

Ecological site R040XC329AZ Sandy Slopes, Dunes 3"-7" p.z.

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General information

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

MLRA notes

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

Major Land Resource Area (MLRA) 40 is the portion of Sonoran Desert that extends from northwest Mexico into southwestern Arizona and southeastern California. This MLRA is hot desert characterized by bimodal precipitation coupled with hot summers and mild winters. These conditions give rise to a rich biological diversity visually dominated by columnar cactus (saguaro) and leguminous trees (palo verde). This unit occurs within the Basin and Range Physiographic Province and is characterized by numerous mountain ranges that rise abruptly from broad, plain-like valleys and basins. Igneous and metamorphic rock classes dominate the mountain ranges, and basin sediments are combinations of fluvial, lacustrine, colluvial and alluvial deposits.

LRU notes

Land Resource Unit (LRU) 40-3, Colorado Sonoran Desert, is characterized by desert scrub vegetation on relict fan remnants with a high amount of desert pavement. Trees are common in large washes and hillslopes. Elevations range from 300 to 1200 feet, and precipitation averages 3 to 7 inches per year. Vegetation includes creosotebush, white bursage, brittlebush, Mormon tea, teddybear cholla, elephant tree, smoke tree, ocotillo, and big galleta. The soil temperature regime is hyperthermic and the soil moisture regime is typic aridic.

Classification relationships

USDA-NRCS Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin: Western Range and Irrigated Region D Major Land Resource Area 40 - Sonoran Basin and Range Land Resource Unit 3 - Colorado Sonoran Desert Ecological Site Sandy Slopes, Dunes, 3"-7" p.z.

U.S. Environmental Protection Agency, Ecological Regions of North America: Level I, Region 10 North American Deserts Level II, 10.2 Warm Deserts Level III, Ecoregion 81, Sonoran Basin and Range Level IV, 81I, 81n, 81o

USDA-USFS Ecological Subregions: Sections of the Conterminous United States Section 322 American Semidesert and Desert Province Section 322B, Sonoran Desert

Ecological site concept

Sandy Slopes, Dunes, 3"-7" p.z., occurs on windblown (eolian) fine sands that form dunes greater than 10' in height with steep slopes (greater than 15%).

Associated sites

R040XC307AZ	Limy Fan, Sandy 3"-7" p.z. Interdune areas, windblown soils in sand sheets or small hummocks
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Similar sites

R040XB232AZ	Sandy Slopes, Dunes 7"-10" p.z. Elevations 1,200' - 2,000' feet, more precipitation;
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Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Ephedra nevadensis</i> (2) <i>Ambrosia dumosa</i>
Herbaceous	(1) <i>Pleuraphis rigida</i> (2) <i>Hesperocallis undulata</i>

Physiographic features

This site occurs on dunes. Slopes are generally 15% percent or greater.

Table 2. Representative physiographic features

Landforms	(1) Dune field (2) Dune
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Climatic features

Annual precipitation ranges from 3 to 7 inches. Annual rainfall is bimodal, with distinct rainy seasons occurring from December to March (winter) and July to September (summer). Rainfall ratios range from 40:60 (winter:summer). Rainfall intensity differs between rainfall seasons. Winter frontal storms develop in the Pacific Ocean and Gulf of California, producing widespread, low-intensity and long duration precipitation events. Winter precipitation is the more dependable water source for vegetation, and snowfall is very rare. During summer months, atmospheric activity in the Gulf of Mexico produces convective thunderstorms when crossing over the mountains in the afternoon. These storms travel across the plains and valleys, producing precipitation of short duration, usually less than 30 minutes, but of moderate to heavy intensity. However, these thunderstorms often produce little more than gusty winds and light showers. Between these two seasons, little to no effective precipitation can occur for several months at a time. May and June are the driest months, and overall humidity is very low.

Overall, average annual rainfall is variable, but increases in variability from east to west across the region. For long-term precipitation data, the coefficient of variation, the ratio of the standard deviation to the mean expressed as a percentage, increases from 44% at Gila Bend (east) to 65% at Mohawk (west).

Winter temperatures are very mild, with an average of 53°F in January, with recorded extremes of 10°F. Summertime temperatures are hot to very hot, averaging 93°F in July, and with recorded extremes of 125°F. Spring and summer growing seasons are equally important for perennial grass, forb and shrub and tree growth. With above average precipitation, cool and warm season annuals, forbs and grasses can be common in their respective seasons. Perennial forbs may only be visible above ground following rainfall events.

