

## Ecological site R030XB156CA Limy 5-7" p.z. (Low Production)

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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.

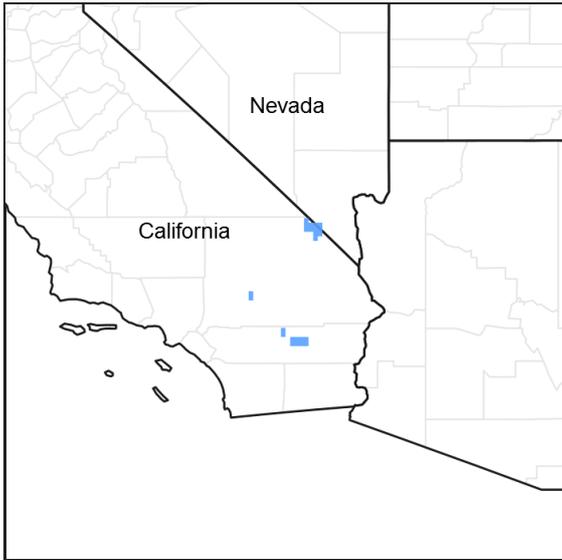


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

### MLRA notes

Major Land Resource Area (MLRA): 030X–Mojave Basin and Range

MLRA Description:

Major Land Resource Area (MLRA) 30, Mojave Desert, 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 climate of the area is hot (primarily hyperthermic and thermic; however at higher elevations, generally above 5000 feet, mesic, cryic and frigid) and dry (aridic). Elevations range from below sea level to over 12,000 feet in the higher mountain areas found within the MLRA. Due to the extreme elevational range found within this MLRA, Land Resource Units (LRUs) were designated to group the MLRA into similar land units.

LRU Description:

This LRU (designated by 'XB') 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. Elevations range from 1800 to 5000 feet and precipitation ranges from 4 to 9 inches per year, but is generally between 5-6 inches. This LRU is characterized primarily by the summer precipitation it receives, ranging from 18 – 35% but averages 25%. Summer precipitation falls between July and September in the form of rain, and winter precipitation falls starting in November and ends between February and March, also mostly in the form of rain; however it does receive between 0 and 3 inches of snow, with an average of 1 inch. The soil temperature regime is thermic and the soil moisture

regime is typic-aridic. Vegetation includes creosote bush, burrobrush, Nevada jointfir, ratany, Mojave yucca, Joshua tree, chollas, cactus, 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 fan aprons, fan remnants, and rarely on low sloping hills, with slopes below 8 percent typical. This site is associated with dry landform positions, and typically occurs on south and west facing aspects. Soils are of varying taxonomy, but share a significant degree of soil horizon development, which may be in the form of calcic horizons, argillic horizons, and/or duripans. These features decrease water infiltration to deep soils depths, and increase the duration that water is held at shallow depths. The site is generally channelized by shallow fluvial drains, which bring moisture in from the surrounding hills and alluvial fans.

Production reference value (RV) is 282 pounds per acre, and ranges from 100 to 400 pounds per acre depending on annual precipitation and annual forb production. Low-growing creosote bush (*Larrea tridentata*) and burrobrush (*Ambrosia dumosa*) are strongly dominant. Dry landform positions and reduced water availability reduces production and cover on this site. Increased temporal moisture availability at shallow depths is responsible for the increased burrobrush component, which is relatively shallow rooted and requires greater surface moisture to thrive.

Data ranges in the physiographic data, climate data, water features, and soil data sections of this Ecological Site Description are based on major components only (15 percent of map unit or greater).

### Classification relationships

Mojave Creosote Bush (Holland 1986).

*Larrea tridentata* Shrubland Alliance (Sawyer et al. 2009).

### Associated sites

R030XB017NV	<b>LIMY HILL 3-5 P.Z.</b> This site occurs on adjacent hillslopes. Creosote bush ( <i>Larrea tridentata</i> ) is dominant.
R030XB139CA	<b>Shallow Dry Hill 4-6 P.Z.</b> This ecological site occurs on adjacent steeper hillslopes. Creosote bush ( <i>Larrea tridentata</i> ) and burrobrush ( <i>Ambrosia dumosa</i> ) dominate.
R030XB140CA	<b>Shallow Hill 4-6" P.Z.</b> This ecological site occurs on adjacent steeper hillslopes. Burrobrush ( <i>Ambrosia dumosa</i> ) and creosote bush ( <i>Larrea tridentata</i> ) dominate.
R030XY159CA	<b>Gravelly Outwash</b> This ecological site occurs on adjacent rarely flooded inset fans. Creosote bush ( <i>Larrea tridentata</i> ) and desertsenna ( <i>Senna armata</i> ) are dominant.

