Ecological site R035XC302AZ
Sedimentary Cliffs
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.

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.

Table 1. Dominant plant species

Tree	(1) *Juniperus monosperma*
Shrub	(1) *Artemisia tridentata ssp. wyomingensis* (2) *Atriplex canescens*
Herbaceous	(1) *Hesperostipa comata* (2) *Poa fendleriana*

Physiographic features

This ecological site occurs as steep canyon walls, with small plateaus and ledges. It typically suffers from excessive drainage. Slopes are over 30 percent.

Table 2. Representative physiographic features

Landforms	(1) Cliff (2) Escarpment
Flooding frequency	None
Ponding frequency	None

Elevation	1,460 – 2,040 m
Slope	30 – 100 %
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

The soil moisture on this ecological site comes from precipitation. The site does not benefit significantly from run-on moisture from other sites. Shallow bedrock areas will concentrate water in deeper soil pockets on ledges, where most of the vegetation production occurs. Because of the shallow soils, larger rainfall events will not be captured by the site. This site contributes runoff to other ecological sites.

Soil features

The soils of this ecological site are very shallow to shallow. The complex geologic strata associated with the site has created a multitude of soil textures, and developments. There are also extreme differences in aspect which affect soil formation.

The soils range from coarse to fine loams. Parent material is typically limestone or sandstone with prominent calcium carbonate influence. Permeability is moderate to rapid, and the avaiable water capacity is very low.

Soil map units correlated to this ecological site include:

SSA 623 Shivwits Area MU's 45 Torriorthents & 51 Merwhitica;

SSA 625 Mohave County Area NE part MU 63
Torriorthents; SSA MU 48 Torriorthents;

SSA-629 Coconino County North Kaibab part MU 48 Torriorthents;

SSA 697 Mohave County Central part MU 126 Torriorthents;

SSA 701 Grand Canyon Area MU's 21 Chilton Puertecito family & Teesto family, 80 Meriwhitica,
112 Lithic Ustic torriorthents & Ustic torriorthents, 113 Seis family & Skos family, 158 Lithic Ustic Haplargids Lithic Ustic torriorthents & Ustic torriorthents;

SSA 707 Little Colorado River 42-Reef/Progresso, 46-Rock Outcrop/Mathis

SSA 711 Navajo Mountain Area 42-Rock Outcrop/Mathis, 67-Rock outcrop;

SSA 712 Canyon de Chelly NM 18-Ustic torriorthents;

SSA-713 Chinle Area MU's 61-Ustic Torriorthents, 63-Rock Outcrop;

SSA 714 Hopi Area MU's 28 Torriorthents, 35 Strych & 40 Ustic torriorthents;

SSA 715 Fort Defiance Area 82-Arches, 100-Teesto family, 101-Torriorthents, 127-Ustic Torriorthents

SSA 717 Shiprock Area 305 and 316 Strych, 311
and 320 Kinusta.

Table 4. Representative soil features

Parent material	(1) Colluvium – limestone and sandstone
Surface texture	(1) Gravelly sand (2) Cobbly loam (3) Sandy clay loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderate
Soil depth	20 – 30 cm
Surface fragment cover <=3"	40 – 80 %
Surface fragment cover >3"	50 – 70 %
Available water capacity (0-101.6cm)	1.78 – 2.29 cm
Calcium carbonate equivalent (0-101.6cm)	10 – 40 %
Electrical conductivity (0-101.6cm)	Not specified

Sodium adsorption ratio (0-101.6cm)	Not specified
Soil reaction (1:1 water) (0-101.6cm)	7.9 – 8.4
Subsurface fragment volume <=3" (Depth not specified)	50 – 70 %
Subsurface fragment volume >3" (Depth not specified)	10 – 20 %

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 3. R035XC302AZ ST Model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Grass/Grasslike					
1	**Cool Season Grasses**			112-224	
	needle and thread	HECO26	*Hesperostipa comata*	22-90	–
	desert needlegrass	ACSP12	*Achnatherum speciosum*	22-90	–
	muttongrass	POFE	*Poa fendleriana*	22-56	–
	squirreltail	ELEL5	*Elymus elymoides*	22-45	–
2	**Warm Season Grasses**			112-280	
	blue grama	BOGR2	*Bouteloua gracilis*	11-67	–
	bush muhly	MUPO2	*Muhlenbergia porteri*	0-28	–
	threeawn	ARIST	*Aristida*	0-28	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0-28	–
	black grama	BOER4	*Bouteloua eriopoda*	0-28	–
	James' galleta	PLJA	*Pleuraphis jamesii*	11-28	–
	spike dropseed	SPCO4	*Sporobolus contractus*	11-28	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	11-28	–
	mesa dropseed	SPFL2	*Sporobolus flexuosus*	11-28	–
	sandhill muhly	MUPU2	*Muhlenbergia pungens*	0-17	–
	ring muhly	MUTO2	*Muhlenbergia torreyi*	0-17	–
Forb					
3	**Forbs**			45-90	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	45-90	–
	Forb, annual	2FA	*Forb, annual*	11-45	–
	Forb, perennial	2FP	*Forb, perennial*	11-45	–
	prairie sagewort	ARFR4	*Artemisia frigida*	11-45	–
	buckwheat	ERIOG	*Eriogonum*	11-45	–
	globemallow	SPHAE	*Sphaeralcea*	11-45	–
Shrub/Vine					
4	**Shrubs**			56-280	
	serviceberry	AMELA	*Amelanchier*	0-45	–
	squirreltail	ELELE	*Elymus elymoides ssp. elymoides*	0-45	–
	Sonoran scrub oak	QUTU2	*Quercus turbinella*	0-45	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0-45	–
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	22-45	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	22-45	–
	rabbitbrush	CHRYS9	*Chrysothamnus*	0-45	–
	jointfir	EPHED	*Ephedra*	22-45	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	9-45	–
	Stansbury cliffrose	PUST	*Purshia stansburiana*	9-45	–
	bastardsage	ERWR	*Eriogonum wrightii*	0-27	–
	antelope bitterbrush	PUTR2	*Purshia tridentata*	0-22	–
	sand sagebrush	ARFI2	*Artemisia filifolia*	0-18	–
	brickellbush	BRICK	*Brickellia*	0-16	–
	manzanita	ARCTO3	*Arctostaphylos*	0-15	–
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	0-9	–
5	**cacti & succulents**			6-34	

	agave	AGAVE	*Agave*	18-45	–
	hedgehog cactus	ECHIN3	*Echinocereus*	18-45	–
	globe cactus	MAMMI	*Mammillaria*	18-45	–
	pricklypear	OPUNT	*Opuntia*	18-45	–
	yucca	YUCCA	*Yucca*	18-45	–
Tree					
6	**Trees**			90-179	
	juniper	JUNIP	*Juniperus*	90-179	–
	twoneedle pinyon	PIED	*Pinus edulis*	90-179	–
	blue grama	BOGR2	*Bouteloua gracilis*	45-90	–
	Gambel oak	QUGA	*Quercus gambelii*	0-45	–

Table 6. Community 1.2 plant community composition

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

Table 7. Community 2.1 plant community composition

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

Table 8. Community 2.2 plant community composition

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

Animal community

This site is typically quite steep which severely restricts use by livestock. Proper distribution is often impossible to attain, and heavy use occurs in the limited access areas frequented by livestock. This site provides a great deal of habitat diversity because of the topography, exposures, plant community variation, and rockiness. Permanent waters are lacking however. It is very important cover for many wildlife species.

Recreational uses

This site consists of canyon walls and plateau breaks. It has a highly diversified plant complex including trees, grasses, forbs, and shrubs. Winters are cold and spring is dry and windy. Late spring, summer, and fall provide pleasant recreation weather. Sport hunting is the major recreation activity of the site.

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.

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.

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Date	01/09/2007
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** **Rills may be common on talus slopes and other areas of soil accumulation due to runoff from adjacent rock outcrop and steep slopes. Much of the soil surface on talus slopes is armored by rock fragments.**

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2. **Presence of water flow patterns:** **Water flow patterns are occasional but may be common on talus slopes and other areas of soil accumulation due to runoff from adjacent rock outcrop and steep slopes. These patterns are usually short and discontinuous due to the frequency of rock fragments on the surface.**

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3. **Number and height of erosional pedestals or terracettes:** **Pedestals and terracettes are occasional but may be common on talus slopes and other areas of soil accumulation due to runoff from adjacent rock outcrop and steep slopes. Much of the soil surface on talus slopes is armored by 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):** **Bare ground ranges from 5-10%. 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. The talus slopes have 3.7 inches of available water capacity (rock outcrop would have close to 0), so the potential to produce plant cover is low.**

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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 course 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 surface textures are variable on the site. All surface horizons contain a significant amount of rock outcrops(gravel and/or boulders). Most soils have 40-80% ground cover of rock fragments (mostly gravels and boulders with some cobbles and stones). When well vegetated or covered with rock armor, the soils have a high resistance to both water an wind erosion. When well vegetated, these soils have a low to moderate resistance to water erosion depending on amount of rock fragment and vegetative cover.

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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 strong fine granular. The thickness of the A-horizon is 1 inch. The color of the A-horizon is not significantly different from the subsurface soil horizons.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** The vegetation communities on this site are scattered and patchy. They are present where there has been some accumulation of soil, such as a talus slope, or in cracks in the bedrock where they can access water. This site is characterized by shrubs, grasses, then forbs, in descending order of dominance. There may be an occasional overstory of trees. Vegetative canopy cover ranges from 5-10% (grasses > forbs = shrubs > trees). Basal cover ranges 0-2% (shrubs > grasses = forbs > trees) for vascular plants and 0-1% for biological crust (cyanobacteria > lichen > moss). Both canopy and basal cover values decrease during a prolonged drought.

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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. Most of the soils are not easily compacted. Rock fragments are common on the soil surface and within the soil profile.

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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: none

    Sub-dominant: shrubs > perennial bunchgrasses > perenial colonizing grasses

    Other: forbs > trees > annual forbs > annual grasses

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

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14. **Average percent litter cover (%) and depth (in):** Of the total litter amount, it would be expected that approximately 80-90% would be herbaceous litter and approximately 10-20% would be woody litter. 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):** 50-100 lbs/ac dry years; 100-200 lbs/ac median years; 200-300 lbs/ac 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:** Pricklypear, Whipple''s cholla and Broom snakeweed are native to the site and have the potential to increase and dominate after heavy grazing. Cheatgrass is an exotic grass that has the potential to invade this site, with or without heavy grazing.

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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/or rhizomes except during the most severe droughts.
