

Ecological site R035XC333AZ

Sandstone Upland

10-14" p.z.

Warm

Last updated: 5/19/2025

Accessed: 06/10/2026

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

This ecological site is found in Common Resource Area 35.3 – the Colorado Plateau Sagebrush – Grasslands. The Common Resource Area occurs within the Colorado Plateau Physiographic Province. It is characterized by a sequence of flat to gently dipping sedimentary rocks eroded into plateaus, valleys and deep canyons. Elevations range from 4800 to 6700 feet and precipitation averages 10 to 14 inches. The elevation range is lower (about 4500 to 6000) on the western side of the Colorado Plateau along the Grand Canyon, and moves up about 500 to 800 feet higher on the eastern side in the areas of the Navajo and Hopi Indian Reservations due to rain shadow effects from the Kaibab Plateau and Mogollon Rim. Common vegetation in this region 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. Sedimentary rock classes dominate the plateau with volcanic fields occurring for the most part near its margin. The soil temperature regime is mesic and the soil moisture regime is ustic aridic.

Ecological site concept

Soils grouped in this site are shallow to bedrock Surface and subsoil textures are loamy fine sand, sand and loamy sand. Parent material is sandstone. Water erosion potential is severe and wind erosion potential is high. This ecological site occurs on structural benches, cuestas and hills. Slopes typically range from 1 to 15 percent.

Table 1. Dominant plant species

Tree	(1) <i>Juniperus osteosperma</i>
Shrub	(1) <i>Coleogyne ramosissima</i> (2) <i>Ephedra nevadensis</i>
Herbaceous	(1) <i>Bouteloua gracilis</i> (2) <i>Sporobolus cryptandrus</i>

Physiographic features

This site is on structural benches, cuestas and hills, specific landform and position is convex slopes on plateaus.

Table 2. Representative physiographic features

Landforms	(1) Plateau (2) Cuesta
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Flooding duration	Very brief (4 to 48 hours) to extremely brief (0.1 to 4 hours)
Flooding frequency	None to rare
Ponding frequency	None to rare
Elevation	1,460 – 2,040 m
Slope	0 – 20 %
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)	170 days
Freeze-free period (average)	190 days
Precipitation total (average)	360 mm

Influencing water features

This site occurs in an upland position. The soil moisture on this ecological site comes from precipitation. It does not benefit from run-in moisture but does sustains excessive runoff.

Soil features

Soils are shallow with depth to bedrock 10" to 20". Surface and subsoil textures are loamy fine sand, sand and loamy sand. Parent material is sandstone. Geologic formation is various sandstone formations. Available water capacity is very low. Water erosion potential is severe; wind erosion potential is high. Soils are non-saline, non-sodic with a pH range of 7.4-8.4. The soil moisture regime is ustic aridic. The soil temperature regime is mesic. Soils are calcareous at soil surface.

Typical taxonomic units on this site include:

- SSA 629 Coconino County North Kaibab part MU 38 Arches;
- SSA 707 Little Colorado River Area MU's 1 & 32 Arches, 46-Nalcase;
- SSA 711 Navajo Mountain Area MU's 25 & 41 Rizno, 26-Arches and 43-Rock Outcrop.

Table 4. Representative soil features

Parent material	(1) Residuum – sandstone
Surface texture	(1) Loamy fine sand (2) Sand (3) Loamy sand
Family particle size	(1) Sandy
Drainage class	Well drained to excessively drained
Permeability class	Rapid to very rapid
Soil depth	30 – 50 cm
Surface fragment cover <=3"	0 – 40 %
Surface fragment cover >3"	0 – 40 %
Available water capacity (0-101.6cm)	0 – 6.35 cm
Calcium carbonate equivalent (0-101.6cm)	0 – 10 %
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	0 – 10
Soil reaction (1:1 water) (0-101.6cm)	7.4 – 8.4

Ecological dynamics

The historic climax plant community (HCPC) for a site in North America is the plant community that existed at the time of European immigration and settlement. It is the plant community that was best adapted to the unique combination of environmental factors associated with the site. The historic climax plant community was in dynamic equilibrium with its environment. It is the plant community that was able to avoid displacement by the suite of disturbances and disturbance patterns (magnitude and frequency) that naturally

occurred within the area occupied by the site. Natural disturbances, such as drought, fire, grazing of native fauna, and insects, were inherent in the development and maintenance of these plant communities. The effects of these disturbances are part of the range of characteristics of the site that contribute to that dynamic equilibrium. Fluctuations in plant community structure and function caused by the effects of these natural disturbances establish the boundaries of dynamic equilibrium. They are accounted for as part of the range of characteristics for an ecological site. Some sites may have a small range of variation, while others have a large range.