### Similar sites

R030XB019NV	<b>Eroded Fan Remnant Pavette 4-6 P.Z.</b> This site is more water-limited, and has a much lower abundance of burrobrush ( <i>Ambrosia dumosa</i> ) as well as lower overall productivity.
R030XB005NV	<b>Arid Active Alluvial Fans</b> This site is less water-limiting, and has higher overall production while maintaining a very similar species composition. Big galleta ( <i>Pleuraphis rigida</i> ) is often present.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Larrea tridentata</i> (2) <i>Ambrosia dumosa</i>

Herbaceous	Not specified
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## Physiographic features

This ecological site occurs on fan aprons, fan remnants, and infrequently, on low sloping hills. South and west-facing aspects are typical. Elevations range from 2460 to 4270 feet. Slopes may range from 2 to 30 percent, but slopes below 8 percent are typical. This site may experience rare sheet flooding of extremely brief duration. Runoff class is negligible to high.

**Table 2. Representative physiographic features**

Landforms	(1) Fan apron (2) Fan remnant
Flooding duration	Extremely brief (0.1 to 4 hours)
Flooding frequency	None to rare
Ponding frequency	None
Elevation	2,460–4,270 ft
Slope	2–30%
Aspect	S, SW, W

## Climatic features

The climate on this site is arid, and characterized by warm, moist winters (30 to 60 degrees F) and hot, dry summers (70 to 100 degrees F). The average annual precipitation ranges from 3 to 7 inches with most falling as rain from November to March. Approximately 25% of the annual precipitation occurs from July to September as a result of summer convection storms. Mean annual air temperature is 55 to 68 degrees F. The frost-free period is 210 to 320 days.

Barstow Fire Station occurs at a lower elevation and has a long-term record from 1980 to 2002. Twentynine Palms Station occurs at a lower elevation and has a long-term record from 1948 to 2002. This climate summary is based on data from both locations. Warm, moist winters (35 to 70 degrees F) and hot, dry summers (60 to 105 degrees F) characterize the climate on this site. Mean annual air temperature is 65 to 70 degrees F. The average annual precipitation is 5 to 7 inches, with most falling as rain from December through March. Approximately 20 to 45% of the annual precipitation occurs from July to September as a result of intense, convection storms.

**Table 3. Representative climatic features**

Frost-free period (average)	320 days
Freeze-free period (average)	0 days
Precipitation total (average)	7 in

## Influencing water features

### Soil features

The soils associated with this ecological site formed in alluvium derived from granitoid, igneous, limestone, dolomite, or mixed parent material. These soils are of varying taxonomy, but share a significant degree of soil horizon development, which may be in the form of calcic horizons, argillic horizons, and or duripans. These features decrease water infiltration to deep soils depths, and increase the duration that water is held at shallow depths. Soils range from very shallow to a duripan to very deep. Surface textures are fine sandy loam, loam, very gravelly sand, gravelly sandy loam and silt, with very gravelly and gravelly sand, loamy sand and sandy loam subsurface textures. Surface gravels (< 3 mm in diameter) range from 0 to 80 percent, and larger fragments range from 0 to 30 percent. Subsurface gravels by volume (for a depth of 0 to 59 inches) range from 8 to 40 percent, and larger fragments

range from 0 to 40 percent. Soils are well to somewhat excessively drained with very slow to rapid permeability.

This ecological site is associated with major components (15 percent or greater) of the following soil series: Colosseum (Sandy-skeletal, carbonatic, thermic Typic Haplocalcids); Yuccabutte (Loamy-skeletal, mixed, superactive, thermic Typic Haplargids); Crosgrain (Loamy-skeletal, mixed, superactive, thermic, shallow Typic Haplodurids); Olympus (Loamy, mixed, superactive, thermic Arenic Haplargids); Popups (Coarse-loamy, mixed, superactive, thermic Argidic Argidurids); Pacific Mesa (Loamy-skeletal, mixed, superactive, thermic Lithic Haplocambids); Pinkcan (Fine-loamy, mixed, superactive, thermic Duric Petroargids); and Edalph (Sandy, mixed, thermic Typic Haplocalcids). It is also correlated with minor components of Arizo dry (Sandy-skeletal, mixed, thermic Typic Torriorthents).

