USDA Natural Resources
Conservation Service

Ecological site R040XD021CA
Very Gravelly Wash

Accessed: 05/05/2024

General information

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

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): 040X–Sonoran Basin and Range

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

Ecological Site Concept -

This small ephemeral stream has rare to occasional flood events, and occurs on interfluves and inset fans on fan remnants with desert pavement surfaces. Soils are very deep, with loamy-skeletal or sandy skeletal particle control section. Creosote bush (Larrea tridentata) is dominant, with brittlebush (Encelia farinosa) co-dominant. Desert lavender (Hyptis emoryi) and white ratany (Krameria grayii) are typically present as secondary species.

Data ranges in the physiographic data, climate data, water features, and soil data sections of this Ecological Site Description are based on all components.

Associated sites

R040XD009CA	**Gravelly Fan Remnants And Fan Aprons** This ecological site occurs on fan remnants and fan aprons near the mountain base. Additional run-on and rocky surfaces promote a creosote bush-Schott's dalea community.
R040XD201CA	**Cobbly Fan Remnants** This ecological site occurs on stony fan remnants with creosote bush and brittlebush dominant.

Table 1. Dominant plant species

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

Physiographic features

This site occurs on interfluves and inset fans on fan remnants with desert pavement surfaces. Elevations range from 69 to 1720 feet. Slopes are typically 4 to 8 percent, but may range from 2 to 15 percent.

Table 2. Representative physiographic features

Landforms	(1) Interfluve (2) Inset fan
Flooding duration	Extremely brief (0.1 to 4 hours) to very brief (4 to 48 hours)
Flooding frequency	Rare to occasional
Elevation	21–524 m
Slope	2–15%
Aspect	Aspect is not a significant factor

Climatic features

The Colorado Desert of California represents the north westernmost portion of the Sonoran Desert. The subtropical Colorado Desert results from the descent of cold air which is heated by compression and arrives hot and dry at the earth's surface. Precipitation is frontal in nature during the winter and convectional in the summer. Reduced summer rainfall and high potential evapotranspiration make the Colorado Desert one of the most arid regions in North America. Mean annual temperatures range from 70 to 81 degrees F, with summer temperatures frequently exceed 105 degrees F. The average annual precipitation ranges from 2 to 4 inches with most falling as rain. Snowfall is rare. Approximately 35% of annual precipitation occurs from July to September as a result of intense convection storms. Spring months are the windiest.

Table 3. Representative climatic features

Frost-free period (average)	365 days
Freeze-free period (average)	365 days
Precipitation total (average)	102 mm

Influencing water features

Soil features

This site occurs on interfluves and inset fans dissecting and bordering desert pavements. Soils are very deep, somewhat excessively drained, and formed in alluvium from mixed sources. Surface textures are very gravelly fine sandy loam, and gravelly coarse sand. Subsurface textures are loamy sand or sandy loam with gravelly modifiers. The soils series associated with this site are Chemehuevi and Rizzo.

The Chemehuevi soils are loamy-skeletal, mixed, superactive, hyperthermic Typic Haplocalcids. The Chemehuevi soils are strongly calcareous soils, with calcic horizons beginning at depths of 2 to 10 inches. The Rizzo soils are sandy-skeletal, mixed, hyperthermic Typic Torriorthents.

This ecological site has been correlated to the following mapunits and soil components in the Colorado Desert Area

Soil Survey (CA803):

Mapunit; Mapunit name; Component; phase; percent
2001; Emptygun-Chemehuevi association, 2 to 30 percent slopes; Chemehuevi;loamy substratum;3
2011; Havasulake gravelly silt loam, 1 to 4 percent slopes; Chemehuevi; loamy substratum;5
2012; Havasulake gravelly sandy loam, 1 to 4 percent slopes; Chemehuevi; loamy substratum; 5
2055; Catfishbay association, 0 to 8 percent slopes; Chemehuevi; loamy substratum; 4
2090; Deprave-Rockhound-Rizzo complex, 2 to 4 percent slopes; Rizzo; occasionally flooded; 3

This ecological site has been correlated to the following mapunits and soil components in the Joshua Tree National Park Soil Survey (CA794):

Mapunit; Mapunit name; Component; phase; percent
2090; Deprave-Rockhound-Rizzo complex, 2 to 4 percent slopes; Rizzo; occasionally flooded; 3

Table 4. Representative soil features

Surface texture	(1) Very gravelly fine sandy loam (2) Gravelly coarse sand
Family particle size	(1) Sandy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderate to rapid
Soil depth	150 cm
Surface fragment cover <=3"	40–65%
Surface fragment cover >3"	3–37%
Available water capacity (0-101.6cm)	2.29–7.62 cm
Calcium carbonate equivalent (0-101.6cm)	0–25%
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)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	20–70%
Subsurface fragment volume >3" (Depth not specified)	0–12%

Ecological dynamics

These small ephemeral streams occur on inset fans, and interfluves that drain stable fan remnants with desert pavement surfaces. These ephemeral streams form dendritic (branched) drainage patterns as they collect runoff from adjacent fan remnants. Desert pavement is distinguished by almost barren, level surfaces covered with tightly interlocked surface gravels, which are often darkly colored by desert varnish. Ephemeral streams among desert pavement surfaces appear as wavy lines of vegetation among the dark barren surfaces. Desert pavement has near surface soil features that reduces the rate of infiltration, thus excess flow drains across the flat surfaces to the multiple small ephemeral streams that have developed on the fan remnants. Drainageways among desert pavement surfaces receive continuous soil disturbance from runoff events, which prevents formation of desert pavement features, such as an interlocking gravelly surface or a vesicular horizon. Instead, soils are composed of very deep sands with very gravelly or extremely gravelly modifiers. Regular flooding of the drainageways flushes the fine eolian dust deposits from the surface, and inhibits the development of the vesicular horizon and the associated uplift of gravels that lead to desert pavement formation. The deep sands allow for quick and deep infiltration of water.

Vegetation is dense and diverse in contrast to the barren desert pavement surfaces, because plants can access deeper water. Creosote bush and brittlebush are dominant, with white ratany and desert lavender common secondary shrubs. A diversity of other shrubs and forbs may be present.

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

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

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

State and transition model

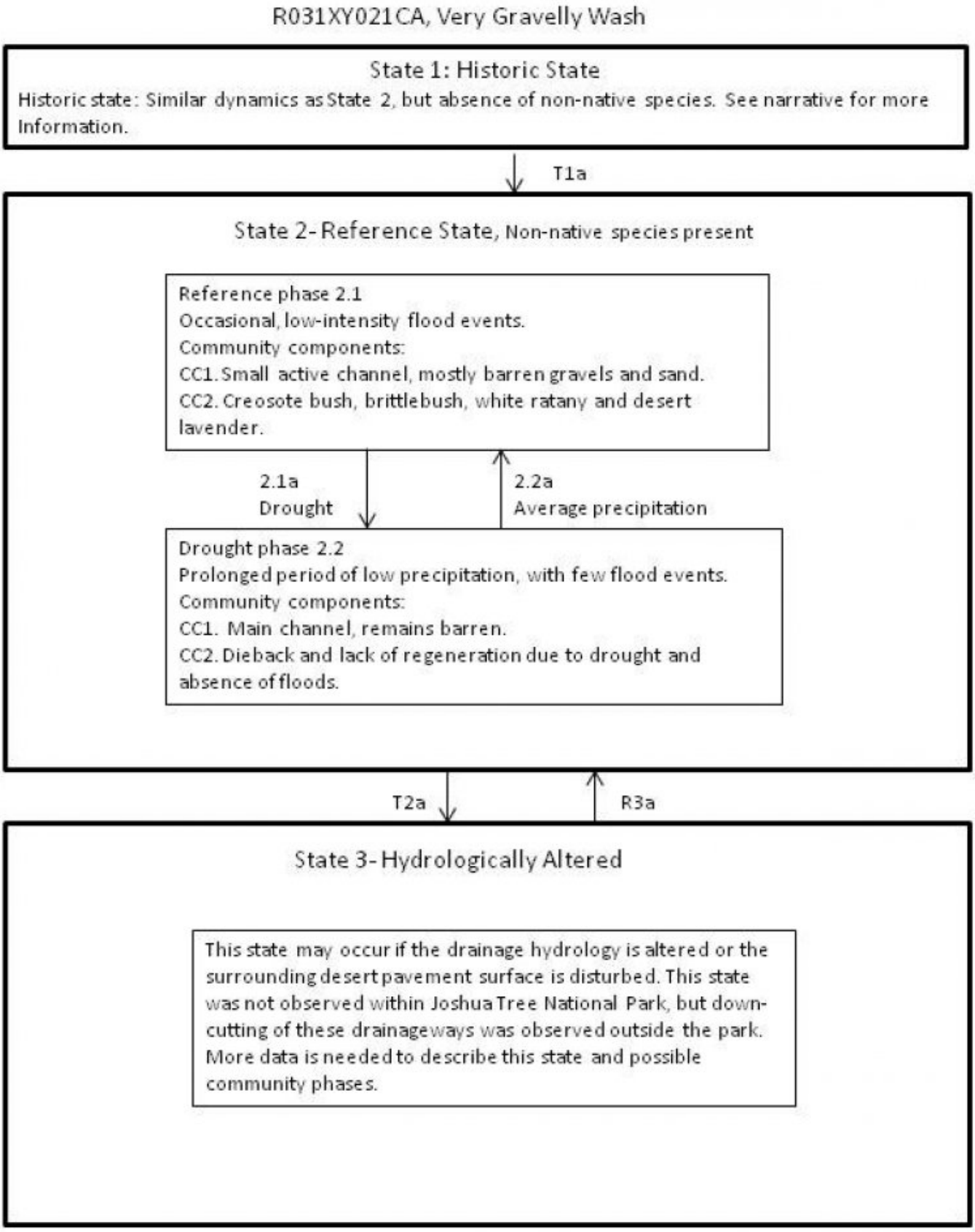

Figure 3. R031XY021CA model

State 1
Historic State

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

State 2
Reference State

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

Community 2.1
Reference Community

Figure 4. Very Gravelly Wash

This community phase is dependent upon unimpaired hydrologic function and average to above average precipitation conditions. These drainageways are relatively stable and confined. There are two community components associated with this community phase. Community component one is in the most actively flooded region of the drainageway, which is composed of barren sands and gravels. Community component two is adjacent to the active zone in the drainageway and on the sideslopes of the drainageway. Brittlebrush is generally dominant, and creosote bush, white ratany and desert lavender are common secondary shrubs. Although always relatively small, there is variation in the size and shape of these draingeways, ranging from smaller channels with primarily creosote bush, to larger channels with a higher diversity of shrubs. Big galleta (*Pleuraphis rigida*), has low cover in the more defined drainageways. Annual production varies with precipitation, but whitemargin sandmat (*Chamaesyce albomarginata*) and desert Indianwheat (*Plantago ovata*) are usually present with notable cover. Other annuals exists, but were not recorded.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	493	745	789
Forb	56	78	90
Grass/Grasslike	11	17	18
Total	**560**	**840**	**897**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	30-35%
Grass/grasslike foliar cover	2-3%
Forb foliar cover	5-7%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

Table 7. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	15-20%
Grass/grasslike basal cover	1-2%
Forb basal cover	2-3%
Non-vascular plants	0%
Biological crusts	0%
Litter	5-7%
Surface fragments >0.25" and <=3"	65-75%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	2-3%

Table 8. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	–	–	5-7%
>0.15 <= 0.3	–	–	–	–
>0.3 <= 0.6	–	10-15%	2-3%	–
>0.6 <= 1.4	–	15-20%	–	–
>1.4 <= 4	–	3-5%	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Community 2.2
Drought Response

This community develops with prolonged or severe drought. Drought is an important shaping force in Mojave Desert plant communities (Webb et al. 2003, Bowers 2005, Hereford et al. 2006, Miriti et al. 2007). Short-lived perennials (such as burrobush, brittlebush, sweetbush, and desertsenna) demonstrate the highest rates of mortality (Webb et al. 2003, Bowers 2005, Hereford et al. 2006, Miriti et al. 2007), and annual species remain dormant in the soil seedbank (Beatley 1969, 1974). Long-lived shrubs (such as creosote bush, white ratany, and desert lavender) are more likely to exhibit branch-pruning, and or limited recruitment during drought (e.g. Hereford et al. 2006, Miriti et al. 2007), leading to reduced cover and biomass in drought-afflicted communities. Brittlebush, when dominant on lower landscape positions, such as alluvial fans, is generally associated with a disturbance community, such as an ephemeral stream (Sawyer et al. 2009). Brittlebush is an extremely drought-tolerant, drought-deciduous shrub. Adaptations in degree of leaf pubescence and leaf size allow brittlebush to occupy sites ranging from relatively mesic coastal environments to extremely arid deserts (Ehleringer and Cook 1990, Sandquist and Ehleringer 1997, Housman et al. 2002, Sandquist and Ehleringer 2003). Frosts cause branch die-back and mortality in adult brittlebush (Sandquist and Ehleringer 1996), and reduce seedling establishment (Bowers 1994). Brittlebush seedlings emerge over multiple pulses in response to cool season rains, with emergence triggered by a minimum of 19 mm of precipitation, and seedlings are killed if freezing temperatures occur within nine days of the trigger event (Bowers 1994). Creosote bush is a long-lived, deep-rooted evergreen shrub dominant across vast areas of the North American warm deserts. Once established, it has very low levels of drought-induced mortality, and it is one of the few shrubs capable of persisting in this extreme environment. White ratany is a long-lived, drought-deciduous shrub that co-occurs as a secondary species with creosote bush over much of its range. It is a root parasite that obtains nutrients from the roots of host plants, which may help to sustain it during of drought. If drought persists or the channel becomes less active due to flow diversion, creosote bush may become the dominant species in the drainageway.

