Ecological site R040XD006CA
Hyper-Arid Abandoned Fans 2-4" 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): 040X–Sonoran Basin and Range

MLRA Description:
Major land resource area (MLRA) 31 is the Lower Colorado Desert. This area is in the extreme southeastern part of California, in areas along the Colorado River, and in Western Arizona. The area is comprised of rough, barren, steep, and strongly dissected mountain ranges, generally northwest to southwest trending that are separated by intermontane basins. Elevation ranges from approximately 275 feet below sea level at the lowest point in the Salton Trough to 2700 feet along low northwest to southeast trending mountain ranges. The average annual precipitation is 2 to 6 inches with high temporal and spatial variability. Winter temperatures are mild, summer temperatures are hot, and seasonal and diurnal temperature fluctuations are large. Monthly minimum temperature averages range from 40 to 80 degrees F (4 to 27 degrees C). Monthly maximum temperature averages range from 65 to 110 degrees F (18 to 43 degrees C) (WRCC 2002). Temperatures are rarely below 28 degrees F, and extremely rarely fall below 24 degrees F. Precipitation is bimodal, with approximately 20 to 40 percent of annual precipitation falling between July and September. This summer rainfall, in combination with very hot temperatures and very few to no days of hard freeze are what characterize this MLRA and distinguish it from the Mojave Desert (MLRA 30).

XD LRU concept:

The XD LRU is an extremely hot and dry portion of the MLRA. Mean annual precipitation is about 4 inches or less where the majority of the precipitation can arrive in only a couple storm events during any given year. The very few hard freezing days allows this region to have Plant Hardiness Zones of 9b or warmer. This LRU covers most of the Lower Colorado Desert except elevations above 500 m where Plant Hardiness Zones are less than 9b.

Classification relationships

Mojave Creosote Bush (Holland, 1986).
Larrea tridentata Shrubland Alliance (Sawyer et al. 2009).

Ecological site concept

This ecological site occurs on gently sloping fan remnants, alluvial fans, and inset fans at elevations of 440 to 1770 feet. The soils associated with this ecological site are generally very deep, well to somewhat excessively drained soils. A hyperthermic, very arid climate with stable landforms and deep soils with minimal additional run-on drives the vegetation community of this ecological site.

Production reference value (RV) is 62 pounds per acre, and depending on precipitation and annual forb production, ranges from 25 to 169 pounds per acre. The reference plant community is dominated almost entirely by creosote bush (Larrea tridentata); this deep-rooted species is the only shrub capable of tolerating the extremely arid conditions of this site. White ratany (Krameria grayi), burrobush (Ambrosia dumosa), and big galleta (Pleuraphis rigida) may be present as very minor species. Annual forbs contribute 20 to 40 percent of annual production during year of average to above average precipitation.

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).

This description was copied from and is equivalent to R031XY006CA. There is ongoing LRU concept development and designation where a request was made by the Region 8 Ecological Site Specialist to avoid using the default XY LRU.

Associated sites

R040XD009CA	**Gravelly Fan Remnants And Fan Aprons** This ecological site occurs on stony fan remnants. Creosote bush (Larrea tridentata) and Schott's dalea (Psorothamnus schottii) are dominant.
R040XD015CA	**Limy 4-6" p.z.** This site occurs on adjacent alluvial fans that receive significantly higher runoff. Creosote bush (Larrea tridentata) and burrobush (Ambrosia dumosa) are dominant.
R040XD200CA	**Rarely Flooded Fans** This ecological site occurs on fan aprons that receive greater moisture. Creosote bush (Larrea tridentata) and brittlebush (Encelia farinosa) are dominant.

Similar sites

R040XD015CA	**Limy 4-6" p.z.** This ecological site receives more moisture, has much higher production, and burrobush (Ambrosia dumosa) is co-dominant with creosote bush (Larrea tridentata).
R040XD009CA	**Gravelly Fan Remnants And Fan Aprons** This ecological site occurs on stony fan remnants. High surface rock fragment cover increases run-on. Production is higher, and Schott's dalea (Psorothamnus schottii) is co-dominant with creosote bush (Larrea tridentata).

