USDA Natural Resources Conservation Service

Ecological site R035XF601AZ
Sedimentary Cliffs 13-17" p.z.

Accessed: 05/02/2024

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.

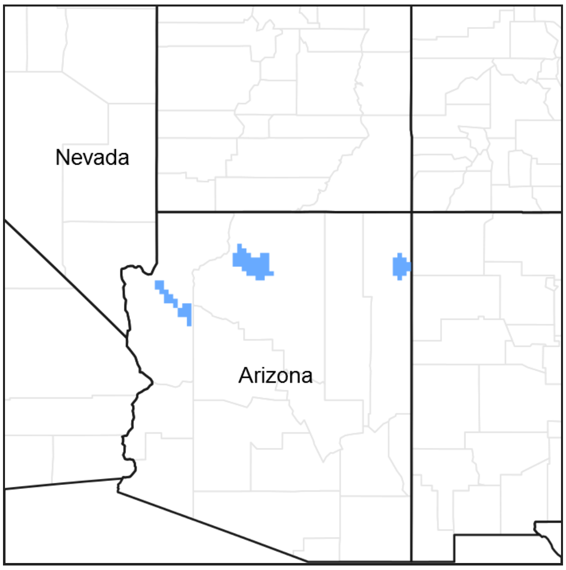


Figure 1. Mapped extent

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

AZ CRA 35.6 - Colorado Plateau Pinyon-Juniper-Sagebrush

Elevations range from 5500 to 7000 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) *Juniperus osteosperma* (2) *Pinus edulis*
Shrub	(1) *Quercus turbinella* (2) *Yucca baccata*
Herbaceous	(1) *Bouteloua curtipendula* (2) *Achnatherum speciosum*

Physiographic features

This site occurs on the escarpments of canyons. It occurs on Kaibab limestone, Toroweep, Coconino sandstone, and Hermit shale. Hazard of erosion by water is moderate to severe and by wind is slight.

Table 2. Representative physiographic features

Landforms	(1) Canyon (2) Escarpment (3) Cliff
Flooding frequency	None
Ponding frequency	None
Elevation	1,676–2,195 m
Slope	35–80%
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

Soil features

Soils on this site vary in depth and it ranges from very shallow to very deep. Surface textures range from extremely flaggy fine sandy loam, flaggy fine sandy loam, to very gravelly loam. Subsurface textures include very channery fine sandy loam, flaggy fine sandy loam, very gravelly loam. Parent material includes sandstone, shale, limestone, granite and sedimentary rock.

Typical taxonomic units include:

SSA-697 Mohave County Central part MU 156 Ustorthents;
SSA-699 Hualapai-Havasupai Area MU 52 Ustorthents;
SSA-701 Grand Canyon Area MU's 6 Aridic Lithic Ustorthents, 73 & 74 Lithic Ustic torriorthents, 82 Metuck and 119 & 120 Skos (family);
SSA-712 Canyon de Chelly Area MU 1 Aridic haplustepts;
SSA-713 Chinle Area MU 1 Aridic haplustepts.

Table 4. Representative soil features

Parent material	(1) Colluvium–sandstone and shale (2) Rockfall deposits–limestone
Surface texture	(1) Extremely flaggy fine sandy loam (2) Flaggy fine sandy loam (3) Very gravelly loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Slow to rapid
Soil depth	13–152 cm
Surface fragment cover <=3"	20–40%
Surface fragment cover >3"	0–20%
Available water capacity (0-101.6cm)	6.35–25.4 cm
Calcium carbonate equivalent (0-101.6cm)	0%
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)	20–50%
Subsurface fragment volume >3" (Depth not specified)	0–20%

Ecological dynamics

The historic climax plant community (HCPC) for a site in North America is the plant community that existed at the time of European immigration and settlement. It is the plant community that was best adapted to the unique combination of environmental factors associated with the site. The historic climax plant community was in dynamic equilibrium with its environment. It is the plant community that was able to avoid displacement by the suite of disturbances and disturbance patterns (magnitude and frequency) that naturally occurred within the area occupied by the site. Natural disturbances, such as drought, fire, grazing of native fauna, and insects, were inherent in the development and maintenance of these plant communities. The effects of these disturbances are part of the range of characteristics of the site that contribute to that dynamic equilibrium. Fluctuations in plant community structure and function caused by the effects of these natural disturbances establish the boundaries of dynamic equilibrium. They are accounted for as part of the range of characteristics for an ecological site. Some sites may have a small range of variation, while others have a large range.

The historic climax plant community of 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 HCPC for this ecological site has been estimated by sampling relict or relatively undisturbed sites and/or reviewing historic records.