The historic climax plant community of an ecological site is not a precise assemblage of species for which the proportions are the same from place to place or from year to year. In all plant communities, variability is apparent in productivity and occurrence of individual species. Spatial boundaries of the communities; however, can be recognized by characteristic patterns of species composition, association, and community structure. The HCPC for this ecological site has been estimated by sampling relict or relatively undisturbed sites and/or reviewing historic records.

Plant communities that are subjected to abnormal disturbances and physical site deterioration or that are protected from natural influences, such as fire and grazing, for long periods seldom typify the historic climax plant community. The physical site deterioration caused by the abnormal disturbance results in the crossing of a threshold or irreversible boundary to another state, or equilibrium, for the ecological site. There may be multiple thresholds and states possible for an ecological site, determined by the type and or severity of abnormal disturbance. The known states and transition pathways for this ecological site are described in the accompanying state and transition model.

The Plant Community Plant Species Composition table provides a list of species and each specie's or group of species' annual production in pounds per acre (air-dry weight) expected in a normal rainfall year. Low and high production yields represent the modal range of variability for that species or group of species across the extent of the ecological site.

The Annual Production by Plant Type table provides the median air-dry production and the fluctuations to be expected during favorable, normal, and unfavorable years.

The present plant community on an ecological site can be compared to the various common vegetation states that can exist on the site. The degree of similarity is expressed through a similarity index. To determine the similarity index, compare the production 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 representative value shown in the Annual Production by Plant Type table for the reference plant community. Variations in production due to above or below normal rainfall, incomplete growing season or utilization must be corrected before comparing it to the site description. The Worksheet for Determining Similarity Index is useful in making these corrections. The accompanying growth curve can be used as a guide for estimating percent of growth completed.

The State and Transition diagram below reflects the current understanding of ecological dynamics for the site and describes the most commonly occurring plant communities found on the site. This diagram may not contain all the possible states, transitions and plant communities at this time. However, as more data is collected, additional information can be incorporated to modify the diagram to describe previously unknown plant communities, states and pathways.

State and transition model

Figure 3. 35.3 Sandstone Upland 10-14"p.z. Warm

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 Grasses			39-84	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	22-45	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	17-34	–
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	6-11	–
2	Other Perennial Grasses			11-17	
	Grass, perennial	2GP	<i>Grass, perennial</i>	9-13	–
	desert needlegrass	ACSP12	<i>Achnatherum speciosum</i>	0-4	–
	black grama	BOER4	<i>Bouteloua eriopoda</i>	0-4	–
	squirreltail	ELELE	<i>Elymus elymoides ssp. elymoides</i>	0-4	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	0-4	–
	sandhill muhly	MUPU2	<i>Muhlenbergia pungens</i>	0-4	–

	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	0-4	-
3	Annual Grasses			1-6	
	Grass, annual	2GA	<i>Grass, annual</i>	1-4	-
	sixweeks fescue	VUOC	<i>Vulpia octoflora</i>	0-4	-
Forb					
4	Dominant Forbs			11-22	
	Forb, annual	2FA	<i>Forb, annual</i>	13-22	-
	fiddleneck	AMSIN	<i>Amsinckia</i>	0-9	-
	plantain	PLANT	<i>Plantago</i>	0-9	-
5	Other Forbs			1-6	
	Forb, perennial	2FP	<i>Forb, perennial</i>	1-4	-
	milkvetch	ASTRA	<i>Astragalus</i>	0-4	-
	phlox	PHLOX	<i>Phlox</i>	0-4	-
	paperflower	PSILO3	<i>Psilostrophe</i>	0-4	-
	globemallow	SPHAE	<i>Sphaeralcea</i>	0-4	-
Shrub/Vine					
6	Dominant Shrubs			280-336	
	blackbrush	CORA	<i>Coleogyne ramosissima</i>	269-336	-
	Cutler's jointfir	EPCU	<i>Ephedra cutleri</i>	13-22	-
	Nevada jointfir	EPNE	<i>Ephedra nevadensis</i>	13-22	-
7	Other Shrubs			22-56	
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	17-28	-
	Bigelow sage	ARBI3	<i>Artemisia bigelovii</i>	0-6	-
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	0-6	-
	Stansbury cliffrose	PUST	<i>Purshia stansburiana</i>	0-6	-
	turpentinebroom	THMO	<i>Thamnosma montana</i>	0-6	-
	mormon tea	EPVI	<i>Ephedra viridis</i>	0-3	-
	hedgehog cactus	ECHIN3	<i>Echinocereus</i>	0-3	-
	Cutler's jointfir	EPCU	<i>Ephedra cutleri</i>	0-2	-
	Eastern Mojave buckwheat	ERFAP	<i>Eriogonum fasciculatum var. polifolium</i>	0-2	-
	grizzlybear pricklypear	OPPOH	<i>Opuntia polyacantha var. hystricina</i>	0-2	-
	narrowleaf yucca	YUAN2	<i>Yucca angustissima</i>	0-2	-
Tree					
8	Dominant Trees			0-13	
	Utah juniper	JUOS	<i>Juniperus osteosperma</i>	0-13	-
9	Trees			0-11	
	Tree	2TREE	<i>Tree</i>	0-9	-
	twoneedle pinyon	PIED	<i>Pinus edulis</i>	0-4	-

