

Ecological site R035XF608AZ Limestone / Sandstone Upland 13-17" 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.

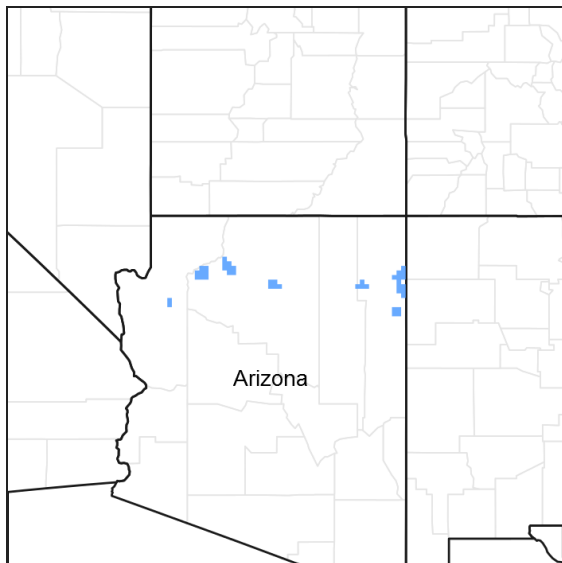


Figure 1. Mapped extent

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 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.

Associated sites

F035XF613AZ	Limestone Hills 13-17" p.z. (PIED, JUOS) Found in complex with the site.
R035XF605AZ	Loamy Upland 13-17" p.z. Found on stream terraces traversing the site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Artemisia tridentata ssp. wyomingensis</i>
Herbaceous	(1) <i>Poa fendleriana</i> (2) <i>Bouteloua gracilis</i>

Physiographic features

This ecological site is found on hills, plateaus and mesas of limestone and calcareous sandstone parent material. The soil of the site is shallow (<20") to bedrock and the surface is usually covered with gravel and small stones. The soil is effervescent at the surface and is strongly to violently effervescent throughout the soil profile. Slopes generally range from 0 to 15 percent, but there can be small areas with steeper slopes within the site.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Mesa (3) Plateau
Flooding frequency	None
Ponding frequency	None
Elevation	1,768–2,225 m
Slope	0–15%
Water table depth	25–51 cm
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)	144 days
Freeze-free period (average)	160 days
Precipitation total (average)	432 mm

Influencing water features

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

Soil features

The soils on this ecological site are shallow over limestone and calcareous sandstone bedrock. Surface textures of the soils range from gravelly very fine sandy loam to very gravelly loam. Subsoil textures include horizons of gravelly to extremely cobbly sandy clay loam and sandy clay loam. The parent geologic materials are limestone and sandstone. There is an argillic horizon that can start at 1" to 7" and descend to 6" to 12". The available water holding capacity is very low. Wind erosion hazard is very slight and the water erosion hazard is slight to moderate. The soil is non-saline and non-sodic, with pH range of 6.6-8.4. Indurated lime cemented pan is at 16-22 inches or sandstone bedrock at 6" to 20".

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

SSA-699 Hualapai/Havasupai Area MU 46 Topocoba;

SSA-701 Grand Canyon Area MU 123 Topocoba;

SSA-707 Little Colorado Area MU 9 Arabrab;

SSA-715 Ft Defiance Area MU 3 Arabrab.

Table 4. Representative soil features

Parent material	(1) Alluvium–limestone and sandstone
Surface texture	(1) Gravelly very fine sandy loam (2) Very gravelly loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Soil depth	25–51 cm
Surface fragment cover <=3"	50–60%
Surface fragment cover >3"	0–10%
Available water capacity (0-101.6cm)	0–6.35 cm
Calcium carbonate equivalent (0-101.6cm)	5–35%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–5
Soil reaction (1:1 water) (0-101.6cm)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	10–30%
Subsurface fragment volume >3" (Depth not specified)	5–60%

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.

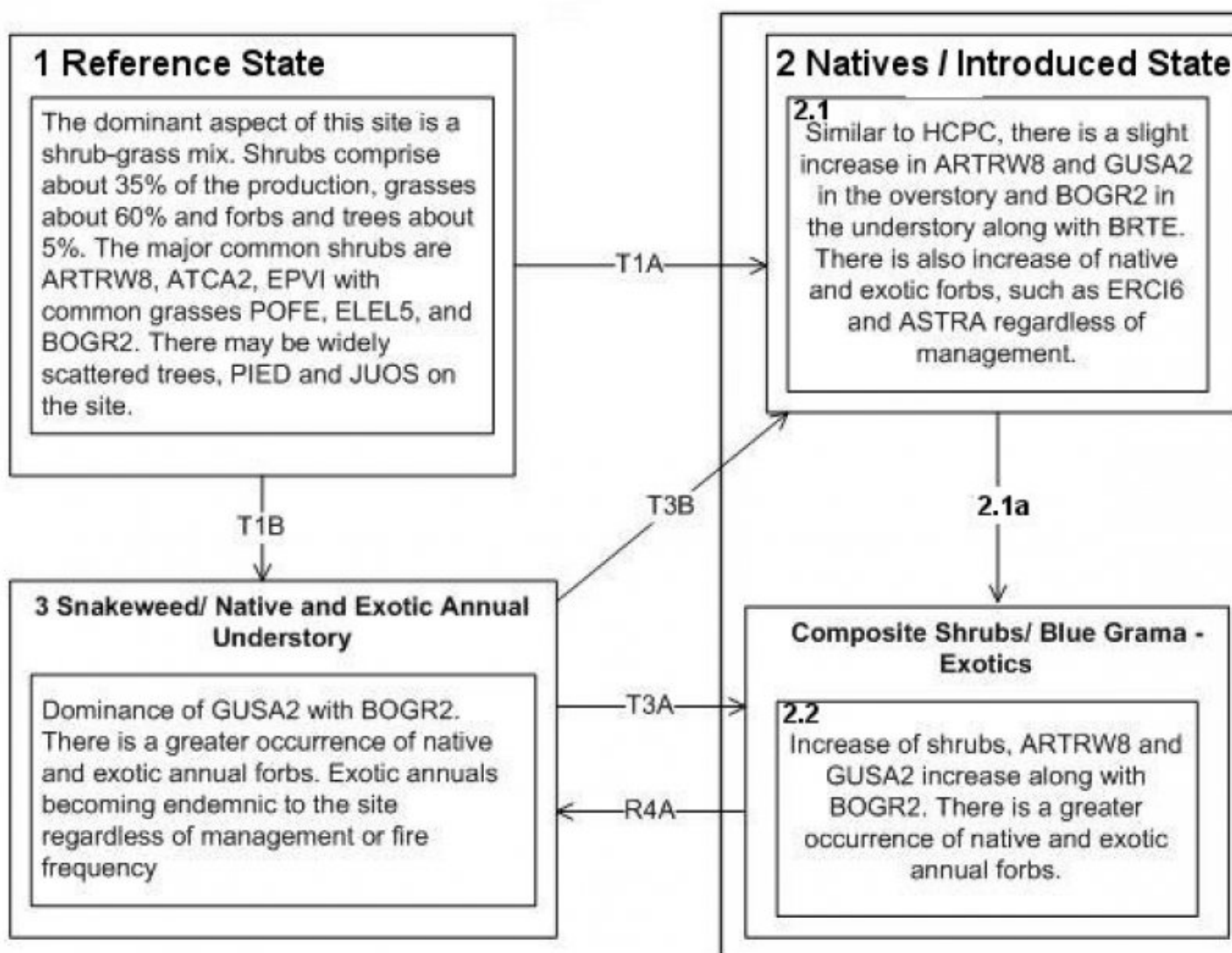
Deterioration of the plant community, hydrology, or soil site stability on an ecological site can result in crossing a threshold or potentially irreversible boundary to another state, or equilibrium. This can occur as a result of the loss of soil surface through erosion, the loss of the stability of 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

35.6 Limestone / Sandstone Upland



Transitions:

T1A – Continuous Moderate Herbivory. Introduction of exotic annuals regardless of management

T1B – Continuous Extreme Herbivory or Fire

2.1a – Continuous Extreme Herbivory

T3A – Proper Grazing Management or No Grazing

T3B – Reseeded with native species, Proper Grazing Management or No Grazing

R4A – Continuous Extreme Herbivory or Fire

ARTRW8 – Wyoming big sage
 ATCA2 – fourwing saltbush
 EPVI – green Mormon tea
 POFE – mutton grass
 ELEL5 – bottlebrush squirreltail
 BOGR2 – blue grama
 PIED – pinyon
 JUOS – Utah Juniper
 GUSA2 – broom snakeweed
 BRTE – cheatgrass
 ERCI6 – filaree
 ASTRA - locoweed

