USDA Natural Resources
Conservation Service

Ecological site R030XB059NV
GRANITIC FAN 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 fan piedmonts, fan skirts and fan aprons. Slope gradients of 2 to 15 percent are typical. Elevations are 800 to about 2200 feet. The soil associated with this site are very deep and are derived from granite, schist or gneiss parent materials. The soils are excessively drained, have low or medium runoff and rapid permeability.

This site is part of group concept R030XB058NV.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Ambrosia dumosa* (2) *Encelia*
Herbaceous	(1) *Pleuraphis rigida* (2) *Achnatherum speciosum*

Physiographic features

This site occurs on fan piedmants, fan skirts and fan aprons. Slope gradients of 2 to 15 percent are typical. Elevations are 800 to about 2200 feet.

Table 2. Representative physiographic features

Landforms	(1) Fan piedmont (2) Fan skirt (3) Fan apron

Elevation	244–671 m
Slope	2–15%

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 74 degrees F. The average growing season is about 280 to 340 days.

Table 3. Representative climatic features

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

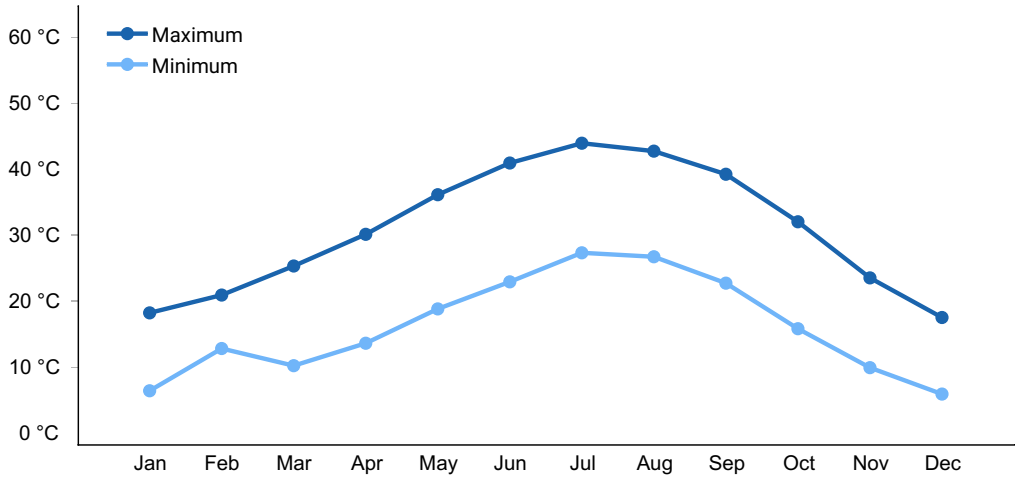


Figure 1. Monthly average minimum and maximum temperature

Influencing water features

There are no influencing water features associated with this site.

Soil features

The soil associated with this site are very deep and are derived from granite, schist or gneiss parent materials. The soils are excessively drained, have low or medium runoff and rapid permeability. Available water capacity is low to very low. The soils are usually dry, but are moist in some part for short periods during winter and spring months and for 10 to 20 days cumulative following summer convection storms during the period July through October. The soils has a typic aridic moisture regime and a hyperthermic temperature

regime.
Soil series associated with this site include Carrwash.

Table 4. Representative soil features

Parent material	(1) Alluvium–granite
Surface texture	(1) Very gravelly coarse sandy loam (2) Extremely gravelly coarse sand
Family particle size	(1) Loamy
Drainage class	Excessively drained
Permeability class	Rapid
Soil depth	183–213 cm
Surface fragment cover <=3"	45–50%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	2.54–5.08 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–2
Soil reaction (1:1 water) (0-101.6cm)	7.9–9
Subsurface fragment volume <=3" (Depth not specified)	40–50%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

