

Ecological site R040XD200CA

Rarely Flooded 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): 040X–Sonoran Basin and Range

MLRA Statement: 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).

Ecological site concept

This ecological site occurs on very rarely flooded to rarely flooded fan aprons and alluvial fans at elevations of 540 to 2730 feet. Soils are very deep and sandy. Production reference value (RV) is 218 pounds per acre and ranges from 100 to 396 pounds per acre depending on annual precipitation and annual forb production. Brittlebush and creosote bush are dominant. 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).

Associated sites

R040XD030CA	Extremely Stony Fan Remnants This ecological site is on extremely stony fan remnants, near the mountain base. Teddybear cholla and a diversity of cacti and shrubs, including creosote bush and brittlebush.
R040XD034CA	Gravelly, Braided, Ephemeral Stream This ephemeral stream is on frequently to occasionally flooded braided drainageways and channels. Burrobrush and desert lavender are dominant with a diversity of other species.
R040XD201CA	Cobbly Fan Remnants This ecological site is on fan remnants with stony surfaces. Creosote bush and brittlebush are dominant, with several cacti species.

R040XD202CA	Stony, Occasionally Flooded Ephemeral Stream This ephemeral stream occurs on occasionally flooded, stony, inset fans, with blue paloverde, brittlebush, creosote bush, and Schott's dalea present.
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Similar sites

R040XD201CA	Cobbly Fan Remnants This ecological site is also dominated by creosote bush and brittlebush, but it is on more stable fan remnants with stony surfaces, and more cacti diversity.
R040XD005CA	Hyper-Arid Active Alluvial Fans 2-4" p.z. This ecological site has a little more active drainage and flow patterns and does not have a significant presence of brittlebush.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Larrea tridentata</i> (2) <i>Encelia farinosa</i>
Herbaceous	Not specified

Physiographic features

This ecological site occurs on fan aprons, alluvial fans, and rarely on bars in drainageways. Elevations range from 540 feet to 2730 feet, with slopes ranging from 2 to 8 percent.

Table 2. Representative physiographic features

Landforms	(1) Fan apron (2) Alluvial fan
Flooding duration	Extremely brief (0.1 to 4 hours) to very brief (4 to 48 hours)
Flooding frequency	None to rare
Ponding frequency	None
Elevation	170 – 830 m
Slope	0 – 10 %

Aspect	Aspect is not a significant factor
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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 60 percent falling in winter between November and March. The mean annual precipitation is 2 to 4 inches, and mean annual air temperature is 73 to 79 degrees F. The frost free period is 360 to 365 days, and freeze free period is 363 to 365 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 weighted averages; numbers in square brackets represent relative weights):

42598, Eagle Mountain, CA (Period of record = 1933 to 2011) [2]

43855, Hayfield Reservoir, CA (Period of record = 1933 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)	370 days
Freeze-free period (average)	370 days
Precipitation total (average)	100 mm

Influencing water features

Soil features

The soils associated with this ecological site are very deep, somewhat excessively to excessively drained, and formed in alluvium from igneous or metamorphic parent material. The surface textures are gravelly loamy sand, gravelly sand, gravelly loamy fine sand, and loamy fine sand. Subsurface horizons are composed of sand, loamy sand and coarse sand with non-gravelly to extremely gravelly (Rizzo) modifiers. Surface rock fragments less than 3 inches in diameter range from 55 to 80 percent cover, and fragments greater than 3 inches range from 0 to 15 percent cover (up to 30 percent on outlier soil). Subsurface percent by volume of rock fragments less than 3 inches (at depths of 1 to 59 inches) ranges from 20 to 46, and greater than 3 inch fragments range from 0 to 14.

This ecological site is associated with the following major soil components (greater than 15 percent of mapunit) : Carsitas, Goldrose and Rizzo. The Carsitas soils are mixed, hyperthermic Typic Torripsammets. The Goldrose soils are sandy, mixed, hyperthermic Typic Torriorthents. The Rizzo soils are sandy-skeletal, mixed, hyperthermic Typic Torriorthents. The Carsitas soils have two C horizons composed of gravelly sand from 0 to 10 inches and gravelly coarse sand below 10 inches. The Goldrose soils have only one thick layer with greater than 35 percent rock fragments, and have stronger structure in a Bw horizon than is found in adjacent soils. The Rizzo soils have greater than 35 percent rock fragments in the particle control section.

