USDA Natural Resources Conservation Service

Ecological site F035XF629AZ
Sandstone Hills 13-17" p.z. (PIED)

Accessed: 05/11/2025

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.

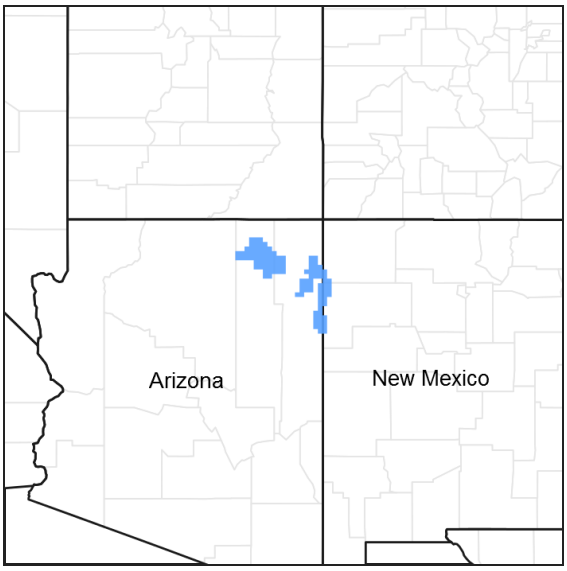

Figure 1. Mapped extent

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) *Pinus edulis*
Shrub	(1) *Cercocarpus montanus* (2) *Purshia tridentata*
Herbaceous	(1) *Poa fendleriana* (2) *Achnatherum hymenoides*

Physiographic features

This site is on backslopes & escarpments of mesas and cuestas. Slopes range from 35-70% and soils on this site are shallow to moderately deep.

Table 2. Representative physiographic features

Landforms	(1) Escarpment (2) Cuesta (3) Mesa
Flooding frequency	None
Ponding frequency	None
Elevation	5,800–7,300 ft
Slope	35–70%
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)	17 in

Influencing water features

Soil features

Soils on this site are shallow to moderately deep. Surface textures include Cobbly sandy loam and very cobbly clay loam. Subsurface textures include loamy sand, sandy loam, fine sandy loam, loamy fine sand, gravelly clay loam, clay loam and silty clay loam.
Parent material is colluvium and residuum derived from sandstone and shale. The soil moisture regime is aridic mesic and temperature regime is Mesic.

Taxonomic units mapped under this site include:

SSA-711 Navajo Mountain Area MU 2 Vesilla;
SSA-713 Chinle Area MU's 5 Vesilla, 49 Sojourn;
SSA-715 Ft Defiance Area MU 102 Vessilla;
SSA-717 Shiprock Area MU's Hozho & Quezcan-413.

Table 4. Representative soil features

Parent material	(1) Colluvium–sandstone and shale
Surface texture	(1) Cobbly sandy loam (2) Very cobbly clay loam
Family particle size	(1) Loamy
Drainage class	Well drained to excessively drained
Permeability class	Moderately rapid to rapid
Soil depth	10–40 in
Surface fragment cover <=3"	5–25%
Surface fragment cover >3"	10–20%
Available water capacity (0-40in)	0–5 in
Calcium carbonate equivalent (0-40in)	5–10%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0–5
Soil reaction (1:1 water) (0-40in)	7.4–9
Subsurface fragment volume <=3" (Depth not specified)	5–35%
Subsurface fragment volume >3" (Depth not specified)	0–10%

