USDA Natural Resources
Conservation Service

Ecological site R030XB192CA
Very Rarely Flooded, Warm Thermic Fan Piedmonts

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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.

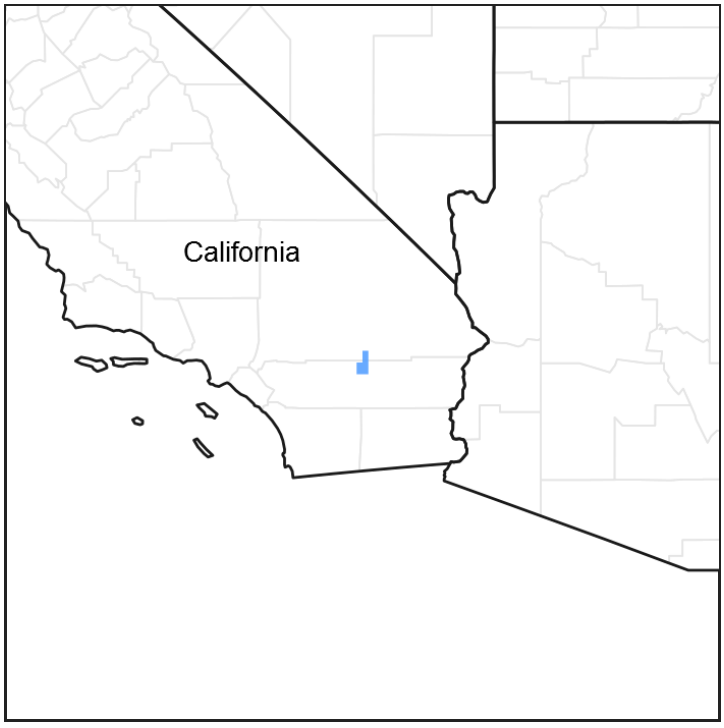


Figure 1. Mapped extent

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 notes

This LRU (designated by 'XB') is found across the eastern half of California, much of the mid-elevations of Nevada, the southernmost portions of western Utah, and the mid-elevations of northwestern Arizona. Elevations range from 1800 to 5000 feet and precipitation ranges from 4 to 9 inches per year, but is generally between 5-6 inches. This LRU is characterized primarily by the summer precipitation it receives, ranging from 18 – 35% but averages 25%. Summer precipitation falls between July and September in the form of rain, and winter precipitation falls starting in November and ends between February and March, also mostly in the form of rain; however it does receive between 0 and 3 inches of snow, with an average of 1 inch. The soil temperature regime is thermic and the soil moisture regime is typic-aridic. Vegetation includes creosote bush, burrobush, Nevada jointfir, ratany, Mojave yucca, Joshua tree, chollas, cactus, big galleta grass and several other warm season grasses. At the upper portions of the LRU, plant production and diversity are greater and blackbrush is a common dominant shrub.

Classification relationships

This ecological site is found within the Larrea tridentata - Ambrosia dumosa Shrubland Alliance, and specifically the Larrea tridentata - Ambrosia dumosa - Senna armata Association (Sawyer et. al. 2009).

Ecological site concept

This ecological site occurs on fan aprons and fan remnants at elevations of approximately 2100 to 4200 feet. The site experiences very rare sheet flooding. Soils are typically very deep, and have a warm thermic soil temperature regime. Production Reference Value (RV) is 244 pounds per acre, and ranges from 125 to 510 pounds per acre. The site is co-dominated by creosote bush (Larrea tridentata) and desertsenna (Senna armata), and big galleta (Pleuraphis rigida) is an important species. Sheet flooding supports a diverse plant community, providing additional moisture and establishment opportunities for species such as desertsenna and big galleta.

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 of map unit or greater).

This is a group concept and provisional STM that also covers R030XB125CA, R030XB194CA, R030XB208CA.

Associated sites

R030XB005NV	**Arid Active Alluvial Fans** R030XB005NV is found on adjacent fan aprons. Creosote bush (Larrea tridentata) and burrobush (Ambrosia dumosa) are dominant species
R030XB174CA	**Sandy Fan Aprons** R030XB174CA is found on adjacent fan aprons. Creosote bush (Larrea tridenata), Joshua tree (Yucca brevifolia) and big galleta (Pleuraphis rigida) are dominant species.
R030XB183CA	**Loamy Very Deep Fan Remnants** R030XB183CA is found on adjacent fan remnants. Blackbrush (Coleogyne ramosissima) and creosote bush (Larrea tridentata) are dominant species.
R030XB188CA	**Cool Shallow to Moderately Deep Fans** R030XB188CA is found on adjacent pediments overlain with alluvium. Creosote bush (Larrea tridentata) and blackbrush (Coleogyne ramosissima) are dominant species.