Minor soil components associated with this site are the Rockhound series and a higher order of Typic Haplargids. The Rockhounds soils are loamy-skeletal, mixed, superactive, hyperthermic Typic Haplargids, and the Typic Haplargids are coarse-loamy, mixed, superactive, hyperthermic Typic Haplargids. These are older soils on fan remnants, which have argillic soil horizons with finer textures. These soils are well drained with slow to moderately rapid permeability. Available water capacity (AWC) is higher at 2.3 to 3.9 inches per upper 40 inches of soil, while more typical AWC is less than 2.5 inches.

This ecological site has been correlated to the following map units and soil components in the Joshua Tree National Park Soil Survey Area (CA794):

Map unit ID; Map unit name; Component; Percent

1555; Goldrose-Carsitas-Chemwash complex, 4 to 8 percent slopes; Goldrose ; ; 35 and Carsitas; very rarely flooded; 30

2120; Rizzo-Deprave complex, 2 to 8 percent slopes; Rizzo; rarely flooded; 35

2409; Rizzo-Chemwash-Carsitas complex, 4 to 8 percent slopes; Goldrose; ; 4
 2421; Carsitas complex, 4 to 8 percent slopes; Carsitas; very rarely flooded; 55 and Rizzo; very rarely flooded; 5 and Typic Haplargids; very rarely flooded; 2
 2140; Rockhound silt loam, 4 to 15 percent slopes; Rockhound; rarely flooded; 10

Table 4. Representative soil features

Surface texture	(1) Gravelly sand (2) Gravelly loamy sand (3) Gravelly loamy fine sand
Family particle size	(1) Sandy
Drainage class	Somewhat excessively drained to excessively drained
Soil depth	150 cm
Surface fragment cover <=3"	60 – 80 %
Surface fragment cover >3"	0 – 30 %
Available water capacity (0-101.6cm)	2.54 – 6.35 cm
Calcium carbonate equivalent (0-101.6cm)	Not specified
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	Not specified
Soil reaction (1:1 water) (0-101.6cm)	10 – 8.4
Subsurface fragment volume <=3" (Depth not specified)	20 – 50 %

Subsurface fragment volume >3" (Depth not specified)	0 – 10 %
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Ecological dynamics

This ecological site occurs on very rarely to rarely flooded fan aprons, alluvial fans, and seldomly on bars in drainageways. The soils are very deep and sandy, with non-gravelly to extremely gravelly texture modifiers. Brittlebush and creosote bush dominate, and burrobrush (*Ambrosia dumosa*) and Schott's dalea (*Psoralea schottii*) are important secondary shrubs. Very rare to rare sheet floods from hillslope and fan runoff favor the establishment of brittlebrush, burrobrush, and Schott's dalea. Deep sandy soils allow for rapid and deep infiltration of water, which supports deep-rooted species such as creosote bush.

Creosote bush is a long-lived, deep-rooted evergreen shrub dominant across vast areas of the North American warm deserts. Creosote bush maintains its evergreen status by using water held in deep soil layers. Creosote bush is typically the dominant shrub on deep coarse soils with little development (Hamerlynk et al. 2002, Hamerlynk and McAuliffe 2008), such as on this ecological site.

Brittlebush is common on steep south-facing slopes (McAuliffe and Devender 1998, Hamerlynk et al.). When dominant on lower landscape positions, such as this site, it is generally present due to disturbance (Sawyer et al. 2009) such as flooding. 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). Desert plants have smaller, more pubescent leaves, and a more compact growth form. Smaller more pubescent leaves reduce leaf temperatures and increase water use efficiency. The tradeoff is that plant productivity declines because smaller leaves have less surface area available for photosynthesis, and because pubescence reduces the absorption of solar radiation (Housman et al. 2002, Sandquist and Ehleringer 2003).

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). Brittlebush seedlings emerge over multiple pulses in response to cool season rains, with emergence triggered by a minimum of 19 mm of precipitation, and seedlings are killed if freezing temperatures occur within nine days of the trigger event (Bowers 1994). The low incidence of frost in MLRA31 allows brittlebush to be a dominant species.

The disturbances impacting this ecological site include drought, invasion by non-native species and fire.