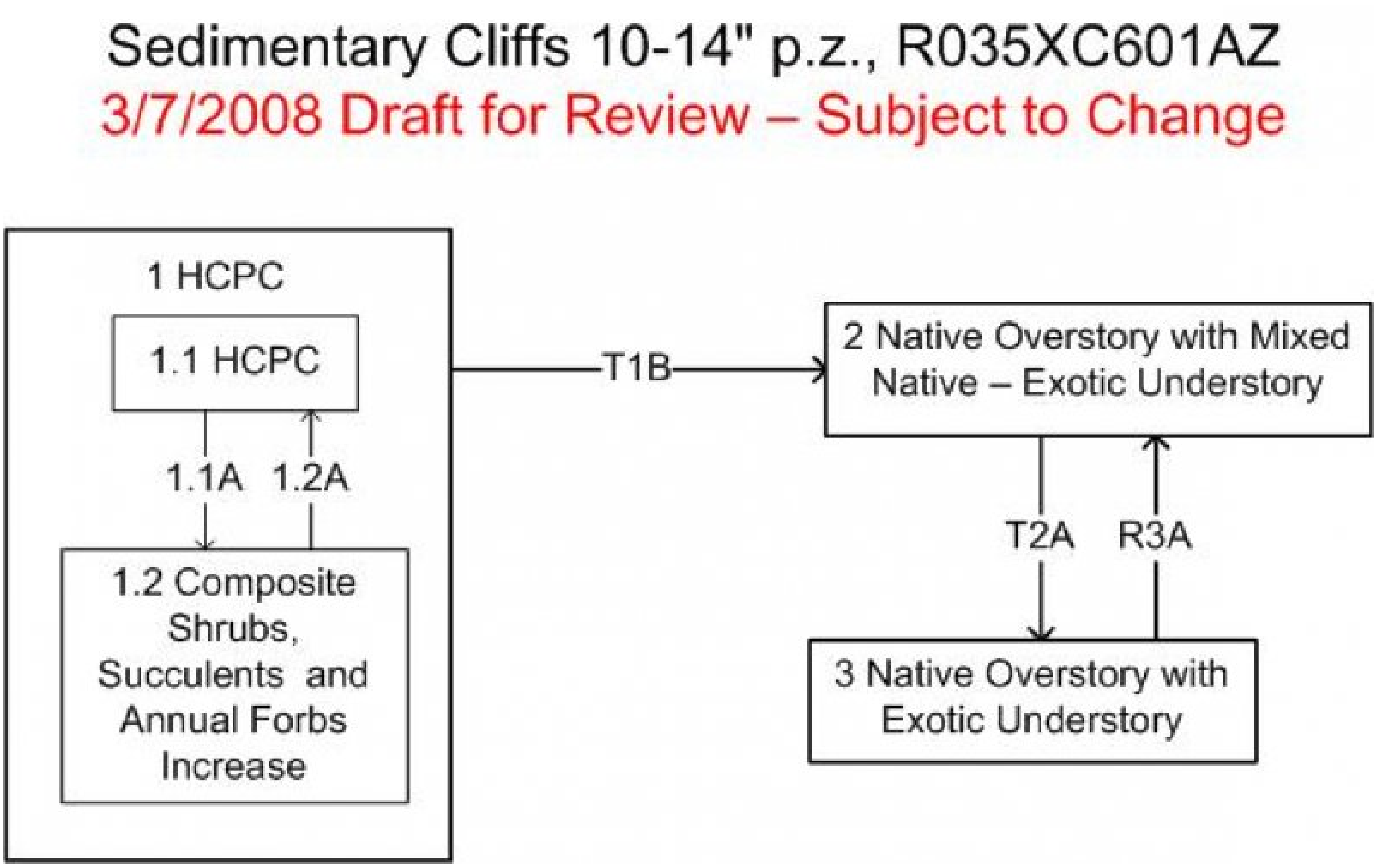
Plant communities that are subjected to abnormal disturbances and physical site deterioration or that are protected from natural influences, such as fire and grazing, for long periods seldom typify the historic climax plant community. The physical site deterioration caused by the abnormal disturbance results in the crossing of a threshold or irreversible boundary to another state, or equilibrium, for the ecological site. There may be multiple thresholds and states possible for an ecological site, determined by the type and or severity of abnormal disturbance. The known states and transition pathways for this ecological site are described below and in the accompanying state and transition model.

1 Historic Climax Plant Community (HCPC)
1.1 HCPC – The plant community is composed of relatively equal amounts of grasses and shrubs, and lesser amounts of forbs and trees. It can be variable due to site conditions.
1.1A – Yearly heavy winter grazing or a fire. Due to slope, this site is not usually heavily grazed.
1.2 Composite Shrub and Sodgrass – Composite shrubs such as broom snakeweed, and succulents such as prickly pear increase over shadscale saltbush and other palatable shrubs. Perennial bunchgrasses decrease in relation to perennial sodgrasses such as galleta.
1.2A – Proper grazing practices and/or rest.
T1A – Exotic grass species such as cheatgrass and red brome are introduced into the site.
2 Native Overstory with Mixed Native – Exotic Understory – Exotic annual grasses are present in the plant community but the amount of native perennial grasses remains relatively unchanged.
T2A – Extreme herbivory favors exotic annual grasses and forbs over native grasses and forbs. Fire is unlikely on this site but if it occurs, it could drive this pathway as well.
3 Native Overstory with Exotic Understory Exotic annual grasses dominate the understory within the plant community.
R3A – Proper grazing practices combined with relevant herbicide treatments and reseeding. Usually not feasible for larger areas.

The Plant Community Plant Species Composition table provides a list of species and each specie's or group of species' annual production in pounds per acre (air-dry weight) expected in a normal rainfall year. Low and high production yields represent the modal range of variability for that species or group of species across the extent of the ecological site.

The Annual Production by Plant Type table provides the median air-dry production and the fluctuations to be expected during favorable, normal, and unfavorable years. The present plant community on an ecological site can be compared to the various common vegetation states that can exist on the site. The degree of similarity is expressed through a similarity index. To determine the similarity index, compare the production of each species to that shown in the plant community description. For each species, count no more than the maximum amount shown for the species, and for each group, count no more than the maximum shown for the group. Divide the resulting total by the total representative value shown in the Annual Production by Plant Type table for the reference plant community. Variations in production due to above or below normal rainfall, incomplete growing season or utilization must be corrected before comparing it to the site description. The Worksheet for Determining Similarity Index is useful in making these corrections. The accompanying growth curve can be used as a guide for estimating percent of growth completed.

State and transition model



State 1
Historic Climax Plant Community

Community 1.1
Historic Climax Plant Community

The dominant aspect of the site is a shrub tree mix with grasses and forbs. The shrubs most dominant are turbinella oak and banana yucca. Scattered trees of Colorado pinyon and Utah juniper are present. The major grasses are Sideoats grama, Desert needlegrass, and muttongrass. With disturbance plants that will increase are Turbinella oak, banana yucca and pricklypear, those that may invade are mainly annuals.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	350	368	386
Shrub/Vine	245	262	280
Tree	35	53	71
Forb	35	53	71
Total	**665**	**736**	**808**

Table 6. Ground cover

Tree foliar cover	0-10%
Shrub/vine/liana foliar cover	10-20%
Grass/grasslike foliar cover	2-10%
Forb foliar cover	0-2%
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	–	–	–	0-2%
>0.15 <= 0.3	–	–	1-5%	–
>0.3 <= 0.6	–	–	2-10%	–
>0.6 <= 1.4	–	5-20%	–	–
>1.4 <= 4	0-10%	0-5%	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Figure 5. Plant community growth curve (percent production by month). AZ3515, 35.6 13-17" p.z. sideoats grama. Most growth occurs 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	20	30	20	10	5	0	0

Figure 6. 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 7. 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 8. Plant community growth curve (percent production by month). AZ3928, 35.6 13-17" p.z. desert needlegrass. Growth begins in the spring, most growth occurs in the summer. Seed set occurs in fall..

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

Figure 9. Plant community growth curve (percent production by month). AZ3929, 35.6 13-17" p.z. turbinella oak. Growth begins in spring and continues through 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	15	15	15	10	0	0

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Tree					
0				35–71	
	Utah juniper	JUOS	*Juniperus osteosperma*	21–35	–
	twoneedle pinyon	PIED	*Pinus edulis*	21–35	–
Shrub/Vine					
0				245–280	
	Sonoran scrub oak	QUTU2	*Quercus turbinella*	105–140	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	7–35	–
	Utah agave	AGUT	*Agave utahensis*	0–35	–
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	0–35	–
	bastardsage	ERWR	*Eriogonum wrightii*	0–21	–
	tulip pricklypear	OPPH	*Opuntia phaeacantha*	7–21	–
	banana yucca	YUBA	*Yucca baccata*	7–21	–
	sacahuista	NOMI	*Nolina microcarpa*	7–15	–
Grass/Grasslike					
0				350–386	
	sideoats grama	BOCU	*Bouteloua curtipendula*	71–105	–
	muttongrass	POFE	*Poa fendleriana*	35–71	–
	desert needlegrass	ACSP12	*Achnatherum speciosum*	35–71	–
	blue grama	BOGR2	*Bouteloua gracilis*	7–35	–
	squirreltail	ELELE	*Elymus elymoides ssp. elymoides*	7–35	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–35	–
	Grass, perennial	2GP	*Grass, perennial*	7–35	–
	Fendler's threeawn	ARPUF	*Aristida purpurea var. fendleriana*	0–15	–
Forb					
0				35–71	
	Forb, perennial	2FP	*Forb, perennial*	7–28	–
	pincushion	CHAEN	*Chaenactis*	7–15	–
	beardtongue	PENST	*Penstemon*	7–15	–
	Forb, annual	2FA	*Forb, annual*	0–15	–

Animal community

Use by any class of livestock is limited by steep slopes and large amounts of rock fragments on the surface.

