Ecological site R040XD002CA
Desert Pavement 2-4" p.z.

Last updated: 3/11/2025
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General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 040X–Sonoran Basin and Range

MLRA Statement:
Major land resource area (MLRA) 31 is the Lower Colorado Desert. This area is in the extreme southeastern part of California, in areas along the Colorado River, and in Western Arizona. The area is comprised of rough, barren, steep, and strongly dissected mountain ranges, generally northwest to southwest trending that are separated by intermontane basins. Elevation ranges from approximately 275 feet below sea level at the lowest point in the Salton Trough to 2700 feet along low northwest to southeast trending mountain ranges. The average annual precipitation is 2 to 6 inches with high temporal and spatial variability. Winter temperatures are mild, summer temperatures are hot, and seasonal and diurnal temperature fluctuations are large. Monthly minimum temperature averages range from 40 to 80 degrees F (4 to 27 degrees C). Monthly maximum temperature averages range from 65 to 110 degrees F (18 to 43 degrees C) (WRCC 2002). Temperatures are rarely below 28 degrees F, and extremely rarely fall below 24 degrees F. Precipitation is bimodal, with approximately 20 to 40 percent of annual precipitation falling between July and September. This summer rainfall, in combination with very hot temperatures and very few to no days of hard freeze are what characterize this MLRA and distinguish it from the Mojave Desert (MLRA 30).

Classification relationships

Mojave Creosote Bush (Holland, 1986).
Larrea tridentata Shrubland Alliance (Sawyer et al. 2009).

Ecological site concept

Ecological Site Concept:
This ecological site occurs on fan remnants, ballena summits, and fan aprons. This site is defined by the presence of desert pavement surfaces with an underlying eolian-deposited horizon dominated by vesicular pores. The desert pavement surface is composed of interlocking rock fragments, and serves to limit water infiltration and plant establishment, which limits vegetation production and diversity. Desert pavement rock fragments are often covered with desert patina, a thin varnish of clay, manganese and iron oxides. Vegetation is dominated by very sparse creosote bush (Larrea tridentata), which is confined to breaks in the pavement surface.

Data ranges in the physiographic data, climate data, water features, and soil data sections of this Ecological Site Description are based on major components only (15 percent or greater).

This description was copied from and is equivalent to R031XY002CA. There is ongoing LRU concept development and designation where a request was made by the Region 8 Ecological Site Specialist to avoid using the default XY LRU.

Associated sites

R040XD021CA	**Very Gravelly Wash** This ecological site is on interfluves and inset fans among the desert pavement. Creosote bush and brittlebush are dominate.
R040XD200CA	**Rarely Flooded Fans** This ecological site occurs on rarely flooded fan aprons and bars of drainageways. Brittlebrush and creosote bush dominate.
R040XD201CA	**Cobbly Fan Remnants** This ecological site occurs on fan remnants with a cobbly surface. Brittlebush and creosote bush are dominant.
R040XD009CA	**Gravelly Fan Remnants And Fan Aprons** This ecological site is on fan aprons, which receive run-on from adjacent mountain slopes. Creosote bush, Schott's dalea, and brittlebush are present.
R040XD010CA	**Valley Wash** This ecological site occurs on large valley washes, distal from the mountains. Blue paloverde, smoketree, and burrobrush are dominant.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Larrea tridentata* (2) *Encelia farinosa*
Herbaceous	(1) *Plantago ovata* (2) *Chorizanthe rigida*

Physiographic features

This site occurs on summits of gently sloping fan remnants which have well developed desert pavement. Elevations range from 460 to 1720 feet, and slopes range from 0 to 8 percent.

Table 2. Representative physiographic features

Landforms	(1) Fan remnant
Flooding duration	Very brief (4 to 48 hours)
Flooding frequency	None to very rare
Elevation	140–524 m
Slope	0–8%
Aspect	Aspect is not a significant factor

Climatic features

The Colorado Desert of California represents the northwesternmost portion of the Sonoran Desert. The subtropical Colorado Desert results from the descent of cold air which is heated by compression and arrives hot and dry at the earth's surface. Precipitation is frontal in nature during the winter and convectional in the summer. Reduced summer rainfall and high potential evapotranspiration make the Colorado Desert one of the most arid regions in North America. Summer temperatures frequently exceed 105 degrees F. Mean annual temperatures range from 68 to 81 degrees F. The mean annual precipitation ranges from 2 to 5 inches with most falling as rain. Approximately 35% of the annual precipitation occurs from July to September as a result of intense convection storms. Spring months are the windiest.

