

# Ecological site R035XC311AZ

## Limy Upland

10-14" p.z.

Last updated: 5/20/2025

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

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 typically very shallow to shallow to a plant root restricting layer. The surface texture ranges from gravelly loam to very gravelly loam. The soil is strongly to violently effervescent throughout the soil profile. This ecological site occurs in an upland position on fans, plateaus and mesas. Slopes range from 1 to 15 percent.

Table 1. Dominant plant species

|            |   |
|------------|---|
| Tree       | Not specified   |
| Shrub      | (1) <i>Atriplex canescens</i>                                       |
| Herbaceous | (1) <i>Hesperostipa comata</i><br>(2) <i>Achnatherum hymenoides</i> |

### Physiographic features

This ecological site occurs in an upland position on fans, plateaus and mesas and does not benefit from run-in moisture. The soil is deep, very to extremely gravelly, and strongly to violently effervescent throughout the soil profile. The soil surface is generally covered with gravels. Slopes range from 1 to 15 percent.

Table 2. Representative physiographic features

|                    |   |
|--------------------|---|
| Landforms          | (1) Fan piedmont<br>(2) Plateau<br>(3) Mesa |
| Flooding frequency | None  |
| Ponding frequency  | None  |
| 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

The soil moisture on this ecological site comes from precipitation. The site does not benefit significantly from run-on moisture. The loamy surface texture of the soil allows the site to capture the majority of the winter storms and the light to moderate summer storms if the site has good vegetative cover. The high calcium carbonate content of the soil reduces the amount of soil moisture available to plants. Intense summer thunderstorms will produce runoff, reducing the amount of effective rainfall.

### Soil features

These soils are typically very shallow to shallow, but occasionally are moderately deep, to a plant root restricting layer. The surface texture ranges from gravelly loam to very gravelly loam. The subsurface texture ranges from gravelly loam to very gravelly clay loam. The soil is strongly to violently effervescent throughout the soil profile. The soil reaction is strongly to very strongly alkaline (pH 8.5-9.4). Water erosion hazard is slight to moderate.

Soil survey map unit components correlated to this ecological site include:

SSA 623 Shivwits Area MU's 33 Havasupai, 49 Mellenthin;

SSA 701 Grand Canyon Area MU's 29 Puertecito, 99 Puertecito family;

SSA 707 Little Colorado River Area MU's 26-Placitas, 39-Skos.

**Table 4. Representative soil features**

|   |   |
|---|---|
| Parent material                             | (1) Alluvium – limestone                              |
| Surface texture                             | (1) Very gravelly loam<br>(2) Extremely gravelly loam |
| Family particle size                        | (1) Loamy   |
| Drainage class                              | Well drained  |
| Permeability class                          | Moderate  |
| Soil depth                                  | 30 – 70 cm  |
| Surface fragment cover <=3"                 | 40 – 60 %   |
| Available water capacity<br>(0-101.6cm)     | 2.49 – 3.2 cm   |
| Calcium carbonate equivalent<br>(0-101.6cm) | 10 – 70 %   |
| Electrical conductivity<br>(0-101.6cm)      | Not specified   |
| Sodium adsorption ratio<br>(0-101.6cm)      | Not specified   |
| Soil reaction (1:1 water)<br>(0-101.6cm)    | 7.9 – 10  |

|  |           |
|--|-----------|
| Subsurface fragment volume <=3"<br>(Depth not specified) | 40 – 60 % |
|--|-----------|

## 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. 35.3 Limy Upland 10-14"p.z.

## Additional community tables

Table 5. Community 1.1 plant community composition

| Group                  | Common Name        | Symbol | Scientific Name                           | Annual Production () | Foliar Cover (%) |
|------------------------|--------------------|--------|---|----------------------|------------------|
| <b>Grass/Grasslike</b> |                    |        |   |                      |                  |
| 1                      | <b>Grasses</b>     |        |   | 179-415              |                  |
|                        | black grama        | BOER4  | <i>Bouteloua eriopoda</i>                 | 34-67                | –                |
|                        | blue grama         | BOGR2  | <i>Bouteloua gracilis</i>                 | 34-67                | –                |
|                        | needle and thread  | HECOC8 | <i>Hesperostipa comata ssp. comata</i>    | 34-67                | –                |
|                        | Indian ricegrass   | ACHY   | <i>Achnatherum hymenoides</i>             | 34-67                | –                |
|                        | desert needlegrass | ACSP12 | <i>Achnatherum speciosum</i>              | 34-67                | –                |
|                        | spike dropseed     | SPCO4  | <i>Sporobolus contractus</i>              | 11-22                | –                |
|                        | sand dropseed      | SPCR   | <i>Sporobolus cryptandrus</i>             | 11-22                | –                |
|                        | Fendler's threeawn | ARPUF  | <i>Aristida purpurea var. fendleriana</i> | 6-17                 | –                |
| <b>Forb</b>            |                    |        |   |                      |                  |

