USDA Natural Resources Conservation Service

Ecological site R030XY159CA
Gravelly Outwash

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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.

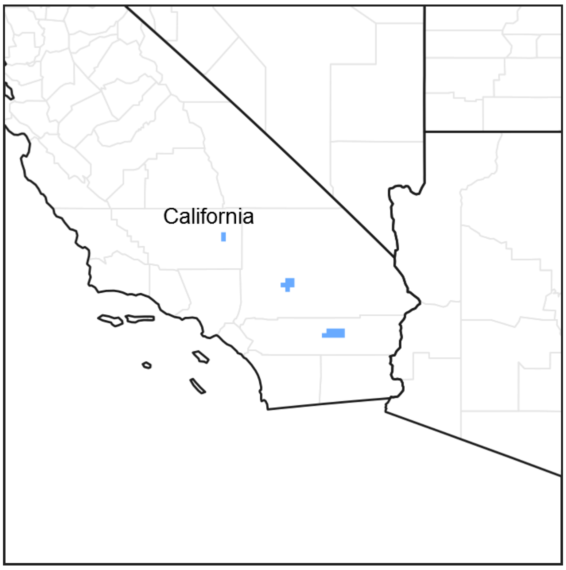

Figure 1. Mapped extent

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 statement:
Major Land Resource Area (MLRA) 30, Mojave Desert, is found in southern California, southern Nevada, the extreme southwest corner of Utah and northwestern Arizona within the Basin and Range Province of the Intermontane Plateaus. The climate of the area is hot (primarily hyperthermic and thermic; however at higher elevations, generally above 5000 feet, mesic, cryic and frigid) and dry (aridic). Elevations range from below sea level to over 12,000 feet in the higher mountain areas found within the MLRA. Due to the extreme elevational range found within this MLRA, land resource units (LRUs) were designated to group the MLRA into similar land units.

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

Classification relationships

Sawyer et al. 2002. Manual of California Vegetation, second edition – no series recognized.

Ecological site concept

This ecological site occurs on gently sloping alluvial fans, fan aprons, and inset fans that are subject to very rare sheet flooding from adjacent slopes at elevations of 1920 to 4100 feet. Soils are very deep, with sandy or gravelly textures, rapid permeability and minimal runoff. Production Reference Value (RV) is 350 pounds per acre, and ranges from 219 to 521 pounds per acre, depending on annual precipitation. The site is dominated by creosote bush (Larrea tridentata) and desertsenna (Senna armata), and burrobush (Ambrosia dumosa) is an important species. Sheet flooding provides additional moisture and establishment opportunities for desertsenna. Deep coarse soils have high water holding capacity, which supports desertsenna and productive creosote bush.

Data ranges in the following physiographic, climate, soils, and community phase data sections are based on major (15% or great of a map unit) components only.

This site is part of group concept R030XB187CA

Associated sites

R030XB005NV	**Arid Active Alluvial Fans** This ecological site occurs on adjacent stable landscapes. Creosote bush (Larrea tridentata) and burrobush (Ambrosia dumosa) are co-dominant.
R030XB019NV	**Eroded Fan Remnant Pavette 4-6 P.Z.** This ecological site occurs on adjacent stable, drier landscapes. The plant community is dominated by low production creosote bush (Larrea tridenata).
R030XB137CA	**Granitic Loam** This ecological site occurs on adjacent fan remnants. Burrobush (Ambrosia dumosa), big galleta (Pleuraphis rigida), and cresoote bush (Larrea tridentata) are co-dominant.

Similar sites

R030XB005NV	**Arid Active Alluvial Fans** This ecological site receives less sheetflooding. Burrobush (Ambrosia dumosa) and creostote bush (Larrea tridentata) are co-dominant, and desertsenna (Senna armata) is a minor shrub if present.
R030XB019NV	**Eroded Fan Remnant Pavette 4-6 P.Z.** This ecological site does not receive sheetflooding, and occurs on drier landscape positions, often with an incipient desert pavement surface. Vegetation consists of sparse cover of creosote bush (Larrea tridentata), burrobush (Ambrosia dumosa) is a minor species, and and desert senna (Senna armata) is not present.
R030XB194CA	**Rarely Flooded Alluvial Fan/Fan Apron** This ecological site occurs on loamy soils with moderate to rapid permeability, and receives more summer precipitation. Jojoba (Simmondsia chinensis) and big galleta (Pleuraphis rigida) are important species.

Table 1. Dominant plant species

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

Physiographic features

This site occurs on gently sloping alluvial fans, fan aprons, and inset fans that are subject to very rare sheet flooding from adjacent slopes. Elevations range from 1920 to 4100 feet, and slopes range from 1 to 8 percent. Runoff class is negligible to low.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Fan apron (3) Inset fan
Flooding duration	Extremely brief (0.1 to 4 hours)
Flooding frequency	Very rare to none
Elevation	585–1,250 m
Slope	1–8%
Aspect	Aspect is not a significant factor

Climatic features

The primary air masses affecting California are cold maritime polar air from the Gulf of Alaska and warmer, moist maritime subtropical air from lower latitudes. Occasionally there are invasions of cold continental polar air from northern Canada or the Rocky Mountains. Precipitation in the area results primarily from the passage of cyclones with associated fronts during fall, winter and spring; from closed cyclones in late winter and spring; and from the flow of moist tropical air from the southeast to the southwest quadrant in the summer.

Barstow Fire Station occurs at a lower elevation and has a long-term record from 1980 to 2002. Twentynine Palms Station occurs at a lower elevation and has a long-term record from 1948 to 2002. This climate summary is based on data from both locations. Warm, moist winters (35 to 70 degrees F) and hot, dry summers (60 to 105 degrees F) characterize the climate on this site. Mean annual air temperature is 65 to 70 degrees F. The average annual precipitation is 4 to 5 inches, with most falling as rain from December through March. Approximately 20 to 45% of the annual precipitation occurs from July to September as a result of intense, convection storms.

Table 3. Representative climatic features

Frost-free period (average)	340 days
Freeze-free period (average)	
Precipitation total (average)	178 mm

Influencing water features

There are no influencing water features associated with this site.

Soil features

The soils associated with this ecological site consists of very deep, somewhat excessively to excessively drained soils that formed in mixed alluvium. Soils typically have rapid permeability due to gravelly sand textures. Surface textures include gravelly loamy coarse sand, coarse sand, very gravelly and gravelly loamy sand, and loamy fine sand, with gravelly and very gravelly sand and loamy sand subsurface textures. Surface rock fragments less than or equal to three inches in diameter range from 35 to 77 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 10 to 35 percent, and subsurface fragments greater than 3 inches in diameter range from 0 to 5 percent (subsurface fragments by volume for a depth of 0 to 59 inches).

The associated soils that are greater than 15 percent of any one map unit are: Hypoint (Sandy, mixed, thermic Typic Torriorthents); Arizo (Sandy-skeletal, mixed, thermic Typic Torriorthents); Koehn (mixed, thermic, Typic Torripsamments); and a higher order Arenic Haplargids. The Hypoint soils have 15 to 35 percent rock fragments in the particle size control section, Arizo soils have 35 to 85 percent, and Koehn soils have 2 to 10 percent. The Arenic haplargids consist of deep sand over an argillic horizon; these soils have high water holding capacity (2.4 to 4).

This ecological site is correlated with the following soil survey areas, map units and soil components:

CA794 Joshua Tree National Park Soil Survey
CA794;3526;Cajon-Hypoint-Arizo association, 1 to 4 percent slopes;Hypoint;;35
CA794;4271;Yuccabutte-Arizo association, 2 to 5 percent slopes;Arizo;rarely flooded;30
CA794;4064;Gravesumit-Helendale complex, 2 to 4 percent slopes;Hypoint;;2

CA670 Kern County SE
CA670;3630; ; Koehn; very rarely flooded;85

CA698 Mojave Desert Area, West Central Part
CA698;3516;Arizo very gravelly loamy sand, 2-4% slopes; Arenic Haplargids;;90
CA698;3518;Arizo-Gravesumit-Daisy-Hypoint complex, 2-8% slopes; Arizo; very rarely flooded;60
CA698; ; Hypoint;;15
CA698; ; Arizo;;4
CA698; ; Hypoint; occasionally flooded;3
CA698; ; 3503; Arizo; very rarely flooded;1
CA698; ; 3519; Arizo; rarely flooded;1

Table 4. Representative soil features

Parent material	(1) Alluvium–granite
Surface texture	(1) Very gravelly loamy sand (2) Gravelly loamy sand (3) Loamy fine sand
Family particle size	(1) Sandy
Drainage class	Well drained to excessively drained
Permeability class	Moderately slow to rapid
Soil depth	152 cm
Surface fragment cover <=3"	35–77%
Surface fragment cover >3"	0–5%
Available water capacity (0-101.6cm)	2.79–10.16 cm
Calcium carbonate equivalent (0-101.6cm)	0–1%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–2
Soil reaction (1:1 water) (0-101.6cm)	6.8–8.2
Subsurface fragment volume <=3" (Depth not specified)	10–35%
Subsurface fragment volume >3" (Depth not specified)	0–5%

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 deep sandy or gravelly soils with rapid permeability and minimal runoff. This site occurs on gently sloping alluvial fans, fan aprons, and inset fans that are subject to very rare sheet flooding from adjacent slopes. Elevations range from 1920 to 4100 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 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 such as flooding (Sawyer et al. 2009).

