Ecological site R030XD039CA
Coarse Gravelly Fans

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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

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 Land Resource Unit (designated by ‘XD’) is found on the eastern side of California. Elevations range from 400 to 2200 feet on average, but may be found up to 3600 feet on southern exposures. Precipitation ranges from 1 to 6 inches per year, but averages between 2-4 inches. This LRU is characterized primarily by the extreme aridity, hot temperatures, hyperthermic soil temperatures and low stature of widely spaced vegetation. Temperatures can reach over 110 degrees Fahrenheit for several weeks in July and August. Summer precipitation falls between July and September, ranging from 20-33% in the form of rain, and winter precipitation falls starting in November and ends between February and March, ranging from 56-70%, also mostly in the form of rain. Vegetation is primarily small, widely-spaced, low-producing creosote bush (Larrea tridentata), burrobush (Ambrosia dumosa), and brittlebush (Encelia farinosa). Ecological Site Concept – This ecological site occurs on fan aprons, alluvial fans, and fan remnants at elevations of 560 to 3610 feet. Soils are very deep, and typically have a high cover of surface gravels and cobbles, and have gravelly to extremely gravelly subsurface textures. This site typically has a very rare surface flooding regime. This ecological site occurs at the southern edge of the Mojave Desert (the Mojave Desert – Sonoran Desert or MLRA30 – 31 boundary). Thus, it represents a transition from a warm desert where winter precipitation is dominant, to a hot desert where summer precipitation is much more significant and frosts are rare. Production reference value (RV) is 186 pounds per acre, and ranges from 120 to 318 pounds per acre depending on annual precipitation. The site is dominated by creosote bush (Larrea tridentata), and brittlebush (Encelia farinosa). A hyperthermic climate with low frost prevalence, deep gravelly soils, and a very rare surface flooding regime drives the vegetation community of this ecological site. Water rapidly permeates through coarse soils to deep soil layers in this hyperthermic climate. The deep-rooted, evergreen, creosote bush accesses deep water while extreme aridity at near surface depths, very rare flooding and low incidence of frost promotes dominance by the brittlebush. The data in the following sections is from major (15% of map unit or greater) components only.

Classification relationships

Encelia farinosa Association of the Encelia farinosa shrubland alliance (Sawyer et al. 2009).

Associated sites

R030XD003CA	**Hyperthermic Steep South Slopes** This ecological site is found on adjacent south-facing mountain and hill slopes. Brittlebush (Encelia farinosa) is dominant.
R030XD006CA	**Abandoned Fan** This ecological site occurs on adjacent fan aprons. Creosote bush (Larrea tridentata) is dominant.

R030XD040CA	**Hyperthermic Steep North Slopes** This ecological site occurs on adjacent north-facing mountain slopes. Burrobush (Ambrosia dumosa) is dominant with a diverse secondary shrub community.
R030XY092NV	**DESERT PATINA** This ecological site occurs on adjacent flat fan remnants with a desert pavement surface. Vegetation is very sparse, and dominated by creosote bush (Larrea tridentata).
R030XY128CA	**Broad, Gravelly, Hyperthermic Ephemeral Stream** This ecological site occurs in medium-sized drainageways adjacent to this site. Desert lavender (Hyptis emoryi), creosote bush (Larrea tridentata) and burrobrush (Hymenoclea salsola) are dominant species.

Similar sites

R030XD041CA	**Channeled Warm Alluvial Fans** This ecological site occurs on soils with lower rock fragment cover on the soil surface and volume in the soil profile. Burrobush (Ambrosia dumosa) is co-dominant with creosote bush (Larrea tridenta).
R030XD003CA	**Hyperthermic Steep South Slopes** This ecological site occurs on mountain and hill slopes. Shrub diversity is lower, and brittlebush (Encelia farinosa) is strongly dominant.
R030XD006CA	**Abandoned Fan** This ecological site occurs on fan aprons receiving much less additional moisture. Creosote bush (Larrea tridentata) is dominant.
R030XD015CA	**Hyper-Arid Fans** This ecological site occurs on soils receiving less additional moisture. Brittlebush (Encelia farinosa) is trace if present, and burrobush (Ambrosia dumosa) is co-dominant with creosote bush (Larrea tridentata).

