Ecological site R030XD041CA
Channeled Warm Alluvial 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 notes

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).

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 channeled fan aprons and fan remnants, typically on the upper portion of the fan piedmont, at elevations of 950 to 2390 feet. Soils are typically very deep with sandy textures. This site typically has a rare surface flooding regime, but may have none to occasional flooding. Production reference value (RV) is 242 pounds per acre, and ranges from 160 to 390 pounds per acre depending on annual precipitation and annual forb production. The site is dominated by creosote bush (Larrea tridentata), and burrobush (Ambrosia dumosa) and brittlebush (Encelia farinosa) are important secondary species. A hyperthermic climate, landform positions near the base of mountains, a channeled alluvial topography with additional run-on from the adjacent mountains, and a rare to occasional surface flooding regime drives the vegetation community of this ecological site. This site is more productive and diverse than landforms at the same elevation with less additional moisture. Data in the following sections is based on Pintobasin components (all minor) associated with this ecological site.

Associated sites

R030XD004CA	**Low-Production Hyperthermic Hills** This ecological site occurs on steep sideslopes of fan remnants. Sparse vegetation is dominated by creosote bush (Larrea tridentata).

R030XD015CA	**Hyper-Arid Fans** This ecological site occurs on adjacent fan aprons receiving less additional moisture. Creosote bush (Larrea tridentata) and burrobush (Ambrosia dumosa) dominate.
R030XD025CA	**Hyperthermic Sandsheets** This ecological site is found on adjacent sandsheets. Creosote bush (Larrea tridentata) and big galleta (Pleuraphis rigida) dominate.
R030XD042CA	**Hyperthermic Shallow To Moderately Deep Fan Remnants** This ecological site is found on adjacent stable fan remnants. Sparse vegetation is dominated by creosote bush (Larrea tridentata).

Similar sites

R030XD015CA	**Hyper-Arid Fans** This ecological site occurs on fan aprons receiving less additional moisture. Channeling is not as prevalent. The plant community is less productive and less diverse, and brittlebush (Encelia farinosa) is not an important species.
R030XD039CA	**Coarse Gravelly Fans** This ecological site occurs on soils with a higher percentage of rock fragments on the surface and in the soil profile. Brittlebush (Encelia farinosa) and creosote bush (Larrea tridentata) dominate.
R030XD006CA	**Abandoned Fan** This ecological site occurs on fan aprons receiving much less additional moisture. The plant community is much less productive and diverse. Creosote bush (Larrea tridenta) is the only dominant shrub.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Larrea tridentata* (2) *Ambrosia dumosa*
Herbaceous	Not specified

Physiographic features

This ecological site occurs on channeled fan aprons and fan remnants, typically on the upper portion of the fan piedmont, at elevations of 950 to 2390 feet. Slopes may range from 2 to 15 percent, but slopes of 2 to 4 percent are typical. This site typically has a rare surface flooding regime, but may have none to occasional flooding. Runoff class is very low to high.

Table 2. Representative physiographic features

Landforms	(1) Fan apron (2) Fan remnant
Flooding duration	Extremely brief (0.1 to 4 hours) to very brief (4 to 48 hours)
Flooding frequency	None to occasional
Ponding frequency	None
Elevation	290 – 730 m
Slope	0 – 20 %

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 dominant soils associated with this ecological site are very deep, somewhat excessively drained soils that formed in alluvium from granitoid and/or gneissic rocks. These soils are sandy in the particle size control section, and permeability is rapid. The surface texture is gravelly sand, and subsurface horizons (1 to 59 inches) are composed of layers of gravelly sand. Surface gravels (3 mm in diameter) are 25 percent, with no larger fragments present on the soil surface. Subsurface gravels by volume (for a depth of 0 to 59 inches) range from

15 to 20 percent, with no larger fragments present.

This ecological site is associated with Pintobasin soils (mixed, hyperthermic Typic Torripsamments); and Carpetflat soils (loamy, mixed, superactive, hyperthermic, shallow Cambidic Haplodurids). The Carpetflat soils are shallow to a duripan, have sandy loam textures with higher clay contents than the Pintobasin soils, and are not typical for this ecological site.

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

2100;Perurose-Coxpin-Pintobasin association, 2 to 15 percent slopes;Pintobasin;rarely flooded, channeled;5; Carpetflat;sandy substratum;1
1520;Pintobasin loamy sand, 2 to 4 percent slopes;Pintobasin;rarely flooded, channeled;5
1526;Pintobasin-Joetree-Joetree complex, 2 to 8 percent slopes;Pintobasin;rarely flooded, channeled;5

Table 4. Representative soil features

Parent material	(1) Alluvium – granite
Surface texture	(1) Gravelly sand
Family particle size	(1) Sandy
Drainage class	Somewhat excessively drained
Permeability class	Rapid
Soil depth	150 cm
Surface fragment cover <=3"	30 %
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	4.06 – 7.11 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)	10
Subsurface fragment volume <=3" (Depth not specified)	20 %
Subsurface fragment volume >3" (Depth not specified)	Not specified

Ecological dynamics

Abiotic Factors

The abiotic factors driving this site are a hyperthermic climate, landform positions near the base of mountains, a channeled alluvial topography with additional run-on from the adjacent mountains, and a rare to occasional surface flooding regime. This ecological site occurs on gently sloping, channeled, fan aprons and fan remnants. It is typically on the upper portion of the fan piedmont, at elevations of 950 to 2390 feet. Soils are typically very deep, but may be shallow to a duripan when on more stable older landforms. Hyperthermic soil temperatures, channeled alluvialtopography, and additional run-on from sheet flooding drives the vegetation community of this ecological site. The reference plant community is a relatively productive, diverse shrub community dominated by creosote bush with burrobush and brittlebush as important secondary species, and several minor shrub species.

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). 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. However, within the hyperthermic soil temperature regime, additional moisture such as received from mountain run-off and sheet-flooding, can increase diversity and production.

The soils associated with this ecological site typically are very deep, have layers of sands with gravelly to extremely gravelly sand, or sandy loam textures when on more stable, developed landforms. In the hyperthermic environment of this ecological site, 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 by the deep-rooted, long-lived evergreen creosote bush (McAuliffe 1994, Hamerlynk et al. 2002, Hamerlynk and McAuliffe 2008). Sheet flow provides additional moisture that increases water availability, and provides soil disturbance, which provides opportunities for establishment of secondary, shorter-lived shrub species such as burrobush and brittlebush. The channeled topography of the alluvial landforms acts to increase the heterogeneity of resources, which also promotes diversity. Species that are more typical of wash or disturbed habitats, such as sweetbush (Bebbia juncea), desertsenna (Senna armata), California jointfir (Ephedra californica), and burrobrush (Hymenoclea salsola) tend to occur in the ephemeral channels of this site.

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), common 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, 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). 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. R030XD041CA

Additional community tables

Table 5. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Shrub/Vine					
1	**Shrubs**			101-135	
	creosote bush	LATR2	*Larrea tridentata*	17-95	1-7
	burrobush	AMDU2	*Ambrosia dumosa*	7-28	1-5
	brittlebush	ENFA	*Encelia farinosa*	1-28	0-3
	burrobrush	HYSA	*Hymenoclea salsola*	0-17	0-2
	sweetbush	BEJU	*Bebbia juncea*	0-11	0-1
	California jointfir	EPCA2	*Ephedra californica*	0-8	0-1
	Wiggins' cholla	CYEC3	*Cylindropuntia echinocarpa*	0-2	0-1
	branched pencil cholla	CYRA9	*Cylindropuntia ramosissima*	0-1	0-1
	desertsenna	SEAR8	*Senna armata*	0-1	0-1
Forb					
2	**Forbs**			78-297	
	smooth desertdandelion	MAGL3	*Malacothrix glabrata*	6-170	1-6
	whitemargin sandmat	CHAL11	*Chamaesyce albomarginata*	1-106	1-7
	pincushion flower	CHFR	*Chaenactis fremontii*	1-45	1-9
	desert dodder	CUDE2	*Cuscuta denticulata*	0-34	0-1
	cryptantha	CRYPT	*Cryptantha*	0-18	0-3
	hairy milkweed	FUHI	*Funastrum hirtellum*	0-17	0-3
	desert Indianwheat	PLOV	*Plantago ovata*	0-2	0-2
	small wirelettuce	STEXE	*Stephanomeria exigua ssp. exigua*	0-1	0-1
	brownplume wirelettuce	STPA4	*Stephanomeria pauciflora*	0-1	0-1
Grass/Grasslike					
3	**Native Perennial Grasses**			0-6	
	big galleta	PLRI3	*Pleuraphis rigida*	0-2	0-1
4	**Non-native annual grasses**			0-1	
	Mediterranean grass	SCHIS	*Schismus*	0-1	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 (%)

Table 9. Community 3.2 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).

Recreational uses

This site may be used for hiking, wildflower viewing, 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.

Inventory data references

The following NRCS plots were used to describe this ecological site: Community Phase 2.1: G1-V (Type location) H1-A H1-I J3-1 J4-B

Type locality

Location 1: San Bernardino County, CA	
UTM zone	N
UTM northing	3773965
UTM easting	644378
General legal description	The type location is approximately 0.15 mile south of Highway 62 in Joshua Tree National Park.

Other references

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Contributors

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Approval

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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	09/13/2026

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:

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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:**