Table 3. Representative climatic features

Frost-free period (average)	365 days
Freeze-free period (average)	365 days

Precipitation total (average)	127 mm

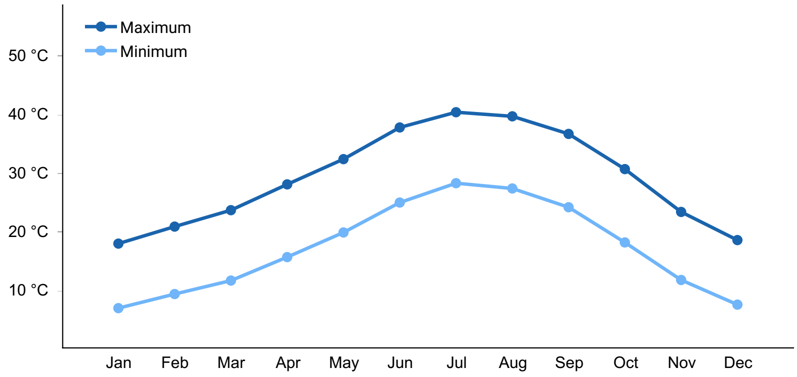

Figure 1. Monthly average minimum and maximum temperature

Influencing water features

There are no influencing water features on this ecological site.

Soil features

This site is defined by a desert pavement surface, composed of tightly interlocking rock fragments typically darkened by desert patina (desert varnish), underlain by a eolian deposits. The soils associated with this site range from moderately deep over a duripan to very deep, and are well drained with slow permeability. They formed in mixed alluvium, from granitic, gneissic, and/or igneous sources. The surface textures are extremely gravelly loam and gravelly sandy loam. Subsurface textures (from depths of 2 inches to 59 inches or to the duripan about 40 inches) are gravelly to extremely gravelly sandy loams and loams, with sand and course sands in the lower horizons of the deeper soils without a duripan. These soils generally have thin A horizon with vesicular pores, under a thin C horizon of rock fragements. Surface rock fragments less than 3 inches in diameter range from 75 to 88 percent cover, and larger fragments range from 2 to 15 percent cover. Subsurface percent by volume of rock fragments less than 3 inches ranges from 20 to 60, and larger fragments range from 1 to 7 percent.

The Havasulake, Rockhound and Deprave soils are major soil components associated with this site (15 percent of mapunit or more). These soils have argillic soil horizons, and a loamy-skeletal particle size control section. The Havasulake soils are loamy-skeletal, mixed, superactive, hyperthermic Typic Calciargids; Rockhounds soils are loamy-skeletal, mixed, superactive, hyperthermic Typic Haplargids; and Deprave soils are loamy-skeletal, mixed, superactive, hyperthermic Argidic Argidurids. The Havasulake soils have calcic horizons, and the Deprave soils have a duripan at depths ranging from 20 to 40 inches.

Soils associated as a minor component with this ecological site are Roostertail, Snaggletooth, and Garywash. The Roostertail soils are loamy-skeletal, mixed, superactive, hyperthermic Duric Petroargids; Snaggletooth soils are fine-loamy, mixed, superactive, hyperthermic Typic Calciargids; Garywash soils are coarse-loamy, mixed, superactive, hyperthermic Typic Haplocalcids; The Roostertail soils have a duripan beginning at depths of 22 to 24 inches, and have extremely gravelly sandy loam surface textures. The Snaggletooth soils have less than 35 percent rock fragments in the particle control section, and have a silt surface texture. The Garywash soils have a fine sandy loam surface texture, with sandy subsurface textures. The Garywash soils have calcic horizons but do not have argillic horizon development.

This ecological site has been correlated to the following mapunits and major soil components in the Colorado Desert Area Soil Survey (CA803):

Mapunit ID; Mapunit name; Component; Percent
2003; Emptygun-Havasulake association, 0 to 50 percent slopes; Havasulake, 25
2011; Havasulake gravelly silt loam, 1 to 4 percent slopes; Havasulake; 85
2012; Havasulake gravelly sandy loam, 1 to 4 percent slopes; Havasulake; 85
2050; Havasulake-Rizzo association, 1 to 8 percent slopes; Havasulake; 15

This ecological site is associated with 9 other mapunits with minor components of Havasulake, and one mapunit with the Garywash soil component.

