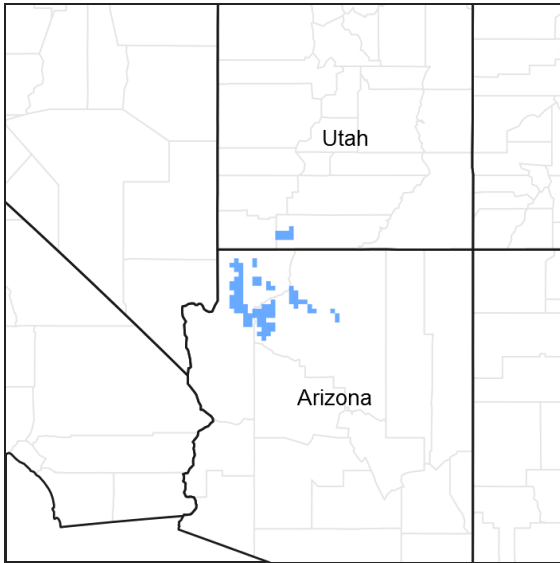


## Ecological site F035XF613AZ Limestone Hills 13-17" p.z. (PIED, JUOS)

Accessed: 05/03/2024

### 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.

**Table 1. Dominant plant species**

Tree	(1) <i>Pinus edulis</i> (2) <i>Juniperus osteosperma</i>
Shrub	(1) <i>Artemisia tridentata ssp. wyomingensis</i> (2) <i>Purshia stansburiana</i>

Herbaceous	(1) <i>Poa fendleriana</i> (2) <i>Bouteloua gracilis</i>
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## Physiographic features

This site is found on backslopes, summits, shoulders and escarpments of hills, mesas and plateaus. Slopes generally range from 15 to 60 percent, but there can be flatter or steeper spots within the site. The soil of this site is very shallow to shallow over limestone bedrock. Surface textures range from gravelly to very gravelly or extremely cobbly loam. Subsurface horizons are gravelly and/or cobbly loam to clay textures. The site does not benefit significantly from run-on moisture from adjacent sites.

**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	15–60%
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 from run-on moisture. Shallow bedrock areas may concentrate water in deeper soil pockets, increasing production in those areas. Because of the shallow soils and steep slopes, larger rainfall events will not be captured by the site, reducing the effective precipitation on this site for plant production. This site contributes runoff to other ecological sites.

## Soil features

Soils are very shallow to shallow to limestone. Surface textures are very cobbly to extremely cobbly loam, gravelly to very gravelly loam and very channery loam. Subsurface textures are very gravelly to very cobbly loam, very gravelly clay loam and very to extremely gravelly clay. Surface materials are alluvium, colluvium and residuum from

limestone. Available water capacity is very low. Water erosion potential is slight to severe. Wind erosion potential is very slight to moderate. Soils are non-sodic, non-saline with pH range of 7.4-8.4. Lime content averages 10-40% for most soils.

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

SSA-623 Shivwits Area MU's 21, 93 & 95 Yumtheska;

SSA-625 Mohave County NE part MU 73 Yumtheska;

SSA-699 Hualapai/Havasupai Area MU's 46 Wodomont, 10 Deama, 27 & 48 Yumtheska;

SSA-701 Grand Canyon area MU's 9, 70, 71, 74 & 76 Yumtheska, 22 Chunkmonk, 22 Wodomont family, 33 Deama, 90 Phizphre, 76 Toqui.

SSA-707 Little Colorado MU 59 Suzmayne

**Table 4. Representative soil features**

Parent material	(1) Alluvium–limestone
Surface texture	(1) Extremely cobbly loam (2) Very cobbly loam (3) Very gravelly loam
Family particle size	(1) Clayey
Permeability class	Slow to moderate
Soil depth	18–51 cm
Surface fragment cover <=3"	20–30%
Surface fragment cover >3"	35–45%
Available water capacity (0-101.6cm)	0–6.35 cm
Calcium carbonate equivalent (0-101.6cm)	15–40%
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	15–20%
Subsurface fragment volume >3" (Depth not specified)	30–40%

## 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.

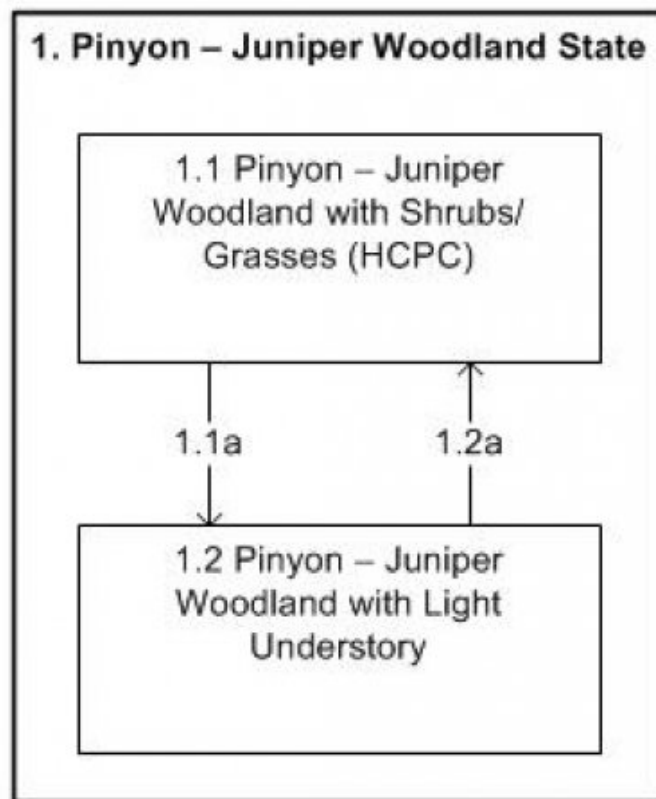
Deterioration of the plant community, hydrology, or soil site stability on an ecological site can result in crossing a threshold or potentially irreversible boundary to another state, or equilibrium. This can occur as a result of the loss of soil surface through erosion, the loss of the stability of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

## 35.6AZ Limestone Slopes 13-17" p.z. (PIED, JUOS) (F035XF613AZ)



### Legend

1.1a = Drought and Continuous Herbivory/Grazing

1.2a = Time/Rest, Favorable climate (wet) and Prescribed grazing

Figure 4. Limestone Hills 13-17"p.z.

### **State 1**

#### **Pinyon-Juniper Woodland**

This state is characterized by an overstory dominance of trees with an understory of shrubs and herbaceous species. Tree canopy is typically 25-40% with a range of 15 to 55% depending on aspect, elevation, slopes, rock cover and soil depth. Major overstory species are pinyon and juniper with scattered large shrubs including Fremont barberry, Stansbury cliffrose, turbinella oak and Utah serviceberry. Major understory species include muttongrass, blue grama, squirreltail, galleta, Wyoming big sagebrush, broom snakeweed, Mormon tea and yucca. Amounts and composition of understory species will vary depending on tree canopy, elevation, aspect, rock cover and drought.

#### **Community 1.1**

##### **Pinyon - Juniper Woodland with Shrubs/ Grasses (HCPC)**



Figure 5. Limestone Slopes 13-17" p.z. (PIED, JUOS)

The Pinyon-Juniper Woodland with Shrubs/Grasses Plant Community(HCPC) has a tree canopy cover that typically ranges from 25% to 45% over grasses, forbs, shrubs and small trees. The dominate aspect of this plant community is a pinyon-juniper woodland with Wyoming big sagebrush, cliffrose, muttongrass and blue grama. On this site the herbaceous species and shrubs have developed in competition with tree species. Understory production potential varies with tree canopy density.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	118	179	241
Shrub/Vine	118	179	241
Tree	6	22	39
Forb	6	22	39
<b>Total</b>	<b>248</b>	<b>402</b>	<b>560</b>

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). AZ3512, 35.6 13-17" p.z. Stansbury cliffrose. Growth begins in spring and continues through the summer. Stem elongation, flowering, and seed set occur in summer..

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

Figure 9. Plant community growth curve (percent production by month). AZ3516, 35.6 13-17" p.z. bottlebrush squirreltail. Early spring growth; goes semi-dormant in summer; some green up in fall..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	5	15	35	20	5	5	5	5	5	0	0

Figure 10. 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 11. 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

## Community 1.2

### Pinyon - Juniper Woodland with Light Understory

This plant community phase the tree canopy that is greater than 35 percent with a lighter understory of shrubs and grasses. Grass and shrub diversity has declined with tree canopy increase. Grasses that will most likely decline are squirreltail, blue grama, junegrass and galleta. Shrub species likely to decline are Wyoming sagebrush and cliffrose. Both perennial and annual forbs will also reduce.

## Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Tree</b>					
0	<b>Trees 4.5'</b>			11–39	
4	<b>Trees &lt;4.5'</b>			11–34	
<b>Grass/Grasslike</b>					
1	<b>Grasses</b>			157–202	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	39–78	–
	muttongrass	POFE	<i>Poa fendleriana</i>	39–78	–
	squirreltail	ELEL5	<i>Elymus elymoides</i>	20–59	–
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	4–39	–
	Fendler's threeawn	ARPUF	<i>Aristida purpurea var. fendleriana</i>	4–20	–
	needle and thread	HECO26	<i>Hesperostipa comata</i>	4–20	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	4–20	–
<b>Forb</b>					
2	<b>Forbs</b>			11–34	
	Forb, annual	2FA	<i>Forb, annual</i>	0–17	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	0–17	–
	Wyoming Indian paintbrush	CALI4	<i>Castilleja linariifolia</i>	0–9	–
	sulphur-flower buckwheat	ERUM	<i>Eriogonum umbellatum</i>	0–9	–
	rock goldenrod	PEPU7	<i>Petradoria pumila</i>	0–9	–
	paperflower	PSILO3	<i>Psilostrophe</i>	0–9	–
<b>Shrub/Vine</b>					
3	<b>Shrubs</b>			157–202	
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata ssp. wyomingensis</i>	39–118	–
	Stansbury cliffrose	PUST	<i>Purshia stansburiana</i>	20–78	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	0–20	–
	Fremont's mahonia	MAFR3	<i>Mahonia fremontii</i>	0–12	–
	Utah serviceberry	AMUT	<i>Amelanchier utahensis</i>	0–12	–
	Sonoran scrub oak	QUTU2	<i>Quercus turbinella</i>	0–12	–
	mormon tea	EPVI	<i>Ephedra viridis</i>	0–12	–
	banana yucca	YUBA	<i>Yucca baccata</i>	0–9	–
	black sagebrush	ARNO4	<i>Artemisia nova</i>	0–4	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0–4	–
	Whipple cholla	CYWH	<i>Cylindropuntia whipplei</i>	0–4	–

Table 7. Community 1.1 forest overstory composition



Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)	Diameter (Cm)	Basal Area (Square M/Hectare)
<b>Tree</b>							
twoneedle pinyon	PIED	<i>Pinus edulis</i>	Native	1.2–7.9	15–25	5.1–30.5	–
Utah juniper	JUOS	<i>Juniperus osteosperma</i>	Native	0.3–4.6	10–15	5.1–25.4	–