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Larrea tridentata*
Herbaceous	(1) *Plantago ovata*

Physiographic features

This site occurs on fan remnants, alluvial fans, and inset fans. Slopes range from 0 to 15 percent, but slopes of 2 to 8 percent are more common. Elevations range from 440 to 1770 feet.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Fan remnant (3) Inset fan
Flooding duration	Extremely brief (0.1 to 4 hours)
Flooding frequency	None to very rare
Elevation	134–539 m
Slope	0–15%
Aspect	Aspect is not a significant factor

Climatic features

The Colorado Desert of California represents the northwesternmost portion of the Sonoran Desert. The subtropical Colorado Desert results from the descent of cold air which is heated by compression and arrives hot and dry at the earth's surface. Precipitation is frontal in nature during the winter and convectional in the summer. Reduced summer rainfall and high potential evapotranspiration make the Colorado Desert one of the most arid regions in North America. Summer temperatures frequently exceed 105 degrees F. The average annual precipitation ranges from 2 to 6 inches with most falling as rain. Snowfall is rare. Approximately 35% of the annual precipitation occurs from July to September as a result of intense convection storms. Spring months are the windiest.

Table 3. Representative climatic features

Frost-free period (average)	365 days
Freeze-free period (average)	365 days
Precipitation total (average)	152 mm

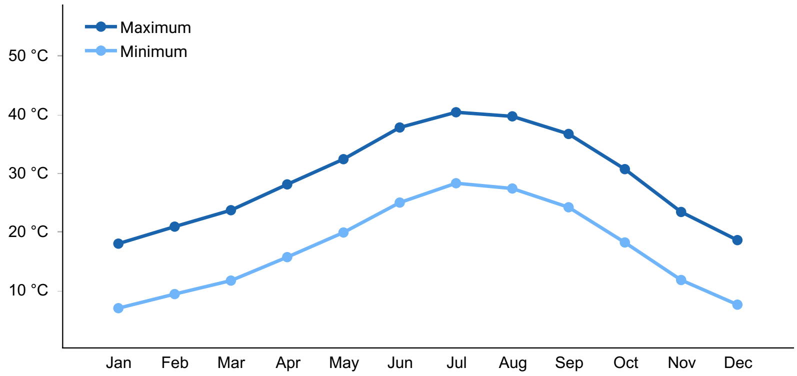

Figure 1. Monthly average minimum and maximum temperature

Influencing water features

Soil features

The soils associated with this ecological site are generally very deep, well to somewhat excessively drained, nad formed in alluvium from granitoid or igneous and metamorphic rock. They typically have calcic horizons and/or argillic horizons, but may be weakly developed sandy-skeletal soils. Surface textures include non-gravelly to very gravelly fine sandy loam, sandy loam, loamy sand, loam, or loamy coarse sand. Subsurface textures are most commonly gravelly to very gravelly sandy loams, but may be non-gravelly to extremely gravelly loams, clay loam, loamy coarse sand, or sandy loam. Surface gravels (< 3 mm in diameter) range from 35 to 95 percent, and larger fragments range from 0 to 15 percent. Subsurface gravels by volume (for a depth of 0 to 59 inches) range from 3 to 80 percent and larger fragments by volume range from 0 to 15 percent.

This ecological site is associated with the following soil components: Catfishbay (coarse-loamy, mixed, superactive, hyperthermic Typic Calciargids), Chemeheuvi (loamy-skeletal, mixed, superactive, hyperthermic Typic Haplocalcids), Chemwash (sandy-skeletal, mixed, hyperthermic Typic Torriorthents), Garywash (coarse-loamy, mixed, superactive, hyperthermic Typic Haplocalcid), Havasulake (loamy-skeletal, mixed, superactive, hyperthermic Typic Calciargids), Rizzo (sandy-skeletal, mixed, hyperthermic Typic Torriorthents), roostertail (loamy-skeletal, mixed, superactive, hyperthermic Duric Petroargids), and Snaggletooth (fine-loamy, mixed, superactive, hyperthermic Typic Calciargids).

The Catfishbay, Garywash, Havasulake, Roostertail, and Snaggletooth soils are very deep soils with calcic horizons. The Catfishbay, Havasulake, and Snaggletooth soils also have argillic horizons, and have loam and clay loam subsurface textures. The Roostertail soils have a duripan at 59 inches. The Garywash soils have relatively high salt and sodium accumulation. The Chemwash and Rizzo soils have little horizon development and differ in the size of gravels.