This ecological site has also been correlated to the following mapunits and major soil components that join both the Colorado Soil Survey (CA803) and Joshua Tree National Park Soil Survey (CA794):

Mapunit ID; Mapunit name; Component; Percent
2090;Deprave-Rockhound-Rizzo complex, 2 to 4 percent slopes; Deprave; 35
2090; Deprave-Rockhound-Rizzo complex, 2 to 4 percent slopes; Rockhound; 25
2091; Deprave-Roostertail association, 0 to 4 percent slopes Deprave; 60
2120; Rizzo-Deprave complex, 2 to 8 percent slopes; Deprave; 35

This ecological site is associated with 6 other joining mapunits with minor components of the following soils: Roostertail, stable; Snaggletooth; and Deprave. This ecological site occurs in 3 additional mapunits only in the Joshua Tree National Park Soil Survey with minor components of Deprave.

Table 4. Representative soil features

Parent material	(1) Alluvium–granite
Surface texture	(1) Very gravelly silt loam (2) Extremely gravelly loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Slow
Soil depth	51 cm
Surface fragment cover <=3"	75–88%
Surface fragment cover >3"	2–15%
Available water capacity (0-101.6cm)	3.3–10.41 cm
Calcium carbonate equivalent (0-101.6cm)	0–20%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–5
Soil reaction (1:1 water) (0-101.6cm)	6.6–9
Subsurface fragment volume <=3" (Depth not specified)	20–60%
Subsurface fragment volume >3" (Depth not specified)	1–7%

Ecological dynamics

This ecological site occurs on fan remnants, and is defined by a desert pavement surface, composed of tightly interlocking rock fragments typically darkened by desert patina (desert varnish), with an underlying eolian-deposited horizon dominated by vesicular pores. A range of soil development is present under the desert pavement surfaces, ranging from moderately deep soils with a duripan to very deep soils with or without argillic horizon development.

Desert pavement has near surface soil features that reduce the rate of infiltration, and reduces germination and establishment of vegetation. Creosote bush is the dominant shrub on desert pavement, and it tends to establish in small breaks in the flat pavement surface where runoff accumulates or rock fragment cover is lower. Annuals may be present in the breaks, or in pockets of eolian sands and silt deposits that overlie the desert pavement. Small drainages dominated by creosote bush and brittlebush (*Encelia farinosa*) dissect the desert pavement surfaces. These drainageways are composed of very deep sands, which allow for quick and deep infiltration of water (See ESD R031XY021CA for more information). Moderate sized, confined drainageways among the desert pavement with high cover of desert ironwood are described in ecological site (R031XY029CA)

Recent theories on the development of desert pavement suggest that eolian dust from nearby dry lake beds have been deposited on the soil surface for thousands of years, and accumulated (through a variety of processes) under the surface gravels (McFadden et al. 1987, McFadden 1998, Meadows et al. 2008). The vesicular layer is composed of eolian clays, silts, and salts, which form vesicle-shaped air pockets due to cycles of wetting and drying (McFadden 1998, Turk et al. 2010). Within the vesicular horizon, a process of shrink and swell activity in the accumulated clays pushes a layer of rock fragments to the surface, creating a nearly level surface of interlocking rock fragments. The surface rock fragments weather to smaller pieces by physical and chemical weathering processes, including heat and salt fracturing. Older desert pavement surfaces may have higher cover of interlocking gravels, and more developed vesicular horizons.

It has been proposed that infiltration through the vesicular horizon decreases with age, increasing runoff, that eventually results in erosion of the pavement surfaces. However, recent studies indicate that infiltration in older vesicular horizons (>10,000 years) may occur though preferential pathways along the vertical ped faces rather than through the ped matrix as in the younger soils, so older and younger soils may have similar infiltration rates but use different infiltration processes (Meadows et al. 2008).