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

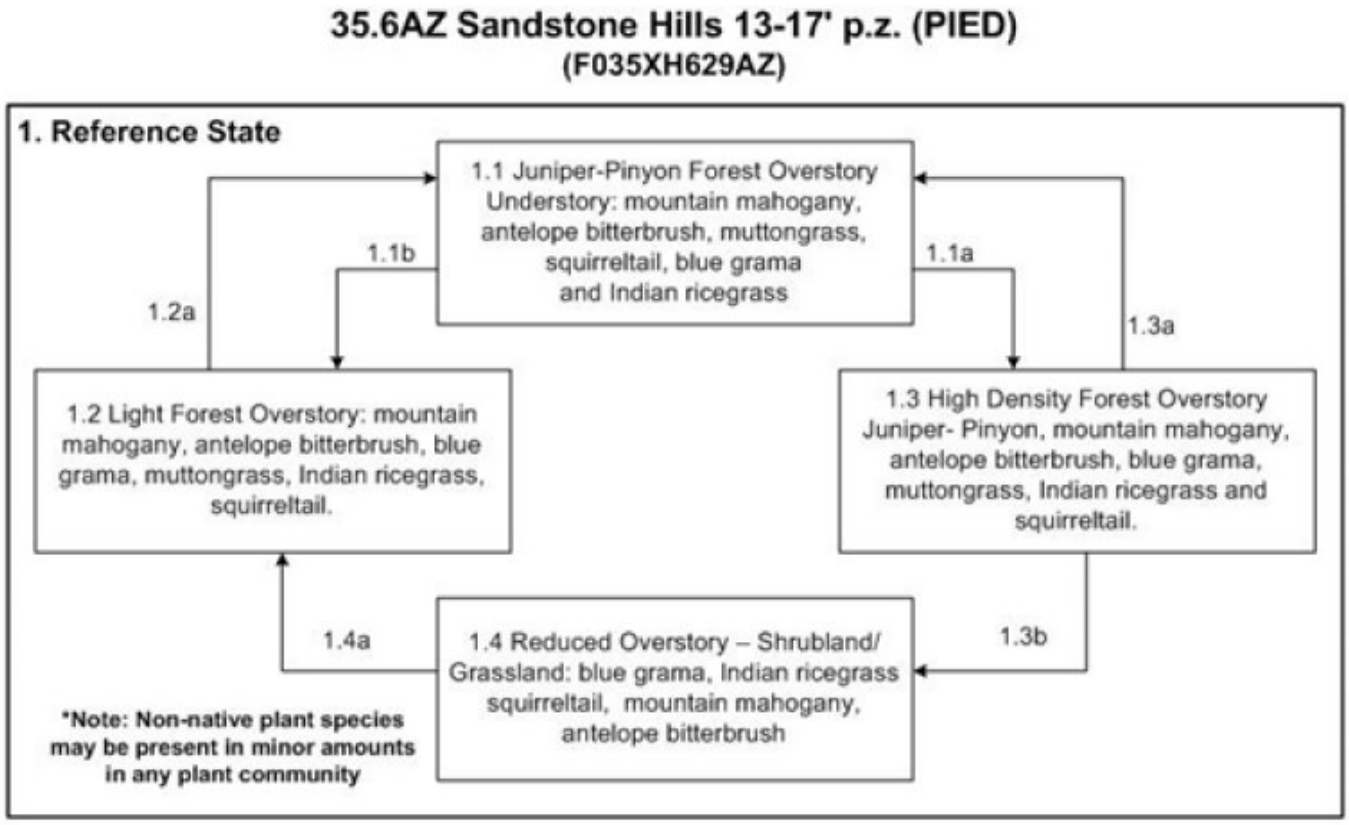

Figure 4. 35.6 Sandstone Hills 13-17"p.z. (PIED)

State 1
Reference State

In this forested site the overstory is dominated by Colorado pinyon and Utah juniper. Understory species include perennial grasses, shrubs, small trees and forbs.

Community 1.1
Juniper-Pinyon Forest Overstory

Figure 5. 35.6 Sandstone Hills 13-17"p.z.