This ecological site is correlated with the following map units and major soil components in the Colorado Desert

Area Soil Survey (CA803):

Mapunit; Mapunit name; Component; Phase; Percent
2001; Emptygun-Chemehuevi association, 2 to 30 percent slopes;Chemehuevi;; 30
2010; Chemehuevi-Rizzo-Emptygun complex, 2 to 30 percent slopes;Chemehuevi;; 35
2030; Garywash gravelly fine sandy loam, 4 to 15 percent slopes; Garywash;; 85
2031; Garywash-Chemehuevi complex, 2 to 8 percent slopes; 2031; Garywash-Chemehuevi complex, 2 to 8 percent slopes; Garywash; sandy substratum; 60 and
Chemehuevi; stony; 25
2400; Rizzo-Chemwash association, 2 to 8 percent slopes; Chemwash;; 35
2401; Rizzo-Chemwash association, eroded, 2 to 8 percent slopes;Chemwash;; 25
2050; Havasulake-Rizzo association, 1 to 8 percent slopes; Havasulake; eroded; 40
2055; Catfishbay association, 0 to 8 percent slopes; Catfishbay; ; 55 and Catfishbay; moderately sloping; 35
2056; Catfishbay loamy fine sand, 4 to 15 percent slopes; Catfishbay ;moderately sloping; 85

This ecological site is associated with an additional 21 minor components of the same soil series listed above in the Colorado Desert Soil Survey Area.

This ecological site is correlated with the following map units and soil components in the Joshua Tree National Park Soil Survey (CA794):

Mapunit; Mapunit name; Component; Phase; Percent
2091; Deprave-Roostertail association, 0 to 4 percent slopes; Roostertail;; 15
2120; Rizzo-Deprave complex, 2 to 8 percent slopes; Rizzo; very rarely flooded; 10
2402; Rizzo-Rizzo, frequently flooded complex, 2 to 8 percent slopes; Catfishbay;; 1

Table 4. Representative soil features

Surface texture	(1) Gravelly sand (2) Very gravelly sandy loam (3) Gravelly loamy sand
Family particle size	(1) Sandy
Drainage class	Well drained to excessively drained
Permeability class	Slow to moderately rapid
Soil depth	142 cm
Surface fragment cover <=3"	35–95%
Surface fragment cover >3"	0–15%
Available water capacity (0-101.6cm)	2.03–14.73 cm
Calcium carbonate equivalent (0-101.6cm)	1–35%
Electrical conductivity (0-101.6cm)	0–16 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–12
Soil reaction (1:1 water) (0-101.6cm)	6.8–9
Subsurface fragment volume <=3" (Depth not specified)	3–80%
Subsurface fragment volume >3" (Depth not specified)	0–15%

Ecological dynamics

Abiotic Factors

This ecological site occurs on gently sloping fan remnants, alluvial fans, and inset fans at elevations of 440 to 1770 feet. The soils associated with this ecological site are generally very deep, well to somewhat excessively drained soils. Soils typically have calcic horizons and/or argillic horizons. A hyperthermic climate with deep to very deep? (aren't some loamy?) soils with no additional run-on from sheet flooding drives the vegetation community of this ecological site. The deep-rooted creosote bush is the only shrub capable of tolerating the extremely arid conditions of this site.

Creosote bush 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). Where soil temperature regimes are thermic (above approximately 2800 feet) and soil moisture availability is higher, shrub production, cover, density and diversity are higher (Bedford et al. 2009). Where the soil temperature regime is hyperthermic and moisture becomes more limiting such as this ecological site, shrub production, cover, density and diversity decline. When soil moisture become even more limiting, due to factors such as very low elevations and hot temperatures, absence of sheet-flow, restrictive surface cover such as desert pavement, or the presence of subsurface horizons that limit infiltration, the shrub community typically becomes even sparser, and is restricted to widely spaced, small creosote bush.

Disturbance dynamics

The primary disturbances influencing this ecological site are drought and invasion by non-native annual plants. 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). At lower elevations, where soil temperature regimes are hyperthermic and soil moisture is more limiting, Mediterranean grass is the dominant non-native grass (Brooks and Berry 2006). 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). However, the low potential for high biomass of annual species limits the continuity of fine fuels in this site, and means that this site is very unlikely to burn.

