Ecological site R030XD021CA
Occasionally Flooded, Hyperthermic, Desert Pavement Ephemeral Stream

Accessed: 04/19/2024

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.

MLRA notes

Major Land Resource Area (MLRA): 030X–Mojave Basin and Range

MLRA statement:
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.

"XY" Land Resource Unit (LRU):
This LRU is found throughout the Mojave Desert MLRA. This LRU designation is set aside for ecological sites that are ubiquitous throughout the MLRA. These sites are driven by environmental or chemical features that override the climatic designations of the other LRU's or are atypical compared to the surrounding landscape. Common overriding XY characteristics within this MLRA include: ephemeral streams subject to flash flood events, riparian areas or other water features, and soils with strong chemical influence (Na, Ca, etc).

Site Concept:
This small ephemeral stream is on inset fans, drainageways, and stream terraces on fan remnants which typically have desert pavement surfaces. Soils are hyperthermic, very deep, and have sandy and gravelly textures. Small, narrow drainageways collect runoff from adjacent fan remnants, and are not associated with larger stream systems. Occasional floods have low volume and intensity, and are contained within the drainageway. Creosote bush (Larrea tridentata), brittlebush (Encelia farinosa), burrobush (Ambrosia dumosa), and white ratany (Krameria grayi) are important species.

Data ranges in the physiographic data, climate data, water features, and soil data sections of this Ecological Site Description are based on major and minor components, since it is often only associated with minor components.

Associated sites

R030XD002CA	**Desert Pavement** This is a desert pavement ecological site which is adjacent to this site. There is low cover of creosote bush.
R030XD006CA	**Abandoned Fan** This ecological site is on adjacent alluvial fans with creosote bush.
R030XD039CA	**Coarse Gravelly Fans** This ecological site is on alluvial fans with creosote bush and brittlebush.
R030XD042CA	**Hyperthermic Shallow To Moderately Deep Fan Remnants** This ecological site is on fan remnants with shallow to moderately deeps soils over a duripan. Sparse creosote is present.

Similar sites

R040XD021CA	**Very Gravelly Wash** This ecological site is on similar drainageways among fan remnants with desert pavement surfaces, but it is in the Sonoran Desert, generally at lower elevations, with higher temperatures, and more summer precipitation.

Table 1. Dominant plant species

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

Physiographic features

This site occurs on inset fans, drainageways and stream terraces (rarely on fan aprons) that drain stable fan remnants covered with desert pavement. Elevations range from 570 to 2800 feet, and slopes are typically 2 to 8 percent, but may range from 0 to 15 percent.

Table 2. Representative physiographic features

Landforms	(1) Inset fan (2) Drainageway (3) Stream terrace
Flooding duration	Very brief (4 to 48 hours)
Flooding frequency	None to occasional
Elevation	570–2,800 ft
Slope	0–15%
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 air temperature is 68 to 73 degrees, and mean annual precipitation is 3 to 5 inches. The frost free period is 300 to 340 days, and freeze free period is estimated to range from 320 to 360 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.

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

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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)	360 days
Precipitation total (average)	5 in