The desert patina, or rock varnish, that coats the rock fragments, harbors an incredibly diverse microbial community, which has been little explored by science (Kuhlman et al. 2006). Desert patina takes thousands of years to develop, and may be used as a record of past climatic and disturbance events such as drought and increased wind erosion, and fire. Ancient intaglios (A figure or design carved into or beneath the surface of hard metal or stone) have been formed by removing the dark patina covered rock fragments, revealing the lighter colored soils beneath. There are large intaglios made in desert pavement surfaces in Blythe, CA and the famous Nasca Lines in Peru (Phillips and Comus 1999).

The limited infiltration of water through desert pavement surfaces has created pools of nitrate accumulation under the desert pavement surface (Graham et al. 2008). Nitrates are deposited along with eolian dust and other salts, and have accumulated over time to the limited depth to which water can infiltrate. Nitrates levels are significantly lower in nearby soils without desert pavement surfaces. If the desert pavement surface is disrupted, and water is able to infiltrate deep into the soils, high levels of nitrates could potentially be leached into ground water. If dust is mobilized, high levels of nitrogen may be spread to distant areas such as alpine lakes or the snow pack of the Sierra Nevada (Graham et al. 2008). Soils with high nitrogen levels and a disrupted pavement surface are also more susceptible to invasion by non-native species such as red brome (*Bromus rubens*), Mediterranean grass (Shismus sp.), and Asian mustard (*Brassica tournefortii*).

This ecological site does not develop vegetation that would carry fire. The non-native Mediterranean grass is present in low amounts.

State and transition model

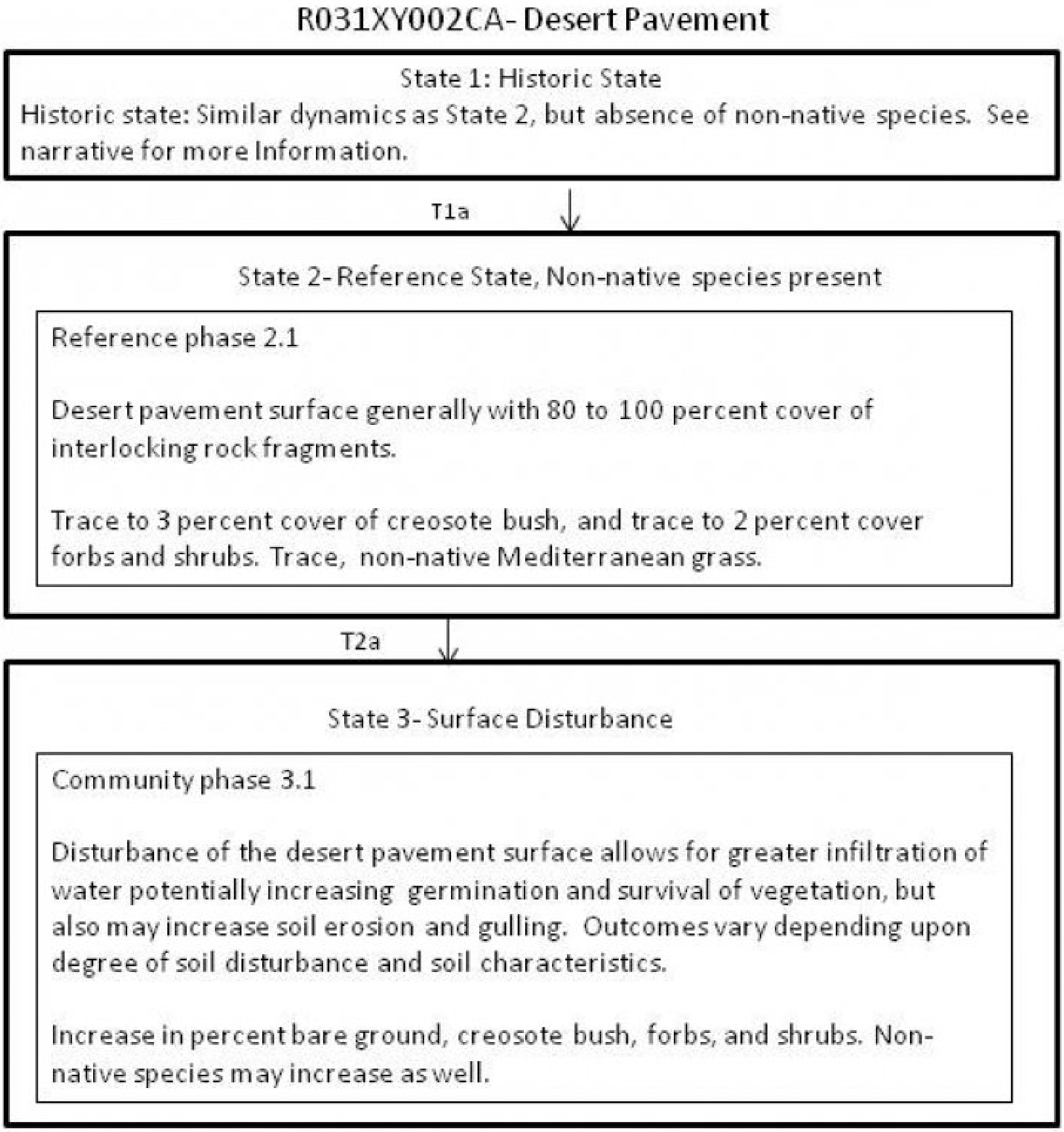

Figure 2. R031XY002CA model

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 Community

Figure 3. Desert Pavement

The tightly interwoven rock fragments in combination with the underlying eolian-deposited horizon creates a soil surface that is generally inhospitable to seed germination, and mostly barren of vegetation with the exception of annual forbs with very shallow root depth requirements and widely scattered creosote bush shrubs. Creosote bush is able to persist due to an ability to establish deep taproots to extract water from deep into the soil profile, and once established, a positive feedback is developed where infiltration rates are greater directly beneath the shrub. Species diversity increases near interfluves and inset fans, where desert pavement surfaces are less intact. Shrubs such as burrobush (*Ambrosia dumosa*), brittlebush (*Encelia farinosa*), white ratany (*Krameria grayi*), and Schott's dalea (*Psorothamnus schottii*), are generally present along these breaks, along with other trace species listed in the table below. Forb cover is low, but may increase in areas with shallow sand or dust deposits over the desert pavement surface. Common forbs brittle spineflower (*Chorizanthe brevicornu*), pincushion flower (*Chaenactis fremontii*), devil's spineflower (*Chorizanthe rigida*), cryptantha (Cryptantha sp.), sowthistle desertdandelion (*Malacothrix sonchoides*) and desert Indianwheat (*Plantago ovata*). The native grasses, low woollygrass (*Dasyochloa pulchella*) and sixweeks threeawn (*Aristida adscensionis*) are present in trace amounts. The non-native annual, Mediterranean grass is present with low cover.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	21	45	122
Forb	6	8	11
Grass/Grasslike	1	3	7
Total	**28**	**56**	**140**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	1-5%
Grass/grasslike foliar cover	0-1%
Forb foliar cover	0-2%
Non-vascular plants	0%
Biological crusts	0%
Litter	1-3%
Surface fragments >0.25" and <=3"	75-90%
Surface fragments >3"	2-15%
Bedrock	0%
Water	0%

Bare ground	1-3%

State 3
Surface Disturbance

This state is characterized by significant disruption of the desert pavement surface. This state needs more investigation to determine disturbance pathways, due to a lack of data and variability in soil characteristics.

Community 3.1
Surface disturbance

Disturbance of the desert pavement will increase the rate and depth of infiltration of direct precipitation and surface run-off into the soils. This will increase the ability of vegetation to establish, and over time creosote bush, burrobush, and brittlebush could develop more continuous cover across the disturbed fan remnants. Non-native grasses and forbs may become more abundant as well. Soils with silt loam (some pedons of Havasulake) and loam textures will be most vulnerable to erosion, because they are not clayey enough to be cohesive, and are composed of fine particles that are light enough to be eroded. They are also not as permeable as sandy soils, so the impact of rain will run off, and carry the newly exposed silts and fines with it. Deeper sandy soils will allow for quicker infiltration, and have heavier particles that take more force to erode (Garywash). In addition, soils with a duripan (Deprave and Roostertail) risk losing a portion of an already limited soil thickness. Eroded desert pavement soils with a duripan would develop a different plant community than on very deep soils. Deep sandy soils with little horizon development have a more favorable soil moisture characteristic than shallow soils with a root and water-limiting duripan, and are thus more susceptible to colonization by native and non-native species. Soil texture and permeability below the surface horizons will also affect the rate of nitrate leaching to ground water and influence susceptibility to wind erosion. Since desert pavement requires thousands of years to develop, recovery times are longer than centuries, making natural recovery of desert pavement virtually impossible in a lifetime.