This plant community is dominated by trees. Tree canopy cover is 25 - 35% with major species of Colorado pinyon at 60% dominance and Utah juniper at 40%. Understory species include grasses at 25% including muttongrass and Indian ricegrass, forbs at 5%, shrubs at 65% including mountain mahogany and antelope bitterbrush and trees under 4.5ft tall at 5%.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	130	195	260
Tree	60	90	120
Grass/Grasslike	50	75	100
Forb	10	15	20
Total	**250**	**375**	**500**

Table 6. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	0-2%	0-1%
>0.5 <= 1	–	0-3%	0-2%	0-1%
>1 <= 2	1-3%	1-5%	1-3%	0-2%
>2 <= 4.5	2-5%	2-10%	–	–
>4.5 <= 13	5-10%	–	–	–
>13 <= 40	5-10%	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Figure 7. 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 8. Plant community growth curve (percent production by month). AZ3561, 35.6 13-17" p.z. all sites. Growth begins in the spring and continues into the fall..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	1	5	16	17	15	15	15	11	5	0	0

Figure 9. 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 10. Plant community growth curve (percent production by month). AZ3930, 35.6 13-17" p.z. banana yucca. Most leaf growth occurs in late spring. Flowers in summer. Seed set occurs in late summer to fall..

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

Community 1.2
Light Forest Overstory

This plant community is characterized by a sparse overstory of woodland species. The crown canopy is generally less than 25%. The understory has more production than the 1.1 plant community with an increase of grasses and forbs and less shrubs. Common grasses include muttongrass, Indian ricegrass, squirreltail and blue grama. Common shrubs include alderleaf mountain-mahogany, antelope bitterbrush and Utah serviceberry.

Community 1.3
High Density Forest Overstory

This plant community is characterized by a more dense overstory of woodland species. The crown canopy is greater than 45%. The understory has less production than the 1.1 plant community with a decrease of perennial grasses and forbs and less shrubs. The understory plant community composition is comprised of grasses, shrubs, forbs and trees (under 4.5 feet tall). Common grasses include blue grama, muttongrass, Indian ricegrass and squirreltail. Dominant shrubs include alderleaf mountain-mahogany and antelope bitterbrush.

Community 1.4
Reduced Overstory - Shrubland/Grassland

This plant community is characterized by a reduced overstory of woodland species. The crown canopy is usually less than 20%, ranging from 5-25%. The understory has more production than the 1.1 plant community with an increase of grasses, forbs and shrubs. The understory plant community is comprised of more grasses, and less shrubs, forbs and trees (under 4.5 feet tall). Common grasses include blue grama, Indian ricegrass and squirreltail. Dominant shrubs include alderleaf mountain-mahogany and antelope bitterbrush with some succulents.

Pathway 1.1b
Community 1.1 to 1.2

Drought, insect infestation, and/or woodcutting

Pathway 1.1a
Community 1.1 to 1.3

Fire exclusion/Lack of natural fire, favorable precipitation, Unmanaged grazing

Pathway 1.2a
Community 1.2 to 1.1

Favorable precipitation, managed grazing, trees compete with shrubs/grass, fire exclusion.

Pathway 1.3a
Community 1.3 to 1.1

Drought, insect infestation, fire.

Pathway 1.3b
Community 1.3 to 1.4

Drought in combination with severe disturbance such as major insect infestation and/or intense fire.

Pathway 1.4a
Community 1.4 to 1.2

Favorable precipitation, seed source for tree regeneration.

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Grasses**			50–100	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	10–25	–
	muttongrass	POFE	*Poa fendleriana*	10–20	–
	squirreltail	ELELE	*Elymus elymoides ssp. elymoides*	5–15	–
	saline wildrye	LESAS	*Leymus salinus ssp. salinus*	5–15	–
	Grass, perennial	2GP	*Grass, perennial*	8–15	–
	James' galleta	PLJA	*Pleuraphis jamesii*	7–10	–
	blue grama	BOGR2	*Bouteloua gracilis*	5–10	–
Forb					
2	**Forbs**			10–25	
	Forb, perennial	2FP	*Forb, perennial*	0–10	–
	milkvetch	ASTRA	*Astragalus*	5–10	–
	beardtongue	PENST	*Penstemon*	5–10	–
Shrub/Vine					
3	**Shrubs**			130–260	
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	30–100	–
	antelope bitterbrush	PUTR2	*Purshia tridentata*	30–80	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	10–20	–
	Utah serviceberry	AMUT	*Amelanchier utahensis*	10–20	–
	mormon tea	EPVI	*Ephedra viridis*	5–15	–
	cliff fendlerbush	FERU	*Fendlera rupicola*	5–15	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	5–15	–
4	**Succulents**			15–30	
	plains pricklypear	OPPO	*Opuntia polyacantha*	5–10	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	5–10	–
	banana yucca	YUBA	*Yucca baccata*	5–10	–
Tree					
5	**Trees**			20–40	
	Utah juniper	JUOS	*Juniperus osteosperma*	10–20	–
	twoneedle pinyon	PIED	*Pinus edulis*	10–20	–