Table 8. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)
<b>Grass/grass-like (Graminoids)</b>					
blue grama	BOGR2	<i>Bouteloua gracilis</i>	Native	0–0.2	3–10
muttongrass	POFE	<i>Poa fendleriana</i>	Native	0–0.5	5–10
James' galleta	PLJA	<i>Pleuraphis jamesii</i>	Native	0–0.3	2–8
squirreltail	ELELE	<i>Elymus elymoides ssp. elymoides</i>	Native	0–0.5	1–7
needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	Native	0–0.6	1–5
Fendler's threeawn	ARPUF	<i>Aristida purpurea var. fendleriana</i>	Native	0–0.5	1–3
prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	Native	0–0.4	1–3
<b>Forb/Herb</b>					
rock goldenrod	PEPUP	<i>Petradoria pumila ssp. pumila</i>	Native	0–0.3	1–2
<b>Shrub/Subshrub</b>					
Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata ssp. wyomingensis</i>	Native	0.3–1.2	5–20
Stansbury cliffrose	PUST	<i>Purshia stansburiana</i>	Native	0.3–2.1	5–15
Sonoran scrub oak	QUTU2	<i>Quercus turbinella</i>	Native	0.3–2.1	3–9
Fremont's mahonia	MAFR3	<i>Mahonia fremontii</i>	Native	0.3–1.8	1–7
broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	Native	0.1–0.3	2–5
Utah serviceberry	AMUT	<i>Amelanchier utahensis</i>	Native	0.1–0.9	1–5
mormon tea	EPVI	<i>Ephedra viridis</i>	Native	0.1–0.9	1–5
sulphur-flower buckwheat	ERUM	<i>Eriogonum umbellatum</i>	Native	0–0.2	1–3
banana yucca	YUBA	<i>Yucca baccata</i>	Native	0–0.9	1–2
<b>Tree</b>					
twoneedle pinyon	PIED	<i>Pinus edulis</i>	Native	1.2–7.6	15–30
Utah juniper	JUOS	<i>Juniperus osteosperma</i>	Native	0.6–4.6	10–20

## Animal community

Site is fair for grazing by cattle, sheep or horses in the summer and fall before canopy exceeds 45%. Management considerations are grazing systems, snow covered forage, steeper slopes (may hinder livestock movement) and proper grazing use.

Water is scarce except for man-made watering facilities. Elk and mule deer use the site for winter cover. Food is adequate for native wildlife species. Competition with livestock can be a problem.

## Recreational uses

Recreational activities include hiking, hunting, wildlife observations and photography. Landscape has fair aesthetic appeal.

## Wood products

Crawler tractor type equipment is best for harvesting, site preparation and precommercial thinning. Shallow, steep soils restrict planting with machines. Slopes over 15%, cobbles and rock outcrops limit equipment use. Some erosion may occur in cutover areas/bare ground/roads/trails/landings, especially on steeper slopes. Compaction potential is fair. Rutting will occur when soils are wet. Revegetation potential is poor because of shallow soils, cobbles and slope.

Harvest mature trees when canopy exceeds 35% and on slopes less than 20%. Cutting posts and Christmas trees will improve wood growth on trees left. Prescribed burning is not recommended. Mechanical tree removal is not practical due to shallow soils and steep slopes. Control pests to prevent tree damage and loss. Fire hazard is low; shallow soils and associated rock outcrop help keep fuel load low.

Site has poor suitability for replanting. Seedling mortality is severe. Natural regeneration is slow, but will occur in time. Seedlings should be protected from grazing. Plant competition is severe because of aggressive grasses competing for moisture. Windthrow hazard is slight; even though soils are shallow, trees root in cracks of sandstone.

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
twoneedle pinyon	<i>PIED</i>	45	55	5	6	–	–	–	

## Type locality

Location 1: Coconino County, AZ	
Township/Range/Section	T29 N. R7 W. S27
General legal description	Frazier Wells quad. - .5 mile NW of Albers Tank; Sec. 27, 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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## 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	
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

## Indicators

1. **Number and extent of rills:**

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2. **Presence of water flow patterns:**

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3. **Number and height of erosional pedestals or terracettes:**

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

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5. **Number of gullies and erosion associated with gullies:**

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

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

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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):**

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

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

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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):**

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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:

Sub-dominant:

Other:

Additional:

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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:**
-