

# Ecological site R035XF604AZ Clayey 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.

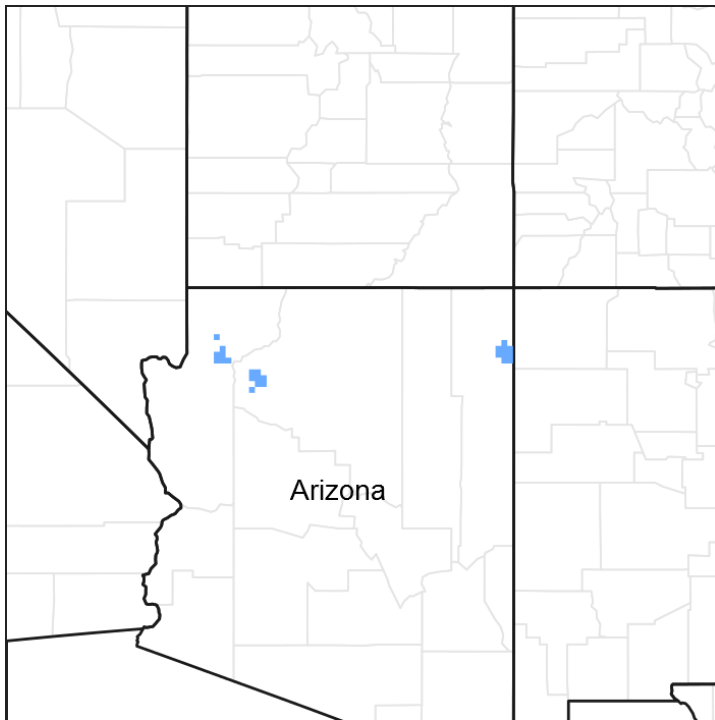


Figure 1. Mapped extent

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.

## Ecological site concept

The soils of this ecological site are deep to very deep. The surface texture is clay. The subsurface texture is clay. Due to the shrink-swell nature of the clay the site is subject to noticeable cracking. This site is found on fans. Slopes range from 0 to 15 percent.

**Table 1. Dominant plant species**

Tree	Not specified
Shrub	(1) <i>Artemisia tridentata ssp. wyomingensis</i>
Herbaceous	(1) <i>Pascopyrum smithii</i> (2) <i>Elymus elymoides ssp. elymoides</i>

## Physiographic features

This site is found on fans. The soil is deep to very deep. The surface textures shrink swell clays that create large cracks when dry. The subsurface horizons range from silty clay to clay. Slopes range from 0 to 15 percent.

**Table 2. Representative physiographic features**

Landforms	(1) Fan remnant
Flooding frequency	None
Ponding duration	Very brief (4 to 48 hours)
Ponding frequency	None to rare
Elevation	1,768–2,225 m
Slope	0–15%
Water table depth	0–183 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. The shrink swell clays in the soil surface creates large cracks when the soil is dry that allows the soil to capture the majority of the winter storms and the summer storms. If the soils is wet and the cracks are swollen shut, the site produce runoff, reducing the amount of effective rainfall.

## Soil features

The soil of this ecological site is deep to very deep to any plant root restricting layer. The surface texture is clay. The subsurface texture is clay. Due to the shrink-swell nature of the clay the site is subject to noticeable cracking. The surface of the soil is non-effervescent becoming slightly effervescent to effervescent at depths greater than 30 inches. The soil is generally non-gravelly, but small amounts of gravel may occur in some soil horizons.

This site is correlated in the following soil surveys and soil map units:

SSA-623 Shivwits Area MU 2 Albers;  
SSA-699 Hualapai-Havasupai Area MU 1 Albers;

SSA-701 Grand Canyon Area MU 1 Albers;  
 SSA-713 Chinle Area MU 52, 53 Tsaile, MU 15 Cumulic Endoaquoll .

**Table 4. Representative soil features**

Parent material	(1) Alluvium–basalt
Surface texture	(1) Silty clay loam (2) Sandy loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Very slow
Soil depth	152 cm
Surface fragment cover ≤3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	17.78–25.4 cm
Calcium carbonate equivalent (0-101.6cm)	0–15%
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Soil reaction (1:1 water) (0-101.6cm)	6.6–7.8
Subsurface fragment volume ≤3" (Depth not specified)	0–10%
Subsurface fragment volume >3" (Depth not specified)	0%

## 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 Clayey Upland 13-17"p.z.

(R035XF604AZ)