The Pacific Mesa soils formed in residuum derived from andesite, and occur on slopes. These soils are not typical for this ecological site, and when correlated with this site, they occurred on a gently sloping plateau. The Arizo soils are very deep with little horizon development, and are not typical for this ecological site.

This ecological site is correlated with the following soil survey areas, map units and soil components:

Soil survey area; Mapunit symbol; Component; phase; component percent

CA805; 3660; Colosseum; very rarely flooded; 65

CA805; 3520; Arizo; dry; 5

CA695; 3661; Colosseum; 65

CA695; 3520; Arizo; dry; 5

CA794; 4271; Yucabutte; warm; 60

CA794; 4030; Crosgrain; 50

CA794; 3440; Pacific Mesa; 30

CA794; 4031; Pinkcan; dry; 15

CA698; 3550; Olympus; 45

CA698; 4110; Popups; 30; Edalph; dry; 15

**Table 4. Representative soil features**

Parent material	(1) Alluvium–granite
Surface texture	(1) Fine sandy loam (2) Loam (3) Very gravelly sand
Family particle size	(1) Sandy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Very slow to rapid
Soil depth	6 in
Surface fragment cover <=3"	0–80%
Surface fragment cover >3"	0–30%
Available water capacity (0-40in)	0.5–4.5 in
Calcium carbonate equivalent (0-40in)	0–20%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0–12
Soil reaction (1:1 water) (0-40in)	6.6–9
Subsurface fragment volume <=3" (Depth not specified)	8–40%

Subsurface fragment volume >3" (Depth not specified)	0–40%
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## Ecological dynamics

### Abiotic factors

Creosote bush – burrobush shrublands dominate fan piedmont landscapes at elevations below 4000 feet in the Mojave Desert (Rundel and Gibson 1996). In arid regions, the availability of moisture is the key resource driving the productivity and composition of vegetation (Noy-Meir 1973, McAuliffe 1994, Hamerlynk et al. 2000, Martre et al. 2002, Austin et al. 2004). In such environments, water availability is highest on coarse soils with little horizon development. This is because water drains rapidly through coarse textured, sandy soils, with minimal loss due to run-off and evaporation (Noy-Meir 1973, Austin et al. 2004). Deep, free-draining soils promote dominance and higher production by the deep-rooted, long-lived evergreen creosote bush (McAuliffe 1994, Hamerlynk et al. 2002, Hamerlynk and McAuliffe 2008). Significant soil horizon development, such as an argillic, calcic, or duripan horizon, reduces infiltration and increases the availability of water at near surface depths, which favors the shallow-rooted, drought-deciduous burrobush, and reduces the productivity of creosote bush (Hamerlynk et al. 2002, Hamerlynk and McAuliffe 2008). The site is generally channelized by shallow fluvial drains, which bring moisture in from the surrounding hills and alluvial fans. This increased moisture also favors an increased burrobush component.

### Disturbance dynamics

The primary disturbances influencing this ecological site are drought, invasion by non-native annual plants, and fire, all of which interact. Drought is an important shaping force in Mojave Desert plant communities (Webb et al. 2003, Bowers 2005, Hereford et al. 2006, Miriti et al. 2007). Short-lived perennial shrubs and perennial grasses demonstrate the highest rates of mortality (Webb et al. 2003, Bowers 2005, Hereford et al. 2006, Miriti et al. 2007), and annual species remain dormant in the soil seedbank (Beatley 1969, 1974, 1976). Long-lived shrubs and trees are more likely to exhibit branch-pruning, and or limited recruitment during drought (e.g. Hereford et al. 2006, Miriti et al. 2007), leading to reduced cover and biomass in drought-afflicted communities.