Ambrosia generally dominates more developed soils with the ability to hold moisture in the upper soil profile. The shallow roots of white bursage are able to effectively use moisture stored in the upper horizons when it is available and survive for extended periods of time when it is not (Hamerlynck et al. 2002). Ambrosia is not able to dominate the deep, weakly developed, coarse textured soils that store water deep in the profile, which is ideal for Larrea. The spatial distribution of soils allows Ambrosia and Larrea to share dominance on these ecological sites. Ambrosia and Larrea can share dominance throughout the successional process, although the relative abundance is likely to change (Marshall 1994). Creosotebush commonly uses white bursage as a nurse plant, young creosotebushes are

frequently found rooted beneath mature white bursage plants (Marshall 1995). White bursage is well adapted to the desert environment but prolonged periods of drought will result a reduction of biomass and possibly kill the plant. Under natural conditions, low available fuel and low fire return interval allowed the establishment of long-lived desert perennial communities.

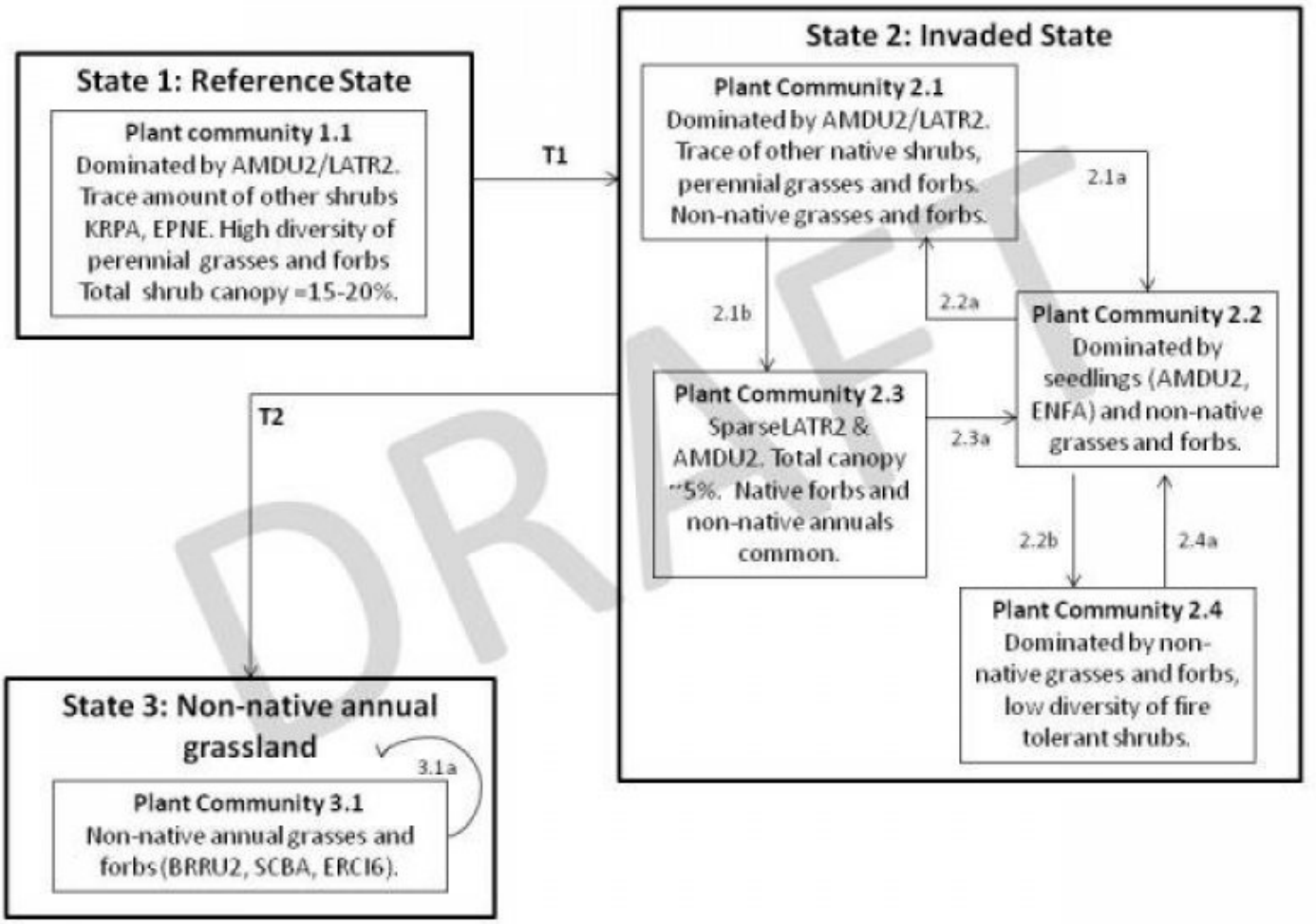
Fine, sandy alluvium on these sites provides material that the wind redistributes to mound-like coppice dunes beneath creosotebush canopies. Heights of coppice dunes increase as a function of creosotebush cover and are tallest on young alluvial surfaces. Moisture absorbed by and stored in the coppice dune enhances plant performance, in turn contributing to the plant's effectiveness as a windbreak allowing for further deposition of eolian sands (McAuliffe et al 2007). Nutrient concentrations in this shrub community are spatially variable. Nutrient resources are concentrated under shrub canopy relative to the interspaces, called islands of fertility (Kieft et al. 1998).

