

KEY TO ECOLOGICAL SITES, MAJOR LAND RESOURCE AREA 41, SOUTHEASTERN ARIZONA BASIN AND RANGE

This area (shown in fig. 1) is in Arizona (89 percent) and New Mexico (11 percent). It makes up about 15,730 square miles (40,765 square kilometers). An ecological site is a distinctive kind of land with specific soil and physical characteristics that differ from other kinds of land in its ability to produce a distinctive kind and amount of vegetation and its ability to respond similarly to management actions and natural disturbances.

PHYSIOGRAPHY

Most of MLRA 41 is in the Mexican Highland Section of the Basin and Range Province of the Intermontane Plateaus. The eastern one-fifth of the area is in the Sonoran Desert Section of that same province and division. This MLRA has mountain ranges that trend southeast to northwest and has relatively smooth valleys between the mountains. The southeast boundary of the part of this MLRA in New Mexico is the Continental Divide. The Gila River runs through the northern end of this area. The San Francisco, San Simon, and San Pedro Rivers are tributaries to the Gila River in this MLRA.

GEOLOGY

Most of MLRA 41 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 in the vicinity of the older intrusives. Some of these sediments have been metamorphosed.

CLIMATE

The average annual precipitation is 9 to 20 inches (230 to 510 millimeters) in most of this area, but it is as much as 45 inches (1,145 millimeters) at the higher elevations. More than half of the precipitation occurs as high-intensity, convective thunderstorms during July, August, and September. Because of Pacific frontal storms, a second rainy season occurs from December to March. Snow falls occasionally in winter. The average annual air temperature is 47 to 68 degrees F (8 to 20 degrees C). The freeze-free period averages 245 days and ranges from 160 to 335 days, decreasing in length with elevation.

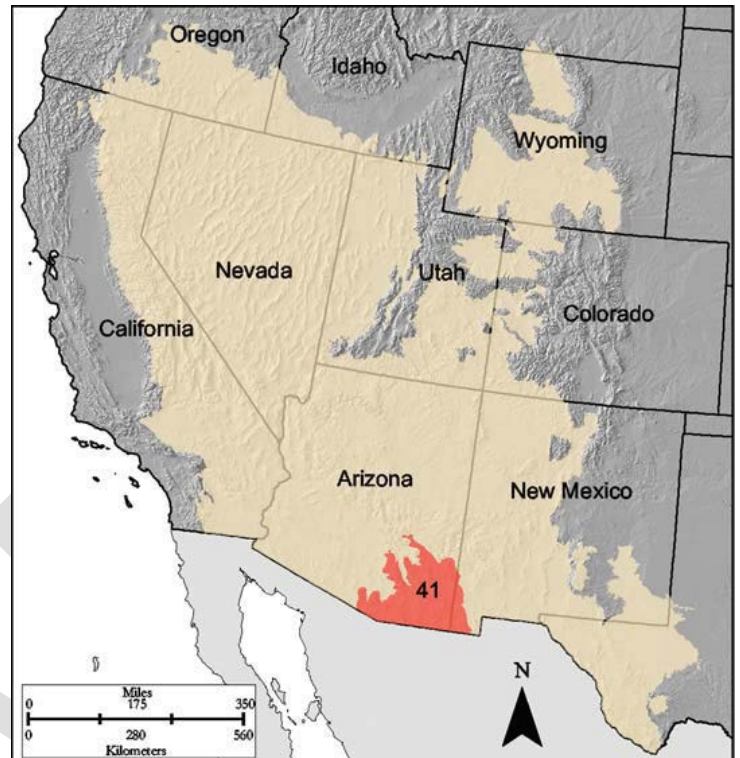


Figure 1 – map taken from Ag Handbook 296

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 on from any NRCS Field Office or from:
<https://esis.sc.egov.usda.gov/>

Ecological Site naming convention has two parts. The first part of each name refers to soil texture or chemistry; the second refers to landscape position. The second parts are thus:

- * Woodland = reference plant community tree dominated
- * Bottom = flooded, yearlong or seasonal water table
- * Swale = flooded, no water table, ephemeral slow-moving aboveground water
- * Wash = flooded, no water table, ephemeral fast-moving aboveground water
- * Upland = not flooded, slopes <8%
- * Slopes = not flooded, slopes \geq 8%, soils moderately deep to deep
- * Hills = non-flooded position, slopes >8%, soils very shallow to shallow

Major Land Resource Area 41 - Land Resource Units (MLRA 41 - LRUs)

Table 1. LRU Name, Precipitation and Elevation Ranges, Soil Temperature and Moisture Classes

LRU Name	Precip Zone (in)	Elevation Range (ft)		Soil Classification	
		Lower Limit	Upper Limit	Temp	Moisture
41-2 Chihuahuan Desert Shrub	8-12	2,600	4,000	Thermic	Typic Aridic
41-3 Southern Arizona Semidesert Grassland	12-16	3,200	5,000	Thermic	Ustic Aridic
41-1 Madrean Oak Savanna	16-20	4,500	6,500	Thermic	Aridic Ustic
41-4 Madrean Oak-Pine Woodland	20-23	6,000	8,500	Mesic	Typic Ustic
41-5 Madrean Mixed Conifer Forest	23-30	8,500	10,700	Frigid	Typic Ustic

Table 3. LRU Transition Descriptions

41-2 to 41-3	On sandy loam and loamy uplands, shrub density decreases while potential grass productivity increases; tobosa and bush muhly dominance of grass community subsides. In bottom sites, trees increasing are netleaf hackberry, western soapberry and black walnut
41-3 to 41-1	Open grassland view becomes interrupted by isolated trees, grassland communities become dominated by blue and side-oats grama and plains lovegrass; yerbe-de-pasmo and wooly groundsel replace snakeweed and burroweed. Hill sites become scattered with Arizona white oak, Emory oak and Mexican blue oak.
41-1 to 41-4	Oak savanna turns into woodland; alligator juniper, Mexican pinyon and silverleaf oak make their appearance.
41-4 to 41-5	Tree canopies close from 20% to 50% with increasing elevation; douglas fir makes appearance; conifers become dominant.

Table 4. Landscape View of Uplands

41-2 desert shrub-grassland – mixture of shrubs, perennial grasses and forbs
41-3 open grassland
41-1 savanna
41-4 evergreen woodland
41-5 conifer forest

Table 5. Commonly occurring upland vegetation and some unique plant species

Common upland species				
LRU	Perennial grasses	Shrubs	Trees	Unique* Plants
41-2	three-awns, tobosa, dropseeds, black grama, bush muhly, burrograss, alkalai sacaton	creosotebush whitethorn acacia, burroweed, snakeweed, soaptree yucca, catclaw acacia, fourwing saltbush, cane cholla, prickly pear, tarbush, mariola.	mesquite	mound saltbush, shadscale, rayless goldenhead, dog-turd cholla, koberlinia, jimmyweed
41-3	gramas, tobosa, tanglehead, big sacaton, Arizona cottontop, curly mesquite, cane beardgrass, threeawns, dropseeds	burroweed, snakeweed, false mequite, range ratany, shrubby buckwheat, creosotebush, soaptree yucca, ocotillo, desert spoon, prickly pear	mesquite	sandpaper bush, knife-leaf condalia, kidneywood, littleleaf sumac, New Mexico feathergrass, amole (tarbush and mariola on limy and gypsum sites)
41-1	gramas, plains lovegrass, bullgrass, crinkleawn, cane beardgrass, texas bluestem, green sprangletop, deer grass, wolftail	sacahuista, shrubby buckwheat, wait-a-bit, velvet pod mimosa, false mesquite, yerbe-de-pasmo, wooly groundsel, rabbitbrush	Arizona white oak, Emory oak, one-seed juniper, mesquite	wooly bunchgrass, pinyon ricegrass, bamboo muhly, Mexican blue oak, Mexican gamagrass, Arizona rosewood, sandpaper oak, Mearn's sumac, cliffrose, canyon grape
41-4	Texas bluestem, bullgrass, beggartick threeawn, plains lovegrass, prairie junegrass, sideoats grama, pinyon ricegrass	manzanita, sacahuista, Wright's silktassel, California bristlebush, shrubby buckwheat, skunkbush sumac, Schott yucca, cliff fenderbush	Arizona white oak, Emory oak, silverleaf oak, alligator juniper,	Arizona madrone, Bigelow bush (Carphochaete), sweet tanglehead, Palmer oak,
41-5	Texas bluestem, bullgrass, beggartick threeawn, plains lovegrass, prairie junegrass, sideoats grama, pinyon ricegrass	manzanita, sacahuista, Wright's silktassel, California bristlebush, shrubby buckwheat, skunkbush sumac, Schott yucca, cliff fenderbush	Apache pine, Chihuahan pine, Mexican pinyon, birchleaf mountain mahogany, ponderosa pine, Mexican white pine; Apache pine and Chihuahuan pine come in at highest elevations	wavyleaf oak, Toumey oak, Douglas fir