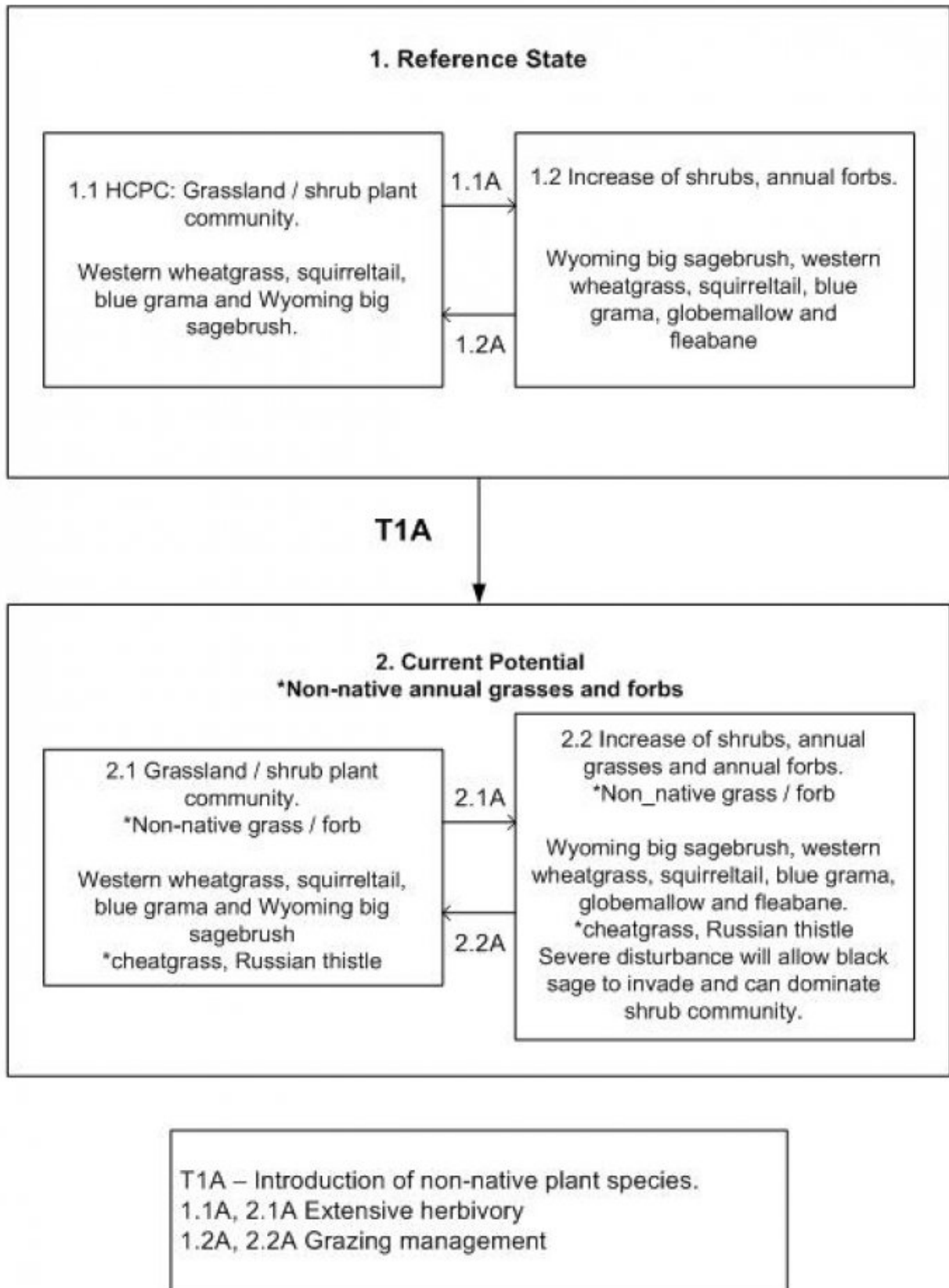


Figure 4. Clayey Upland 13-17"p.z.

## State 1 Reference State

This is a grassland / shrub mix. The approximate total production breakdown is grasses are 65-75%, forbs 1-5%, shrubs 15-25%. Western wheatgrass, squirreltail and blue grama are the dominant grasses and Wyoming big sagebrush is the dominant shrub.

## Community 1.1 Historic Climax Plant Community

The dominant aspect of this site is a grassland with some shrubs. Major grasses are western wheatgrass, bottlebrush squirreltail and blue grama. Wyoming big sagebrush is the dominant shrub. With severe disturbance, Wyoming big sagebrush and western wheatgrass will increase 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	392	504	616
Shrub/Vine	90	157	224
Forb	11	34	56
<b>Total</b>	<b>493</b>	<b>695</b>	<b>896</b>

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0-1%
Grass/grasslike foliar cover	0-2%
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	–	–	15-20%	–
>0.3 <= 0.6	–	0-1%	–	–
>0.6 <= 1.4	–	–	–	–
>1.4 <= 4	–	–	–	–
>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). AZ3601, 35.6 13-17" p.z. western wheatgrass. Growth begins in the spring and continues into fall during the rainy season..**

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

**Figure 10. Plant community growth curve (percent production by month). AZ3926, 35.6 13-17" p.z. fourwing saltbush. Growth begins in the spring and continues through the summer. Seed stalk extension 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	10	15	20	20	15	15	5	0	0

## **Community 1.2**

### **Increased Shrubs**

Disturbance has led to the increased shrub production of Wyoming big sagebrush and Greene rabbitbrush. Perennial grass production decreases and annual forbs increase.

### **Pathway 1.1A**

#### **Community 1.1 to 1.2**

Disturbance reduces native perennial grasses. Shrubs increase and annual forbs and grasses increase.

### **Pathway 1.2A**

#### **Community 1.2 to 1.1**

Grazing management.

## **State 2**

### **Non-Native and Native Invaded**

Cheatgrass and Russian thistle have been introduced to the site. Some areas of severe surface disturbance allows native black sage to invade and dominate the site. Note: Introduction of non-native annuals species creates an irreversible change in the plant community

### **Community 2.1**

#### **Grasses and Shrubs w/ Non-Natives**



**Figure 11. Grassland with Black Sagebrush**

This is a reflection of plant community 1.1 with introduced non-native annuals introduced on the site. Russian thistle and cheatgrass are the most common invaders.

## **Community 2.2**

### **Increased Shrubs and Non-Native Introduction**

This plant community can resemble plant community 1.2. There is a difference of possible shrub dominance. Black sage can invade and increase to dominance on areas of severe surface disturbance. Once again, cheatgrass and Russian thistle are the common non-native invaders.

### **Pathway 2.1A**

#### **Community 2.1 to 2.2**

Continuous disturbance allows shrubs to increase. Perennial grasses reduced and annuals increase.

### **Pathway 2.2A**

#### **Community 2.2 to 2.1**

Careful management and shrub treatment.

### **Transition T1A**

#### **State 1 to 2**

Introduction of non-native annual plant species.

## **Additional community tables**

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Grasses</b>			392–616	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	224–308	–
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	84–140	–
	squirreltail	ELELE	<i>Elymus elymoides ssp. elymoides</i>	84–140	–
	Grass, perennial	2GP	<i>Grass, perennial</i>	6–39	–
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	0–39	–
	Fendler's threeawn	ARPUF	<i>Aristida purpurea var. fendleriana</i>	0–17	–
	Grass, annual	2GA	<i>Grass, annual</i>	0–17	–
<b>Forb</b>					
2	<b>Forbs</b>			11–56	
	squirreltail	ELELE	<i>Elymus elymoides ssp. elymoides</i>	78–118	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	6–22	–
	Forb, annual	2FA	<i>Forb, annual</i>	6–17	–
	pingue rubberweed	HYRI	<i>Hymenoxys richardsonii</i>	6–11	–
	globemallow	SPHAE	<i>Sphaeralcea</i>	0–6	–
	fleabane	ERIGE2	<i>Erigeron</i>	0–6	–
<b>Shrub/Vine</b>					
3	<b>Shrubs</b>			90–224	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	78–118	–
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata ssp. wyomingensis</i>	78–118	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	6–39	–
	black sagebrush	ARNO4	<i>Artemisia nova</i>	8–39	–
	Greene's rabbitbrush	CHGR6	<i>Chrysothamnus greenei</i>	8–39	–
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	0–17	–

## Animal community

Wildlife found on this site include: mule deer, pronghorn antelope, coyote, snakes, lizards, cottontail rabbit, blactail jackrabbit, and rodents.

## Type locality

Location 1: Coconino County, AZ	
Township/Range/Section	T29 N. R7 W. S21
General legal description	Frazier Well quad - Laguna Valley area; Sec. 21, 28, T 29 N., R. 7 W., Hualapai Indian Reservation, Arizona.

## 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, 5/19/2025

## 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)	Dan Carroll
Contact for lead author	State Rangeland Management Specialist, NRCS-Arizona State Office, Phoenix,AZ

Date	09/12/2012
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

## Indicators

1. **Number and extent of rills:** None. Good grass cover and 0-3% slope equals slow runoff .  

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2. **Presence of water flow patterns:** None.  

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3. **Number and height of erosional pedestals or terracettes:** Very rare and only visible if there is an area of reduced plant cover.  

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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 20-40%.  

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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):** Fine litter may be transported by wind and water. Water runoff is slow and with the large amount of plant production the distance traveled would be minimal. Some fine litter might travel a considerable distance by wind force.  

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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):** High amounts of vegetation production (mostly grasses) yields moderate to high resistance to water erosion. The soil is up to a moderate risk of wind

erosion.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Massive to strong thick platy structure that is 4-7" thick. This is a well vegetated grassland, too.
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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** There is a fairly even distribution of grasses with scattered shrubs and a small amount of forbs. This plant community on this site is only slight to moderate in the ability to capture and store moisture.
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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):** Strong thick platy structure at the surface in some areas might be mistaken for a compaction layer.
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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: Grasses >>

Sub-dominant: Shrubs>>

Other: Forbs

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 survive in all years except during the most severe droughts.
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14. **Average percent litter cover (%) and depth ( in):** 15 to 25%.
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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** The expected annual production for this site in a normal year of precipitation is 575 to 675 pounds per acre total production.
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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 and western wheatgrass will increase with continuous disturbance. Severe disturbance can bring black sagebrush to invade and dominate the site. Annual forbs can invade either of the prior scenarios and cheatgrass is a non-native invader to this site.
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17. **Perennial plant reproductive capability:** All plant species 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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