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Larrea tridentata* (2) *Encelia farinosa*
Herbaceous	Not specified

Physiographic features

This ecological site occurs on alluvial fans, fan aprons and fan remnants at elevations of 560 to 3610 feet, and slopes ranging from 2 to 15 percent. Flooding frequency (sheet flow) is none to very rare, and is extremely brief in duration. Runoff class is very low to low.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Fan apron (3) Fan remnant
Flooding duration	Extremely brief (0.1 to 4 hours)
Flooding frequency	Very rare
Ponding frequency	None
Elevation	170 – 1,100 m
Slope	0 – 20 %
Aspect	Aspect is not a significant factor

Climatic features

The climate of this ecological site is characterized by hot temperatures, aridity, and a bimodal precipitation pattern. Precipitation falls as rain, with 30 percent falling in summer between July and October, and 65 percent falling in winter between November and March. The mean annual precipitation is 3 to 5 inches and mean annual air temperature is 68 to 73 degrees F. The frost free period is 300 to 340 days.

Maximum and minimum monthly climate data for this ESD were generated by the Climate Summarizer (http://www.nm.nrcs.usda.gov/technical/handbooks/nrph/Climate_Summarizer.xls) using data from the following climate stations (results are unweighted averages):

42598, Eagle Mountain, CA (Period of record = 1933 to 2011) [1]

43855, Hayfield Reservoir, CA (Period of record = 1933 to 2011) [1]

049099, Twentynine Palms, California (Period of record = 1935 to 2011) [1]

The data from multiple weather were combined to most accurately reflect the climatic conditions of this ecological site.

Table 3 Representative climatic features

Frost-free period (average)	340 days
Freeze-free period (average)	
Precipitation total (average)	130 mm

Influencing water features

Soil features

The soils associated with this ecological site are very deep, well to excessively drained, and formed in alluvium from granitoid, gneissic and igneous sources. Surface textures include loamy sand, fine sandy loam and very gravelly sandy loam with gravelly sand to extremely gravelly sand surbsurface textures, or gravelly and very gravelly sandy loam textures on stable fan remnants. Surface gravels (3 mm in diameter) range from 35 to 65 percent, and larger fragments range from 2 to 28 percent. Subsurface gravels by volume (for a depth of 0 to 59 inches) range from 3 to 50 percent and larger fragments by volume range from 0 to 25 percent.

This ecological site is associated with the Pintobasin soils (mixed, hyperthermic Typic Torripsamments); Carrizo soils (sandy-skeletal, mixed, hyperthermic Typic Torriorthents); and Rubylee (coarse-loamy, mixed, superactive, hyperthermic Typic Haplargids).

The Pintobasin and Carrizo soils are the soils most frequently associated with this ecological site. These soils are composed of stratified layers of very deep sands with little horizon development. The Carrizo soils have coarsetextures and are sandy-skeletal in the particle size control section while Pintobasin soils are sandy throughout. The Rubylee soils have an argillic horizon beginning at 3 inches below the surface. These soils typically have a desert pavement surface, but do not when associated with this ecological site.

