

Ecological site F035XF619AZ

Limestone Upland

13-17" p.z. (JUOS, PIED)

Last updated: 5/20/2025

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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 occurs in Common Resource Area 35.6 - the Colorado Plateau Pinyon-Juniper-Sagebrush The Common Resource Area occurs within the Colorado Plateau Physiographic Province. Elevations range from 5800 to 7300 feet and precipitation averages 13 to 17 inches per year. Vegetation includes pinyon, juniper, big sagebrush, cliffrose, Mormon tea, muttongrass, prairie junegrass, squirreltail, western wheatgrass, and blue grama. The soil temperature regime is mesic and the soil moisture regime is aridic ustic. 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.

Ecological site concept

Soils grouped on this site are very shallow to moderately deep with surface textures that include extremely cherty very fine sandy loam, extremely cobbly loam and gravelly to extremely gravelly loam. This ecological site is found on hills, escarpments and fan terraces of undulating plateaus. Slopes generally range from 2-25%.

Table 1. Dominant plant species

Tree	(1) <i>Juniperus osteosperma</i> (2) <i>Pinus edulis</i>
Shrub	(1) <i>Purshia stansburiana</i> (2) <i>Quercus turbinella</i>
Herbaceous	(1) <i>Bouteloua curtipendula</i> (2) <i>Poa fendleriana</i>

Physiographic features

This site is found on hills, escarpments and fan terraces of undulating plateaus very shallow to moderately deep soils. Slopes generally range from 2-25% with some areas of short runs up to 35%.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Escarpment (3) Terrace
Flooding frequency	None
Ponding frequency	None to rare
Elevation	1,770 – 2,230 m
Slope	0 – 30 %
Aspect	Aspect is not a significant factor

Climatic features

The climate of this land resource unit is semiarid with warm summers and cool winters. The mean annual precipitation ranges from 13 – 17 inches, but it is very erratic, often varying substantially from year to year. The majority of the precipitation comes from October through April. This precipitation comes as gentle rain or snow from frontal storms coming out of the Pacific Ocean. Snow is common from November through February. Generally no more than a few inches of snow accumulates, melting within a few days, but may last a week or more. 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 47 to 49 degrees Fahrenheit (F). The frost-free period (air temperature > 32 degrees F) ranges from 113 to 144 days (@ 50 percent probability). Strong winds are common, especially in the spring.

Table 3 Representative climatic features

Frost-free period (average)	140 days
Freeze-free period (average)	160 days
Precipitation total (average)	430 mm

Influencing water features

This site occurs in an upland position. The soil moisture on this ecological site comes from precipitation. It neither benefits from run-in moisture nor sustains excessive runoff unless denuded of its vegetation.

Soil features

Soils on this site are very shallow to moderately deep with surface textures that include extremely cherty very fine sandy loam, extremely cobbly loam and gravelly to extremely gravelly loam. Subsurface textures include loam, very gravelly, very cobbly to extremely cobbly loams, gravelly clay loam, clay, cobbly clay to very cobbly clay. They are derived from residuum and alluvium from limestone and basalt. The Geologic formations include Tonto Group (Muav limestone); Quaternary alluvium from Kaibab limestone; basalt.

Typical taxonomic units include:

SSA-625 Mohave county NE part MU's 71 & 72 Yumtheska;
 SSA-629 Coconino County N. Kaibab part MU's 14 17 & 52 Houserock, 51 52 Yumtheska;
 SSA-697 Central Mohave county MU's 33 Tovar, 33 Dye, 88 Milkweed, 88 Quartermaster;
 SSA-699 Hualapai/Havasupai Area MU's 47 Toqui & Tovar, 57 Wodomont, 25 Milkweed & Quartermaster;
 SSA-701 Grand Canyon area MU's 23 Chunkmonk family, 23 123 167 Wodomont family, 36 Disterheff, 83 84 Natank, 167 Topocoba family & 36 83 84 125 131 172 173 175 Yumtheska;
 SSA-707 Little Colorado MU - 9 Gladel.

