

Ecological site R040XC309AZ

Limy Slopes, Gypsum

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 with a high amount of desert pavement on relict fan remnants. Trees are only in large washes and on 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 Limy Slopes, Gypsum, 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, 81l, 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

Limy Slopes, Gypsum, 3"-7" p.z., occurs on moderately to steeply sloping uplands. Slopes are generally greater than 8%. The calcareous, alluvial soils are deep, with a large gypsum content. The crystal gypsum content, combined with the steep slopes, make this ecological site extremely susceptible to water erosion, affecting use and management options.

Associated sites

R040XC326AZ	Desert Pavement 3"-7" p.z. uplands adjacent
R040XC317AZ	Saline Upland 3"-7" p.z. large waterways below

Similar sites

R040XC302AZ	Limy Slopes 3"-7" p.z. soils without visible gypsum crystals
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Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Larrea tridentata</i> (2) <i>Ambrosia dumosa</i>
Herbaceous	Not specified

Physiographic features

This site occurs on hillslopes and ridgetops generally associated with relict lakebed sediments.

Table 2. Representative physiographic features

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, the coldest month. 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)	260-370 days
Freeze-free period (characteristic range)	350-370 days
Precipitation total (characteristic range)	100-130 mm
Frost-free period (actual range)	250-370 days
Freeze-free period (actual range)	300-370 days

Precipitation total (actual range)	100-180 mm
Frost-free period (average)	300 days
Freeze-free period (average)	350 days
Precipitation total (average)	130 mm

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

Influencing water features

Soil features

These moderately deep to deep soils form in calcareous and gypsiferous lacustrine deposits. They are both very calcareous and have over 15% gypsum content in the soil profile. Fine gypsum masses and fine gypsum crystals occur in the subsoil. High gypsum content makes the soil extremely vulnerable to water erosion. Plant-soil moisture relationships are poor.

Table 4. Representative soil features

Parent material	(1) Lacustrine deposits
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Ecological dynamics

Limy Slopes, Gypsum, 3"-7" p.z., is an open and simple ecological site. Only one state, Shrubland, has been observed. The large gypsum content makes the site extremely vulnerable to water erosion. Any disturbance that removes the surface horizon could result in extreme erosion. Once exposed, the highly gypsiferous subsoils does not support plant growth. Areas of geological erosion are located adjacent to this ecological site (Figure 8). These barren areas are not caused by human disturbance, so are not considered to represent a separate state, and exemplify the erosive nature of these gypsic soils.

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Grass/Grasslike					
1	Perennial Grasses			0-3	
	threeawn	ARIST	<i>Aristida</i>	0-1	–
	low woollygrass	DAPU7	<i>Dasyochloa pulchella</i>	0-1	–
	bush muhly	MUPO2	<i>Muhlenbergia porteri</i>	0-1	–
	big galleta	PLRI3	<i>Pleuraphis rigida</i>	0-1	–
2	Annual Grasses			2-3	
	sixweeks threeawn	ARAD	<i>Aristida adscensionis</i>	0-1	–

	needle grama	BOAR	<i>Bouteloua aristoides</i>	0-1	–
	sixweeks grama	BOBA2	<i>Bouteloua barbata</i>	0-1	–
	slim tridens	TRMU	<i>Tridens muticus</i>	0-1	–
Forb					
3	Perennial Forbs			0-3	
	desert trumpet	ERIN4	<i>Eriogonum inflatum</i>	0-3	–
	Gordon's bladderpod	LEGO	<i>Lesquerella gordonii</i>	0-1	–
	Coulter's globemallow	SPCO2	<i>Sphaeralcea coulteri</i>	0-1	–
	desert marigold	BAMU	<i>Baileya multiradiata</i>	0-1	–
	devil's spineflower	CHRI	<i>Chorizanthe rigida</i>	0-1	–
4	Annual Forbs			10-15	
	trailing windmills	ALIN	<i>Allionia incarnata</i>	0-1	–
	cryptantha	CRYPT	<i>Cryptantha</i>	0-1	–
	flatcrown buckwheat	ERDE6	<i>Eriogonum deflexum</i>	0-1	–
	spurge	EUPHO	<i>Euphorbia</i>	0-1	–
	combseed	PECTO	<i>Pectocarya</i>	0-1	–
	desert globemallow	SPAM2	<i>Sphaeralcea ambigua</i>	0-1	–
	devil's spineflower	CHRI	<i>Chorizanthe rigida</i>	0-1	–
Shrub/Vine					
5	Shrubs and cactus			3-50	
	creosote bush	LATR2	<i>Larrea tridentata</i>	3-15	–
	yellow paloverde	PAMI5	<i>Parkinsonia microphylla</i>	0-9	–
	cholla	CYLIN2	<i>Cylindropuntia</i>	0-6	–
	brittlebush	ENFA	<i>Encelia farinosa</i>	0-6	–
	scarlet hedgehog cactus	ECCO5	<i>Echinocereus coccineus</i>	0-1	–
	beavertail pricklypear	OPBA2	<i>Opuntia basilaris</i>	0-1	–

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.

Approval

Kendra Moseley, 5/29/2025

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	09/16/2026
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. Number and extent of rills:

2. Presence of water flow patterns:

3. Number and height of erosional pedestals or terracettes:

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

5. Number of gullies and erosion associated with gullies:

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

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

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

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

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

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

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

Dominant:

Sub-dominant:

Other:

Additional:

13. Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):

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

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

16. Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:

17. Perennial plant reproductive capability:
