USDA Natural Resources
Conservation Service

Ecological site R030XB099NV
GRAVELLY RIDGE 5-7 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 occurs on eroded fan remnants and ballenas in the upper fan piedmont below 3100 feet elevation. Soils formed in alluvium derived predominantly from igneous sources on slopes greater than 15 percent slope. Rock fragments cover more than 80 percent of the soil surface.

Associated sites

R030XB019NV	**Eroded Fan Remnant Pavette 4-6 P.Z.**
R030XB028NV	**VALLEY WASH**
R030XB077NV	**STEEP SOUTH SLOPE**

Similar sites

R030XB018NV	**GRANITIC LOAM 3-5 P.Z.** ERFAP codominant shrub; VIDE2 important shrub
R030XB077NV	**STEEP SOUTH SLOPE** ENFA dominant plant; site restricted to steep, south-facing aspects
R030XB016NV	**GRANITIC HILL 3-5 P.Z.** More productive site; ERFAP codominant shrub
R030XB098NV	**GRAVELLY OUTWASH** BEJU and HYSA important shrubs; occurs within inset fans on outer margins of ephemeral stream channels

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Encelia farinosa* (2) *Ambrosia dumosa*
Herbaceous	Not specified

Physiographic features

This site occurs on summits and sideslopes of fan remnants, inset fans, and ballenas on all aspects. Slopes gradients range from 2 to 50 percent, but slope gradients of 8 to 50 percent are typical. Elevations are 492 to about 3110 feet.

Table 2. Representative physiographic features

Landforms	(1) Fan remnant (2) Ballena (3) Inset fan
Elevation	150–948 m
Slope	2–50%

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 7 inches. Mean annual air temperature is 69 to 78 degrees F. The average growing season is about 280 to 360 days.

Table 3. Representative climatic features

Frost-free period (average)	360 days
Freeze-free period (average)	
Precipitation total (average)	178 mm

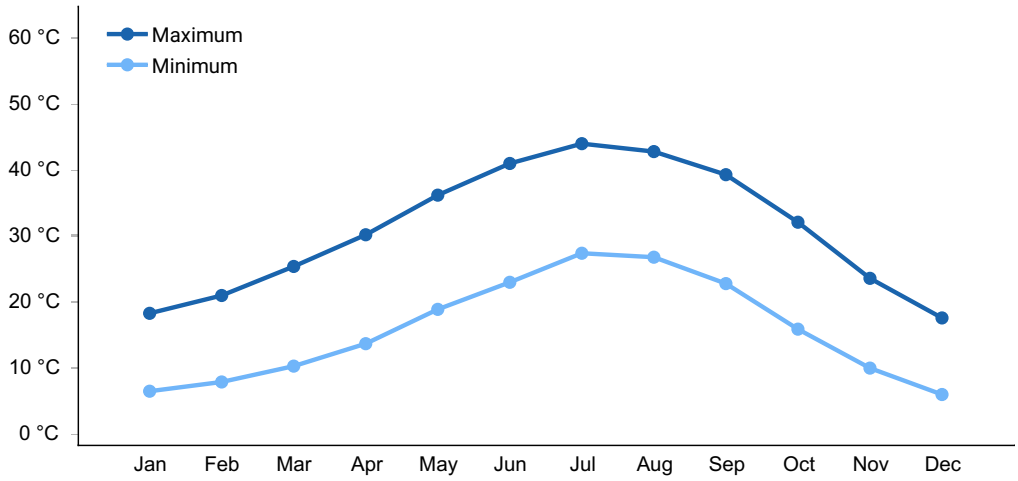


Figure 1. Monthly average minimum and maximum temperature

Influencing water features

There are no influencing water features associated with this site.

Soil features

The soil associated with this site are shallow to very deep and derived from mixed sources. A continuous surface cover of at least 75 percent gravels, cobbles, and stones is typical. Desert pavement is common on the summits of fan remnants. These soils are well drained to excessively drained, available water capacity is very low, and runoff is low to high. Soil series associated with this site include Carrwash, Heleweiser, Hiller, Huevi, Snapcan, and Varwash.

Table 4. Representative soil features

Surface texture	(1) Very gravelly coarse sandy loam (2) Extremely cobbly sandy loam (3) Extremely gravelly sandy loam
Drainage class	Well drained to excessively drained
Permeability class	Moderate to moderately rapid
Soil depth	56–213 cm
Surface fragment cover <=3"	35–60%
Surface fragment cover >3"	2–30%

Available water capacity (0-101.6cm)	3.81–7.37 cm
Calcium carbonate equivalent (0-101.6cm)	0–35%
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)	6.1–9
Subsurface fragment volume <=3" (Depth not specified)	27–62%
Subsurface fragment volume >3" (Depth not specified)	2–50%

Ecological dynamics

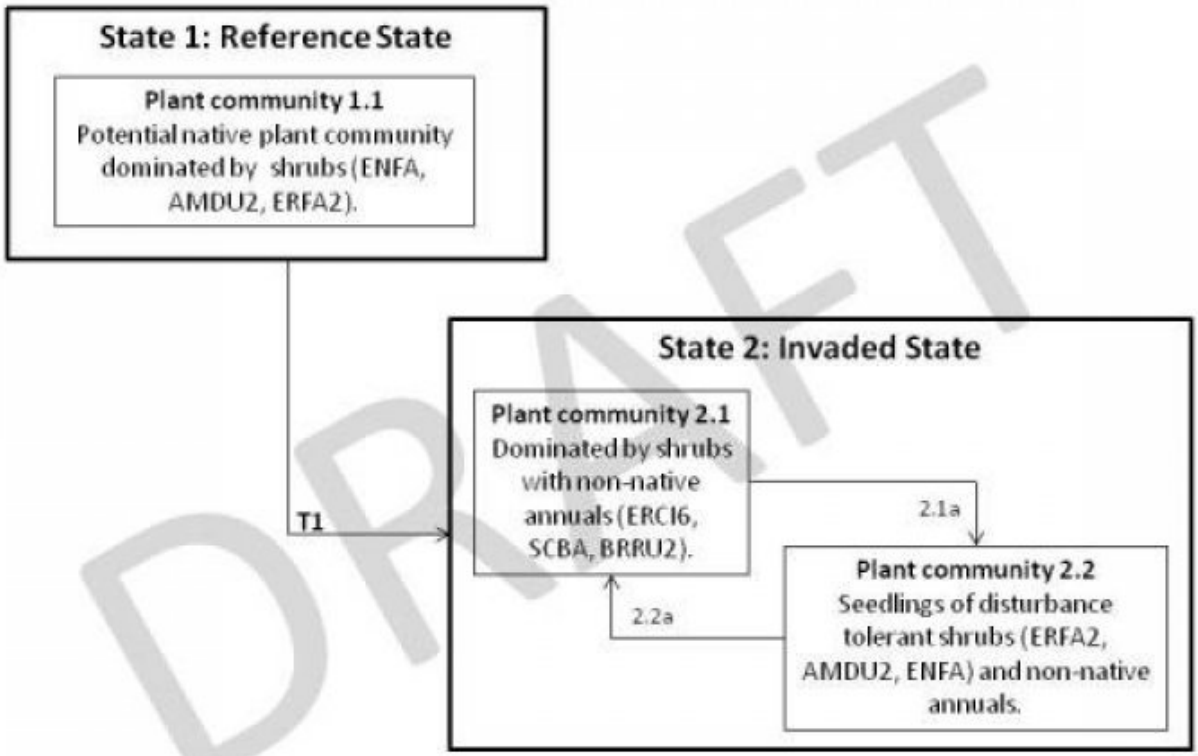
Brittlebush prefers steep slopes with a southern exposure. Brittlebush is drought tolerant and provides important soil stabilization on steep sites. Alleopathic properties make it an extremely successful competitor with winter annuals (Tesky 1993). California buckwheat thrives on rocky shallow soils. This site provides important habitat and feed for numerous wildlife species, including butterflies, lizards, and bighorn sheep (Montalov 2010).