White bursage and creosotebush dominated shrublands are susceptible to wildfire resulting from annual variations in rainfall. Years with increased rainfall stimulate the growth of non-native annual grasses creating a continuous fuel bed that facilitates the spread of fire (Brooks and Matchett 2006). However, the creosotebush dominated ecotone has a low potential of conversion to an annual grassland. Years of elevated precipitation rarely occur, precluding the development of an extensive layer of herbaceous biomass required to significantly change the local fire dynamics.

The primary effect of fire is the reduction of perennial shrub cover. White bursage has little success resprouting post fire. However, regeneration from seed has been observed to be successful several years post fire (Brown and Minnich 1986). Creosotebush recovers poorly following fire. It very rarely resprouts and establishment by seed is very slow (Brown and Minnich 1986). Damage to big galleta varies, though it is generally top-killed. If big galleta is dry, the damage may be severe. When plants are green, the damage is less, survival is likely and the plants will most likely resprout from rhizomes.

Initial post-burn plant communities in the white bursage/creosotebush ecotone will be composed primarily of brittlebush and white bursage seedlings, as well as, herbaceous vegetation, including an abundance of non-native annuals (cheatgrass, red brome, Mediterranean grass, and red stem filiaree). Brown and Minnich (1986) observed brittlebush seedlings to be prolific on burned Larrea sites the first growing season post-fire. Big galleta, white bursage and Opuntia spp. were observed on burned sites after the first growing season.

State and transition model



State 1
Reference State

This state represents the natural range of variability under pristine conditions. Community phase changes are primarily driven by long-term drought and insect attack. Wildfire is infrequent and patchy in this ecological site due to low fuel loading and widely spaced shrubs.

Community 1.1
Reference Plant Community

The reference plant community is dominated by white bursage and Encelia spp. Potential vegetative composition is about 10% grasses, 10% annual and perennial forbs and 80% shrubs. Approximate ground cover (basal and crown) is less than 7 percent.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	67	179	269
Forb	8	22	34
Grass/Grasslike	9	22	34
Total	**84**	**223**	**337**

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. AMDU and ENCEL persist after invasion by non-native annuals, but the other shrubs and desirable grasses may be unsuccessful in competing with the non-natives. A biotic threshold has been crossed, with the introduction of non-native annuals that cannot be removed from the system. At this time ecological function has not changed, however the resiliency of the state has been reduced by the presence of non-native annual species. The non-natives have the potential to alter disturbance regimes significantly from their natural or historic range of disturbances.

