal composition and the colorful flowering of wild flowers and shrubs during the spring and early summer. This site offers rewarding opportunities to photographers and for nature study. This site is used for hiking and has potential for upland and big game hunting.

Other products

Seeds of shadscale were used by Native Americans for bread and mush.

Type locality

Location 1: Clark County, NV	
Township/Range/Section	T20S R67E S14
General legal description	Lake Mead National Recreation Area, Clark County, Nevada. Approximately one mile west of Miner's Cove along the west side of the Overton Arm of Lake Mead.

Other references

Belnap, J. 1995. Surface Disturbances: Their role in accelerating desertification. Environmental Monitoring and Assessment. 37: 39-57.

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

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

Williams, J.D. 1994. Microbiotic Crusts: A Review (Final Draft). [Online] http://www.icbemp.gov/science/williams.pdf

Contributors

CJT/GKB

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 Rangeland Management Specalist
Date	07/14/2010
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, but may be evident in areas recently subjected to summer convection storms.

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2. **Presence of water flow patterns:** Waterflow patterns are none to rare. A few waterflow patterns may be evident in areas recently subjected to summer convection storms. Where flow patterns are observed, they are short in length and stable.

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3. **Number and height of erosional pedestals or terracettes:** Pedestals are none to rare with occurrence typically limited to areas within waterflow patterns.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare Ground 70-80%

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

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

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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 convection storms or rapid snowmelt events. Persistent litter (large woody material) will remain in place except during large rainfall events.

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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):** Soil stability values should be 1 to 3 on the soil textures found on this site. (To be field tested.)

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Surface soil structure is typically moderate medium to moderate thin platy. Soil surface colors are light and soils are typified by an ochric epipedon. Organic matter of the surface 2 to 3 inches is less than 1 percent.

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. Platy or massive sub-surface horizons or gypsic horizons are not to be interpreted as compacted layers.

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 > associated Mojave Desert shrubs

    Sub-dominant: perennial forbs > perennial bunchgrasses = annual forbs

    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; mature bunchgrasses commonly (±15%) have dead centers.

14. **Average percent litter cover (%) and depth (in):** Between plant interspaces and under shrubs up to 10 %.

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** For normal or average growing season ±200lbs/ac. Favorable years 350 lbs/ac and unfavorable years 100 lbs/ac or less.

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 annuals such as red brome, redstem filaree, annual mustards, and Mediterranean grass.

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