Similar sites

R030XY159CA	**Gravelly Outwash** R030XY159CA occurs on sandy-skeletal soils with lower mean annual precipitation. Desert needlegrass (Achnatherum speciosum) is an important species, and jojoba (Simmondsia chinensis) is not an important species.
R030XB174CA	**Sandy Fan Aprons** R030XB174CA is found in cooler climates with fewer frost free days. It is dominated by big galleta (Pleuraphis rigida), creosote bush (Larrea tridentata), and Joshua tree (Yucca brevifolia). It does not have a significant component of jojoba (Simmondsia chinensis) or desertsenna (Senna armata).
R030XY038CA	**Flooded Gravelly Fans** R030XY038CA occurs on lower elevation sites with sandy-skeletal soils. Schott’s dahlia (Psorothamnus schottii) is a dominant species.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Senna armata* (2) *Larrea tridentata*
Herbaceous	(1) *Pleuraphis rigida*

Physiographic features

This ecological site occurs on fan aprons and fan remnants at 2120 to 4180 feet in elevation. Slopes range from 2 to 8 percent. Sheet flooding frequency is very rare, and runoff class is low.

Table 2. Representative physiographic features

Landforms	(1) Fan apron (2) Fan remnant
Flooding frequency	Very rare
Elevation	646–1,274 m
Slope	2–8%
Aspect	Aspect is not a significant factor

Climatic features

The climate on this site is arid characterized by cool, somewhat moist winters and hot, somewhat moist summers. The average annual precipitation ranges from 3 to 7 inches with a little over half of precipitation falling as rain from November to March, and a little less than half falling with monsoonal storms from July to October. Mean annual air temperature is 55 to 68 degrees F. The frost free period is 280 to 320 days per year.

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:

044405, Joshua Tree, CA (Period of record = 1959 – 2010) [1]

49099, Twentynine Palms, California (Period of record = 1935 – 2011) [1]

Table 3. Representative climatic features

Frost-free period (average)	320 days
Freeze-free period (average)	
Precipitation total (average)	178 mm

Influencing water features

Soil features

The soils associated with this ecological site formed in alluvium derived from granitoid. Soils are typically very deep and well to somewhat excessively drained with slow to moderate permeability. Surface textures are loamy sand or sandy loam, with sandy clay loam or sandy loam and sand subsurface textures. Surface rock fragments less than or equal to three inches in diameter range from 30 to 55 percent, and rock fragments greater than 3 inches in diameter range from 0 to 5 percent. Subsurface fragments less than or equal to three inches in diameter range from 25 to 30 percent, and subsurface fragments greater than 3 inches in diameter range from 10 to 25 percent (subsurface fragments by volume for a depth of 0 to 79 inches).

The associated soils that are greater than 15 percent of any one map unit are: Morongo series - mixed, thermic Typic Torripsamments; and Bluecut series - fine-loamy, mixed, superactive, thermic Typic Paleargids. 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: Yander series - mixed, thermic Typic Torripsamments; Nasagold series - coarse-loamy, mixed, superactive, thermic Typic Haplocambids; and Cronese series - coarse-loamy, mixed, superactive, thermic Typic Haplocalcids. The Morongo soils have a loamy sand surface texture with loamy sand, sand, and gravelly coarse sand beneath. The Bluecut soils have a sandy loam surface texture with gravelly sandy clay loam, gravelly sandy loam, gravelly loamy sand and gravelly sand beneath. The Bluecut soils have an argillic horizon at depths of 10 to 14 inches that has a combined thickness of 13 to greater than 78 inches. Yander soils are deep to paralithic bedrock. Nasagold soils have gravelly loamy sand surface textures with fine sandy loam and sandy loam beneath. The Cronese soils have sandy loam surface textures with coarse sandy loam, loamy coarse sand and gravelly coarse sandy loam beneath. These soils have a calcic horizon occurring over depths of 14 to 80 inches (BAk, Bkq).

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

3684;Morongo loamy sand, 4 to 8 percent slopes, warm;Morongo;warm;85
3683;Morongo-Bluecut association, 2 to 8 percent slopes;Bluecut;very rarely flooded;30;
Cronese;very rarely flooded;3
3684;Morongo loamy sand, 4 to 8 percent slopes, warm;Nasagold;warm;5
4245;Bluecut-Morongo-Yander association, 2 to 8 percent slopes;Yander;warm, very rarely flooded;10

Table 4. Representative soil features

Parent material	(1) Alluvium–granite
Surface texture	(1) Loamy sand (2) Sandy loam
Family particle size	(1) Sandy

Drainage class	Well drained to somewhat excessively drained
Permeability class	Slow to moderate
Soil depth	152 cm
Surface fragment cover <=3"	30–55%
Surface fragment cover >3"	0–5%
Available water capacity (0-101.6cm)	4.06–12.19 cm
Calcium carbonate equivalent (0-101.6cm)	0–1%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–4
Soil reaction (1:1 water) (0-101.6cm)	6.6–8
Subsurface fragment volume <=3" (Depth not specified)	10–25%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

Abiotic factors

The most important abiotic factors driving this ecological site are recurrent sheetflow, defined as relatively high-frequency, low-magnitude overland flow occurring in a continuous sheet and restricted to laminar flow (flow is smooth with no turbulence) (Cooke et al. 1993), and a warm thermic climate. This site occurs on fan aprons and fan remnants at elevations of approximately 2100 to 4200 feet. Soils are typically very deep, and have loamy sand or sandy loam surface textures. The site is co-dominated by creosote bush and desertsenna, and big galleta is an important species.

Regular sheetflow maintains a diverse plant community and promotes co-dominance by desertsenna, a leguminous shrub found in Mojave and Sonoran desert wash habitats (Baldwin et al. 2002), and commonly associated with creosote bush communities subject to disturbances (Sawyer et al. 2009). Creosote bush is a dominant species throughout the Mojave and Sonoran Deserts on fan piedmonts with deep soils and a thermic to hyperthermic climate. When disturbance rates are low, extreme longevity and low mortality rates allow creosote bush to be strongly dominant, but with recurrent disturbance, shorter-lived species are able to establish and persist in the plant community. Big galleta is a very drought-tolerant C4 perennial grass that occurs on a range of soil types, but is dominant

only on sandy soils where soil moisture is most readily available (McAuliffe 1994, Austin et al. 2004). Big galleta cover and biomass increases in areas receiving additional moisture (NRCS data).

Disturbance Dynamics

The major disturbances influencing this ecological site are sheetfloods, invasion by non-native species, drought and fire.

Low intensity sheetflow maintains the composition of the reference plant community. Rare sheetflood, defined as relatively low-frequency, high magnitude sheets of unconfined flood water moving down a slope with flow both laminar and turbulent (Cooke et al. 1993), may alter community composition, increasing the abundance of disturbance adapted desertsenna.

Conversely, the absence of water may also alter the composition of the reference plant community. Drought, and the absence of regular flooding, will shift community dominance to creosote bush, while shorter-lived species that require disturbance for establishment, like desertsenna and big galleta, will die out. Drought is an important shaping force across Mojave Desert plant communities (Webb et al. 2003, Bowers 2005, Hereford et al. 2006, Miriti et al. 2007). In addition to altered community composition, mortality of shorter-lived species and branch-pruning of drought-tolerant longer-lived species leads to reduced cover and biomass in drought-afflicted communities.

Non-native annual grasses (red brome [*Bromus rubens*], cheatgrass [*Bromus tectorum*] and Mediterranean grass [Schismus species]) 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). Annual grass cover and production is directly related to winter precipitation (Beatley 1969, Brooks and Berry 2006, Hereford et al. 2006, Allen et al. 2009), and several years of drought may reduce the abundance of non-native annuals in the soil sandbank (Minnich 2003). Non-native annual cover and biomass is highest on sandy soils (Rao et al. 2010), because of the higher availability of water in these soils (Noy-Meir 1973, Austin et al. 2004). Flooding provides additional moisture for annuals, but water erosion may limit high biomass of annual species in this ecological site.

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). 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).

