

Ecological site R040XA123AZ **Volcanic Hills 10"-13" 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.

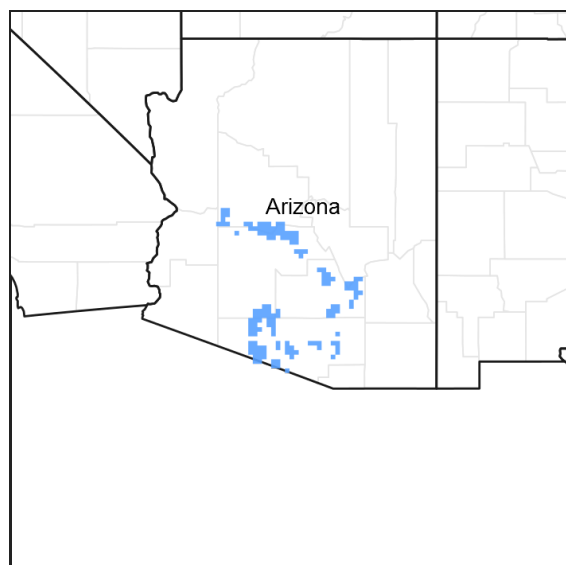


Figure 1. Mapped extent

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) <i>Parkinsonia microphylla</i> (2) <i>Carnegia gigantea</i>
Shrub	(1) <i>Simmondsia chinensis</i>
Herbaceous	(1) <i>Sphaeralcea ambigua</i>

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.

Table 2. Representative physiographic features

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

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.

Table 4. Representative soil features

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%

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 group. Divide 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

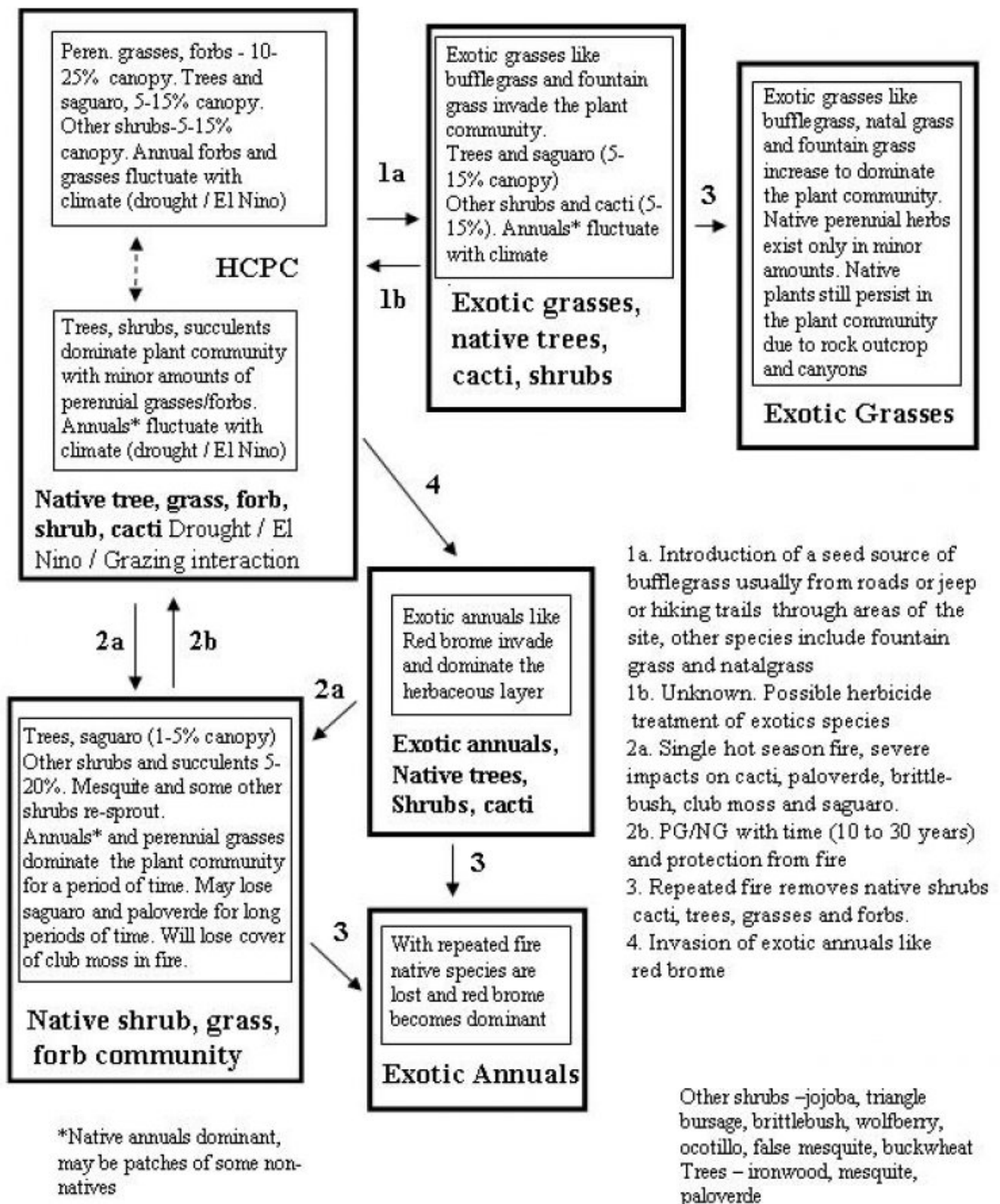


Figure 4. State and Transition, Volcanic Hills 10-13" pz.

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 from 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 multi-aged and persistent on this site although very favorable years for establishment may result in very heavy stands on some slopes many years later.

Table 5. Annual production by plant type

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 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%

Table 7. Canopy structure (% cover)

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 buffleggrass 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 buffleggrass or fountain grass has burned one or more times. Increasing amounts of buffleggrass 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 occurrence 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 grasses			6–67	
	slender grama	BORE2	<i>Bouteloua repens</i>	1–56	–
	curly-mesquite	HIBE	<i>Hilaria belangeri</i>	0–56	–
	slim tridens	TRMU	<i>Tridens muticus</i>	1–22	–
2	Dominant mid grasses			17–123	
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	6–56	–
	tobosagrass	PLMU3	<i>Pleuraphis mutica</i>	6–56	–
	tanglehead	HECO10	<i>Heteropogon contortus</i>	6–45	–
	bush muhly	MUPO2	<i>Muhlenbergia porteri</i>	1–34	–
	desert needlegrass	ACSP12	<i>Achnatherum speciosum</i>	0–28	–
	cane bluestem	BOBA3	<i>Bothriochloa barbinodis</i>	0–11	–
	Arizona cottontop	DICA8	<i>Digitaria californica</i>	0–11	–
3	Miscellaneous perennial grasses			2–34	
	spidergrass	ARTE3	<i>Aristida ternipes</i>	1–28	–
	Parish's threeawn	ARPUP5	<i>Aristida purpurea</i> var. <i>parishii</i>	1–17	–
	purple threeawn	ARPU9	<i>Aristida purpurea</i>	0–11	–
	red grama	BOTR2	<i>Bouteloua trifida</i>	0–11	–
	Hall's panicgrass	PAHA	<i>Panicum hallii</i>	0–11	–
	big galleta	PLRI3	<i>Pleuraphis rigida</i>	0–11	–
	large-spike bristlegrass	SEMA5	<i>Setaria macrostachya</i>	0–6	–
	black grama	BOER4	<i>Bouteloua eriopoda</i>	0–6	–
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	0–6	–

	hairy grama	BOHI2	<i>Bouteloua hirsuta</i>	0–2	–
	fall witchgrass	DICO6	<i>Digitaria cognata</i>	0–2	–
	southwestern bristlegrass	SESC2	<i>Setaria scheelei</i>	0–2	–
	plains bristlegrass	SEVU2	<i>Setaria vulpiseta</i>	0–2	–
	muttongrass	POFE	<i>Poa fendleriana</i>	0–2	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	0–2	–
	common wolfstail	LYPH	<i>Lycurus phleoides</i>	0–2	–
	Wright's threeawn	ARPUW	<i>Aristida purpurea</i> var. <i>wrightii</i>	0–2	–
	Havard's threeawn	ARHA3	<i>Aristida havardii</i>	0–2	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	0–1	–
	squirreltail	ELELE	<i>Elymus elymoides</i> ssp. <i>elymoides</i>	0–1	–
	nineawn pappusgrass	ENDE	<i>Enneapogon desvauxii</i>	0–1	–
	low woollygrass	DAPU7	<i>Dasyochloa pulchella</i>	0–1	–
4	Annual grasses			2–448	
	mucronate sprangeltop	LEPAB	<i>Leptochloa panicea</i> ssp. <i>brachiata</i>	0–224	–
	Mexican panicgrass	PAHI5	<i>Panicum hirticaule</i>	0–140	–
	sixweeks threeawn	ARAD	<i>Aristida adscensionis</i>	1–112	–
	needle grama	BOAR	<i>Bouteloua aristidoides</i>	0–56	–
	sixweeks grama	BOBA2	<i>Bouteloua barbata</i>	0–56	–
	Rothrock's grama	BORO2	<i>Bouteloua rothrockii</i>	0–56	–
	prairie threeawn	AROL	<i>Aristida oligantha</i>	0–28	–
	Eastwood fescue	VUMIC	<i>Vulpia microstachys</i> var. <i>ciliata</i>	0–28	–
	Pacific fescue	VUMIP	<i>Vulpia microstachys</i> var. <i>pauciflora</i>	0–28	–
	sixweeks fescue	VUOC	<i>Vulpia octoflora</i>	1–28	–
	Mexican sprangletop	LEFUU	<i>Leptochloa fusca</i> ssp. <i>uninervia</i>	0–28	–
	Bigelow's bluegrass	POBI	<i>Poa bigelovii</i>	0–11	–
	delicate muhly	MUFR	<i>Muhlenbergia fragilis</i>	0–11	–
	littleseed muhly	MUMI	<i>Muhlenbergia microsperma</i>	0–11	–
	witchgrass	PACA6	<i>Panicum capillare</i>	0–6	–
	Grisebach's bristlegrass	SEGR6	<i>Setaria grisebachii</i>	0–6	–
	Madagascar dropseed	SPPY2	<i>Sporobolus pyramidatus</i>	0–2	–
	Arizona signalgrass	URAR	<i>Urochloa arizonica</i>	0–2	–
	Arizona brome	BRAR4	<i>Bromus arizonicus</i>	0–2	–
	feather fingergrass	CHVI4	<i>Chloris virgata</i>	0–2	–
	bearded cupgrass	ERAR5	<i>Eriochloa aristata</i>	0–2	–
	canyon cupgrass	ERLE7	<i>Eriochloa lemmonii</i>	0–2	–
	desert lovegrass	ERPEM	<i>Eragrostis pectinacea</i> var. <i>miserrima</i>	0–2	–
	tufted lovegrass	ERPEP2	<i>Eragrostis pectinacea</i> var. <i>pectinacea</i>	0–2	–
	little barley	HOPU	<i>Hordeum pusillum</i>	0–2	–
	goldentop grass	LAAU	<i>Lamarckia aurea</i>	0–2	–
	fragilegrass	AETE	<i>Aegopogon tenellus</i>	0–1	–
Forb					