Table 8. Community 1.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
twoneedle pinyon	PIED	*Pinus edulis*	Native	5–30	10–20	6–10	–
Utah juniper	JUOS	*Juniperus osteosperma*	Native	2–15	10–15	5–8	–

Animal community

This site is only fair for livestock grazing due to steep slopes and the presence of boulders and rocks. Cattle, sheep, goats and horses can use the site during the late spring, summer and fall.
Main considerations are slope which hinders distribution and damage to young trees by trampling.
Wildlife use the site lightly due to lack of water in scattered springs and/or man-made watering facilities. Cover is good for most species and food sources are good. Many species winter here.

Recreational uses

Recreational opportunities include hiking, wildlife observations and photography.

Wood products

Pinyon pine and Juniper provide opportunities for firewood collection when dead and down. The pinyon also provides opportunities for christmas trees and the juniper provides fence posts.

Other information

Woodland Interpretations:
Site Index: 35 - 45
Fuelwood (cds/ac): 4 - 6
Fence Posts (7 ft)/ac: 5 - 10
Christmas trees/ac: 5 - 10
CMAI* per year: 4 cuft/ac
Productivity class: 1

* CMAI is the "Culmination of Mean Annual Increment" or highest average growth rate of the stand in the units specified.

Woodland Uses and Interpretations
Equipment Suitability:
Harvesting: Crawler tractor best on slopes < 50%
Site Preparation: Crawler tractor type limited use
Tree Planting: Best to do by hand
Precommercial thinning: Crawler tractor type limited use

Equipment Limitations:
Slope: steep slopes, boulders, cobbles limit equipment use
Unsurfaced roads: Boulders and Cobbles limiting factors
Stoniness/Rock Outcrop: Slight (some rock outcrop present)
Water Table/Flooding: None

Erosion potentials:
Cutover areas/bare ground: Water - Severe and Wind moderate.
Roads/Trails/Landings: Water - Severe and Wind moderate.

Soil Management:
Compaction potential: Fair
Rutting potential: Some rutting may occur when wet
Revegetation potential: Poor because of slopes, cobbles boulders.

Silviculture potentials & limitations:
Harvest Cutting: Should not be done due to low productivity and very steep slopes with rocks
Thinning & Improvement: not recommended
Prescribed burning: not recommended
Mechanical Tree Removal: not recommended
Pest Control: Control pests to prevent tree damage & loss
Fire Hazard: Low (gravel on soil surface helps keep fuel load low)
Suitability for replanting: Poor (soils are droughty)

Seedling Mortality: Severe (low available water)
Natural Regeneration: Very slow (but will occur in time)
Seedling Protection: Seedlings should be protected from grazing and trampling
Plant competition: Severe (droughty soil)
Windthrow Hazard: Severe (rooting depth > 40”)

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*	35	45	2	4	75	202	–	
twoneedle pinyon	*PIED*	35	45	4	4	–	–	N/A	Chojnacky, David C. 1986. Pinyon-juniper site quality and volume growth equations for Nevada. USDA, Forest Service. Intermountain Research Station Research Paper INT-372.

Type locality

Location 1: McKinley County, NM	
Township/Range/Section	T25N R20W S8
General legal description	Roof Butte Quad - Navajo Reservation, New Mexico, Section 8, T25N, R20W.

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):**

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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):**

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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:**

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17. **Perennial plant reproductive capability:**
