

# Ecological site R040XB230AZ

## Desert Pavement 7"-10" 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) 40-2, Middle Sonoran Desert, is characterized by desert scrub vegetation on relict fan remnants with a moderate amount of desert pavement. Trees are common in washes, bottoms and hillslopes. Elevations range from 1200 to 2000 feet, and precipitation averages 7 to 10 inches per year. Vegetation includes saguaro, palo verde, creosotebush, triangle bursage, brittlebush, prickly pear, cholla, desert saltbush, wolfberry bush muhly, threeawns, 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 2 - Middle Sonoran Desert Ecological Site Desert Pavement, 7"-10" 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

Desert Pavement, 7"-10" p.z., occurs on fan remnants. Terrain is flat or nearly so (less than 4% slope). Soil surface is armored with interlocking rock fragments (desert pavement), and the surface horizon contains vesicular (bubble-like) pores which limit infiltration. Vegetation is absent or nearly so. Aspect is barren land.

### Associated sites

R040XB208AZ	<b>Limy Upland, Deep 7"-10" p.z.</b> adjacent uplands, does not have heavily armored surface
R040XB229AZ	<b>Sandy Loam Drainage 7"-10" p.z.</b> small drainages braided throughout, often originating on site. Plant community benefits from rainfall runoff from Desert Pavement ecological site.
R040XB216AZ	<b>Sandy Wash 7"-10" p.z.</b> large drainages adjacent to or dissecting site

### Similar sites

R040XC326AZ	<b>Desert Pavement 3"-7" p.z.</b> Elevations 300'-1,200'; dark varnish on surface fragments and well-developed Av soil horizon
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Figure 1. Desert Pavement, 7"-10" p.z.. Sandy Loam Drainage and Sandy Wash ecological sites are visible at margins.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) <i>Forb, annual</i>

### Physiographic features

This site occurs on fan remnants. Slopes are from 0%–4%. Elevations range from 1,200 to 2,000 feet.

Table 2. Representative physiographic features

Landforms	(1) Fan remnant
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### Climatic features

Annual precipitation ranges from 7 to 10 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) in the southern part, and 60:40 in the central and northern parts. 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 most 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. 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.

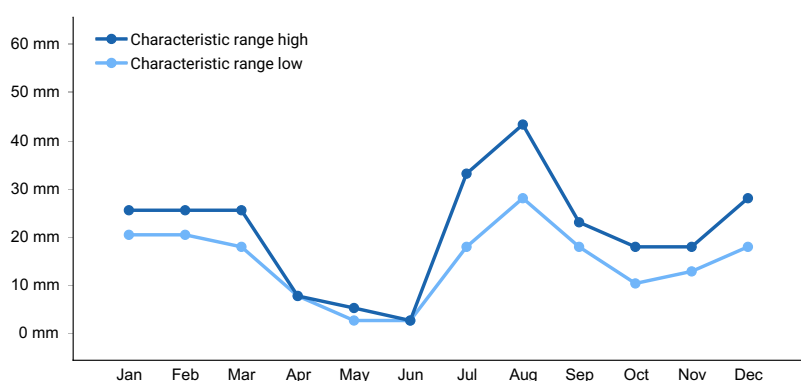
Overall, average annual rainfall is variable, but increases in variability from east to west across the region. For long-term precipitation data, the coefficient of variation, the ratio of the standard deviation to the mean expressed as a percentage, increases from 38% at Florence (east) to 46% at Aguila (west).

Winter temperatures are very mild, with very few days having short periods of freezing temperatures. Summertime temperatures are hot to very hot, with many days in June and July exceeding 105°F. The number of frost-free days ranges from 280 in major river valleys with cold air drainage to between 320 and 350 in upland areas.

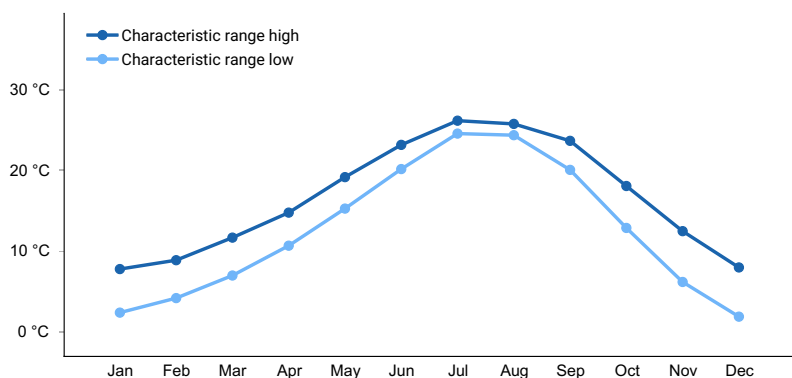
Spring and the summer growing seasons are equally important for perennial grass, forb and shrub growth. With above average precipitation, cool and warm season annual forbs and grasses can be common in their respective seasons. Perennial forage species can remain green throughout the year with sufficient available moisture.

**Table 3. Representative climatic features**

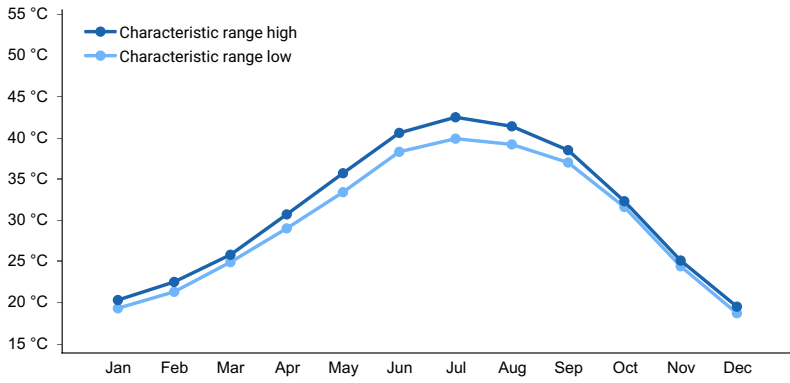
Frost-free period (characteristic range)	240-365 days
Freeze-free period (characteristic range)	344-365 days
Precipitation total (characteristic range)	178-254 mm
Frost-free period (actual range)	217-365 days
Freeze-free period (actual range)	282-365 days
Precipitation total (actual range)	178-254 mm
Frost-free period (average)	291 days
Freeze-free period (average)	344 days
Precipitation total (average)	203 mm



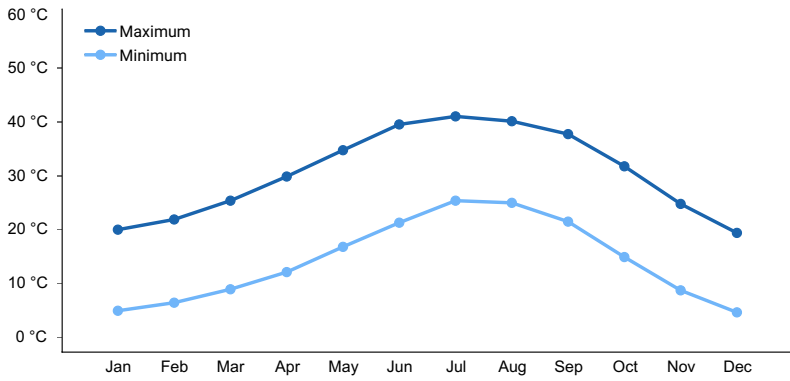
**Figure 2. Monthly precipitation range**



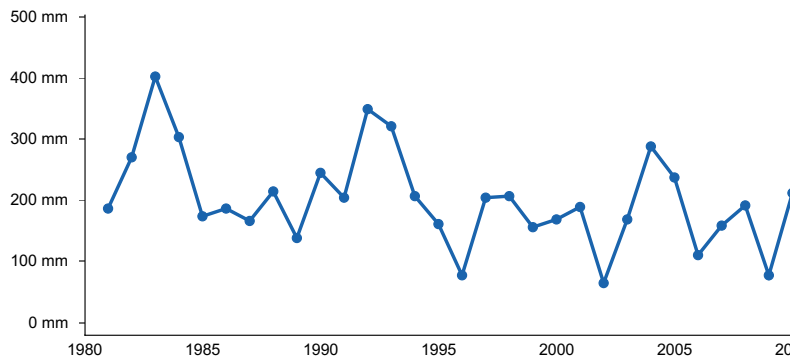
**Figure 3. Monthly minimum temperature range**



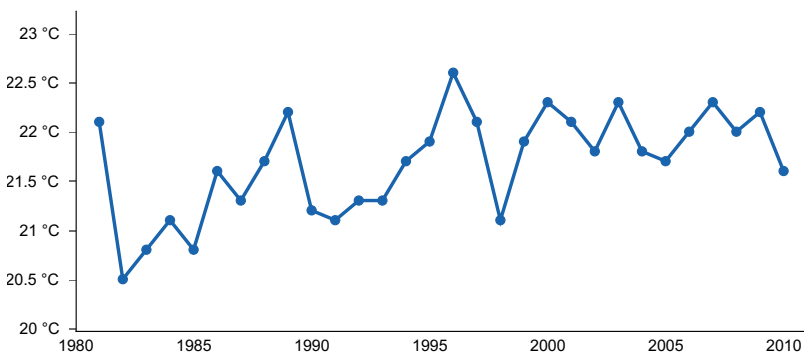
**Figure 4. Monthly maximum temperature range**



**Figure 5. Monthly average minimum and maximum temperature**



**Figure 6. Annual precipitation pattern**



**Figure 7. Annual average temperature pattern**

### Climate stations used

- (1) MARICOPA 4 N [USC00025270], Laveen, AZ
- (2) KOFA MINE [USC00024702], Wellton, AZ
- (3) ALAMO DAM [USC00020100], Salome, AZ

- (4) AJO [USC00020080], Ajo, AZ
- (5) ORGAN PIPE CACTUS NM [USC00026132], West Pima County, AZ
- (6) ARIZONA CITY [USC00020404], Arizona City, AZ

## Influencing water features

No water features are associated with this ecological site.

## Soil features

These deep soils form in very gravelly alluvium of various ages and mixed origins. Subsurface soil characteristics are variable. Plant-soil moisture relationships are poor.

**Table 4. Representative soil features**

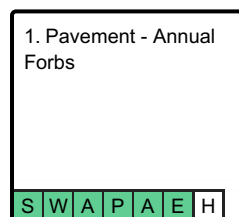
Surface texture	(1) (2)
Family particle size	(1) Loamy
Soil depth	152 cm
Surface fragment cover <=3"	97–99%
Surface fragment cover >3"	1–10%

## Ecological dynamics

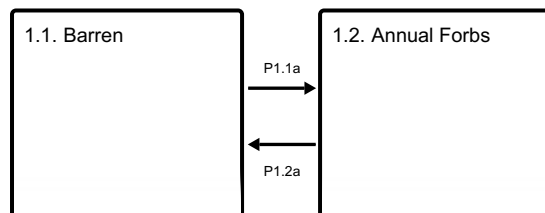
Desert Pavement, 7"-10" p.z., occurs on fan remnants. Terrain is flat to very gently sloping. Rainfall infiltration rate is very slow as the soil surface is armored with interlocking rock fragments and the surface horizon has vesicular pores. Infiltration occurs to a greater extent during low-intensity winter rainfall events as compared to more intense summer thunderstorms. Sandy Loam Drainage and Sandy Wash ecological sites benefit from additional run-on moisture from Desert Pavement sites. Annual forbs are typically absent, though they may flourish for a short time after an unusually wet winter. Aspect is barren land.

## State and transition model

### Ecosystem states



### State 1 submodel, plant communities



## State 1

### Pavement - Annual Forbs

The reference state is a barren expanse of rock-armored soil. Very few perennial plants are present except for the occasional creosote or white bursage. These isolated shrubs are inconsequential to ecological site dynamics, and likely indicate localized inclusions of the Limy Upland, Deep, ecological site.

## Community 1.1 Barren



Figure 8. interlocking rock cover



Figure 9. Spineflower stems. The two near the 85 m mark are covered with termite residue.

The site is barren. Individual spineflower stems can be encountered at almost any time of year because their woody stem persists after senescence.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Forb	–	–	112
Shrub/Vine	–	6	17
<b>Total</b>	–	<b>6</b>	<b>129</b>

Table 6. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	0-1%
Grass/grasslike basal cover	0%
Forb basal cover	0-1%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%
Surface fragments >0.25" and <=3"	97-99%

Surface fragments >3"	0-10%
Bedrock	0%
Water	0%
Bare ground	1-3%

## Community 1.2 Annual Forbs



Figure 11. Flourish of annual forbs following unusually wet winter.

Annual forbs flourish following winter precipitation, reaching maturity in the early spring. Species present and total annual production is highly variable from year to year, depending upon rainfall timing and amounts. Maximum production years occur approximately every 10 years.

### Pathway P1.1a Community 1.1 to 1.2



Barren



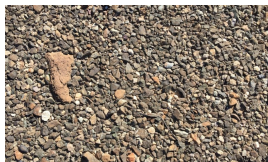
Annual Forbs

Winter precipitation.

### Pathway P1.2a Community 1.2 to 1.1



Annual Forbs



Barren

Desert climate, limited precipitation.

## Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Forb</b>					
1	<b>Annual Forbs</b>			0–112	
	Forb, annual	2FA	<i>Forb, annual</i>	0–112	–
	devil's spineflower	CHRI	<i>Chorizanthe rigida</i>	0–2	–
<b>Shrub/Vine</b>					
2	<b>Shrubs</b>			0–11	
	creosote bush	LATR2	<i>Larrea tridentata</i>	0–6	–
	burrobush	AMDU2	<i>Ambrosia dumosa</i>	0–6	–

## 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, 10/17/2024

## 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	11/22/2024
Approved by	Kendra Moseley
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):**
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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):**
- 
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):**
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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:**
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