

## Ecological site R035XC348AZ Limestone Hills 10-14" 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): 035X–Colorado Plateau

AZ CRA 35.3 – Colorado Plateau Sagebrush – Grasslands

Elevations range from 4500 to 6000 feet and precipitation averages 10 to 14 inches. Vegetation includes Wyoming big sagebrush, Utah juniper, Colorado pinyon - cliffrose, Mormon tea, fourwing saltbush, blackbrush Indian ricegrass, needle and thread, western wheatgrass Galleta, black grama, blue grama, and sand dropseed. The soil temperature regime is mesic and the soil moisture regime is ustic aridic. This unit occurs within the Colorado Plateau Physiographic Province and is characterized by a sequence of flat to gently dipping sedimentary rocks eroded into plateaus, valleys and deep canyons. Sedimentary rock classes dominate the plateau with volcanic fields occurring for the most part near its margin.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Coleogyne ramosissima</i> (2) <i>Agave utahensis</i>
Herbaceous	(1) <i>Bouteloua curtipendula</i> (2) <i>Tridens muticus</i>

## Physiographic features

This ecological site occurs as undulating hills on mesas and plateaus. The soil is very shallow. The surface texture of the soil is extremely cobbly loam. Subsurface textures range from extremely cobbly loam to extremely gravelly sandy loam. Outcrops of limestone are commonly intermixed with this site. Slopes range from 1 to 35 percent. The site occurs on all aspects.

**Table 2. Representative physiographic features**

Landforms	(1) Hill (2) Plateau (3) Mesa
Flooding frequency	None
Ponding frequency	None
Elevation	1,402–1,463 m
Slope	1–35%
Aspect	Aspect is not a significant factor

## Climatic features

Winter summer moisture ratios range from 70:30 to 60:40. Late spring is usually the driest period, and early fall moisture can be sporadic. Summer rains fall from June through September; moisture originates in the Gulf of Mexico and creates convective, usually brief, intense thunderstorms. Cool season moisture from October through May tends to be frontal; it originates in the Pacific and the Gulf of California and falls in widespread storms with longer duration and lower intensity. Precipitation generally comes as snow from December through February. Accumulations above 12 inches are not common but can occur. Snow usually lasts for 3-4 days, but can persist much longer. Summer daytime temperatures are commonly 95 - 100 F and on occasion exceed 105 F. Winter air temperatures can regularly go below 10 F and have been recorded below - 20 F.

**Table 3. Representative climatic features**

Frost-free period (average)	168 days
Freeze-free period (average)	193 days
Precipitation total (average)	356 mm

## Influencing water features

### Soil features

The soil of this ecological site is very shallow and has been formed from limestone residuum. Rock outcrop is common. The surface texture is extremely cobbly loam. Subsurface textures range from extremely cobbly loam to extremely gravelly sandy loam. Calcium carbonate content averages between 25 and 35 percent.

Typical soils mapped on this site include:

SSA 697 Mohave County Central Part MU's 56 Hindu and 86 Meriwhitica;  
SSA 699 Hualapai-Havasupai Area MU 8 Meriwhitica.

**Table 4. Representative soil features**

Parent material	(1) Residuum–limestone
Surface texture	(1) Extremely cobbly loam (2) Extremely gravelly loam

Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderate
Soil depth	8–25 cm
Surface fragment cover <=3"	15%
Surface fragment cover >3"	65%
Available water capacity (0-101.6cm)	0.81–1.22 cm
Calcium carbonate equivalent (0-101.6cm)	15–35%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	20–60%
Subsurface fragment volume >3" (Depth not specified)	35–50%

## 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 grazing, fire, 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 shown for the group. Divide the resulting total by the total normal year production shown in the plant community description. If 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  
Historic Climax Plant Community**

**Community 1.1  
Historic Climax Plant Community**

The dominant aspect of the site is a shrub-grassland. The major shrubs are blackbrush and Utah agave. Dominant grasses are sideoats grama and slim tridens. Forb are few. Plants likely to increase or invade with servere disturbance include blackbrush, Utah agave, broom snakeweed, red brome, and cheatgrass.

**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	140	–	196
Forb	6	–	28
Tree	–	–	6
<b>Total</b>	<b>482</b>	–	<b>622</b>

**Table 6. Ground cover**

Tree foliar cover	0%
Shrub/vine/liana foliar cover	3%

Grass/grasslike foliar cover	1%
Forb foliar cover	0%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%
Surface fragments >0.25" and <=3"	65%
Surface fragments >3"	15%
Bedrock	0%
Water	0%
Bare ground	0%

Table 7. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	–	–	–
>0.15 <= 0.3	–	–	–	–
>0.3 <= 0.6	–	–	–	–
>0.6 <= 1.4	–	–	–	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Figure 5. Plant community growth curve (percent production by month). AZ3502, 35.1 10-14" p.z. black grama. Growth occurs mostly during the summer to early fall rainy season..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	0	5	15	30	30	15	5	0	0

Figure 6. Plant community growth curve (percent production by month). AZ3512, 35.6 13-17" p.z. Stansbury cliffrose. Growth begins in spring and continues through the summer. Stem elongation, flowering, and seed set occur in summer..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	20	20	30	20	5	0	0	0

Figure 7. Plant community growth curve (percent production by month). AZ3531, 35.3 10-14" p.z. all sites. Growth begins in the spring and continues through the summer..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	1	3	17	18	10	19	20	10	1	1	0

Figure 8. Plant community growth curve (percent production by month). AZ5103, 35.1 10-14" p.z. sideoats grama. Most growth occurs in summer and early fall during the rainy season..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	10	20	30	20	10	5	0	0

## **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				56–84	
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	56–84	–
2				28–56	
	slim tridens	TRMU	<i>Tridens muticus</i>	28–56	–
3				6–28	
	black grama	BOER4	<i>Bouteloua eriopoda</i>	6–28	–
4				0–11	
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	0–11	–
5				0–11	
	Fendler's threeawn	ARPUF	<i>Aristida purpurea var. fendleriana</i>	0–11	–
6				0–11	
	squirreltail	ELELE	<i>Elymus elymoides ssp. elymoides</i>	0–11	–
7				0–6	
	hairy woollygrass	ERPI5	<i>Erioneuron pilosum</i>	0–6	–
8				0–6	
	Grass, perennial	2GP	<i>Grass, perennial</i>	0–6	–
<b>Forb</b>					
9				0–6	
	globemallow	SPHAE	<i>Sphaeralcea</i>	0–6	–
10				6–22	
	Forb, perennial	2FP	<i>Forb, perennial</i>	6–22	–
11				0–6	
	Forb, annual	2FA	<i>Forb, annual</i>	0–6	–
<b>Shrub/Vine</b>					
12				168–224	
	blackbrush	CORA	<i>Coleogyne ramosissima</i>	168–224	–
13				56–84	
	Utah agave	AGUT	<i>Agave utahensis</i>	56–84	–
14				6–28	
	Mexican cliffrose	PUME	<i>Purshia mexicana</i>	6–28	–
15				0–11	
	banana yucca	YUBA	<i>Yucca baccata</i>	0–11	–
16				6–17	
	tulip pricklypear	OPPH	<i>Opuntia phaeacantha</i>	6–17	–
17				0–11	
	mormon tea	EPVI	<i>Ephedra viridis</i>	0–11	–
18				6–17	
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	6–17	–
19				6–28	
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	6–28	–

## Animal community

Movement of animals across this site is limited by the amount of cobbles on the surface.

## Type locality

Location 1: Coconino County, AZ	
Township/Range/Section	T27 N. R12 W. S27
General legal description	Hindu Canyon Quad. - 3 miles north of Plain Tank; Sec. 27, T27N., R12W.; Hualapai Indian Reservation, Arizona

## 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)	Karlynn Huling
Contact for lead author	NRCS Flagstaff Area Office
Date	03/24/2006
Approved by	S. Cassady
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

## Indicators

- 1. Number and extent of rills:** A few rills may form due to loamy surface textures, moderate permeability, very rapid runoff, and steep slopes, but they are not likely in most areas due to extensive surface cover of rock fragment armor and large amounts of rock fragments in the soil profile.

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- 2. Presence of water flow patterns:** Water flow patterns may occur due to moderate permeability, very shallow depth to bedrock, very rapid runoff, and steep slopes, but they are not likely due to the extensive surface cover of rock fragment armor. There will be more water flow patterns in steeper areas and in areas adjacent to large expanses of rock outcrop.

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- 3. Number and height of erosional pedestals or terracettes:** Some short pedestals and terracettes may form, but they will be limited by the amount of surface rock fragments.

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- 4. Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** The site may have 0-20% bare ground. Areas with a greater cover of rock fragments and/or rock outcrop



will have less bare ground. Drought may cause an increase in bare ground. This site has only one inch of available water capacity, so it does not have the potential to produce a lot of plant cover.

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

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None

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7. **Amount of litter movement (describe size and distance expected to travel):** Herbaceous, fine woody and some coarse woody litter will be transported in water flow pathways. Most coarse woody litter will remain under shrub and tree canopies. There may be more litter movement in areas that are adjacent to large expanses of rock outcrop.

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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):** Soil aggregate stability ratings average six under plant canopy and five in the interspaces. Soil surface textures are loam or sandy loam. All surface horizons contain a significant amount of rock fragments (cobbles and/or gravels). Most soils have 50-90% cover of rock fragments (mostly gravels and cobbles, but also stones and boulders). When well vegetated or covered with rock armor, the soils have a high resistance to both water and wind erosion.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface structure is mostly platy (weak to moderate, thick), with some granular (moderate fine) and subangular blocky (weak medium). Surface thickness range is 1-3 inches. Color is variable depending upon parent material.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** This site is characterized by a patchy distribution of mostly shrubs and grasses depending upon the location of bedrock outcrops. Canopy cover averages about 30% and is dominated by shrubs. Basal plant cover averages about 4% and is also dominated by shrubs. Plant cover (especially basal cover) is reduced by the amount of rock fragment and/or bedrock ground cover. Both plant cover values decrease during a prolonged drought. This type of plant community is only slightly effective at capturing and storing precipitation.

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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. This soil is not easily compacted due to extensive cover of rock fragment armor and the high volume of rock fragments within surface horizons of the profile. Inclusions without many rock fragments will compact easily below 1-3 inches. Most soils have a naturally platy surface structure.

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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: shrubs >>

Sub-dominant: warm season bunchgrasses > Agave family >

Other: Minor: warm season colonizing grasses = cool season bunchgrasses = forbs >

Trace: cacti = trees

Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** All plant functional groups are adapted to survival except during the most severe droughts. Severe winter droughts affect shrubs and trees the most. Severe summer drought affects grasses the most.
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14. **Average percent litter cover (%) and depth ( in):** Litter consists of a combination of herbaceous and woody. Litter amounts increase during the first few years of drought, then decrease in later years.
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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 350-450 pounds per acre (dry weight) in drought years, 450-550 pounds per acre in median years, 550-650 pounds per acre in wet years.
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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:** Cheatgrass and red brome are exotic annual grasses that can invade the site regardless of management. They may dominate the site for a few years following a fire.
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17. **Perennial plant reproductive capability:** All plants native to the site are adapted to the climate and are capable of producing seeds, stolons and rhizomes except during the most severe droughts.
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