Brittlebush is valuable for rehabilitating critical stabilization areas and disturbed sites, and is easily transplanted and can also be established from direct seeding. Creosostebush is poorly adapted to fire and experiences almost no recruitment under natural conditions. The life strategy of short-lived perennials like brittlebush may be better adapted to the current climatic conditions and disturbance regimes. In a long term plant succession study at a site fully protected from human impacts, the abundance of creosotebush obviously declined, while brittlebush experienced high recruitment and noticeable establishment within the stand (Turner 1990). Such changes in species composition can be attributed to the natural successional processes of this desert ecosystem.

The low fuel loads limits the ability of fire to spread on these sites. Yearly variation in fuel conditions can be contributed to production of annual species, native and nonnative. In years with high production of annual species, the risk of fire is greater to perennial shrubs, due to the continuous fuel load. The native species of this ecological site are well adapted to disturbance, easily establish from seed and will persist throughout the successional process on this ecological site.
Post-fire, brittlebush may dominate a site (Brown and Minnich 1986). Brittlebush has some ability to sprout but primarily reproduces from wind dispersed seed from offsite seed sources. Although fire initially causes high mortality, brittlebush has been known to rapidly recover to pre-burn densities, largely due to seedling establishment (Tesky 1993). Fire

generally causes high mortality in Mojave buckwheat. Regeneration largely occurs from seed and frequent fires can severely decrease the seedbank. Mojave buckwheat seeds require light for germination allowing it to thrive in a post-fire landscape due to the absence of shading from existing vegetation (Montalov 2010). Seedlings emerge during the rainy season and survival can be as high as 80 to 90 percent. White bursage is generally killed by fire or other disturbances. However, it reproduces both vegetatively and sexually, making it ideal for colonizing disturbed sites (Marshall 1994).

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 wildfire, long-term drought and insect attack. The plant communities of this site are dynamic in response to changes in disturbance regimes and weather patterns.

Community 1.1
Reference Plant Community

The reference plant community is dominated by white brittlebush and white bursage. Potential native vegetative composition is about 5% grasses, 20% perennial and annual forbs, and 75% shrubs. Approximate ground cover (basal and crown) is less than 10 percent.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	127	189	252
Forb	34	50	67
Grass/Grasslike	8	12	17
Total	**169**	**251**	**336**

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. ENFA and AMDU 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. Ecological resiliency has been reduced by the presence of non-native annuals which have the potential to alter disturbance regimes significantly from their natural or historic range of variability.

Community 2.1
Plant Community Phase 2.1

Compositionally similar to the reference state with a trace of non-native annuals in the understory. Native shrubs persist through invasion, while the native bunchgrasses and perennial forbs are at a competitive disadvantage for space and resources.

Community 2.2
Plant Community Phase 2.2

This plant community is characterized by the regeneration of disturbance tolerant native

shrubs. Non-native annuals persist.

Pathway 2.1a
Community 2.1 to 2.2

Following disturbance native shrubs readily establish from seed, assuming the presence of an offsite seed source.

Pathway 2.2a
Community 2.2 to 2.1

With time shrubs mature and dominate the site.

Transition 1
State 1 to 2

Introduction of non-native species due to a combination of factors including; surface disturbance, changes in the kinds of animals and their grazing patterns, drought, changes in fire history or any other type of vegetation removal. Non-natives can alter disturbance regimes significantly from their natural or historic range and change ecological processes therefore creating an unlikely scenario to restore the site back to reference.