This site is an important area for nesting locations for many species of birds and escape routes for Big Horn Sheep.

The rock outcrops also provide resting cover, hunting perches, and dens for small animals.

Wildlife known to inhabit this site are Mule deer, coyote Blacktail jackrabbit, Cottontail rabbit, Lizards, Snakes, Raptors and a variety of small birds.

Recreational uses

Recreation is limited due to steep slopes and rough terrain. Some uses are hunting, wildlife observation, and photography.

Type locality

Location 1: Coconino County, AZ	
Township/Range/Section	T26N R9W S11
General legal description	Robbers Roost Canyon Quad, about 2 miles northwest of Robbers Roost Canyon; Section 11, T26N, R9W, Hualapai Indian Reservation, 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)	Kevin Williams
Contact for lead author	NRCS Page Soil Survey
Date	11/11/2006
Approved by	S. Cassady
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills may becomon on talus slopes and other areas of soil accumulation due to runoff from adjacent rock outcrop, steep slopes, and loamy soil surface textures. Much of the soil surface on talus slops is armored with rock fragments.

2. **Presence of water flow patterns:** Water flow patterns are occasional, but may be common on talus slopes and other areas of soil accumulation due to runoff from adjacent rock outcrop and steep slopes, and loamy soil surface textures. hese patterns are usually short and discontinuous due to the frequency of rock fragments on the soil surface.

3. **Number and height of erosional pedestals or terracettes:** Pedestals and terracettes are occasioal but may be common on talus slopes and other areas of soil accumulation due to runoff from adjacent rock outcrop and steep slopes.

Much of the soil surface on talus slopes is armored by rock fragments.

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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 5-10%. Areas with a greater cover of rock ragments and/or rock outcro will have less bare ground. Drought may cause an increase in bare ground. The soils have 4.4-8.4 inches of available wate capacty, so the potential to produce plant cover is low to moderate.

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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):** Herbacious, fine woody and some coarse woody litter will be transported in water flow patterns. Most coarse woody litter will remain under shrub and tree canopies. There may be more litter movement in areas that are adjacent to large expanses of rock outcrop.

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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 textures are loam. All surfac horizons contain a significant amount of rock fragments (gravels and/or cobbles). Most soils have 40-70% cover of rock fragments (mostly gravels with some cobbles, bounders and stones). When well vegetated or covered with rock armor, the soils have a high resistance to both water and wind erosion. When well vegetated, these soils have a low to moderate resistance towater erosion depending upon the amount of rock fragment and vegetative cover.

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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 weak thin platy. The thickness of the A-horizon is 2-5 inches. The color is not significanty different than the subsurface soil horizons.

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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 trees, shrubs, grasses, then forbs, in descending order of dominance. Vegetative cover ranges from 10-30% (trees > rasses = shrubs > forbs). Basal cover ranges 0-3% (shrubs - grasses) for vascular plants and 0-10% for biological crust (cyanobacteria > lichen > moss). Both canopy and basal cover values decrease during a prolonged drought. This type of plant community is moderately 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. These soils are not naturally compacted, but the soil textures are fine enough that animal or human traffic could cause the formation of compaction layers within the soils. The soils have a naturally thin platy structure.

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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: trees >>

Sub-dominant: shrubs > perennial bunchgrasses > perennial colonizing grasses > perennial forbs > nnual grasses > annual forbs

Other:

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 survival in all but the most severe droughts. Severe winter droughts affect shrubs and trees most. Severe summer droughts affect grasses the most.

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14. **Average percent litter cover (%) and depth (in):** Of the total litter amount, it would be expected that approximatel 55-75% would be herbaceous litter and approixmately 25-45% would be wody litter. Litter amounts increase during the first few years of drought and 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):** 100-200 lbs/ac dry years; 200-400 lbs/ac median years; 400-600 lbs/ac 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:** Broom snakeweed, rubber rabbitbrush, prickly pear, Cutler''s jointfir are native to the site and have the potential to increase and dominate after heavy grazing. Cheatgrass is an exotic grass that has the potential to invade the site, with or without disturbance.

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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/or rhizomes except during the most severe drought.
