USDA Natural Resources
Conservation Service

Ecological site F035XC322AZ
Sandstone Upland 10-14" p.z. (JUOS)

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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.

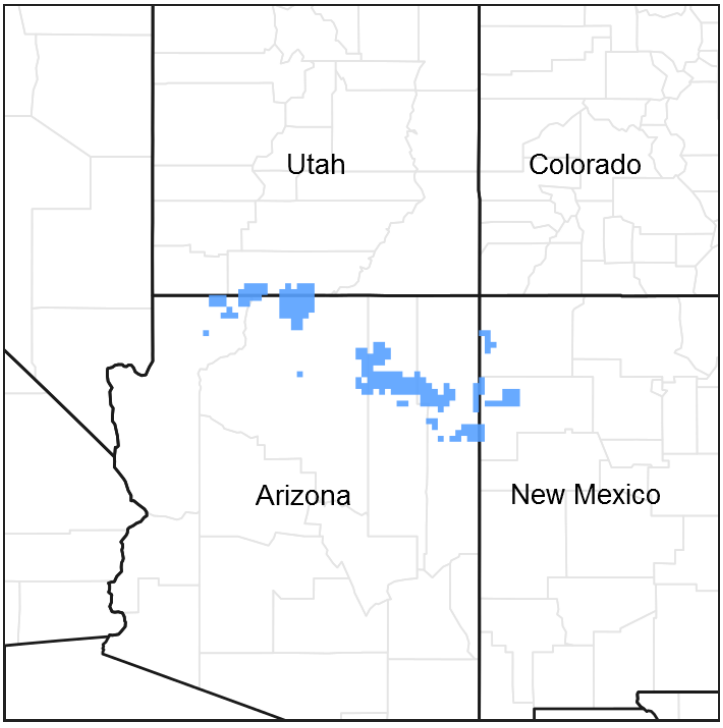

Figure 1. Mapped extent

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 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

This site occurs on well-drained soils that are shallow or very shallow to sandstone bedrock. Typical landforms are cuestas, structural benches, and fan terraces.

Table 1. Dominant plant species

Tree	(1) *Juniperus osteosperma*
Shrub	(1) *Artemisia bigelovii* (2) *Purshia stansburiana*
Herbaceous	(1) *Achnatherum hymenoides* (2) *Hesperostipa neomexicana*

Physiographic features

This ecological site occurs on shallow dipslopes of cuestas, structural benches, fan terraces, and stabilized dunes of mesas and plateaus. The soil depth ranges from very shallow to shallow. The slope of this ecological site ranges from 1 to 15 percent, but there may be areas with slopes to 20%. Rock outcrop is associated with this site.

Table 2. Representative physiographic features

Landforms	(1) Cuesta (2) Structural bench (3) Plateau
Elevation	1,463–2,042 m
Slope	1–15%
Aspect	Aspect is not a significant factor

Climatic features

Winter to 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)	168 days
Freeze-free period (average)	193 days
Precipitation total (average)	356 mm

Influencing water features

This site occurs in an upland position. The soil moisture on this ecological site comes from precipitation. It neither benefits from run-in moisture nor sustains excessive runoff.

Soil features

Soils are very shallow to shallow and well drained. They are formed in eolian sand over local alluvium derived dominantly from sandstone. The soil surface texture ranges from loamy fine sand to very channery loam. The range in depth to sandstone bedrock is 4-20 inches. Available water capacity is very low. Permeability is from slow to rapid. Water erosion hazard is moderate; wind erosion hazard is moderately high to very high. Runoff is slow to medium. Soils are slightly to moderately alkaline (pH 7.4-8.4).

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

SSA 625 Mohave County NE part MU's 6 & 7 Bidonia;

SSA 629 Coconino County North Kaibab part MU's 2, 3 & 39 Arches, 6 Bidonia;

SSA 701 Grand Canyon Area MU 163 Houserock family;

SSA 714 Hopi Area MU 38 Travessilla;

SSA 715 Fort Defiance Area AZ/NM MU's 99 Rizno, 109 & 110 Skyvillage;

SSA 717 Shiprock Area AZ/NM MU's 300, 301, 304 & 308 Farview, 309 Rizno.