State and transition model

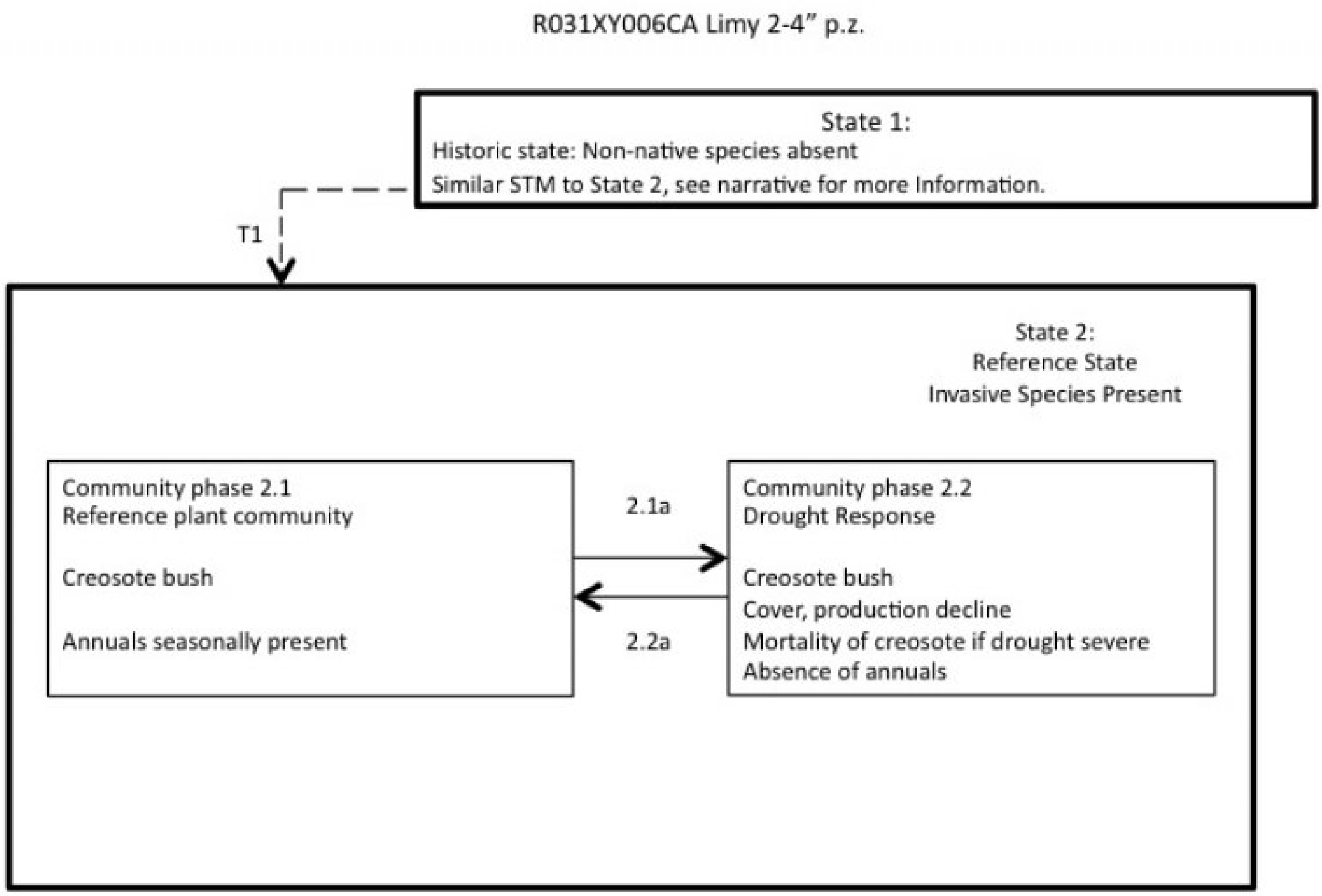

Figure 2. R031XY006CA

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 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 3. Community Phase 2.1

Figure 4. Community Phase 2.1

The reference plant community is dominated almost entirely by creosote bush. White ratany, burrobush, and big galleta may be present as very minor species. Annual forbs may contribute 20 to 40 percent of annual production during year of average to above average precipitation. Common species include desert Indianwheat (*Plantago ovata*), pincushion flower (*Chaenactis fremontii*), and cryptantha species (Cryptantha). This site can sometimes appear like a young desert patina, which is what it may become if the site continues to remain stable for many years.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	28	56	109
Forb	–	13	78
Grass/Grasslike	–	–	2
Total	**28**	**69**	**189**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	2-10%
Grass/grasslike foliar cover	0-5%
Forb foliar cover	5-25%
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	7-10%
Grass/grasslike basal cover	0%
Forb basal cover	2-10%
Non-vascular plants	0%
Biological crusts	0-1%
Litter	5-7%
Surface fragments >0.25" and <=3"	70-80%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	5-7%

Table 8. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	–	0-3%	5-25%
>0.15 <= 0.3	–	–	–	–
>0.3 <= 0.6	–	2-3%	–	–
>0.6 <= 1.4	–	–	–	–
>1.4 <= 4	–	7-10%	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

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 creosote bush and white ratany, mortality of burrobush and big galleta, and lack of emergence of annual forbs. 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.