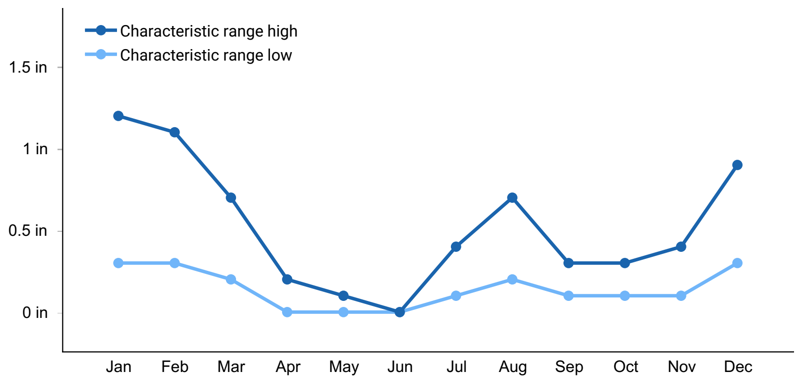

Figure 1. Monthly precipitation range

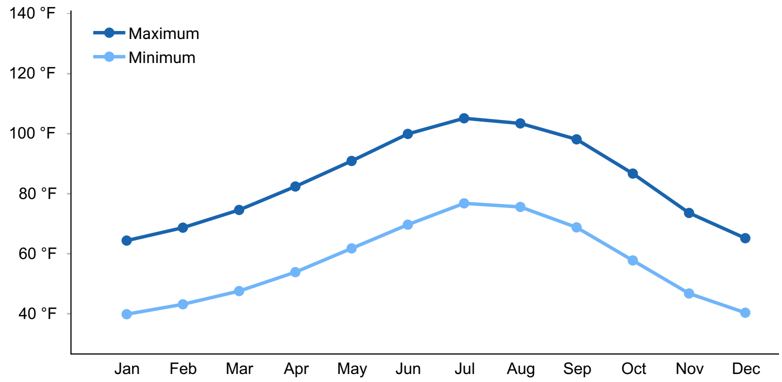

Figure 2. Monthly average minimum and maximum temperature

Influencing water features

Soil features

The soils associated with this ecological site are very deep, excessively drained, and formed in alluvium from granitoid, igneous or mixed parent material. Surface textures are very gravelly loamy sand, gravelly loamy sand, and gravelly sand. Subsurface horizons (1 to 59 inches) are composed of stratified layers of sandy textures with gravelly to extremely gravelly modifiers. Surface rock fragments less than 3 inches range from 34 to 79 percent cover, and fragments greater than 3 inches range from 1 to 20 percent cover. Subsurface percent by volume of rock fragments less than 3 inches ranges from 15 to 60, and greater that 3 inch fragments range from 1 to 10 percent.

The Carrizo soils are Sandy-skeletal, mixed, hyperthermic Typic Torriorthents. This site is associated with a minor component of Cambidic Haplodurids, but data has not been entered in NASIS at time of this writing.

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

Map unit ID; Map unit name; Component; phase; percent
1540; Carrizo-Russiroks complex, 2 to 8 percent slopes; Carrizo; occasionally flooded, rocky surface; 20
1541; Carrizo-Cambidic Haplodurids association, 4 to 15 percent slopes; Cambidic Haplodurids; rarely flooded; 2
2068; Aquapeak-Carpetflat-Pintobasin complex, 0 to 4 percent slopes; Carrizo; occasionally flooded, rocky surface; 1
2070; Missionsweet-Carpetflat association, 2 to 30 percent slopes; occasionally flooded, rocky surface; 6
2076; Oldale-Carrizo complex, 2 to 8 percent slopes; occasionally flooded, rocky surface; 5
2077; Oldale-Carrizo association, 2 to 8 percent slopes; Carrizo; occasionally flooded, rocky surface; 10
2110; Descent association, 4 to 50 percent slopes; Carrizo; occasionally flooded, rocky surface; 5

Table 4. Representative soil features

Parent material	(1) Alluvium–granite
Surface texture	(1) Very gravelly loamy sand (2) Gravelly loamy sand (3) Gravelly sand
Family particle size	(1) Sandy
Drainage class	Well drained to excessively drained
Permeability class	Moderately rapid to rapid
Soil depth	59 in
Surface fragment cover <=3"	34–79%
Surface fragment cover >3"	1–20%
Available water capacity (0-40in)	0.5–2.2 in
Calcium carbonate equivalent (0-40in)	0–5%
Electrical conductivity (0-40in)	0 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	6.4–8.8
Subsurface fragment volume <=3" (Depth not specified)	15–60%
Subsurface fragment volume >3" (Depth not specified)	1–10%

Ecological dynamics

These small ephemeral streams are on inset fans, drainageways, and stream terraces that drain stable fan remnants that typically have desert pavement surfaces. These ephemeral streams form dendritic (branched) drainage patterns as they collect runoff from adjacent fan remnants. Desert pavement is distinguished by almost barren, level surfaces covered with tightly interlocked surface gravels, which are often darkly colored by desert varnish. Ephemeral streams among desert pavement surfaces appear as wavy lines of vegetation among the dark barren surfaces. Desert pavement has near surface soil features that reduce the rate of infiltration, thus excess flow drains across the flat surfaces to the multiple small ephemeral streams that have developed on the fan remnants

Drainageways among desert pavement surfaces receive continuous soil disturbance from runoff events that prevents formation of desert pavement features, such as an interlocking gravelly surface, or a vesicular horizon. Instead, they are composed of very deep sands with very gravelly or extremely gravelly modifiers. Regular flooding of the drainageways flushes the fine eolian dust deposits from the surface and inhibits the development of the vesicular horizon and the associated uplift of gravels. The deep sands allow for quick and deep infiltration of water. Vegetation is dense and diverse in contrast to the barren desert pavement surfaces, because they can access the deeper water. Creosote bush, brittlebush, burrobush, and white ratany are dominant. A diversity of other shrubs and forbs may be present.