***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.**

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

- A. Soils with a water table available to plant community
 - 1. Soils with a perennial high water-table (3-15 ft.)
 - a) *Soils sandy and with redox features – Sandy Bottom, woodland (F041XA113AZ)*
 - b) *Soils loamy to clayey with redox features - Loamy Bottom Cienega (R041XA119AZ)*
 - 2. Soils with seasonal (summer) water table (3-15 ft.) – Loamy Bottom (R041XA114AZ)
- B. Soils without a water table available to plant community
 - 1. Soils sandy - Sandy Wash, woodland (F041XA112AZ)
 - 2. Soils sandy loam to clay loam - Loamy Swale (R041XA115AZ)

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

- A. Gently sloping terrain (slopes predominantly <8%)
 - 1. Soils Shallow (≤ 20 " depth)
 - a) *Soils calcareous - Limy Upland (R041XA105AZ)*
 - b) *Soils non-calcareous - Shallow Upland (R041XA117AZ)*
 - 2. Soils moderately deep to deep (> 20 " depth)
 - a) *Soils calcareous - Loamy Upland, Limy (R041XA116AZ)*
 - b) *Soils non-calcareous in upper 10 inches*
 - (1) Soils without an argillic horizon - Deep Sandy Loam Upland (R041XA127AZ)
 - (2) Soils with an argillic horizon
 - (a) Soils with sandy loam surface 4 in. or thicker - Sandy Loam Upland (R041XA110AZ)
 - (b) Soils with sandy loam surface < 4 in. or loam surface - Loamy Upland (R041XA108AZ)
 - (c) Soils with clay loam surface (not vertic) - Clay Loam Upland (R041XA109AZ)
 - (d) Soils with a clayey surface (vertic) - Clayey Upland (R041XA126AZ)
- B. Steeply sloping terrain (slopes predominantly $\geq 8\%$)
 - 1. Soils shallow (≤ 20 " depth)
 - a) *Soils calcareous - Limestone Hills (R041XA103AZ)*
 - b) *Soils non-calcareous*
 - (1) Soils over granite, schist, gneiss, rhyolite (acid igneous) - Shallow Hills (R041XA102AZ)
 - (2) Soils over basalt, andesite, welded tuff (basic igneous) - Volcanic Hills (R041XA111AZ)
 - 2. Soils moderately deep and deep (> 20 " depth)
 - a) *Soils calcareous throughout - Limy Slopes (R041XA104AZ)*
 - b) *Soils non calcareous in the upper 10 inches*
 - (1) Surface & subsurf.soils are loamy (course textured) - Loamy Slopes (R041XA107AZ)
 - (2) Surface loamy or clayey, clayey subsurface (fine particle size) - Clayey Slopes (R041XA118AZ)

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

- A. Soils with a water table available to plant community
 - 1. Non-saline to slightly saline soils ($EC_e < 8$ ds/m)
 - a) Soils with a perennial high water-table (3-15 ft.) - Sandy Bottom, woodland (F041XB218AZ)
 - b) Soils with water table at 20 to 50 ft. – Loamy Bottom, woodland (F041XB221AZ)
 - 2. Moderately to strongly saline soils ($EC_e \geq 8$ ds/m)
 - a) Soils coarse textured stream alluvium - Saline Bottom, woodland (F041XB222AZ)
 - b) Soils fine textured (clayey) - Saline Bottom (R041XB211AZ)
- B. Soils without a water table available to the plant community
 - 1. Soils sandy - Sandy Wash (R041XB213AZ)
 - 2. Soils loamy to clayey - Loamy Swale (R041XB209AZ)
 - 3. Soils clayey (vertic) - Clayey Swale (R041XB202AZ)

