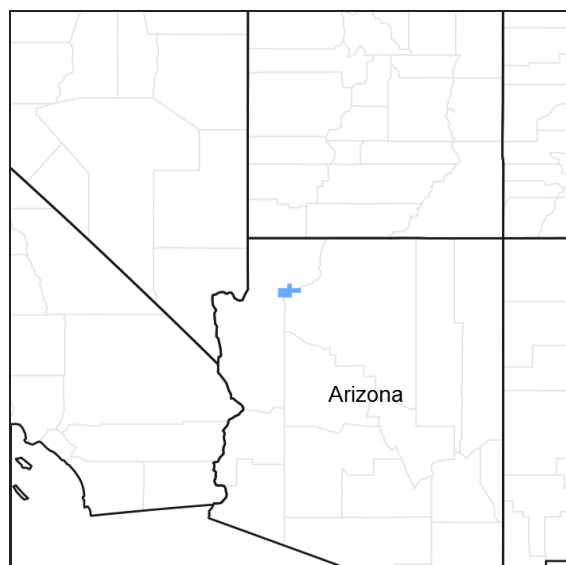


## **Ecological site R035XE510AZ** **Sandstone Upland 6-10" p.z.**

Accessed: 05/13/2025

### 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

AZ CRA 35.5 – Grand Canyon Corridor

Elevations range from 1600 to 4500 feet and precipitation averages 6 to 10 inches per year. Extreme elevation and aspect changes make this area unique. Vegetation includes Mormon tea, catclaw, white brittlebush, blackbrush, prickly pear, cholla species, big galleta, and blue threeawn. The soil temperature regime ranges from thermic to mesic and the soil moisture regime is typic aridic. This unit occurs within the Colorado Plateau Physiographic Province and is characterized by extreme vertical escarpments and strong aspect differences over short distances. Sedimentary rock classes dominate the Grand Canyon and exposures consist of a thick sequence of relatively undeformed formations.

### Associated sites

R035XE517AZ	<b>Limy Slopes 6-10" p.z. Shallow</b> Areas of soils with a petrocalcic horizon, often on the colluvial slopes and fans above the exposed sandstone.
R035XE519AZ	<b>Limy Upland 6-10" p.z. Shallow</b> Areas of soils with a petrocalcic horizon, often on fan terraces mixed in with the exposed sandstone.

**Table 1. Dominant plant species**

Tree	Not specified
Shrub	(1) <i>Coleogyne ramosissima</i> (2) <i>Quercus turbinella</i>
Herbaceous	(1) <i>Bouteloua eriopoda</i> (2) <i>Achnatherum speciosum</i>

## Physiographic features

This ecological site occurs in an upland position on the exposed sandstone formations. Soils are very shallow to shallow loamy sands and sandy loams, often with a great deal of bedrock outcrop. There are also occasional outcrops of nearly vertical bedrock as the bench or plateau changes to a different level. Soils are moderately to violently effervescent at the surface.

**Table 2. Representative physiographic features**

Landforms	(1) Plateau (2) Structural bench
Flooding frequency	None
Ponding frequency	None
Elevation	488–1,402 m
Slope	1–15%
Aspect	Aspect is not a significant factor

## Climatic features

The climate of the land resource unit is arid to semiarid with warm summers and cool winters. The mean annual precipitation ranges from 6 – 10 inches, but it is very erratic, often varying substantially from year to year. The majority of the precipitation falls during the between October through May. This precipitation comes as gentle rain or occasionally snow from frontal storms coming out to the Pacific Ocean. Snow is infrequent and rarely last more than 1-2 days. 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 55 to 69 degrees Fahrenheit (F). The frost-free period (air temperature > 32 degrees F) ranges from 180 to 220 days (@ 50 percent probability).

**Table 3. Representative climatic features**

Frost-free period (average)	200 days
Freeze-free period (average)	220 days
Precipitation total (average)	254 mm

## Influencing water features

### Soil features

Soils on this ecological site range from loamy sands to sandy loams and are often gravelly to very gravelly. They are generally found in the depressions and concavities of exposed plateaus and are usually very shallow to shallow in depth. There are occasional areas that are moderately deep as a result of eolian deposits.

Typical taxonomic units on this site include:

SSA-699 Hualapai-Havasupai Area MU 43 Splanod;

SSA-701 Grand Canyon Area MU's 69 Lithic torriorthents and 111 Lithic Ustic torriorthents.

**Table 4. Representative soil features**

Parent material	(1) Residuum—calcareous sandstone (2) Alluvium—shale
Surface texture	(1) Gravelly sandy loam (2) Very gravelly loamy fine sand (3) Loamy sand
Family particle size	(1) Sandy
Drainage class	Well drained
Permeability class	Moderately rapid to rapid
Soil depth	8–51 cm
Surface fragment cover <=3"	0–25%
Available water capacity (0-101.6cm)	1.85–2.64 cm
Calcium carbonate equivalent (0-101.6cm)	10–30%
Electrical conductivity (0-101.6cm)	0–2 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)	0–40%

## Ecological dynamics

The plant communities found on an ecological site are naturally variable. Composition and production will vary with yearly conditions, location, aspect, and the natural variability of the soils. The historical climax plant community represents the natural potential plant communities found on relict or relatively undisturbed sites. Other plant communities described here represent plant communities that are known to occur when the site is disturbed by factors such as grazing, fire, or drought.

Production data provided in this site description is standardized to air-dry weight at the end of the summer growing season. The plant communities described in this site description are based on near normal rainfall years.

NRCS uses a Similarity Index to compare existing plant communities to the plant communities described here. Similarity Index is determined by comparing the production and composition of a plant community to the production and composition of a plant community described in this site description. To determine Similarity Index, compare the production (air-dry weight) 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 normal year production shown in the plant community description. If rainfall has been significantly above or below normal, use the total production shown for above or below normal years. If field data is not collected at the end of the summer growing season, then the field data must be corrected to the end of the year production before comparing it to the site description. The growth curve can be used as a guide for estimating production at the end of the summer growing season.

## State and transition model



## State 1 Historic Climax Plant Community

### Community 1.1 Historic Climax Plant Community

This plant community has a significant component of cool season perennial grasses and a slightly lesser amount of warm season perennial grasses. It often has a large component of blackbrush, with substantial amounts of other shrubs such as turbinella oak and littleleaf mountainmahogany. A great variety of other shrubs and half-shrubs can be found on the site in small amounts, and agaves and yuccas are fairly comon. Pinyon and juniper trees are scattered across the site at the higher elevations.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	147	—	273
Grass/Grasslike	105	—	168
Forb	21	—	43
Tree	—	—	4
<b>Total</b>	<b>273</b>	—	<b>488</b>

Table 6. Ground cover

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

**Figure 5. Plant community growth curve (percent production by month).**  
**AZ3033, 30.23 6-10" p.z. fourwing saltbush.** Growth begins in the spring and continues into early summer. Seed stalk extension and seed set occurs in summer..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	25	40	15	10	5	0	0	0	0

**Figure 6. Plant community growth curve (percent production by month).**  
**AZ3036, 40-3AZ 10-12" p.z. black grama.** Growth begins in the spring, most growth occurs during the summer rainy season..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	10	15	20	30	20	5	0	0	0

**Figure 7. Plant community growth curve (percent production by month).**  
**AZ3039, 30.28 10-13" p.z. Indian ricegrass.** Growth begins in the spring, most growth occurs in April and May, goes dormant during the summer heat..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	10	25	40	15	0	0	5	5	0	0

**Figure 8. Plant community growth curve (percent production by month).**  
**AZ3010, 35.5 6-10" p.z. galleta.** Growth begins in the spring, goes dormant in May through June, most growth occurs during the summer rainy season..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	10	10	0	0	15	55	10	0	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 (%)
<b>Grass/Grasslike</b>					
1	<b>Common Native Perennial Summer Mid Grasses</b>			45–84	
	black grama	BOER4	<i>Bouteloua eriopoda</i>	11–34	–
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	11–34	–
	spike dropseed	SPCO4	<i>Sporobolus contractus</i>	6–22	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	6–22	–
	mesa dropseed	SPFL2	<i>Sporobolus flexuosus</i>	6–22	–
2	<b>Occasional Native Perennial Summer Short Grasses</b>			6–22	
	Grass, perennial	2GP	<i>Grass, perennial</i>	0–11	–
	cane bluestem	BOBA3	<i>Bothriochloa barbinodis</i>	0–11	–
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	0–11	–
	low woollygrass	DAPU7	<i>Dasyochloa pulchella</i>	0–11	–
	nineawn pappusgrass	ENDE	<i>Enneapogon desvauxii</i>	0–11	–
	bush muhly	MUPO2	<i>Muhlenbergia porteri</i>	0–11	–
	big galleta	PLRI3	<i>Pleuraphis rigida</i>	0–11	–
3	<b>Common Native Perennial Spring Mid Grasses</b>			62–106	
	desert needlegrass	ACSP12	<i>Achnatherum speciosum</i>	11–28	–
	needle and thread	HECOC8	<i>Hesperostipa comata</i> ssp. <i>comata</i>	11–28	–
	New Mexico feathergrass	HENE5	<i>Hesperostipa neomexicana</i>	11–28	–
	slim tridens	TRMU	<i>Tridens muticus</i>	6–22	–
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	6–22	–
	purple threeawn	ARPU9	<i>Aristida purpurea</i>	6–11	–
	blue threeawn	ARPUN	<i>Aristida purpurea</i> var. <i>nealleyi</i>	6–11	–
	Grass, perennial	2GP	<i>Grass, perennial</i>	0–11	–
4	<b>Occasional Native Annual Grasses</b>			0–11	
	Grass, annual	2GA	<i>Grass, annual</i>	0–11	–
	sixweeks threeawn	ARAD	<i>Aristida adscensionis</i>	0–11	–
	sixweeks grama	BOBA2	<i>Bouteloua barbata</i>	0–11	–
	sixweeks fescue	VUOC	<i>Vulpia octoflora</i>	0–11	–
<b>Forb</b>					
5	<b>Occasional Native Perennial Spring Forbs</b>			6–22	
	Forb, perennial	2FP	<i>Forb, perennial</i>	0–6	–
	brownfoot	ACWR5	<i>Acourtia wrightii</i>	0–6	–
	winding mariposa lily	CAFL	<i>Calochortus flexuosus</i>	0–6	–
	sego lily	CANU3	<i>Calochortus nuttallii</i>	0–6	–
	pale bastard toadflax	COUMP	<i>Comandra umbellata</i> ssp.	0–6	–

			<i>pallida</i>		
	tawny cryptantha	CRFU	<i>Cryptantha fulvocanescens</i>	0–6	–
	desert trumpet	ERIN4	<i>Eriogonum inflatum</i>	0–6	–
	Gordon's bladderpod	LEGO	<i>Lesquerella gordonii</i>	0–6	–
	spiny phlox	PHHO	<i>Phlox hoodii</i>	0–6	–
	globemallow	SPHAE	<i>Sphaeralcea</i>	0–6	–
6	<b>Occasional Native Perennial Summer Forbs</b>			0–11	
	Forb, perennial	2FP	<i>Forb, perennial</i>	0–11	–
	Indian paintbrush	CASTI2	<i>Castilleja</i>	0–11	–
	Colorado four o'clock	MIMU	<i>Mirabilis multiflora</i>	0–11	–
	beardtongue	PENST	<i>Penstemon</i>	0–11	–
	brownplume wirelettuce	STPA4	<i>Stephanomeria pauciflora</i>	0–11	–
7	<b>Occasional Native Annual Forbs</b>			0–11	
	Forb, annual	2FA	<i>Forb, annual</i>	0–11	–
	fiddleneck	AMSIN	<i>Amsinckia</i>	0–11	–
	milkvetch	ASTRA	<i>Astragalus</i>	0–11	–
	flatcrown buckwheat	ERDE6	<i>Eriogonum deflexum</i>	0–11	–
	fleabane	ERIGE2	<i>Erigeron</i>	0–11	–
	popcornflower	PLAGI	<i>Plagiobothrys</i>	0–11	–
	desert Indianwheat	PLOV	<i>Plantago ovata</i>	0–11	–
<b>Shrub/Vine</b>					
8	<b>Occasional Native Half Shrubs</b>			6–22	
	Subshrub (<.5m)	2SUBS	<i>Subshrub (&lt;.5m)</i>	0–11	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	0–11	–
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	0–11	–
	mountain phlox	PHAU3	<i>Phlox austromontana</i>	0–11	–
	whitestem paperflower	PSCO2	<i>Psilostrophe cooperi</i>	0–11	–
	pricklyleaf dogweed	THAC	<i>Thymophylla acerosa</i>	0–11	–
	turpentinebroom	THMO	<i>Thamnosma montana</i>	0–11	–
	Mojave woodyaster	XYTO2	<i>Xylorhiza tortifolia</i>	0–11	–
9	<b>Dominant Native Mid Shrubs</b>			62–168	
	blackbrush	CORA	<i>Coleogyne ramosissima</i>	22–84	–
	Sonoran scrub oak	QUTU2	<i>Quercus turbinella</i>	22–62	–
	littleleaf mountain mahogany	CEIN7	<i>Cercocarpus intricatus</i>	22–62	–
10	<b>Common native Shrubs</b>			22–62	
	Bigelow sage	ARBI3	<i>Artemisia bigelovii</i>	6–22	–
	desert ceanothus	CEGR	<i>Ceanothus greggii</i>	6–22	–
	Nevada jointfir	EPNE	<i>Ephedra nevadensis</i>	6–22	–
	mormon tea	EPVI	<i>Ephedra viridis</i>	6–22	–
	spiny greasebush	GLSP	<i>Glossopetalon spinescens</i>	6–22	–
	Stansbury cliffrose	PUST	<i>Purshia stansburiana</i>	6–22	–
11	<b>Occasional Native Shrubs</b>			6–62	
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	0–11	–
	catclaw acacia	ACGR	<i>Acacia greggii</i>	0–11	–

	Wright's beebrush	ALWR	<i>Aloysia wrightii</i>	0–11	–
	pointleaf manzanita	ARPU5	<i>Arctostaphylos pungens</i>	0–11	–
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	0–11	–
	alderleaf mountain mahogany	CEMO2	<i>Cercocarpus montanus</i>	0–11	–
	ragged rockflower	CRBI2	<i>Crossosoma bigelovii</i>	0–11	–
	crispleaf buckwheat	ERCO14	<i>Eriogonum corymbosum</i>	0–11	–
	Heermann's buckwheat	ERHE	<i>Eriogonum heermannii</i>	0–11	–
	Apache plume	FAPA	<i>Fallugia paradoxa</i>	0–11	–
	Fremont's mahonia	MAFR3	<i>Mahonia fremontii</i>	0–11	–
	skunkbush sumac	RHTR	<i>Rhus trilobata</i>	0–11	–
12	<b>Occasional Native Cacti</b>			11–28	
	Engelmann's hedgehog cactus	ECEN	<i>Echinocereus engelmannii</i>	0–11	–
	kingcup cactus	ECTR	<i>Echinocereus triglochidiatus</i>	0–11	–
	dollarjoint pricklypear	OPCH	<i>Opuntia chlorotica</i>	0–11	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0–11	–
	cottontop cactus	ECPO2	<i>Echinocactus polycephalus</i>	0–6	–
13	<b>Occasional Native Agavi-Yucca-Like</b>			11–28	
	Utah agave	AGUT	<i>Agave utahensis</i>	0–11	–
	sacahuista	NOMI	<i>Nolina microcarpa</i>	0–11	–
	banana yucca	YUBA	<i>Yucca baccata</i>	0–11	–
	soaptree yucca	YUEL	<i>Yucca elata</i>	0–11	–
<b>Tree</b>					
14	<b>Occasional Native Trees</b>			0–6	
	Utah juniper	JUOS	<i>Juniperus osteosperma</i>	0–6	–
	twoneedle pinyon	PIED	<i>Pinus edulis</i>	0–6	–