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

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

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

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

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

	Ajo Mountain scrub oak	QUAJ	<i>Quercus ajoensis</i>	0–6	–
	arrow poison plant	SEBI9	<i>Sebastiania bilocularis</i>	0–2	–
	Lemmon's ragwort	SELE8	<i>Senecio lemmonii</i>	0–2	–
	Schott's yellowhood	NISC	<i>Nissolia schottii</i>	0–2	–
	Florida hopbush	DOVI	<i>Dodonaea viscosa</i>	0–2	–
	Tahitian kidneywood	EYOR	<i>Eysenhardtia orthocarpa</i>	0–2	–
	desert lavender	HYEM	<i>Hyptis emoryi</i>	0–2	–
	beloperone	JUCA8	<i>Justicia californica</i>	0–2	–
	Goodding's tansyaster	MAPIG2	<i>Machaeranthera pinnatifida</i> ssp. <i>gooddingii</i> var. <i>gooddingii</i>	0–2	–
	lacy tansyaster	MAPIP4	<i>Machaeranthera pinnatifida</i> ssp. <i>pinnatifida</i> var. <i>pinnatifida</i>	0–2	–
	mouse's eye	BEMY	<i>Bernardia myricifolia</i>	0–2	–
	fragrant bursera	BUFA	<i>Bursera fagaroides</i>	1–2	–
	Arizona wrightwort	CAAR7	<i>Carlowrightia arizonica</i>	0–2	–
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	0–2	–
	shortleaf baccharis	BABR	<i>Baccharis brachyphylla</i>	0–2	–
	yerba de pasmo	BAPT	<i>Baccharis pteronioides</i>	0–2	–
	desertbroom	BASA2	<i>Baccharis sarothroides</i>	0–1	–
	cattle saltbush	ATPO	<i>Atriplex polycarpa</i>	0–1	–
	knifeleaf condalia	COSP3	<i>Condalia spathulata</i>	0–1	–
	Arizona rosewood	VACA5	<i>Vauquelinia californica</i>	0–1	–
	lotebush	ZIOB	<i>Ziziphus obtusifolia</i>	0–1	–
	prairie acacia	ACANH	<i>Acacia angustissima</i> var. <i>hirta</i>	0–1	–
	whitestem milkweed	ASAL	<i>Asclepias albicans</i>	0–1	–
	horsetail milkweed	ASSU2	<i>Asclepias subverticillata</i>	0–1	–
Tree					
15	Trees			73–280	
	yellow paloverde	PAMI5	<i>Parkinsonia microphylla</i>	11–224	–
	desert ironwood	OLTE	<i>Olneya tesota</i>	0–112	–
	velvet mesquite	PRVE	<i>Prosopis velutina</i>	0–56	–
	crucifixion thorn	CAHO3	<i>Canotia holacantha</i>	0–17	–

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, AZ	
General 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, AZ	
Township/Range/Section	T4S R17E S23
General legal description	San Carlos FO - Mineral Strip - Deer Creek
Location 5: Maricopa County, 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	N
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, 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.

Author(s)/participant(s)	Dave Womack, Dan Robinett, Emilio Carrillo
Contact for lead author	NRCS Tucson Area Office
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.

3. **Number and height of erosional pedestals or terracettes:** Pedestals are uncommon on perennial grass and shrubs

(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.
-
9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Weak thin 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% palo verde, 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 Niño 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 annual-production):** 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, buffleggrass

17. **Perennial plant reproductive capability:** Not impaired for shrubs, drought impaired for perennial grasses and forbs.
