

Ecological site R035XE516AZ

Sedimentary Cliffs

6-10" p.z.

Accessed: 06/18/2026

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): 035X–Colorado Plateau

Common Resource Area 35.5 – Grand Canyon Corridor Elevations range from 1600 to 4500 feet and precipitation averages 6 to 10 inches per year. Extreme elevation and aspect changes make this area unique. Vegetation includes Mormon tea, catclaw, white brittlebush, blackbrush, prickly pear, cholla species, big galleta, and blue threeawn. The soil temperature regime ranges from thermic to mesic and the soil moisture regime is typical aridic. This unit occurs within the Colorado Plateau Physiographic Province and is characterized by extreme vertical escarpments and strong aspect differences over short distances. Sedimentary rock classes dominate the Grand Canyon and exposures consist of a thick sequence of relatively undeformed formations.

Associated sites

R035XE502AZ	<p>Channery Hills 6-10" p.z.</p> <p>Areas of mudstone/siltstone with no colluvium from geologic formations above.</p>
R035XE504AZ	<p>Schist Hills 6-10" p.z.</p> <p>Areas of intermixing of igneous formations such as Vishnu Schist.</p>

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Ephedra viridis</i> (2) <i>Encelia farinosa</i>
Herbaceous	(1) <i>Pleuraphis rigida</i> (2) <i>Pleuraphis jamesii</i>

Physiographic features

This ecological site occurs on the ledges and steep colluvial slopes of the cliffs and escarpments of various sedimentary formations. Soils are sandy loam and fine sandy loam, and range in depth from a few inches in pockets in the bedrock to deep on some steep slopes. This site occurs on all aspects, and the plant communities are significantly influenced by the strong relief and aspect changes. Slopes on some ledges are as low as 2 percent, but the typical slope range is 15 to 60 percent and can be much higher. Eolian sand deposits from 1/2 to 3 inches in depth, especially in the wind corridors, are an important influence.

Table 2. Representative physiographic features

Landforms	(1) Escarpment (2) Scarp (3) Canyon
Flooding frequency	None
Ponding frequency	None
Elevation	490 – 1,400 m
Slope	20 – 100 %
Water table depth	150 – 180 cm
Aspect	Aspect is not a significant factor

Climatic features

The climate of the land resource unit is arid to semiarid with warm summers and cool winters. The mean annual precipitation ranges from 6 – 10 inches, but it is very erratic, often varying substantially from year to year. The majority of the precipitation falls during the between October through May. This precipitation comes as gentle rain or occasionally snow from frontal storms coming out to the Pacific Ocean. Snow is infrequent and rarely last more than 1-2 days. The remaining precipitation comes from July through September as spotty, unreliable and sometimes violent thunderstorms. The moisture for this precipitation originates in the Gulf of Mexico (and the Pacific Ocean in the fall) and flows into the area on the north end of the Mexican monsoon. Late May through late June is generally a dry period. The mean annual air temperature ranges from 55 to 69 degrees Fahrenheit (F). The frost-free period (air temperature > 32 degrees F) ranges from 180 to 220 days (@ 50 percent probability).

Table 3 Representative climatic features

Frost-free period (average)	200 days
Freeze-free period (average)	220 days
Precipitation total (average)	250 mm

Influencing water features

Soil moisture on this ecological site if from precipitation. The bedrock on the site can concentrate moisture in areas with deeper soil pockets, increasing available soil moisture in those areas.

Soil features

Soil surface textures are sandy loam to loamy very fine sand and are very gravelly to extremely stony or channery. Soil depth can range from 4 to 60 inches, but is commonly 20 to 50 inches to bedrock. The surface can range from slightly to strongly effervescent. Soils may be slightly saline, depending on the influence of certain formations.