Table 4. Representative soil features

Parent material	(1) Alluvium–sandstone
Surface texture	(1) Loamy fine sand (2) Sandy loam (3) Channery loam
Family particle size	(1) Loamy
Drainage class	Well drained to moderately well drained
Permeability class	Slow to rapid
Soil depth	10–51 cm
Surface fragment cover <=3"	0–35%
Surface fragment cover >3"	0–15%
Available water capacity (0-101.6cm)	0.33–0.38 cm
Calcium carbonate equivalent (0-101.6cm)	0–2%
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–25%
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

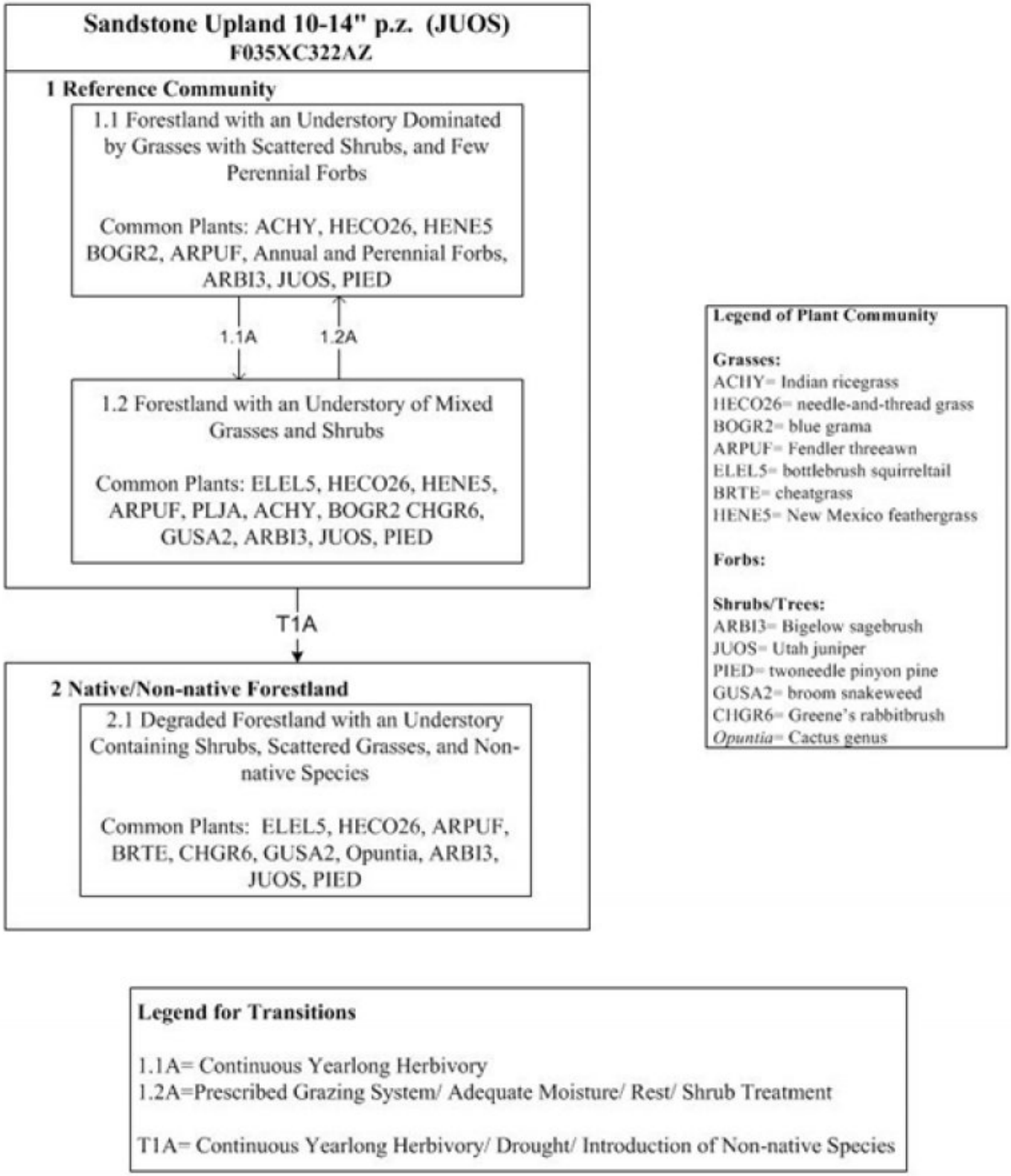

Figure 4. 35.3 Sandstone Upland 10-14"p.z. (JUOS)

State 1
Reference State Plant Community

The reference state has a mixed plant community made up of Utah juniper and twoneedle

pinyon pine with a understory of grasses, forbs and shrubs. There is a mixture of cool and warm season grasses. Plant species most likely to increase or invade on this site are cheatgrass, thrifty goldenweed, stemless goldenweed, other annual weedy forbs, broom snakeweed, Greene rabbitbrush and Bigelow sagebrush. Unmanaged grazing during the winter and spring periods will decrease cool season grasses which are replaced by lower forage value grasses and forbs.

Community 1.1
Forestland with Grass Understory

Figure 5. 35.3 Sandstone Upland 10-14" p.z.

Figure 6. 35.3 Sandstone upland 10-14" p.z.

In this plant community the site is characterized as a forestland with an understory dominated by perennial grasses with scattered shrubs and a few perennial forbs. The tree canopy ranges from 25-35% with Utah juniper and Colorado pinyon as major overstory species. The understory is mostly Indian ricegrass, New Mexico feathergrass, blue grama, needle and thread, Bigelow sagebrush and Stansbury cliffrose.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	202	269	336
Shrub/Vine	101	135	168
Tree	11	22	34
Forb	11	22	34
Total	**325**	**448**	**572**

Figure 8. Plant community growth curve (percent production by month). AZ3531, 35.3 10-14" p.z. all sites. Growth begins in the spring and continues through the summer..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	1	3	17	18	10	19	20	10	1	1	0

Community 1.2
Forestland with an Understory of Mixed Grasses and Shrubs

Continuous disturbance has increased the shrub component such as broom snakeweed, Bigelow sagebrush and Greene rabbitbrush on this site. The overstory remains similar to the 1.1 community. The perennial grass component decreases slightly. Managed grazing allows for the potential of native cool and warm season grasses to regenerate themselves. The potential for erosion increases slightly due to more bareground.

Pathway 1.1A
Community 1.1 to 1.2

Unmanaged grazing, drought.

Pathway 1.2A
Community 1.2 to 1.1

Managed grazing, favorable precipitation, shrub treatment.

State 2
Native/Non-native Forestland

This state is a forested site with shrubs as the dominant understory with introduced non-native species.

Community 2.1
Degraded Forestland

Shrubs such as Bigelow sagebrush, broom snakeweed, rabbitbrush and opuntia become the dominant understory of this forested site due to continuous disturbance. The overstory canopy cover of juniper and pinyon may increase. Introduced non-native species such as cheatgrass, red brome and Russian thistle are commonly found and have the potential to further increase. Perennial grasses occur scattered throughout the site. Erosion potential is higher due to more bare ground.

Transition T1A
State 1 to 2

Umanaged grazing, drought, introduction of non-natives.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Dominant Cool Season Grasses**			135–230	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	67–112	–
	needle and thread	HECO26	*Hesperostipa comata*	22–67	–
	New Mexico feathergrass	HENE5	*Hesperostipa neomexicana*	22–67	–
2	**Dominant Warm Season Grasses**			22–67	
	blue grama	BOGR2	*Bouteloua gracilis*	22–67	–
3	**Other Perennial Grasses**			22–62	
	squirreltail	ELEL5	*Elymus elymoides*	0–22	–
	James' galleta	PLJA	*Pleuraphis jamesii*	0–22	–
	muttongrass	POFE	*Poa fendleriana*	0–22	–
	dropseed	SPORO	*Sporobolus*	0–22	–
	sandhill muhly	MUPU2	*Muhlenbergia pungens*	0–11	–
	Fendler's threeawn	ARPUF	*Aristida purpurea var. fendleriana*	0–11	–
4	**Annual Grasses**			0–11	
	sixweeks grama	BOBA2	*Bouteloua barbata*	0–11	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–11	–

Forb					
5	**Forbs**			11–34	
	rose heath	CHER2	*Chaetopappa ericoides*	0–9	–
	James' cryptantha	CRCIJ	*Cryptantha cinerea var. jamesii*	0–9	–
	Forb, annual	2FA	*Forb, annual*	0–9	–
	Forb, perennial	2FP	*Forb, perennial*	0–9	–
	Wyoming Indian paintbrush	CALI4	*Castilleja linariifolia*	0–9	–
	rock goldenrod	PEPU7	*Petradoria pumila*	0–9	–
	spiny phlox	PHHO	*Phlox hoodii*	0–4	–
	woolly paperflower	PSTA	*Psilostrophe tagetina*	0–4	–
	stemless mock goldenweed	STAC	*Stenotus acaulis*	0–4	–
	thrift mock goldenweed	STARA	*Stenotus armerioides var. armerioides*	0–4	–
	mariposa lily	CALOC	*Calochortus*	0–4	–
	buckwheat	ERIOG	*Eriogonum*	0–4	–
Shrub/Vine					
6	**Dominant Shrubs**			45–101	
	Bigelow sage	ARBI3	*Artemisia bigelovii*	22–67	–
	Stansbury cliffrose	PUST	*Purshia stansburiana*	11–34	–
7	**Other Shrubs**			45–90	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	0–17	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–17	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	6–17	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	6–11	–
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	0–9	–
	Greene's rabbitbrush	CHGR6	*Chrysothamnus greenei*	0–9	–
	mormon tea	EPVI	*Ephedra viridis*	0–9	–
	antelope bitterbrush	PUTR2	*Purshia tridentata*	0–9	–
	spineless horsebrush	TECA2	*Tetradymia canescens*	0–9	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–9	–

	Utah serviceberry	AMUT	*Amelanchier utahensis*	0–9	–
	banana yucca	YUBA	*Yucca baccata*	0–4	–
	common dunebroom	PAFI4	*Parryella filifolia*	0–4	–
Tree					
8	**Trees**			11–34	
	Utah juniper	JUOS	*Juniperus osteosperma*	6–28	–
	twoneedle pinyon	PIED	*Pinus edulis*	0–6	–

Animal community

This site is suitable for grazing by all classes of livestock (i.e. cattle, sheep, goats, horses) during most periods except when snow cover restricts availability of forage. Planned grazing systems and proper use adapt well on this site. This site will respond to management rather slowly, particularly in areas that have historically been grazed heavily. Woodland wildlife species use this site extensively for nesting, food, and cover. Grassland species use the site for cover and food when adjacent to grassy openings. Wildlife habitat evaluations should be done prior to any tree removal to identify important food sources, cover, nesting sources, and travel corridors.

Recreational uses

This site occurs on shallow dipslopes of cuestas, structural benches, fan terraces, and stablized dunes of mesas and plateaus. It offers high aesthetic appeal, particularly where it borders open grasslands for contrasts. Springs are windy. Summers are warm, and winters are cold. Potential recreational activities include the following: hunting, hiking, wildlife observations, and photography.

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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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.

Author(s)/participant(s)	
Contact for lead author	
Date	05/21/2025
Approved by	Kendra Moseley
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:**
