

## Ecological site R038XB215AZ Clayey Hills 16-20" 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.

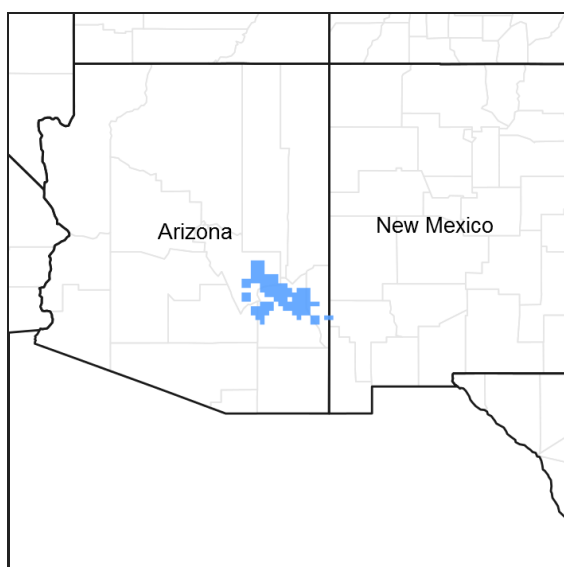


Figure 1. Mapped extent

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): 038X–Mogollon Transition South

AZ 38.2 - Middle Mogollon Transition

Elevations range from 4000 to 5500 feet and precipitation averages 16 to 20 inches per year. Vegetation includes turbinella oak, Wright siltkassel, hollyleaf buckthorn, desert buckbrush, one-seed juniper, alligator juniper, pinyon, algerita, sugar sumac, prairie junegrass, blue grama, curly mesquite, bottlebrush squirreltail, muttongrass, cane beardgrass, plains lovegrass and bullgrass. The soil temperature regime ranges from thermic to mesic and the soil moisture regime is aridic ustic. This unit occurs within the Transition Zone Physiographic Province and is characterized by canyons and structural troughs or valleys. Igneous, metamorphic and sedimentary rock classes occur on rough mountainous terrain in association with less extensive sediment filled valleys exhibiting little integrated drainage.

### Classification relationships

Similar site to TES (Terrestrial Ecosystem site) map unit numbers 430, 441, 462, 464 and 465, on the Prescott national Forest in Yavapai county in central Arizona.

### Associated sites

R038XB202AZ	<b>Clayey Upland 16-20" p.z.</b>
R038XB203AZ	<b>Clay Loam Upland 16-20" p.z.</b>
R038XB209AZ	<b>Loamy Upland 16-20" p.z.</b>

## Similar sites

R041XC301AZ	<b>Basalt Hills 12-16" p.z.</b>
R038XA117AZ	<b>Volcanic Hills 12-16" p.z. Clayey</b>

**Table 1. Dominant plant species**

Tree	(1) <i>Juniperus</i> (2) <i>quercus</i>
Shrub	(1) <i>eriogonum wrightii</i> (2) <i>Opuntia engelmannii</i> var. <i>engelmannii</i>
Herbaceous	(1) <i>bouteloua curtipendula</i> (2) <i>leptochloa dubia</i>

## Physiographic features

This site occurs in the middle to upper elevations of the Mogollon Transition zone, south of the Rim in central Arizona. It occurs on rugged mountain slopes, ridge-tops and mesa sides.

**Table 2. Representative physiographic features**

Landforms	(1) Hill (2) Mountain slope (3) Ridge
Flooding frequency	None
Elevation	1,219–1,798 m
Slope	15–70%
Aspect	N, E, S

## Climatic features

Precipitation in this common resource area averages 16 to 20 inches annually. The winter-summer rainfall ratio ranges from about 60/40% in the western part of the area to 45/55% in the eastern part. Summer rains fall July through September; and are from high-intensity, convective, thunderstorms. This moisture originates primarily from the Gulf of Mexico, but can come from the remnants of Pacific hurricanes in September. Winter moisture is frontal, originates in the north Pacific, and falls as rain or snow in widespread storms of low intensity and long duration. Snowfall ranges from 5 to 35 inches per year and can occur from November through April. Snow seldom persists for more than a week. May and June are the driest months of the year. Humidity is moderate to low all year. Average annual air temperatures range from 51 to 60 degrees F (thermic temperature regime). Daytime temperatures in the summer are commonly in the low 90's. Freezing temperatures are common from October through April. The actual precipitation, available moisture and temperature vary, depending on, region, elevation, rain shadow effect and aspect.

**Table 3. Representative climatic features**

Frost-free period (average)	180 days
Freeze-free period (average)	240 days
Precipitation total (average)	508 mm

## Influencing water features

There are no water features associated with this site.

## Soil features

These soils are shallow (10 to 20 inches) and dark colored. They are clayey throughout (smectitic) and well drained. They have formed in residuum and slope alluvium from basalt, andesite, related volcanic tuffs and ash, and quartzite. The surface textures are clayloam to clay. Surfaces are well covered by dark colored; gravels, cobbles and stones. The effective rooting depth is limited by hard bedrock at 10 to 20 inches. Runoff is moderate to high on moist soils. The erosion hazard is slight due to gravel, cobble and rock covers.

The soils mapped on this site include: SSA663 Gila-Duncan area MU's 13 Cabezon & 34 Luzena and SSA675 San Carlos IR area MU's 9 Beaumain, 16 Beaumain & Budlamp, 44 Beaumain & Kuykendall, 47 Beaumain & Limpia family, 69 Magoffin & Beaumain, 22 Cherrycow family, 27 Coppercan, 43 Hurds family & Brunopeak, 46 Kuykendall & Woodcutter, 67 Ustorthents & Haplustolls, 68 Argiustolls & Haplustepts, 88 Turist family.

**Table 4. Representative soil features**

Parent material	(1) Residuum–basalt (2) Slope alluvium–andesite
Surface texture	(1) Very cobbly clay (2) Cobbly clay loam (3) Stony clay loam
Family particle size	(1) Clayey
Drainage class	Moderately well drained to well drained
Permeability class	Moderately slow to slow
Soil depth	25–51 cm
Surface fragment cover <=3"	25–50%
Surface fragment cover >3"	5–15%
Available water capacity (0-101.6cm)	2.03–6.1 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)	7–8.2
Subsurface fragment volume <=3" (Depth not specified)	15–45%
Subsurface fragment volume >3" (Depth not specified)	1–10%

## Ecological dynamics

The historic native plant community is a mixed grassland with lesser amounts of trees, shrubs, succulents, forbs and grasses. Southern exposures have a grassland aspect. Northern exposures have a mixed shrub, tree and grassland community. The plant community includes a diverse flora of native annual grasses and forbs of both the winter and summer seasons. Periodic wildfires occurred at moderate intervals (10 to 15 years) and helped maintain a balance between herbaceous plants and shrubs. In the absence of fire for longer periods, shrubby species, trees and cacti can become dominant. The interactions of drought, fire and continuous livestock grazing can, over time, result in the loss of palatable perennial grasses and half shrubs. In "El Nino" years following summer drought,

annual forbs like; goldeneye, bitterweed and sunflower can dominate the plant community for a short time, especially on warm exposures, until perennial grasses can recover their basal cover. In some situations non-native annuals can dominate the site. These species can , over time, diminish the soil seed-bank of native annual species. Non-native annuals can act to increase the fire frequency of areas of the site near roads and urban areas, where the incidence of man-made fires is high.

## State and transition model

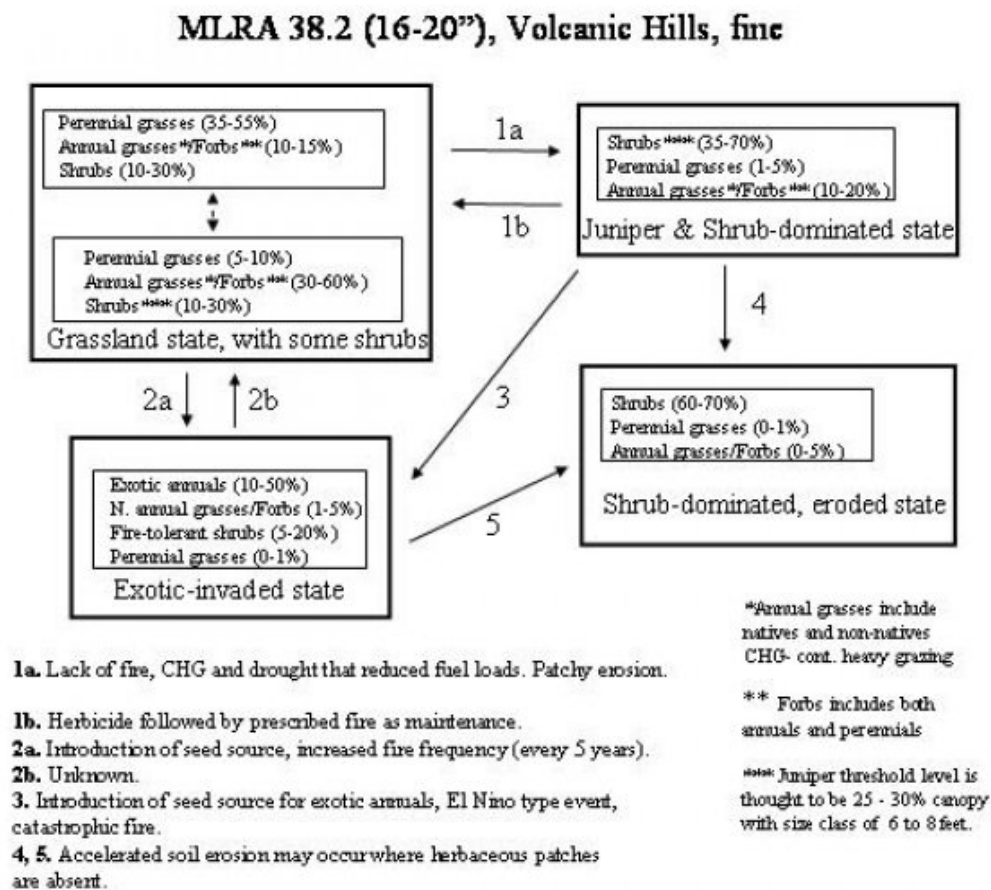


Figure 4. State and Transition, Volcanic Hills, fine 16-20"

## State 1 Grassland State

### Community 1.1 Historic Native Plant Community

Grassland state, with some shrubs



\* Left photo is potential plant community of mid-grasses on a southern exposure; 5 years after fire (elevation 5200 ft.).  
 \* Right photo is potential plant community on a northern exposure, with turbinella and emory oak, beargrass and juniper.  
 \* Total canopy cover ranges from 60% to 85%.

