

Ecological site R040XA123AZ Volcanic Hills 10"-13" P.Z.

Accessed: 05/12/2025

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.



Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

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

AZ 40.1 – Upper Sonoran Desert

Elevations range from 2000 to 3200 feet and precipitation averages 10 to 13 inches per year. Vegetation includes saguaro, palo verde, mesquite, creosotebush, triangle bursage, prickly pear, cholla, limberbush, wolfberry, bush muhly, threeawns, ocotillo, and globe mallow. The soil temperature regime is thermic and the soil moisture regime is typic aridic. 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 sediments filling the basins represent combinations of fluvial, lacustrine, colluvial and alluvial deposits.

Associated sites

R040XA101AZ	Basalt Hills 10"-13" p.z.
R040XA103AZ	Clayey Slopes 10"-13" p.z.
R040XA105AZ	Shallow Hills 10"-13" p.z.

Similar sites

R040XB222AZ	Volcanic Hills 7"-10" p.z.
R041XC323AZ	Volcanic Hills 12-16" p.z. Loamy
R038XA133AZ	Volcanic/Metamorphic Hills 12-16" p.z.

Table 1. Dominant plant species

Tree	(1) Parkinsonia microphylla (2) Carnegia gigantea
Shrub	(1) Simmondsia chinensis
Herbaceous	(1) Sphaeralcea ambigua

Physiographic features

This site occurs in the upper elevations of the Sonoran Desert in southern Arizona. Slope aspect is site differentiating at elevations near common resource area boundaries. It occurs on steep hill-slopes and ridge-tops.

Landforms	(1) Hill(2) Ridge(3) Mountain slope
Flooding frequency	None
Ponding frequency	None
Elevation	671–1,219 m
Slope	15–75%
Aspect	N, E, S

Table 2. Representative physiographic features

Climatic features

Precipitation in the sub resource area ranges from 10 to 13 inches in the southern part, along the Mexican border with elevations from about 1900 to 3200 feet. Precipitation in the northern part of the resource area ranges from 11 to 14 inches with elevations from about 1700 to 3500 feet. Winter-summer rainfall ratios range from 40%-60% in the southern portions of the land resource unit, to 50%-50% in the central portions, to 60%-40% in the northern part of the land resource unit. As one moves from east to west in this resource area rains become slightly more unpredictable and variable with Coefficients of Variation of annual rainfall equal to 29% at Tucson and 36% at Carefree. Summer rains fall July through Sept., originate in the Gulf of Mexico, and are convective, usually brief, intense thunderstorms. Cool season moisture tends to be frontal, originating in the Pacific and Gulf of California. This winter precipitation falls in widespread storms with long duration and low intensity. Snow is rare and seldom lasts more than an hour or two. May and June are the driest months of the year. Humidity is generally very low.

Winter temperatures are mild, with very few days recording freezing temperatures in the morning. Summer temperatures are warm to hot, with several days in June and July exceeding 105 degrees F.

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

Table 3. Representative climatic features

Frost-free period (average)	265 days
Freeze-free period (average)	0 days
Precipitation total (average)	330 mm

Influencing water features

There are no water features associated with this site.

Soil features

These are shallow soils formed on intermediate igneous parent material (Andesite, Dacite, Diorite) related agglomerates, tuffs and breccia. Bedrock is usually hard and unweathered. They are non to slightly calcareous, loamy textured and have well developed covers of gravels, cobbles and stones. Numerous areas of rock outcrop occur intermingled with soil areas. Outcrops can be as high as 35% of the area. Plant-soil moisture relationships are fair to good.

Soils mapped on this site include: in

SSA-645 Aguilla-Carefree MU's Lehmans-72, 73, 104 & 105;

SSA-661 Eastern Pinal Southern Gila counties MU Lehmans-835;

SSA-669 Eastern Pima county MU Lehmans-41;

SSA-703 Tohono O'odham MU's Bosa-40 & Lahitas-40.

Parent material	(1) Residuum–andesite
Surface texture	(1) Very gravelly sandy loam(2) Very cobbly sandy loam(3) Very gravelly loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately rapid to moderate
Soil depth	13–51 cm
Surface fragment cover <=3"	40–60%
Surface fragment cover >3"	10–30%
Available water capacity (0-101.6cm)	2.79–6.35 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–2
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.2
Subsurface fragment volume <=3" (Depth not specified)	35–65%
Subsurface fragment volume >3" (Depth not specified)	0–20%

Table 4. Representative soil features

Ecological dynamics

The plant communities found on an ecological site are naturally variable. Composition and production will vary with yearly conditions, location, aspect, and the natural variability of the soils. The Historical Climax Plant Community represents the natural potential plant communities found on relict or relatively undisturbed sites. Other plant communities described here represent plant communities that are known to occur when the site is disturbed by factors such as fire, grazing, or drought.

Production data provided in this site description is standardized to air dry weight at the end of the summer growing season. The plant communities described in this site description are based on near normal rainfall years.

NRCS uses a Similarity Index to compare existing plant communities to the plant communities described here. Similarity Index is determined by comparing the production and composition of a plant community to the production and composition of a plant community described in this site description. To determine Similarity Index, compare the production (air dry weight) of each species to that shown in the plant community description. For each species, count no more than the maximum amount shown for the species, and for each group, count no more than the maximum amount shown for the resulting total by the total normal year production shown in the plant community description. If the rainfall has been significantly above or below normal, use the total production shown for above or below normal years. If field data is not collected at the end of the summer growing season, then the field data must be corrected to the end of the year production before comparing it to the site description. The growth curve can be used as a guide for estimating production at the end of the summer growing season.

State and transition model

MLRA 40-1 (10-13"), Volcanic Hills



Figure 4. State and Transition, Volcanic Hills 10-13" pz.

State 1 Historical Climax Plant Community

Community 1.1 Historical Climax Plant Community

The potential plant community on this site is a diverse mixture of desert shrubs, trees, cacti and perennial grasses and forbs. The aspect is shrubland. With continuous, heavy grazing, herbaceous and suffrutescent forage species are removed from the plant community and shrubs like triangle bursage, white brittle bush, whitethorn acacia, hopseed bush, prickly pear and cholla can increase to occupy the vacancy. Well developed gravel and cobble covers protect the soil from erosion and protect forage species from heavy utilization. The dark color of surface rocks warms the soil allowing plants to grow later into the fall with available moisture and to green up earlier in the spring. Areas of rock outcrop tend to magnify water received by adjacent soil areas. Percent bare ground on the site ranges from 5 to 20. Plant populations for major shrub species range form 10 to 300 per acre for jojoba, 10 to 200 per acre for creosotebush or whitethorn, 20 to 250 per acre for littleleaf paloverde, 50 to 200 ocotillo per acre, 50 to 200 wolfberry per acre, 50 to 300 mormon tea per acre, 10 to 200 mint bush per acre and 0 to 20 saguaro per acre. North exposures have a higher percentage cover of perennial grasses and forbs than warm exposures. Grass cover ranges from 0-10% on north slopes and 0-2% on south slopes. Forb cover ranges from 1-25% on north slopes and 0-6% on south slopes. Warm exposures have a higher percentage of trees and succulents than north slopes. The half shrub community on north slopes is dominated by species like calliandra, goldeneye, mintbush and mormon tea while on south slopes brittlebush, ratany, limberbush and bursage are dominant. Jojoba will have its higher cover on north aspects while southern aspects will have more ocotillo, whitethorn and wolfberry. The percent of annual forbs and grasses in the plant community can range from 5% in dry years to nearly 70% in very wet winters or summers. The yearly production of annuals ranges from 20 lbs per acre to over 1500 lbs. per acre (from dry year to wet year). Severe drought can reduce the cover of perennial grasses and suffrutescent forbs to less than 1%. Drought can also reduce the cover of sub-shrubs like brittlebush and bursage. The dynamics of Saguaro on this site is unlike the 200-300 year cycle found on deep upland sites in the Upper Sonoran desert. Saguaro recruitment can occur in any favorable year due to numerous rocky habitats favorable for establishment. Saguaro populations tend to be multiaged and persistent on this site although very favorable years for establishment may result in very heavy stands on some slopes many years later.

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Forb	56	84	712
Shrub/Vine	114	448	577
Grass/Grasslike	28	112	504
Tree	73	224	280
Total	271	868	2073

Table 5. Annual production by plant type

Table 6. Soil surface cover

Tree basal cover	0-1%
Shrub/vine/liana basal cover	1-6%
Grass/grasslike basal cover	0-1%
Forb basal cover	0-1%
Non-vascular plants	0%
Biological crusts	0-5%
Litter	5-65%
Surface fragments >0.25" and <=3"	30-60%
Surface fragments >3"	5-35%
Bedrock	1-20%
Water	0%
Bare ground	5-25%

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	-	0-1%	0-15%	0-15%
>0.15 <= 0.3	-	0-10%	1-15%	1-20%
>0.3 <= 0.6	-	2-12%	0-5%	1-5%
>0.6 <= 1.4	0-1%	1-5%	0-1%	0-1%
>1.4 <= 4	0-15%	0-1%	-	-
>4 <= 12	0-1%	-	-	-
>12 <= 24	-	-	-	-
>24 <= 37	-	-	-	-
>37	-	_	-	-

Figure 6. Plant community growth curve (percent production by month). AZ4011, 40.1 10-13" p.z. hill sites. Growth begins in the late winter, goes semi-dormant in the drought period of late May through early July, growth continues in the summer through early fall..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	5	15	20	5	5	10	15	15	5	5	0

State 2 Native trees, cacti, shrubs and fire

Community 2.1 Native trees, cacti, shrubs and fire

This plant community occurs as a result of a single hot season fire. Paloverde and saguaro can be severely impacted and may take long periods of time (30-50 years) to recover to pre-fire levels. Perennial and annual grasses and forbs dominate the community for some time until shrubs like wolfberry, ocotillo and jojoba can recover. This plant community can produce enough herbaceous fuel from native species of grasses and / or forbs to carry fire in El Nino years or after unusually wet summers. The natural incidence of fire in this MLRA is very low and fires are much more common from man-made ignitions. Areas of the site close to urban zones or along heavily travelled roads and highways will experience a higher rate of fires.

State 3 Exotic perennial grasses with natives

Community 3.1 Exotic perennial grasses with natives

This community occurs where bufflegrass and / or fountain grass invade the native plant community. These species occupy the niches of low shrubs like false mesquite, janusia, twinberry or triangle goldeneye and can displace species like wolfberry and jojoba.

State 4 Exotic perennial grasses and fire

Community 4.1 Exotic perennial grasses and fire

This community occurs where a native plant community that has been invaded by bufflegrass or fountain grass has burned one or more times. Increasing amounts of bufflegrass leads to more uniform fine fuels. In areas adjacent to roads and urban areas the risk of repeated fires will increase. As fire frequency increases the dominance of the exotic grasses increase.