Soil Survey Map Unit Components Correlated to This Ecological Site:

Mohave County NE part (AZ625) Map units 65-Torriorthents;

Coconino County North Kaibab part (AZ629) Map Units 43-Torriorthents;

Hualapai-Havasupai Area (AZ699) Map Units 39 Torriorthents;

Grand Canyon Area (AZ701) Map Units 68 & 115 Lithic Torriorthents and 117 Typic torriorthents;

Little Colorado River Area (AZ707) Map Units 45-Lithic torriorthents Supai Group, 47-Lithic Torriorthents Hermit Formation, 48 Typic torriorthents Tonto Group Redwall Formation.

Table 4. Representative soil features

Parent material	(1) Colluvium – sandstone and shale (2) Residuum – limestone and sandstone
Surface texture	(1) Very gravelly sandy loam (2) Extremely stony loamy very fine sand (3) Extremely channery
Family particle size	(1) Sandy
Drainage class	Well drained
Permeability class	Moderate to moderately rapid
Soil depth	10 – 150 cm
Surface fragment cover <=3"	20 %
Surface fragment cover >3"	40 %
Available water capacity (0-101.6cm)	0 – 12.7 cm
Calcium carbonate equivalent (0-101.6cm)	10 – 30 %
Electrical conductivity (0-101.6cm)	0 – 10 mmhos/cm

Soil reaction (1:1 water) (0-101.6cm)	7.9 – 8.4
Subsurface fragment volume <=3" (Depth not specified)	30 %
Subsurface fragment volume >3" (Depth not specified)	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

Figure 3. 355 SedimentaryCliffs S&T

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Grass/Grasslike					
1	Dominant Native perennial Summer Mid Grasses			17-56	
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	17-39	–
	big galleta	PLRI3	<i>Pleuraphis rigida</i>	17-39	–
	bush muhly	MUPO2	<i>Muhlenbergia porteri</i>	6-17	–
2	Occasional Native Perennial Summer Mid Grasses			6-17	
	Grass, perennial	2GP	<i>Grass, perennial</i>	0-17	–
	cane bluestem	BOBA3	<i>Bothriochloa barbinodis</i>	0-17	–
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	0-17	–
	black grama	BOER4	<i>Bouteloua eriopoda</i>	0-17	–
	spike dropseed	SPCO4	<i>Sporobolus contractus</i>	0-17	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	0-17	–
	mesa dropseed	SPFL2	<i>Sporobolus flexuosus</i>	0-17	–

