

## Ecological site DX035X04B314 Sandstone Upland 10-14" p.z.

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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.

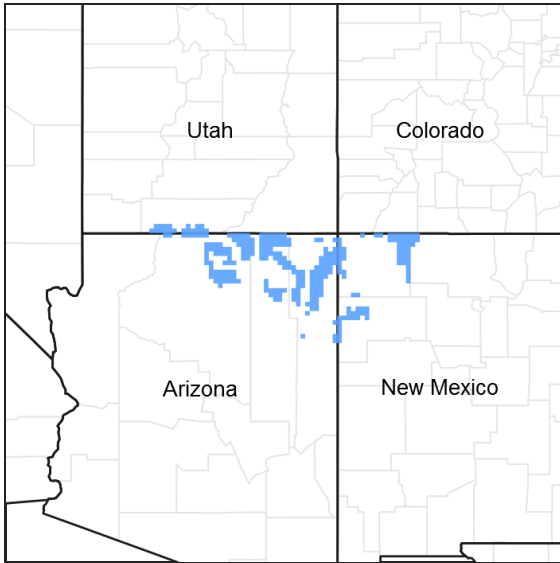


Figure 1. Mapped extent

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.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Artemisia bigelovii</i>

Herbaceous	(1) <i>Achnatherum hymenoides</i> (2) <i>Bouteloua gracilis</i>
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## Legacy ID

R035XC314AZ

## Physiographic features

This ecological site occurs on dissected plateaus, fan terraces and mesas. The soil of this site is very shallow to shallow to sandstone bedrock. The soil surface texture ranges from gravelly fine sandy loam to fine sand. Subsurface horizon textures include loam, loamy fine sand, fine sand and may be channery or gravelly. The soil is slightly to strongly effervescent in the surface and strongly effervescent throughout the subsurface profile. Slopes generally range from 0 to 15 percent, occasionally as much as 25 percent.

**Table 2. Representative physiographic features**

Landforms	(1) Plateau (2) Terrace (3) Mesa
Flooding frequency	None
Ponding frequency	None
Elevation	1,463–2,042 m
Slope	0–15%
Aspect	Aspect is not a significant factor

## Climatic features

Winter 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

### 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 gravelly fine sandy loam to fine sand. Subsurface horizon textures include loam, loamy fine sand, fine sand and may be channery or gravelly. The soil is slightly to strongly effervescent in the surface and strongly effervescent throughout the subsurface profile. The range in depth to sandstone bedrock is 4-20 inches. Available water capacity is low. Water erosion hazard is moderate; wind erosion hazard is high. Soils are mildly to moderately alkaline (pH 7.4-8.4).

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

SSA 707 Little Colorado River Area: 1-Rock Outcrop

SSA 711 Navajo Mountain Area: 3-Arches, 8-Moclom, 11-Eslendo, 12-Rizno, 32-Arches, 41-Wayneco, 42-Nascase;

SSA 712 Canyon de Chelly NM: 17-Moano family, 20-Wayneco family;

SSA 713 Chinle Area: 3-Rizno, 6-Arches, 11-Rizno, 14-Moclom, 27-Lithin Ustic Torriorthents, 43-Arches, 50-Lithic Ustic Torriorthents

SSA 715 Fort Defiance Area AZ/NM: 14-Bond family/Skyvillage, 26-Bond;

SSA 717 Shiprock Area AZ/NM: Arches.

**Table 4. Representative soil features**

Parent material	(1) Eolian sands–sandstone
Surface texture	(1) Gravelly fine sandy loam (2) Fine sand (3) Loamy fine sand
Family particle size	(1) Loamy
Drainage class	Well drained to excessively drained
Permeability class	Moderately rapid to rapid
Soil depth	10–51 cm
Surface fragment cover <=3"	0–30%
Surface fragment cover >3"	0–10%
Available water capacity (0-101.6cm)	3.25–4.06 cm
Calcium carbonate equivalent (0-101.6cm)	0–10%
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)	0–10%

## 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

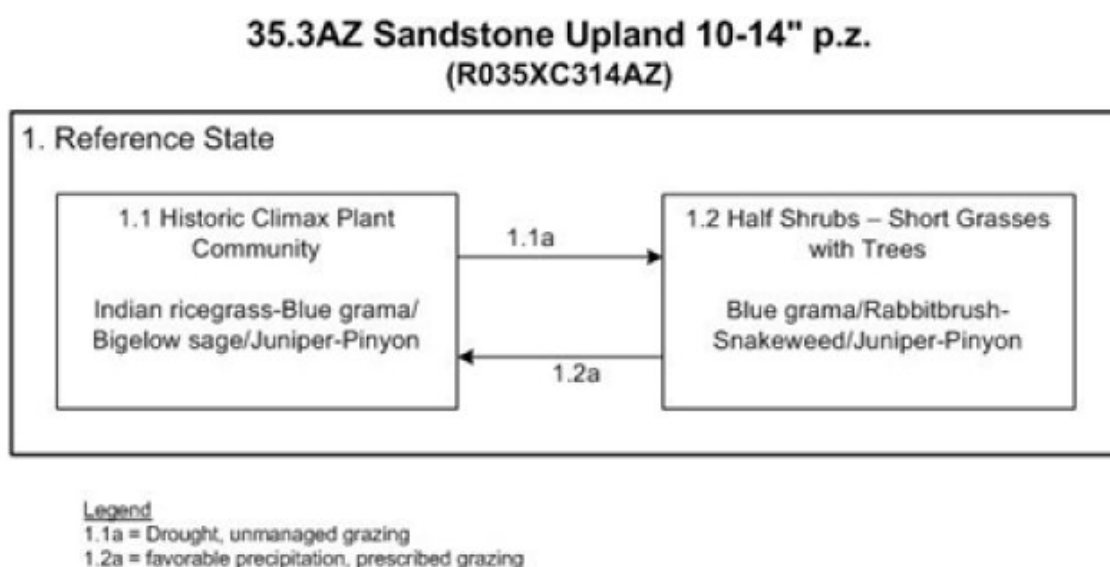


Figure 4. STM - R035XC314AZ

### State 1 Reference State

The dominant aspect of this site is a grassland and shrub mix with scattered trees.

### Community 1.1 Historic Climax Plant Community



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

The dominant aspect of this site is a grassland and shrub mix with scattered Utah juniper and/or Colorado Pinyon. Major grasses are Indian ricegrass, needle and thread, blue grama and galleta. Shrubs include Bigelow sagebrush, antelope bitterbrush, stansbury cliffrose and green mormon tea. There may trace amounts of non-native annuals present. Plant species most likely to increase or invade on this site are cheatgrass, thrifty goldenweed, stemless goldenweed, annual weeds, broom snakeweed, Greene rabbitbrush Bigelow rubber rabbitbrush and Bigelow sagebrush. Continuous grazing during the winter and spring will decrease cool season grasses which are replaced by lower forage value grasses and forbs.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	202	224	247
Shrub/Vine	179	202	224
Tree	–	22	45
Forb	22	34	39
<b>Total</b>	<b>403</b>	<b>482</b>	<b>555</b>

Figure 7. 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

### Half Shrubs - Short Grasses with Trees

This plant community is characterized by an increase of low growing shrubs such as snakeweed, rabbitbrush, Bigelow sagebrush and other native shrubs. There is a decline of cool season grasses in the interspaces and an increase of shortgrasses such as blue grama. There may trace or minor amounts of non-native annuals present.

#### Pathway 1.1a

##### Community 1.1 to 1.2

Drought, improper grazing

#### Pathway 1.2a

##### Community 1.2 to 1.1

Favorable precipitation, prescribed grazing

## Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Dominant Cool Season Grasses</b>			112–168	
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	34–78	–
	needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	6–45	–
	New Mexico feathergrass	HENE5	<i>Hesperostipa neomexicana</i>	6–45	–
	squirreltail	ELELE	<i>Elymus elymoides ssp. elymoides</i>	6–28	–
2	<b>Dominant Warm Season Grasses</b>			45–90	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	34–67	–
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	11–45	–
	black grama	BOER4	<i>Bouteloua eriopoda</i>	6–28	–
3	<b>Other Grasses</b>			11–34	
	Grass, perennial	2GP	<i>Grass, perennial</i>	6–17	–
	Fendler's threeawn	ARPUF	<i>Aristida purpurea var. fendleriana</i>	0–17	–
	sandhill muhly	MUPU2	<i>Muhlenbergia pungens</i>	0–11	–
	Grass, annual	2GA	<i>Grass, annual</i>	6–11	–
	muttongrass	POFE	<i>Poa fendleriana</i>	0–9	–
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	0–9	–
<b>Forb</b>					
4	<b>Forbs</b>			11–39	
	thrift mock goldenweed	STARA	<i>Stenotus armerioides var. armerioides</i>	4–13	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	6–11	–
	Forb, annual	2FA	<i>Forb, annual</i>	0–6	–
	Wyoming Indian paintbrush	CALI4	<i>Castilleja linariifolia</i>	0–6	–
	James' cryptantha	CRCIJ	<i>Cryptantha cinerea var. jamesii</i>	0–6	–
	spreading phlox	PHDI3	<i>Phlox diffusa</i>	0–6	–
	woolly paperflower	PSTA	<i>Psilostrophe tagetina</i>	0–6	–
<b>Shrub/Vine</b>					
5	<b>Dominant Shrubs</b>			90–224	
	Bigelow sage	ARBI3	<i>Artemisia bigelovii</i>	45–90	–
	Greene's rabbitbrush	CHGR6	<i>Chrysothamnus greenei</i>	6–22	–
	Torrey's jointfir	EPTO	<i>Ephedra torreyana</i>	6–22	–
	mormon tea	EPVI	<i>Ephedra viridis</i>	6–22	–
	rubber rabbitbrush	ERNAH	<i>Ericameria nauseosa ssp. nauseosa var. hololeuca</i>	6–22	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	6–22	–
	Stansbury cliffrose	PUST	<i>Purshia stansburiana</i>	6–22	–
	antelope bitterbrush	PUTR2	<i>Purshia tridentata</i>	6–22	–
	squirreltail	ELELE	<i>Elymus elymoides ssp. elymoides</i>	0–22	–

