Ecological site R030XD006CA
Abandoned Fan

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General information

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

MLRA notes

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

The Mojave Desert Major Land Resource Area (MLRA 30) 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 Mojave Desert is a transitional area between hot deserts and cold deserts where close proximity of these desert types exert enough influence on each other to distinguish these desert types from the hot and cold deserts beyond the Mojave. Kottek et. al 2006 defines hot deserts as areas where mean annual air temperatures are above 64 F (18 C) and cold deserts as areas where mean annual air temperatures are below 64 F (18 C). Steep elevation gradients within the Mojave create islands of low elevation hot desert areas surrounded by islands of high elevation cold desert areas. The Mojave Desert receives less than 10 inches of mean annual precipitation. Mojave Desert low elevation areas are often hyper-arid while high elevation cold deserts are often semi-arid with the majority of the Mojave being an arid climate. Hyper-arid areas receive less than 4 inches of mean annual precipitation and semi-arid areas receive more than 8 inches of precipitation (Salem 1989). The western Mojave receives very little precipitation during the summer months while the eastern Mojave experiences some summer monsoonal activity. In summary, the Mojave is a land of extremes. Elevation gradients contribute to extremely hot and dry summers and cold moist winters where temperature highs and lows can fluctuate greatly between day and night, from day to day and from winter to summer. Precipitation falls more consistently at higher elevations while lower elevations can experience long intervals without any precipitation. Lower elevations also experience a low frequency of precipitation events so that the majority of annual precipitation may come in only a couple precipitation events during the whole year. Hot desert areas influence cold desert areas by increasing the extreme highs and shortening the length of below freezing events. Cold desert areas influence hot desert areas by increasing the extreme lows and increasing the length of below freezing events. Average precipitation and temperature values contribute little understanding to the extremes which govern wildland plant communities across the Mojave. Hyper-Arid Mojave Land Resource Unit (XD)

LRU notes

The Mojave Desert is currently divided into 4 Land Resource Units (LRUs). This ecological site is within the Hyper-Arid Mojave LRU, extremely hot and dry low elevation troughs within the Mojave Desert. The Hyper-Arid Mojave LRU is designated by the 'XD' symbol within the ecological site ID. This LRU is found within the Death Valley/Mojave Central Trough, as well as portions of the Mojave exposed to the Salton Sea Trough and the Colorado River Valley. This LRU is essentially equivalent to the Death Valley/Mojave Central Trough, Arid Valleys and Canyonlands, and associated Mojave Sand Dunes and Mojave Playas of EPA Level IV Ecoregions. Elevations are predominantly below 1650 feet with precipitation is less than 4 inches per year. Mountain slopes within the watersheds of these low elevation troughs may extend up to approximately 2460 feet (750 m). This LRU is distinguished by its extremely aridity where a nearly barren landscape is occupied by widely spaced shrubs. Vegetation includes creosote bush, burrobush, big galleta grass with many annual species able to take advantage of infrequent precipitation events which occur in this LRU. Playa species such as Mojave seablite and saltbush species are also common in this LRU.

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 abandoned alluvial fans and fan aprons with soils which are very deep, and are composed of layers of sand, coarse sand and loamy sand with varying amounts of gravel and cobbles. This ecological site tends to occupy distal fan positions, far from sources of run-on, and this site typically has no sheet-flow from flash-flooding events. Production reference value (RV) is 67 pounds per acre, and ranges from 21 to 191 pounds per acre depending on annual precipitation and annual forb production. Vegetation is sparse, and dominated by low-statured creosote bush (Larrea tridentata). A hyperthermic climate with deep sandy soils with no additional run-on from sheet flooding drives the vegetation community of this ecological site. The deep-rooted creosote bush is the only shrub capable of tolerating the extremely arid conditions. The data in the following sections is from major (15% of mapunit or greater) components only. This is a group concept and provisional STM that also covers R030XD042CA.