Transition T2A
State 2 to 3

This transition occurs with large-scale displacement of the desert pavement surface. This could be from off-road vehicle use or road construction through the desert pavement. Displacement of large areas of pavement and disturbance of the fine-textured vesicular horizon will cause increased wind and water erosion. Larger scale disturbances can also mobilize nitrates that exist in high amounts near the soil surface, which can cause contamination of surface run-off and groundwaters (Graham et al. 2008).

Additional community tables

Table 7. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
1	**Shrubs**			13–110	
	creosote bush	LATR2	*Larrea tridentata*	13–87	1–3
	brittlebush	ENFA	*Encelia farinosa*	0–11	0–1
	white ratany	KRGR	*Krameria grayi*	0–6	0–1
	burrobush	AMDU2	*Ambrosia dumosa*	0–3	0–1
	Schott's dalea	PSSC5	*Psorothamnus schottii*	0–2	0–1
2	**Cactuses**			1–4	
	branched pencil cholla	CYRA9	*Cylindropuntia ramosissima*	0–2	0–1
	Wiggins' cholla	CYEC3	*Cylindropuntia echinocarpa*	0–1	0–1
	beavertail pricklypear	OPBA2	*Opuntia basilaris*	0–1	–
3	**Ocotillo**			0–3	
	ocotillo	FOSP2	*Fouquieria splendens*	0–3	0–1
Grass/Grasslike					
7	**Annual Grasses**			1–3	
	sixweeks grama	BOBA2	*Bouteloua barbata*	0–2	0–1
	sixweeks threeawn	ARAD	*Aristida adscensionis*	0–1	0–1
Forb					
8	**Perennial Forbs**			2–7	
	desert trumpet	ERIN4	*Eriogonum inflatum*	0–2	0–1
	Parry's false prairie-clover	MAPA7	*Marina parryi*	0–2	0–1
	wirelettuce	STEPH	*Stephanomeria*	0–2	0–1
9	**Annual Forbs**			3–7	
	devil's spineflower	CHRI	*Chorizanthe rigida*	0–2	0–1
	sowthistle desertdandelion	MASO	*Malacothrix sonchoides*	0–2	0–1
	desert Indianwheat	PLOV	*Plantago ovata*	0–2	0–1
	cryptantha	CRYPT	*Cryptantha*	0–1	0–1
	beetle spurge	EUER2	*Euphorbia eriantha*	0–1	0–1
	brittle spineflower	CHBR	*Chorizanthe brevicornu*	0–1	0–1
	pincushion flower	CHFR	*Chaenactis fremontii*	0–1	0–1

Animal community

This site provides habitat for mammals such as long-tailed pocket mice, black-tailed jackrabbits and coyotes. Lizards that may occur include western whiptail and side-blotched lizard. Desert tortoise may dig depressions in the desert pavement to collect rainwater. Birds that may occur include common ravens, horned larks, rock wrens and sparrows.

Hydrological functions

Much of the rainfall received on the site drains into the narrow channels on the pavement margins.

Recreational uses

This site is highly valued for open space and those interested in desert ecology. Uses include mountain biking, hiking, bird watching and botanizing. Desert Patinas arise from very long periods of time with no surface disturbance. The exposed rock faces turn dark over hundreds, maybe even thousands, of years. This dark layer is commonly called desert varnish. It is a layer of clay minerals, manganese and iron. The manganese is deposited by manganese-oxidizing bacteria over a long period of time. The dark-black varnish contains more manganese, whereas the dark-brown varnish contains more iron. Varnish color darkens with age. The lighter, reddish underside of the rocks results from red clays and iron hydroxides deposited by the underlying soil.

Inventory data references

The type locality for Colorado Desert Area (CA803) soil survey (Chemehuevi area) is listed in Type Locality table below.

The following NRCS vegetation plots are the from Joshua Tree National Park Soil Survey:

019- Joshua Tree Type location
VIPA-03
VIPA-06
H3-X
EOVP-13

Type locality

Location 1: Riverside County, CA	
UTM zone	N
UTM northing	3738887
UTM easting	642177
General legal description	The type location is about 1.2 miles east of the gaging station on just north of Big Wash and the MWD Aqueduct Road, in Joshua Tree National Park.