3	Occasional Native Perennial Summer Short Grasses			0-11	
	Grass, perennial	2GP	<i>Grass, perennial</i>	0-11	–
	Rothrock's grama	BORO2	<i>Bouteloua rothrockii</i>	0-11	–
	red grama	BOTR2	<i>Bouteloua trifida</i>	0-11	–
	low woollygrass	DAPU7	<i>Dasyochloa pulchella</i>	0-11	–
4	Common Native Perennial Spring Mid Grasses			6-39	
	purple threeawn	ARPU9	<i>Aristida purpurea</i>	0-11	–
	blue threeawn	ARPUN	<i>Aristida purpurea var. nealleyi</i>	0-11	–
5	Occasional Native Perennial Spring Mid Grasses			6-17	
	Grass, perennial	2GP	<i>Grass, perennial</i>	0-17	–
	desert needlegrass	ACSP12	<i>Achnatherum speciosum</i>	0-17	–
	needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	0-17	–
	New Mexico feathergrass	HENE5	<i>Hesperostipa neomexicana</i>	0-17	–
	slim tridens	TRMU	<i>Tridens muticus</i>	0-17	–
6	Occasional Native Annual Grasses			6-39	
	Grass, annual	2GA	<i>Grass, annual</i>	0-17	–
	sixweeks threeawn	ARAD	<i>Aristida adscensionis</i>	0-17	–
	sixweeks grama	BOBA2	<i>Bouteloua barbata</i>	0-17	–
	muhly	MUHLE	<i>Muhlenbergia</i>	0-17	–
	panicgrass	PANIC	<i>Panicum</i>	0-17	–
	sixweeks fescue	VUOC	<i>Vulpia octoflora</i>	0-17	–
Forb					
7	Occasional Native Perennial Spring Short Forbs			6-17	
	Forb, perennial	2FP	<i>Forb, perennial</i>	0-17	–
	brownfoot	ACWR5	<i>Acourtia wrightii</i>	0-17	–
	desert trumpet	ERIN4	<i>Eriogonum inflatum</i>	0-17	–
	desert stingbush	EUUR	<i>Eucnide urens</i>	0-17	–
	desert pepperweed	LEFR2	<i>Lepidium fremontii</i>	0-17	–
	roving sailor	MAAN9	<i>Maurandella antirrhiniflora</i>	0-17	–
	phlox	PHLOX	<i>Phlox</i>	0-17	–
	globemallow	SPHAE	<i>Sphaeralcea</i>	0-17	–
8	Occasional Native Perennial Summer Short Forbs			6-17	
	Forb, perennial	2FP	<i>Forb, perennial</i>	0-17	–
	trailing windmills	ALIN	<i>Allionia incarnata</i>	0-17	–
	Indian paintbrush	CASTI2	<i>Castilleja</i>	0-17	–
	Colorado four o'clock	MIMU	<i>Mirabilis multiflora</i>	0-17	–
	goldenrod	SOLID	<i>Solidago</i>	0-17	–
	brownplume wirelettuce	STPA4	<i>Stephanomeria pauciflora</i>	0-17	–
9	Occasional Native Annual Forbs			62-39	
	Forb, annual	2FA	<i>Forb, annual</i>	0-6	–
	fiddleneck	AMSIN	<i>Amsinckia</i>	0-6	–
	white easterbonnets	ANLA7	<i>Antheropeas lanosum</i>	0-6	–
	Crescent milkvetch	ASAM5	<i>Astragalus amphioxys</i>	0-6	–
	Esteve's pincushion	CHST	<i>Chaenactis stevioides</i>	0-6	–
	thistle	CIRSI	<i>Cirsium</i>	0-6	–
	sacred thorn-apple	DAWR2	<i>Datura wrightii</i>	0-6	–

	flatcrown buckwheat	ERDE6	<i>Eriogonum deflexum</i>	0-6	-
	fleabane	ERIGE2	<i>Erigeron</i>	0-6	-
	Texas stork's bill	ERTE13	<i>Erodium texanum</i>	0-6	-
	spurge	EUPHO	<i>Euphorbia</i>	0-6	-
	shaggyfruit pepperweed	LELA	<i>Lepidium lasiocarpum</i>	0-6	-
	desertdandelion	MALAC3	<i>Malacothrix</i>	0-6	-
	desert tobacco	NIOB	<i>Nicotiana obtusifolia</i>	0-6	-
	phacelia	PHACE	<i>Phacelia</i>	0-6	-
	yellow nightshade groundcherry	PHCR4	<i>Physalis crassifolia</i>	0-6	-
	popcornflower	PLAGI	<i>Plagiobothrys</i>	0-6	-
	desert Indianwheat	PLOV	<i>Plantago ovata</i>	0-6	-
	woolly tidestromia	TILA2	<i>Tidestromia lanuginosa</i>	0-6	-
Shrub/Vine					
10	Common Native Half Shrubs			17-56	
	Subshrub (<.5m)	2SUBS	<i>Subshrub (<.5m)</i>	0-11	-
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	0-11	-
	dyssodia	DYSSO	<i>Dyssodia</i>	0-11	-
	starry bedstraw	GAST	<i>Galium stellatum</i>	0-11	-
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	0-11	-
	lacy tansyaster	MAPI	<i>Machaeranthera pinnatifida</i>	0-11	-
	mountain phlox	PHAU3	<i>Phlox austromontana</i>	0-11	-
	bush arrowleaf	PLPL	<i>Pleurocoronis pluriseta</i>	0-11	-
	slender poreleaf	POGR5	<i>Porophyllum gracile</i>	0-11	-
	Coues' cassia	SECO10	<i>Senna covesii</i>	0-11	-
	desert princesplume	STPI	<i>Stanleya pinnata</i>	0-11	-
	pricklyleaf dogweed	THAC	<i>Thymophylla acerosa</i>	0-11	-
	turpentinebroom	THMO	<i>Thamnosma montana</i>	0-11	-
	woody crinklemat	TICA3	<i>Tiquilia canescens</i>	0-11	-
	matted crinklemat	TILA6	<i>Tiquilia latior</i>	0-11	-
	goldeneye	VIGUI	<i>Viguiera</i>	0-11	-
	Mojave woodyaster	XYTO2	<i>Xylorhiza tortifolia</i>	0-11	-
11	Dominant Native Shrubs			90-179	
	brittlebush	ENFA	<i>Encelia farinosa</i>	34-112	-
	Nevada jointfir	EPNE	<i>Ephedra nevadensis</i>	17-34	-
	Torrey's jointfir	EPTO	<i>Ephedra torreyana</i>	17-34	-
	mormon tea	EPVI	<i>Ephedra viridis</i>	17-34	-
	catclaw acacia	ACGR	<i>Acacia greggii</i>	6-34	-
12	Occasional Native Mid Shrubs			17-34	
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	0-56	-
	Wright's beebrush	ALWR	<i>Aloysia wrightii</i>	0-56	-
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	0-56	-
	shadscale saltbush	ATCO	<i>Atriplex confertifolia</i>	0-56	-
	shortleaf baccharis	BABR	<i>Baccharis brachyphylla</i>	0-56	-
	sweetbush	BEJU	<i>Bebbia juncea</i>	0-56	-
	California brickellbush	BRCA3	<i>Brickellia californica</i>	0-56	-
	netleaf hackberry	CELAR	<i>Celtis laevigata var. reticulata</i>	0-56	-

	button brittlebush	ENFR	<i>Encelia frutescens</i>	0-56	-
	Apache plume	FAPA	<i>Fallugia paradoxa</i>	0-56	-
	ocotillo	FOSP2	<i>Fouquieria splendens</i>	0-56	-
	burrobrush	HYSA	<i>Hymenoclea salsola</i>	0-56	-
	water jacket	LYAN	<i>Lycium andersonii</i>	0-56	-
	Arizona desert-thorn	LYEX	<i>Lycium exsertum</i>	0-56	-
	mariola	PAIN2	<i>Parthenium incanum</i>	0-56	-
	honey mesquite	PRGL2	<i>Prosopis glandulosa</i>	0-56	-
	Fremont's dalea	PSFR	<i>Psoralea fremontii</i>	0-56	-
	skunkbush sumac	RHTR	<i>Rhus trilobata</i>	0-56	-
	purple sage	SADO4	<i>Salvia dorrii</i>	0-56	-
	American threefold	TRCA8	<i>Trixis californica</i>	0-56	-
13	Common Native Cacti			6-34	
	beavertail pricklypear	OPBA2	<i>Opuntia basilaris</i>	0-17	-
	cactus apple	OPEN3	<i>Opuntia engelmannii</i>	0-17	-
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0-17	-
	dollarjoint pricklypear	OPCH	<i>Opuntia chlorotica</i>	0-6	-
	Engelmann's hedgehog cactus	ECEN	<i>Echinocereus engelmannii</i>	0-6	-
	cottontop cactus	ECPO2	<i>Echinocactus polycephalus</i>	0-6	-
	kingcup cactus	ECTR	<i>Echinocereus triglochidiatus</i>	0-6	-
	California barrel cactus	FECY	<i>Ferocactus cylindraceus</i>	0-6	-
14	Occasional Native Agave-Yucca-Like			6-17	
	Utah agave	AGUT	<i>Agave utahensis</i>	0-11	-
	sacahuista	NOMI	<i>Nolina microcarpa</i>	0-11	-
	narrowleaf yucca	YUAN2	<i>Yucca angustissima</i>	0-11	-
	banana yucca	YUBA	<i>Yucca baccata</i>	0-11	-
	soaptree yucca	YUEL	<i>Yucca elata</i>	0-11	-

Table 6. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Animal community

This is an important site for birds that utilize cliffs for nesting and cover. Other wildlife may utilize accessible areas of the site for food and cover. Bedrock outcroppings can hold puddles of water temporarily after rain events.

Hydrological functions

This site can be important in contributing run-on moisture to adjacent sites.

Recreational uses

This site is used for recreational rock climbing.

Wood products

This site does not produce wood products.

Type locality

Location 1: Coconino County, AZ	
Latitude	36° 26'5"
Longitude	111° 51'13"
General legal description	In the interior of the Grand Canyon; 2,551 feet southwest of Tatahatso Wash;

Other references

Updates and revisions for this ESD were conducted as part of a 2007-2012 Interagency Technical Assistance Agreement between the Bureau of Indian Affairs–Navajo Region and the NRCS-Arizona.

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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 State Rangeland Management Specialist, Phoenix Az.
Date	04/18/2006
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** The soils on the site are variable. Till formation may be common in areas that have loam and sandy loam surface textures, moderate permeability, few surface rock fragments, rapid runoff, and very steep slopes. Rill formation is not likely in areas that have loamy sand surface textures, rapid to very rapid permeability, and a high cover of rock fragments, especially on the more gentle slopes.

2. **Presence of water flow patterns:** Soils on this site are variable. Water flow patterns may be common in areas that have moderate permeability, shallow depth, few surface rock fragments and very steep slopes. They are not likely in areas with rapid to very rapid permeability, deeper soils, and a high cover of rock fragments, especially on the more gentle slopes.

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.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** This site should have no more than 40% 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.

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

6. **Extent of wind scoured, blowouts and/or depositional areas:** Soils on this site are variable. Most areas will not have any significant signs of wind erosion. Areas with loamy sand surfaces may have a few minor blowouts and depositional areas.

7. **Amount of litter movement (describe size and distance expected to travel):** Herbaceous and fine woody litter will be transported in water flow pathways and by wind. Most coarse woody litter will remain under shrub canopies, but some will be transported in water flow pathways in the steepest areas.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil surface textures include loamy sands, sandy loam, fine sandy loam and loam. All surface horizons are very to extremely gravelly, channery, stony or bouldery. Most soils have a significant amount of rock fragments on the surface; the average is 20% gravels and 40% cobbles, channers, or stones. When well vegetated or covered with rock fragment armor, these soils have a low to high resistance to water erosion and a moderate to high resistance to wind erosion.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface structure may be subangular blocky (weak, fine), granular (moderate, fine), single grain, platy (weak, thin), or massive. Surface thickness range is 1-10 inches. Color is variable depending upon parent material.

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 with some grass and a few forbs. Plant distribution is influenced by changes in soil (texture, depth, amount and size of rock fragments), hydrology (slope, position on the slope,

amount of bedrock, cracking and weathering of the bedrock), and aspect across the site. Both plant cover values (canopy and basal) decrease during prolonged drought.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. These soils are not easily compacted due to the extensive cover of rock fragment armor and the high volume of rock fragments within the surface horizon of the profile.

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 colonizing grasses >

Other: Minor: half shrubs = cool season bunchgrasses = warm season bunchgrasses > cacti = perennial forbs = annual forbs = annual grasses >

Additional: Trace: Agave family.

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 in all years except the most severe droughts. Severe winter droughts affect shrubs the most. Severe summer droughts affect grasses the most.

14. **Average percent litter cover (%) and depth (in):** Mostly woody litter with some herbaceous. Litter amounts increase during the first few years of drought, then decrease in later years.

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**
250-300 pounds per acre (dry weight) in dry years, 300-400 pounds per acre in median years, 400-450 pounds per acre in wet years.

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: Access to and through this site may be extremely difficult. These conditions have preserved the native plant communities and biodiversity in most areas. More information is needed to determine which native or exotic species is capable of increasing or dominating the site, especially in the more accessible areas.**

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 in most years except for the most severe droughts.