Non-native annual species such as red brome (*Bromus rubens*), Mediterranean grass (*Schismus barbatus*), redstem stork's bill (*Erodium cicutarium*) and Asian mustard (*Brassica tournefortii*) have become naturalized throughout the Mojave Desert over the past century (Rickard and Beatley 1965, D'Antonio and Vitousek 1992, Brooks 1999, Reid et al. 2006, Norton et al. 2007). Like native annuals, nonnative annual cover and production is directly related to winter precipitation (Beatley 1969, Brooks and Berry 2006, Barrows et al. 2009).

Invasion by non-native annual grasses has increased the flammability of Mojave Desert vegetation communities by providing a continuous fine fuel layer between widely spaced shrubs (Brown and Minnich 1986, Brooks 1999, Brooks et al. 2004, Rao and Allen 2010, Rao et al. 2010). After fire, these communities appear to be more susceptible to invasion by exotic grasses, leading to a grass-fire cycle (D'Antonio and Vitousek 1992). The low potential for high productivity of annual species in this ecological site means that it is relatively resilient to fire. However, after years of extremely high winter precipitation, this site may burn (Brown and Minnich 1986, Brooks et al. 2007).

## State and transition model

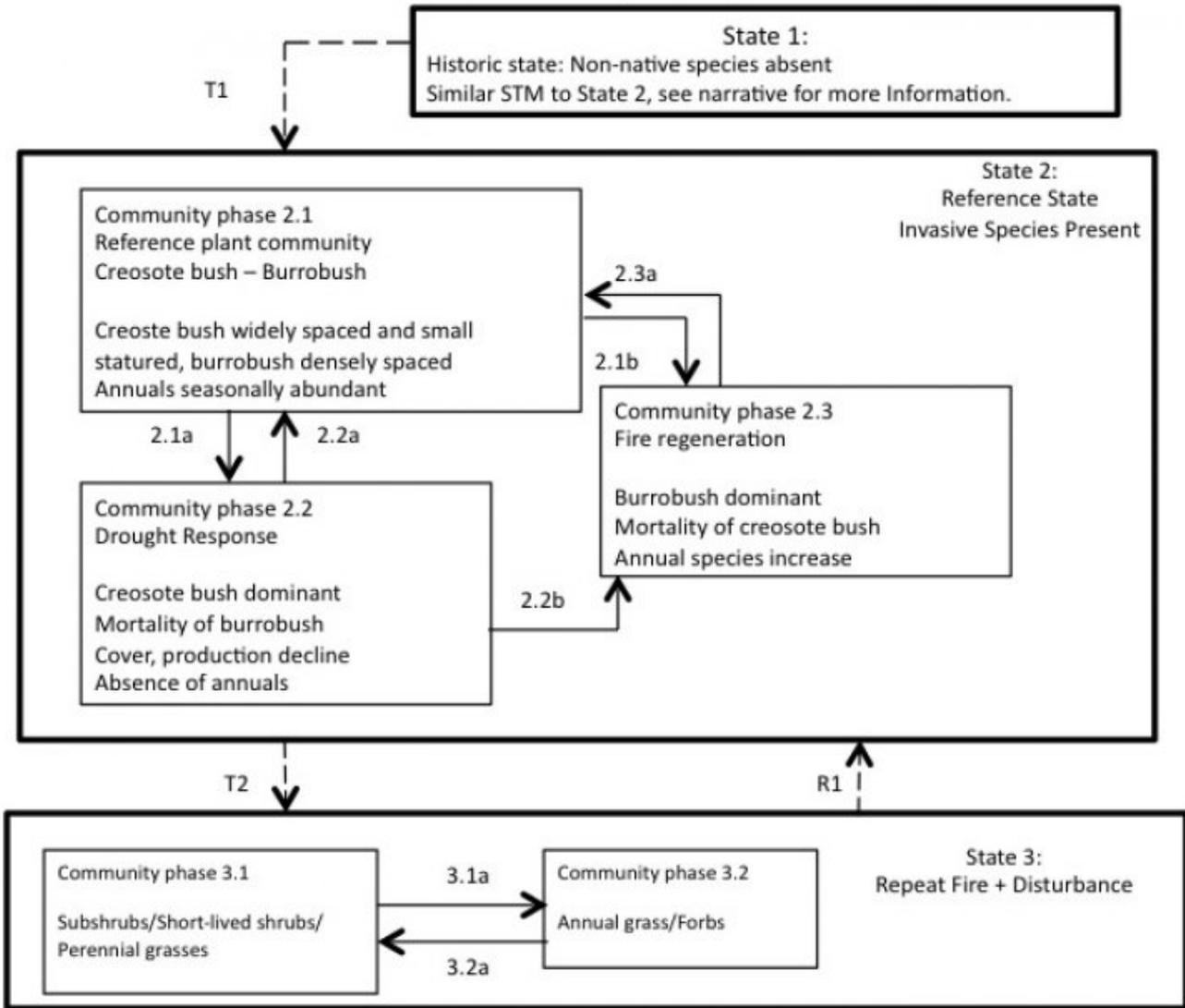


Figure 3. R030XB156CA

### State 1 Historic State

State 1 represents the historic range of variability for this ecological site. This state no longer exists due to the ubiquitous naturalization of non-native species in the Mojave Desert. Periodic drought and rare fire were the natural disturbances influencing this ecological site. Fire would have been a very rare occurrence due to the lack of a continuous fine fuel layer between shrubs. Data for this State does not exist, but dynamics and composition would have been similar to State 2, except with only native species present. See State 2 narrative for more detailed information.

### State 2 Reference State

State 2 represents the current range of variability for this site. Non-native annuals, including red brome, Mediterranean grass, red-stem stork’s bill, and Asian mustard are naturalized in this plant community. Their abundance varies with precipitation, but they are at least sparsely present (as current year’s growth or present in the soil seedbank).

### Community 2.1 Reference Plant Community



Figure 4. Community Phase 2.1