Community 2.1
Plant Community Phase 2.1

This plant community is compositionally similar to the reference plant community with the presence of non-native species in the understory. At this time ecological processes remain largely unchanged at this time.

Community 2.2
Plant Community Phase 2.2

This plant community is dominated by seedlings of native species tolerant of post fire conditions and non-native annuals. Limited creosotebush and other mature shrubs will remain, surviving individuals act as nurse plants. Seedlings are dominated by white bursage and brittlebush.

Community 2.3
Plant Community Phase 2.3

This plant community is characterized by the heavy disturbance. Total shrub canopy is

reduced. Remaining vegetation exists as islands on the landscape. Non-natives are able to persist with increased disturbance. Shrubs experience reduced vigor due to increased soil compaction.

Community 2.4
Plant Community Phase 2.4

This plant community is characterized by an increased in non-native annual biomass. This plant community is identified as “at-risk”. Few species from the reference community remain in this community phase due to unfavorable conditions created by a shorter fire return interval.

Pathway 2.1a
Community 2.1 to 2.2

Large or small scale fire removes long-lived shrub community and herbaceous vegetation. Mature shrubs experience high rates of mortality.

Pathway 2.1b
Community 2.1 to 2.3

Heavy reoccurring disturbance decrease shrub canopy.

Pathway 2.2a
Community 2.2 to 2.1

With time and the absence of fire shrubs mature and densities increase.

Pathway 2.2b
Community 2.2 to 2.4

Reoccurring fire favors establishment non-native annuals and excludes native woody perennials.

Pathway 2.3a
Community 2.3 to 2.2

With time and continued absence of fire and/or removal of disturbance native perennial seedlings establish from adjacent in-tack shrub communities.

Pathway 2.4a
Community 2.4 to 2.2

Time without fire allows shrub seedlings to establish from nearby seed source.

State 3
Non-Native Annual Grassland

An abiotic threshold has been crossed, triggered by a frequent and repeated fire. Native species are unable to establish and persist in the presence of increased fire, favoring the establishment of annual grassland. Ecological processes including energy capture and nutrient cycling have changes dramatically.

Community 3.1
Plant Community Phase 3.1

This plant community is characterized by frequent fire return interval and a monoculture of non-native annual grasses. This alternative stable state is extremely persistent due to strong feedbacks, including fire regimes and soil nutrient cycling.

Transition 1
State 1 to 2

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

Transition 2
State 2 to 3

Frequent and repeated fire excludes woody vegetation and favors the establishment of non-native annual grassland.

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	**Primary Perennial Grasses**			16–34	
	big galleta	PLRI3	*Pleuraphis rigida*	11–22	–
	desert needlegrass	ACSP12	*Achnatherum speciosum*	4–11	–
2	**Secondary Perennial Grasses**			1–11	
	threeawn	ARIST	*Aristida*	1–4	–
3	**Annual Grasses**			1–11	
Forb					
4	**Perennial forbs**			1–11	
	desert globemallow	SPAM2	*Sphaeralcea ambigua*	1–4	–
5	**Annual forbs**			1–22	
Shrub/Vine					
6	**Primary shrubs**			83–157	
	burrobush	AMDU2	*Ambrosia dumosa*	56–78	–
	creosote bush	LATR2	*Larrea tridentata*	11–22	–
	brittlebush	ENFA	*Encelia farinosa*	3–15	–
	button brittlebush	ENFR	*Encelia frutescens*	3–15	–
	Virgin River brittlebush	ENVI	*Encelia virginensis*	3–15	–
7	**Secondary shrubs**			11–45	
	jointfir	EPHED	*Ephedra*	2–7	–
	beavertail pricklypear	OPBA2	*Opuntia basilaris*	2–7	–
	Fremont's dalea	PSFR	*Psorothamnus fremontii*	2–7	–
	Mojave yucca	YUSC2	*Yucca schidigera*	2–7	–