Figure 4. 35.6 LimestoneSandstoneUpland S&T

State 1
Reference State

Community 1.1

Historic Climax Plant Community

The dominant aspect of this site is a shrub-grass mix. The major shrubs are Wyoming big sagebrush, fourwing salttush and green mormon tea. The dominant grasses are muttongrass, bottlebrush squirreltail and blue grama. With disturbance, blue grama and Wyoming big sagebrush will increase and cheatgrass and annual forbs will invade.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	426	471	504
Shrub/Vine	224	269	291
Forb	6	22	34
Tree	–	17	22
Total	656	779	851

Table 6. Ground cover

Tree foliar cover	0-1%
Shrub/vine/liana foliar cover	1-2%
Grass/grasslike foliar cover	1-2%
Forb foliar cover	0%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

Table 7. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	–	–	0-1%
>0.15 <= 0.3	–	–	5-10%	–
>0.3 <= 0.6	–	–	–	–
>0.6 <= 1.4	–	10-15%	–	–
>1.4 <= 4	1-2%	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Figure 6. Plant community growth curve (percent production by month). AZ3504, 35.3 10-14" p.z. bottlebrush squirreltail. Growth occurs in late winter, spring, and fall. Plants often remain green through the winter..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	5	15	35	25	10	0	0	5	5	0	0

Figure 7. Plant community growth curve (percent production by month). AZ3506, 35.6 13-17" p.z. blue grama. Growth occurs mostly in summer and early fall during the rainy season..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	10	15	25	30	15	0	0	0

Figure 8. Plant community growth curve (percent production by month). AZ3602, 35.6 13-17" p.z. muttongrass. Most growth occurs in early to mid spring, plants may be green in the fall. Seed set occurs by summer..

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

Figure 9. Plant community growth curve (percent production by month). AZ3603, 35.6 13-17" p.z. Wyoming big sagebrush. Most growth occurs in the summer. Seed set occurs in the fall..

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

State 2

Natives / Introduced Annuals State

The communities in this state are similar to those in the reference state, but introduced annuals are now part of the plant community and compete with native species. The biotic integrity, fire frequency/intensity, and/or hydrologic function of the site has been altered.

Community 2.1

Natives with Introduced Annuals

This plant community is similar to the historic climax plant community, but includes introduced annuals such as cheatgrass.

Community 2.2

Shrub with Introduced Annuals Community

This plant community is dominated with native shrubs and a mix of native and non-native annuals in the understory. Perennial grasses are limited primarily to sod forming grasses like blue grama.

State 3

Half Shrub / Introduced Annuals State

The plant communities in this state have lost the larger shrub and bunchgrass components of the plant community. Soil site stability and watershed function and biotic integrity are slight to moderately departed from the reference state.

Community 3.1

Snakeweed -Blue Grama - Cheatgrass

This plant community is dominated by snakeweed and blue grama with introduced annual such as cheatgrass.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	Cool Season Perennials			191–269	
	muttongrass	POFE	<i>Poa fendleriana</i>	146–182	–
	squirreltail	ELELE	<i>Elymus elymoides ssp. elymoides</i>	37–73	–
	needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	8–37	–
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	8–37	–
2	Warm Season Perennials			110–146	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	110–146	–
3	Other Grasses			8–37	
	Grass, perennial	2GP	<i>Grass, perennial</i>	8–37	–
Forb					
4	Perennial Forbs			8–28	
	needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	7–36	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	8–22	–
	rose heath	CHER2	<i>Chaetopappa ericoides</i>	0–7	–
5	Annual Forbs			7–15	
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	7–36	–
	Forb, annual	2FA	<i>Forb, annual</i>	7–15	–
Shrub/Vine					
6	Dominant Shrubs			118–168	
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata ssp. wyomingensis</i>	110–146	–
	mormon tea	EPVI	<i>Ephedra viridis</i>	8–37	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	8–22	–
7	Other Shrubs			6–56	
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	8–37	–
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	0–37	–
8	Cactus			0–15	
	Forb, perennial	2FP	<i>Forb, perennial</i>	7–22	–
	banana yucca	YUBA	<i>Yucca baccata</i>	0–15	–
Tree					
9	Trees			0–22	
	Utah juniper	JUOS	<i>Juniperus osteosperma</i>	0–15	–
	twoneedle pinyon	PIED	<i>Pinus edulis</i>	0–8	–

Animal community

Wildlife found on the ecological site includes mule deer, coyote, blacktail jackrabbit, snakes, pronghorn antelope, cottontail rabbit, meadow lark and lizards.

Type locality

Location 1: Coconino County, AZ	
Township/Range/Section	T32 N. R6 W. S17

General legal description	National Canyon Quad. - Mesa between National Canyon and Mohawk Canyon; Sec. 17, 20, and 31, T. 32 N., R. 6 W.; Hualapai Indian Reservation, Arizona.
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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.

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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.

Author(s)/participant(s)	Karlynn Huling
Contact for lead author	NRCS Flagstaff Area Office
Date	04/20/2006
Approved by	S. Cassady
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

- Number and extent of rills:** Some rill formation is possible, especially on steeper slopes due to loamy and clay loam surface textures, slow permeability, shallow depth, rapid runoff, and moderate amounts of bare ground. Rill formation will be reduced if the soil has a lot of rock fragment armor on the surface.

- Presence of water flow patterns:** Water flow patterns may be occasional to common due to slow permeability, shallow depth, rapid runoff, and moderate amount of bare ground. There will be more water flow patterns in steeper areas adjacent to inclusions of rock outcrop or very shallow (<10 inches deep) soils, especially if there isn't much rock fragment armor on the surface.

- Number and height of erosional pedestals or terracettes:** Some pedestals and terracettes may form, but they should be very short.

- Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Areas with a greater cover of rock fragments will have less bare ground. Drought may cause an increase

in bare ground. This site has only one inch of available water capacity, so the potential to produce plant cover is very low.

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
-
7. **Amount of litter movement (describe size and distance expected to travel):** Herbaceous and fine woody litter will be transported in water flow pathways. Coarse woody litter will remain under shrub and tree canopies. Litter movement may be greater in areas adjacent to inclusions of rock outcrop and very shallow (<10 inches deep) soils.
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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 texture is generally very fine sandy loam. Most surface horizons contain a significant amount of rock fragments (mainly gravels). Many soils have a significant cover of rock fragment (mainly gravels) armor on the surface. When well vegetated or covered with rock armor, the soils have a moderate to high resistance to both water and wind erosion.
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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 mostly granular(weak fine granular). Surface thickness averages about one inch. Color is variable depending upon parent material.
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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 relatively even distribution of mostly shrubs and grasses. There may be small patches of trees. Canopy cover averages about 30% (15% shrubs, 10% grasses, 2% trees, 1% forbs). Basal cover averages about 5% (2% shrubs, 2% grasses, 1% trees). The cover is reduced by the amount of rock fragment and bedrock ground cover. Both cover values decrease during a prolonged drought. This type of plant community is only slightly effective at capturing and storing precipitation.
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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. Due to very fine sandy loam surfaces and sandy clay loam subsurface textures, these soils may be easily compacted, but they are generally protected by a significant amount of rock fragment armor on the surface and within the surface horizons.
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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: cool season bunchgrasses >
- Sub-dominant: shrubs > warm season bunchgrasses >
- Other: minor: forbs >
- Trace: trees = Agave family

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 years except during the most severe droughts. Severe winter droughts affect shrubs and trees the most. Severe summer droughts affect grasses the most.
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14. **Average percent litter cover (%) and depth (in):** Litter consists of a combination of woody and herbaceous. 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):** 400-600 pounds per acre (dry weight) in drought years, 600-700 pounds per acre in median years, 700-850 pounds per acre in 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:** Wyoming big sagebrush is native to the site, but has the potential to increase and dominate the site after heavy grazing. Broom snakeweed is a native that has the potential to increase and dominate the site after a sagebrush fire and heavy grazing. Cheatgrass is an exotic annual that is becoming endemic to the site regardless of management of fire frequency. It may become dominant after a sagebrush fire, even with conservative or no 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 rhizomes in most years except during the most severe droughts.
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