The stable gravel surface and the flat topography of the desert pavement are resistant to erosion, and provide little sediment to the streams during flood events. Occasional floods have low volume and intensity, and are contained within the drainageway. These draingeways are in stable positions, and are not inclined to braid or migrate, unless disturbed.

If the desert pavement surface is disturbed, and the protective gravels are removed, surface erosion and gullying may increase sediment and run off to the adjacent ephemeral streams. Road development and associated ditches alter drainage patterns, which may cause drainageways to become wider, deeper, and braided.

This ecological site is very unlikely to burn, or to burn extensively due to the large expanses of barren desert pavement between the vegetated channels. Non-native species were not recorded in the plot data, but are present in low amounts in the area. However, they will not likely form a continuous fuel load to carry fire.

State and transition model

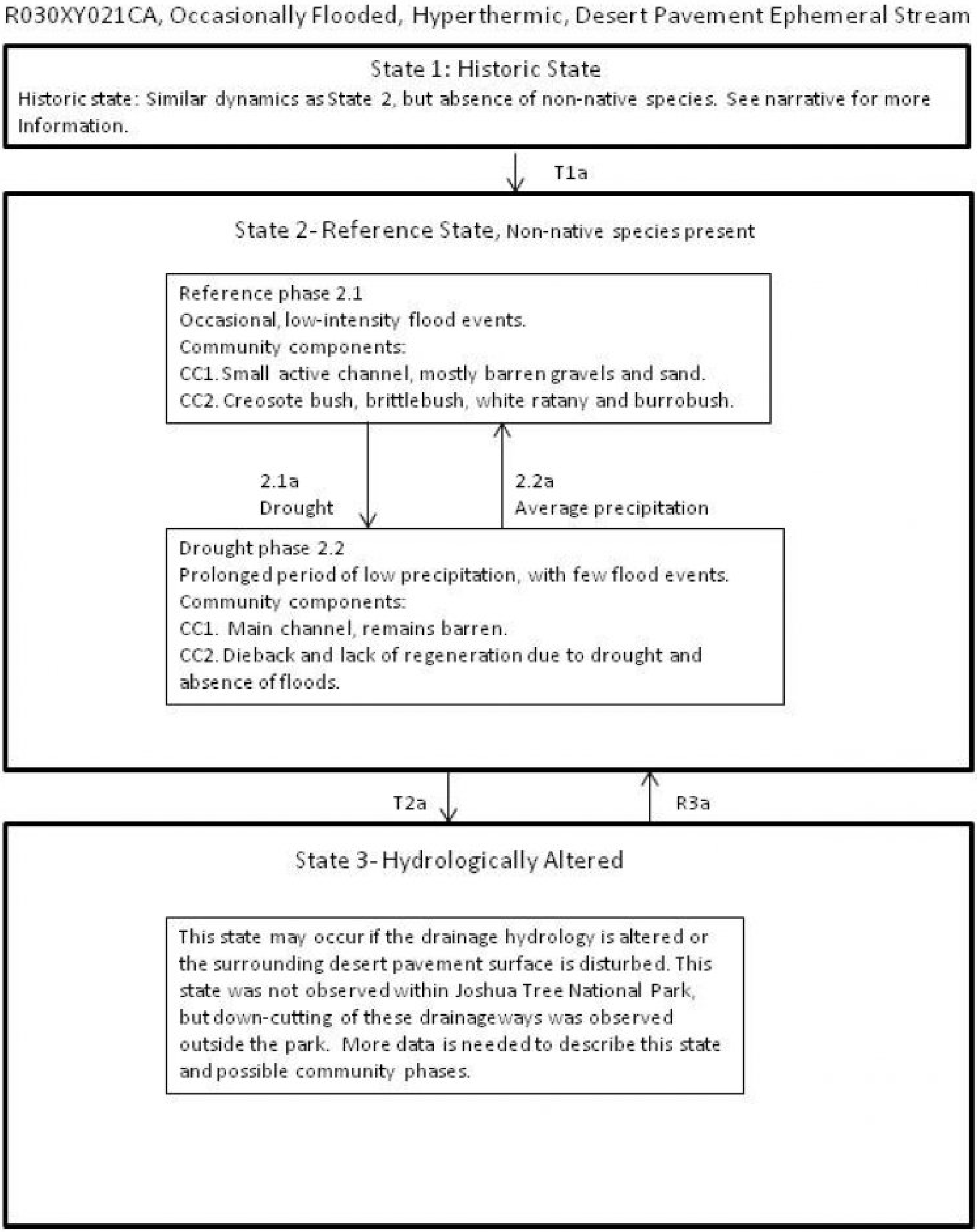

Figure 3. R030XY021CA Model

State 1
Historic State

State 1 represents the historic-natural condition for this ecological site. It is similar to State 2, but has only native species. If we were to include dynamics for this state it would be the same as displayed in State 2. The presence of non-native species is minimal in State 2, and has not altered the hydrology or fire frequency.

State 2
Reference State

This state represents the most common and most ecologically intact condition for this ecological site at the present time.

Community 2.1
Reference Phase

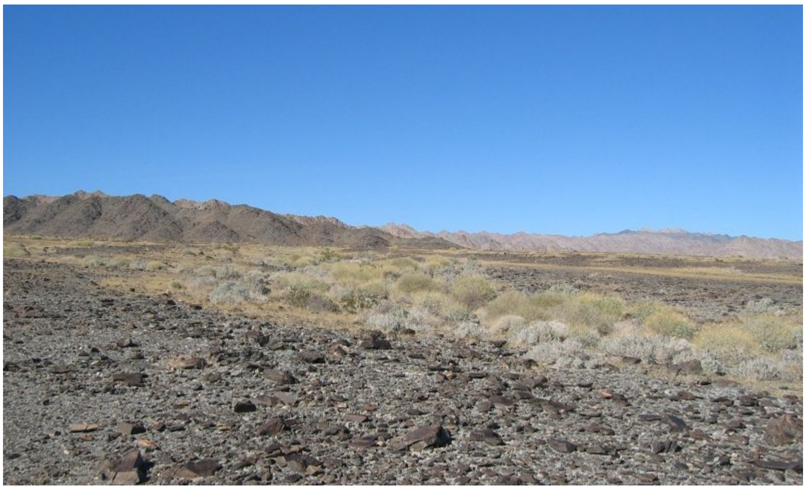

Figure 4. Community Phase 2.1 Brittlebush - Creosote bush

Figure 5. Community Phase 2.1 Brittlebrush-Creosote bush

Figure 6. Community Phase 2.1 Brittlebush - Creosote bush

This community phase is dependent upon unimpaired hydrologic function and average to above average precipitation conditions. These drainageways are relatively stable and confined. There are two community components associated with this community phase. Community component one is in the most actively flooded region of the drainageway, which is composed of barren sands and gravels. Community component two is adjacent to the active zone in the drainageway and on the sideslopes of the drainageway. Brittlebrush is generally dominant, and creosote bush, burrobush, white ratany and sweetbush (*Bebbia juncea*) are common secondary shrubs. Although always relatively small, there is variation in the size and shape of these draingeways, ranging from smaller channels with primarily creosote bush, to larger channels with a higher diversity of shrubs, such as sweetbush and occasionally desert lavender (*Hyptis emoryi*). At the upper elevations ranges of this ecological site, or in areas with more precipitation, creosote bush and burrobush increase, brittlebush is less dominant, and desertsenna (*Senna armata*), jojoba (*Simmondsia chinensis*), Wiggens' cholla (*Cylindropuntia echinocarpa*) and branched pencil cholla (*Cylindropuntia ramosissima*) may be present. Big galleta (*Pleuraphis rigida*), has low cover in the more defined drainageways. Annual production varies with precipitation, but Abrams' sandmat (*Chamaesyce abramsiana*), cryptantha (Cryptantha sp.), smooth desertdandelion (*Malacothrix glabrata*), and desert Indianwheat (*Plantago ovata*) are usually present with notable cover. Other species include brittle spineflower (*Chorizanthe brevicornu*), pincushion flower (*Chaenactis fremontii*), buckwheat (Eriogonum sp.), Mojave desertstar (*Monoptilon bellioides*), ghost flower (*Mohavea confertiflora*), birdcage evening primrose (Oenothera deltoids) and chia (*Salvia columbariae*).

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	60	100	115
Forb	40	80	90
Grass/Grasslike	0	10	20
Total	**100**	**190**	**225**

Community 2.2
Drought Response

This community develops with prolonged or severe drought. 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 perennials (such as burrobush, brittlebush, sweetbush, and desertsenna) 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). Long-lived shrubs (such as creosote bush, white ratany, and desert lavender) 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. Brittlebush, when dominant on lower landscape positions, such as alluvial fans, is generally associated with a disturbance community, such as an ephemeral stream (Sawyer et al. 2009). 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). 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). 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. 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. If drought persists or the channel becomes less active due to flow diversion, creosote bush may become the main species in the drainageway.

