USDA Natural Resources
Conservation Service

Ecological site DX035X04B335
Sandstone/Shale Hills 10-14" p.z.

Accessed: 05/14/2025

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.

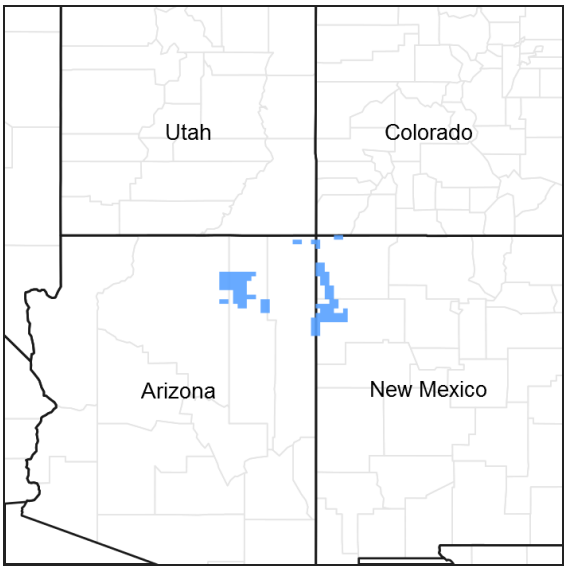

Figure 1. Mapped extent

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

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.

Similar sites

R035XC320AZ	**Shale Hills 10-14" p.z.** Sites on steep slopes shallow or moderately deep to highly weathered shale

R035XC337AZ	**Sandstone/Shale Upland 10-14" p.z.** Sites on slopes less than 20% shallow to sandstone and shale

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex confertifolia* (2) *Artemisia bigelovii*
Herbaceous	(1) *Pleuraphis jamesii* (2) *Sporobolus airoides*

Legacy ID

R035XC335AZ

Physiographic features

Landform and position are footslopes and backslopes of mountains, canyon sides, and mesas.

Table 2. Representative physiographic features

Landforms	(1) Canyon (2) Mesa (3) Mountain
Flooding frequency	None
Ponding frequency	None
Elevation	1,768–2,042 m
Slope	15–70%
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 thunderstoms. Cool season moisture from October though 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. Mean annual air temperature is 50-52 F. Mean annual soil temperature is 52-54 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

The soil moisture on this ecological site comes from precipitation. The site does not benefit from run-on moisture. Shallow bedrock areas may concentrate water in deeper soil pockets, increasing production in those areas. Because of the shallow clayey soils and steep slopes, larger rainfall events will not be captured by the site, reducing

the effective precipitation on this site for plant production. This site contributes runoff to other ecological sites.

Soil features

Soils are very shallow to shallow. Surface textures are clay loam, very gravelly clay loam, and very channery clay loam. Subsurface textures are clay loam, silty clay loam, and silty clay. Parent material is alluvium, residuum from shale, and sandstone. Geologic formation is mancos shale, mesa verde group, menefee. Available water capacity is very low. Water erosion potential is moderate to severe; wind erosion potential is moderate. Soils are slightly to moderately saline and slightly sodic with a pH range of 7.4-8.4. Soft shale fragments - 15-75%.

Typical taxonomic units on this site include:

SSA 715 Fort Defiance Area AZ/NM MU 30 and 100 Eagleye, 53 Zyme.

Table 4. Representative soil features

Parent material	(1) Alluvium–sandstone and shale
Surface texture	(1) Very channery clay loam (2) Very gravelly clay loam (3) Clay loam
Family particle size	(1) Loamy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Slow
Soil depth	25–51 cm
Surface fragment cover <=3"	0–45%
Surface fragment cover >3"	0–45%
Available water capacity (0-101.6cm)	0–6.35 cm
Calcium carbonate equivalent (0-101.6cm)	1–10%
Electrical conductivity (0-101.6cm)	2–16 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–13
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–10%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

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 historic climax plant community for this ecological site has been described by sampling relict or relatively undisturbed sites and/or reviewing historic records. The historic climax plant community is the plant community that evolved over time with the soil forming process and long term changes in climatic conditions of the area. It is the plant community that was best adapted to the unique combination of environmental factors associated with the site.

