Ecological site R030XD042CA
Hyperthermic Shallow To Moderately Deep Fan Remnants

Accessed: 04/20/2024

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 ‘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 stable, undulating fan remnants and fan aprons over fan remnants at elevations of 525 to 2560 feet. Dominant soils have a high degree of horizon development, and typically have a root and water limiting silica and/or calcium carbonate- cemented duripan at shallow to moderately deep depths.

Vegetation is very sparse, and is typically patchy, restricted to breaks in the remnant surface. Shrub density is less than 100 individuals per acre. Production reference value (RV) is 45 pounds per acre, and depending on precipitation annual forb production, ranges from 20 to 85 pounds per acre. The site is dominated by creosote bush (Larrea tridentata), with burrobush (Ambrosia dumosa) and white ratany (Krameria grayi) are sparsely present. Root limiting soil horizons coupled with hyperthermic soil temperatures and low precipitation limits production and shrub density.

The data in the following sections is from major (15% of map unit or greater) components only.

Classification relationships

This ecological site is found within the Larrea tridentata Shrubland Alliance (Sawyer et al. 2009).

Associated sites

R030XD003CA	**Hyperthermic Steep South Slopes** R030XD003CA is found on adjacent hillslopes. Brittlebush (Encelia farinosa) is dominant.
R030XD004CA	**Low-Production Hyperthermic Hills** R030XD004CA is found on adjacent hillslopes and steep sideslopes of fan remnants. Sparse vegetation is dominated by creosote bush (Larrea tridentata).
R030XD006CA	**Abandoned Fan** R030XD006CA occurs on adjacent fan aprons. Creosote bush (Larrea tridentata) is dominant.
R030XD008CA	**Hyperthermic Sandhill** R030XD008CA occurs on adjacent dunes. Big galleta (Pleuraphis rigida) is dominant, and creosote bush (Larrea tridentata) is a common secondary shrub.
R030XD015CA	**Hyper-Arid Fans** R030XD015CA is found on adjacent rarely flooded fan aprons. Creosote bush (Larrea tridentata) and burrobush (Ambrosia dumosa) are co-dominant.
R030XY023CA	**Hyperthermic Dissected Shallow Pediment** R030XD023CA is found on adjacent pediments. Mojave indigobush (Psorothamnus arborescens) and desertsenna (Senna armata) are dominant.
R030XD025CA	**Hyperthermic Sandsheets** R030XD025CA occurs on adjacent sandsheets. Creosote bush (Larrea tridentata) is dominant and big galleta (Pleuraphis rigida), burrobush (Ambrosia dumosa) and dyebush (Psorothamnus emoryi) are secondary species.
R030XD041CA	**Channeled Warm Alluvial Fans** R030XD041CA is found on adjacent rarely flooded, channeled fan remnants. Creosote bush (Larrea tridentata), brittlebush (Encelia farinosa) and burrobush (Ambrosia dumosa) are dominant.
R030XY001CA	**Occasionally Flooded, Hyperthermic, Diffuse Ephemeral Stream** R030XY001CA is found on adjacent occasionally flooded, small ephemeral drainageways. Creosote bush (Larrea tridentata) and Schott's dalea (Psorothamnus schottii) are dominant.

Similar sites

R030XD015CA	**Hyper-Arid Fans** R030XD015CA occurs on rarely flooded fan aprons and fan remnants,typically with deeper soils. Production and shrub density are much higher, and the site is co-dominated by creosote bush (Larrea tridentata) and burrobush (Ambrosia dumosa).
R030XD006CA	**Abandoned Fan** R030XD006CA occurs on fan aprons and fan remnants with typically deeper soils. Production and shrub density is higher.

Table 1. Dominant plant species

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

Physiographic features

This ecological site occurs on very stable, moderately undulating fan remnants and fan aprons on fan remnants at elevations of 520 to 2560 feet. Slopes may range from 0 to 30 percent, but slopes below 15 percent are typical. Runoff class is very low to medium.

Table 2. Representative physiographic features

Landforms	(1) Fan remnant (2) Fan apron
Flooding frequency	None
Ponding frequency	None
Elevation	520–2,560 ft
Slope	0–30%
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)	0 days

Precipitation total (average)	5 in

Influencing water features

Soil features

The soils typically associated with this ecological site occur on stable fan remnants and formed in alluvium from gneissic, granitoid, and/or igneous sources. These soils have a high degree of horizon development. They range from shallow to moderately deep over silica or silica and calcium carbonate-cemented duripans. Surface textures are loamy fine sand, loamy sand, or very gravelly loam, with sandy and loamy subsurface textures. Surface gravels (< 3 mm in diameter) range from 55 to 65 percent, and larger fragments range from 15 to 25 percent. Subsurface gravels by volume (for a depth of 0 to 59 inches) range from 0 to 25 percent and larger fragments by volume range from 0 to 2 percent. Soils are somewhat excessively to well drained with rapid permeability.

The associated soil series that are 15 percent or greater of any one map unit are: Perurose (sandy, mixed, hyperthermic Cambidic Haplodurids); Coxpin (sandy, mixed, hyperthermic, shallow Cambidic Haplodurids); Carpetflat (loamy, mixed, superactive, hyperthermic, shallow Cambidic Haplodurids); Buzzardsprings (Sandy, mixed, hyperthermic Typic Haplocalcids); Pintobasin (mixed, hyperthermic Typic Torripsamments), Aquapeak (Loamy, mixed, superactive, hyperthermic, shallow Argidic Argidurids), and a higher order of Cambidic Haplodurids. Other soils on which this site is found are typically 5 percent or less of any map unit when associated with this site. They are: Rubylee (coarse-loamy, mixed, superactive, hyperthermic typic haplargids); Oldale (Loamy-skeletal, mixed, superactive, hyperthermic Typic Haplargids); and Typic Torriorthents.

The Perurose soils are typically sandy throughout and moderately deep to a duripan. The Coxpin soils are shallow to a duripan and have a sandy particle size control section. The Cambidic Haplodurids soils are shallow to a duripan, and have a gravel surface horizon. The Carpetflat soils are very shallow to shallow to a duripan, and have a loamy particle size control section. Buzzardsprings soils do not have a root-limiting horizon, but a calcic horizon occurs at 4 to 14 inches below the soil surface. The Aquapeak soils are very shallow to shallow over a duripan, with a loamy particle size contol section and a well developed argillic horizon above the pan. Buzzardsprings, Carpetflat, Oldale, and Rubylee soils often have a desert pavement surface, but when associated with this ecological site, the pavement is incipient. In combination with the arid environment of this ecological site, the incipient pavement surface restricts vegetation production and density, although not to the degree that fully developed pavement does. Pintobasin and the Typic Torriorthents soils are deep sands and are not typical for this ecological site. Where they are associated with this ecological site, they occur on stable, undulating fan aprons over fan remnants surrounded by soils with a high degree of development (Perurose and Coxpin) and very sparse vegetation. The Rubylee and Oldale soils have a well developed argillic horizon beginning at 3 to 5 inches below the surface; these soils are not typically 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:

1513; Carrizo-Rubylee complex, 1 to 4 percent slopes; Oldale;; 5
1517; Pintobasin-Dalelake complex, 2 to 8 percent slopes; Perurose;;1
1530; Dalelake fine sand, 0 to 4 percent slopes; Typic Torriorthents;; 5
1541; Carrizo-Cambidic Haplodurids association, 4 to 15 percent slopes; Cambidic Haplodurids;; 40
1550; Buzzardsprings-Coxpin-Dalelake complex, 2 to 8 percent slopes; Coxpin;; 25
2100; Perurose-Coxpin-Pintobasin association, 2 to 15 percent slopes; Perurose;; 50 and Aquapeak; extremely stony; 1 and Coxpin;; 25 and Pintobasin; gravelly surface; 15
2101; Perurose-Pintobasin complex, 2 to 4 percent slopes; Coxpin;; 5
2065; Dalelake-Aquapeak-Coxpin association, 2 to 8 percent slopes; Buzzardsprings; fine sand; 1 and Coxpin;; 25 and Perurose;; 5
2067; Aquapeak-Buzzard Springs-Dalelake complex, 2 to 30 percent slopes;Aquapeak;overblown; 30
2068; Aquapeak-Carpetflat-Pintobasin complex, 0 to 4 percent slopes; Carpetflat;nongravelly surface; 35 and Rubylee; nongravelly surface; 1
2716; Dalelake complex, 4 to 30 percent slopes; Perurose;; 5
2717; Dalelake-Rock outcrop-Buzzardsprings association, 4 to 30 percent slopes; Buzzardsprings; fine sand; 20