Pathway 2.1a

Community 2.1 to 2.2

This pathway is caused by a prolonged or severe drought.

Pathway 2.2a
Community 2.2 to 2.1

This pathway occurs with the return of average to above average precipitation and associated flood events.

State 3
Hydrologically Altered State

This state may occur if the drainage hydrology is altered or the surrounding desert pavement surface is disturbed. This state was not observed within the Joshua Tree National Park, but downcutting of these drainageways was observed outside the park. More data is needed to describe this state and possible community phases.

Community 3.1
Hydrologically Altered

Headcutting may occur when drainages are bisected by roads, and roadside ditches are manually created or created as a result of erosion from runoff. If the ditches have a lower base level the natural drainages may headcut to level out the channel gradient. Roads and ditches can either divert flow away from or concentrate flow to an area below the road. Loss of flow will cause species richness to decline. Increased flow will cause the channel to erode, widening and/or downcutting to accommodate the increased flow. If the adjacent stable desert pavement surfaces are disturbed, it may alter sediment delivery and flow distribution to the drainageways.

Transition T2
State 2 to 3

Surface flow alterations or disturbance of the adjacent desert pavement surfaces can trigger a transition to State 3.

Restoration pathway R3a
State 3 to 2

Restoration from State 3 back to State 2 would be an intensive task. Individual site assessments would be required to determine proper restoration methods. Some hydrological modifications are not feasible restored, such as ground water depletion. However, road diversions can be redesigned to allow proper stream alignment and flow. Since these channels are relatively confined and do not braid or migrate, proper locations for culverts or breaks are easier to identify. Seeds or plants of appropriate species may need to be reintroduced to the restored channels.

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**			60–115	
	brittlebush	ENFA	*Encelia farinosa*	40–85	1–20
	creosote bush	LATR2	*Larrea tridentata*	20–50	2–20
	white ratany	KRGR	*Krameria grayi*	2–20	1–6
	desertsenna	SEAR8	*Senna armata*	0–20	0–2
	desert lavender	HYEM	*Hyptis emoryi*	0–20	0–2
	sweetbush	BEJU	*Bebbia juncea*	0–15	0–4
	jojoba	SICH	*Simmondsia chinensis*	0–10	0–1
	burrobush	AMDU2	*Ambrosia dumosa*	0–1	0–3
	Wiggins' cholla	CYEC3	*Cylindropuntia echinocarpa*	0–1	0–1
	branched pencil cholla	CYRA9	*Cylindropuntia ramosissima*	0–1	0–1
Grass/Grasslike					
2	**Perennial Grass**			0–20	
	big galleta	PLRI3	*Pleuraphis rigida*	0–20	0–2
Forb					
3	**Forbs**			40–90	
	cryptantha	CRYPT	*Cryptantha*	25–35	0–5
	Abrams' sandmat	CHAB2	*Chamaesyce abramsiana*	15–25	0–1
	smooth desertdandelion	MAGL3	*Malacothrix glabrata*	10–20	0–3
	desert Indianwheat	PLOV	*Plantago ovata*	4–8	0–2
	chia	SACO6	*Salvia columbariae*	0–1	0–1
	Mojave desertstar	MOBE2	*Monoptilon bellioides*	0–1	0–1
	ghost flower	MOCO	*Mohavea confertiflora*	0–1	0–1
	birdcage evening primrose	OEDE2	*Oenothera deltoides*	0–1	0–1
	brittle spineflower	CHBR	*Chorizanthe brevicornu*	0–1	0–1
	pincushion flower	CHFR	*Chaenactis fremontii*	0–1	0–1
	buckwheat	ERIOG	*Eriogonum*	0–1	0–1

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 (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. Brittlebush is used as forage by desert bighorn sheep and mule deer.

Hydrological functions

Ephemeral drainages maintain water quality by allowing energy dissipation from flow events. These systems transport nutrients and sediments, and store sediments and nutrients in deposition zones. Ephemeral drainages provide temporary storage of surface water, and longer duration storage of subsurface water (Levick et al. 2008).

Recreational uses

This site may be used for hiking and aesthetic enjoyment.

Other products

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).

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:

J5-M
701-break
PIMO-04B

Type locality

Location 1: Riverside County, CA	
UTM zone	N
UTM northing	3749208
UTM easting	659021
General legal description	The type location is west of HW177, in Joshua Tree National Park, about 15 miles north of Desert Center, CA.

Other references

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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:**

17. **Perennial plant reproductive capability:**