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

- A. Gently sloping terrain (slopes predominantly $< 8\%$)
 - 1. Moderately to strongly saline soils ($EC_e \geq 8$ ds/m) - Saline Upland (R041XB212AZ)
 - 2. Slightly to non-saline soils ($EC_e < 8$ ds/m)
 - a) Soils calcareous throughout
 - (1) Soils gypsic - Gypsum Upland (R041XB219AZ)
 - (2) Soils not gypsic
 - (a) Soils shallow (less than 20 inches deep) or skeletal - Limy Upland (R041XB208AZ)
 - (b) Soils moderately deep to deep (> 20 inches), not skeletal - Limy Fan (R041XB206AZ)
 - b) Soils non calcareous in upper 10 inches, moderately deep to deep (> 20 inches)
 - (1) Soils with an argillic horizon
 - (a) Soils with sandy loam surface > 4 in. - Sandy Loam Upland (R041XB215AZ)
 - (b) Soils with sandy loam surface < 4 in. OR loam surface - Loamy Upland (R041XB210AZ)
 - (c) Soils with a clay loam surface (not vertic) – Clay Loam Upland (R041XB204AZ)
 - (d) Soils with a clayey surface (vertic) - Clayey Upland (R041XB203AZ)
 - (2) Soils without an argillic horizon
 - (a) Soils sandy and eolian in origin - Sandy Upland (R041XB214AZ)
 - (b) Soils loamy fine sand to sandy loam - Deep Sandy Loam Upland (R041XB230AZ)
- B. Steeply sloping terrain (slopes predominantly $\geq 8\%$)
 - 1. Soils shallow (≤ 20 " depth)
 - a) Soils calcareous throughout
 - (1) Soils over limestone and marl parent materials - Limestone Hills (R041XB220AZ)
 - (2) Soils over sandstone and mudstone - Sandstone / Mudstone Hills (R041XB225AZ)
 - (3) Soils over basalt - Basalt Hills (R041XB223AZ)
 - b) Soils non calcareous in upper 10 inches
 - (1) Soils over granite, schist, gneiss, rhyolite (acid igneous) - Shallow Hills (R041XB205AZ)
 - (2) Soils over basalt, andesite, welded tuff (basic igneous) - Volcanic Hills (R041XB2unassigned)
 - 2. Soils moderately deep and deep (> 20 inches)
 - a) Soils calcareous throughout -
 - (1) Soils gypsic - Gypsic Breaks (R041XB201AZ)
 - (2) Soils not gypsic - Limy Slopes (R041XB207AZ)
 - b) Soils non-calcareous in the upper 10 inches -
 - (1) Surface&sub-surf. loamy (course textured) - Loamy Slopes (R041XB217AZ)
 - (2) Surface loamy or clayey, sub-surface clayey (fine textured) - Clayey Slopes (R041XB216AZ)

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 ($EC_e \geq 8$ ds/m) - Saline Bottom (R041XC315AZ)
 - 2. Slightly to non-saline soils ($EC_e < 8$ ds/m)
 - a) *Soils with redox features*
 - (1) Soils sandy - Sandy Bottom, woodland (R041XC317AZ)
 - (2) Soils loamy to clayey – Loamy Bottom, cienega (R041XC327AZ)
 - b) *Soils without redox features*
 - (1) Seasonal (summer) water table (3-15 ft.) - Loamy Bottom (R041XC312AZ)
 - (2) Deep water table (>50 ft. depth) - Loamy Bottom, woodland (R041XC310AZ)
- B. Soils without a water table available to the plant community
 - 1. Soils sandy - Sandy Wash (R041XC316AZ)
 - 2. Soils sandy loam to clay loam - Loamy Swale (R041XC311AZ)
 - 3. Soils clayey (vertic) - Clayey Swale (R041XC302AZ)

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

- A. Gently sloping terrain (slopes predominantly <8%)
 - 1. Soils shallow (≤ 20 " depth)
 - a) *Soils calcareous throughout-*
 - (1) Soils gypsic – Limy Upland, Gypsum (R041XC334AZ)
 - (2) Soils not gypsic - Limy Upland (R041XC309AZ)
 - b) *Soils non-calcareous- Shallow Upland (R041XC322AZ)*
 - 2. Soils moderately deep to deep (>20" depth)
 - a) *Moderately to strongly saline soils ($EC_e \geq 8$ ds/m)*
 - (1) Soils sandy and eolian (windblown) in origin - Sandy Upland (R041XC326AZ)
 - (2) Soils sandy loam to clay loam - Saline Upland (R041XC328AZ)
 - b) *Soils non-saline to slightly saline ($EC_e < 8$ ds/m)*
 - (1) Soils calcareous throughout
 - (a) Soils gypsic – Limy Fan, Gypsum (R041XC332AZ)
 - (b) Soils not gypsic
 - (i) *Soils skeletal - Limy Upland, Deep (R041XC331AZ)*
 - (ii) *Soils not skeletal*
 - (a) Soils with an argillic horizon - Loamy Upland, Limy (R041XC324AZ)
 - (b) Soils without an argillic horizon - Limy Fan (R041XC320AZ)
 - (2) Soils non calcareous in upper 10 inches
 - (a) Soils with an argillic horizon
 - (i) *Soils with sandy loam surface ≥ 4 " - Sandy Loam Upland (R041XC319AZ)*
 - (ii) *Soils with loam surface or sandy loam surface <4" - Loamy Upland (R041XC313AZ)*
 - (iii) *Soils with a clay loam surface (not vertic) - Clay Loam Upland (R041XC305AZ)*
 - (iv) *Soils with a clayey surface (vertic) - Clayey Upland (R041XC304AZ)*
 - (b) Soils without an argillic horizon
 - (i) *Soils sandy and eolian in origin - Sandy Upland (R041XC325AZ)*
 - (ii) *Soils loamy fine sand to sandy loam - Sandy Loam Upland, Deep (R041XC318AZ)*
 - B. Steeply sloping terrain (slopes predominantly $\geq 8\%$)
 - 1. Soils very shallow to shallow (≤ 20 " depth)
 - a) *Soils very shallow over welded tuff (<10" depth) - Tuff Hills (R041XC329AZ)*
 - b) *Soils shallow (10-20" depth)*
 - (1) Soils calcareous throughout - Limestone Hills (R041XC307AZ)
 - (2) Soils non-calcareous in upper 10 inches
 - (a) Soils over granite, schist, gneiss, rhyolite (acid igneous) - Shallow Hills (R041XC306AZ)
 - (b) Soils over basalt, andesite, welded tuff (basic igneous)
 - (i) *Soils loamy - Volcanic Hills, Loamy (R041XC323AZ)*
 - (ii) *Soils clayey - Volcanic Hills, Clayey (R041XC330AZ)*
 - 2. Soils moderately deep and deep (>20" depth)
 - a) *Soils calcareous throughout*
 - (1) Soils gypsic – Limy Slopes, Gypsum (R041XC333AZ)
 - (2) Soils not gypsic - Limy Slopes (R041XC308AZ)
 - b) *Soils non calcareous in the upper 10 inches*
 - (1) Surface & sub-surface loamy (course textured) - Loamy Slopes (R041XC314AZ)
 - (2) Surface loamy or clayey, subsurface clayey (fine textured) - Clayey Slopes (R041XC303AZ)

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

- A. Soils with a perennial high water-table (3-15 ft.) - Sandy Bottom, woodland (F041XD425AZ)
- B. Soils without a high water table (3-15 ft) - Sandy Bottom (R041XD4unassigned)

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

A. Slopes less than 8%

1. Soils moderately deep and deep (>20 inches)

- a) *Soils with sandy loam surface 4 in. or thicker - Sandy Loam Upland, woodland (F041XD422AZ)*
- b) *Soils with sandy loam surface < 4 in., or loam or clay loam surface - Loamy Upland, woodland (R041XD4unassigned)*

B. Slopes greater than 8%

1. Soils shallow (less than 20 inches deep)

- a) *Soils calcareous throughout - Limestone Hills, woodland (F041XD421AZ)*
- b) *Soils non calcareous*
 - (1) *Soils over granite, schist, gneiss, rhyolite (acid igneous) - Shallow Hills, woodland (F041XD420AZ)*
 - (2) *Soils over basalt, andesite, welded tuff (basic igneous) - Volcanic Hills, woodland (F041XD423AZ)*

2. Soils moderately deep and deep (>20 inches)

- a) *Soils calcareous throughout - Limy Slopes, QUERCUS, COME (R041XD4unassigned)*
- b) *Soils non calcareous upper 10 inches - Loamy Hills (QUAR, QUEM) (F041XD424AZ)*

I. Mountains, QUHY, QUAR (F041XE530AZ)

II. Mountains, PIPO (F041XE528AZ)

III. Mountains, PSME, PIPO (F041XE529AZ)

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