Table 4. Representative soil features

Parent material	(1) Residuum – basalt (2) Alluvium – limestone
Surface texture	(1) Very gravelly loam (2) Extremely cobbly loam (3) Extremely gravelly loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Slow to moderately rapid
Soil depth	10 – 80 cm
Surface fragment cover <=3"	20 – 30 %
Surface fragment cover >3"	20 – 50 %
Available water capacity (0-101.6cm)	0 – 6.35 cm
Calcium carbonate equivalent (0-101.6cm)	20 – 40 %
Soil reaction (1:1 water) (0-101.6cm)	6.6 – 8.4
Subsurface fragment volume <=3" (Depth not specified)	0 – 20 %

Subsurface fragment volume >3" (Depth not specified)	10 – 40 %
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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. Limestone Upland 13-17"p.z.

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Grass/Grasslike					
1	Common Grasses			73-129	
	muttongrass	POFE	<i>Poa fendleriana</i>	50-78	–
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	50-73	–
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	26-50	–
2	Occasional Grasses			22-78	
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	6-26	–
	Fendler's threeawn	ARPUF	<i>Aristida purpurea var. fendleriana</i>	0-26	–
	black grama	BOER4	<i>Bouteloua eriopoda</i>	6-26	–
	squirreltail	ELEL5	<i>Elymus elymoides</i>	6-26	–
	needle and thread	HECO26	<i>Hesperostipa comata</i>	6-26	–

	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	0-26	-
	Grass, annual	2GA	<i>Grass, annual</i>	0-10	-
	Grass, perennial	2GP	<i>Grass, perennial</i>	0-10	-
Forb					
3	Forbs			17-34	
	Forb, annual	2FA	<i>Forb, annual</i>	0-11	-
	Forb, perennial	2FP	<i>Forb, perennial</i>	0-11	-
	pingue rubberweed	HYRI	<i>Hymenoxys richardsonii</i>	0-10	-
	paperflower	PSILO3	<i>Psilostrophe</i>	0-10	-
	globemallow	SPHAE	<i>Sphaeralcea</i>	0-6	-
Shrub/Vine					
4	Common Shrubs			151-252	
	Stansbury cliffrose	PUST	<i>Purshia stansburiana</i>	50-101	-
	Sonoran scrub oak	QUTU2	<i>Quercus turbinella</i>	26-76	-
	desert ceanothus	CEGR	<i>Ceanothus greggii</i>	26-76	-
	pricklypear	OPUNT	<i>Opuntia</i>	26-50	-
5	Other Shrubs			73-135	
	banana yucca	YUBA	<i>Yucca baccata</i>	6-50	-
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	6-50	-
	Fremont's mahonia	MAFR3	<i>Mahonia fremontii</i>	0-26	-
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	0-26	-
	Subshrub (<.5m)	2SUBS	<i>Subshrub (<.5m)</i>	0-26	-
	pointleaf manzanita	ARPU5	<i>Arctostaphylos pungens</i>	0-26	-
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata ssp. wyomingensis</i>	6-26	-
	mormon tea	EPVI	<i>Ephedra viridis</i>	6-26	-
	ashy silktassel	GAFL2	<i>Garrya flavescens</i>	0-26	-
Tree					
6	Trees			17-39	
	Utah juniper	JUOS	<i>Juniperus osteosperma</i>	6-28	-
	twoneedle pinyon	PIED	<i>Pinus edulis</i>	0-17	-
	singleleaf pinyon	PIMO	<i>Pinus monophylla</i>	0-17	-

Table 6. Community 1.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height M	Canopy Cover (%)	Diameter Cm	Basal Area (square M/hectare)
Tree							
Utah juniper	JUOS	<i>Juniperus osteosperma</i>	Native	0.6-5.5	30-40	10.2-33	-
singleleaf pinyon	PIMO	<i>Pinus monophylla</i>	Native	0.9-7.6	10-20	7.6-27.9	-

Table 7. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (m)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	Native	0.1-0.8	5-15
blue grama	BOGR2	<i>Bouteloua gracilis</i>	Native	0-0.4	3-8
Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	Native	0.1-0.5	1-4
black grama	BOER4	<i>Bouteloua eriopoda</i>	Native	0-0.5	1-3
squirreltail	ELELE	<i>Elymus elymoides ssp. elymoides</i>	Native	0.1-1	1-3
needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	Native	0.1-1.2	1-3