Juniper, cacti and shrub dominated state



\* Left photo is a south slope dominated by high canopy cover of whitethorn acacia, prickly pear and one seed juniper.  
 \* Right photo shows an east aspect, with a 30% canopy of redberry juniper plus whitethorn acacia and prickly pear, at 4200 ft. elevation.  
 \* Neither area has experienced fire for at least 40 years.

Shrub dominated, eroded state



\* Left photo is a south aspect at 5000 ft. elevation, with shrubs like mesquite, catclaw acacia, whitethorn acacia, and prickly pear, and few remaining perennial grasses.  
 \* Right photo shows heavy stand of annual goldeneye in the understory of the only grassed southwest facing slopes.  
 \* Trailing from heavy livestock use causes compaction and accelerated sheet and rill erosion.

Reintroduction of Fire



\* Left photo is of a north facing slope burned in 1995 to control invasion of redberry and one seed juniper.  
 \* Right photo is of Somboro Butte in eastern Pinal county that has burned, completely, three times in the last 40 years.

Figure 5. Volcanic Hills, clayey 16-20" pz. photos

The historic, native, plant community is a grassland dominated by sideoats and blue grama, green sprangletop, plains lovegrass and cane beardgrass and dotted with trees and shrubs. Cool season grasses like prairie junegrass, bottlebrush squirreltail and muttongrass are important in the plant community. A rich flora of native annual forbs and grasses, of both the winter and summer seasons, exist in the plant community. Periodic, naturally occurring, wildfires were important in maintaining the potential plant community. Northern exposures have a higher percentage of cool season grasses and trees and shrubs than will occur on south slopes. Grass cover on north aspects will range from 10-30% with 20-35% cover of trees and shrubs. North slopes will also be more likely to experience tree increases especially singleleaf pinon and oak species. Southern exposures will have a higher percentage of perennial grasses and half shrubs in the plant community. Grass cover on south aspects will range from 25-45% with 10-15% cover of shrubs. Shrubs like prickly pear, wait a bit mimosa, mesquite and juniper can increase to dominate southern exposures. At elevations near precipitation zone upper boundaries the northern slopes will look more like the woodland plant community of the 20 inch precip zone in MLRA 39. At lower precipitaion zone boundaries southern exposures will look more like the plant community of the site in the 12 to 16 inch precip zone of MLRA 38.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	684	897	1233
Shrub/Vine	168	448	897
Forb	39	168	504
Tree	11	56	168
<b>Total</b>	<b>902</b>	<b>1569</b>	<b>2802</b>

Table 6. Ground cover

Tree foliar cover	0-1%
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Shrub/vine/liana foliar cover	2-8%
Grass/grasslike foliar cover	4-8%
Forb foliar cover	0-1%
Non-vascular plants	0-1%
Biological crusts	0-1%
Litter	15-55%
Surface fragments >0.25" and <=3"	25-50%
Surface fragments >3"	5-15%
Bedrock	5-15%
Water	0%
Bare ground	3-15%

**Table 7. Canopy structure (% cover)**

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

**Figure 7. Plant community growth curve (percent production by month).**  
**AZ3812, 38.2 16-20" p.z. all sites. Growth begins in the spring and continues into the summer and fall..**

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

## State 2

### Juniper and Shrub Dominated State

#### Community 2.1

##### Juniper and Shrub Dominated Plant Community

Perennial grass canopy cover is reduced due to the interactions of drought, grazing and / or fire. Juniper, turbinella oak and cacti can increase to dominate the overstory plant community. Juniper increases from areas of rock outcrop, that are protected from severe fire due to lack of fuel. When juniper cover exceeds 30%, and size class exceeds 6-8 ft., fire may no longer be effective in restoring a balance to the plant community. Annuals , both native and non-native, can dominate the understory. Fire frequency is reduced but the site can still burn, especially after "E Nino" years produce heavy fuel loads of annual grasses and forbs.

## State 3

### Shrub Dominated and Eroded State

#### Community 3.1

## Shrub Dominated and Eroded Plant Community

Shrubs like, whitethorn acacia, mesquite, wait a bit mimosa and turbinella oak; succulents like, prickley pear and cane cholla and trees like, juniper species and singleleaf pinyon can increase to dominate the site in the absence of fire for very long periods of time. Under these circumstances, northern aspects can resemble woodlands. Native and non-native annual forbs and grasses can dominate the understory. The major woody plants are fire resistant once established. Catastrophic fires would remove less tolerant species like pinyon and cacti and leave intact the sprouting woody plants to become more and more dominant. Extreme rainfall events coupled with; the fire, drought and grazing interaction, can lead to rilling of steep slopes.

### State 4

#### Exotic - Invaded state

### Community 4.1

#### Exotic Forb and Grass Invaded Plant Community

Non-native annual grasses and forbs like; red brome, cheatgrass, and wild oats, can invade and dominate areas of the site with very low perennial grass cover. These species can, over time, reduce the seed-bank of native annual grasses and forbs. Their presence can increase the fire frequency (of man made fires) especially where roads and urban areas are adjacent to areas of the site.

## Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>mid grasses</b>			448–560	
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	112–392	–
	green sprangletop	LEDU	<i>Leptochloa dubia</i>	56–224	–
	plains lovegrass	ERIN	<i>Eragrostis intermedia</i>	11–168	–
	cane bluestem	BOBA3	<i>Bothriochloa barbinodis</i>	22–112	–
2	<b>cool season grasses</b>			56–112	
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	11–84	–
	muttongrass	POFE	<i>Poa fendleriana</i>	0–56	–
	squirreltail	ELEL5	<i>Elymus elymoides</i>	6–56	–
	muttongrass	POFEL	<i>Poa fendleriana ssp. longiligula</i>	0–28	–
	bluebunch wheatgrass	PSSP6	<i>Pseudoroegneria spicata</i>	0–28	–
	desert needlegrass	ACSP12	<i>Achnatherum speciosum</i>	0–22	–
3	<b>misc. perennial grasses</b>			56–224	
	spidergrass	ARTE3	<i>Aristida ternipes</i>	11–56	–
	black grama	BOER4	<i>Bouteloua eriopoda</i>	11–56	–
	vine mesquite	PAOB	<i>Panicum obtusum</i>	0–56	–
	Texas bluestem	SCCI2	<i>Schizachyrium cirratum</i>	0–56	–
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	0–56	–
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	0–28	–
	tobosagrass	PLMU3	<i>Pleuraphis mutica</i>	0–28	–
	plains bristlegrass	SEVU2	<i>Setaria vulpiseta</i>	0–28	–
	slim tridens	TRMUE	<i>Tridens muticus var. elongatus</i>	0–28	–
	bush muhly	MUPO2	<i>Muhlenbergia porteri</i>	0–28	–

	deergrass	MURI2	<i>Muhlenbergia rigens</i>	0–28	–
	spidergrass	ARTEG	<i>Aristida ternipes</i> var. <i>gentilis</i>	0–28	–
	purple threeawn	ARPUP6	<i>Aristida purpurea</i> var. <i>purpurea</i>	0–28	–
	Arizona cottontop	DICA8	<i>Digitaria californica</i>	0–22	–
	southwestern bristlegrass	SESC2	<i>Setaria scheelei</i>	0–22	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	0–17	–
	New Mexico muhly	MUPA2	<i>Muhlenbergia pauciflora</i>	0–17	–
	bullgrass	MUEM	<i>Muhlenbergia emersleyi</i>	0–11	–
	slender muhly	MUTE4	<i>Muhlenbergia tenuifolia</i>	0–11	–
	blue threeawn	ARPUN	<i>Aristida purpurea</i> var. <i>nealleyi</i>	0–11	–
	Parish's threeawn	ARPUP5	<i>Aristida purpurea</i> var. <i>parishii</i>	0–11	–
	Fendler threeawn	ARPUL	<i>Aristida purpurea</i> var. <i>longiseta</i>	0–6	–
4	<b>annual grasses</b>			11–112	
	sixweeks threeawn	ARAD	<i>Aristida adscensionis</i>	0–112	–
	prairie threeawn	AROL	<i>Aristida oligantha</i>	0–112	–
	needle grama	BOAR	<i>Bouteloua aristidoides</i>	0–112	–
	Mexican sprangletop	LEFUU	<i>Leptochloa fusca</i> ssp. <i>uninervia</i>	22–112	–
	mucronate sprangletop	LEPAB	<i>Leptochloa panicea</i> ssp. <i>brachiata</i>	22–112	–
	Mexican panicgrass	PAHI5	<i>Panicum hirticaule</i>	0–112	–
	sticky sprangletop	LEVI5	<i>Leptochloa viscida</i>	0–56	–
	small fescue	VUMI	<i>Vulpia microstachys</i>	0–56	–
	Eastwood fescue	VUMIC	<i>Vulpia microstachys</i> var. <i>ciliata</i>	0–56	–
	sixweeks fescue	VUOC	<i>Vulpia octoflora</i>	0–56	–
	witchgrass	PACA6	<i>Panicum capillare</i>	0–56	–
	sixweeks grama	BOBA2	<i>Bouteloua barbata</i>	0–56	–
	Arizona brome	BRAR4	<i>Bromus arizonicus</i>	0–56	–
	feather fingergrass	CHVI4	<i>Chloris virgata</i>	0–56	–
	little barley	HOPU	<i>Hordeum pusillum</i>	0–34	–
	canyon cupgrass	ERLE7	<i>Eriochloa lemmonii</i>	0–28	–
	tufted lovegrass	ERPE	<i>Eragrostis pectinacea</i>	0–28	–
	desert lovegrass	ERPEM	<i>Eragrostis pectinacea</i> var. <i>miserrima</i>	0–28	–
	delicate muhly	MUFR	<i>Muhlenbergia fragilis</i>	0–28	–
	littleseed muhly	MUMI	<i>Muhlenbergia microsperma</i>	0–28	–
	Bigelow's bluegrass	POBI	<i>Poa bigelovii</i>	0–28	–
	Arizona signalgrass	URAR	<i>Urochloa arizonica</i>	0–28	–
5	<b>short grasses</b>			112–224	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	6–56	–
	purple grama	BORA	<i>Bouteloua radicata</i>	6–56	–
	slender grama	BORE2	<i>Bouteloua repens</i>	6–56	–
	curly-mesquite	HIBE	<i>Hilaria belangeri</i>	6–56	–
	Hall's panicgrass	PAHA	<i>Panicum hallii</i>	1–56	–
	slim tridens	TRMU	<i>Tridens muticus</i>	0–28	–
	common wolfstail	LYPH	<i>Lycurus phleoides</i>	0–28	–



	hairy grama	BOHI2	<i>Bouteloua hirsuta</i>	0–28	–
	sprucetop grama	BOCH	<i>Bouteloua chondrosioides</i>	0–11	–
<b>Forb</b>					
6	<b>perennial forbs</b>			28–168	
	white sagebrush	ARLUM2	<i>Artemisia ludoviciana</i> ssp. <i>mexicana</i>	6–56	–
	Wright's thimblehead	HYWR	<i>Hymenothrix wrightii</i>	1–56	–
	tarragon	ARDR4	<i>Artemisia dracunculus</i>	1–28	–
	southwestern mock vervain	GLGO	<i>Glandularia gooddingii</i>	1–17	–
	Indian rushpea	HOGL2	<i>Hoffmannseggia glauca</i>	1–17	–
	largeflower onion	ALMA4	<i>Allium macropetalum</i>	0–17	–
	wealeaf bur ragweed	AMCO3	<i>Ambrosia confertiflora</i>	1–17	–
	bluedicks	DICA14	<i>Dichelostemma capitatum</i>	2–17	–
	desert globemallow	SPAM2	<i>Sphaeralcea ambigua</i>	1–17	–
	brownplume wirelettuce	STPA4	<i>Stephanomeria pauciflora</i>	0–17	–
	prairie spiderwort	TROC	<i>Tradescantia occidentalis</i>	0–11	–
	hillside vervain	VENE	<i>Verbena neomexicana</i>	0–11	–
	scarlet spiderling	BOCO	<i>Boerhavia coccinea</i>	0–11	–
	fineleaf hymenopappus	HYFIL	<i>Hymenopappus filifolius</i> var. <i>lugens</i>	0–11	–
	El Paso skyrocket	IPTH2	<i>Ipomopsis thurberi</i>	0–11	–
	gumhead	GYGL	<i>Gymnosperma glutinosum</i>	0–11	–
	Wright's deervetch	LOWR	<i>Lotus wrightii</i>	0–11	–
	lacy tansyaster	MAPI	<i>Machaeranthera pinnatifida</i>	1–11	–
	wishbone-bush	MILAV	<i>Mirabilis laevis</i> var. <i>villosa</i>	0–6	–
	Colorado four o'clock	MIMU	<i>Mirabilis multiflora</i>	0–6	–
	lemon beebalm	MOCIA	<i>Monarda citriodora</i> ssp. <i>austromontana</i>	0–6	–
	pearly globe amaranth	GONI	<i>Gomphrena nitida</i>	0–6	–
	Arizona wrightwort	CAAR7	<i>Carlowrightia arizonica</i>	0–6	–
	fleabane	ERIGE2	<i>Erigeron</i>	1–6	–
	Arizona snakecotton	FRAR2	<i>Froelichia arizonica</i>	0–6	–
	Cooley's bundleflower	DECO2	<i>Desmanthus cooleyi</i>	0–6	–
	tuber anemone	ANTU	<i>Anemone tuberosa</i>	0–6	–
	Braun's rockcress	ARPE3	<i>Arabis perstellata</i>	0–6	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	0–6	–
	dwarf Indian mallow	ABPA3	<i>Abutilon parvulum</i>	0–6	–
	brownfoot	ACWR5	<i>Acourtia wrightii</i>	0–6	–
	trailing windmills	ALIN	<i>Allionia incarnata</i>	0–6	–
	vetch	VICIA	<i>Vicia</i>	0–6	–
	branched noseburn	TRRA5	<i>Tragia ramosa</i>	0–6	–
	Rusby's globemallow	SPRU2	<i>Sphaeralcea rusbyi</i>	0–6	–
	Parry's beardtongue	PEPA24	<i>Penstemon parryi</i>	0–6	–
	canaigre dock	RUHY	<i>Rumex hymenosepalus</i>	0–6	–
	twinleaf senna	SEBA3	<i>Senna bauhinioides</i>	0–6	–

	Lemmon's ragwort	SELE8	<i>Senecio lemmonii</i>	0–6	–
	longflower tube tongue	JULO3	<i>Justicia longii</i>	0–6	–
	desert larkspur	DEPA	<i>Delphinium parishii</i>	0–2	–
	tall mountain larkspur	DESC	<i>Delphinium scaposum</i>	0–2	–
	sego lily	CANU3	<i>Calochortus nuttallii</i>	0–2	–
	wavyleaf Indian paintbrush	CAAPM	<i>Castilleja applegatei</i> ssp. <i>martinii</i>	0–2	–
	ragged nettlespurge	JAMA	<i>Jatropha macrorhiza</i>	0–2	–
	New Mexico groundsel	PANE7	<i>Packera neomexicana</i>	0–2	–
	Oak Creek ragwort	PAQU8	<i>Packera quercetorum</i>	0–1	–
	toadflax penstemon	PELI2	<i>Penstemon linarioides</i>	0–1	–
	desert penstemon	PEPS	<i>Penstemon pseudospectabilis</i>	0–1	–
	scurfpea	PSORA2	<i>Psoralidium</i>	0–1	–
7	<b>annual forbs</b>			11–336	
	bristly fiddleneck	AMTE3	<i>Amsinckia tessellata</i>	0–84	–
	California poppy	ESCAM	<i>Eschscholzia californica</i> ssp. <i>mexicana</i>	0–84	–
	longleaf false goldeneye	HELOA2	<i>Helimeris longifolia</i> var. <i>annua</i>	0–56	–
	bitter rubberweed	HYOD	<i>Hymenoxys odorata</i>	0–56	–
	carelessweed	AMPA	<i>Amaranthus palmeri</i>	0–56	–
	milkvetch	ASTRA	<i>Astragalus</i>	0–56	–
	Forb, annual	2FA	<i>Forb, annual</i>	0–56	–
	manybristle chinchweed	PEPA2	<i>Pectis papposa</i>	0–56	–
	Arizona popcornflower	PLAR	<i>Plagiobothrys arizonicus</i>	6–56	–
	creamcups	PLCA5	<i>Platystemon californicus</i>	0–56	–
	desert Indianwheat	PLOV	<i>Plantago ovata</i>	1–56	–
	woolly plantain	PLPA2	<i>Plantago patagonica</i>	1–56	–
	crestrib morning-glory	IPCO2	<i>Ipomoea costellata</i>	0–56	–
	trefoil	LOTUS	<i>Lotus</i>	0–56	–
	Arizona lupine	LUAR4	<i>Lupinus arizonicus</i>	0–56	–
	Coulter's lupine	LUSP2	<i>Lupinus sparsiflorus</i>	0–56	–
	slender goldenweed	MAGR10	<i>Machaeranthera gracilis</i>	0–56	–
	tanseyleaf tansyaster	MATA2	<i>Machaeranthera tanacetifolia</i>	0–56	–
	hollowleaf annual lupine	LUSU3	<i>Lupinus succulentus</i>	0–28	–
	miniature lupine	LUBI	<i>Lupinus bicolor</i>	0–28	–
	hairy caltrop	KAHI	<i>Kallstroemia hirsutissima</i>	0–28	–
	California goldfields	LACA7	<i>Lasthenia californica</i>	0–28	–
	Goodding's bladderpod	LEGO2	<i>Lesquerella gooddingii</i>	0–28	–
	shaggyfruit pepperweed	LELA	<i>Lepidium lasiocarpum</i>	0–28	–
	Thurber's pepperweed	LETH2	<i>Lepidium thurberi</i>	0–28	–
	foothill deervetch	LOHU2	<i>Lotus humistratus</i>	0–28	–
	purslane	PORTU	<i>Portulaca</i>	0–28	–
	phacelia	PHACE	<i>Phacelia</i>	0–28	–
	coastal bird's-foot trefoil	LOSA	<i>Lotus salsuginosus</i>	0–28	–
	New Mexico plumeseed	RANE	<i>Rafinesquia neomexicana</i>	0–28	–

	Coulter's spiderling	BOCO2	<i>Boerhavia coulteri</i>	0–28	–
	fivewing spiderling	BOIN	<i>Boerhavia intermedia</i>	0–28	–
	hoary bowlesia	BOIN3	<i>Bowlesia incana</i>	0–28	–
	New Mexico thistle	CINE	<i>Cirsium neomexicanum</i>	0–28	–
	cryptantha	CRYPT	<i>Cryptantha</i>	0–28	–
	western tansymustard	DEPI	<i>Descurainia pinnata</i>	0–28	–
	miniature woollystar	ERDI2	<i>Eriastrum diffusum</i>	0–28	–
	spreading fleabane	ERDI4	<i>Erigeron divergens</i>	0–28	–
	spurge	EUPHO	<i>Euphorbia</i>	0–28	–
	curlycup gumweed	GRSQ	<i>Grindelia squarrosa</i>	0–28	–
	common sunflower	HEAN3	<i>Helianthus annuus</i>	0–28	–
	sorrel buckwheat	ERPO4	<i>Eriogonum polycladon</i>	0–17	–
	American wild carrot	DAPU3	<i>Daucus pusillus</i>	0–17	–
	scrambled eggs	COAU2	<i>Corydalis aurea</i>	0–17	–
	ragwort	SENEC	<i>Senecio</i>	0–17	–
	spreading fanpetals	SIAB	<i>Sida abutifolia</i>	0–17	–
	sleepy silene	SIAN2	<i>Silene antirrhina</i>	0–17	–
	New Mexico fanpetals	SINE	<i>Sida neomexicana</i>	0–17	–
	sand fringe pod	THCU	<i>Thysanocarpus curvipes</i>	0–17	–
	green carpetweed	MOVE	<i>Mollugo verticillata</i>	0–17	–
	evening primrose	OENOT	<i>Oenothera</i>	0–17	–
	Florida pellitory	PAFL3	<i>Parietaria floridana</i>	0–17	–
	desert unicorn-plant	PRAL4	<i>Proboscidea althaeifolia</i>	0–17	–
	doubleclaw	PRPA2	<i>Proboscidea parviflora</i>	0–17	–
	sweet four o'clock	MILO2	<i>Mirabilis longiflora</i>	0–11	–
	annual agoseris	AGHE2	<i>Agoseris heterophylla</i>	0–11	–
	star gilia	GIST	<i>Gilia stellata</i>	0–6	–
	desertparsley	LOMAT	<i>Lomatium</i>	0–6	–
	grassleaf lettuce	LAGRA	<i>Lactuca graminifolia</i> var. <i>arizonica</i>	0–6	–