Location 2: San Bernardino County, CA	
UTM zone	N
UTM northing	3812218
UTM easting	736668
Latitude	34° 25′ 27″
Longitude	114° 25′ 28″
General legal description	This site is located off the powerline road in Chemehuevi Wash OHV area, about 5 miles east of West Well.

Other references

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Approval

Kendra Moseley, 3/11/2025

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	P Novak-Echenique, Dustin Detweiler
Contact for lead author	Dustin Detweiler
Date	10/20/2014
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills are none. Rock fragments armor the soil surface.

2. **Presence of water flow patterns:** None

3. **Number and height of erosional pedestals or terracettes:** None

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare Ground typically < 10% but may be as high as 20% in less developed pavement areas; surface rock fragments typically between 80 and 98% but may be as low as 65%; shrub canopy is typically < 5% and may be slightly higher in areas with weak pavement development.

5. **Number of gullies and erosion associated with gullies:** None

6. **Extent of wind scoured, blowouts and/or depositional areas:** None

7. **Amount of litter movement (describe size and distance expected to travel):** Fine litter (foliage from grasses and annual & perennial forbs) expected to move distance of slope length during intense summer convection storms or rapid snowmelt events. Persistent litter (large woody material) will remain in place except during large rainfall events.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Much of the soil surface in this ESD is covered by gravel. In areas where the soil is present at the surface there can be as much as 5% incipient algal/fungal crust cover as well as trace amounts of cyanolichen crusts. Soil surface areas with biological crusts typically have a soil surface stability value of 5. Subsurface soil stability under the crust is usually 0 or single grained material. Shrubs in this ecological site tend to trap eolian material. Soil surface stability values under shrubs is often single grained material with a stability value of 0. Biological crusts may be present under shrubs but are more easily found in the intershrub spaces.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Desert pavement is composed of a gravel surface without much soil at the surface. Those areas of exposed soil at the surface may range in surface structure from single grain to strong very thick platy. The wide range of structure can be explained by eolian deposition forming the single grain structure while areas without a layer of eolian deposition can have a vesicular horizon which forms the strong very thick platy structure. Soil surface colors are very pale to light and typified. Organic matter of the surface 2 to 3 inches is less than 1 percent.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Sparse shrub canopy and associated litter may contribute to some infiltration at this site but this ecological site is dominated by gravel pavement which in combination with vesicular horizons greatly reduces infiltration and increases runoff. Areas with disturbed, open or weakly developed pavement have less runoff and higher infiltration rates.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. Subsoil argillic horizons should not be interpreted as compacted.

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: Long-lived evergreen shrubs (creosote bush) = annual forbs

    Sub-dominant: associated shrubs (burrobush) > annual grasses > perennial grass

    Other:

    Additional: Annual forbs and annual grasses respond to the timing and amount of precipitation events. In some cases for this ecological site, annual production and cover may be higher than creosote production which is why annual forbs are listed under the dominant category. Although there is very little creosote bush at this site, the plant is perennial and remains at the site regardless of precipitation events.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Dead branches within individual shrubs are common. Burrobush and perennial grasses can be expected to show mortality during drought. A lack in the presence of annual species, live or standing dead may suggest extreme drought conditions exist where grazing is not present.

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14. **Average percent litter cover (%) and depth (in):** Percent litter in the interspaces between the very few plants is trace to 5%. Litter is usually very small pieces of plant debris.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** For normal or average growing season ± 60 lbs/ac. Favorable years ± 100 lbs/ac and unfavorable years ± 10 lbs/ac. Areas with broken up areas of desert pavement can have higher production than these listed here.

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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:** Potential invaders on this site include red brome, redstem filaree, and Mediterranean grass. Although a potential exists for these species to become invaders, the harsh conditions of this ecological site are likely to prevent dominance by any of these non-native species. Mediterranean grass does have the potential to exist as a co-dominant.

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17. **Perennial plant reproductive capability:** Droughty conditions, gravel pavement and vesicular horizons greatly limit seed crops at this site when compared to surrounding areas without pavement. Creosote bush may depend solely on clonal reproduction. Burrobush establishment may depend on favorable years and is found mainly at the edges of the pavement or in open areas within the pavement. There is also very little vegetation cover which in combination with very little seed production greatly limits the perennial plant reproductive capability of this site.