Natural disturbances, such as drought, fire, grazing of native fauna, and insects, are inherent in the development

and maintenance of these plant communities. The effects of these disturbances are part of the range of characteristics of the ecological site. Fluctuations in plant community structure and function caused by the effects of natural disturbances help establish the boundaries and characteristics of an ecological site. They are accounted for as part of the range of characteristics of the ecological site. Recognizable plant community phases are identified in the reference state of the ecological site. Some sites may have a small range of variation, while others have a large range. Some plant community phases may exist for long periods of time, while others may only occur for a couple of years after a disturbance.

Deterioration of the plant community, hydrology, or soil site stability on an ecological site can result in crossing a threshold or potentially irreversible boundary to another state, or equilibrium. This can occur as a result of the loss of soil surface through erosion, the loss of the stability of the site due to disturbances that cause active erosion on the site, increases in the amounts and/or patterns or runoff from rainstorms, changes in availability of surface and subsurface water, significant changes in plant structural and functional types, or the introduction of non-native species. When these thresholds are crossed, the potential of the ecological site to return to the historic climax plant community can be lost, or restoration will require significant inputs . There may be multiple states possible for an ecological site, determined by the type and or severity of disturbance.

The known states and transition pathways for this ecological site are described in the state and transition model. Within each state, there may be one or more known plant community phases. These community phases describe the different plant community that can be recognized and mapped across this ecological site. The state and transition model is intended to help land users recognize the current plant community on the ecological site, and the management options for improving the plant community to the desired plant community.

Plant production information in this site description is standardized to the annual production on an air-dry weight basis in near normal rainfall years.

State and transition model

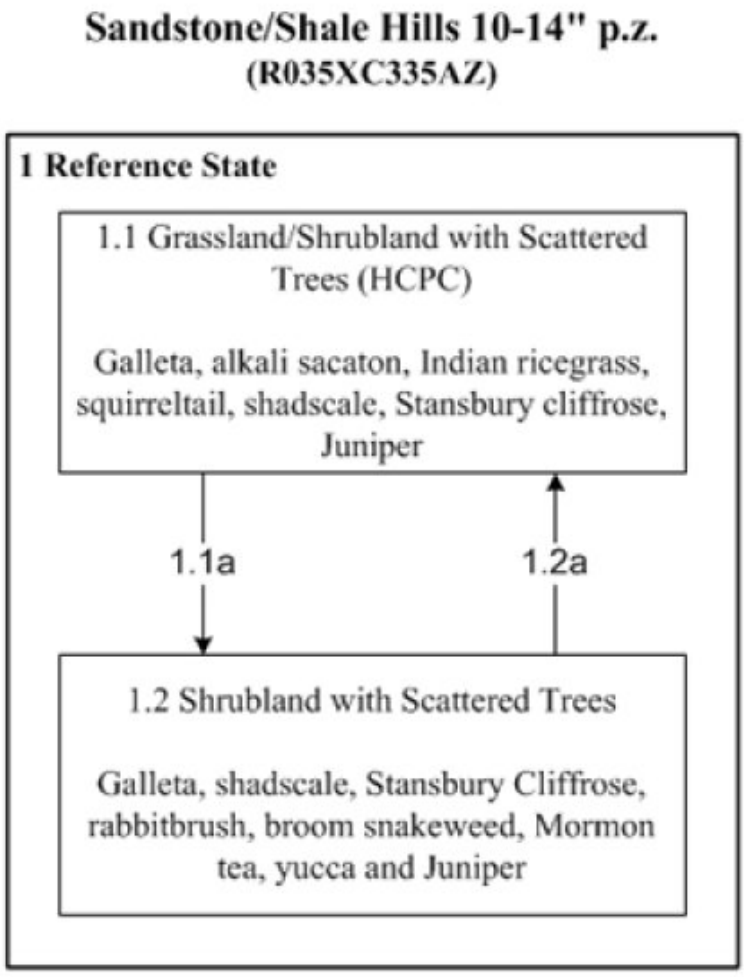

Figure 4. STM - R035XC335AZ

State 1
Reference State

Community 1.1
Grassland/Shrubland with Scattered Trees (HCPC)

Figure 5. Sandstone/Shale Hills 10-14" p.z.

The dominant aspect of this site is a mix of shrubs and grasses with widely scattered trees on slopes. Grasses include galleta, Indian ricegrass, and alkali sacaton. Shadscale is the major shrub with some Bigelow sagebrush, Greene's rabbitbrush, Stanbury cliffrose, and dwarf rabbitbrush. Overstory consists of scattered Utah junipers with an occasional Colorado pinyon present on the site. Introduced annual forbs and grasses may be present in trace amounts.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	135	224	319
Shrub/Vine	129	202	286
Tree	22	39	56
Forb	22	39	56
Total	**308**	**504**	**717**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0%
Grass/grasslike foliar cover	0%
Forb foliar cover	0%
Non-vascular plants	0%
Biological crusts	0%
Litter	5-15%
Surface fragments >0.25" and <=3"	5-25%
Surface fragments >3"	0-25%
Bedrock	0%
Water	0%
Bare ground	20-35%

Figure 7. Plant community growth curve (percent production by month). AZ3503, 35.3 10-14" p.z. galleta. Growth begins in spring, most growth occurs during summer and early fall rainy season. Plants will green up again in the fall..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	0	5	20	15	20	30	10	0	0

Figure 8. Plant community growth curve (percent production by month). AZ3505, 35.3 10-14" p.z. Indian ricegrass. Growth begins in spring, with semi-dormancy occurring during July through August. Plants will green up again in the fall..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	10	20	25	20	5	5	10	5	0	0

Figure 9. Plant community growth curve (percent production by month). AZ3507, 35.3 10-14" p.z. alkali sacaton. Growth begins in late spring, most growth occurs in summer and early fall..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	20	15	20	30	10	0	0	0

Figure 10. Plant community growth curve (percent production by month). AZ3509, 35.3 10-14" p.z. shadscale saltbush. Growth begins in spring and extends through the summer. Seed set occurs in summer to early fall..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	25	25	15	15	10	5	0	0	0

Community 1.2
Shrubland with Scattered Trees

This plant community is dominated by shrubs with scattered trees. There is an increase of bare ground with the decrease of perennial grasses. Native grasses such as James' galleta, alkali sacaton or Indian grasses are still found in small percentages. Shrubs like shadscale saltbush are also found, but there is an increase of rabbitbrush, snakeweed, mormon tea, yucca and junipers . Prescribed grazing will allow this site the rest it needs for the native herbaceous species to maintain their vigor. Introduced annual forbs and grasses may be present in trace amounts.

Pathway 1.1a
Community 1.1 to 1.2

Severe or prolong drought, continuous grazing, reduced perennial herbaceous cover, shrub increase

Pathway 1.2a
Community 1.2 to 1.1

Prescribed grazing or no grazing, favorable precipitation or return to more normal moisture regime.

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Grasses**			135–319	
	James' galleta	PLJA	*Pleuraphis jamesii*	73–129	–
	alkali sacaton	SPAI	*Sporobolus airoides*	50–101	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	28–50	

	Indian ricegrass	ACHY	*Achnatherum hymenoides*	28–50	–
	squirreltail	ELEL5	*Elymus elymoides*	6–28	–
	needle and thread	HECO26	*Hesperostipa comata*	0–16	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–11	–
	Fendler's threeawn	ARPUF	*Aristida purpurea var. fendleriana*	0–11	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–11	–
	Grass, annual	2GA	*Grass, annual*	0–11	–
	Grass, perennial	2GP	*Grass, perennial*	0–11	–
Forb					
2	**Forbs**			22–56	
	James' galleta	PLJA	*Pleuraphis jamesii*	52–64	–
	Forb, perennial	2FP	*Forb, perennial*	0–16	–
	globemallow	SPHAE	*Sphaeralcea*	0–10	–
	desert princesplume	STPI	*Stanleya pinnata*	0–10	–
	milkvetch	ASTRA	*Astragalus*	0–6	–
	rose heath	CHER2	*Chaetopappa ericoides*	0–6	–
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–6	–
	buckwheat	ERIOG	*Eriogonum*	0–6	–
	Fendler's bladderpod	LEFE	*Lesquerella fendleri*	0–6	–
	Forb, annual	2FA	*Forb, annual*	0–6	–
Shrub/Vine					
3	**Shrubs**			129–286	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	73–129	–
	Bigelow sage	ARBI3	*Artemisia bigelovii*	22–56	–
	Stansbury cliffrose	PUST	*Purshia stansburiana*	11–45	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	12–38	–
	Greene's rabbitbrush	CHGR6	*Chrysothamnus greenei*	6–28	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–17	–
	mormon tea	EPVI	*Ephedra viridis*	0–17	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–17	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–17	–
	longflower rabbitbrush	CHDE2	*Chrysothamnus depressus*	0–17	–
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	0–11	–
	Mojave seablite	SUMO	*Suaeda moquinii*	0–11	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–11	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–11	–
	slenderleaf buckwheat	ERLE10	*Eriogonum leptophyllum*	0–11	–
Tree					
4	**Trees**			22–56	
	Utah juniper	JUOS	*Juniperus osteosperma*	6–50	–
	twoneedle pinyon	PIED	*Pinus edulis*	0–17	–
	squirreltail	ELELE	*Elymus elymoides ssp. elymoides*	2–12	–