#### Shrub/Vine

8	<b>deciduous shrubs</b>			28–112	
	Texas mulberry	MOMI	<i>Morus microphylla</i>	0–28	–
	cliff fendlerbush	FERU	<i>Fendlera rupicola</i>	0–28	–
	singleleaf ash	FRAN2	<i>Fraxinus anomala</i>	0–17	–
	singleleaf ash	FRANL	<i>Fraxinus anomala</i> var. <i>lowellii</i>	0–17	–
	common hoptree	PTTRA	<i>Ptelea trifoliata</i> ssp. <i>angustifolia</i>	0–17	–
	desert sweet	CHMI2	<i>Chamaebatiaria millefolium</i>	0–17	–
	Wright's beebrush	ALWR	<i>Aloysia wrightii</i>	0–17	–
	New Mexico locust	RONE	<i>Robinia neomexicana</i>	0–17	–
	Arizona necklace pod	SOAR3	<i>Sophora arizonica</i>	0–11	–
	currant	RIBES	<i>Ribes</i>	0–11	–
	ambrosia leaf bur ragweed	AMAM2	<i>Ambrosia ambrosioides</i>	0–11	–
	Thurber's desert honeysuckle	ANTH2	<i>Anisacanthus thurberi</i>	0–11	–

	whitethorn acacia	ACCO2	<i>Acacia constricta</i>	0–11	–
	catclaw acacia	ACGR	<i>Acacia greggii</i>	0–11	–
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	0–6	–
	skunkbush sumac	RHTR	<i>Rhus trilobata</i>	0–6	–
	catclaw mimosa	MIACB	<i>Mimosa aculeaticarpa</i> var. <i>biuncifera</i>	0–6	–
	pale desert-thorn	LYPA	<i>Lycium pallidum</i>	0–2	–
9	<b>half shrubs</b>			22–168	
	bastardsage	ERWR	<i>Eriogonum wrightii</i>	0–56	–
	rough menodora	MESC	<i>Menodora scabra</i>	2–56	–
	Wright's snakeroot	AGWR2	<i>Ageratina wrightii</i>	0–28	–
	California brickellbush	BRCA3	<i>Brickellia californica</i>	0–22	–
	Coulter's brickellbush	BRCO	<i>Brickellia coulteri</i>	0–17	–
	fairyduster	CAER	<i>Calliandra eriophylla</i>	0–11	–
	yerba de pasmo	BAPT	<i>Baccharis pteronioides</i>	0–11	–
	starry bedstraw	GAST	<i>Galium stellatum</i>	0–11	–
	longleaf phlox	PHLO2	<i>Phlox longifolia</i>	0–11	–
	heartleaf goldeneye	VICO	<i>Viguiera cordifolia</i>	0–11	–
	toothleaf goldeneye	VIDEL2	<i>Viguiera dentata</i> var. <i>lancifolia</i>	0–11	–
	littleleaf ratany	KRER	<i>Krameria erecta</i>	0–6	–
	spiny menodora	MESP2	<i>Menodora spinescens</i>	0–6	–
10	<b>succulents</b>			22–168	
	sacahuista	NOMI	<i>Nolina microcarpa</i>	11–112	–
	cactus apple	OPEN3	<i>Opuntia engelmannii</i>	6–56	–
	goldenflower century plant	AGCH2	<i>Agave chrysantha</i>	0–39	–
	walkingstick cactus	CYSP8	<i>Cylindropuntia spinosior</i>	0–28	–
	banana yucca	YUBA	<i>Yucca baccata</i>	1–22	–
	common sotol	DAWH2	<i>Dasyllirion wheeleri</i>	0–17	–
	Palmer's century plant	AGPA3	<i>Agave palmeri</i>	0–17	–
	Parry's agave	AGPA4	<i>Agave parryi</i>	0–17	–
	Schott's century plant	AGSC3	<i>Agave schottii</i>	0–17	–
	Whipple cholla	CYWH	<i>Cylindropuntia whipplei</i>	0–11	–
	soaptree yucca	YUEL	<i>Yucca elata</i>	0–11	–
	twistspine pricklypear	OPMA2	<i>Opuntia macrorhiza</i>	0–11	–
	dollarjoint pricklypear	OPCH	<i>Opuntia chlorotica</i>	0–11	–
	candy barrelcactus	FEWI	<i>Ferocactus wislizeni</i>	0–6	–
	Graham's nipple cactus	MAGR9	<i>Mammillaria grahamii</i>	1–6	–
	Arizona hedgehog cactus	ECCOA	<i>Echinocereus coccineus</i> var. <i>arizonicus</i>	0–6	–
	Engelmann's hedgehog cactus	ECEN	<i>Echinocereus engelmannii</i>	0–2	–
	pinkflower hedgehog cactus	ECFE	<i>Echinocereus fendleri</i>	0–2	–
	spiny star	ESVI2	<i>Escobaria vivipara</i>	0–1	–
11	<b>increaser half-shrubs</b>			0–56	