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**			6–26	
	low woollygrass	DAPU7	*Dasyochloa pulchella*	1–6	–
2	**Annual Grasses**			1–38	
Forb					
3	**Perennial Forbs**			1–12	
4	**Annual Forbs**			1–26	
	fiddleneck	AMSIN	*Amsinckia*	1–8	–
	desert trumpet	ERIN4	*Eriogonum inflatum*	1–8	–
Shrub/Vine					
5	**Primary Shrubs**			94–240	
	burrobush	AMDU2	*Ambrosia dumosa*	63–113	–
	brittlebush	ENFA	*Encelia farinosa*	26–89	–
	creosote bush	LATR2	*Larrea tridentata*	6–38	–
6	**Secondary Shrubs**			12–50	
	hedgehog cactus	ECHIN3	*Echinocereus*	2–8	–
	California barrel cactus	FECY	*Ferocactus cylindraceus*	2–8	–
	white ratany	KRGR	*Krameria grayi*	2–8	–
	beavertail pricklypear	OPBA2	*Opuntia basilaris*	2–8	–
	Parish's goldeneye	VIPA14	*Viguiera parishii*	2–8	–

Animal community

Livestock Interpretations:
This site has limited value for livestock grazing, due to the low forage production, steep slopes, and stony surfaces. White bursage is of intermediate forage value. It is fair to good forage for horses and fair to poor for cattle and sheep. However, because there is often little other forage where white bursage grows, it is often highly valuable to browsing animals and is sensitive to browsing. White brittlebush has no forage value for domestic livestock. White brittlebush infestation reduces forage production because it competes strongly with buffelgrass. High intensity livestock grazing can reduce white brittlebush growth, but causes no significant change after 3 years. 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. White brittlebush is a browse species of desert mule deer and desert bighorn sheep. Creosotebush is unpalatable to most browsing wildlife.

Hydrological functions

Available water capacity is very low and runoff is medium to 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 for photographers and for nature study.

Other products

White bursage is a host for sandfood, a parasitic plant. Sandfood was a valuable food supply for Native Americans. The stems of brittle bush exude a clear resin used by the Indians as glue and chewing gum. Creosotebush has been highly valued for its medicinal properties by Native Americans. 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, white brittlebush, and cresotebush may be used to revegetate disturbed sites in southwestern deserts. Once established, these species may improve sites for annuals and other perennials that grow under their canopies by trapping fine soil, organic matter, and symbiont propagules. Water infiltration and storage may also improve.

Type locality

Location 1: Clark County, NV	
Township/Range/Section	T29S R65E S6
General legal description	Bill Gays Butte area, southwest of Cottonwood Cove along powerline road that runs through Cottonwood Valley, Clark County, Nevada.

Other references

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Contributors

BLS
Dustin Detweiler

Approval

Sarah Quistberg, 2/26/2025

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 Specialist
Date	07/19/2010
Approved by	Sarah Quistberg
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills are rare. A few rills can be expected on steeper slopes in areas recently subjected to summer convection storms. Rock fragments armor the surface.

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2. **Presence of water flow patterns:** Water flow patterns are rare but can be expected in areas recently subjected to summer convection storms, usually on steeper slopes.

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3. **Number and height of erosional pedestals or terracettes:** Pedestals are none to rare. Occurrence is usually limited to areas of 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 15-25%; surface cover of rock fragments to 70%; shrub canopy to 10%.

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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.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil stability values should be 1 to 4 on most 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 structure is typically strong thick platy to weak fine subangular blocky. Soil surface colors are light and soils are typified by an ochric epipedon. Organic matter of the surface horizon is typically less than 1 percent dropping off quickly below. Organic matter content can be more or less depending on micro-topography.

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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):** Compacted layers are not typical.

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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, bunchgrasses > annual grasses > perennial forbs > annual 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; some of the mature bunchgrasses (<10%) have dead centers.

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

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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 ± 225 lbs/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-stem filaree, red brome, and Mediterranean grass. Creosote bush and teddybear cholla are increasers on this site.

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