The reference community for this ecological site is almost exclusively composed of low-growing creosote bush (*Larrea tridentata*) and burrobush (*Ambrosia dumosa*), with lesser dominants including white ratany and littleleaf ratany (*Krameria grayi* and *K. erecta*), Mojave yucca (*Yucca schidigra*), chollas (*Cylindropuntia* spp.), cacti (*Echinocereus* spp. and *Ferocactus cylindraceus*), ephedras (*Ephedra* spp.) and a sparse understory composed primarily of the annual forbs, curvenut combseed (*Pectocarya recurvata*), pincushion flower (*Chaenactis fremontii*) and desert calico (*Loeseliastrum matthewsii*). The community is characterized by its low production, with 3-4 foot-tall creosote bush (*Larrea tridentata*), but high abundance of burrobush.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	95	170	200
Forb	5	70	125
Grass/Grasslike	0	2	10
<b>Total</b>	<b>100</b>	<b>242</b>	<b>335</b>

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	15-20%
Grass/grasslike foliar cover	0%
Forb foliar cover	5-7%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

Table 7. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	10-15%
Grass/grasslike basal cover	0%

Forb basal cover	3-5%
Non-vascular plants	0%
Biological crusts	0%
Litter	20-25%
Surface fragments >0.25" and <=3"	40-50%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

**Table 8. Canopy structure (% cover)**

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	–	5-7%
>0.5 <= 1	–	–	–	–
>1 <= 2	–	1-2%	–	–
>2 <= 4.5	–	3-5%	–	–
>4.5 <= 13	–	7-10%	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

**Figure 6. Plant community growth curve (percent production by month). CA3004, Burrobush XB. Growth starts in early spring, flowering and seed set occur by July. Dormancy occurs during the hot summer months. With sufficient summer/fall precipitation, some vegetation may break dormancy and produce a flush of new growth..**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	5	25	35	20	0	0	10	5	0	0	0

**Figure 7. Plant community growth curve (percent production by month). CA3011, Burrobush . Growth starts in early spring; flowering and seed set occur by June. Plants go dormant as a result of summer stress. New twig and leaf growth are initiated after summer and winter rains..**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	5	25	30	20	10	0	5	5	0	0	0

**Figure 8. Plant community growth curve (percent production by month). CA3015, Creosote bush XB. Growth starts in early spring with flowering and seed set occurring by July. Dormancy occurs during the hot summer months. With sufficient summer/fall precipitation, some vegetation may break dormancy and produce a flush of growth..**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	5	20	30	20	10	0	10	5	0	0	0