Non-native annual species such as Mediterranean grass (*Schismus barbatus*), redstem stork's bill (*Erodium cicutarium*) and Asian mustard (*Brassica tournefortii*) have become naturalized in the Colorado Desert over the past century (Brown and Minnich 1986, D'Antonio and Vitousek 1992, Brooks and Berry 2006). 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, Brooks and Berry 2006, Barrows et al. 2009).

This site has the potential for relatively high biomass of native and non-native annual species during years of higher precipitation, and has fairly high shrub cover, so has a relatively high risk of fire (Brown and Minnich, 1986). Creosote bush is poorly adapted to fire (Webb et al. 2010), while a brittlebush dominated community recovers rapidly (Brown and Minnich 1986, Steers and Allen 2011). Repeat burning could trigger a transition to an altered state dominated by brittlebush.

Desert regions are characterized by low mean annual precipitation and extreme variability in the amount of precipitation received in any year or decade (Hereford et al. 2006). Thus, episodic mortality in response to periods of drought is important in shaping desert community dynamics (Hereford et al. 2006, Miriti et al. 2007).

State and transition model

Figure 3. R031XY200CA Model

Additional community tables

Table 5. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (t)	Foliar Cover (%)
Shrub/Vine					
1	Shrubs			56-224	
	creosote bush	LATR2	<i>Larrea tridentata</i>	34-146	4-15
	burrobrush	AMDU2	<i>Ambrosia dumosa</i>	0-45	0-3

	brittlebush	ENFA	<i>Encelia farinosa</i>	16-34	1-3
	burrobrush	HYSA	<i>Hymenoclea salsola</i>	0-9	0-2
	Schott's dalea	PSSC5	<i>Psoralea schottii</i>	0-6	0-1
	ocotillo	FOSP2	<i>Fouquieria splendens</i>	0-6	0-1
	branched pencil cholla	CYRA9	<i>Cylindropuntia ramosissima</i>	0-6	0-1
Forb					
2	Forbs			56-151	
	chia	SACO6	<i>Salvia columbariae</i>	6-112	1-4
	cryptantha	CRYPT	<i>Cryptantha</i>	1-56	1-13
	sowthistle desertdandelion	MASO	<i>Malacothrix sonchoides</i>	3-45	1-6
	desert Indianwheat	PLOV	<i>Plantago ovata</i>	0-34	0-9
	lupine	LUPIN	<i>Lupinus</i>	0-22	0-3
	pincushion flower	CHFR	<i>Chaenactis fremontii</i>	0-6	0-2
	buckwheat	ERIOG	<i>Eriogonum</i>	0-1	1-2
	desert poppy	ESGL	<i>Eschscholzia glyptosperma</i>	0-1	0-1
	pygmy poppy	ESMI	<i>Eschscholzia minutiflora</i>	0-1	0-1
	birdcage evening primrose	OEDE2	<i>Oenothera deltoides</i>	0-1	0-1
5	Non-native forbs			0-34	
	redstem stork's bill	ERIC6	<i>Erodium cicutarium</i>	0-34	0-6
	Asian mustard	BRT0	<i>Brassica tournefortii</i>	0-6	0-1
Grass/Grasslike					
3	Annual grass			0-1	
	Mediterranean grass	SCHIS	<i>Schismus</i>	0-1	0-1
Tree					
4	Trees			0-34	
	desert ironwood	OLTE	<i>Olneya tesota</i>	0-45	0-1
	blue paloverde	PAFL6	<i>Parkinsonia florida</i>	0-11	0-1

Table 6. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 7. Community 2.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 8. Community 3.1 plant community composition

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

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 (*Boottettix argentatus*) feeds solely on creosote leaves (Pavlik 2008). Brittlebush is used as forage by desert bighorn sheep and mule deer.

Hydrological functions

This ecological site allows for rapid infiltration of run-off from the nearby mountain slopes.

Recreational uses

This ecological site may be used for cross-country hiking and aesthetic enjoyment. When brittlebush is in flower, it lights up the area with its yellow blooms.

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>. 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 vegetation plots were used to describe this ecological site: 8181001 1250014906 HASP04- Type location HASP06 J5-D

Type locality

Location 1: Riverside County, CA	
UTM zone	N
UTM northing	3730877
UTM easting	632932
General legal description	The type location is approximately half way between Chirioco Summit and Desert Center, north of HW 10, on BIM property, just outside the boundary of Joshua Tree National Park.

Other references

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Approval

Kendra Moseley, 3/11/2025

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)	
Contact for lead author	
Date	09/14/2026
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:
