USDA Natural Resources Conservation Service

Ecological site R030XD004CA
Low-Production Hyperthermic Hills

Accessed: 05/08/2024

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.

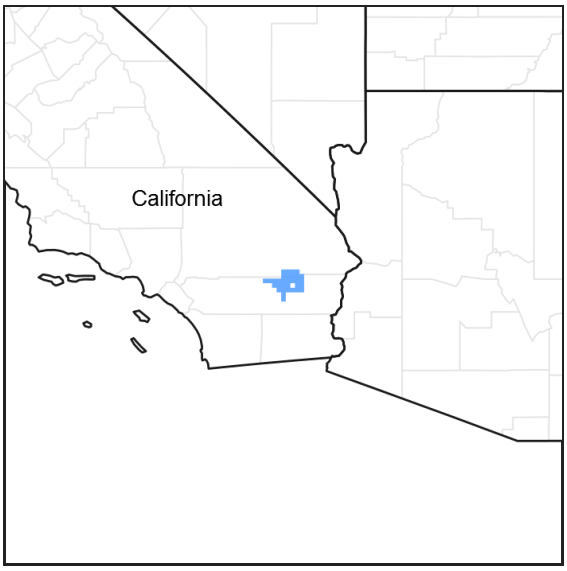


Figure 1. Mapped extent

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 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 very dry mountain slopes, hills, and steep sideslopes of fan remnants, at elevations of 570 to 3990 feet. Soils have gravel or channery surface textures, and a high volume of large (greater than 3 inches in diameter) rock fragments by volume in the soil profile.

Vegetation is dominated by very sparse, small creosote bush (Larrea tridentata), and annual forbs contribute 50 to 80 percent of annual production during years of average to above average precipitation. Production Reference Value (RV) is 149 pounds per acre and ranges from 26 to 428 pounds per acre depending on precipitation and annual forb production. A very dry climate, steep slopes and rocky soils with low moisture holding capacity restrict the potential vegetation to this sparse community.

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

Classification relationships

Mojave Creosote Bush (Holland 1986).

Larrea tridentata Shrubland Alliance (Sawyer et al. 2009).

Associated sites

R030XD001CA	**Hyperthermic Dry Hills** This ecological site is found on adjacent cooler slopes. Creosote bush (Larrea tridentata) and burrobush (Ambrosia dumosa) are dominant.
R030XD003CA	**Hyperthermic Steep South Slopes** This ecological site is found on adjacent south-facing slopes. Brittlebush (Encelia farinosa) is dominant.
R030XD006CA	**Abandoned Fan** This ecological site is found on adjacent fan remnants with deep sandy soils. Creosote bush (Larrea tridentata) is dominant.
R030XD008CA	**Hyperthermic Sandhill** This ecological site is found on adjacent sandhills. Big galleta (Pleuraphis rigida) and creosote bush (Larrea tridentata) dominate.
R030XD014CA	**Hyperthermic Sandy Plains** This ecological site is found on adjacent semi-active sandsheets. Big galleta (Pleuraphis rigida) is dominant.
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** R030XD042CA is found on adjacent stable fan remnants with a high degree of soil horizon development. Vegetation is sparse and dominated by creosote bush (Larrea tridentata).
R030XY092NV	**DESERT PATINA** This ecological site is found on adjacent stable fan remnants. Surfaces are covered with desert pavement and very sparse vegetation is dominated by creosote bush (Larrea tridentata).

Similar sites

R030XD006CA	**Abandoned Fan** This ecological site is found on fan aprons and fan remnants.