2820; Rock outcrop-Impedimenta complex, 4 to 30 percent slopes; Perurose;; 1

Table 4. Representative soil features

Parent material	(1) Alluvium–granite
Surface texture	(1) Fine sandy loam (2) Fine sand (3) Loamy fine sand
Family particle size	(1) Sandy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Slow to rapid
Soil depth	4 in
Surface fragment cover <=3"	40–70%
Surface fragment cover >3"	0–40%
Available water capacity (0-40in)	0.3–3.5 in
Calcium carbonate equivalent (0-40in)	0–20%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0–4
Soil reaction (1:1 water) (0-40in)	6.1–9.4
Subsurface fragment volume <=3" (Depth not specified)	0–65%
Subsurface fragment volume >3" (Depth not specified)	0–25%

Ecological dynamics

Abiotic Factors

Stable landforms with a high degree of soil horizon development leading to root and/or water restricting layers, coupled with hyperthermic soil temperatures and low precipitation drive the vegetation community of this ecological site. The vegetation community is very sparse, with low production and diversity, and is typically patchy, restricted to breaks in the remnant surface. Shrubs are limited to establishment in locations where roots can gain access to cracks in the duripan. Plants are aggregated because established shrubs alter soil properties below the shrub canopy and in the rhizosphere, creating a zone more hospitable for additional plant establishment in a ‘fertile island’ effect (Muller 1953, Walker et al. 2001, Bolling and Walker 2002). The site is dominated by creosote bush, with burrobush and white ratany typically sparsely present.

The availability of soil water is the critical resource shaping plant communities in arid environments (Noy-Meir 1973, McAuliffe 1994, Hamerlynk et al. 2002, Martre et al. 2002, Austin et al. 2004). On older geomorphic surfaces, where soils have had very long periods of time to develop, the development of water restricting subsurface horizons limits infiltration and thus increases evaporation, which decreases the availability of water (Hamerlynk et al. 2002, Hamerlynk and McAuliffe 2008, Bedford et al. 2009). Plant communities on these old, stable landforms are characterized by low density and low productivity relative to younger landforms with lesser developed soils (Bedford et al. 2009).

Low soil moisture availability and high surface rock fragment cover limits annual forb production and cover, but during years of average to above average precipitation, annual forbs comprise 30 to 50 percent of production on

this site. Annual cover and production is associated with shrub cover, rivulets in the remnant surface receiving additional run-on, and patches of soil with lower surface rock fragment cover.

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 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 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). When undisturbed, the high surface rock fragment cover and water-limiting soils of this ecological site restrict establishment and biomass of non-native species, but where soil surface gravels and durinodes have been disturbed, exposing the underlying sand, Asian mustard and Mediterranean grass may become more abundant. Soil disturbance, such as from construction or off-road vehicle use not only increases the susceptibility of this site to invasion, but it disrupts the unique soil characteristics that shape the vegetation community of this site.