Table 3. Representative climatic features

Frost-free period (characteristic range)	262-365 days
Freeze-free period (characteristic range)	348-365 days
Precipitation total (characteristic range)	102-127 mm
Frost-free period (actual range)	247-365 days
Freeze-free period (actual range)	296-365 days
Precipitation total (actual range)	102-178 mm
Frost-free period (average)	303 days
Freeze-free period (average)	348 days

Precipitation total (average)

127 mm

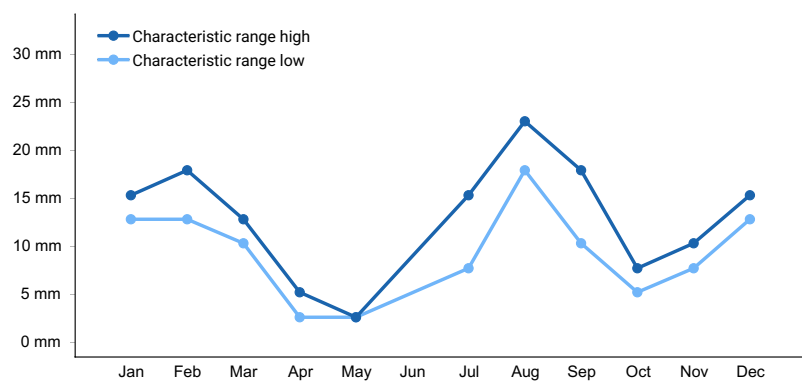


Figure 1. Monthly precipitation range

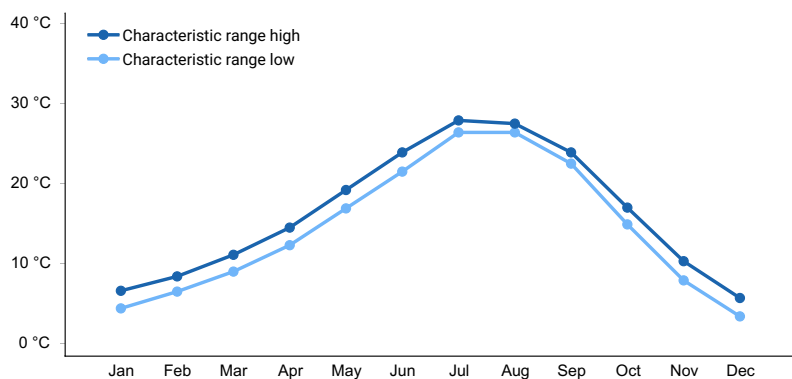


Figure 2. Monthly minimum temperature range

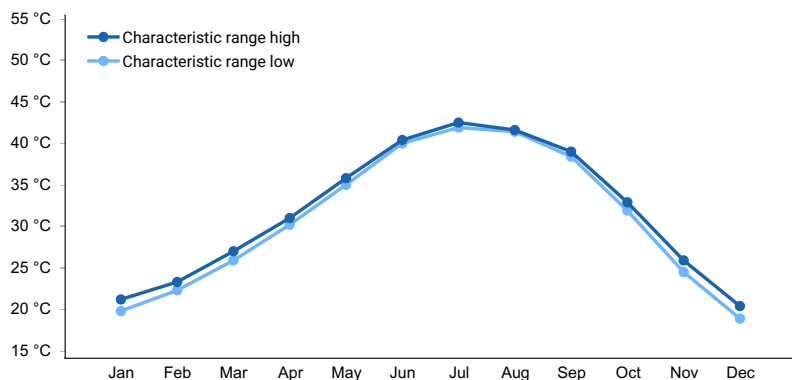


Figure 3. Monthly maximum temperature range

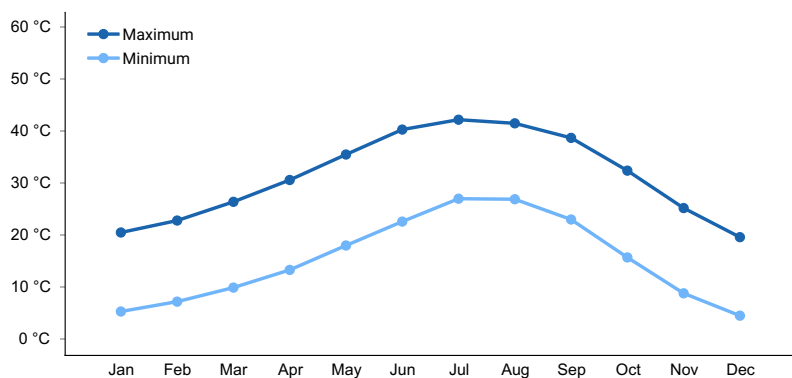


Figure 4. Monthly average minimum and maximum temperature

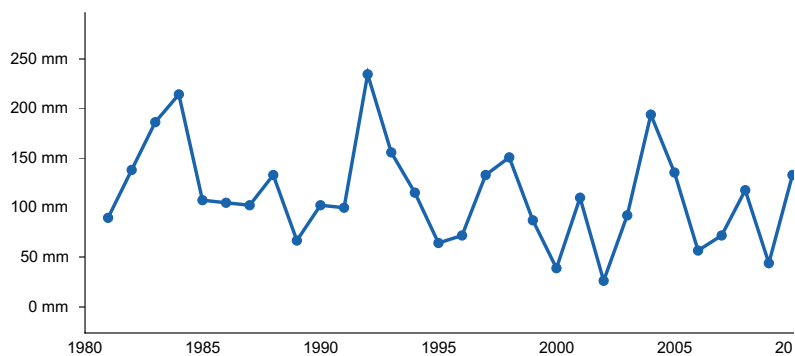


Figure 5. Annual precipitation pattern

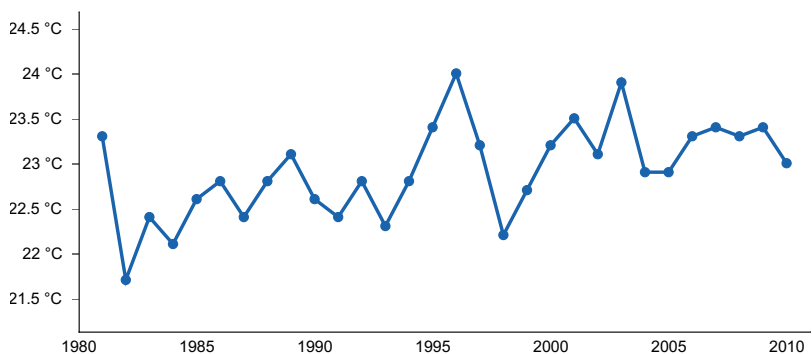


Figure 6. Annual average temperature pattern

Climate stations used

- (1) YUMA PROVING GROUND [USW00003125], Yuma, AZ
- (2) EHRENBURG 2 E [USC00022790], Cibola, AZ
- (3) TACNA 3 NE [USC00028396], Roll, AZ
- (4) GILA BEND [USC00023393], Gila Bend, AZ
- (5) QUARTZSITE [USC00026865], Parker, AZ

Influencing water features

Soil features

These soils form in deep, fine sands. Plant-soil moisture relationships are very good, as the subsoil moisture holding capacity exceeds moisture inputs, and that moisture is available to plants.

