USDA Natural Resources Conservation Service

Ecological site R040XB205AZ
Clay Loam Upland 7"-10" p.z.

Accessed: 05/21/2025

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.

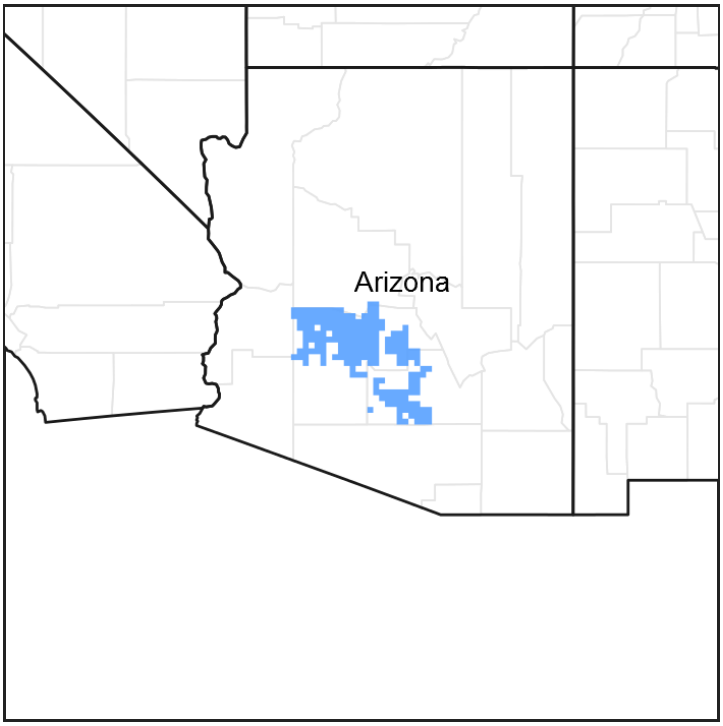


Figure 1. Mapped extent

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 40.2 – Middle Sonoran Desert

Elevations range from 1200 to 2000 feet and precipitation averages 7 to 10 inches per

year. Vegetation includes saguaro, palo verde, creosotebush, triangle bursage, brittlebush, prickly pear, cholla, desert saltbush, wolfberry bush muhly, threeawns, and big galleta. The soil temperature regime is hyperthermic and the soil moisture regime is typic aridic. 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.

Table 1. Dominant plant species

Tree	(1) *Parkinsonia microphylla* (2) *Prosopis glandulosa*
Shrub	(1) *Olneya tesota* (2) *Castela emoryi*
Herbaceous	(1) *Pleuraphis mutica* (2) *Muhlenbergia porteri*

Physiographic features

This site occurs on fan terraces and stream terraces. Slopes range from 1 to 3%. Elevations are from 1000 to 2050 feet.

Table 2. Representative physiographic features

Landforms	(1) Fan (2) Terrace (3) Stream terrace
Elevation	305–625 m
Slope	1–3%

Climatic features

Precipitation in the sub-resource area ranges from 7 to 10 inches. Elevations range from 900 to 2050 feet. Winter-summer rainfall ratios range from 40% to 60% in the southern part along the international boundary, to 60% to 40% in the central and northern parts of the sub-resource area. As one moves from east to west in this resource area rains become more unpredictable and variable with Coefficients of Variation of annual rainfall equal to 38% at Florence and 46% at Aguila. Summer rains fall July- September, originate in the Gulf of Mexico, and are convective, usually brief, intense thunderstorms. Summer precipitation is extremely erratic and undependable in this area. Cool season moisture tends to be frontal, originates in the Pacific and Gulf of California, and falls in widespread storms with long duration and low intensity. This is the dependable moisture supply for vegetation in the area. Snow is very rare and usually melts on contact. May-June is the

driest time of the year. Humidity is very low.

Winter temperatures are very mild with very few days recording freezing for short periods of time. Summertime temperatures are hot to very hot with many days in June-July exceeding 105 degrees F. Frost-free days range from 280 at stations in major river valleys with cold air drainage to 320 to 350 days at upland stations.

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)	350 days
Freeze-free period (average)	0 days
Precipitation total (average)	254 mm

Influencing water features

Soil features

These are old soils formed in clayey alluvium from mixed origins. They are deep and have moderate shrink-swell potentials. They do not crack and churn with wetting and dryng. Plant-soil moisture relationships are fair.
Soils mapped on this site include: in SSA-645 Aguila-Carefree area MU's Contine-22 & 46, Eba-39, Ebon-44, 45, 46, 47 & 48, Luke-74 & Mohall-77; SSA-651 Central Maricopa County MU's Tremant-AkB, Cs, MTB, Tg, Th, TPB, TrA, TrB & TSC, Ebon-CeD, EbD & EPD, Glenbar-Go3 & Gt, Laveen-Le, Mohall-Mr & MV, Trix-Tt; SSA-659 Western Pinal County MU's Contine-9 & Mohall-32; SSA-661 Eastern Pinal-Southern Gila Counties MU's Ebon-207 & 580.

Table 4. Representative soil features

Surface texture	(1) Gravelly loam (2) Very gravelly clay loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Moderately slow to slow
Soil depth	102–152 cm
Surface fragment cover <=3"	1–45%

Surface fragment cover >3"	0–5%
Available water capacity (0-101.6cm)	8.13–22.86 cm
Calcium carbonate equivalent (0-101.6cm)	5–30%
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	1–45%
Subsurface fragment volume >3" (Depth not specified)	0–5%

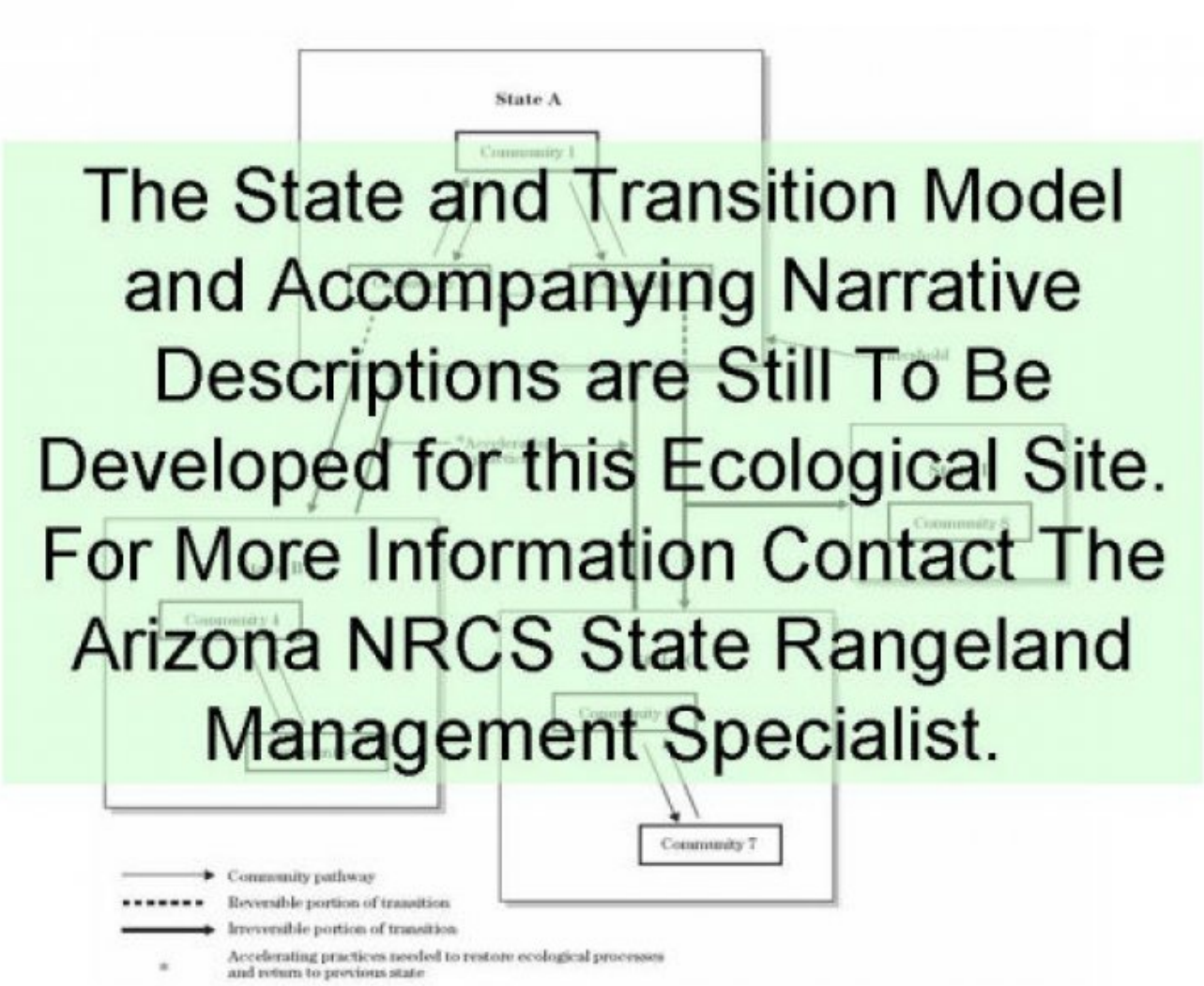
Ecological dynamics

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



State 1
Historical Climax Plant Community

Community 1.1
Historical Climax Plant Community

The potential plant community on this site is a mixture of perennial and annual grasses and forbs and desert shrubs and cacti. The aspect is shrubland. With continuous, heavy grazing, forage species like Tobosa, threeawns and globemallow are removed from the plant community and replaced by species like; creosote bush, triangle bursage, mesquite and cacti. Several cool season, introduced annual species have become entrenched on areas of this site and have displaced native grasses and forbs. These species include; red brome, mediterranean grass, filaree, tumbleweed, and London rocket mustard. This site is a poor user of intense summer thunderstorms. Heavy surface textures, low plant cover and a lack of cracking combine to inefficient use of summer precipitation. In areas where perennial plant cover has been lost and erosion is accelerated, mechanical treatments to harvest water onto seeded strips (contour borders, basins) has resulted in excellent stands

of native trees and shrubs like; fourwing saltbush, mesquite and Mexican paloverde. Trees on this site occur as shrubby individuals due to the clayey soil textures near the surface. Cryptogam cover can be moderate on non-gravelly surfaces.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	157	–	247
Grass/Grasslike	112	–	157
Forb	67	–	112
Total	**336**	**–**	**516**

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1				45–90	
	tobosagrass	PLMU3	*Pleuraphis mutica*	45–90	–
2				22–45	
	purple threeawn	ARPU9	*Aristida purpurea*	0–6	–
	bush muhly	MUPO2	*Muhlenbergia porteri*	0–6	–
	Parish's threeawn	ARPUP5	*Aristida purpurea var. parishii*	0–3	–
	Wright's threeawn	ARPUW	*Aristida purpurea var. wrightii*	0–3	–
	big galleta	PLRI3	*Pleuraphis rigida*	0–3	–
	spidergrass	ARTE3	*Aristida ternipes*	0–2	–
	spidergrass	ARTEG	*Aristida ternipes var. gentilis*	0–2	–
	red grama	BOTR2	*Bouteloua trifida*	0–1	–
	Arizona cottontop	DICA8	*Digitaria californica*	0–1	–
	whiplash pappusgrass	PAVA2	*Pappophorum vaginatum*	0–1	–
	plains bristlegrass	SEVU2	*Setaria vulpiseta*	0–1	–
3	**Annuals**			22–67	
	sixweeks threeawn	ARAD	*Aristida adscensionis*	0–11	–

	prairie threeawn	AROL	*Aristida oligantha*	0–11	–
	needle grama	BOAR	*Bouteloua aristidoides*	0–11	–
	sixweeks grama	BOBA2	*Bouteloua barbata*	0–11	–
	Eastwood fescue	VUMIC	*Vulpia microstachys var. ciliata*	0–11	–
	Pacific fescue	VUMIP	*Vulpia microstachys var. pauciflora*	0–11	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–11	–
	Rothrock's grama	BORO2	*Bouteloua rothrockii*	0–6	–
	Arizona brome	BRAR4	*Bromus arizonicus*	0–1	–
	feather fingergrass	CHVI4	*Chloris virgata*	0–1	–
	desert lovegrass	ERPEM	*Eragrostis pectinacea var. miserrima*	0–1	–
	tufted lovegrass	ERPEP2	*Eragrostis pectinacea var. pectinacea*	0–1	–
	bearded sprangletop	LEFUF	*Leptochloa fusca ssp. fascicularis*	0–1	–
	mucronate sprangletop	LEPA6	*Leptochloa panicea*	0–1	–
	delicate muhly	MUFR	*Muhlenbergia fragilis*	0–1	–
	littleseed muhly	MUMI	*Muhlenbergia microsperma*	0–1	–
	Bigelow's bluegrass	POBI	*Poa bigelovii*	0–1	–
	Arizona signalgrass	URAR	*Urochloa arizonica*	0–1	–
4				4–22	
	Alga	2ALGA	*Alga*	2–11	–
	Lichen	2LICHN	*Lichen*	1–6	–
	Moss	2MOSS	*Moss*	1–3	–
	Fungus	2FUNGI	*Fungus*	1–2	–
Forb					
5				22–45	
	desert globemallow	SPAM2	*Sphaeralcea ambigua*	0–6	–
	Louisiana vetch	VILU	*Vicia ludoviciana*	0–6	–
	Emory's globemallow	SPEM	*Sphaeralcea emoryi*	0–3	–
	spear globemallow	SPHA	*Sphaeralcea hastulata*	0–3	–
	Indian rushpea	HOGL2	*Hoffmannseggia glauca*	0–2	–
	dwarf desertpeony	ACNA2	*Acourtia nana*	0–1	

	dwarf desertpeony	ACNA2	*Acourtia nana*	0–1	–
6				45–90	
	bristly fiddleneck	AMTE3	*Amsinckia tessellata*	0–11	–
	western tansymustard	DEPI	*Descurainia pinnata*	0–11	–
	common fiddleneck	AMMEI2	*Amsinckia menziesii var. intermedia*	0–11	–
	shaggyfruit pepperweed	LELA	*Lepidium lasiocarpum*	0–6	–
	Arizona lupine	LUAR4	*Lupinus arizonicus*	0–6	–
	Coulter's lupine	LUSP2	*Lupinus sparsiflorus*	0–6	–
	sleepy silene	SIAN2	*Silene antirrhina*	0–3	–
	Coulter's globemallow	SPCO2	*Sphaeralcea coulteri*	0–1	–
	woollyhead neststraw	STMI2	*Stylocline micropoides*	0–1	–
	cutleaf thelypody	THLA	*Thelypodium laciniatum*	0–1	–
	woolly tidestromia	TILA2	*Tidestromia lanuginosa*	0–1	–
	Bigelow's linanthus	LIBI2	*Linanthus bigelovii*	0–1	–
	linanthus	LINAN2	*Linanthus*	0–1	–
	coastal bird's-foot trefoil	LOSA	*Lotus salsuginosus*	0–1	–
	brownfoot	ACWR5	*Acourtia wrightii*	0–1	–
	weakleaf bur ragweed	AMCO3	*Ambrosia confertiflora*	0–1	–
	fringed amaranth	AMFI	*Amaranthus fimbriatus*	0–1	–
	disc mayweed	MADI6	*Matricaria discoidea*	0–1	–
	Nuttall's povertyweed	MONU	*Monolepis nuttalliana*	0–1	–
	bristly nama	NAHI	*Nama hispidum*	0–1	–
	evening primrose	OENOT	*Oenothera*	0–1	–
	lineleaf whitepuff	OLLI	*Oligomeris linifolia*	0–1	–
	locoweed	OXYTR	*Oxytropis*	0–1	–
	Florida pellitory	PAFL3	*Parietaria floridana*	0–1	–
	combseed	PECTO	*Pectocarya*	0–1	–
	manybristle chinchweed	PEPA2	*Pectis papposa*	0–1	–
	phacelia	PHACE	*Phacelia*	0–1	–

	slimjim bean	PHFI3	*Phaseolus filiformis*	0–1	–
	desert Indianwheat	PLOV	*Plantago ovata*	0–1	–
	redseed plantain	PLRH	*Plantago rhodosperma*	0–1	–
	New Mexico plumeseed	RANE	*Rafinesquia neomexicana*	0–1	–
	bluedicks	DICA14	*Dichelostemma capitatum*	0–1	–
	touristplant	DIWI2	*Dimorphocarpa wislizeni*	0–1	–
	flatcrown buckwheat	ERDE6	*Eriogonum deflexum*	0–1	–
	miniature woollystar	ERDI2	*Eriastrum diffusum*	0–1	–
	fleabane	ERIGE2	*Erigeron*	0–1	–
	common woolly sunflower	ERLA6	*Eriophyllum lanatum*	0–1	–
	Texas stork's bill	ERTE13	*Erodium texanum*	0–1	–
	California poppy	ESCAM	*Eschscholzia californica ssp. mexicana*	0–1	–
	pygmy poppy	ESMI	*Eschscholzia minutiflora*	0–1	–
	hairy desertsunflower	GECA2	*Geraea canescens*	0–1	–
	gilia	GILIA	*Gilia*	0–1	–
	morningglory	IPER	*Ipomoea eriocarpa*	0–1	–
	Arizona poppy	KAGR	*Kallstroemia grandiflora*	0–1	–
	California goldfields	LACA7	*Lasthenia californica*	0–1	–
	Gordon's bladderpod	LEGO	*Lesquerella gordonii*	0–1	–
	tuber anemone	ANTU	*Anemone tuberosa*	0–1	–
	milkvetch	ASTRA	*Astragalus*	0–1	–
	wheelscale saltbush	ATELF	*Atriplex elegans var. fasciculata*	0–1	–
	big saltbush	ATLE	*Atriplex lentiformis*	0–1	–
	Wright's saltbush	ATWR	*Atriplex wrightii*	0–1	–
	spiderling	BOERH2	*Boerhavia*	0–1	–
	hoary bowlesia	BOIN3	*Bowlesia incana*	0–1	–
	exserted Indian paintbrush	CAEXE	*Castilleja exserta ssp. exserta*	0–1	–
	yellow tackstem	CAPA7	*Calycoseris parryi*	0–1	–
	white tackstem	CAWR	*Calycoseris wrightii*	0–1	–

	southern Sierra pincushion	CHAL	*Chaenactis alpigena*	0–1	–
	whitemargin sandmat	CHAL11	*Chamaesyce albomarginata*	0–1	–
	brittle spineflower	CHBR	*Chorizanthe brevicornu*	0–1	–
	aridland goosefoot	CHDE	*Chenopodium desiccatum*	0–1	–
	hyssopleaf sandmat	CHHY3	*Chamaesyce hyssopifolia*	0–1	–
	devil's spineflower	CHRI	*Chorizanthe rigida*	0–1	–
	New Mexico thistle	CINE	*Cirsium neomexicanum*	0–1	–
	sand pygmyweed	CRCO34	*Crassula connata*	0–1	–
	cryptantha	CRYPT	*Cryptantha*	0–1	–
	fingerleaf gourd	CUDI	*Cucurbita digitata*	0–1	–
	hairy prairie clover	DAMO	*Dalea mollis*	0–1	–
	American wild carrot	DAPU3	*Daucus pusillus*	0–1	–
	carelessweed	AMPA	*Amaranthus palmeri*	0–1	–
Shrub/Vine					
7				45–90	
	triangle bur ragweed	AMDE4	*Ambrosia deltoidea*	6–17	–
	burrobush	AMDU2	*Ambrosia dumosa*	6–11	–
	white ratany	KRGR	*Krameria grayi*	2–11	–
	littleleaf ratany	KRER	*Krameria erecta*	2–6	–
	Nevada jointfir	EPNE	*Ephedra nevadensis*	0–3	–
8				45–90	
	fourwing saltbush	ATCA2	*Atriplex canescens*	6–17	–
	water jacket	LYAN	*Lycium andersonii*	0–3	–
	Berlandier's wolfberry	LYBE	*Lycium berlandieri*	0–3	–
	Arizona desert-thorn	LYEX	*Lycium exsertum*	0–3	–
	yellow paloverde	PAMI5	*Parkinsonia microphylla*	0–3	–
	desert ironwood	OLTE	*Olneya tesota*	0–2	–
	Jerusalem thorn	PAAC3	*Parkinsonia aculeata*	0–2	–
	whitethorn acacia	ACCO2	*Acacia constricta*	0–2	–
	catclaw acacia	ACGR	*Acacia greggii*	0–1	–
	crucifixion thorn	CAEM4	*Castela emoryi*	0–1	–

	creosote bush	LATR2	*Larrea tridentata*	0–1	–
	blue paloverde	PAFL6	*Parkinsonia florida*	0–1	–
	velvet mesquite	PRVE	*Prosopis velutina*	0–1	–
	lotebush	ZIOB	*Ziziphus obtusifolia*	0–1	–
9				4–22	
	alkali goldenbush	ISACA2	*Isocoma acradenia var. acradenia*	6–11	–
	burroweed	ISTE2	*Isocoma tenuisecta*	0–3	–
	desertbroom	BASA2	*Baccharis sarothroides*	0–2	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–2	–
10				22–45	
	Leconte's barrel cactus	FECYL	*Ferocactus cylindraceus var. lecontei*	0–2	–
	Emory's barrel cactus	FEEM	*Ferocactus emoryi*	0–2	–
	candy barrelcactus	FEWI	*Ferocactus wislizeni*	0–2	–
	beavertail pricklypear	OPBA2	*Opuntia basilaris*	0–2	–
	dollarjoint pricklypear	OPCH	*Opuntia chlorotica*	0–2	–
	nightblooming cereus	PEGR3	*Peniocereus greggii*	0–1	–
	banana yucca	YUBA	*Yucca baccata*	0–1	–
	twistspine pricklypear	OPMAM3	*Opuntia macrorhiza var. macrorhiza*	0–1	–
	Engelmann's hedgehog cactus	ECEN	*Echinocereus engelmannii*	0–1	–

Animal community

Perennial grasses grow year-round with available moisture. The potential plant community on this site is deficient in digestible protein in the fall and winter. Due to the coarseness of tobosa, the other perennial grasses will usually be over-used before tobosa in grazed. Utilization of these grasses should not exceed 50% in either the spring or summer growing season. In wet winters the produciton of annual grasses and forbs can provide for very high stocking rates for a March-May grazing season.

Water developments are very important to wildlife species on this site. Cover and diversity are often lacking for the larger desert mammals like mule deer and javalina but the high production of winter annuals makes this site an important springtime forage area for those

species. This site is home to a variety of small mammals and their predators.

Other information

T&E: Antilocarpa Americana sonoriensis
Sonoran pronghorn

Type locality

Location 1: Maricopa County, AZ	
Township/Range/Section	T1S R7E S15
General legal description	Chandler FO - General Motors Proving Grounds
Location 2: Pima County, AZ	
Township/Range/Section	T8S R10E S29
General legal description	Tucson FO - Deep Well Ranch
Location 3: Pima County, AZ	
General legal description	Sells FO - Shuck Toak Dist. Flat between the Vaca Hills west of Queen Well

Contributors

Dan Robinett
Dan Robinett, J. Norris
Larry D. Ellicott
Steve Barker

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	03/07/2005
Approved by	S. Cassady

Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills are common and continuous in absence of high gravel cover.

---

2. **Presence of water flow patterns:** Water flow patterns are common, continuous, occupy 15-20% of area.

---

3. **Number and height of erosional pedestals or terracettes:** Shrubs have symmetrical mounds caused by the actions of splash, erosion and rodent activity. There are no pedestals on rock or gravel fragments and no terracettes are present.

---

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is 10-60%. Expect low values in dry years.

---

5. **Number of gullies and erosion associated with gullies:** None

---

6. **Extent of wind scoured, blowouts and/or depositional areas:** No evidence of soil movement by wind.

---

7. **Amount of litter movement (describe size and distance expected to travel):** Woody litter remains under shrub canopies.

---

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil surface resistance to erosion is good under shrub canopies to moderate in interspaces due to crusts formed by raindrop impact.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Weak thin platy to granular to subgranular blocky; 5-7.5YR5/6 dry, 5-7.5YR4/6 moist, to 4 inches thick

---

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Canopy 15-25%. Herbaceous litter is present in some years and absent in others. Large shrubs with large coppice mounds with high infiltration rates. Subshrubs with small mounds with high infiltration rates. Mounds occupy 15-30% of the surface and are evenly spaced over the area.

---

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: subshrubs = large shrubs & trees > winter annuals > summer annuals > perennial grasses and forbs > succulents > cryptogams (Note: in El Nino years, annual forbs and grasses are #1 in above ground weight).

    Sub-dominant:

    Other:

    Additional:

---

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** 0-50% canopy mortality on trees & shrubs; 100% mortality on perennial grasses.

---

14. **Average percent litter cover (%) and depth (in):** Herbaceous litter is not persistent on the site.

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 250 lbs/ac unfavorable precipitation; 400 lbs/ac normal precipitation; 650 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:** Sahara mustard (potential)

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