## Community 2.2 Drought Response

This community phase is characterized by an overall decline in cover due to branch-pruning and lack of recruitment

of longer-lived species, mortality of shorter-lived perennials, and lack of emergence of annual forbs and grasses. Burrobush and big galleta are likely to decline due to drought-induced mortality, while creosote bush remains stable. Creosote bush is an evergreen species capable of utilizing moisture at any time of the year. This ability buffers populations from the effects of drought that occur as the absence of the winter rains (the primary source of moisture for this ecological site). Further, creosote bush germinates in response to moisture during the warm season, so may still recruit if warm season rains occur during winter drought (Hereford et al. 2006). Creosote bush exhibits branch-pruning during severe drought, but mortality during drought in the Mojave Desert is very low (Webb et al. 2003, Hereford et al. 2006). Nevertheless, during severe drought, creosote bush mortality may occur. Big galleta may suffer very high rates of drought-induced mortality (Webb et al. 2003; Hereford et al. 2006); however, big galleta can respond very quickly to brief, intermittent rain during rare summer monsoonal events, which can buffer big galleta populations in the absence of more predictable winter rains. This community is at reduced risk of burning, and if it is ignited, will experience lower severity, smaller fires because of reductions in annual and perennial biomass (Minnich 2003). However, drought immediately after a period of heavy moisture, results in standing biomass of native fuels that may carry a fire one year post-production (Minnich 2003), and standing dead biomass of non-native annuals that may provide fuel for 2 -3 years post-fire (Minnich 2003; Rao et al. 2010).

## **Community 2.3**

### **Fire regeneration community**

This community phase is characterized by severe declines in creosote bush, and an increase in shrub diversity. Creosote bush is generally killed by fire, and is slow to re-colonize burned areas due to specific recruitment requirements (Brown and Minnich 1986, Brooks et al. 2007, Steers and Allen 2011). Creosote bush communities in the Mojave Desert may resemble the natural range of variation found in pre-fire conditions in terms of species composition in as little as nineteen years (Engel and Abella 2011), but creosote communities in the Colorado Desert may show little recovery after 30 years (Steers and Allen 2011). The timing and severity of fire, as well as post-fire climate conditions determines trajectories of recovery (Brown and Minnich 1986, Steers and Allen 2011). Initially, the post-burn community is dominated by non-native grasses, native annuals and native subshrubs. Native annuals likely to be present include curvenut combseed, pincushion flower, and cryptantha, but many different species could be at a particular site. Subshrubs that often become dominant after fire include desert globemallow (*Sphaeralcea ambigua*), desert trumpet (*Eriogonum inflatum*), brownplume wirelettuce (*Stephanomeria pauciflora*), and desert marigold (*Baileya multiradiata*). With time, shrub cover increases with colonization by short-lived shrubs from off-site dispersal (including burrobush and burrobrush (*Hymenoclea salsola*)). With a long period of time without fire, creosote bush begins to regain dominance as shorter-lived species die out (Vasek 1983, Abella 2009). This community is an at-risk phase, as the increased cover and biomass of big galleta and non-native annual grasses increases the likelihood of repeat burning. If the fire return interval is less than 20 years, this community is very likely to transition to State 3.

### **Pathway 2.1a**

#### **Community 2.1 to 2.2**

This pathway occurs with prolonged or severe drought.

### **Pathway 2.1b**

#### **Community 2.1 to 2.3**

This pathway occurs with moderate to severe fire.

### **Pathway 2.2a**

#### **Community 2.2 to 2.1**

This pathway occurs with a return to average or above average precipitation.

### **Pathway 2.2b**

#### **Community 2.2 to 2.3**

This pathway occurs with moderate to severe fire, and takes place within three years of a very wet period. At longer than three years of drought, the community is at low risk of burning.

## **Pathway 2.3a**

### **Community 2.3 to 2.1**

This pathway occurs with time without fire and without other additional disturbance.

## **State 3**

### **Repeated fire State**

This state develops when the fire return interval is less than 20 years. This state has been significantly altered from the natural range of variability found in States 1 and 2. Creosote bush is lost, and non-native annual grasses, native sub-shrubs, and short-lived shrubs dominate the community. Annual grasses and forbs are abundant immediately post-fire, with dominance by perennial grasses, subshrubs and short-lived perennials several years post-fire.

## **Community 3.1**

### **Subshrubs/Short-lived shrubs**

This community phase develops with time without fire (5-20 years), and is dominated by subshrubs (desert globemallow, desert trumpet, brownplume wirelettuce and desert marigold) and short-lived shrubs (burrobush, burrobrush). There is high cover of non-native and native annuals during wet years. This community is at high risk of repeat burning due to high cover of fine fuels.