State and transition model

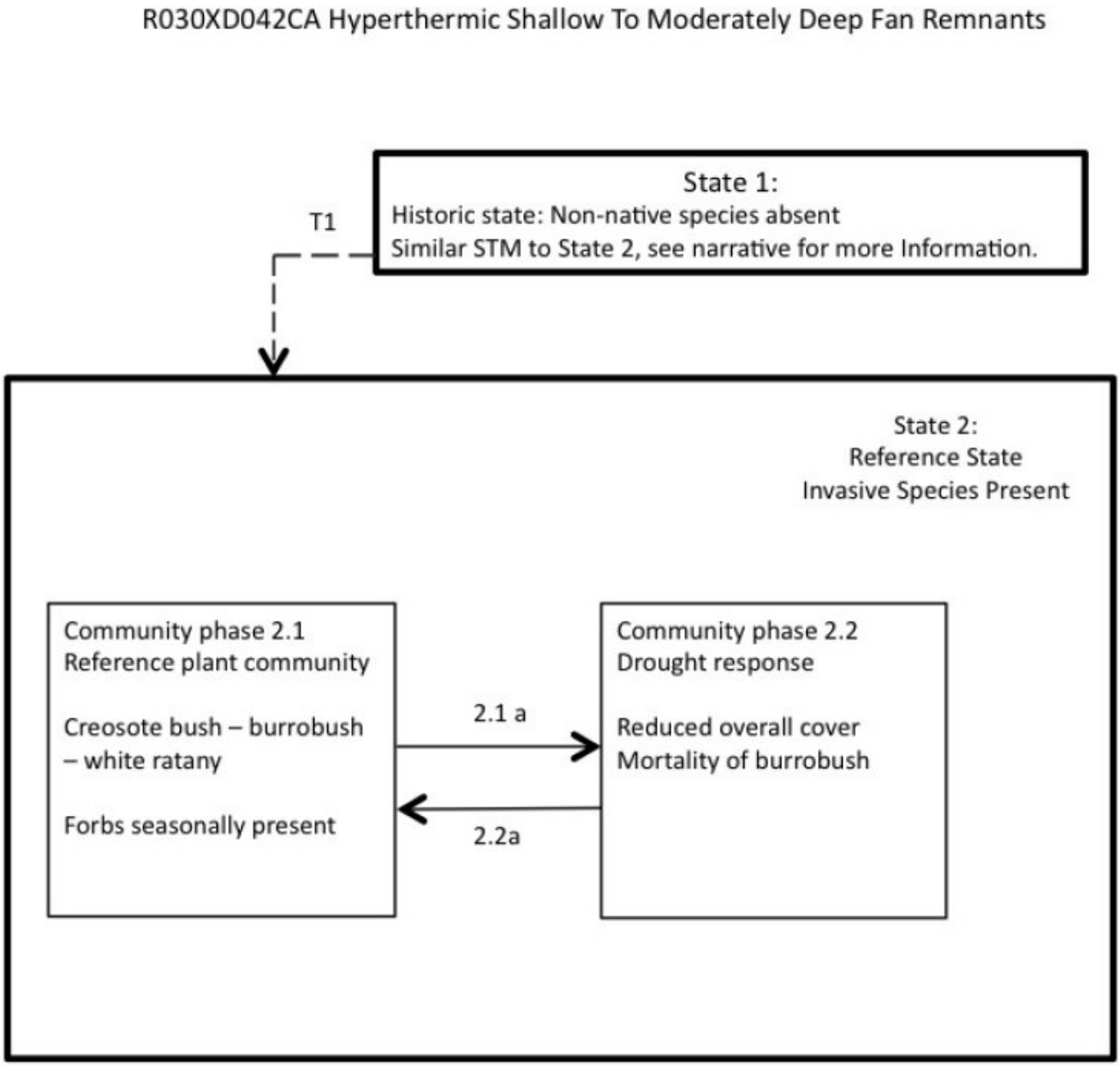

Figure 4. R030XD042CA

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 was the natural disturbance influencing this ecological site. 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 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 5. Community Phase 2.1

The reference plant community consists of sparse, small shrubs that are restricted to breaks in the remnant surface. Creosote bush is dominant, and burrobush and white ratany are typically sparsely present. Native annuals are present with average to above average winter precipitation, and common species include cryptantha (Cryptantha spp.), Esteve's pincushion (Chaenactis steviodes), and desert Indianwheat (*Plantago ovata*). The non-native annual's Mediterranean grass and Asian mustard may be sparsely present. Annual cover and production is associated with shrub cover, rivulets in the remnant surface receiving additional run-on, and patches of soil with lower surface rock fragment cover. Soil disturbance, such as from construction or off-road vehicle use, that disrupts rock fragment cover increases colonization opportunities for native and non-native perennials and annuals, and can increase site productivity, especially on deeper soils such as Perurose and Buzzardsprings. This not only increases the susceptibility of this site to invasion by non-native species, but it disrupts the unique soil characteristics that shape the vegetation community of this site.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Forb	0	15	44
Shrub/Vine	20	30	40
Grass/Grasslike	0	0	1
Total	**20**	**45**	**85**

Community 2.2
Drought response

This community phase is characterized by declines in cover and production due to branch-pruning of creosote bush and white ratany, mortality of burrobush, and lack of emergence of annual species. Creosote bush is a long-lived, deep-rooted evergreen shrub dominant across vast areas of the North American warm deserts. Once established, it has very low levels of drought-induced mortality, and it is one of the few shrubs capable of persisting in this extreme environment. White ratany is a long-lived, drought-deciduous shrub that co-occurs as a secondary species with creosote bush over much of its range. It is a root parasite that obtains nutrients from the roots of host plants, which may help to sustain it during of drought (Griffith 1991). Burrobush is a short-lived, shallow-rooted drought-

deciduous shrub that is co-dominant with creosote bush over vast areas of the Mojave and Sonoran Deserts. It can take persist in this site due to the longer duration of water availability at shallow depths during the winter wet period, but during extreme or long periods of drought, is subject to high mortality.

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 precipitation.

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.

Additional community tables

Table 6. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
1	**Shrubs**			20–40	
	burrobush	AMDU2	*Ambrosia dumosa*	8–26	1–2
	creosote bush	LATR2	*Larrea tridentata*	11–22	1–3
	white ratany	KRGR	*Krameria grayi*	0–4	0–1
	branched pencil cholla	CYRA9	*Cylindropuntia ramosissima*	0–1	0–1
Forb					
2	**Native forbs**			0–44	
	cryptantha	CRYPT	*Cryptantha*	0–44	0–4
	pincushion flower	CHFR	*Chaenactis fremontii*	0–24	0–3
	desert Indianwheat	PLOV	*Plantago ovata*	0–11	0–3
	small wirelettuce	STEX	*Stephanomeria exigua*	0–1	0–1
	brownplume wirelettuce	STPA4	*Stephanomeria pauciflora*	0–1	0–1
	devil's spineflower	CHRI	*Chorizanthe rigida*	0–1	0–1
	desert marigold	BAMU	*Baileya multiradiata*	0–1	0–1
	Abrams' sandmat	CHAB2	*Chamaesyce abramsiana*	0–1	0–1
	lupine	LUPIN	*Lupinus*	0–1	0–1
5	**Non-native annual forbs**			0–1	
	Asian mustard	BRTO	*Brassica tournefortii*	0–1	0–1
Grass/Grasslike					
3	**Native perennial grasses**			0–1	
	low woollygrass	DAPU7	*Dasyochloa pulchella*	0–1	0–1
4	**Non-native annual grasses**			0–1	
	common Mediterranean grass	SCBA	*Schismus barbatus*	0–1	0–1

Animal community

This ecological site is 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). The sparse vegetation of this ecological site does not provide good cover nor food for animals.

Recreational uses

This site may be used for 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.

Inventory data references

Community Phase 2.1:

I5-H (Type location)
CC-3B
H4-H

Type locality

Location 1: Riverside County, CA	
UTM zone	N
UTM northing	3750120
UTM easting	651629
General legal description	The type location is approximately 6.8 miles northwest of the junction of Highway 177 and MWD Aqueduct Road, and 0.6 miles north of the junction of MWD Powerline Road and MWD Aqueduct Road on the border of Joshua Tree National Park.

Other references

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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:**

   _____

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:

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17. **Perennial plant reproductive capability:**