|                   |                        |       |  |         |   |
|-------------------|------------------------|-------|--|---------|---|
| 2                 | <b>Forbs</b>           |       |  | 6-28    |   |
|                   | spike dropseed         | SPCO4 | <i>Sporobolus contractus</i>                 | 25-50   | – |
|                   | sand dropseed          | SPCR  | <i>Sporobolus cryptandrus</i>                | 25-50   | – |
|                   | Forb, annual           | 2FA   | <i>Forb, annual</i>                          | 2-8     | – |
|                   | Forb, perennial        | 2FP   | <i>Forb, perennial</i>                       | 2-8     | – |
|                   | globemallow            | SPHAE | <i>Sphaeralcea</i>                           | 2-8     | – |
|                   | thrift mock goldenweed | STARA | <i>Stenotus armerioides var. armerioides</i> | 2-8     | – |
| <b>Shrub/Vine</b> |                        |       |  |         |   |
| 3                 | <b>Shrubs</b>          |       |  | 118-275 |   |
|                   | black grama            | BOER4 | <i>Bouteloua eriopoda</i>                    | 76-126  | – |
|                   | blue grama             | BOGR2 | <i>Bouteloua gracilis</i>                    | 76-126  | – |
|                   | big sagebrush          | ARTR2 | <i>Artemisia tridentata</i>                  | 34-84   | – |
|                   | fourwing saltbush      | ATCA2 | <i>Atriplex canescens</i>                    | 34-67   | – |
|                   | jointfir               | EPHED | <i>Ephedra</i>                               | 34-67   | – |
|                   | Apache plume           | FAPA  | <i>Fallugia paradoxa</i>                     | 6-17    | – |
|                   | broom snakeweed        | GUSA2 | <i>Gutierrezia sarothrae</i>                 | 6-17    | – |
|                   | Stansbury cliffrose    | PUST  | <i>Purshia stansburiana</i>                  | 6-17    | – |
|                   | thrift mock goldenweed | STARA | <i>Stenotus armerioides var. armerioides</i> | 6-17    | – |
|                   | Greene's rabbitbrush   | CHGR6 | <i>Chrysothamnus greenei</i>                 | 6-17    | – |
|                   | pricklypear            | OPUNT | <i>Opuntia</i>                               | 3-13    | – |
|                   | globe cactus           | MAMMI | <i>Mammillaria</i>                           | 2-9     | – |
|                   | yucca                  | YUCCA | <i>Yucca</i>                                 | 2-9     | – |
| <b>Tree</b>       |                        |       |  |         |   |
| 4                 | <b>Trees</b>           |       |  | 0-28    |   |
|                   | Utah juniper           | JUOS  | <i>Juniperus osteosperma</i>                 | 0-28    | – |
|                   | threeawn               | ARIST | <i>Aristida</i>                              | 4-16    | – |

Table 6. Community 1.2 plant community composition

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

## Animal community

This site is suitable for year-long grazing by all classes of domestic livestock, but responds best to a planned grazing system that allows for occasional rest. Low productivity and very slow range recovery require special management considerations. No waters occur naturally on the site, but some areas are suitable for stock ponds. Additional permanent waters would benefit most wildlife populations. This site is not as productive or diverse as other sites because of limy soils that affect plant growth. However, soil conditions do encourage cliffrose, a valuable winter browse for mule deer.

## Recreational uses

This site occurs as undulating plains or limestone uplifts such as benches or outcrops. It often has a somewhat 'dwarfed' plant community due to limy soils. It appears as an open shrubby grassland. Winters are cold, and summers can be quite warm. Spring and fall temperatures are pleasant with cool nights but strong winds that often prevail during the day. Thunderstorms occur during the summer. Snow and occasional rain falls during the winter. This site is suitable for hunting and cross-country riding.

## 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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Unknown

## 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.

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|--|--|
| Author(s)/participant(s)                       | Kenneth Gishi  |
| Contact for lead author                        | State Rangeland Management Specialist, NRCS-Arizona<br>State Office, Phoenix, AZ |
| Date   | 08/01/2012   |
| Approved by                                    |  |
| Approval date                                  |  |
| Composition (Indicators 10 and 12)<br>based on | Annual Production  |

## Indicators

1. **Number and extent of rills:** None, due to surface rock cover providing armoring for surface and well drained soils.

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2. **Presence of water flow patterns:** Very few on level slopes and few on slopes. Water flow patterns are very short and not connected.

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3. **Number and height of erosional pedestals or terracettes:** Pedestals and terracettes are infrequent on perennial grasses and are less than 1 inch in height.

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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 should not exceed 35 percent.

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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): Most litter, especially woody litter will remain in place. Some fines and medium size litter will move in water flow paths.

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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): The expected soil stability average should 4, with values of 2 to 5 across the site. When the site is well vegetated and covered with rock fragments, the soils have a high resistance to erosion.

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9. Soil surface structure and SOM content (include type of structure and A-horizon color and thickness): Soil surface is about 2 to 5 inches thick with platy structure (weak – thick). Color can vary due to parent material. Use specific soil survey information for the soils you are evaluating.

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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 characterized by a uniform distribution of grasses (55-65%) and shrubs (35-45%) with a few forbs (1-5%). There may be a light overstory of scattered trees at higher elevations. Shrubs dominant the canopy, followed by grasses.

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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. The soil subsurface will have a argillic layer within 8 inches of the surface.

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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: Shrubs > Cool season bunchgrasses >

Sub-dominant: warm season colonizing grasses > warm season bunchgrass > forbs

Other: Trees = Cacti

Additional:

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13. Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence): All functional groups are adapted for survival except during the most severe droughts. Severe winter droughts affect shrubs and trees the most. Severe summer droughts affect grasses the most. Very shallow (<10") soils will show the most mortality in all functional groups

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

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**15. Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production): In a normal year the expected annual production is 400-500 lbs/ac.**

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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, big sagebrush and pricklypear cactus are all native to the site but have the potential to increase and co-dominate the site. Juniper can also increase on the site at higher elevations. Red brome, cheatgrass, redstem filaree and Russian thistle are all non-native annuals that can invade and establish on the site, regardless of management or lack of disturbance.**

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

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