USDA Natural Resources
Conservation Service

Ecological site R040XB221AZ
Sandy Loam, Deep 7"-10" p.z.

Accessed: 05/13/2025

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.

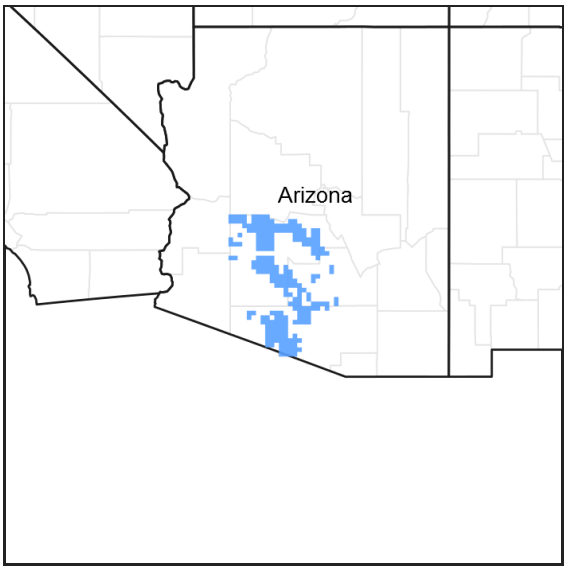

Figure 1. Mapped extent

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*
Shrub	(1) *Larrea tridentata var. tridentata* (2) *Ambrosia deltoidea*
Herbaceous	(1) *Muhlenbergia porteri* (2) *Pleuraphis rigida*

Physiographic features

This site occurs on fan terraces and stream terraces. Slopes are from 1% to 8%. Elevations range from 1000 to 2200 feet.

Table 2. Representative physiographic features

Landforms	(1) Fan (2) Terrace (3) Stream terrace
Elevation	305–671 m
Slope	1–8%

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 deep soils formed in recent sandy alluvium of mixed origins. They are sandy loam throughout to at least moderate depths (30 inches). Cambic horizons are not clayey. Plant-soil moisture relationships are fair to good. They are non-calcareous in the surface 4 inches.

Soils mapped on this site include: SSA-645 Aguila-Carefree area MU's Antho-1, 2, 3 & 115, Anthony-5 & 7, Carrizo-29, Denure-29 & 58, Maripo-3, Momoli-29, 58 & 90; SSA-653 Gila Bend-Ajo area MU's Denure-22, Momoli XGrSL-49 & Momoli-53; SSA-659 Western Pinal county MU Denure-15 & 33; SSA-703 Tohono O'odham area MU's Denure-20 and Pahaka-20 & 43.

Table 4. Representative soil features

Surface texture	(1) Sandy loam

Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately rapid
Soil depth	152 cm
Surface fragment cover <=3"	1–10%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	18.29–21.34 cm
Calcium carbonate equivalent (0-101.6cm)	1–5%
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)	1–10%
Subsurface fragment volume >3" (Depth not specified)	0%

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

The State and Transition Model and Accompanying Narrative Descriptions are Still To Be Developed for this Ecological Site. For More Information Contact The Arizona NRCS State Rangeland Management Specialist.

State 1
Historical Climax Plant Community

Community 1.1
Historical Climax Plant Community

The potential plant community on this site is a mixture of desert trees, shrubs and cacti with minor amounts of perennial grasses and forbs. Annual grasses and forbs are important in this plant community. The aspect is shrubland. Perennial, herbaceous forage species like bush muhly and globemallow are quickly removed from the plant community with heavy grazing or from drought. A few introduced, cool season, annuals like; Mediterranean grass and London rocket mustard have become entrenched on areas of this site and compete with native annual forbs and grasses. The coarse textured soils make good use of both winter and summer rainfall, but are droughty for shallow rooted species like perennial grasses and forbs. The surfaces of these soils usually lack an effective cover of gravels. Plant populations of major species include; from 1 to 10 plants per acre for the tree group, 50 to 350 plants per acre for creosotebush and 500 to 1500 plants per acre for the bursage-ratany group. Trees on this site can reach fair size due to the deep coarse textured soils.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	336	–	392
Grass/Grasslike	28	–	112
Forb	56	–	84
Tree	28	–	56
Total	**448**	**–**	**644**

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				28–56	
	bush muhly	MUPO2	*Muhlenbergia porteri*	11–45	–
	big galleta	PLRI3	*Pleuraphis rigida*	0–11	–
2				6–17	
	Parish's threeawn	ARPUP5	*Aristida purpurea var. parishii*	0–3	–
	Wright's threeawn	ARPUW	*Aristida purpurea var. wrightii*	0–3	–
	spidergrass	ARTE3	*Aristida ternipes*	0–1	–
	spidergrass	ARTEG	*Aristida ternipes var. gentilis*	0–1	–
	low woollygrass	DAPU7	*Dasyochloa pulchella*	0–1	–
	Arizona cottontop	DICA8	*Digitaria californica*	0–1	–
	plains bristlegrass	SEVU2	*Setaria vulpiseta*	0–1	–
	spike dropseed	SPCO4	*Sporobolus contractus*	0–1	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–1	–
	mesa dropseed	SPFL2	*Sporobolus flexuosus*	0–1	–
	slim tridens	TRMU	*Tridens muticus*	0–1	–
	desert needlegrass	ACSP12	*Achnatherum speciosum*	0–1	–
	Santa Rita threeawn	ARCAG	*Aristida californica var. glabrata*	0–1	–
3				6–56	
	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*	0–6	–
	Rothrock's grama	BORO2	*Bouteloua rothrockii*	0–6	–
	Eastwood fescue	VUMIC	*Vulpia microstachys var. ciliata*	0–6	–
	Pacific fescue	VUMIP	*Vulpia microstachys var. pauciflora*	0–6	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–6	–
	Arizona brome	BRAR4	*Bromus arizonicus*	0–1	–
	feather fingergrass	CHVI4	*Chloris virgata*	0–1	–
	canyon cupgrass	ERLE7	*Eriochloa lemmonii*	0–1	–
	desert lovegrass	ERPEM	*Eragrostis pectinacea var. miserrima*	0–1	–
	tufted lovegrass	ERPEP2	*Eragrostis pectinacea var. pectinacea*	0–1	–

	Mexican sprangletop	LEFUU	*Leptochloa fusca ssp. uninervia*	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				6–11	
	Alga	2ALGA	*Alga*	2–4	–
	Fungus	2FUNGI	*Fungus*	1–2	–
	Lichen	2LICHN	*Lichen*	1–2	–
	Moss	2MOSS	*Moss*	1–2	–
Forb					
5				56–84	
	desert globemallow	SPAM2	*Sphaeralcea ambigua*	0–6	–
	buckwheat	ERIOG	*Eriogonum*	0–6	–
	Coulter's globemallow	SPCO2	*Sphaeralcea coulteri*	0–3	–
	Emory's globemallow	SPEM	*Sphaeralcea emoryi*	0–3	–
	globemallow	SPHAE	*Sphaeralcea*	0–3	–
	evening primrose	OENOT	*Oenothera*	0–3	–
	desert Indianwheat	PLOV	*Plantago ovata*	0–3	–
	desert trumpet	ERIN4	*Eriogonum inflatum*	0–2	–
	combseed	PECTO	*Pectocarya*	0–2	–
	bristly fiddleneck	AMTE3	*Amsinckia tessellata*	0–2	–
	milkweed	ASCLE	*Asclepias*	0–1	–
	milkvetch	ASTRA	*Astragalus*	0–1	–
	wheelscale saltbush	ATEL	*Atriplex elegans*	0–1	–
	wheelscale saltbush	ATELF	*Atriplex elegans var. fasciculata*	0–1	–
	Wright's saltbush	ATWR	*Atriplex wrightii*	0–1	–
	desert marigold	BAMU	*Baileya multiradiata*	0–1	–
	Coulter's spiderling	BOCO2	*Boerhavia coulteri*	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	–
	whitemargin sandmat	CHAL11	*Chamaesyce albomarginata*	0–1	–
	lambsquarters	CHAL7	*Chenopodium album*	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	–
	sand pygmyweed	CRCOC	*Crassula connata var. connata*	0–1	–
	cryptantha	CRYPT	*Cryptantha*	0–1	–