State 5 Native plant community with exotic annuals

Community 5.1 Native plant community with exotic annuals

This plant community occurs where the native community has been invaded by red brome and / or schismus. Red brome occupies the niche of the native winter annual forbs and grasses. This exotic annual grass will fluctuate from nearly nothing in a dry winter to dominance of the understory plant community in a El Nino winter.

State 6 Exotic annuals and fire

Community 6.1 Exotic annuals and fire

This plant community occurs where a native plant community which has been invaded by red brome has burned repeatedly. As fires become more frequent the native trees, shrubs and succulents are removed from the plant community and red brome becomes dominant. In areas of the site near urban areas and along heavily travelled roads this will be a more common occurence due to an increased source of ignitions.

Additional community tables

 Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass	/Grasslike			• • •	
1	Dominant short grasse	s		6–67	
	slender grama	BORE2	Bouteloua repens	1–56	_
	curly-mesquite	HIBE	Hilaria belangeri	0–56	-
	slim tridens	TRMU	Tridens muticus	1–22	-
2	Dominant mid grasses	-		17–123	
	sideoats grama	BOCU	Bouteloua curtipendula	6–56	-
	tobosagrass	PLMU3	Pleuraphis mutica	6–56	-
	tanglehead	HECO10	Heteropogon contortus	6–45	-
	bush muhly	MUPO2	Muhlenbergia porteri	1–34	-
	desert needlegrass	ACSP12	Achnatherum speciosum	0–28	-
	cane bluestem	BOBA3	Bothriochloa barbinodis	0–11	_
	Arizona cottontop	DICA8	Digitaria californica	0–11	_
3	Miscellaneous perennia	al grasses		2–34	
	spidergrass	ARTE3	Aristida ternipes	1–28	_
	Parish's threeawn	ARPUP5	Aristida purpurea var. parishii	1–17	_
	purple threeawn	ARPU9	Aristida purpurea	0–11	_
	red grama	BOTR2	Bouteloua trifida	0–11	_
	Hall's panicgrass	PAHA	Panicum hallii	0–11	_
	big galleta	PLRI3	Pleuraphis rigida	0–11	_
	large-spike bristlegrass	SEMA5	Setaria macrostachya	0–6	_
	black grama	BOER4	Bouteloua eriopoda	0–6	_
	blue grama	BOGR2	Bouteloua gracilis	0–6	_

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Pacific fescue VUMIP Vulpia microstachys var. pauciflora 0–28 –	-
sixweeks fescue VUOC Vulpia octoflora 1–28 –	-
Mexican sprangletop LEFUU Leptochloa fusca ssp. uninervia 0-28 -	-
Bigelow's bluegrass POBI Poa bigelovii 0–11 –	-
delicate muhly MUFR Muhlenbergia fragilis 0-11 -	-
littleseed muhly MUMI Muhlenbergia microsperma 0–11 –	-
witchgrass PACA6 Panicum capillare 0–6 –	-
Grisebach's SEGR6 Setaria grisebachii 0–6 –	-
Madagascar dropseed SPPY2 Sporobolus pyramidatus 0-2 -	-
Arizona signalgrass URAR Urochloa arizonica 0-2 -	-
Arizona brome BRAR4 Bromus arizonicus 0-2 -	-
feather fingergrass CHVI4 Chloris virgata 0-2 -	-
bearded cupgrass ERAR5 Eriochloa aristata 0–2 –	-
canyon cupgrass ERLE7 Eriochloa lemmonii 0–2 –	-
desert lovegrass ERPEM Eragrostis pectinacea var. miserrima 0–2 –	-]
tufted lovegrass ERPEP2 Eragrostis pectinacea var. pectinacea 0–2 –	-
little barley HOPU Hordeum pusillum 0–2 –	-
goldentop grass LAAU Lamarckia aurea 0-2 -	-]
fragilegrass AETE Aegopogon tenellus 0–1 –	-
Forb	