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

1527;Pintobasin gravelly loamy fine sand, 4 to 15 percent slopes;Pintobasin;90
2111;Descent-Rubylee association, 8 to 50 percent slopes;Rubylee;very rarely flooded;40
1540;Carrizo-Russiroks complex, 2 to 8 percent slopes;Carrizo;very rarely flooded;35
1542;Carrizo complex, 4 to 15 percent slopes;Carrizo;very rarely flooded;70; Carrizo;steep;6; Pintobasin;1
2077;Oldale-Carrizo association, 2 to 8 percent slopes;Carrizo;very rarely flooded;15
1250;Ironlung-Rock outcrop complex, 30 to 75 percent slopes;Pintobasin;steep;1
1255;Goldenhills-Bulletproof-Fanhill-Whiterobe complex, 30 to 75 percent slopes;Rubylee;very rarely flooded;1

Table 4. Representative soil features

Parent material	(1) Alluvium – granite
Surface texture	(1) Very gravelly sandy loam (2) Sandy loam (3) Loamy sand
Family particle size	(1) Sandy
Drainage class	Well drained to excessively drained
Permeability class	Moderately rapid to rapid
Soil depth	150 cm
Surface fragment cover <=3"	40 – 70 %
Surface fragment cover >3"	0 – 30 %
Available water capacity (0-101.6cm)	2.54 – 9.14 cm

Calcium carbonate equivalent (0-101.6cm)	0 – 10 %
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	Not specified
Soil reaction (1:1 water) (0-101.6cm)	6.1 – 10
Subsurface fragment volume <=3" (Depth not specified)	0 – 50 %
Subsurface fragment volume >3" (Depth not specified)	0 – 30 %

Ecological dynamics

Abiotic Factors

The abiotic factors driving this site are very deep, coarse textured soils, hyperthermic soil temperatures, and a very rare surface flooding regime. This ecological site occurs on fan aprons, alluvial fans, and fan remnants, at elevations of 560 to 3610 feet. Soils are very deep, and have a high cover of surface gravels and cobbles, and gravelly to extremely gravelly subsurface textures. This site typically has a very rare surface flooding regime. This ecological site occurs at the southern edge of the Mojave Desert (the Mojave Desert -Lower Colorado Desert or MLRA30-31 boundary). Thus, it represents a transition from a warm desert where winter precipitation is dominant, to a hot desert where summer precipitation is much more significant, and frosts are rare. A hyperthermic climate with low frost prevalence, gravelly soils, and a very rare surface flooding regime drives the vegetation community of this ecological site. Very deep, coarse-textured soils and hyperthermic soil temperatures favor dominance by the deep-rooted creosote bush, while additional run-on and an arid climate with low frost pravelence supports dominance by brittlebush.

The soils associated with this ecological site are composed of stratified layers of gravelly to extremely gravelly sands. In the hyperthermic environment of this ecological site, water drains rapidly through these coarse gravelly soils, with minimal loss due to run-off and evaporation (Noy-Meir 1973, Austin et al. 2004). This results in greater water availability at deep depths, but little at near surface depths. Deep, free-draining soils promote dominance by the deep-rooted, long-lived evergreen creosote bush, which accesses deep water (McAuliffe 1994, Hamerlynk et al. 2002, Hamerlynk and McAuliffe 2008). Extreme aridity at near surface levels promotes dominance by brittlebush. Brittlebush is an extremely drought-tolerant, drought-deciduous shrub. Adaptations in degree of leaf pubescence and leaf size allow brittlebush to occupy sites ranging from relatively mesic coastal environments to extremely arid deserts (Ehleringer and Cook 1990, Sandquist and Ehleringer 1997, Housman et al. 2002, Sandquist and Ehleringer 2003). Throughout its range, brittlebush is most abundant on extremely arid topographical positions, such as steep south-facing slopes (McAuliffe and Devender 1998, Martre et al. 2002). While leaf and shoot-adaptations allow brittlebush to withstand hot temperatures and extreme aridity, freezing temperatures restrict brittlebush. Frosts cause branch die-back and mortality in adult brittlebush (Sandquist and Ehleringer 1996), and reduce seedling establishment (Bowers 1994). The rare occurrence of frost in this ecological site also promotes dominance by brittlebush. Very rare sheet flow provides additional moisture and provides soil disturbance, which provides opportunities for establishment of brittlebush.

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 and Colorado 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), common Mediterranean grass (Schismus barbatus), redstem stork's bill (Erodium cicutarium) and Asian mustard (Brassica tournefortii) have become naturalized throughout the Mojave and Colorado Deserts over the past century (Rickard and Beatley 1965, D'Antonio and Vitousek 1992, Brooks 1999, Reid et al. 2006, Norton et al. 2007). In lower elevations, where soil temperature regimes are hyperthermic and soil moisture is more limiting, Common 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). 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). In the Colorado Desert, brittlebush quickly becomes dominant after fire in creosote bush dominated communities, and severe or repeated fire may lead to an altered, brittlebush dominated state (Brown and Minnich 1986, Steers and Allen 2011).

State and transition model

Figure 3. R030XD039CA

Additional community tables

Table 5. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Shrub/Vine					
1	**Native shrubs**			135-267	
	brittlebush	ENFA	*Encelia farinosa*	20-213	4-15
	creosote bush	LATR2	*Larrea tridentata*	34-146	3-6
	burrobush	AMDU2	*Ambrosia dumosa*	0-56	0-4
	California barrel cactus	FECY	*Ferocactus cylindraceus*	0-34	0-1
	California fagonbush	FALA	*Fagonia laevis*	0-20	0-1
	teddybear cholla	CYBI9	*Cylindropuntia bigelovii*	0-7	0-1
	Wiggins' cholla	CYEC3	*Cylindropuntia echinocarpa*	0-4	0-1
	desert lavender	HYEM	*Hyptis emoryi*	0-3	0-1
	Schott's dalea	PSSC5	*Psorothamnus schottii*	0-3	0-1
Forb					
2	**Native forbs**			0-78	
	pincushion flower	CHFR	*Chaenactis fremontii*	0-34	0-2
	cryptantha	CRYPT	*Cryptantha*	0-7	0-9
	desert Indianwheat	PLOV	*Plantago ovata*	0-6	0-15
4	**Non-native annual forbs**			0-1	
	Asian mustard	BRTO	*Brassica tournefortii*	0-1	0-1
Grass/Grasslike					
3	**Native grasses**			0-1	
	low woollygrass	DAPU7	*Dasyochloa pulchella*	0-1	0-1
5	**Non-native annual grass**			0-11	
	Mediterranean grass	SCHIS	*Schismus*	0-11	0-1

Table 6. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 7. Community 2.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 8. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Animal community

This ecological site is preferred 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). This ecological site provides habitat for many reptiles and mammals. Brittlebush is used as forage by desert bighorn sheep and mule deer.

Recreational uses

This ecological site may be used for cross-country hiking and aesthetic enjoyment.

Other products

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. Brittlebush has medicinal uses for Native Americans, including as a poultice for pain and for toothaches. Brittlebush resin is used as chewing gum, to fasten arrow points to twigs, to waterproof water bottles, and is melted to make a varnish. Brittlebush twigs were used as kindling for quick fires. http://herb.umd.umich.edu/herb/search.pl?searchstring=Encelia+farinosa. Brittlebush resin is burned as incense in churches in Mexico (Tesky 1993).

Inventory data references

The following NRCS plots were used to describe this site: Community Phase 2.1: FANHILL-1 (Type location) 011211-01 124972056B I5-B J5-G

Type locality

Location 1: Riverside County, CA	
UTM zone	N
UTM northing	3750111
UTM easting	569110
General legal description	The type location is just inside the southern boundary of Joshua Tree National Park, approximately 0.14 mile north of Thousand Palms Canyon Road, approximately 3 miles from the intersection of Dillon Road and Thousand Palms Canyon Road.

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Contributors

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Approval

Kendra Moseley, 10/21/2024

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	08/31/2026
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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

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

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

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

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

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

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

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

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

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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:

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

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

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

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:**

17. **Perennial plant reproductive capability:**