

Ecological site R038XC317AZ

Volcanic Hills 20-24"

Last updated: 5/07/2020

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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.

MLRA notes

Major Land Resource Area (MLRA): 038X–Mogollon Transition South

AZ 38.3 – Upper Mogollon Transition

Elevations range from 5100-7000 feet and precipitation averages 20 to 27 inches per year. Vegetation includes Gambel oak, Arizona white oak, Emory oak, pinyon, alligator juniper, one seed juniper, Arizona cypress, ponderosa pine, shrubby buckwheat, sacahuista, skunkbush sumac, Wright silktassle, blue grama, sideoats grama, muttongrass, western wheatgrass, and bottlebrush squirreltail. The soil temperature regime is mesic and the soil moisture regime is typic 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.

Associated sites

R038XB205AZ	<b>Limestone Hills 16-20" p.z.</b> The Limestone Hills ecological site in LRU 38-2 is at the elevations below this site. Turbinella oak will increase in abundance and alligator juniper will decrease in abundance on the Limestone Hills site in 38-2.
R038XC303AZ	<b>Clay Loam Upland 20-24" p.z.</b> The Clayloam Upland ecological site is on soils with less than 15% slope and in LRU 38-3 is likely a slightly more mesic site and tends to be less prone to invasion by oaks and other shrubs. The Clayloam Upland ecological site tends to have minimal to no oaks on the site.
R038XC316AZ	<b>Clayey Slopes 20-24"</b> The Clayey Slopes ecological site in LRU 38-3 has deep cobbly soil, has slightly more herbaceous production, and less amounts of shrub and tree production than the Volcanic Hills site.

Table 1. Dominant plant species

Tree	(1) <i>Juniperus deppeana</i> (2) <i>Quercus grisea</i>
Shrub	(1) <i>Cercocarpus montanus</i>
Herbaceous	(1) <i>Bouteloua curtipendula</i> (2) <i>Elymus elymoides</i>

Physiographic features

Thimble soils generally occur on summits and backslopes of mountains with Ruidoso soils generally occurring on lower back slopes and along drainageways.

**Table 2. Representative physiographic features**

Landforms	(1) Mountain (2) Mountain slope
Flooding frequency	None
Ponding frequency	None
Elevation	1,524–2,195 m
Slope	15–70%
Aspect	N, E, S

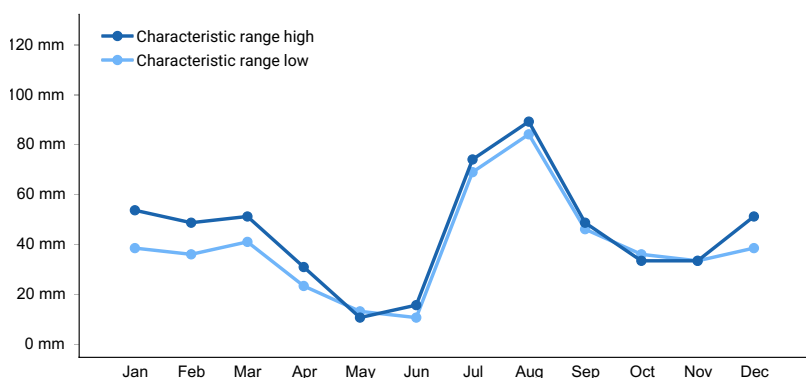
## Climatic features

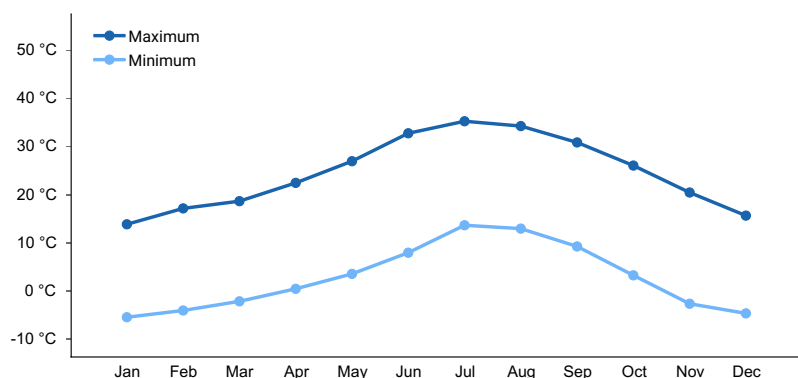
Precipitation in this common resource area averages approximately 20 to 24 inches annually. Precipitation is lower and temperatures are cooler in the eastern part of the MLRA. The winter-summer rainfall ratio ranges from about 60/40% in the western part of the area to 45/55% in the eastern part. Summer 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 10 to 18 inches per year and can occur from November through April. May and June are the driest months of the year. Humidity is generally low all year.

Average annual air temperatures range from 50 to 57 degrees F (mesic temperature regime). Daytime temps in the summer are commonly in the mid 80's in the eastern portion of the MLRA and the low to mid 90's in the western portion. Freezing temperatures are common from October through April. The actual precipitation, available moisture and temperature varies, depending on, region, elevation, rain shadow effect and aspect.

**Table 3. Representative climatic features**

Frost-free period (average)	167 days
Freeze-free period (average)	188 days
Precipitation total (average)	610 mm

**Figure 1. Monthly precipitation range**



**Figure 2. Monthly average minimum and maximum temperature**

## Influencing water features

### Soil features

Thimble soils generally occurs on summits and back slopes with parent material of clayey alluvium and/or colluvium derived from basalt and/or volcanic breccia.

Ruidoso family soils generally occurs on lower back slopes and along drainageways with the parent material of colluvium and/or slope alluvium over residuum weathered from volcanic breccia

Soils mapped on this site include: from SSA-675 San Carlos IR Area - MU's Thimble-82 & 73, Ruidoso family-73.

**Table 4. Representative soil features**

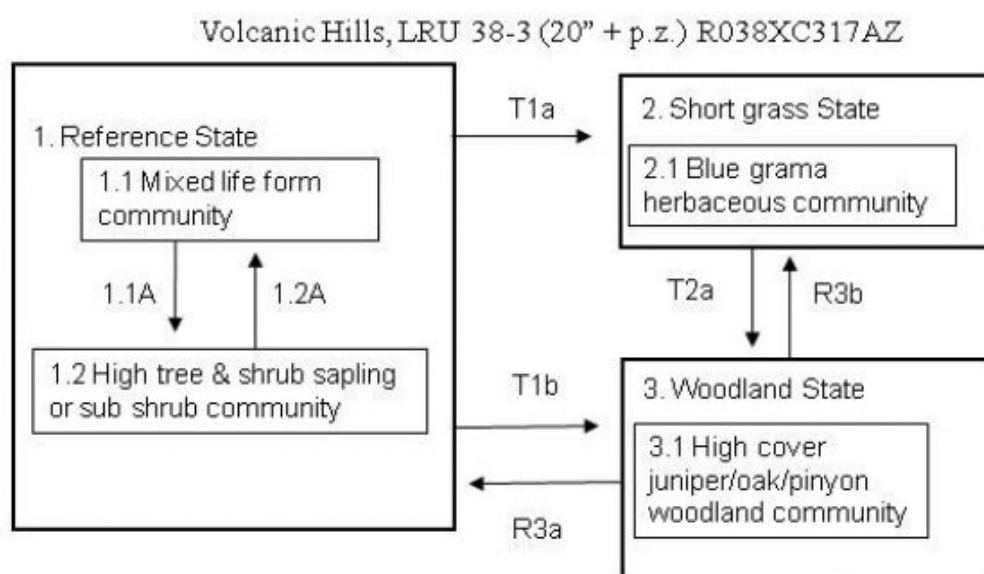
Parent material	(1) Residuum–andesite (2) Residuum–basalt (3) Colluvium–basic volcanic breccia
Surface texture	(1) Extremely cobbly loam (2) Very cobbly loam (3) Very cobbly loam
Family particle size	(1) Clayey
Drainage class	Moderately well drained
Permeability class	Moderately slow to slow
Soil depth	20–51 cm
Surface fragment cover ≤3"	20–50%
Surface fragment cover >3"	30–40%
Available water capacity (0-101.6cm)	1.52–10.92 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
Soil reaction (1:1 water) (0-101.6cm)	6.6–7.8
Subsurface fragment volume ≤3" (Depth not specified)	25–90%
Subsurface fragment volume >3" (Depth not specified)	35–55%

## Ecological dynamics

The historic native plant community is a savanna with equal amounts of trees and shrubs on south slopes and lesser amounts of succulents and forbs. Shrubs are less prevalent on north slopes. Alligator juniper is the primary juniper species. The plant community includes a 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 trees and shrubs. In the absence of fire for longer periods, shrubby species and trees 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.

Warm aspects can be dominated by oneseed or redberry juniper instead of alligator juniper. In some areas, young (< 8-10" DRC) alligator juniper trees have experienced mortality at the lower elevations and/or warmer aspects of the site. These trees likely established in a wetter period at the lower elevational range of the species and have died in the recent drought.

## State and transition model



### LEGEND

- 1.1a = Favorable climate for tree/shrub establishment
- 1.2a = Mortality of young trees & shrubs from fire or drought kills subshrubs
- T1a = High intensity continuous herbivory
- T1b = Trees grow to maturity in absence of fire for very long periods
- T2a = Continuous high intensity herbivory and trees growing to maturity in absence of fire
- R3a = Wildfire with remnant mid grasses in tree interspaces
- R3b = Wildfire with remnant short grasses in tree interspaces

## Reference State

Grass, shrubs, and trees are all represented in the Reference State.

## Community 1.1

### Mixed life form community



Midgrasses are the dominant herbaceous species. Mature grey oak and alligator juniper trees > 18-24" Diameter at Root Collar (DRC) are present at 10-20 per acre. Mature Emory oak > 18" DRC are present at 2-5/ac and pinyon pine > 12" DBH are present at 2-5/acre. Mountain mahogany is the dominant shrub and has approximately 10-15% canopy on warm exposures and 1-2% on cool exposures. Fires likely burned at 7-10 year intervals as the adjacent ponderosa pine forest communities. Plains lovegrass, bullgrass, and cane beargrass are more prevalent on warmer aspects in the western part of the LRU.

Table 5. Annual production by plant type

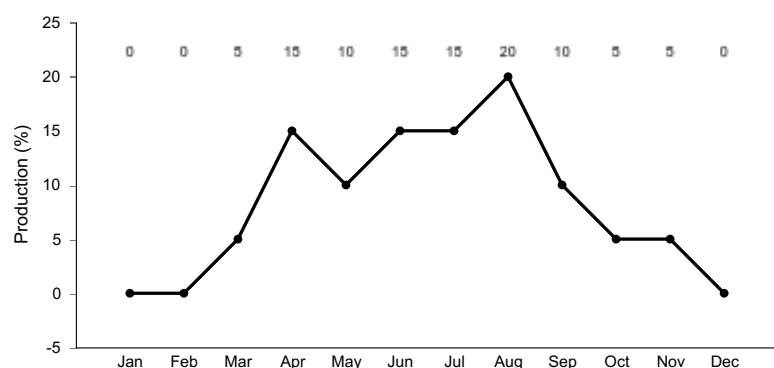
Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	813	1261	1597
Tree	684	796	908
Shrub/Vine	336	375	432
Forb	56	213	325
<b>Total</b>	<b>1889</b>	<b>2645</b>	<b>3262</b>

Table 6. Soil surface cover

Tree basal cover	1-2%
Shrub/vine/liana basal cover	1-2%
Grass/grasslike basal cover	5-10%
Forb basal cover	0-1%
Non-vascular plants	0%
Biological crusts	0%
Litter	50-60%
Surface fragments >0.25" and <=3"	5-10%
Surface fragments >3"	30-40%
Bedrock	0%
Water	0%
Bare ground	0%

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

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	—	—	2-5%	2-5%
>0.15 <= 0.3	—	—	5-10%	5-10%
>0.3 <= 0.6	—	—	20-30%	2-5%
>0.6 <= 1.4	—	5-10%	15-25%	—
>1.4 <= 4	0-1%	—	—	—
>4 <= 12	5-10%	—	—	—
>12 <= 24	—	—	—	—
>24 <= 37	—	—	—	—
>37	—	—	—	—



**Figure 4. Plant community growth curve (percent production by month).**  
**AZ3813, 38.3 20-24"p.z. all sites. Growth begins in the spring and continues**  
**into the summer and fall..**

## State 2

### Short grass State

Midgrasses have been replaced by short grasses.

## Community 2.1

### Blue grama herbaceous community



The vigor of sideoats grama has been reduced from continuous heavy herbivory by cattle, elk, or horses. It has been replaced by blue grama or hairy grama. Blue grama is the dominant herbaceous plant in the plant community on cooler aspects and hairy grama on warmer aspects. Trees and shrubs are represented as in the Reference Plant Community.



## **State 3**

### **Woodland State**

Tree regeneration has grown to maturity in the absence of fire for very long periods and dominates the site.

### **Community 3.1**

#### **High cover juniper/oak woodland community**



As found in the Reference Plant Community, mature grey oak and alligator juniper trees > 18-24" Diameter at Root Collar (DRC) are present at 10-20 per acre. Mature Emory oak > 18" DRC are present at 2-5/ac and pinyon pine > 12" DBH are present at 2-5/acre. In addition, juniper and oak regeneration in the interspaces of parent trees have increased in size to 10-15 feet in height and < 12" DRC in the absence of fire and now dominate the interspaces of parent trees. In some areas grasses still occupy the interspaces at 100-200 lbs/ac. Warm aspects can be dominated by one seed or redberry juniper instead of alligator juniper. In some areas, young (< 8-10" DRC) alligator juniper trees have experienced mortality at the lower elevations and/or warmer aspects of the site. These trees likely established in a wetter period at the lower elevational range of the species and have died in the recent drought.

### **Transition 1a**

#### **State 1 to 2**

High intensity continuous herbivory by livestock or wildlife reduces the vigor and abundance of sideoats grama and increases the abundance of short grasses like blue grama on cool aspects or hairy grama on warm aspects. Horses being more apt to use steeper slopes can have equally detrimental effects.

### **Transition 1b**

#### **State 1 to 3**

Absence of fires for very long periods allows tree regeneration to grow to maturity, increase in size, and dominate the site.

### **Transition 2a**

#### **State 2 to 3**

Absence of fires for very long periods allows tree regeneration to grow to maturity, increase in size, and dominate the site.

### **Restoration pathway 3a**

#### **State 3 to 1**

This restoration pathway is an assumption and needs additional investigation. Areas with 80-90% tree canopy have been observed with mid grass densities of 5-10 plants per square yard. Extreme wildfire is the only practical way to reduce tree abundance. Brush management applied to similar wooded environments with similar grass plant densities in LRU 38-3 has demonstrated favorable responses in grass production where range planting was

unnecessary. This restoration is only practical where there is remnant mid grasses in tree interspaces and they are not destroyed by fire. Aerial range planting is the only practical seeding method and may be required in the event of high grass mortality.

## Restoration pathway 3b State 3 to 2

This restoration pathway is an assumption and needs additional investigation. Areas with 80-90% tree canopy have been observed with short grass densities of 5-10 plants per square yard. Extreme wildfire is the only practical way to reduce tree abundance. Brush management applied to similar wooded environments with similar grass plant densities in LRU 38-3 has demonstrated favorable responses in grass production where range planting was unnecessary. This restoration is only practical where there is remnant short grasses in tree interspaces and they are not destroyed by fire. Aerial range planting is the only practical seeding method and may be required in the event of high grass mortality.

## 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>Midgrasses</b>			673–953	
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	673–897	–
	plains lovegrass	ERIN	<i>Eragrostis intermedia</i>	6–112	–
	longtongue muhly	MULO	<i>Muhlenbergia longiligula</i>	22–67	–
	Texas bluestem	SCCI2	<i>Schizachyrium cirratum</i>	6–11	–
	green sprangletop	LEDU	<i>Leptochloa dubia</i>	6–11	–
2	<b>Short grasses</b>			22–112	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	22–112	–
	hairy grama	BOHI2	<i>Bouteloua hirsuta</i>	22–112	–
3	<b>Cool season grasses</b>			196–420	
	squirreldtail	ELEL5	<i>Elymus elymoides</i>	112–252	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	56–112	–
	muttongrass	POFE	<i>Poa fendleriana</i>	28–56	–
4	<b>Miscellaneous grasses</b>			0–56	
	cane bluestem	BOBA3	<i>Bothriochloa barbinodis</i>	0–28	–
	bullgrass	MUEM	<i>Muhlenbergia emersleyi</i>	0–28	–
	Hall's panicgrass	PAHA	<i>Panicum hallii</i>	0–6	–
	Fendler threeawn	ARPUL	<i>Aristida purpurea</i> var. <i>longiseta</i>	0–6	–
	spidergrass	ARTE3	<i>Aristida ternipes</i>	0–6	–
5	<b>Annual grasses</b>			11–56	
	Eastwood fescue	VUMIC	<i>Vulpia microstachys</i> var. <i>ciliata</i>	1–28	–
	Pacific fescue	VUMIP	<i>Vulpia microstachys</i> var. <i>pauciflora</i>	1–28	–
	witchgrass	PACA6	<i>Panicum capillare</i>	1–6	–
	Mexican panicgrass	PAHI5	<i>Panicum hirticaule</i>	1–6	–
	sixweeks threeawn	ARAD	<i>Aristida adscensionis</i>	1–6	–
	prairie threeawn	AROL	<i>Aristida oligantha</i>	1–6	–
	Arizona brome	BRAR4	<i>Bromus arizonicus</i>	0–1	–



	tufted lovegrass	ERPE	<i>Eragrostis pectinacea</i>	0–1	–
<b>Forb</b>					
6	<b>Perennial forbs</b>			56–140	
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	56–84	–
	wealeaf bur ragweed	AMCO3	<i>Ambrosia confertiflora</i>	6–28	–
	Cooley's bundleflower	DECO2	<i>Desmanthus cooleyi</i>	1–6	–
	Lewis flax	LILE3	<i>Linum lewisii</i>	1–2	–
	New Mexico groundsel	PANE7	<i>Packera neomexicana</i>	0–1	–
	Oak Creek ragwort	PAQU8	<i>Packera quercetorum</i>	0–1	–
	Flagstaff ragwort	SEAC2	<i>Senecio actinella</i>	0–1	–
	catnip noseburn	TRNE	<i>Tragia nepetifolia</i>	0–1	–
	branched noseburn	TRRA5	<i>Tragia ramosa</i>	0–1	–
	tarragon	ARDR4	<i>Artemisia dracunculus</i>	0–1	–
	bluedicks	DICA14	<i>Dichelostemma capitatum</i>	0–1	–
	fleabane	ERIGE2	<i>Erigeron</i>	0–1	–
	southwestern mock vervain	GLGO	<i>Glandularia gooddingii</i>	0–1	–
	sego lily	CANU3	<i>Calochortus nuttallii</i>	0–1	–
	Indian paintbrush	CASTI2	<i>Castilleja</i>	0–1	–
	bastard toadflax	COUM	<i>Comandra umbellata</i>	0–1	–
	pale agoseris	AGGL	<i>Agoseris glauca</i>	0–1	–
7	<b>Annual forbs</b>			6–56	
	longleaf false goldeneye	HELO6	<i>Heliomeris longifolia</i>	6–34	–
	Wright's bird's beak	COWR2	<i>Cordylanthus wrightii</i>	0–17	–
	desert Indianwheat	PLOV	<i>Plantago ovata</i>	0–11	–
	American wild carrot	DAPU3	<i>Daucus pusillus</i>	0–2	–
	Virginia pepperweed	LEVI3	<i>Lepidium virginicum</i>	0–1	–
	Coulter's lupine	LUSP2	<i>Lupinus sparsiflorus</i>	0–1	–
	cryptantha	CRYPT	<i>Cryptantha</i>	0–1	–
	New Mexico thistle	CINE	<i>Cirsium neomexicanum</i>	0–1	–
<b>Shrub/Vine</b>					
8	<b>Evergreen shrubs</b>			45–280	
	alderleaf mountain mahogany	CEMO2	<i>Cercocarpus montanus</i>	22–191	–
	pointleaf manzanita	ARPU5	<i>Arctostaphylos pungens</i>	22–67	–
	hollyleaf redberry	RHIL	<i>Rhamnus ilicifolia</i>	0–28	–
	Sonoran scrub oak	QUTU2	<i>Quercus turbinella</i>	0–6	–
9	<b>Miscellaneous shrubs</b>			1–11	
	catclaw mimosa	MIACB	<i>Mimosa aculeaticarpa</i> var. <i>biuncifera</i>	0–11	–
	skunkbush sumac	RHTR	<i>Rhus trilobata</i>	1–3	–
10	<b>Sub shrubs</b>			1–17	
	prairie acacia	ACAN	<i>Acacia angustissima</i>	0–11	–
	bastardsage	ERWR	<i>Eriogonum wrightii</i>	1–11	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	0–4	–

11	<b>Succulents</b>			17–67	
	goldenflower century plant	AGCH2	<i>Agave chrysantha</i>	6–28	–
	sacahuista	NOMI	<i>Nolina microcarpa</i>	6–17	–
	Parry's agave	AGPA4	<i>Agave parryi</i>	6–11	–
	cactus apple	OPEN3	<i>Opuntia engelmannii</i>	0–6	–
	walkingstick cactus	CYSP8	<i>Cylindropuntia spinosior</i>	0–1	–
	pinkflower hedgehog cactus	ECFE	<i>Echinocereus fendleri</i>	0–1	–
<b>Tree</b>					
12	<b>Trees</b>			347–796	
	gray oak	QUGR3	<i>Quercus grisea</i>	202–404	–
	Emory oak	QUEM	<i>Quercus emoryi</i>	45–168	–
	redberry juniper	JUCO11	<i>Juniperus coahuilensis</i>	0–112	–
	alligator juniper	JUDE2	<i>Juniperus deppeana</i>	56–112	–
	oneseed juniper	JUMO	<i>Juniperus monosperma</i>	0–112	–
	twoneedle pinyon	PIED	<i>Pinus edulis</i>	45–112	–
	singleleaf pinyon	PIMO	<i>Pinus monophylla</i>	45–112	–

## Animal community

This site is a significant habitat for whitetail deer. Elk and mule deer utilize this site to a fair degree given the diversity of forage.

This site has limited use by livestock in summer unless water is less than 1/2 mile away. There are limited areas of very cobbly surfaces that receive little livestock use. This site has some susceptibility to erosion in areas with very high livestock or wildlife utilization like bed grounds, trails, and areas adjacent to water. High gravel and rock cover protect the site to a fair degree. Horses make significant use of this site and can severely deteriorate areas if left unmanaged.

## Hydrological functions

The Reference Plant Community is not conducive to rill formation. There is a high cover of grass, trees, and shrubs with woody species being scattered and herbaceous species being abundant to the perimeter of woody species. Grass plants are less than 1 foot apart in the interspaces of woody species and provide a highly sinuous flow path for overland flow. Gravel and cobble covers are high on this site and add to the protection and sinuous water flow path of the site.

Where grass cover is lost soil erosion can become a problem however it is hard to detect since gravels and cobbles remain in place.