Table 4. Representative soil features

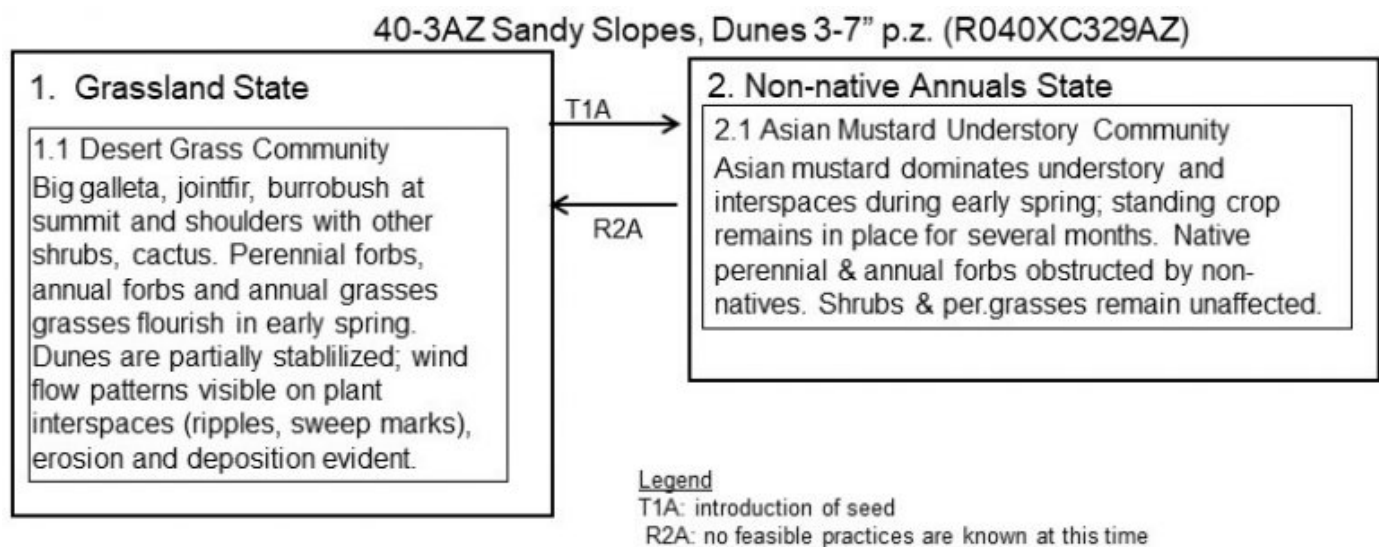
Surface texture	(1) Fine sand
Family particle size	(1) Sandy
Drainage class	Excessively drained
Permeability class	Moderately rapid
Soil depth	152 cm
Available water capacity (0-101.6cm)	9.14–12.19 cm
Calcium carbonate equivalent (0-101.6cm)	0–3%
Electrical conductivity (0-101.6cm)	0 mmhos/cm

Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.4

Ecological dynamics

Sandy Slopes, Dunes, 3"-7" p.z., supports a mixed plant community on wind-blown, fine sands. Two ecological states can occur, Grassland and Non-Native Annuals. Both are dominated by big galleta, with scattered shrubs and cactus. Trees are largely absent. Early spring growth of annual and perennial forbs can be highly productive following wet winters. The Non-native Annuals state may be difficult to observe in the field due to the early spring growing period, and Asian mustard, the predominant species, readily breaks up and disperses with wind. Fire is not a typical disturbance, though Non-native Annuals may carry a fire under the right fuel conditions. Lightning is an unlikely ignition source as Asian mustard biomass is typically dispersed prior to the occurrence of summer convective thunderstorms. Current field observations indicate burned areas are confined to roadsides. Plant-soil relationships are excellent. Aspect is desert shrub-grassland.

State and transition model



State 1 Grassland (Reference)



Figure 7. Sandy Slopes, Dunes 3"-7" p.z.

Grassland is a mixed desert plant community on wind-blown fine sands. The reference plant community is highly productive since all rainfall is captured and retained in the soil for long periods. Big galleta, jointfir and burrobrush predominate, along with a variety of subshrubs and forbs. Cholla, creosotebush and ocotillo are widely scattered, mostly occurring on more stable summits, shoulders, and leeward side-slopes. Windward areas are unstable, with active windblown sands scouring large areas bare. Spring annuals and spring seasonal perennials (such as desert lily and birdcage evening primrose) flourish with sufficient winter precipitation.

Community 1.1
Desert Grass-Shrub



The plant community is a mixture of perennial and annual grasses, forbs and desert shrubs.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	84	146	210
Forb	45	67	90
Shrub/Vine	—	13	28
Total	129	226	328

State 2
Non-native Annuals



Figure 9. Typical flourish of spring annuals. Asian mustard is visible in center-right.

Community 2.1
Asian Mustard-Grass-Shrub



Figure 10. Asian mustard flourished after wet winter. Dead stems present in all interspaces.

Non-native Annuals occurs primarily after Asian mustard seeds are introduced to the site. Asian mustard germinates early in the season, uses available moisture, and spreads a dense, low canopy that may impede germination and growth of native forbs. Other non-native annual forbs or grasses may be present but seem to not affect ecosystem dynamics as much as Asian mustard. Seed transport mechanisms are mechanical, either via wind-blown transport (the entire mature plant will tumble) or via animal transport of sticky (mucilaginous) seeds. Non-native Annuals will look much like Grassland for most of the year. During wet springs, Asian mustard will flourish, and the dead-standing plants may persist for a short time after the growing season. Currently, no management techniques have succeeded in removing Asian mustard and restoring Grassland.

Transition T1A
State 1 to 2



Grassland (Reference)

Non-native Annuals

Seed introduction via wind dispersal or mechanical transport.

Restoration pathway R2A

State 2 to 1



Non-native Annuals



Grassland (Reference)

No known mechanism to remove non-native forbs.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	Perennial Grass			37–211	
	big galleta	PLRI3	<i>Pleuraphis rigida</i>	96–210	–
3	Annual Grasses			39–78	
	sixweeks threeawn	ARAD	<i>Aristida adscensionis</i>	0–11	–
	prairie threeawn	AROL	<i>Aristida oligantha</i>	0–11	–
	needle grama	BOAR	<i>Bouteloua aristoides</i>	0–11	–
	sixweeks grama	BOBA2	<i>Bouteloua barbata</i>	0–11	–
	witchgrass	PACA6	<i>Panicum capillare</i>	0–11	–
	sixweeks fescue	VUOC	<i>Vulpia octoflora</i>	0–11	–
	Rothrock's grama	BORO2	<i>Bouteloua rothrockii</i>	0–6	–
	Arizona brome	BRAR4	<i>Bromus arizonicus</i>	0–1	–
	feather fingergrass	CHVI4	<i>Chloris virgata</i>	0–1	–
	canyon cupgrass	ERLE7	<i>Eriochloa lemmonii</i>	0–1	–
	tufted lovegrass	ERPEP2	<i>Eragrostis pectinacea</i> var. <i>pectinacea</i>	0–1	–
	Mexican sprangletop	LEFUU	<i>Leptochloa fusca</i> ssp. <i>uninervia</i>	0–1	–
	mucronate sprangletop	LEPA6	<i>Leptochloa panicea</i>	0–1	–
	Bigelow's bluegrass	POBI	<i>Poa bigelovii</i>	0–1	–
	Arizona signalgrass	URAR	<i>Urochloa arizonica</i>	0–1	–
Forb					
4	Perennial Forbs			8–39	
	birdcage evening primrose	OEDE2	<i>Oenothera deltoides</i>	2–8	–
	desert lily	HEUN2	<i>Hesperocallis undulata</i>	2–8	–
	whitemargin sandmat	CHAL11	<i>Chamaesyce albomarginata</i>	1–4	–
	desert sand verbena	ABVI	<i>Abronia villosa</i>	1–3	–
	desert marigold	BAMU	<i>Baileya multiradiata</i>	0–3	–
	desert twinbugs	DICA4	<i>Dicoria canescens</i>	0–3	–
	canaigre dock	RUHY	<i>Rumex hymenosepalus</i>	0–1	–
	smooth threadleaf ragwort	SEFLM	<i>Senecio flaccidus</i> var. <i>monoensis</i>	0–1	–
	lacy tansyaster	MAPIP4	<i>Machaeranthera pinnatifida</i> ssp. <i>pinnatifida</i>	0–1	–