State and transition model

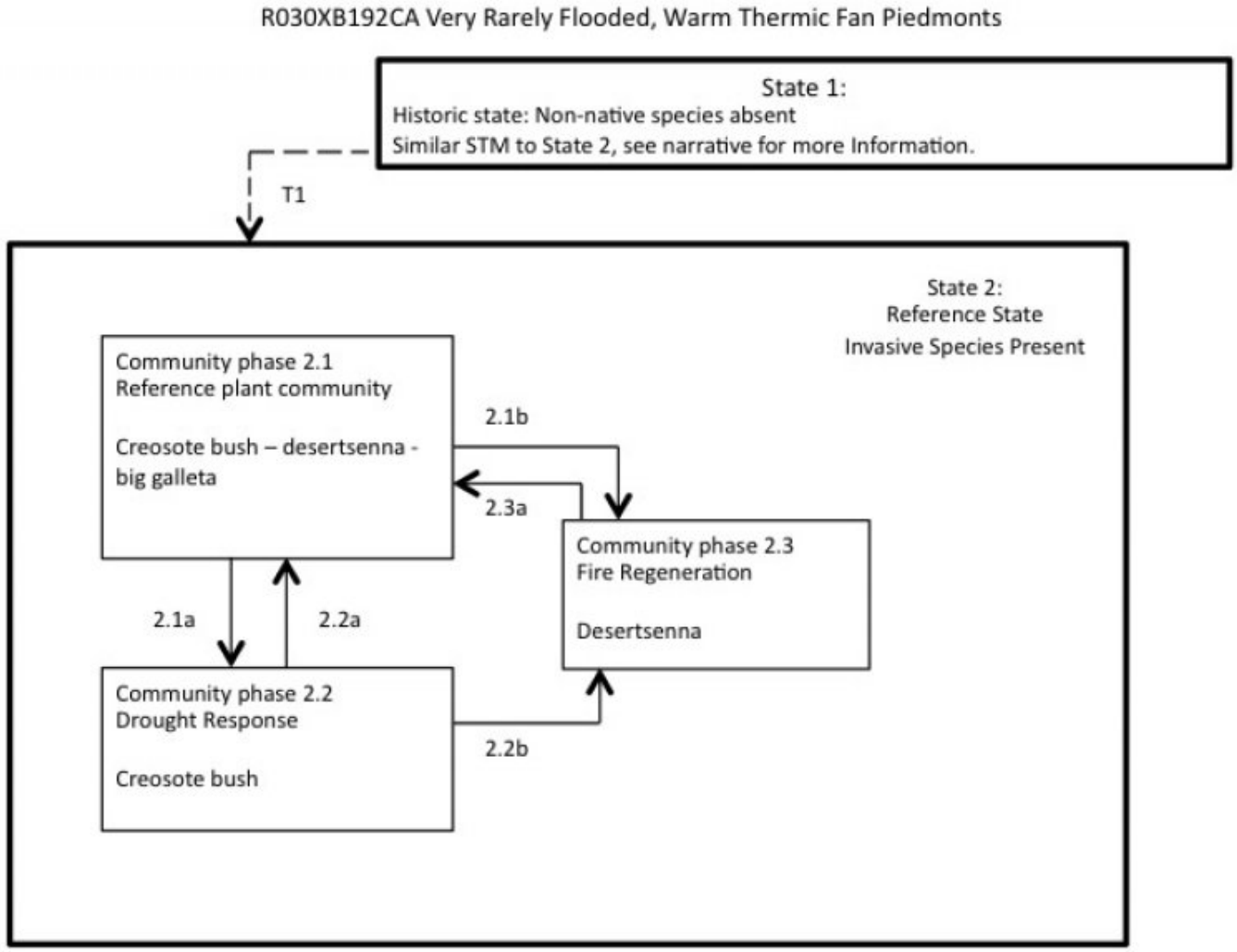


Figure 4. R030XB192CA

State 1
Historic State

State 1 represents the historic range of variability for this ecological site. This state no longer exists due to the ubiquitous naturalization of non-native species in the Mojave Desert. Periodic drought and rare fire were the natural disturbances influencing this ecological site. Fire would have been a very rare occurrence due to the lack of a continuous fine fuel layer between shrubs (Brown and Minnich 1986, Brooks et al. 2007). Data for this State does not exist, but dynamics and composition would have been similar to State 2, except with only native species present. See State 2 narrative for more detailed information.