6	<b>Other Shrubs</b>			6–22	
	Fendler's threeawn	ARPUF	<i>Aristida purpurea</i> var. <i>fendleriana</i>	0–13	–
	Utah serviceberry	AMUT	<i>Amelanchier utahensis</i>	0–6	–
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i>	0–6	–
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	0–6	–
	pricklypear	OPUNT	<i>Opuntia</i>	0–6	–
	spineless horsebrush	TECA2	<i>Tetradymia canescens</i>	0–6	–
	narrowleaf yucca	YUAN2	<i>Yucca angustissima</i>	0–4	–
<b>Tree</b>					
7	<b>Trees</b>			0–45	
	Utah juniper	JUOS	<i>Juniperus osteosperma</i>	0–34	–
	twoneedle pinyon	PIED	<i>Pinus edulis</i>	0–22	–
	sandhill muhly	MUPU2	<i>Muhlenbergia pungens</i>	0–13	–

### Animal community

This site is suitable for grazing by all classes of livestock during most periods except when snow cover restricts availability of forage. Planned grazing systems adapt well on this site. This site will respond to management rather slowly, particularly on spots that have historically been concentration areas.

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, cover, nesting sources and travel corridors.

### Recreational uses

This site occurs on fan terraces and mesas. It has high aesthetic appeal, particularly where it borders open grasslands for contrasts. Winters are cold, summers are warm. Spring is windy. Summer and fall are comfortable for hunting, hiking and wildlife observation.

### Type locality

Location 1: Navajo County, AZ	
Township/Range/Section	T29N R20E S13
General legal description	5-6 mi. northeast of Keams Canyon on the Hopi Reservation
Location 2: Navajo County, AZ	
Township/Range/Section	T29N R20E S24
General legal description	5-6 mi. northeast of Keams Canyon on the Hopi Reservation
Location 3: Apache County, AZ	
Township/Range/Section	T41 N. R13 E. S7
General legal description	Teec Nos Pos quad. - Sec. 7, T. 41 N., R 13 E.; 3.5 miles NE of Teec Nos Pos, Navajo 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)	Kevin Williams
Contact for lead author	NRCS State Rangeland Management Specialist, Arizona State Office, Phoenix, AZ
Date	10/04/2006
Approved by	Byron Lambeth
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

## Indicators

- 1. Number and extent of rills:** Rills may be common on steeper slopes due to high amount of rock outcrop directing runoff onto soils and low potential to support vegetative growth on shallow and very shallow soils.

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- 2. Presence of water flow patterns:** Water flow patterns may be common on the steeper slopes due to high amount of rock outcrop directing runoff onto the soils and low potential for supporting vegetative growth on the shallow and very shallow soils. These patterns are short and discontinuous across larger soil areas, but may be longer and more continuous where soils lie adjacent to bedrock.

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- 3. Number and height of erosional pedestals or terracettes:** Pedestals and terracettes may be common due to the high potential for wind erosion.

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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 10-40%. Bare ground will be reduced by the amount of surface rock fragments and rock outcrop found on the site. This site has 1.0-1.6 inches 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 sandy 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 range from gravelly fine sandy loam to loamy sand. Soil surface gravel ranges from 5-10%. 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 structures are moderate weak thin platy. Surface thickness of the A-horizon is 1 inch. Color of the A-horizon does not differ significantly from 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 a patchy distribution of mostly shrubs and trees with some grasses and a few forbs. Biological crusts help stabilize the soils. The patches of plants are found where there are soil deposits or sandstone bedrock cracks that will secure roots and hold moisture. Canopy cover ranges from 5-15% (trees = shrubs = grasses). Basal cover ranges from 0-2% (grasses) for vascular plants and 10% for biological crust (cyanobacteria > lichen > moss). Canopy cover and basal cover potential is reduced by the amount of rock outcrop. Both plant cover values decrease during a prolonged drought.
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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. Most soils on the site are not easily compacted. The loamy soils could be compacted. Soils have a naturally platy surface 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: shrubs >
- Sub-dominant: perennial bunchgrass > perennial colonizing grasses >> perennial forbs >> annual 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 drought affects trees and shrubs most. Severe summer drought affects 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 approximately 60-80% would be herbaceous litter and approximately 20-40% would be woody litter. Litter amounts increase during the first few years of drought, then 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):** 50-100 lbs/ac dry years; 100-400 lbs/ac median years; 400-500 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, threadleaf snakeweed, and Cutler's jointfir are native to the site but have the potential to increase and dominate after heavy grazing. Cheatgrass and red brome are exotic annual grasses that have invaded many areas, with or without grazing impacts. 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 except during the most severe droughts.

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