			var. <i>pinnaurica</i>		
5	Annual Forbs			39–78	
	desert Indianwheat	PLOV	<i>Plantago ovata</i>	0–11	–
	desert globemallow	SPAM2	<i>Sphaeralcea ambigua</i>	0–6	–
	Coulter's globemallow	SPCO2	<i>Sphaeralcea coulteri</i>	0–6	–
	common fiddleneck	AMMEI2	<i>Amsinckia menziesii</i> var. <i>intermedia</i>	0–6	–
	bristly fiddleneck	AMTE3	<i>Amsinckia tessellata</i>	0–6	–
	Booth's evening primrose	CABOI	<i>Camissonia boothii</i> ssp. <i>intermedia</i>	0–3	–
	chuckwalla combseed	PEHE	<i>Pectocarya heterocarpa</i>	0–3	–
	broadfruit combseed	PEPL	<i>Pectocarya platycarpa</i>	0–2	–
	wingnut cryptantha	CRPT	<i>Cryptantha pterocarya</i>	0–2	–
	hairy prairie clover	DAMO	<i>Dalea mollis</i>	0–1	–
	soft prairie clover	DAMO2	<i>Dalea mollissima</i>	0–1	–
	California shieldpod	DICA7	<i>Dithyrea californica</i>	0–1	–
	miniature woollystar	ERDI2	<i>Eriastrum diffusum</i>	0–1	–
	woolly sunflower	ERIOP2	<i>Eriophyllum</i>	0–1	–
	kidneyleaf buckwheat	ERRE3	<i>Eriogonum reniforme</i>	0–1	–
	Thomas' buckwheat	ERTH	<i>Eriogonum thomasi</i>	0–1	–
	little deserttrumpet	ERTR8	<i>Eriogonum trichopes</i>	0–1	–
	California poppy	ESCAM	<i>Eschscholzia californica</i> ssp. <i>mexicana</i>	0–1	–
	spurge	EUPHO	<i>Euphorbia</i>	0–1	–
	Arizona poppy	KAGR	<i>Kallstroemia grandiflora</i>	0–1	–
	Great Basin langloisia	LASE3	<i>Langloisia setosissima</i>	0–1	–
	shaggyfruit pepperweed	LELA	<i>Lepidium lasiocarpum</i>	0–1	–
	Bigelow's linanthus	LIBI2	<i>Linanthus bigelovii</i>	0–1	–
	foothill deervetch	LOHU2	<i>Lotus humistratus</i>	0–1	–
	desert deervetch	LOMI	<i>Lotus micranthus</i>	0–1	–
	bajada lupine	LUCO	<i>Lupinus concinnus</i>	0–1	–
	Coulter's lupine	LUSP2	<i>Lupinus sparsiflorus</i>	0–1	–
	onyxflower	ACCO3	<i>Achyronychia cooperi</i>	0–1	–
	small wirelettuce	STEX	<i>Stephanomeria exigua</i>	0–1	–
	longbeak streptanthella	STLO4	<i>Streptanthella longirostris</i>	0–1	–
	woolly tidestromia	TILA2	<i>Tidestromia lanuginosa</i>	0–1	–
	manybristle chinchweed	PEPA2	<i>Pectis papposa</i>	0–1	–
	desert unicorn-plant	PRAL4	<i>Proboscidea althaeifolia</i>	0–1	–
	New Mexico plumeseed	RANE	<i>Rafinesquia neomexicana</i>	0–1	–
	California desertdandelion	MACA6	<i>Malacothrix californica</i>	0–1	–
	yellowcomet	MEAF2	<i>Mentzelia affinis</i>	0–1	–

	whitestem blazingstar	MEAL6	<i>Mentzelia albicaulis</i>	0–1	–
	cottonheads	NEDE	<i>Nemacaulis denudata</i>	0–1	–
	glandular threadplant	NEGL	<i>Nemacladus glanduliferus</i>	0–1	–
	desert evening primrose	OEPR	<i>Oenothera primiveris</i>	0–1	–
	giant Spanish needle	PAARG	<i>Palafoxia arida</i> var. <i>gigantea</i>	0–1	–
	brittle spineflower	CHBR	<i>Chorizanthe brevicornu</i>	0–1	–
	Esteve's pincushion	CHST	<i>Chaenactis stevioides</i>	0–1	–
	Panamint cryptantha	CRAN4	<i>Cryptantha angustifolia</i>	0–1	–
	redroot cryptantha	CRMI	<i>Cryptantha micrantha</i>	0–1	–
	New Mexico silverbush	ARNE2	<i>Argythamnia neomexicana</i>	0–1	–
	Cedros milkvetch	ASIN6	<i>Astragalus insularis</i>	0–1	–
	spiderling	BOERH2	<i>Boerhavia</i>	0–1	–
Shrub/Vine					
6	Shrubs			0–28	
	jointfir	EPHED	<i>Ephedra</i>	2–22	–
	ocotillo	FOSP2	<i>Fouquieria splendens</i>	0–11	–
	burrobush	AMDU2	<i>Ambrosia dumosa</i>	1–11	–
	white ratany	KRGR	<i>Krameria grayi</i>	0–9	–
	dyebush	PSEM	<i>Psoralea emoryi</i>	0–6	–
	creosote bush	LATR2	<i>Larrea tridentata</i>	0–6	–
7	Cactus			8–39	
	blue paloverde	PAFL6	<i>Parkinsonia florida</i>	6–17	–
	yellow paloverde	PAMI5	<i>Parkinsonia microphylla</i>	6–17	–

Other references

Griffith, G.E., Omernik, J.M., Johnson, C.B., and Turner, D.S., 2014, Ecoregions of Arizona (poster): U.S. Geological Survey Open-File Report 2014-1141, with map, scale 1:1,325,000, <https://dx.doi.org/10.3133/ofr20141141>. ISSN 2331-1258 (online)

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296.

Contributors

Wilma Renken

Approval

Kendra Moseley, 3/04/2025

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators

are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	10/22/2019
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):**

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:**