	hairy prairie clover	DAMO	*Dalea mollis*	0–1	–
	American wild carrot	DAPU3	*Daucus pusillus*	0–1	–
	western tansymustard	DEPI	*Descurainia pinnata*	0–1	–
	touristplant	DIWI2	*Dimorphocarpa wislizeni*	0–1	–
	flatcrown buckwheat	ERDE6	*Eriogonum deflexum*	0–1	–
	miniature woollystar	ERDI2	*Eriastrum diffusum*	0–1	–
	erigenia	ERIGE	*Erigenia*	0–1	–
	woolly sunflower	ERIOP2	*Eriophyllum*	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	–
	spurge	EUPHO	*Euphorbia*	0–1	–
	hairy desertsunflower	GECA2	*Geraea canescens*	0–1	–
	gilia	GILIA	*Gilia*	0–1	–
	desert lily	HEUN2	*Hesperocallis undulata*	0–1	–
	Arizona poppy	KAGR	*Kallstroemia grandiflora*	0–1	–
	Gordon's bladderpod	LEGO	*Lesquerella gordonii*	0–1	–
	shaggyfruit pepperweed	LELA	*Lepidium lasiocarpum*	0–1	–
	pepperweed	LEPID	*Lepidium*	0–1	–
	foothill deervetch	LOHU2	*Lotus humistratus*	0–1	–
	Arizona lupine	LUAR4	*Lupinus arizonicus*	0–1	–
	Coulter's lupine	LUSP2	*Lupinus sparsiflorus*	0–1	–
	disc mayweed	MADI6	*Matricaria discoidea*	0–1	–
	lacy tansyaster	MAPIP4	*Machaeranthera pinnatifida ssp. pinnatifida var. pinnatifida*	0–1	–
	bristly nama	NAHI	*Nama hispidum*	0–1	–
	glandular threadplant	NEGL	*Nemacladus glanduliferus*	0–1	–
	manybristle chinchweed	PEPA2	*Pectis papposa*	0–1	–
	phacelia	PHACE	*Phacelia*	0–1	–
	Florida pellitory	PAFL3	*Parietaria floridana*	0–1	–
	brownfoot	ACWR5	*Acourtia wrightii*	0–1	–
	weakleaf bur ragweed	AMCO3	*Ambrosia confertiflora*	0–1	–
	fringed amaranth	AMFI	*Amaranthus fimbriatus*	0–1	–
	common fiddleneck	AMMEI2	*Amsinckia menziesii var. intermedia*	0–1	–
	carelessweed	AMPA	*Amaranthus palmeri*	0–1	–
	woollyhead neststraw	STMI2	*Stylocline micropoides*	0–1	–
	brownplume wirelettuce	STPA4	*Stephanomeria pauciflora*	0–1	–
	sand fringepod	THCU	*Thysanocarpus curvipes*	0–1	–
	cutleaf thelypody	THLA	*Thelypodium laciniatum*	0–1	–
	woolly tidestromia	TILA2	*Tidestromia lanuginosa*	0–1	–
	doubleclaw	PRPA2	*Proboscidea parviflora*	0–1	–
	New Mexico plumeseed	RANE	*Rafinesquia neomexicana*	0–1	–

	sleepy silene	SIAN2	*Silene antirrhina*	0–1	–
Tree					
6				28–56	
	yellow paloverde	PAMI5	*Parkinsonia microphylla*	6–17	–
	velvet mesquite	PRVE	*Prosopis velutina*	6–17	–
	desert ironwood	OLTE	*Olneya tesota*	2–11	–
Shrub/Vine					
7				84–112	
	creosote bush	LATR2	*Larrea tridentata*	84–112	–
8				224–280	
	triangle bur ragweed	AMDE4	*Ambrosia deltoidea*	56–112	–
	burrobush	AMDU2	*Ambrosia dumosa*	45–90	–
	white ratany	KRGR	*Krameria grayi*	22–45	–
	littleleaf ratany	KRER	*Krameria erecta*	11–34	–
9				6–11	
	burrobrush	HYSA	*Hymenoclea salsola*	0–2	–
	alkali goldenbush	ISACA2	*Isocoma acradenia var. acradenia*	0–1	–
	southern goldenbush	ISPL	*Isocoma pluriflora*	0–1	–
	burroweed	ISTE2	*Isocoma tenuisecta*	0–1	–
	sangre de cristo	JACA2	*Jatropha cardiophylla*	0–1	–
	Arizona nettlespurge	JACI	*Jatropha cinerea*	0–1	–
	water jacket	LYAN	*Lycium andersonii*	0–1	–
	Berlandier's wolfberry	LYBE	*Lycium berlandieri*	0–1	–
	Arizona desert-thorn	LYEX	*Lycium exsertum*	0–1	–
	whitestem paperflower	PSCO2	*Psilostrophe cooperi*	0–1	–
	Mexican bladdersage	SAME	*Salazaria mexicana*	0–1	–
	arrow poision plant	SEBI9	*Sebastiania bilocularis*	0–1	–
	desertrue	THAMN	*Thamnosma*	0–1	–
	lotebush	ZIOB	*Ziziphus obtusifolia*	0–1	–
	whitethorn acacia	ACCO2	*Acacia constricta*	0–1	–
	rayless goldenhead	ACSP	*Acamptopappus sphaerocephalus*	0–1	–
	cattle saltbush	ATPO	*Atriplex polycarpa*	0–1	–
	desertbroom	BASA2	*Baccharis sarothroides*	0–1	–
	brittlebush	ENFA	*Encelia farinosa*	0–1	–
	Nevada jointfir	EPNE	*Ephedra nevadensis*	0–1	–
	ocotillo	FOSP2	*Fouquieria splendens*	0–1	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–1	–
10				6–28	
	Engelmann's hedgehog cactus	ECEN	*Echinocereus engelmannii*	0–2	–
	candy barrelcactus	FEWI	*Ferocactus wislizeni*	0–2	–
	beavertail pricklypear	OPBA2	*Opuntia basilaris*	0–1	–
	senita cactus	PASC14	*Pachycereus schottii*	0–1	–
	nightblooming cereus	PEGR3	*Peniocereus greggii*	0–1	–

	organpipe cactus	STTH3	*Stenocereus thurberi*	0–1	–

Animal community

This site produces very little herbaceous forage for year round use. In wet winters the production of cool season annual forbs and grasses can be high and provides for considerable extra grazing capacity in the March-May season.

Water developments are very important to wildlife species on this site. Cover and diversity are lacking for the larger desert mammals. This site is home to a variety of small mammals, reptiles and their predators.

Other information

T&E: Antilocapra Americana sonoriensis
(Sonoran pronghorn)
Leptonycteris curasoae yerbebuena
(Lesser long-nosed bat)

Type locality

Location 1: Maricopa County, AZ	
Township/Range/Section	T6N R14W S3
General legal description	Phoenix FO - Cunningham Pass
Location 2: Maricopa County, AZ	
Township/Range/Section	T1N R8E S19
General legal description	Chandler FO - Apache Junction
Location 3: Pinal County, AZ	
Township/Range/Section	T5S R7E S18
General legal description	Casa Grande FO - Sacaton Mountain
Location 4: Pima County, AZ	
Township/Range/Section	T17S R1E S21
General legal description	Sells FO - Kupk Hills
Location 5: Pima County, AZ	
Township/Range/Section	T14S R5W S28
General legal description	Tucson FO - Organ Pipe National Monument
Location 6: Pima County, AZ	
Township/Range/Section	T12S R6E S15
General legal description	Tucson FO - Aguirre Valley
Location 7: Maricopa County, AZ	
Township/Range/Section	T8S R2W S4
General legal description	Buckeye FO - Sand Tank Valley

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	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, and 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):** 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):** Herbaceous litter can move by wind and water. 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 thir platy to granular; 7.5-10YR6/4 dry, 7.5-10YR4/4 moist, to 2 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 mouds 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 > trees > large shrubs > winter annuals > summer annuals > perennial grasses and forbs > succulents > crytogams (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, 90-100% 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):** 300 lbs/ac unfavorable precipitation; 500 lbs/ac normal precipitation; 750 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), schismus, filaree

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