Pathway 2.1a
Community 2.1 to 2.2

This pathway is caused by a prolonged or severe drought.

Pathway 2.2a
Community 2.2 to 2.1

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

State 3
Hydrologically Altered State

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

Community 3.1
Hydrologically Altered

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

Transition T2
State 2 to 3

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

Restoration pathway R3a
State 3 to 2

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

Additional community tables

Table 9. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
1	**Shrubs**			493–789	
	creosote bush	LATR2	*Larrea tridentata*	325–516	–
	brittlebush	ENFA	*Encelia farinosa*	95–157	–
	white ratany	KRGR	*Krameria grayi*	45–72	–
	desert lavender	HYEM	*Hyptis emoryi*	28–45	–
Grass/Grasslike					
2	**Perennial Grass**			11–18	
	big galleta	PLRI3	*Pleuraphis rigida*	11–18	–
Forb					
3	**Forbs**			56–90	
	whitemargin sandmat	CHAL11	*Chamaesyce albomarginata*	45–72	–
	desert Indianwheat	PLOV	*Plantago ovata*	11–18	–

Animal community

This site is dominated by creosote bush, the root mound of which is well suited for small mammals to burrow in. These animals include ground squirrels, lizards, and mice. Additionally, this site receives abundant moisture in the form of run-off which makes for periodic wildflower shows. This then provides good food plants for the small mammals. Also, many birds perch on the branches of the creosote bush.

Hydrological functions

This site is a narrow, concave channel which drains the surrounding desert patinas.

Recreational uses

This site would be of great interest to those who study desert ecology. A high production community in a region which receives little rain, the site illustrates how important moisture run-off is. Due to this increased moisture, the site also has good periodic wildflower shows which provide many photographic opportunities.

Other information

One abundant plant of the site, brittlebush, was favored by Native Americans of the area for its fragrant sap which they would dry and burn like incense. This practice was observed by the early Spanish settlers and prompted them to name the plant 'incienso,' or incense in Spanish. This same sap is a water soluble substance that inhibits the growth of several winter annuals.

Type locality

Location 1: San Bernardino County, CA	
UTM zone	N
UTM northing	3811724
UTM easting	736268
Latitude	34° 25′ 12″
Longitude	114° 25′ 44″
General legal description	This site is located about 3 miles east of West Well on the powerline road in Chemehuevi Wash OHV area. The powerline road intersects a north-south road at this point. The type location is about one half mile south on this road.

Other references

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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.

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Ehleringer, J. R. and C. S. Cook. 1990. Characteristics of Encelia species differing in leaf reflectance and transpiration rate under common garden conditions. Oecologia 82:484-489.

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Housman, D. C., M. V. Price, and R. A. Redak. 2002. Architecture of coastal and desert Encelia farinosa (Asteraceae): consequences of plastic and heritable variation in leaf characteristics. American Journal of Botany 89:1303-1310.

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.

Sandquist, D. R. and J. R. Ehleringer. 1997. Intraspecific variation in leaf pubescene and drought response in

Encelia farinosa associated with contrasting desert environments. New Phytologist 135:635-644.

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Sandquist, J. R. and J. R. Ehleringer. 1996. Potential adaptability and constraints of response to changing climates for Encelia farinosa var. phenicodonta from southern Baja California, Mexico. Madroño 43:465-478.

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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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Rangeland health reference sheet

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

Author(s)/participant(s)	
Contact for lead author	
Date	
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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

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

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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:**

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17. **Perennial plant reproductive capability:**