Fendler's threeawn	ARPUF	<i>Aristida purpurea var. fendleriana</i>	Native	0-0.4	1-2
muttongrass	POFE	<i>Poa fendleriana</i>	Native	0-0.5	1-2
Shrub/Subshrub					
Stansbury cliffrose	PUST	<i>Purshia stansburiana</i>	Native	0.9-2.4	8-15
Sonoran scrub oak	QUTU2	<i>Quercus turbinella</i>	Native	0.6-2.1	4-10
desert ceanothus	CEGR	<i>Ceanothus greggii</i>	Native	0.3-1.5	3-9
mormon tea	EPVI	<i>Ephedra viridis</i>	Native	0.3-0.9	2-5
mountain big sagebrush	ARTRV	<i>Artemisia tridentata ssp. vaseyana</i>	Native	0.1-1.1	2-5
pointleaf manzanita	ARPU5	<i>Arctostaphylos pungens</i>	Native	0.1-1.2	3-5
broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	Native	0-0.3	2-5
ashy silktassel	GAFL2	<i>Garrya flavescens</i>	Native	0.3-1.5	1-4
Fremont's mahonia	MAFR3	<i>Mahonia fremontii</i>	Native	0.3-1.5	1-3
Fremont's mahonia	MAFR3	<i>Mahonia fremontii</i>	Native	0.3-1.8	1-2
Tree					
Utah juniper	JUOS	<i>Juniperus osteosperma</i>	Native	0.6-6.1	30-40
singleleaf pinyon	PIMO	<i>Pinus monophylla</i>	Native	0.6-3.4	10-20

Table 8. Community 1.2 plant community composition

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

The suitability of this site for livestock grazing is only fair. Many of the brush species are not palatable. Management considerations include Prescribed Grazing, Water developments, stock trails on the steep slopes and Range Planting after disturbance such as fire, wood harvesting etc.. Wildlife use may be limited because of scarce water sources in natural springs and pockets. There is, however, a good diversity of food sources, good cover for most species and the topography provides escape habitat.

Recreational uses

Recreational activities available are hiking, wildlife observations, photography and star gazing at night.

Wood products

Steep slopes, rock outcrops and shallow soils limit the types of equipment and the ability to do tree planting and harvesting. Revegetation potential is poor due to shallow rocky soil and steep slopes. Rubber tired equipment on less than 15% slopes and crawler tractors on steeper slopes. Silvicultural considerations and potentials include: harvesting mature trees (fuelwood and posts) when canopy exceeds 35%; harvesting of posts and Christmas trees will thin and improve the stand; prescribed burning is not recommended due to the effect of increasing the shrub density and retarding the tree growth. Suitability for replanting is poor due to shallow rocky soils. Seedling mortality is severe for same reason. Natural regeneration is slow, but can occur in time. Seedlings should be protected from trampling, etc. due to grazing. Plant competition is moderate because of shallow soil. Windthrow hazard is moderate as some trees may blow over due to shallow soil.

Table 9. Representative site productivity

Common Name	Symbol	Site Index Low	Site Index High	CMAI Low	CMAI High	Age Of CMAI	Site Index Curve Code	Site Index Curve Basis	Citation
Utah juniper	JUOS	60	70	6	7	–	–	–	

Type locality

Location 1: Mohave County, AZ	
Township/Range/Section	T25N R17W S11

General legal description	Milkweed Canyon SW Quad - 1 mile SE of Quail Tank; Section 11, T25N, R17W; Hualapai Indian Reservation, AZ.
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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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Approval

Kendra Moseley, 5/20/2025

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)	
Contact for lead author	
Date	05/12/2026
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. Number and extent of rills:

2. Presence of water flow patterns:

3. Number and height of erosional pedestals or terracettes:

4. Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):

5. Number of gullies and erosion associated with gullies:

6. Extent of wind scoured, blowouts and/or depositional areas:

7. Amount of litter movement (describe size and distance expected to travel):

8. Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):

9. Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):

10. Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:

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

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:

Sub-dominant:

Other:

Additional:

13. Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):

14. Average percent litter cover (%) and depth (in):

15. Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):

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:

17. Perennial plant reproductive capability:
