

# MAJOR LAND RESOURCE AREA 40

## SONORAN BASIN AND RANGE

This area is almost entirely in Arizona, but it includes a very small part of California (fig. 1). It makes up about 31,765 square miles (82,310 square kilometers). The cities of Yuma, Tucson, and Phoenix are in this MLRA. Interstate 10 crosses the center of this area and turns to the southeast outside of Phoenix. Interstate 17 ends in Phoenix. Interstate 19 runs from Tucson to the Mexican border. Interstate 8 crosses the southern part of the MLRA. It ends where it intersects Interstate 10 southeast of Phoenix. Many wilderness study areas occur in this MLRA. The Tonto and Prescott National Forests and Saguaro and Organ Pipe Cactus National Monuments also occur in this MLRA. The Yuma Proving Grounds, the Barry M. Goldwater Air Force Bombing Range, and the Tohono O'odham, Colorado River, Salt River, and Gila River Indian Reservations are in the area.

### PHYSIOGRAPHY

This area is in the Sonoran Desert Section of the Basin and Range Province of the Intermontane Plateaus. Many short, fault-block mountain ranges trending southeast to northwest rise abruptly from the smooth or gently sloping desert valley floors. These include the Painted Rock, Gila Bend, Big Horn, Copper, Granite, and Santa Rosa Mountains. Elevation ranges from 980 to 3,600 feet (300 to 1,100 meters) in most of this area, but it is as high as 4,590 feet (1,400 meters) in the mountains. The Santa Cruz River flows north through Tucson from the Mexican border at Nogales, nearly reaching the Gila River south of Phoenix. The Salt River intersects the Gila River south of Phoenix. The Gila River then flows west across the southern part of the MLRA to the Colorado River.

### GEOLOGY

Most of this area is covered by deep alluvium washed in from the adjacent mountains. These deposits of silt, sand, and gravel are very young in the present-day drainageways and much older on the valley floors and terraces. This MLRA is an area of intensive volcanism. Isolated outcrops of granite are more than 1 billion years old. Most of the andesite and basalt flows are Tertiary in age, forming in the past 50 million years. Some basalts, however, formed around 4 million years ago, and another series of intrusives appeared in the late Cretaceous to early Tertiary. Some outcrops of Paleozoic sediments are associated with the uplift



Figure 1 - Map taken from Ag Handbook 296

in the vicinity of the older intrusives. Some of these sediments have been metamorphosed.

### CLIMATE

The average annual precipitation is 3 to 10 inches (75 to 255 millimeters) in most of this area. Rainfall can average 22 inches (560 millimeters) per year in the mountain ranges. Most of the rainfall occurs as high-intensity, convective thunderstorms, mainly from July to September, and as Pacific frontal storms from December to March. Snowfall is rare, except at the higher elevations. The average annual air temperature is 58 to 74 degrees F (15 to 23 degrees C). The freeze-free period averages 285 days and ranges from 205 to 365 days, decreasing in length with increasing elevation.

### ECOLOGICAL SITE KEY

The following ecological site key and LRU description allows users to ascertain ecological sites by first determining their landscape position and then soil physical and chemical characteristics. Complete Ecological Site Descriptions are available from any NRCS Field Office or online at: <https://esis.sc.egov.usda.gov>

**I. Flooded (bottom position, flooded from the valley-side or over-bank)**

**A. Soils with water table available to the plant community**

1. Soils sandy with redox features - Sandy Bottom, woodland (F040XA125AZ)
2. Soils without redox features - Loamy Bottom, woodland (F040XA124AZ)

**B. Soils without a water table available to the plant community**

1. Soils sandy - Sandy Wash (R040XA115AZ)
2. Soils fine sandy loam to clay loam - Loamy Swale (R040XA112AZ)
3. Soils clayey - Clayey Swale (R040XA102AZ)

**II. Not Flooded (upland position, receives only precipitation)**

**A. Gently sloping terrain (slopes predominantly <15%)**

1. Soils Shallow ( $\leq 20''$  depth) -
  - a) *Soils calcareous - Limy Upland (R040XA111AZ)*
  - b) *Soils non-calcareous - Shallow Upland (R040XA121AZ)*
2. Soils moderately deep to deep ( $> 20''$  depth)
  - a) *Soils calcareous in upper 10'' or throughout*
    - (1) Soils gypsic - Gypsum Upland (R040XA126AZ)
    - (2) Soils not gypsic
      - (a) Soils with argillic horizon (or clay cambic) - Loamy Upland, Limy (R040XA130AZ)
      - (b) Soils skeletal ( $\geq 35\%$  gravels) - Limy Upland, Deep (R040XA106AZ)
      - (c) Soils not skeletal ( $< 35\%$  gravels) and without argillic - Limy Fan (R040XA108AZ)
  - b) *Soils non-calcareous in upper 10 inches*
    - (1) Soils without an argillic horizon
      - (a) Soils sandy and eolian in origin - Sandy Upland (R040XA116AZ)
      - (b) Soils loamy fine sand to sandy loam - Sandy Loam Upland, Deep (R040XA117AZ)
    - (2) Soils with an argillic (or clay cambic) horizon
      - (a) Soils with sandy loam surface 4 in. or thicker - Sandy Loam Upland (R040XA118AZ)
      - (b) Soils with sandy loam surface  $< 4$  in. or loam surface - Loamy Upland (R040XA114AZ)
      - (c) Soils with a subsurface calcareous influence - Loamy Upland, Limy (R040XA130AZ)
      - (d) Soils with a clayey surface - Clay Loam Upland (R040XA120AZ)
      - (e) Soils with a clayey surface, vertic - Clayey Upland (R040XA104AZ)

**B. Steeply sloping terrain (slopes predominantly  $\geq 15\%$ )**

1. Soils shallow ( $\leq 20''$  depth)
  - a) *Soils calcareous throughout*
    - (1) Soils over limestone parent materials - Limestone Hills (R040XA107AZ)
    - (2) Soils over fanglomerate and conglomerate - Conglomerate Hills (R040XA128AZ)
    - (3) Soils over Basalt parent materials - Basalt Hills (R040XA101AZ)
    - (4) Soils over volcanic rock, breccia and agglomerates - Limy Hills (R040XA129AZ)
  - b) *Soils non calcareous in upper 10 inches*
    - (1) Soils over granite, gneiss, schist, rhyolite - Shallow Hills (R040XA105AZ)
    - (2) Soils over andesite, dacite, basalt and welded tuff - Volcanic Hills (R040XA123AZ)
    - (3) Soils over schist - Schist Hills (R040XA119AZ)
2. Soils moderately deep and deep ( $> 20''$  depth)
  - a) *Soils calcareous throughout*
    - (1) Soils gypsic - Gypsum Slopes (R040XA127AZ)
    - (2) Soils not gypsic - Limy Slopes (R040XA110AZ)
  - b) *Soils non calcareous in the upper 10 inches*
    - (1) Soils sandy loam to clay loam - Loamy Slopes (R040XA113AZ)
    - (2) Soils clay loam to clay - Clayey Slopes (R040XA103AZ)

**I. Flooded (bottom position, flooded from the valley-side or over-bank)****A. Soils with water table available to plant community**

1. Soils sandy with redox features - Sandy Bottom, woodland (F040XB215AZ)
2. Soils loamy without redox features - Loamy Bottom, woodland (F040XB214AZ)

**B. Soils without a water table available to plant community**

1. Moderately to strongly saline soils ( $EC \geq 8$  dS/m) - Saline Bottom (R040XB227AZ)
2. Non-saline to slightly saline soils ( $EC < 8$  dS/m)
  - a) Soils sandy - Sandy Wash (R040XB216AZ)
  - b) Soils fine sandy loam to clay loam - Loamy Swale (R040XB211AZ)
  - c) Soils clayey - Clayey Swale (R040XB203AZ)
  - d) Soils sandy loam to loam within small drainages - Sandy Loam Swale (R040XB2unassigned)

**II. Not Flooded (upland position, receives only precipitation)****A. Gently sloping terrain (slopes predominantly  $< 15\%$ )**

1. Soil surface desert pavement, vegetation largely absent - Desert Pavement (R040XB2unassigned)
2. Soil surface without desert pavement, vegetation present
  - a) Soils shallow ( $\leq 20$ " depth)
    - (1) Soils calcareous - Limy Upland (R040XB210AZ)
    - (2) Soils non-calcareous - Shallow Upland (R040XB220AZ)
  - b) Soils moderately deep to deep ( $> 20$ " depth)
    - (1) Moderately saline to strongly saline soils ( $EC \geq 8$  dS/m)
      - (a) Soils sandy, eolian in origin - Sandy Upland, Saline (R040XB224AZ)
      - (b) Soils sandy loam - Sandy Loam Upland, Saline (R040XB226AZ)
      - (c) Soils loam to clay loam - Loamy Upland, Saline (R040XB225AZ)
      - (d) Soils clayey - Clayey Upland, Saline (R040XB223AZ)
    - (2) Non-saline to slightly saline soils ( $EC \leq 8$  dS/m)
      - (a) Soils calcareous throughout
        - (i) Soils skeletal ( $\geq 35\%$  gravels) - Limy Upland, Deep (R040XB208AZ)
        - (ii) Soils not skeletal ( $< 35\%$  gravels) - Limy Fan (R040XB207AZ)
      - (b) Soils non calcareous in surface horizon
        - (i) Soils with an argillic (or clay cambic) horizon
          - (a) Soils with sandy loam surface 4 in. or thicker - Sandy Loam Upland (R040XB218AZ)
          - (b) Soils with sandy loam surface  $< 4$  in. or loam surface - Loamy Upland (R040XB213AZ)
          - (c) Soils with clay loam surface (not vertic) - Clay Loam Upland (R040XB205AZ)
          - (d) Soils with a clayey surface (vertic) - Clayey Upland (R040XB204AZ)
        - (ii) Soils without an argillic horizon
          - (a) Soils sandy and eolian in origin - Sandy Upland (R040XB217AZ)
          - (b) Soils loamy fine sand to sandy loam - Sandy Loam, Deep (R040XB221AZ)