Table 6. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 7. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 8. Community 2.2 plant community composition

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

This site is suitable for grazing during any period of the year by cows and calves, stocker cattle, sheep and horses. Prescribed grazing systems can benefit this site by allowing rest periods for the cool season species. The potential plant community provides a variety of food and cover plants for wildlife. When the vegetation complex retrogresses then unpalatable shrub species increase and the site becomes less usable as a foraging area for some species. Grazing practices that encourage cool season grass species are beneficial to antelope, cottontails and rodents. Shrubs that provide both food and cover should be maintained.

Recreational uses

Site is located on gently sloping plains and mesa tops which lend themselves to activities such as horseback riding, hiking, wildlife observation, photography and hunting. Winters are cold, however, relatively mild spring, fall and summer months are attractive to recreationists.

Type locality

Location 1: Coconino County, AZ	
Township/Range/Section	T41N R7E S8
General legal description	Water Pockets 7 1/2 min quad, about 15 mi NW of Page on the east side of Cedar Mountain.

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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Approval

Kendra Moseley, 5/19/2025

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)	Kenneth Gishi
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Date	03/09/2012
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Not expected due to coarse textured soils, variable rock cover and low slopes. On steepest slopes very few rills may occur and will be less than 10 feet in length, especially where adjacent to exposed bedrock.

2. **Presence of water flow patterns:** Generally none expected on most slopes, but a few short (3-5 feet) water flow patterns may occur on steeper slopes.

3. **Number and height of erosional pedestals or terracettes:** Very few pedestals around long-lived plants along established water flow patterns on steeper slopes. Some soil mounding or deposition is common around shrubs and is common and should not be confused with erosional pedestals.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 15-45%. The amount of bare ground can vary widely depending on the amount of rock fragments, bedrock, and biological crust present on the site

5. **Number of gullies and erosion associated with gullies:** None, there should be no active gullies on this site.

6. **Extent of wind scoured, blowouts and/or depositional areas:** There can be some deposition (1"-2") around long lived shrubs and perennial shrubs.

7. **Amount of litter movement (describe size and distance expected to travel):** Fine litter is transported by wind and water in plant interspaces. Woody litter should not move from beneath shrubs and trees.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** This site should have an average soil stability rating of 3, with a rating of 3 to 4 under plant canopies and a rating of 2 to 3 in interspaces. Surface textures range from sand to gravelly loamy fine sand to sandy loam.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** The soil surface typically ranges from 4 to 12" thick. Structure is mostly single grain, loose to weak medium platy. Color ranges from light red (2.5YR 6/6) to strong brown (7.5YR 5/6).
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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 dominance of shrubs, grasses and forbs in descending order. Soils on site have rapid to very rapid permeability. High shrub canopy with scattered bunch grasses reduce raindrop impact allowing for optimum infiltration. Prolong droughts reduces perennial grass cover which can cause a decreased infiltration, especially during intense storm events.
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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 expected due to coarse textured soils.
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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: Evergreen shrubs (blackbrush, Ephedra) >>
- Sub-dominant: Warm seasoning grasses > Cool season grasses > other shrubs > perennial forbs > annual forbs
- Other:
- Additional:
-
13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** In years with normal to above normal precipitation there should be only slight mortality or decadence in shrubs or grasses. Only in severe prolong droughts will there be a significant mortality in shrubs and perennial bunch grasses. It should be noted that in periods of water stress blackbrush will drop its leaves.
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14. **Average percent litter cover (%) and depth (in):** The amount of litter cover will vary with different climatic conditions on the site. Litter distribution and depth will differ in plant interspaces and under canopies. Litter depth will be higher, up to 1/4", under canopies. Litter amounts will increase in the first years of drought and decrease in the later years of a drought.
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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Average annual production on this site is expected to be 350 to 400 lbs/ac in a year of average annual production.
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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:** Broom snakeweed, Ephedra

species, wavyleaf oak are all native to the site, but have the potential to increase on degraded sites. Russian thistle, cheatgrass, and other introduced annuals have the potential to invade the site.

17. Perennial plant reproductive capability: All plants native to the site are adapted to the climate and capable of producing seeds, stolons and/or rhizomes except during the most severe droughts.