## **Community 3.2**

### **Annual grass/forbs**

This community phase occurs one to five years post-fire. The community is dominated by non-native annual species including red brome, Mediterranean grass and red-stem stork's bill, and native forbs. Native subshrubs including globemallow, desert trumpet, brownplume wirelettuce and desert marigold may be abundant. Seedlings of short-lived shrubs may be present, and may include burrobush, and burrobrush. This community is at high-risk of repeat burning due to high fine fuel cover. This community is also susceptible to wind and water erosion, due to the loss of stabilizing shrub cover (Bull 1997). This can lead to arroyo development near ephemeral drainage channels. Furthermore, the loss of vegetation structure present in the historic and reference state decreases the suitability of this habitat for wildlife (Brooks et al. 2007, Vamstad 2009). Since rodent seed caching is important for the dispersal and establishment of many desert species this can further inhibit recovery.

## **Pathway 3.1a**

### **Community 3.1 to 3.2**

This pathway occurs with fire.

## **Pathway 3.2a**

### **Community 3.2 to 3.1**

This pathway occurs with time without fire (> 5 years).

## **Transition 1**

### **State 1 to 2**

This transition occurred with the naturalization of non-native species in this ecological site. Non-native species were introduced with settlement of the Mojave Desert region in the 1860s. Post-settlement cattle and sheep grazing, as well as dryland farming, helped to spread and facilitate their establishment (Brooks and Pyke 2000, Brooks et al. 2007).

## **Transition 2**

### **State 2 to 3**

This transition occurs when the fire return interval is less than 20 years, or when the fire regeneration community suffers additional disturbance such as off-road vehicle use.

## **Transition 1 State 3 to 2**

Restoration of arid desert communities severely altered by repeat fire at the landscape scale is very difficult (Allen 1993). Reducing invasion of non-native grasses that increase after fire may help promote native plant recovery, and reduce the probability of repeat burning (Fuhrmann et al. 2009, Matchett et al. 2009, Steers and Allen 2010); however, accomplishing this at a landscape scale, for a time period long enough to be effective, has not yet been accomplished. In small-scale trials, Fusilade, a grass-specific herbicide, was successful in reducing invasive grasses in burned creosote bush communities in the Colorado Desert in the initial three years after fire (Steers and Allen 2010). The long-term efficacy of such treatments on a landscape scale, and non-target effects have not yet been determined. The pre-emergent herbicide Plateau was applied in conjunction with aerial seeding of natives after fire in Zion National Park (Fuhrmann et al. 2009, Matchett et al. 2009). Initial results indicate that autumn application of Plateau after fire is most effective for reducing cheatgrass (*Bromus tectorum*), but longer-term monitoring is needed to evaluate long-term and non-target effects. In addition to controlling invasive species, active recovery of native vegetation may be attempted. Methods may include seeding of early native colonizers such as desert globemallow, burrobrush, threeawns (*Aristida* spp.), and desert marigold (e.g. Abella et al. 2009, Abella et al. 2012). Increased native cover may help to reduce non-native plant invasion, helps to stabilize soils, provides a source of food and cover for wildlife, including desert tortoise (*Gopherus agassizii*), and provides microsites that facilitate creosote bush establishment. However, the amount of seed required for success is often prohibitive. Large-scale planting of both early colonizers and community dominants tends to be more successful in terms of plant survival, especially if outplants receive supplemental watering during the first two years (Allen 1993). Creosote bush and burrobrush can be successfully propagated and outplanted.