The soils associated with this ecological site are very deep sands and gravels. In arid regions, the availability of moisture is the key resource driving the productivity and composition of vegetation (Noy-Meir 1973, McAuliffe 1994, Martre et al. 2002, Hamerlynk and McAuliffe 2003, Austin et al. 2004). Because water drains rapidly through coarse textured, sandy soils, with minimal loss due to run-off and evaporation, water availability is higher in coarse textured soils in arid regions (Noy-Meir, 1973, Austin et al. 2004). 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. In the Mojave and Sonoran Deserts, creosote bush reaches maximum dominance and growth on young, coarse textured, weakly developed soils where water infiltration is rapid (McAuliffe 1994, Hamerlynk et al. 2002, Hamerlynk and McAuliffe 2003, 2008). Creosote cover and biomass is also greater in areas receiving rare and diffuse additional run-on (Schwinning et al. 2010).

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, 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, drought-induced mortality of shorter-lived species such as burrobush, 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

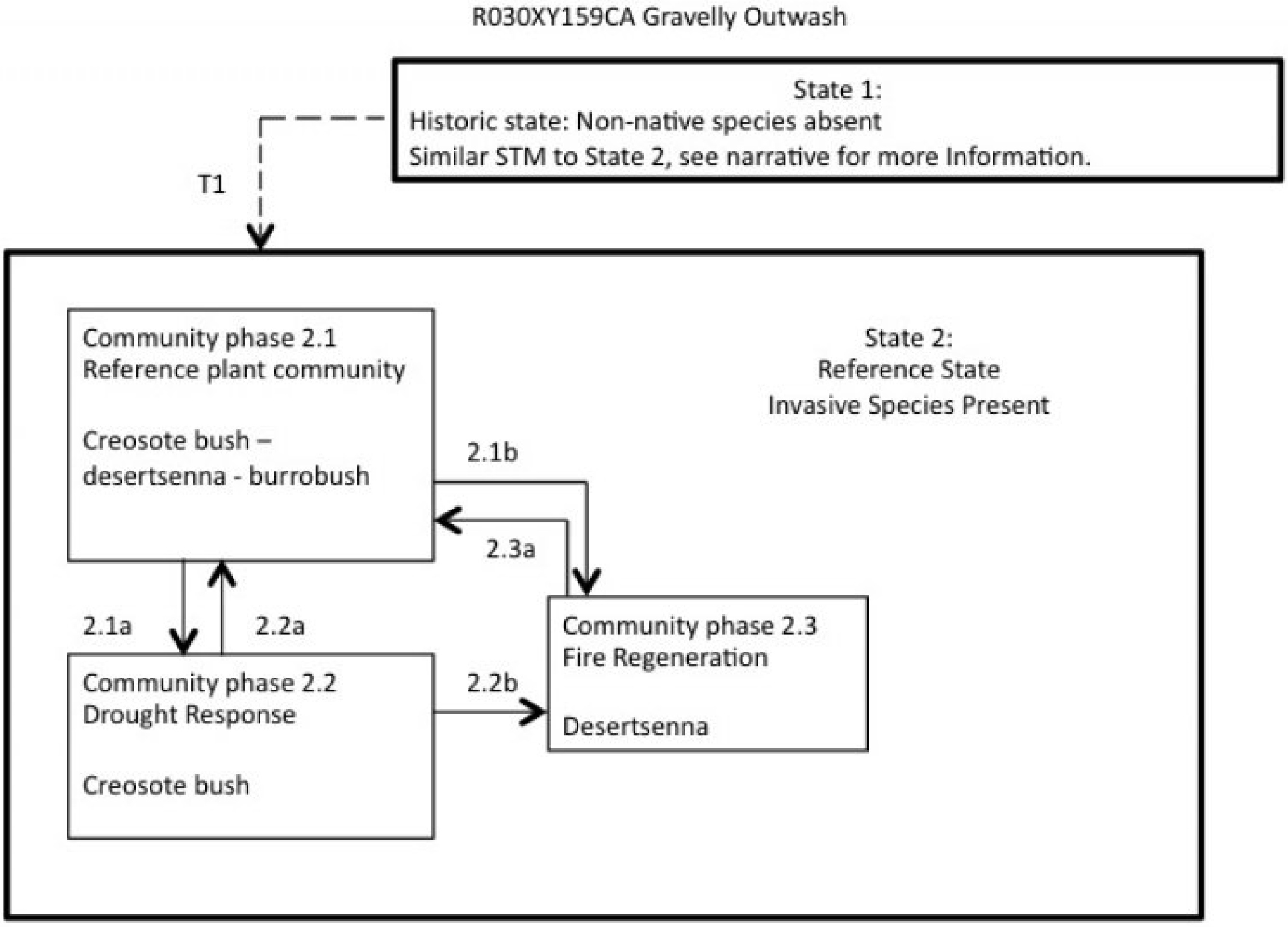

Figure 3. R030XY159CA

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 was the natural disturbance influencing this ecological site. 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.

Community 1.1
Historic Reference Community

This community phase no longer exists due to the naturalization of non-native species in the Mojave Desert. The historic reference community composition would have been similar to community phase 2.1, but without non-native species.

State 2
Reference State

State 2 represents the current range of variability for this site. Non-native annuals, including Mediterranean grass and red-stem stork's bill are naturalized at low levels in this plant community. Their abundance varies with precipitation, but they are at least sparsely present (as current year's growth or present in the soil seedbank).

Community 2.1
Reference Plant Community

Figure 4. Community Phase 2.1

The reference plant community is characterized by an open canopy of widely spaced shrubs 1 to 1.5 meters tall. Creosote bush and desertsenna dominate, and burrobush is an important secondary shrub. Potential vegetative composition is 5% grasses, 5% forbs and 90% shrubs. A relatively high diversity of minor shrub species may be present, including but not limited to white ratany (*Krameria grayi*), cottontop cactus (Echincactus polycephalus), Wiggin's cholla (*Cylindropuntia echinocarpa*), and Mojave yucca (*Yucca schidigera*). Native forbs are abundant with above average precipitation, and common species include smooth desertdandelion (*Malacothrix glabrata*), bristly fiddleneck (*Amsinckia tessellata*), chia (*Salvia columbariae*), and pincushion flower (Chaenactis). The non-native annual forb redstem stork's bill may be relatively abundant, and the non-native annual grass common Mediterranean grass may be sparsely present.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	235	340	469