Associated sites

R030XD039CA	**Coarse Gravelly Fans** This ecological site is found on adjacent occasionally flooded alluvial fans. Creosote bush (Larrea tridenata), burrobush (Ambrosia dumosa) and brittlebush (Encelia farinosa) are dominant.
R030XD004CA	**Low-Production Hyperthermic Hills** This ecological site is found on steep sideslopes of adjacent fan remnants. Sparse vegetation is dominated by creosote bush (Larrea tridentata).
R030XD008CA	**Hyperthermic Sandhill** This ecological site is found on adjacent sandhills. Big galleta (Pleuraphis rigida) and creosote bush (Larrea tridentata) are dominant.
R030XD014CA	**Hyperthermic Sandy Plains** This ecological site is found on adjacent semi-active sandsheets. Big galleta (Pleuraphis rigida) is dominant.
R030XD015CA	**Hyper-Arid Fans** This ecological site is found on adjacent fan aprons with rare surface flooding. Creosote bush (Larrea tridentata) and burrobush (Ambrosia dumosa) dominate.
R030XD025CA	**Hyperthermic Sandsheets** This ecological site is found on adjacent sandsheets. Creosote bush (Larrea tridentata) and big galleta (Pleuraphis rigida) dominate.
R030XD042CA	**Hyperthermic Shallow To Moderately Deep Fan Remnants** This ecological site is found on adjacent very stable fan remnants. Creosote bush (Larrea tridentata) is dominant.
R030XY001CA	**Occasionally Flooded, Hyperthermic, Diffuse Ephemeral Stream** This ecological site is found on adjacent occasionally flooded drainageways. Creosote bush (Larrea tridentata) and Schott's dalea (Psorothamnus schottii) dominate.
R030XY092NV	**DESERT PATINA** This ecological site is found on adjacent fan remnants with desert pavement surface. Very sparse vegetation is dominated by creosote bush (Larrea tridentata).

Similar sites

R030XD015CA	**Hyper-Arid Fans** This ecological site occurs on landform positions receiving more surface flooding. This site is more productive, shrub density is higher, and burrobush (Ambrosia dumosa) is co-dominant with creosote bush (Larrea tridentata).
R030XD042CA	**Hyperthermic Shallow To Moderately Deep Fan Remnants** This ecological site occurs on very stable fan remnants with a high degree of soil horizon development. It has lower production and shrub density.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Larrea tridentata*
Herbaceous	(1) *Plantago ovata*

Physiographic features

This ecological site occurs on alluvial fans and fan aprons at elevations of 670 to 2620 feet, and slopes ranging from 0 to 8 percent. This site typically does not receive flooding, and runoff class is negligible to very low.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Fan apron
Flooding duration	Brief (2 to 7 days)
Elevation	200 – 800 m
Slope	0 – 10 %
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)	
Precipitation total (average)	130 mm

Influencing water features

Soil features

The soils associated with this ecological site are very deep, somewhat excessively to excessively drained, and formed in alluvium from predominantly granitioid rocks. These soils are sandy or sandy-skeletal in the particle size control section, and permeability is moderately rapid to rapid. Surface textures include fine sand, gravelly loamy fine sand, fine sandy loam. Subsurface horizons (1 to 59 inches) are composed of layers of fine sand and sand textures with gravelly to very gravelly modifiers. Surface gravels (3 mm in diameter) range from 30 to 75 percent, and larger fragments range from 0 to 11 percent. Subsurface gravels by volume (for a depth of 0 to 59 inches) range from 1 to 50 percent and larger fragments by volume range from 0 to 25 percent.

This ecological site is associated with Pintobasin soils (mixed, hyperthermic Typic Torripsamments); Carrizo soils (sandy-skeletal, mixed, hyperthermic Typic Torriorthents); and Joetree soils (mixed, hyperthermic Typic Torripsamments). Carrizo soils are sandy and have greater than 35 percent rock fragments in the particle contol section. Joetree and Pintobasin soils are sandy throughout with few rock fragments. The difference between the Joetree and the Pintobasin soils is that Joetree soils have an argillic horizon from 40 to 59 inches with sandy loam or sandy clay loam textures.

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

Mapunit;Mapunit name;Component;Local phase;Component percent
1513;Carrizo-Rubylee complex, 1 to 4 percent slopes;Carrizo; 60
2065;Dalelake-Aquapeak-Coxpin association, 2 to 8 percent slopes;Carrizo; 1
2076;Oldale-Carrizo complex, 2 to 8 percent slopes;Carrizo;30; Pintobasin;very rarely flooded;2
2077;Oldale-Carrizo association, 2 to 8 percent slopes;Carrizo; 25
2060;Joetree-Dalelake-Pintobasin complex, 0 to 2 percent slopes;Joetree;very rarely flooded;35
1514;Carrizo-Pintobasin-Rubylee complex, 0 to 4 percent slopes;Pintobasin;fine sandy loam;30
1515;Pintobasin-Carrizo complex, 2 to 8 percent slopes;Pintobasin; 80
1516;Pintobasin fine sandy loam, 0 to 2 percent slopes;Pintobasin;fine sandy loam;90
1517;Pintobasin-Dalelake complex, 2 to 8 percent slopes;Pintobasin; 65
1522;Pintobasin sand, 1 to 3 percent slopes, rarely flooded;Pintobasin; 5
1525;Pintobasin complex, 2 to 4 percent slopes, 10
1530;Dalelake fine sand, 0 to 4 percent slopes;Pintobasin; 5
2060;Joetree-Dalelake-Pintobasin complex, 0 to 2 percent slopes;Pintobasin;fine sandy loam;25
2068;Aquapeak-Carpetflat-Pintobasin complex, 0 to 4 percent slopes;Pintobasin; 15
2076;Oldale-Carrizo complex, 2 to 8 percent slopes;Pintobasin;very rarely flooded;2
2715;Dalelake-Sheephole-Pintobasin complex, 2 to 8 percent slopes;Pintobasin; 25

Table 4. Representative soil features

Parent material	(1) Alluvium – granite

Surface texture	(1) Fine sandy loam (2) Gravelly loamy fine sand (3) Fine sand
Family particle size	(1) Sandy
Drainage class	Somewhat excessively drained to excessively drained
Permeability class	Moderately rapid to rapid
Soil depth	150 cm
Surface fragment cover <=3"	30 – 80 %
Surface fragment cover >3"	0 – 10 %
Available water capacity (0-101.6cm)	2.29 – 9.65 cm
Calcium carbonate equivalent (0-101.6cm)	0 – 10 %
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	Not specified
Soil reaction (1:1 water) (0-101.6cm)	10 – 8.8
Subsurface fragment volume <=3" (Depth not specified)	0 – 50 %

Subsurface fragment volume >3" (Depth not specified)	0 – 30 %

Ecological dynamics

Abiotic Factors

The abiotic factors driving this site are This ecological site occurs on gently sloping alluvial fans and fan aprons at elevations of 670 to 2620 feet. Soils are very deep, and are composed of layers of sand, coarse sand and loamy sand with varying amounts of gravel and cobbles. This site typically has no sheet-flow from flash-flooding events. A hyperthermic climate with deep sandy soils with no additional run-on from sheet flooding drives the vegetation community of this ecological site. The deep-rooted creosote bush is the only shrub capable of tolerating the extremely arid conditions of this site.

Creosote bush shrublands dominate fan piedmont landscapes at elevations below 4000 feet in the Mojave Desert (Rundel and Gibson 1996). In arid regions, the availability of moisture is the key resource driving the productivity and composition of vegetation (Noy-Meir 1973, McAuliffe 1994, Hamerlynk et al. 2000, Martre et al. 2002, Austin et al. 2004). Where soil temperature regimes are thermic (above approximately 2800 feet) and soil moisture availability is higher, shrub production, cover, density and diversity are higher (Bedford et al. 2009). Where the soil temperature regime is hyperthermic and moisture becomes more limiting such as this ecological site, shrub production, cover, density and diversity decline. When soil moisture becomes even more limiting, due to factors such as very low elevations and hot temperatures, absence of sheet-flow, restrictive surface cover such as desert pavement, or the presence of subsurface horizons that limit infiltration, the shrub community typically becomes even sparser, and is restricted to widely spaced, small creosote bush.

This ecological site tends to occupy distal fan positions, far from sources of run-on. Infrequent precipitation rapidly infiltrates these sandy soils, with minimal loss due to run-off and evaporation (Noy-Meir 1973, Austin et al. 2004), leaving very little water available at near surface depths. Deep, free-draining soils promote dominance by the deep-rooted, long-lived evergreen creosote bush, which can access water held at deep levels (McAuliffe 1994, Hamerlynk et al. 2002, Hamerlynk and McAuliffe 2008). Shallow-rooted species like burrobush (Ambrosia dumosa), which is co-dominant with creosote bush in soils or environments with greater moisture availability, cannot survive in the arid conditions of this site.

Disturbance dynamics

The primary disturbances influencing this ecological site are drought, invasion by non-native annual plants, and fire, all of which interact. Drought is an important shaping force in Mojave Desert plant communities (Webb et al. 2003, Bowers 2005, Hereford et al. 2006, Miriti et al. 2007). Short-lived perennial shrubs and perennial grasses demonstrate the highest rates of mortality (Webb et al. 2003, Bowers 2005, Hereford et al. 2006, Miriti et al. 2007), and annual species remain dormant in the soil seedbank (Beatley 1969, 1974, 1976). Long-lived shrubs and trees are more likely to exhibit branch-pruning, and or limited recruitment during drought (e.g. Hereford et al. 2006, Miriti et al. 2007), leading to reduced cover and biomass in drought-afflicted communities.

Non-native annual species such as red brome (Bromus rubens), 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). In 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). The fine sand textures that are typical for this ecological site provide preferred habitat for Asian mustard, and this site has a high potential for invasion by this species during wet years.

Invasion by non-native annual grasses has increased the flammability of Mojave Desert vegetation communities by providing a continuous fine fuel layer between widely spaced shrubs (Brown and Minnich 1986, Brooks 1999, Brooks et al. 2004, Rao and Allen 2010, Rao et al. 2010). After fire, these communities appear to be more susceptible to invasion by exotic grasses, leading to a grass-fire cycle (D'Antonio and Vitousek 1992). The low potential for high productivity of annual species in this ecological site means that it is relatively resilient to fire. However, after years of extremely high winter precipitation, this site may burn (Brown and Minnich 1986, Brooks et al. 2007).

State and transition model

Figure 3. R030XD006CA

Additional community tables

Table 5. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Shrub/Vine					
1	**Native Shrubs**			11-82	
	creosote bush	LATR2	*Larrea tridentata*	11-78	2-7
	burrobush	AMDU2	*Ambrosia dumosa*	0-2	0-1
	white ratany	KRGR	*Krameria grayi*	0-1	0-1
Forb					
2	**Native annual forbs**			0-28	
	cryptantha	CRYPT	*Cryptantha*	0-22	0
	desert Indianwheat	PLOV	*Plantago ovata*	0-7	0-12
	smooth desertdandelion	MAGL3	*Malacothrix glabrata*	0-6	0-3
	devil's spineflower	CHRI	*Chorizanthe rigida*	0-4	0
	Mojave desertstar	MOBE2	*Monoptilon bellioides*	0-1	0
5	**Non-native annual forbs**			0-67	
	Asian mustard	BRTO	*Brassica tournefortii*	0-67	0-5
Grass/Grasslike					
3	**Non-native annual grasses**			0-2	
	Mediterranean grass	SCHIS	*Schismus*	0-2	0-1
4	**Perennial Grass**			0-1	
	big galleta	PLRI3	*Pleuraphis rigida*	0-1	0

Table 6. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 7. Community 2.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 8. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Animal community

This ecological site provides critical habitat for the threatened desert tortoise (Gopherus agassizii agassizii). Creosote bush shrublands provides a home for an abundance of specialist insect species, for example, creosote bush flowers provide nutrition for over twenty species of bees, and the creosote bush grasshopper (Bootettix argentatus) feeds solely on creosote leaves (Pavlik 2008).

Recreational uses

This site is highly valued for open space and those interested in desert ecology. Uses include mountain biking, hiking, bird watching and botanizing. Desert tortoise and annual wildflowers may also attract visitors during the spring.

Other products

Creosote bush is an important medicinal plant for Native Americans. It has a very wide range of uses from treatment for consumption, bowl complaints, and menstrual cramps, to induce vomiting, relief for arthritis, rheumatism, aching bones and sprains, congestion and cold, as an antiseptic and disinfectant, dandruff, antispasmodic, to induce urination, gonorrhea, and to cancer treatment. (This list is not exhaustive). http://herb.umd.umich.edu/herb/search.pl?searchstring=Larrea+tridentata. Creosote bush stems are used to make weapons, digging tools, and basket handles, and creosote gum is used for knife and awl handles. Creosote bush branches are used as thatch in dwelling construction. http://herb.umd.umich.edu/herb/search.pl?searchstring=Larrea+tridentata.