	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	1–34	–
	burroweed	ISTE2	<i>Isocoma tenuisecta</i>	0–17	–
	turpentine bush	ERLA12	<i>Ericameria laricifolia</i>	0–17	–
	narrowleaf goldenbush	ERLI6	<i>Ericameria linearifolia</i>	0–11	–
12	<b>evergreen shrubs</b>			56–336	
	Sonoran scrub oak	QUTU2	<i>Quercus turbinella</i>	11–224	–
	desert ceanothus	CEGR	<i>Ceanothus greggii</i>	6–112	–
	redberry buckthorn	RHCRC	<i>Rhamnus crocea</i> ssp. <i>crocea</i>	0–28	–
	canyon live oak	QUCH2	<i>Quercus chrysolepis</i>	0–17	–
	Palmer oak	QUPA10	<i>Quercus palmeri</i>	0–17	–
	California buckthorn	FRCA12	<i>Frangula californica</i>	0–17	–
	Wright's silttassel	GAWR3	<i>Garrya wrightii</i>	0–17	–
	red barberry	MAHA4	<i>Mahonia haematocarpa</i>	0–17	–
	algerita	MATR3	<i>Mahonia trifoliolata</i>	0–17	–
	curl-leaf mountain mahogany	CELE3	<i>Cercocarpus ledifolius</i>	0–17	–
	alderleaf mountain mahogany	CEMO2	<i>Cercocarpus montanus</i>	0–17	–
	birchleaf mountain mahogany	CEMOG	<i>Cercocarpus montanus</i> var. <i>glaber</i>	0–17	–
	Pringle manzanita	ARPRP	<i>Arctostaphylos pringlei</i> ssp. <i>pringlei</i>	0–17	–
	pointleaf manzanita	ARPU5	<i>Arctostaphylos pungens</i>	0–17	–
	Mexican cliffrose	PUME	<i>Purshia mexicana</i>	0–11	–
	stretchberry	FOPUP	<i>Forestiera pubescens</i> var. <i>pubescens</i>	0–11	–
	Apache plume	FAPA	<i>Fallugia paradoxa</i>	0–6	–
<b>Tree</b>					
13	<b>trees</b>			22–168	
	redberry juniper	JUCO11	<i>Juniperus coahuilensis</i>	0–56	–
	alligator juniper	JUDE2	<i>Juniperus deppeana</i>	0–56	–
	oneseed juniper	JUMO	<i>Juniperus monosperma</i>	0–56	–
	Arizona white oak	QUAR	<i>Quercus arizonica</i>	0–28	–
	Emory oak	QUEM	<i>Quercus emoryi</i>	0–28	–
	gray oak	QUGR3	<i>Quercus grisea</i>	0–28	–
	Utah juniper	JUOS	<i>Juniperus osteosperma</i>	0–28	–
	netleaf hackberry	CELAR	<i>Celtis laevigata</i> var. <i>reticulata</i>	0–17	–
	blue paloverde	PAFL6	<i>Parkinsonia florida</i>	0–11	–
	velvet mesquite	PRVE	<i>Prosopis velutina</i>	0–6	–

## Animal community

This site is suitable for grazing year round, but is not easily traversed by livestock. Livestock grazing use is concentrated on south slopes, canyon bottoms and ridgetops. North slopes are little used. Slopes greater than 50% and areas with very cobbly surfaces limit grazing use by cattle. Areas of rock outcrop and rock slides form barriers to livestock movement. The site is susceptible to erosion in overgrazed areas like bed-grounds, livestock trails and lower slopes adjacent to water.

The site has good habitat diversity for a great variety of mountain and grassland wildlife species. It is a foraging area for elk.

## Hydrological functions

This site has very rough surfaces, due to a high cover of gravels, cobbles and stones, which act to hold water on the site. When the soils are dry, it produces little runoff. It produces significant runoff only when heavy rain falls on snow or moist soils.

## Recreational uses

Hunting, camping, horseback riding, backpacking, rock hounding, photography.

## Wood products

Limited harvest of fuel-wood, fence posts and stays from pinyon, juniper and oak species.

## Other products

There is some native harvest of food plants like; acorns, juniper berries, pinyon nuts, mulberries, wild onions, grass nuts, thistle, prickley pear tunas and mescal.

There is some harvest of beargrass and skunkbush sumac as fiber for basket making.

There is some harvest of pinyon pine, pitch for waterproofing baskets.

There is some harvest of herbaceous sage for a variety of uses.

## Contributors

Dan Robinett

Larry D. Ellicott

## 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, Emilio Carrillo
Contact for lead author	USDA NRCS Tucson Area Office
Date	05/09/2008
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

## Indicators

1. **Number and extent of rills:** Rills are very uncommon due to the high rock fragment cover and perennial grass plant density on this site.

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2. **Presence of water flow patterns:** Water flow patterns are 1-2 feet in length and broken by rock fragments and frequent perennial grass plant bases.

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3. **Number and height of erosional pedestals or terracettes:** High rock fragments and perennial grass plant cover reduce the incidence of erosional pedestals.
- 
4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 3-15%
- 
5. **Number of gullies and erosion associated with gullies:** None present on this site.
- 
6. **Extent of wind scoured, blowouts and/or depositional areas:** None present on this site.
- 
7. **Amount of litter movement (describe size and distance expected to travel):** Litter moves 1-2 feet before being trapped by rock fragments or perennial grass plant bases.
- 
8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil surface stability values range from 5-6.
- 
9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Weak granular to moderate fine subangular blocky. 5YR 4/2 to 10YR 5/2 dry, 5YR 3/3 to 10YR 3/3 moist. Thickness to 2 inches.
- 
10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Perennial grasses are the dominant in the plant community and contribute the most towards infiltration. Plants are well distributed across site with average spacing of 1-2 feet between perennial grass plants.
- 
11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None present on this site.
- 
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: warm season mid grasses >> other warm season grasses = cool season grasses = evergreen shrubs
- Sub-dominant: short grasses = perennial forbs = annual grasses = annual forbs. (In el nino years annual forbs and grasses >= warm season mid grasses).
- Other: deciduous shrubs = half shrubs = succulents

Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Some. Approximately 30-40% of basal cover of perennial grasses is lost in prolonged drought. 10-15% of shrub canopy is lost during prolonged drought. Desert ceanothus may experience 50-90% mortality in prolonged drought.
- 
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):** 1400
- 
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:** one seed juniper, red berry juniper, turbinella oak (north slopes). Prickly pear, mesquite, catclaw and white thorn acacia (south slopes).
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17. **Perennial plant reproductive capability:** Not affected following several years of prolonged regional drought.
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