5	Parasites			1-17	
	mesquite mistletoe	PHCA8	Phoradendron californicum	1–11	-
	bigseed alfalfa dodder	CUIN	Cuscuta indecora	0—6	-
6	Dominant perennial for	'bs		45–78	
	slender janusia	JAGR	Janusia gracilis	11–28	-
	rough menodora	MESC	Menodora scabra	6–28	_
	desert globemallow	SPAM2	Sphaeralcea ambigua	2–28	
	brownplume wirelettuce	STPA4	Stephanomeria pauciflora	1–11	
	longflower tube tongue	JULO3	Justicia longii	0–11	_
	narrowleaf silverbush	ARLA12	Argythamnia lanceolata	1–11	_
	weakleaf bur ragweed	AMCO3	Ambrosia confertiflora	1–6	
	dwarf Indian mallow	ABPA3	Abutilon parvulum	0–6	_
	Parry's false prairie- clover	MAPA7	Marina parryi	0–6	-
	lacy tansyaster	MAPIP4	Machaeranthera pinnatifida ssp. pinnatifida var. pinnatifida	1–6	_
	wishbone-bush	MILAV	Mirabilis laevis var. villosa	0–6	
	cockroachplant	HACR3	Haplophyton crooksii	0—6	-
	slender poreleaf	POGR5	Porophyllum gracile	1–6	_
	Coues' cassia	SECO10	Senna covesii	1–6	_
	desert rosemallow	HICO	Hibiscus coulteri	2–4	_
	brownfoot	ACWR5	Acourtia wrightii	0–4	-
	dense ayenia	AYMI	Ayenia microphylla	0–4	_
	Arizona wrightwort	CAAR7	Carlowrightia arizonica	0–4	-
	bluedicks	DICA14	Dichelostemma capitatum	0–3	
	white sagebrush	ARLU	Artemisia ludoviciana	0–2	-
	San Felipe dogweed	ADPO	Adenophyllum porophylloides	0–2	
	trailing windmills	ALIN	Allionia incarnata	0–2	_
	Parry's beardtongue	PEPA24	Penstemon parryi	1–2	_
	Louisiana vetch	VILUL2	Vicia ludoviciana ssp. ludoviciana	0–1	
	pelotazo	ABIN	Abutilon incanum	0–1	
	perennial rockcress	ARPE2	Arabis perennans	0–1	_
	spurge	EUPHO	Euphorbia	0–1	
	California suncup	CACA32	Camissonia californica	0–1	_
	desert larkspur	DEPA	Delphinium parishii	0–1	_
	tall mountain larkspur	DESC	Delphinium scaposum	0–1	_
7	Annual forbs			6–527	
	bristly fiddleneck	AMTE3	Amsinckia tessellata	0–112	_
	California poppy	ESCAM	Eschscholzia californica ssp. mexicana	0–112	
	Coulter's lupine	LUSP2	Lupinus sparsiflorus	0–112	_
	thelypody	THELY	Thelypodium	0–56	_
	Arizona poppy	KAGR	Kallstroemia grandiflora	0–56	
	western tansymustard	DEPI	Descurainia pinnata	1–56	_
	exserted Indian paintbrush	CAEXE	Castilleja exserta ssp. exserta	0–28	_

phacelia	PHACE	Phacelia	0–28
woolly tidestromia	TILA2	Tidestromia lanuginosa	0–11
sleepy silene	SIAN2	Silene antirrhina	0–11
coastal bird's-foot trefoil	LOSAB	Lotus salsuginosus var. brevivexillus	0–11
milkvetch	ASTRA	Astragalus	0–11
American wild carrot	DAPU3	Daucus pusillus	0–11
goosefoot	CHENO	Chenopodium	0–11
shaggyfruit pepperweed	LELA	Lepidium lasiocarpum	0–11
miniature woollystar	ERDI2	Eriastrum diffusum	0–6
New Mexico thistle	CINE	Cirsium neomexicanum	0–6
carelessweed	AMPA	Amaranthus palmeri	0–6
desert Indianwheat	PLOV	Plantago ovata	1–6
buckwheat	ERIOG	Eriogonum	1–6
combseed	PECTO	Pectocarya	0–6
shrubby deervetch	LORI3	Lotus rigidus	1–3
plains blackfoot	MELE2	Melampodium leucanthum	0–2
cryptantha	CRYPT	Cryptantha	0–2
spreading fleabane	ERDI4	Erigeron divergens	0–2
crestrib morning-glory	IPCO2	Ipomoea costellata	0–2
redstar	IPCO3	Ipomoea coccinea	0–2
desert trumpet	ERIN4	Eriogonum inflatum	0–1
Arizona cottonrose	LOAR12	Logfia arizonica	0–1
Gordon's bladderpod	LEGO	Lesquerella gordonii	0–1
spurge	EUPHO	Euphorbia	0–1
California fagonbush	FALA	Fagonia laevis	0–1
fringed twinevine	FUCYC	Funastrum cynanchoides ssp. cynanchoides	0-1
Davis Mountain mock vervain	GLBIC	Glandularia bipinnatifida var. ciliata	0-1
paleface	HIDE	Hibiscus denudatus	0–1
Newberry's velvetmallow	HONE	Horsfordia newberryi	0-1
hyssopleaf sandmat	CHHY3	Chamaesyce hyssopifolia	0–1
flatcrown buckwheat	ERDE6	Eriogonum deflexum	0–1
desert marigold	BAMU	Baileya multiradiata	0-1
scarlet spiderling	BOCO	Boerhavia coccinea	0–1
spiderling	BOERH2	Boerhavia	0–1
hoary bowlesia	BOIN3	Bowlesia incana	0–1
fringed redmaids	CACI2	Calandrinia ciliata	0–1
naked mariposa lily	CANU2	Calochortus nudus	0–1
whitemargin sandmat	CHAL11	Chamaesyce albomarginata	0–1
brittle spineflower	CHBR	Chorizanthe brevicornu	0–1
tuber anemone	ANTU	Anemone tuberosa	0–1
New Mexico silverbush	ARNE2	Argythamnia neomexicana	0–1