## Type locality

Location 1: Coconino County, AZ	
Township/Range/Section	T32N R6W S14
Latitude	36° 14' 20"
Longitude	112° 58' 52"
General legal description	Hualapai Indian Reservation near the confluence of National Canyon and the Grand Canyon; approximately 3500 feet west and 1000 feet north of the projected southeast corner of Section 14, T. 32 N., R. 6 W

## 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)	Karlynn Huling
Contact for lead author	NRCS Flagstaff Area Office
Date	04/18/2006
Approved by	S. Cassady
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

## Indicators

- 1. Number and extent of rills:** Minor rill formation may occur, mostly on steeper slopes without rock fragment armor, due to sandy loam textures, moderate permeability, very shallow depth, and high amount of rock outcrop directing runoff onto the soils.

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- 2. Presence of water flow patterns:** Water flow patterns may be common due to moderate permeability, very shallow depth, and rapid runoff of the soils. There will be more water flow patterns in the steeper areas adjacent to rock outcrop.

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- 3. Number and height of erosional pedestals or terracettes:** Some pedestals and terracettes may form, but they should be very short.

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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 will be reduced by the amount of surface rock fragments and rock outcrop found on the site. This site has less than one inch of available water capacity, so the potential for production of plant cover is very low. Drought may cause an increase in bare ground.

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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:** There may be occasional areas with sandier surfaces that have small blowouts and minor depositional areas around rock outcrop and plant bases.

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- 7. Amount of litter movement (describe size and distance expected to travel):** Herbaceous and fine woody litter will be transported in water flow pathways and by wind. Coarse woody litter will remain under shrub and tree canopies. Litter movement may be greatest in areas that are adjacent to 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 usually fine sandy loam or sandy loam. Most surface horizons have a significant amount of gravel. Many areas have a large amount of rock fragments covering the soil surface. When well vegetated or

covered with rock fragment armor, these soils have a high resistance to water erosion and a moderate resistance to wind erosion.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface structure may be platy (moderate, thick), granular (moderate, fine), or subangular blocky (weak, fine). Surface thickness is 1-2 inches. Color is variable depending upon parent material.
- 
10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** This site is characterized by a patchy distribution of mostly shrubs with a lot of grasses and a few forbs. The patches of plants are found where there are soil deposits or sandstone bedrock cracks that will secure roots and hold moisture. Canopy cover averages 21% (10% shrubs, 10% grasses, 1% forbs). Basal cover averages 2% (1% shrubs, 1% grasses). The cover is reduced by the amount of rock outcrop cover. Both plant cover values decrease during a prolonged drought.
- 
11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. Some of the soils could be easily compacted, but they are generally protected by rock fragments in the profile. Some soils have a naturally platy surface structure.
- 
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: shrubs >>
- Sub-dominant: cool season bunchgrasses > warm season colonizing grasses >
- Other: Minor: warm season bunchgrasses > forbs > Agave family = cacti >
- Trace: trees = annual grasses
- Additional:
- 
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 except during the most severe droughts. Severe winter droughts affect shrubs and trees the most. Severe summer droughts affect grasses the most.
- 
14. **Average percent litter cover (%) and depth ( in):** Litter consists of a combination of woody and herbaceous. Litter amounts increase during the first few years of drought, then decrease in later years.
- 
15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 250-300 pounds per acre (dry weight) in dry years, 300-400 pounds per acre in median years, 400-500 pounds per acre in wet years.
- 
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 and threadleaf snakeweed are native to the site but have the capacity to increase with overgrazing. Red brome and cheatgrass are exotic annual grasses that have invaded many areas. These grasses can increase greatly during wet winters and springs.

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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 rhizomes in most years except for the most severe droughts.
-