Pathway 2.1a
Community 2.1 to 2.2

This pathway occurs with prolonged or severe drought.

Pathway 2.2a
Community 2.2 to 2.1

This pathway occurs with time and a return to average or above average climatic conditions.

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 Southwest 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).

Additional community tables

Table 9. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
1	**Native shrubs**			28–109	
	creosote bush	LATR2	*Larrea tridentata*	11–109	2–5
	white ratany	KRGR	*Krameria grayi*	0–11	0–1
	burrobush	AMDU2	*Ambrosia dumosa*	0–6	0–1
	teddybear cholla	CYBI9	*Cylindropuntia bigelovii*	0–2	0–1
Forb					
2	**Forbs**			0–78	
	pincushion flower	CHFR	*Chaenactis fremontii*	0–43	0–15
	desert Indianwheat	PLOV	*Plantago ovata*	0–22	0–13
	cryptantha	CRYPT	*Cryptantha*	0–13	0–1
Grass/Grasslike					
3	**Annual Grass**			0–1	
	sixweeks threeawn	ARAD	*Aristida adscensionis*	0–1	0–1
4	**Perennial Grass**			0–1	
	big galleta	PLRI3	*Pleuraphis rigida*	0–1	0

Animal community

This ecological site provides critical habitat for the threatened desert tortoise (Gopherus agassizii agassizii). Creosote bush shrublands provides a home for an abundance of specialist insect species, for example, creosote bush flowers provide nutrition for over twenty species of bees, and the creosote bush grasshopper (Bootettix argentatus) feeds solely on creosote leaves (Pavlik 2008).

Recreational uses

This site is highly valued for open space and those interested in desert ecology. Uses include mountain biking, hiking, bird watching and botanizing. Desert tortoise and annual wildflowers may also attract visitors during the spring.

Other information

Creosote bush is an important medicinal plant for Native Americans. It has a very wide range of uses from treatment for consumption, bowl 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 Range Inventory Plots:

1248014701
AM054
EOVP-07

Type locality

Location 1: San Bernardino County, CA	
UTM zone	N
UTM northing	3815268
UTM easting	728762
Latitude	34° 27′ 13″
Longitude	114° 30′ 35″
General legal description	The type locality for Limy 2-4 is located several miles south of Lake Havasu rd. on the Needles-Parker trail (dirt), in the Chemehuevi Wash OHV area.

Other references

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Approval

Scott Woodall, 2/08/2019

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; Dustin Detweiler
Contact for lead author	State Rangeland Management Specialist
Date	07/14/2009
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills are none to rare. Rock fragments armor the soil surface against erosion.

2. **Presence of water flow patterns:** Water flow patterns are none to few. This is an abandoned alluvial fan which no longer receives sheet flow from higher elevations. Any water flow patterns which may develop are dependent on the very little bit of on-site precipitation this site may receive. Also, rock fragments armor the soils and prevent water flow patterns from developing.

3. **Number and height of erosional pedestals or terracettes:** Pedestals and terracettes are none.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is variable (5-10%) depending on surface rock fragments.

5. **Number of gullies and erosion associated with gullies:** These site is usually on small relict fans which stand up above active alluvial fans. There should be no gullies on this site, however; channel avulsion and head ward erosion from nearby washes could lead to the formation of gullies (or wash expansion) on this site.

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

7. **Amount of litter movement (describe size and distance expected to travel):** Litter typically remains in place or is trapped under the first plant encountered. Persistent litter (large woody material) will remain in place except during large rainfall 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 3 to 6 on most soil textures and varies depending on canopy cover.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface structure is typically medium to thick platy or weak fine granular. Soil surface colors are light and the soils have 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 break raindrop impact.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. Subangular blocky structure, or massive or calcic sub-surface 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: Creosotebush

    Sub-dominant: annual forbs > desert shrubs > perennial and annual grasses

    Other:

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Dead branches within individual shrubs are common and standing dead shrub canopy material may be as much as 25% of total woody canopy.

14. **Average percent litter cover (%) and depth (in):** Litter is concentrated under shrubs and generally stays in place.

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** For normal or average growing season ~60 lbs/ac

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** Red brome, red-stem filaree, mustards, and Mediterranean grass are invaders on this site.

17. **Perennial plant reproductive capability:** All functional groups should reproduce in normal and above-normal rainfall years.