State 2
Reference State

State 2 represents the current range of variability for this site. Non-native annuals,

including red brome and red-stem stork's bill (*Erodium cicutarium*) are naturalized at low levels in this plant community. Their abundance varies with precipitation, but they are at least sparsely present (as current years growth or present in the soil seedbank).

Community 2.1
Current potential plant community

Figure 5. Community Phase 2.1

The reference plant community is maintained by periods of average climatic conditions, sheetflow with very rare sheetflooding, and the absence of fire. It is co-dominated by creosote bush, and desertsenna, and big galleta is an important species. Jojoba (*Simmondsia chinensis*), may be an important secondary shrub in this ecological site. Jojoba is a long-lived (> 100 years), evergreen shrub found in a range of habitats throughout the Sonoran Desert, with a northern geographical limit at Twentynine Palms, California. Jojoba has optimal growth in hot climates where mean annual rainfall is greater than 12 inches per year. In areas with lower precipitation (Matthews 1994), jojoba is associated with sites receiving additional runon, such as in flooded fans, washes and rocky slope (Sawyer et al. 2009). Secondary shrubs include Mojave yucca (*Yucca schidigera*), white ratany (*Krameria grayi*), branched pencil cholla (*Cylindropuntia ramosissima*), wiggins cholla (*Cylindropuntia echinocarpa*), Nevada jointfir (*Ephedra nevadensis*), and burrobrush (*Hymenoclea salsola*). Annual forbs present with winter precipitation commonly include bristly fiddleneck (*Amsinckia tessellata*), pincushion flower (*Chaenactis fremontii*), distant phacelia (*Phacelia distans*), whitedaisy tidytips and (*Layia glandulosa*). The non-native annuals red-stem stork's bill and red brome are typically present. Sheetflood events increase establishment opportunities for desertsenna and big galleta, and these species become more abundant within the reference plant community after higher intensity sheetflood events.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	129	186	373
Forb	–	106	123
Grass/Grasslike	–	20	45
Tree	–	4	6
Total	**129**	**316**	**547**

Community 2.2
Drought Response

This community phase is characterized by strong dominance by creosote bush with decline in desertsenna, big galleta and other short-lived species with mortality and a lack of conditions suitable for establishment. Creosote bush is an evergreen species capable of utilizing moisture at any time of the year. This ability buffers populations from the effects of drought that occur as the absence of the winter rains (the primary source of moisture for this ecological site). Further, creosote bush germinates in response to moisture during the warm season, so may still recruit if warm season rains occur during winter drought (Hereford et al. 2006). Creosote bush exhibits branch-pruning during severe drought, but mortality during drought in the Mojave Desert is very low (Webb et al. 2003, Hereford et al. 2006). Jojoba recruitment is likely to be limited by drought because of reduced germination and/or increased seedling mortality, but adult mortality rates are low (Matthews 1994).

Community 2.3
Regeneration Phase

Figure 7. Community Phase 2.3

This community phase is characterized by severe declines in creosote bush and strong dominance by desertsenna. Mexican bladder sage and big galleta are important species. Other shrubs are sparsely present, and may include white ratany, wiggins cholla, Nevada jointfir and turpentine bush (*Thamnosma montana*) (though given variability in post-disturbance trajectories, other secondary shrub species may also be present). Creosote bush is generally killed by fire, and is slow to re-colonize burned areas due to specific recruitment requirements (Brown and Minnich 1986, Brooks et al. 2007, Steers and Allen 2011). Desertsenna colonizes disturbed areas from seed areas relatively quickly, and may dominate post-fire communities (Alford et al.). With no additional disturbance and adequate warm-season precipitation for creosote bush establishment, creosote bush communities in the Mojave desert may resemble the natural range of variation found in pre-fire conditions in terms of species composition in as little as nineteen years (Engel and Abella 2011). However, creosote communities in the Colorado Desert may show little recovery after 30 years (Steers and Allen 2011). The timing and severity of fire, as well as post-fire climate conditions determines trajectories of recovery (Brown and Minnich 1986, Steers and Allen 2011). With a long period of time without fire or high intensity flooding, creosote bush regains co-dominance as shorter-lived species die out. The lack of high cover and biomass of annual species in this ecological site, and regular low-level disturbance that promotes establishment of native shrubs means the likelihood of a grass-fire cycle in this ecological site is low.