R030XD001CA	**Hyperthermic Dry Hills** This ecological site is found on similar landforms and soils, but in cooler positions and generally on north-facing slopes. Production and diversity are higher and burrobush (Ambrosia dumosa) is an important species.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Larrea tridentata*
Herbaceous	(1) *Chaenactis fremontii*

Physiographic features

This site occurs on dry mountain slopes, hills and sideslopes of fan remnants and mountains. Elevations range from 570 to 2540 feet, and slopes are typically greater than 8 percent, but may range from 4 to 75 percent. Runoff class is low to very high.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Mountain slope (3) Fan remnant
Flooding frequency	None
Ponding frequency	None
Elevation	174–762 m
Slope	4–75%
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 280 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)	127 mm

Influencing water features

Soil features

The dominant soils associated with this ecological site are skeletal and very shallow to shallow over bedrock or a duripan; or are very deep with channery textures. These soils occur on mountain slopes and hills and formed from colluvium and residuum derived from granite and gneiss over bedrock; or soils occur on sideslopes of fan remnants, and formed in alluvium derived from granitoid and/or gneiss. Surface textures are typically gravels, extremely channery, or cobbles, but may be loamy fine sand. Subsurface textures are loamy sand or sandy loam with very to extremely gravelly or channery modifiers.

The associated soil series that are 15 percent or greater of any one map unit are: Descent (sandy-skeletal, mixed, hyperthermic Typic Torriorthents); Missionsweet (loamy-skeletal, mixed, superactive, hyperthermic, shallow Cambidic Haplodurids); Supplymine (loamy-skeletal, mixed, superactive, hyperthermic Typic Haplocalcids); Blackeagle (loamy-skeletal, mixed, superactive, hyperthermic Lithic Haplocambids); Bolero (sandy-skeletal, mixed, hyperthermic Lithic Torriorthents); and Ironage (loamy-skeletal, mixed, superactive, hyperthermic Lithic Calciargids). Other soils on which this site is found are typically 10 percent or less of any map unit when associated with this site. They are: Goldenhills (sandy-skeletal, mixed hyperthermic Typic Torriothents); Meccapass (loamy-skeletal, mixed, superactive, hyperthermic Typic Haplocambids); Whipple (loamy-skeletal, mixed, superactive, hyperthermic Lithic Haplargids); Marbolite (loamy-skeletal, mixed, superactive, hyperthermic Lithic Haplargids); Pintobasin (mixed, hyperthermic Typic Torripsamments); and Sunmill (coarse-loamy, mixed, superactive, hyperthermic Typic Calciargids).

The Bolero, Blackeagle, Meccapass, Whipple, Marbolite, Ironage, Goldenhills, and Supplymine soils occur on hill and mountain slopes. These soils are very shallow to shallow over bedrock, apart from Supplymine, which is moderately deep, and Goldenhills, which is deep to very deep. The Descent and Missionsweet soils occur on sideslopes of fan remnants and ballenas. The Descent soils are very deep, and typically have channery textures throughout the soil profile. The Missionsweet soils are shallow to a duripan. All of the aforementioned soils have greater than 35 percent rock fragments throughout the particle size control section. The Pintobasin and Sunmill soils are very deep, and occur on fan remnants and fan aprons; when correlated with this ecological site, they occur on steep sideslopes of fan remnants.

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

1220;Jadestorm-Blackeagle-Rock outcrop complex, 15 to 50 percent slopes;Blackeagle;cool;20; Whipple;;6
2085;Rainbowsend-Goldenbell complex, 4 to 50 percent slopes;Blackeagle;cool;10
2830;Rock outcrop-Blackeagle complex, 30 to 75 percent slopes, dry;Blackeagle;cool;10; Marbolite;;4
2825;Rock outcrop-Supplymine-Bolero-Ironage complex, 15 to 60 percent slopes;Bolero;dry;15; Ironage;;15; Supplymine;;25
2091;Deprave-Roostertail association, 0 to 4 percent slopes;Descent;;5
2110;Descent association, 4 to 50 percent slopes;Descent;;80
2130;Goldenbell-Descent association, 2 to 15 percent slopes;Descent;;40; Descent;eroded;1
1415;Bolero-Rock outcrop complex, 30 to 75 percent slopes;Goldenhills;dry;10
1230;Jadestorm-Rock outcrop complex, 30 to 75 percent slopes;Meccapass;dry;10
2068;Aquapeak-Carpetflat-Pintobasin complex, 0 to 4 percent slopes;Missionsweet;;2
2070;Missionsweet-Carpetflat association, 2 to 30 percent slopes;Missionsweet;;60
2075;Oldale-Missionsweet association, 0 to 15 percent slopes;Missionsweet;;30; Missionsweet;steep;1
2076;Oldale-Carrizo complex, 2 to 8 percent slopes;Missionsweet;;6
2100;Perurose-Coxpin-Pintobasin association, 2 to 15 percent slopes;Pintobasin;steep;1
2065;Dalelake-Aquapeak-Coxpin association, 2 to 8 percent slopes;Sunmill;;1

Table 4. Representative soil features

Parent material	(1) Alluvium–granite (2) Colluvium–granite (3) Residuum–gneiss

Surface texture	(1) Gravel
Family particle size	(1) Loamy
Drainage class	Well drained to excessively drained
Permeability class	Slow to rapid
Soil depth	36–152 cm
Surface fragment cover <=3"	40–78%
Surface fragment cover >3"	7–55%
Available water capacity (0-101.6cm)	1.02–7.11 cm
Calcium carbonate equivalent (0-101.6cm)	0–25%
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	6.2–9
Subsurface fragment volume <=3" (Depth not specified)	15–90%
Subsurface fragment volume >3" (Depth not specified)	0–55%

Ecological dynamics

Abiotic Factors

The most important abiotic factors driving this site are a very dry climate with hyperthermic soil temperatures, steep slopes and rocky soils with low moisture holding capacity. The extreme aridity of this site restricts the potential vegetation to a very sparse creosote bush community with annual forbs contributing 50 to 80 percent of annual production during average to above average precipitation conditions.

This ecological site occurs in the eastern Mojave Desert, near the border of the Lower Colorado Desert with which it shares the characteristics of extreme aridity and strong winds. Steeper slopes experience greater degrees of water stress (Monson et al. 1992, Martre et al. 2002), and skeletal soils have little water holding capacity. Lack of available shallow soil moisture prevents survival of the shallow rooted burrobush (*Ambrosia dumosa*) and brittlebush (*Encelia farinosa*), which commonly co-occur with creosote bush in this environment. Creosote bush is a very long-lived, deep-rooted evergreen shrub that tends to be associated with coarse textured soils with little horizon development, and reaches greatest biomass and age on deep soils with large deep water reserves (McAuliffe 1994, Hamerlynk et al. 2002, Hamerlynk and McAuliffe 2008). On steep slopes, biomass and age are limited by erosional processes that cause shrub mortality, and by reduced deep soil water availability. On the shallow lithic soils of this ecological site, the deep-rooted creosote bush can access water held in fractured bedrock, allowing it persist on these very dry slopes. Similarly, it can access cracks in the duripan. On the deep soils of this site, the deep-roots of creosote bush can access deep water sources that rapidly permeate through the skeletal soils.

Disturbance Dynamics

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

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). Short-lived perennial shrubs 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.

The hot temperatures and skeletal soils of this ecological site reduce available soil moisture, which limits the susceptibility of this site to invasion by non-native annuals. However, microsites that are sheltered by large rock fragments and/or that receive additional run-on are susceptible to invasion by Mediterranean grass (*Schismus barbatus*). This non-native annual may usurp space from native annuals that also depend on these microsites for establishment.

The extremely sparse vegetation of this ecological site, with the low potential for high biomass of annual species limits the continuity of fine fuels in this site, and means that this site is extremely unlikely to burn.

State and transition model

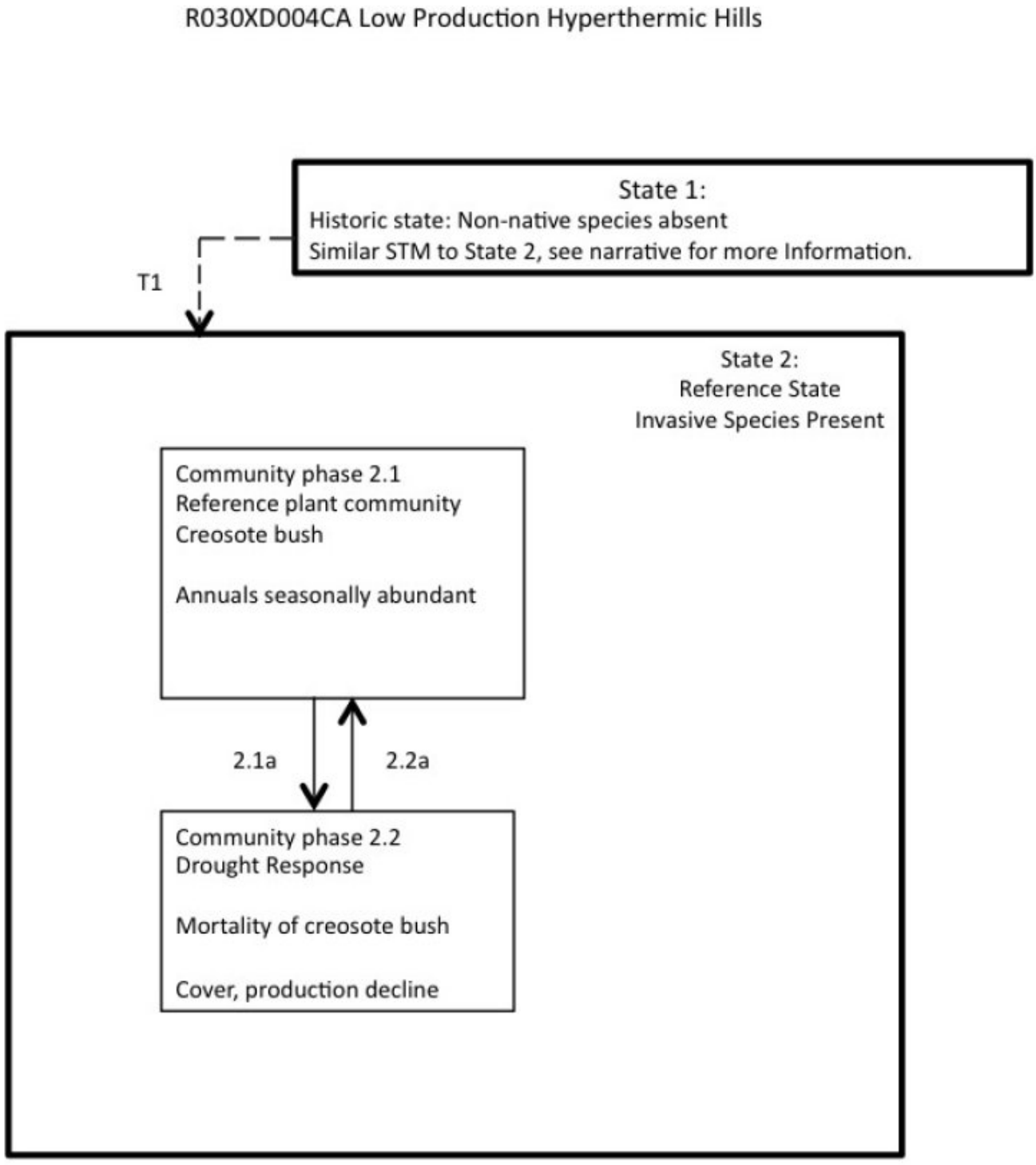


Figure 4. R030XD004CA

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 and Colorado Deserts. Drought and very rare fire were the natural disturbances influencing this ecological site. Data for this State does not exist, but it 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 (*Schismus barbatus*) are naturalized in this plant community. Abundance varies with precipitation, but it is 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

This community phase is dominated by sparse, very small creosote bush at 1 to 3 percent cover. The small statured native perennial grass low woollygrass (*Dasyochloa pulchella*) may be sparsely present. Annuals forb species contribute more than half of the production on this ecological site during average precipitation years, and 80 percent of production during years of above average precipitation. Most of this biomass comes from smooth pincushion flower (*Chaenactis fremontii*). Desert indianwheat (*Plantago ovata*) may also be abundant, and other common species include curvenut combseed (*Pectocarya recurvata*) and cryptantha (Cryptantha spp.). The non-native annual grass Mediterranean grass is sparsely present.

Table 5. Annual production by plant type

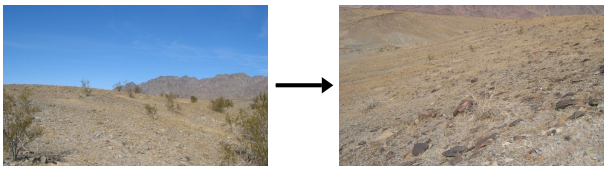
Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Forb	1	90	381
Shrub/Vine	28	77	95
Grass/Grasslike	–	–	3
Total	**29**	**167**	**479**

Community 2.2
Drought response

Figure 7. Community Phase 2.2

This community phase is characterized by an overall decline in cover due branch-pruning, lack of recruitment and mortality of creosote bush, and lack of emergence of annual forbs.

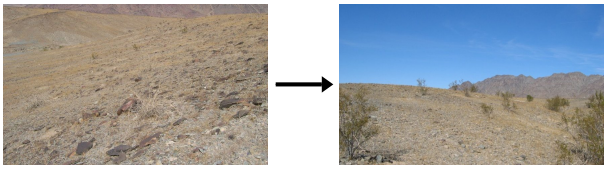
Pathway 2.1a
Community 2.1 to 2.2



Reference plant community **Drought response**

This pathway occurs with prolonged or severe drought.

Pathway 2.2a
Community 2.2 to 2.1



Drought response **Reference plant community**

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.

Additional community tables

Table 6. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
1	**Native shrubs**			28–95	
	sedge	CAREX	*Carex*	1608–2746	–
	Virginia wildrye	ELVI3	*Elymus virginicus*	1608–2746	–
	squirreltail	ELELE	*Elymus elymoides ssp. elymoides*	224–336	–
	creosote bush	LATR2	*Larrea tridentata*	28–95	1–3
Forb					
3	**Native annual forbs**			1–381	
	pincushion flower	CHFR	*Chaenactis fremontii*	0–381	1–10
	desert Indianwheat	PLOV	*Plantago ovata*	0–62	0–2
	curvenut combseed	PERE	*Pectocarya recurvata*	0–9	1
	Forb, annual	2FA	*Forb, annual*	0–6	0–1
	cryptantha	CRYPT	*Cryptantha*	0–4	0–1
Grass/Grasslike					
4	**Perennial Grasses**			0–2	
	ticktrefoil	DESMO	*Desmodium*	196–336	–
	lespedeza	LESPE	*Lespedeza*	196–336	–
	prairie snoutbean	RHLA5	*Rhynchosia latifolia*	196–336	–
	fuzzybean	STROP	*Strophostyles*	196–336	–
	low woollygrass	DAPU7	*Dasyochloa pulchella*	0–2	0–1
5	**Non-native annual grasses**			0–1	
	Mediterranean grass	SCHIS	*Schismus*	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 or food for animals.

Recreational uses

This site may be used for hiking and aesthetic enjoyment.

Inventory data references

Community Phase 2.1:

EOVP-04 (Type location)
DD-16
E1-J
E2-H
J3-H
LL-2
BB-5b
DD-10
DD-11
DD-5

Type locality

Location 1: Riverside County, CA	
UTM zone	N
UTM northing	3742190
UTM easting	655844
General legal description	The type location is approximately 160 feet north of the MWD Aqueduct Road on the southern border of Joshua Tree National Park, approximately 1.3 miles northwest of the intersection of the MWD Aqueduct Road and the Desert Center Rice Road.

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:**