Forb	10	29	72
Grass/Grasslike	–	24	44
Total	**245**	**393**	**585**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	2-10%
Grass/grasslike foliar cover	0-5%
Forb foliar cover	0-5%
Non-vascular plants	0%
Biological crusts	0%
Litter	10-20%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	20-60%
Bedrock	0%
Water	0%
Bare ground	20-50%

Figure 6. Plant community growth curve (percent production by month).

CA3002, Creosote bush XY. Growth starts in early spring, flowering and seed set occur by July. Dormancy occurs during the hot summer months. With sufficient summer/fall precipitation, some vegetation may break dormancy and produce a flush of growth..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	5	20	40	20	15	0	0	0	0	0	0

Figure 7. Plant community growth curve (percent production by month). CA3015, Creosote bush XB. Growth starts in early spring with flowering and seed set occurring by July. Dormancy occurs during the hot summer months. With sufficient summer/fall precipitation, some vegetation may break dormancy and produce a flush of growth..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	5	20	30	20	10	0	10	5	0	0	0

Figure 8. Plant community growth curve (percent production by month). CA3017, Desert Senna. Growth starts in spring, flowering occurs from April to May and after summer/fall rains..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	10	20	40	15	5	5	5	0	0	0

Figure 9. Plant community growth curve (percent production by month). CA3083, Burrobush XY. Growth begins in mid-winter and by late spring, seed has set..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	5	30	45	20	0	0	0	0	0	0	0

Community 2.2
Drought Response

This community phase is characterized by strong dominance by creosote bush with decline in desertsenna, burrobush, 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).

Community 2.3
Fire Regeneration Community

This community phase is characterized by severe declines in creosote bush and strong dominance by desertsenna. Other shrubs are sparsely present, and may include burrobush, white ratany, and Wiggin's cholla (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.). Burrobush is killed by fire, but can re-colonize burned areas relatively quickly, and will regain dominance faster than creosote bush. 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). 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.

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

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

This community pathway occurs with time without fire.