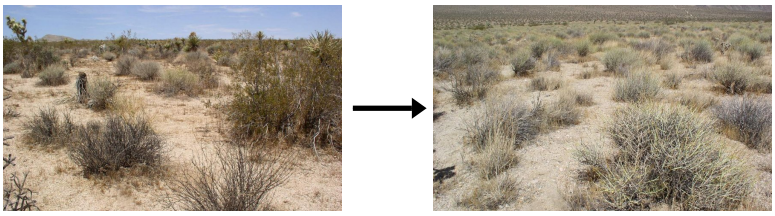
Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	111	158	206
Grass/Grasslike	–	45	67
Forb	–	39	45
Tree	–	4	4
Total	**111**	**246**	**322**

Pathway 2.1a
Community 2.1 to 2.2

This pathway occurs with prolonged or severe drought and the absence of sheetflow.

Pathway 2.1b
Community 2.1 to 2.3



Current potential plant community

Regeneration Phase

This pathway occurs with moderate to severe fire.

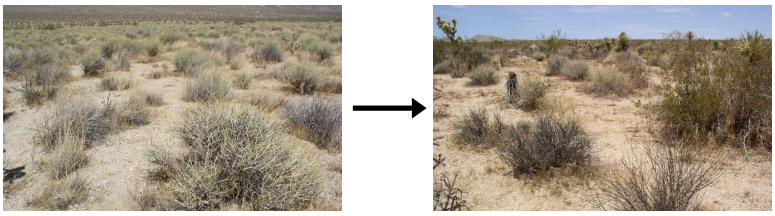
Pathway 2.2a
Community 2.2 to 2.1

This community pathway occurs with time and a return to average or above average precipitation and sheetflow events.

Pathway 2.2b
Community 2.2 to 2.3

This pathway occurs with moderate to severe fire, and takes place within three years of a very wet period. At longer than three years of drought, the community is at low risk of burning.

Pathway 2.3a
Community 2.3 to 2.1



Regeneration Phase

Current potential plant community

This community pathway occurs with time without fire.

Transition 1
State 1 to 2

This transition occurred with the introduction and naturalization of non-native species, including red brome (*Bromus rubens*), cheatgrass (*Bromus tectorum*), Mediterranean grass (Schismus spp), and red-stem stork's bill (*Erodium cicutarium*). This transition is irreversible.

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	**Native shrubs**			129–373	
	creosote bush	LATR2	*Larrea tridentata*	11–291	5–15
	desertsenna	SEAR8	*Senna armata*	2–67	1–4
	Mojave yucca	YUSC2	*Yucca schidigera*	0–41	0–2
	branched pencil cholla	CYRA9	*Cylindropuntia ramosissima*	0–34	0–1
	burrobush	AMDU2	*Ambrosia dumosa*	0–31	0–3
	jojoba	SICH	*Simmondsia chinensis*	0–22	0–2
	Mojave woodyaster	XYTO2	*Xylorhiza tortifolia*	0–22	0–2
	white ratany	KRGR	*Krameria grayi*	0–22	0–1
	burrobrush	HYSA	*Hymenoclea salsola*	0–15	0–3
	Nevada jointfir	EPNE	*Ephedra nevadensis*	0–11	0–2
	Wiggins' cholla	CYEC3	*Cylindropuntia echinocarpa*	0–3	0–1
Tree					
2	**Trees**			0–6	
	Joshua tree	YUBR	*Yucca brevifolia*	0–6	0–1
Grass/Grasslike					
3	**Native perennial grasses**			13–45	
	big galleta	PLRI3	*Pleuraphis rigida*	13–45	0–5
6	**Non-native annual grasses**			0–11	
	red brome	BRRU2	*Bromus rubens*	0–11	0–1
Forb					
4	**Native forbs**			0–123	
	pincushion flower	CHFR	*Chaenactis fremontii*	0–34	0–1
	bristly fiddleneck	AMTE3	*Amsinckia tessellata*	0–22	0–3
	whitedaisy tidytips	LAGL5	*Layia glandulosa*	0–11	0–1
	distant phacelia	PHDI	*Phacelia distans*	0–11	0–1
	Great Basin langloisia	LASE3	*Langloisia setosissima*	0–1	0–1
	Panamint cryptantha	CRAN4	*Cryptantha angustifolia*	0–1	0–1