	largeflower onion	ALMA4	Allium macropetalum	0–1	_
	common fiddleneck	AMMEI2	Amsinckia menziesii var. intermedia	0–1	_
	blazingstar	MENTZ	Mentzelia	0–1	_
	Lindley's silverpuffs	MILI5	Microseris lindleyi	0–1	
	green carpetweed	MOVE	Mollugo verticillata	0–1	_
	glandular threadplant	NEGL	Nemacladus glanduliferus	0–1	_
	desert tobacco	NIOBO	Nicotiana obtusifolia var. obtusifolia	0–1	_
	evening primrose	OENOT	Oenothera	0–1	_
	Florida pellitory	PAFL3	Parietaria floridana	0–1	_
	Emory's rockdaisy	PEEM	Perityle emoryi	0–1	
	Coulter's lyrepod	LYCO4	Lyrocarpa coulteri	0–1	
	tansyaster	MACHA	Machaeranthera	0–1	_
	whitestem blazingstar	MEAL6	Mentzelia albicaulis	0–1	
	glandleaf milkwort	POMA7	Polygala macradenia	0–1	-
	New Mexico plumeseed	RANE	Rafinesquia neomexicana	0–1	-
	chia	SACO6	Salvia columbariae	0–1	_
	Leiberg stonecrop	SELE	Sedum leibergii	0–1	_
	ragwort	SENEC	Senecio	0–1	_
	bean	PHASE	Phaseolus	0–1	_
	orange fameflower	PHAU13	Phemeranthus aurantiacus	0–1	
	Arizona popcornflower	PLAR	Plagiobothrys arizonicus	0–1	_
	silverleaf nightshade	SOEL	Solanum elaeagnifolium	0–1	
	lyreleaf jewelflower	STCA5	Streptanthus carinatus	0–1	
	woollyhead neststraw	STMI2	Stylocline micropoides	0–1	_
	sand fringepod	THCU	Thysanocarpus curvipes	0–1	_
	vervain	VERBE	Verbena	0–1	
8	Ferns and fern allies			6–90	
	Arizona spikemoss	SEAR2	Selaginella arizonica	2–84	_
	cliffbrake	PELLA	Pellaea	1–6	_
	lipfern	CHEIL	Cheilanthes	1–6	_
	cloak fern	NOTHO	Notholaena	0–2	
Shrub	/Vine				
9	Dominant low shrubs			34–224	
	triangle bur ragweed	AMDE4	Ambrosia deltoidea	0–45	_
	brittlebush	ENFA	Encelia farinosa	0–34	_
	broom snakeweed	GUSA2	Gutierrezia sarothrae	1–28	_
	bastardsage	ERWR	Eriogonum wrightii	0–17	
	Parish's goldeneye	VIPA14	Viguiera parishii	2–17	
	Eastern Mojave buckwheat	ERFA2	Eriogonum fasciculatum	1–17	_
	fairyduster	CAER	Calliandra eriophylla	6–17	_
	pelotazo	ABIN	Abutilon incanum	1–17	_
	California copperleaf	ACCA3	Acalypha californica	0–6	_
	ravless goldenhead	ACSP	Acamptopappus sphaerocephalus	0–6	_

	,	· · ·			
	sweetbush	BEJU	Bebbia juncea	0–6	_
	Coulter's brickellbush	BRCO	Brickellia coulteri	1–6	_
	ragged rockflower	CRBI2	Crossosoma bigelovii	1–6	
	turpentine bush	ERLA12	Ericameria laricifolia	0–6	_
	rock sage	SAPI2	Salvia pinguifolia	0–6	_
	American threefold	TRCA8	Trixis californica	1–6	
	littleleaf ratany	KRER	Krameria erecta	0–6	
	white ratany	KRGR	Krameria grayi	0–6	
	slender poreleaf	POGR5	Porophyllum gracile	0–2	
	whitestem paperflower	PSCO2	Psilostrophe cooperi	0–2	
	Mexican bladdersage	SAME	Salazaria mexicana	0–2	_
	Mojave sage	SAMO3	Salvia mohavensis	0–2	
	starry bedstraw	GAST	Galium stellatum	0–2	
	desert rosemallow	HICO	Hibiscus coulteri	0–2	_
	toothleaf goldeneye	VIDE3	Viguiera dentata	0–2	_
	woody crinklemat	TICAC	Tiquilia canescens var. canescens	0–2	
	Mojave woodyaster	XYTOT	Xylorhiza tortifolia var. tortifolia	0–2	_
	desert zinnia	ZIAC	Zinnia acerosa	0–2	_
	Chihuahuan brickellbush	BRFL	Brickellia floribunda	0–2	_
	rough brickellbush	BRMIS	Brickellia microphylla var. scabra	0–2	_
	desert yellow fleabane	ERLI	Erigeron linearis	0–1	
	Sonoran croton	CRSO	Croton sonorae	0–1	_
12	Succulents			45–146	
	saguaro	CAGI10	Carnegiea gigantea	6–84	_
	cactus apple	OPEN3	Opuntia engelmannii	17–50	_
	staghorn cholla	CYVE3	Cylindropuntia versicolor	1–22	_
	banana yucca	YUBA	Yucca baccata	0–17	_
	purple pricklypear	OPMA8	Opuntia macrocentra	0–11	_
	tulip pricklypear	OPPH	Opuntia phaeacantha	1–11	
	buck-horn cholla	CYAC8	Cylindropuntia acanthocarpa	0–11	_
	Schott's century plant	AGSC3	Agave schottii	0–11	_
	teddybear cholla	CYBI9	Cylindropuntia bigelovii	0–6	_
	jumping cholla	CYFUF	Cylindropuntia fulgida var. fulgida	0–6	_
	candy barrelcactus	FEWI	Ferocactus wislizeni	1–6	
	senita cactus	PASC14	Pachycereus schottii	0–6	_
	organpipe cactus	STTH3	Stenocereus thurberi	0–6	_
	Leding's hedgehog cactus	ECLE2	Echinocereus ledingii	0–3	-
	Christmas cactus	CYLE8	Cylindropuntia leptocaulis	0–2	_
	Graham's nipple cactus	MAGR9	Mammillaria grahamii	0–2	_
	Thornber's nipple cactus	MATH	Mammillaria thornberi	0–2	_
	beavertail pricklypear	OPBA2	Opuntia basilaris	0–2	_
	L				

	dollarjoint pricklypear	UPCH	Opuntia chiorotica	0-2	-
	common sotol	DAWH2	Dasylirion wheeleri	0–2	_
	desert agave	AGDE	Agave deserti	0–2	Ι
	Leconte's barrel cactus	FECYL	Ferocactus cylindraceus var. lecontei	0–2	_
	Santa Rita pricklypear	OPSA	Opuntia santa-rita	0–2	_
	Emory's barrel cactus	FEEM	Ferocactus emoryi	0–1	_
	Engelmann's hedgehog cactus	ECEN	Echinocereus engelmannii	0–1	_
	redspine fishhook cactus	ECER2	Echinomastus erectocentrus	0–1	-
	pinkflower hedgehog cactus	ECFA	Echinocereus fasciculatus	0–1	-
	Arizona pencil cholla	CYAR14	Cylindropuntia arbuscula	0–1	-
	rainbow cactus	ECPE	Echinocereus pectinatus	0–1	-
	spinystar	ESVIV	Escobaria vivipara var. vivipara	0–1	_
13	Dominant large shrubs			34–168	
	jojoba	SICH	Simmondsia chinensis	11–112	_
	ocotillo	FOSP2	Fouquieria splendens	6–67	_
	whitethorn acacia	ACCO2	Acacia constricta	1–56	_
	catclaw acacia	ACGR	Acacia greggii	6–34	_
	Berlandier's wolfberry	LYBE	Lycium berlandieri	6–28	_
	Wright's beebrush	ALWR	Aloysia wrightii	1–11	-
	spiny hackberry	CEEH	Celtis ehrenbergiana	1–11	_
	creosote bush	LATRT	Larrea tridentata var. tridentata	1–11	-
	water jacket	LYAN	Lycium andersonii	0–6	_
	snapdragon penstemon	KEANM	Keckiella antirrhinoides ssp. microphylla	0–6	-
	Arizona desert-thorn	LYEX	Lycium exsertum	1–6	-
	Warnock's snakewood	COWA	Condalia warnockii	0–6	-
	stretchberry	FOPUP	Forestiera pubescens var. pubescens	0–3	_
	desert ceanothus	CEGR	Ceanothus greggii	0–3	_
	alderleaf mountain mahogany	CEMO2	Cercocarpus montanus	0–3	_
	red barberry	MAHA4	Mahonia haematocarpa	0–3	_
	catclaw mimosa	MIACB	Mimosa aculeaticarpa var. biuncifera	0–3	_
	Mexican cliffrose	PUME	Purshia mexicana	0–3	_
	sugar sumac	RHOV	Rhus ovata	0–3	_
	skunkbush sumac	RHTR	Rhus trilobata	0–3	-
	Sonoran scrub oak	QUTU2	Quercus turbinella	0–2	-
	Schott's pygmycedar	PESC4	Peucephyllum schottii	0–2	_
	Nevada jointfir	EPNE	Ephedra nevadensis	0–2	-
	cliff fendlerbush	FERU	Fendlera rupicola	0–2	_
14	Miscellaneous shrubs			2–39	
	Las Animas nakedwood	COCA18	Colubrina californica	0–6	_
	sangre de cristo	JACA2	Jatropha cardiophylla	0–6	_
	Arizona mimosa	MIDIL	Mimosa distachya var. laxiflora	0–6	_

Ajo Mountain scrub oak	QUAJ	Quercus ajoensis	0–6	_
arrow poision plant	SEBI9	Sebastiania bilocularis	0–2	_
Lemmon's ragwort	SELE8	Senecio lemmonii	0–2	_
Schott's yellowhood	NISC	Nissolia schottii	0–2	_
Florida hopbush	DOVI	Dodonaea viscosa	0–2	_
Tahitian kidneywood	EYOR	Eysenhardtia orthocarpa	0–2	_
desert lavender	HYEM	Hyptis emoryi	0–2	_
beloperone	JUCA8	Justicia californica	0–2	_
Goodding's tansyaster	MAPIG2	Machaeranthera pinnatifida ssp. gooddingii var. gooddingii	0–2	-
lacy tansyaster	MAPIP4	Machaeranthera pinnatifida ssp. pinnatifida var. pinnatifida	0–2	_
mouse's eye	BEMY	Bernardia myricifolia	0–2	_
fragrant bursera	BUFA	Bursera fagaroides	1–2	_
Arizona wrightwort	CAAR7	Carlowrightia arizonica	0–2	_
fourwing saltbush	ATCA2	Atriplex canescens	0–2	_
shortleaf baccharis	BABR	Baccharis brachyphylla	0–2	_
yerba de pasmo	BAPT	Baccharis pteronioides	0–2	_
desertbroom	BASA2	Baccharis sarothroides	0–1	_
cattle saltbush	ATPO	Atriplex polycarpa	0–1	_
knifeleaf condalia	COSP3	Condalia spathulata	0–1	_
Arizona rosewood	VACA5	Vauquelinia californica	0–1	_
lotebush	ZIOB	Ziziphus obtusifolia	0–1	_
prairie acacia	ACANH	Acacia angustissima var. hirta	0–1	_
whitestem milkweed	ASAL	Asclepias albicans	0–1	_
horsetail milkweed	ASSU2	Asclepias subverticillata	0–1	
	-			
Trees			73–280	
yellow paloverde	PAMI5	Parkinsonia microphylla	11–224	_
desert ironwood	OLTE	Olneya tesota	0–112	_
velvet mesquite	PRVE	Prosopis velutina	0–56	_
crucifixion thorn	CAHO3	Canotia holacantha	0–17	-
	Ajo Mountain scrub oakarrow poision plantLemmon's ragwortSchott's yellowhoodFlorida hopbushTahitian kidneywooddesert lavenderbeloperoneGoodding's tansyasterlacy tansyasterfragrant burseraArizona wrightwortfourwing saltbushshortleaf baccharisyerba de pasmodesertbroomcattle saltbushknifeleaf condaliaArizona rosewoodlotebushprairie acaciawhitestem milkweedhorsetail milkweedyellow paloverdedesert ironwoodvelvet mesquitecrucifixion thorn	Ajo Mountain scrub oakQUAJarrow poision plantSEBI9Lemmon's ragwortSELE8Schott's yellowhoodNISCFlorida hopbushDOVITahitian kidneywoodEYORdesert lavenderHYEMbeloperoneJUCA8Goodding's tansyasterMAPIG2inouse's eyeBEMYfragrant burseraBUFAArizona wrightwortGAAR7fourwing saltbushBAPTdesertbroomBAPTdesertbroomGOSP3Arizona cosewoodVACA5lotebushZIOBprairie acaciaACANHwhitestem milkweedASALhorsetail milkweedASU2yellow paloverdePAMI5desert ironwoodPAMI5velvet mesquitePRVEcrucifixion thornCAHO3	Ajo Mountain scrub oakQUAJQuercus ajoensisarrow poision plantSEBI9Sebastiania bilocularisLemmon's ragwortSELE8Senecio lemmoniiSchott's yellowhoodNISCNissolia schottiiFlorida hopbushDOVIDodonaea viscosaTahitian kidneywoodEYOREysenhardtia orthocarpadesert lavenderHYEMHyptis emoryibeloperoneJUCA8Justicia californicaGoodding's tansyasterMAPIG2Machaeranthera pinnatifida ssp. gooddingiilacy tansyasterMAPIA4Bernardia myricifoliamouse's eyeBEMYBernardia myricifoliafragrant burseraBUFABursera fagaroidesshortleaf baccharisBABRBaccharis brachyphyllayerba de pasmoBAPTBaccharis brachyphyllaknifelaaf condaliaCOSP3Condalia spathulataArizona rosewoodVACA5Vauquelinia californicaknifelaaf condaliaASALAsclepias albicanshorsetail milkweedASALAsclepias albicanshorsetail milkweedASALAsclepias albicanshorsetail milkweedPAMI5Parkinsonia microphylladesert ironwoodOLTEOlneya tesotavelvet mesquitePRVEProsopis velutinacrucifixion thornCAHO3Canota holacantha	Ajo Mountain scrub oakQUAJQuercus ajoensis0arrow poision plantSEBI9Sebastiania bilocularis0arrow poision plantSELE8Senecio lemmonii0Schott's yellowhoodNISCNissolia schottii0Schott's yellowhoodNISCNissolia schottii0Tahitian kidneywoodEYOREysenhardita orthocarpa0desert lavenderHYEMHyptis enoryi0beloperoneJUCA8Justicia californica0Goodding's tansyasterMAPIG2Machaeranthera pinnatifida ssp. gooddingii0Goodsing's tansyasterMAPIP4Machaeranthera pinnatifida ssp. pinnatifida0nouse's eyeBEMYBernardia myricifolia00rizona wrightwortCAAR7Carlowrightia arizonica00fourwing saltbushATCA2Atriplex canescens00shortleaf baccharisBABRBaccharis pteronioides00gesethroomBAS2Baccharis sarothroides00knifeleaf condaliaCOSP3Condalia spathulata00rizona rosewoodVACASVauquelinia californica00rinifie acaciaACANHAcacia angustissim var. hirta00rigita caciaACANHAcacia angustissim var. hirta00rigita caciaACANHAcacia angustissim var. hirta00rigita caciaACANHAcacia angustissim var. hirta00rigita cacia <td< td=""></td<>

Animal community

Steep slopes, very cobbly surfaces and numerous areas of rock outcrop hinder livestock distribution. The site is not well suited to grazing by cows in the hot season except in areas where ridges trend north-south and western exposures are shady in the morning and eastern exposures in the afternoon. In such cases, distribution will be fairly good even in the summer. South facing slopes are used more in the winter due to warm temperatures and early spring greenup. North aspects, being shady and cooler, are used more in the fall due to a longer green season. The plant community has an excellent variety of browse, perennial grasses and forbs providing adequate nutrition throughout the year. Herbaceous forage is high quality due to soils with high exchangeable bases. Seep and canyon water are usually available in the winter-spring rainy season and also for short periods in the summer rainy season. Areas of slick-rock outcrop and hard rock in canyon bottoms offer good opportunity for tricktank water developments. Bluff and rimrock outcrops can form natural barriers with the addition of minimal actual fence construction.

Seasonally available water, forage diversity, cover and topography make this site home to a great variety of wildlife

including the larger desert mammals. Large areas of bluff and rimrock outcrop make this site a favorite of desert bighorn sheep. Water developemts are especially important to larger mammals to make the seasonal supplies more permanent. The desert tortoise dens on cobble covered southern exposures in the winter.