Transition 1
State 1 to 2

This transition occurred with the naturalization of non-native species in this ecological site. Non-native species were introduced with settlement of the Southwest Desert region in the 1860s.

Additional community tables

Table 7. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Perennial Grasses**			0–27	
	Grass, perennial	2GP	*Grass, perennial*	0–17	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–10	–
2	**Annual Grass**			0–17	
	Grass, annual	2GA	*Grass, annual*	0–17	–
7	**Non-native annual grass**			0–1	
	common Mediterranean grass	SCBA	*Schismus barbatus*	0–1	0–1
Forb					
3	**Perennial Forbs**			2–21	
	Forb, perennial	2FP	*Forb, perennial*	1–11	–
	desert trumpet	ERIN4	*Eriogonum inflatum*	1–10	–
4	**Native Annual Forbs**			0–72	
	bristly fiddleneck	AMTE3	*Amsinckia tessellata*	0–40	0–4
	chia	SACO6	*Salvia columbariae*	0–13	0–1
	Forb, annual	2FA	*Forb, annual*	1–11	–
	smooth desertdandelion	MAGL3	*Malacothrix glabrata*	0–9	0–3
	blazingstar	MENTZ	*Mentzelia*	0–3	–
	evening primrose	OENOT	*Oenothera*	0–2	–
	woolly easterbonnets	ANWA	*Antheropeas wallacei*	0–2	–
	pincushion	CHAEN	*Chaenactis*	0–2	–
	gilia	GILIA	*Gilia*	0–2	–
	giant woollystar	ERDE2	*Eriastrum densifolium*	0–1	0–1
	manybristle chinchweed	PEPA2	*Pectis papposa*	0–1	0–1
8	**Non-native annual forbs**			0–9	
	redstem stork's bill	ERCI6	*Erodium cicutarium*	0–9	0–2
Shrub/Vine					
5	**Dominant Shrubs**			235–409	
	creosote bush	LATR2	*Larrea tridentata*	101–235	8–20
	desertsenna	SEAR8	*Senna armata*	34–224	3–20
	burrobush	AMDU2	*Ambrosia dumosa*	10–26	1–5
6	**Other shrubs**			8–59	
	Mojave yucca	YUSC2	*Yucca schidigera*	0–13	0–1
	burrobrush	HYSA	*Hymenoclea salsola*	0–11	0–1
	Wiggins' cholla	CYEC3	*Cylindropuntia echinocarpa*	0–11	0–1
	water jacket	LYAN	*Lycium andersonii*	0–11	–
	white ratany	KRGR	*Krameria grayi*	0–9	0–3
	brownplume wirelettuce	STPA4	*Stephanomeria pauciflora*	0–6	0–1
	desert pepperweed	LEFR2	*Lepidium fremontii*	0–6	–
	Fremont's dalea	PSFR	*Psorothamnus fremontii*	0–3	–
	cottontop cactus	ECPO2	*Echinocactus polycephalus*	0–1	0–1

Animal community

Small mammals, coyotes and black-tailed jackrabbits may occur on this site. Common lizards include western whiptail and desert spiny lizard. This site also has suitable habitat for desert tortoise. Common birds include horned larks, black-throated larks, house finches and common ravens.

This site has limited value for livestock grazing due to low productivity and lack of stockwater. Desertsenna may be lightly browsed in the absence of more desirable forage. Creosote bush is unpalatable to livestock. Burrobush is fair browse for cattle and horses, and fair to good browse for goats.

Plant use by selected wildlife species:
Desertsenna, creosote bush and burrobush are desirable cover for black-tailed jackrabbits, non-game birds and small mammals.

Desertsenna and burrobush also provide desirable seed crops for non-game birds and small mammals.

Recreational uses

This site has off-highway vehicle use or heavy military vehicle use. Destruction of smaller desertsenna individuals is likely where heavy traffic occurs.

Inventory data references

Line transects: 11 transects from 4/03 to 7/03 in San Bernardino, CA

NV-ECS-1: 2 from 12/97-3/98 in San Bernardino, CA

CA794 survey line point intercepts (lpi) and production plots:
POWA45
COWE07

Type locality

Location 1: San Bernardino County, CA	
UTM zone	N
UTM northing	540278
UTM easting	3832829
Latitude	34° 38′ 11″
Longitude	116° 33′ 38″
General legal description	Three miles north of Bessemer Mine, southeast of Rodman Mountains, San Bernardino Co., CA. Elevation 3900 feet.

Other references

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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	05/14/2025
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):**

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):

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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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:**

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17. **Perennial plant reproductive capability:**