When trees increase they can become relatively effective at capturing high amounts of rainfall in their canopies. This high interception is suggested by Hydrologic Model TR-55 for high juniper cover. However substantial soil loss has likely occurred where nearly all herbaceous plants have been lost, this being difficult to detect where gravels and cobbles have been left on site.

## Recreational uses

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

## Wood products

Limited harvest of fuel-wood, fence posts and stays from juniper, pinyon, and oak species. These activities are restricted to the tops of slopes where access roads have been installed on ridges or where roads have been

installed across gentler sloping areas that have low cobble cover.

## Other products

Western Apache use approximately 700 species of plants in the region. This site provides an important source of plants and animals for traditional uses in the reference state. As the site degrades to woodland the number of species of plants and animals used for traditional purposes declines significantly.

## Type locality

Location 1: Gila County, AZ	
General legal description	Slopes southeast of and above Seneca Lake

## Contributors

Dave Womack  
Larry D. Ellicott

## Approval

Scott Woodall, 5/07/2020

## 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, Scott Stratton, Dan Robinett, Emilio Carrillo
Contact for lead author	USDA NRCS Tucson Area Office.
Date	05/15/2011
Approved by	Scott Woodall
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

## Indicators

- 1. Number and extent of rills:** The reference site is not conducive to rill formation. There is high cover of grass, trees, and shrubs with woody species being scattered and herbaceous species abundant to the perimeter of woody species. Grass plants are less than 1 foot apart in the interspaces of woody species and in addition to high gravel and rock cover provide a highly sinuous flow path for overland flow.

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- 2. Presence of water flow patterns:** Water flow paths are very hard to observe on the site due to high herbaceous litter, high density of herbaceous plants, and high gravel and rock cover. Perennial grass plants are less than 1 foot apart in the interspaces of woody species and in addition to high gravel and rock cover provide a highly sinuous flow path for overland flow.

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3. **Number and height of erosional pedestals or terracettes:** None present on the site. Herbaceous production is dominated by very dense bunchgrasses that are not conducive to pedestalling or terracette formation. There are approximately 10-15 perennial bunch grass plants per square yard in the interspaces between woody species.
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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 0-1%.
- 
5. **Number of gullies and erosion associated with gullies:** None present on the site.
- 
6. **Extent of wind scoured, blowouts and/or depositional areas:** None present on the site. Plant community is shrub and tree dotted savanna with very dense perennial bunch grass plants and 35-45% gravel and rock cover in the interspaces that is not conducive to wind erosion.
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7. **Amount of litter movement (describe size and distance expected to travel):** Herbaceous litter is transported less than 2 feet before being intercepted by high density perennial bunch grass plants. Woody litter stays in place near parent plants.
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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Stability values range from 5-6 across most of the site.
- 
9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Weak to moderate fine to medium granular structure 1-2 inches thick. Color is 5YR 4/2 to 7.5YR 3/2 dry and 5YR 2.5/2 to 7.5YR 2.3/2 moist. Organic matter is 1-3%.
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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Perennial bunch grass plants are the most extensive in terms of canopy cover on the site and at 10-15 plants per square yard in interspaces of trees are highly effective at promoting infiltration and reducing the energy of water that leaves the site.
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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 the site. Argillic horizon at 1-2 inches deep may be mistaken for a compaction layer. High gravel and cobble in subsurface are usually easily detected.
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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: perennial bunch grass > trees > cool season grass > evergreen shrubs > perennial forbs = short grasses
- Sub-dominant: succulents = miscellaneous grass = annual grass = annual forbs

Other:

Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** 5-10% canopy mortality of trees and shrubs.
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14. **Average percent litter cover (%) and depth ( in):**
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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 1685 lbs/ac in below average year, 2360 lbs/ac in average year, 2910 lbs/ac in above average year.
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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:** Alligator juniper is the most common species on cooler aspects, one seed or redberry juniper on warmer aspects. Oaks are second most common species. Annual goldeneye can become problematic where trees and shrubs have not increased and continuous herbivory from livestock or wildlife have reduced vigor of short grasses.
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17. **Perennial plant reproductive capability:** Not affected despite several years of prolonged drought in region.
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