Hydrological functions

This site is a fair producer of runoff due to steep slopes and shallow soils. Very gravelly and cobbly soil surfaces tend to hold water on the site. In areas with lots of rock outcrop there is a potential to develop water sources using rock catchments.

Recreational uses

Hunting, hiking, bird watching, photography, horseback riding, rock hounding

Wood products

Some paloverde, ironwood and mesquite for camp-fires and branding fires.

Other products

Stones and cobbles, saguaro ribs, cholla skeletons. Tradtional foods like saguaro fruits, prickly pear tunas, cactus flower buds and jojoba nuts. Traditional herbs like coyote tobacco, mint bush, club moss, globe mallow and limberbush.

Inventory data references

Range 417s include 3 in excellent condition and 3 in good condition.

Type locality

Location 1: Pima County, AZ							
Township/Range/Section T14S R12E S10							
General legal description Tucson FO - Tucson Mtn. Park - Gates Pass							
Location 2: Pima County,	Location 2: Pima County, AZ						
General legal description	al legal description Sells Field Office - South Mountain 32 degrees 00' X 112 degrees 9'						
Location 3: Pima County,	AZ						
General legal description Sells Field Office - Artesia Mtn. 31 degrees 52' 30" X 111 degrees 51' 30"							
Location 4: Gila County, A	AZ						
Township/Range/Section T4S R17E S23							
General legal description San Carlos FO - Mineral Strip - Deer Creek							
Location 5: Maricopa Cou	nty, AZ						
Township/Range/Section T1N R10E S35							
General legal description Chandler FO - Quarter Circle U Ranch, Frazier Pas.							
Location 6: Pinal County, AZ							
Township/Range/Section T9S R9E S15							
General legal description	Casa Grande FO - Picacho Peak State Park						
Location 7: Pima County, AZ							
UTM zone	Ν						
UTM northing 3615043.46							

UTM easting	373662.66						
General legal description	Barry Goldwater Gunnery Range, Sand Tank Mountains, Sonoran Desert National Monument						
Location 8: Pima County,	Location 8: Pima County, AZ						
Township/Range/Section	T14S R13E S15						
General legal description	Tumamoc Hills, UA Desert Botanical Laboratory, ungrazed since 1906						

Other references

Vegetation change and plant demography in permanent plots in the Sonoran Desert. Deb Goldberg, Ray Turner. Ecology 67(3), 1986, pp. 695-712.

Effects of drought on shrub survival and longevity in the northern Sonoran Desert. Janice Bowers. Journal of the Torrey Botanical Society 132(3), 2005, pp. 421-431.

The Changing Mile Re-visited. Ray Turner, Robert Webb. University of Arizona press, 2003.

Exotic plants at the desert Laboratory, Tucson, Arizona. Tony Burgess, Janice Bowers and Ray Turner. Madrono, 38(2). 1991, pp. 96-114.

Contributors

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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.

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Date	12/13/2005
Approved by	S. Cassady
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

- 1. **Number and extent of rills:** Rills are present on this site with high gravel cover but follow fractures, bedding planes and joints in the bedrock parent materials. Soils with high rock cover have no natural rills.
- 2. Presence of water flow patterns: Uncommon; broken primarily by high rock and gravel cover.

(1-2 per 50 plants and no more than 1 inch of root exposed); limited soil material not conducive to forming continuous stands of plants that promote terracettes; high rock cover forms limited natural terracettes.

- 4. Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground): Estimated at 1-2%. Gravel cover 90-95%, rock 2-3%. Some soils may have 90-95% rock cover.
- 5. Number of gullies and erosion associated with gullies: None
- 6. Extent of wind scoured, blowouts and/or depositional areas: None
- 7. Amount of litter movement (describe size and distance expected to travel): Woody litter stays in place, herbaceous litter transported in limited flow paths.
- 8. Soil surface (top few mm) resistance to erosion (stability values are averages most sites will show a range of values): Expect values of 1-2 in canopy interspaces, and 4-5 under plant canopies.
- Soil surface structure and SOM content (include type of structure and A-horizon color and thickness): Weak thir platy to weak granular; thickness to 5 inches.
- 10. Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff: Canopy cover = 26%; 35-40% of canopy cover is shrubs, 20-25% half shrubs, 15-20% paloverde, 7-8% succulents, 3-4% perennial grass, 3-4% perennial forbs. Cover is well dispersed throughout the site. North facing slopes may have tree and shrub cover values reversed versus above values and higher values for succulents.
- 11. Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site): None
- 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: shrubs > half shrubs > trees > succulents > perennial grasses and forbs (Note: In El Nino years, annual forbs and grasses are #1 in above ground weight). North slopes may have trees > succulents > half shrubs > shrubs > perennial forbs > perennial grasses.

Sub-dominant:

Other:

Additional:

- 13. Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence): 3 and 15% canopy mortality of triangle bursage and jojoba, respectively at Gates Pass west slope. 5-10% mortality of bursage at Tumamoc Hill north slope.
- 14. Average percent litter cover (%) and depth (in):
- 15. Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annualproduction): 242 lbs/ac unfavorable precipitation; 775 lbs/ac normal precipitation; 1850 lbs/ac favorable precipitation
- 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: Filaree, Red brome, bufflegrass
- 17. Perennial plant reproductive capability: Not impaired for shrubs, drought impaired for perennial grasses and forbs.