Animal community

Livestock Interpretations:
This site has limited value for livestock grazing, due to the low forage production. Grazing management should be keyed to perennial grass or 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. White brittlebush has no forage value for domestic livestock. Bush encelia has no forage value for domestic livestock. Encelia has no forage value for domestic livestock. 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. 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. Young desert needlegrass is palatable to all classes of livestock. Mature herbage is moderately grazed by horses and cattle, but rarely grazed by sheep. 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.
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. White brittlebush is a browse species for mule deer and desert bighorn sheep. In arroyo habitats of southwestern Utah, bush encelia is important to the desert tortoise as a source of succulent forage in periods of low moisture. Virgin River encelia is important to the desert tortoise as a source of succulent forage in periods of low moisture. Encelia is a browse species for mule deer and desert bighorn sheep. 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. 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. Young desert needlegrass is palatable to many species of wildlife. Desert needlegrass produces considerable basal foliage and is good forage while young. Desert bighorn sheep graze desert needlegrass. In southern Nevada, big galleta is heavily utilized by bighorn sheep and in some blackbrush communities it is referred to as 'preferred habitat.' Mule deer utilize trace amounts of big galleta.

Hydrological functions

Runoff is very low to low. Permeability is moderately rapid.

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 camping and hiking and has potential for upland and big game hunting.

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 Native Americans. 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. Big galleta's clumped growth form stabilizes blowing sand.

Type locality

Location 1: Clark County, NV	
Township/Range/Section	T32S R66E S9
UTM zone	N
UTM northing	3895827
UTM easting	715959
Latitude	35° 10′ 56″
Longitude	114° 37′ 42″
General legal description	NW1/4 Section 9, T32S. R66E. MDBM 3.5 miles northwest of Laughlin, off the Needles highway, approximately 2,700 feet west along the road to the Laughlin landfill, Clark County, Nevada.

Other references

Brooks, M.L. 1999. Habitat invisibility and dominance by alien annual plants in the western Mojave Desert. Biological Invasions. 1: 325-337.

Brown, D.E. and R.A. Minnich. 1986. Fire and changes in creosotebush Scrub of the western Sonoran Desert, California. American Midland Naturalist. 116.2: 411-422.

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

Hamerlynck, E.P., J.R. McAuliffe, E.V. McDonald and S.D. Smith. 2002. Ecological

Responses of Two Mojave Desert Shrubs to Soils Horizon Development and Soil Water Dynamics. Ecology. 83.3: 768-779.

McAuliffe, J.R., E.P. Hamerlynck, and M.C. Eppes. 2007. Landscape dynamics fostering the development and persistence of long-lived creosotebush (Larrea tridentata) clones in the Mojave Desert. J. of Arid Environments. 69:96-126.

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

Contributors

RWA

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 Specialist
Date	04/26/2010
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.

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2. **Presence of water flow patterns:** Water flow patterns are none to rare. A few water flow 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 water flow 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 ±50%; surface rock fragments to ±50%; shrub canopy to 7%; basal area for perennial herbaceous plants ±1%.

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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 catastrophic 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 coarse 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 strong thick platy. Soil surface colors are light and typified by an ochric epipedon. Organic matter of the surface 2 to 3 inches is less than 1 percent.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Shrub canopy and associated litter break raindrop impact.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile**

features which may be mistaken for compaction on this site): None

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant: Mojave Desert shrubs

    Sub-dominant: warm-season, perennial grasses > annual forbs > cool-season, perennial bunchgrasses > perennial forbs

    Other:

    Additional:

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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.

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14. **Average percent litter cover (%) and depth (in):** Between plant interspaces (Trace).

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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.

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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 Red brome, filaree, and Mediterranean grass.

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17. **Perennial plant reproductive capability:** All functional groups should reproduce in above average growing season years.