5	**Non-native annual forbs**			0–67	
	redstem stork's bill	ERCI6	*Erodium cicutarium*	0–67	0–6

Table 8. Community 2.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
1	**Native shrubs**			111–206	
	desertsenna	SEAR8	*Senna armata*	82–141	7–12
	creosote bush	LATR2	*Larrea tridentata*	6–46	0–7
	Nevada jointfir	EPNE	*Ephedra nevadensis*	0–11	0–2
	Mexican bladdersage	SAME	*Salazaria mexicana*	6–8	0–3
	white ratany	KRGR	*Krameria grayi*	0–4	0–1
	Wiggins' cholla	CYEC3	*Cylindropuntia echinocarpa*	0–4	0–1
	turpentinebroom	THMO	*Thamnosma montana*	0–2	0–1
Tree					
2	**Trees**			0–4	
	Joshua tree	YUBR	*Yucca brevifolia*	0–4	0–1
Grass/Grasslike					
3	**Native perennial grasses**			0–36	
	big galleta	PLRI3	*Pleuraphis rigida*	0–36	0–4
5	**Non-native annual grasses**			0–34	
	red brome	BRRU2	*Bromus rubens*	0–34	0–5
Forb					
4	**Native forbs**			0–45	
	smooth desertdandelion	MAGL3	*Malacothrix glabrata*	0–22	0–1
	bristly fiddleneck	AMTE3	*Amsinckia tessellata*	0–11	0–1
	pincushion flower	CHFR	*Chaenactis fremontii*	0–11	0–1
	Great Basin langloisia	LASE3	*Langloisia setosissima*	0–1	0–1

Animal community

This ecological site is preferred 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). A diverse assemblage of reptiles and mammals are likely to be found in this site.

Recreational uses

This site may be used for hiking and aesthetic enjoyment.

Other information

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.

Jojoba seed oil has great value economically. It is used in cosmetics, pharmaceuticals, detergents, and in a range of commercial products including wax, varnishes, lubricants, adhesives and linoleum. Jojaba has widespread medicinal use by Native Americans. Native Americans and early settlers in the Southwest used jojoba nuts to make a substitute for coffee (Matthews 1994).

Inventory data references

The following NRCS plots were used to describe this ecological site:

Community Phase 2.1:
12497-057-B
33116H105 (Type location)
1249706116
SMR1-B4
12497-127-09

Community Phase 2.3:
12497-127-A
12497-127-B

Type locality

Location 1: San Bernardino County, CA	
UTM zone	N
UTM northing	3758744
UTM easting	589917
General legal description	The type location is approximately 0.6 miles northwest (125 degrees) from the parking area at the end of Stirrup Tank Road in Joshua Tree National Park.

Other references

Alford, E. J., J. H. Brock, and G. J. Gottfried. 2005. Effects of fire on Sonoran Desert Plant Communities. USDA Forest Service.

Allen, E. B., L. E. Rao, R. J. Steers, A. Bytnerowicz, and M. E. Fenn. 2009. Impacts of atmospheric nitrogen deposition on vegetation and soils at Joshua Tree National Park. Pages 78-100 in R. H. Webb, L. F. Fenstermaker, J. S. Heaton, D. L. Hughson, E. V. McDonald, and D. M. Miller, editors. The Mojave Desert. University of Nevada Press, Reno, Nevada.

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.

Baldwin, B. G., S. Boyd, B. J. Ertter, R. W. Patterson, T. J. Rosatti, and D. H. Wilken. 2002. The Jepson Desert Manual. University of California Press, Berkely and Los Angeles, California.

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

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.

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.

Cooke, R. U., A. Warren, and A. S. Goudie. 1993. Desert Geomorphology. UCL Press, London.

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.

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.

Matthews, Robin F. 1994. *Simmondsia chinensis*. In: Fire Effects Information System, [Online].
U.S. Department of Agriculture, Forest Service,
Rocky Mountain Research Station, Fire Sciences Laboratory (Producer).
Available: http://www.fs.fed.us/database/feis/ [2012, January 26].

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.

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.

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

Alice Lee Miller
Allison Tokunaga

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	05/21/2025
Approved by	Kendra Moseley
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):**

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

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

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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:**