Inventory data references

The following NRCS plots were used to describe this ecological site: D1-M (Type location) 1248014701 J5-K MW-D PFPR-3 PW-D

Type locality

Location 1: Riverside County, CA	
UTM zone	N
UTM northing	3774342
UTM easting	623922
General legal description	The type location is approximately 1.65 miles east of the intersection of Highway 62 and Ironage Road, 0.12 mile south of Highway 62 on the border of Joshua Tree National Park.

Other references

Abella, S. R. 2009. Post-fire plant recovery in the Mojave and Sonoran Deserts of western North America. Journal of Arid Environments 73:699-707.

Austin, A. T., L. Yahdjian, J. M. Stark, J. Belnap, A. Porporato, U. Norton, D. A. Ravetta, and S. M. Scheaeffer. 2004. Water pulses and biogeochemical cycles in arid and semiarid ecosystems. Oecologia 141:221-235.

Barrows, C. W., E. B. Allen, M. L. Brooks, and M. F. Allen. 2009. Effects of an invasive plant on a desert sand dune landscape. Biological Invasions 11:673-686.

Beatley, J. C. 1969. Dependence of desert rodents on winter annuals and precipitation. Ecology 50:721-724.

Beatley, J. C. 1974. Effects of rainfall and temperature on the distribution and behavior of Larrea tridentata (Creosote-bush) in the Mojave Desert of Nevada. Ecology 55:245-261.

Beatley, J. C. 1976. Rainfall and fluctuating plant populations in relation to distributions and numbers of desert rodents in southern Nevada. Oecologia 24:21-42.

Bedford, D. R., D. M. Miller, K. M. Schmidt, and G. A. Phelps. 2009. Landscape-scale relationships between surficial geology, soil texture, topography, and creosote bush size and density in the eastern Mojave Desert of California. Pages 252-277 in R. H. Webb, L. F. Fenstermaker, J. S. Heaton, D. L. Hughson, E. V. McDonald, and D. H. Miller, editors. The Mojave Desert: ecosystem processes and sustainability. University of Nevada Press, Reno, NV.

Bowers, J. E. 2005. Effects of drought on shrub survival and longevity in the northern Sonoran Desert. Journal of the Torrey Botanical Society 132:421-431.

Brooks, M. L. 1999. Habitat invasibility and dominance by alien annual plants in the western Mojave Desert. Biological Invasions 1:325-337.

Brooks, M. L. and K. H. Berry. 2006. Dominance and environmental correlates of alien annual plants in the Mojave Desert, USA. Journal of Arid Environments 67:100-124.

Brooks, M. L., C. M. D'Antonio, D. M. Richardson, J. B. Grace, J. E. Keeley, J. M. DiTomaso, R. J. Hobbs, M. Pellant, and D. Pyke. 2004. Effects of invasive alien plants on fire regimes. Bioscience 54:677-689.

Brooks, M. L., T. C. Esque, and T. Duck. 2007. Creosotebush, blackbrush, and interior chaparral shrublands. RMRS-GTR-202.

Brooks, M. L. and D. A. Pyke. 2000. Invasive plants and fire in the deserts of North America. Pages 1-14 in Fire conference 2000: the first national congress on fire ecology, prevention, and management. Tall Timbers Research Station, Tallahassee, FL.

Brown, D. E. and R. A. Minnich. 1986. Fire and Changes in Creosote Bush Scrub of the Western Sonoran Desert, California. American Midland Naturalist 116:411-422.

Bull, W. B. 1997. Discontinuous ephemeral streams. Geomorphology 19:227-276.

D'Antonio, C. M. and P. M. Vitousek. 1992. Biological invasions by exotic grasses, the grass/fire cycle, and global change. Annual Review of Ecology and Systematics 23:63-87.

Engel, E. C. and S. R. Abella. 2011. Vegetation recovery in a desert landscape after wildfires: influences of community type, time since fire and contingency effects. Journal of Applied Ecology 48:1401-1410.

Hamerlynk, E. P. and J. R. McAuliffe. 2008. Soil-dependent canopy die-back and plant mortality in two Mojave Desert shrubs. Journal of Arid Environments 72:1793-1802.

Hamerlynk, E. P., J. R. McAuliffe, E. V. McDonald, and S. D. Smith. 2002. Ecological responses of two Mojave desert shrubs to soil horizon development and soil water dynamics. Ecology 83:768-779.

Hamerlynk, E. P., J. R. McAuliffe, and S. D. Smith. 2000. Effects of surface and sub-surface soil horizons on the seasonal performance of Larrea tridentata (creosotebush). Functional Ecology 14:596-606.

Hereford, R., R. H. Webb, and C. I. Longpre. 2006. Precipitation history and ecosystem response to multidecadal precipitation variability in the Mojave Desert region, 1893-2001. Journal of Arid Environments 67:13-34.

Holland, R. F. 1986. Preliminary descriptions of the terrestrial natural communities of California. State of California Department of Fish and Game, Sacramento, CA.

Martre, P., G. B. North, E. G. Bobich, and P. S. Nobel. 2002. Root deployment and shoot growth for two desert species in response to soil rockiness. American Journal of Botany 89:1933-1939.

McAuliffe, J. R. 1994. Landscape evolution, soil formation, and ecological patterns and processes in Sonoran Desert bajadas. Ecological Monographs 64:112-148.

Minnich, R. A. 2003. Fire and dynamics of temperature desert woodlands in Joshua Tree National Park. Contract, Joshua Tree National Park.

Miriti, M. N., S. Rodriguez-Buritica, S. J. Wright, and H. F. Howe. 2007. Episodic death across species of desert shrubs. Ecology 88:32-36.

Norton, J. B., T. A. Monaco, and U. Norton. 2007. Mediterranean annual grasses in western North America: kids in a candy store. Plant Soil 298:1-5.

Noy-Meir, I. 1973. Desert ecosystems: environment and producers. Annual Review of Ecology and Systematics 4:25-51.

Pavlik, B. M. 2008. The California Deserts: an ecological rediscovery. University of California Press, Ltd., Berkeley and Los Angeles, California.

Rao, L. E. and E. B. Allen. 2010. Combined effects of precipitation and nitrogen deposition on native and invasive winter annual production in California deserts. Oecologia 162:1035-1046.

Rao, L. E., E. B. Allen, and T. M. Meixner. 2010. Risk-based determination of critical nitrogen deposition loads for fire spread in southern California deserts. Ecological Applications 20:1320-1335.

Reid, C. R., S. Goodrich, and J. E. Bowns. 2006. Cheatgrass and red brome: history and biology of two invaders. Pages 27-32 in Shrublands under fire: disturbance and recovery in a changing world. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Cedar City, Utah.

Rickard, W. H. and J. C. Beatley. 1965. Canopy-coverage of the desert shrub vegetation mosaic of the Nevada test site. Ecology 46:524-529.

Rundel, P. W. and A. C. Gibson. 1996. Ecological communities and processes in a Mojave Desert Ecosystem: Rock Valley Nevada. Cambridge University Press, Cambridge, England.

Sawyer, J. O., T. Keeler-Woolf, and J. M. Evans. 2009. A manual of California vegetation. 2nd edition. California Native Plant Society, Sacramento, California.

Steers, R. J. and E. B. Allen. 2011. Fire effects on perennial vegetation in the western Colorado Desert, USA. Fire Ecology 7:59-74.

Vamstad, M. S. 2009. Effects of fire on vegetation and small mammal communities in a Mojave Desert Joshua tree woodland. M.S. University of California, Riverside, Riverside, Ca.

Vasek, F. C. 1983. Plant succession in the Mojave Desert. Crossosoma 9:1-23.

Webb, R. H., M. B. Muroy, T. C. Esque, D. E. Boyer, L. A. DeFalco, D. F. Haines, D. Oldershaw, S. J. Scoles, K. A. Thomas, J. B. Blainey, and P. A. Medica. 2003. Perennial vegetation data from permanent plots on the Nevada Test Site, Nye County, Nevada. U.S. Geological Society, Tucson, AZ.

Contributors

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Approval

Kendra Moseley, 10/21/2024

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	08/27/2026
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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:**