### **Additional community tables**

**Table 9. Community 2.1 plant community composition**

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
<b>Shrub/Vine</b>					
1	<b>Perennial Shrubs</b>			95–230	
	creosote bush	LATR2	<i>Larrea tridentata</i>	40–150	7–10
	burrobush	AMDU2	<i>Ambrosia dumosa</i>	20–90	3–5
	white ratany	KRGR	<i>Krameria grayi</i>	0–15	0–1
	littleleaf ratany	KRER	<i>Krameria erecta</i>	0–8	0–1
	Mojave yucca	YUSC2	<i>Yucca schidigera</i>	0–3	–
	burrobrush	HYSA	<i>Hymenoclea salsola</i>	0–2	0–1
	buckhorn cholla	CYACA2	<i>Cylindropuntia acanthocarpa</i> var. <i>acanthocarpa</i>	0–2	0–1
	Engelmann's hedgehog cactus	ECEN	<i>Echinocereus engelmannii</i>	0–2	0–1
	Death Valley jointfir	EPFU	<i>Ephedra funerea</i>	0–2	0–1
	Nevada jointfir	EPNE	<i>Ephedra nevadensis</i>	0–2	0–1
	California barrel cactus	FECY	<i>Ferocactus cylindraceus</i>	0–1	0–1
	cottontop cactus	ECPO2	<i>Echinocactus polycephalus</i>	0–1	0–1
	Wiggins' cholla	CYEC3	<i>Cylindropuntia echinocarpa</i>	0–1	0–1
	branched pencil cholla	CYRA9	<i>Cylindropuntia ramosissima</i>	0–1	0–1
<b>Forb</b>					
2	<b>Native Forbs</b>			5–150	
	curvenut combseed	PERE	<i>Pectocarya recurvata</i>	0–150	0–10
	cryptantha	CRYPT	<i>Cryptantha</i>	0–13	0–2
	pincushion flower	CHFR	<i>Chaenactis fremontii</i>	0–8	0–3
	desert Indianwheat	PLOV	<i>Plantago ovata</i>	0–5	0–2
	desert globemallow	SPAM2	<i>Sphaeralcea ambigua</i>	0–5	0–1
	desert calico	LOMA10	<i>Loeseliastrum matthewsii</i>	0–2	0–1
4	<b>Non-native annual forbs</b>			0–84	
	redstem stork's bill	ERCI6	<i>Erodium cicutarium</i>	0–84	0–15
<b>Grass/Grasslike</b>					
3	<b>Non-native annual grasses</b>			0–20	
	red brome	BRRU2	<i>Bromus rubens</i>	0–30	0–5
	common Mediterranean grass	SCBA	<i>Schismus barbatus</i>	0–1	0–1

## Animal community

This community is dominated by creosote bush and burrobush which are very important shrubs for burrowing animals since it provides good burrowing in and around the root-mounds. The shrub cover here is moderate to low, providing some cover from predators. The high production of annual forbs in good rain years provides good forage for all small mammals and rodents.

## Recreational uses

This site is highly valued for open space and those interested in desert ecology. Desert tortoise, annual wildflowers and shrubs may also attract visitors during the spring months.

## Other products

Creosote bush is an important medicinal plant for Native Americans. It has a very wide range of uses from treatment for consumption, bowel complaints, and menstrual cramps, to induce vomiting, relief for arthritis, rheumatism, aching bones and sprains, congestion and cold, as an antiseptic and disinfectant, dandruff, antispasmodic, to induce urination, gonorrhea, and to cancer treatment. (This list is not exhaustive).

<http://herb.umd.umich.edu/herb/search.pl?searchstring=Larrea+tridentata>.

Creosote bush stems are used to make weapons, digging tools, and basket handles, and creosote gum is used for knife and awl handles. Creosote bush branches are used as thatch in dwelling construction.

<http://herb.umd.umich.edu/herb/search.pl?searchstring=Larrea+tridentata>.

## Inventory data references

CA794 Ipi and production plots 2010:

WAWA01

COWE06

POWA10

## Type locality

Location 1: San Bernardino County, CA	
UTM zone	N
UTM northing	3817866
UTM easting	523603
Latitude	4° 9' 21"
Longitude	88° 22' 17"
General legal description	This site is located in Johnson Valley Off-Highway Vehicle Area about 2-3 miles south of the powerline road on a perpendicular route leading to Soggy Dry Lake.

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## **Contributors**

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## 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)	
Contact for lead author	
Date	
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

### Indicators

1. **Number and extent of rills:**

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2. **Presence of water flow patterns:**

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3. **Number and height of erosional pedestals or terracettes:**

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

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5. **Number of gullies and erosion associated with gullies:**

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6. **Extent of wind scoured, blowouts and/or depositional areas:**

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7. **Amount of litter movement (describe size and distance expected to travel):**

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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):**

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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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):**

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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:

Sub-dominant:

Other:

Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth ( in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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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:**

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17. **Perennial plant reproductive capability:**

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