**B. Steeply sloping terrain (slopes predominantly  $\geq 15\%$ )**

1. Soils shallow ( $\leq 20$ " depth)
  - a) Soils calcareous throughout
    - (1) Surface fragments heavily coated with desert varnish - Basalt Hills (R040XB201AZ)
    - (2) Surface fragments not coated with desert varnish
      - (a) Parent material with paralithic contact (weathered, able to hand-dig) - Paralithic Hills (R040XB202AZ)
      - (b) Parent material with lithic contact (indurated, unable to hand-dig) - Lithic Hills (R040XB2unassignedAZ)
  - b) Soils non-calcareous in upper 10 inches
    - (1) Parent material with para-lithic contact (weathered, able to hand-dig) - Shallow Hills (R040XB206AZ)
    - (2) Soil/parent material with lithic contact (indurated, unable to hand-dig) - Volcanic Hills (R040XB222AZ)
2. Soils moderately deep and deep ( $> 20$ " depth)
  - a) Soils eolian - Sandy Slopes, Dunes (R040XB232AZ)
  - b) Soils alluvial, fluvial, or other
    - (1) Soils calcareous throughout - Limy Slopes (R040XB209AZ)
    - (2) Soils non calcareous in the upper 10 inches - Loamy Slopes (R040XB212AZ)

**I. Flooded (bottom position, flooded from the valley-side or over-bank)****A. Soils with water table available to plant community**

1. Moderately to strongly saline soils ( $EC \geq 8$  dS/m) - Saline Bottom (R040XC315AZ)
2. Slightly saline to non-saline soils ( $EC < 8$  dS/m)
  - a) Soils with redox features, perennial water table apparent - Sandy Bottom, woodland (F040XC327AZ)
  - b) Soils loamy, without redox features - Loamy Bottom, woodland (F040XC328AZ)

**B. Soils without water table available to plant community**

1. Moderately saline to strongly saline soils ( $EC \geq 8$  dS/m) - Saline Swale (R040XC314AZ)
2. Non-saline to slightly saline soils ( $EC < 8$  dS/m)
  - a) Soils sandy - Sandy Wash (R040XC318AZ)
  - b) Soils fine sandy loam to clay loam - Loamy Swale (R040XC312AZ)
  - c) Soils clayey - Clayey Swale (R040XC303AZ)
  - d) Soils sandy loam to loam, small drainages - Sandy Loam Swale (R040XC3unassigned)

**II. Not Flooded (upland position, receives only precipitation)****A. Gently sloping terrain (slopes predominantly  $< 15\%$ )**

1. Soil surface desert pavement, vegetation largely absent - Desert Pavement (R040XC3unassigned)
2. Soil surface without desert pavement, vegetation present
  - a) Soils shallow ( $\leq 20$ " depth)
    - (1) Soils calcareous - Limy Upland (R040XC310AZ)
    - (2) Soils non-calcareous - Shallow Upland (R040XC322AZ)
  - b) Soils moderately deep to deep ( $> 20$ " depth)
    - (1) Soils moderately saline to strongly saline ( $EC > 8$  dS/m) - Saline Upland (R040XC317AZ)
    - (2) Soils non-saline to slightly saline ( $EC < 8$  dS/m)
      - (a) Soils calcareous in upper 6 inches
        - (i) Soils skeletal ( $> 35\%$  gravels) - Limy Upland, Deep (R040XC311AZ)
        - (ii) Soils not skeletal ( $\leq 35\%$  gravels)
          - (a) Soils sandy (eolian) - Limy Fan, Sandy (R040XC307AZ)
          - (b) Soils sandy loam to loam - Limy Fan (R040XC306AZ)
      - (b) Soils non-calcareous in upper 6"
        - (i) Soils with an argillic (or clay cambic) horizon
          - (a) Soils with sandy loam surface  $\geq 4$ " - Sandy Loam Upland (R040XC320AZ)
          - (b) Soils with sandy loam surface  $< 4$ " or loam surface - Loamy Upland (R040XC313AZ)
        - (ii) Soils without an argillic horizon
          - (a) Soils sandy and eolian in origin - Sandy Upland (R040XC319AZ)
          - (b) Soils loamy fine sand to sandy loam - Sandy Loam, Deep (R040XCunassignedAZ)

**B. Steeply sloping terrain (slopes predominantly  $\geq 15\%$ ) (FIELD TEST CONCEPTS)**

1. Soils shallow ( $\leq 20$ " depth)
  - a) Soils over fanglomerate and conglomerate - Limy Hills (R040XC308AZ)
  - b) Soils over basalt - Basalt Hills (R040XC301AZ)
  - c) Soils over schist - Schist Hills (R040XC321AZ)
  - d) Soils over granite and rhyolite - Granitic Hills (R040XC305AZ)
  - e) Soils over andesite, dacite, other volcanics - Volcanic Hills (R040XC324AZ)
2. Soils moderately deep and deep ( $> 20$ " depth) -
  - a) Soils eolian - Sandy Slopes, Dunes (R040XC329AZ)
  - b) Soils alluvial, fluvial, or other- Breaks (R040XC302AZ)

## Major Land Resource Area 40 - Land Resource Units (MLRA 40 - LRUs)

**Table 1. Precipitation and Elevation Ranges**

LRU Name	Precip Zone (in)	Elevation Range (ft)	
		Lower Limit	Upper Limit
40-3 Colorado (Lower) Sonoran	3-7	300	1,200
40-2 Middle Sonoran Desert	7-10	1,200	2,000
40-1 Upper Sonoran Desert	10-13	2,000	3,800

**Table 2. Soil Temperature and Moisture Class**

LRU	Temperature	Moisture
40-3	Hyperthermic	Typic Aridic
40-2	Hyperthermic	Typic Aridic
40-1	Thermic	Typic Aridic

**Table 3. LRU Transition Descriptions**

40-3 to 40-2	Scattered shrubs move into desert pavement areas; half shrubs present outside shrub canopies; trees appear in smaller washes and drainageways.
40-2 to 40-1	Trees move out of bottoms onto deep upland sites; desert pavement largely absent. Buckthorn and teddybear cholla yeild to jumping and staghorn chollas, ironwood yields to little leaf palo verde, white bursage yields to triangle leaf bursage
40-1 to 38-1	Transition occurs with increasing elevation and northward progression. Grass and shrub cover increases. Saguaros drop out. Canotia, beargrass, and desert ceanothus appear.
40-1 to 41-3	Transition occurs with increasing elevation and eastward progression. Grass cover increases. Saguaros drop out. Shrub and succulent diversity decreases.

**Table 4. Landscape View of Uplands**

40-3	desert scrub with high % desert pavement areas, trees confined to large watercourses, bottoms and hillsites
40-2	desert scrub with moderate % desert pavement areas; trees common to all sized washes, bottoms and hills
40-1	desert scrub with no desert pavement, trees not confined to watercourses or hills

**Table 5. Commonly occurring upland vegetation**

LRU	Name	Common upland species		
		Perennial grasses	Shrubs	Trees
40-3	Colorado (Lower) Sonoran Desert	big galleta	white bursage, burrobrush, brittlebush, creosotebush and desert saltbush	none
40-2	Middle Sonoran Desert	big galleta, bush muhly and three-awn (significant amounts of perennial grass occur on bottom and non-calcareous sites)	white bursage, creosotebush, desert saltbush, white ratany, wolfberry, buckhorn cholla, teddybear cholla	ironwood, littleleaf palo verde - confined to water courses
40-1	Upper Sonoran Desert	bush muhly, threeawns, dropseeds, Rothrock grama, slim tridens, black grama	triangle-leaf bursage, creosotebush, whitethorn acacia, jojoba, desert zinnia, false mesquite, prickly pear, jumping cholla and staghorn cholla	littleleaf palo verde, mesquite - not restricted to water courses

**Table 6. Unique Species and Saguaro occurrence**

LRU	Name	Unique* Plants	Saguaro (indicator of MLRA)
40-3	Colorado (Lower) Sonoran Desert	smoketree, elephant tree, bitter condalia, hollyleaf saltbush, white dalea, silver cholla, diamond cholla, fagonia, sand food	generally confined to hillslopes; this LRU defines the lower elevation and rainfall range for saguaro
40-2	Middle Sonoran Desert	two-flower trichloris, organpipe cactus, holocantha, jumping bean, thinleaf fourwing saltbush, torrey wolfberry, alkalai goldenweed, desert stipa	scattered on uplands; common on hillslopes
40-1	Upper Sonoran Desert	red grama, Pima pappusgrass, pencil cholla, limberbush, yerbe-de-venado	common throughout LRU; this LRU provides optimum growing conditions for saguaro and reaches the high rainfall and elevation range for saguaro

\*Unique plants are generally confined within the LRU. However, there are several instances of them growing in an adjacent LRU; therefore, these species are not LRU indicators.