Animal community

Wildlife found on site are cottontail rabbit, sage sparrow, snakes, mule deer and lizards.

Recreational uses

Site has a high aesthetic appeal, particularly where it borders open grasslands for contrast. Hunting, hiking, and wildlife observation are the main recreational activities.

Wood products

This site has low to moderate potential for fuelwood cutting due to slopes.

Type locality

Location 1: Navajo County, AZ	
Township/Range/Section	T27N R19E S10
General legal description	5 mi SE of Polacca, Hopi Indian Reservation, Arizona
Location 2: Apache County, AZ	
General legal description	About 6 miles SW of Lukachukai, AZ, West of Route 12 on hills

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.

This site was originally 035XC349AZ - Clayey Slopes 9-13" p.z.

Contributors

HSH
Karlynn Huling
Ken Gishi
Kenneth Gishi
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)	Kenneth Gishi
Contact for lead author	Holbrook ESD Office
Date	03/15/2012
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Somewhat common, due to steep slopes. Rills up to 20 feet long. On slopes with significant amounts of coarse fragments will have few rills.

2. **Presence of water flow patterns:** Somewhat common throughout site. Flow patterns may be long and sinuous and connected on steep slopes. On sites with significant amounts of coarse fragments will have less evident water flow patterns.

3. **Number and height of erosional pedestals or terracettes:** Some long-lived plants may show some slight pedestals of less than a ½" on slopes. Terracettes are common.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Expected bare ground range 20-35 percent depending on surface rock fragments. Soil can be covered with up to 60 percent of rock fragments, mostly comprised of channers and gravels.

5. **Number of gullies and erosion associated with gullies:** None to very few. When site is well vegetated and covered with rock fragments, gullies are stable and will only show minor signs of active erosion. Gullies should be shallow due to depth to bedrock and/or armored with larger rock fragments (flagstones and boulders).

6. **Extent of wind scoured, blowouts and/or depositional areas:** Deposition and blowouts by wind are not expected.

7. **Amount of litter movement (describe size and distance expected to travel):** Due to steepness of the site, litter redistribution by water is common and expected in water flow patterns.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** The expected average soil stability is 3. Surface rock fragments, litter, and vegetation cover aid in reducing erosion. Surface textures are very channery clay loam, very gravelly clay loam, clay loam and clay.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface horizon is 2 to 4 inches deep. Structure is mostly moderately medium platy parting to moderate or strong fine granular structure. Surface color mostly pale brown (10YR 6/3) to light yellowish brown (10YR 6/4).

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Due to steepness and moderate amounts of rock fragments of this site, vegetation only has minimum effect on infiltration and runoff. This site is characterized by a slight dominance of grasses over shrubs with a light canopy of scattered trees. When well vegetated the cover lends to slowing runoff and allowing for some infiltration.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None

---

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 perennial grasses > Half shrubs

    Sub-dominant: Cool season perennial grasses >= Large shrubs > Trees = Forbs

    Other:

    Additional:

---

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 but the most severe droughts. Severe winter droughts affect the shrubs the most. Severe summer droughts affect grasses the most.

---

14. **Average percent litter cover (%) and depth (in):** Litter depth can vary due to weather and cover type dominance

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** The expected annual total production in an average year is 400 – 500 lbs/ac.

---

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:** Shadscale, broom snakeweed and annual forbs are native to the site but may have the potential to increase with continued disturbance. Cheatgrass, annual wheatgrass, and Russian thistle are non-native annuals that have the potential to invade the site with or without disturbance.

---

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