

Ecological site R035XC320AZ  
Shale Hills 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.

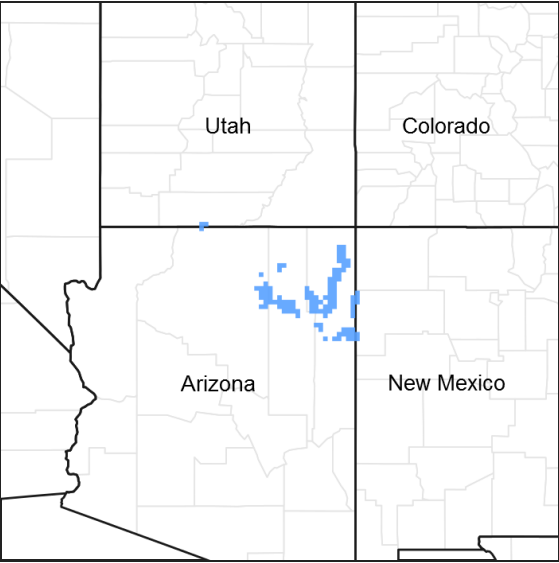


Figure 1. Mapped extent

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>Atriplex confertifolia</i>

Herbaceous	(1) <i>Sporobolus airoides</i> (2) <i>Pleuraphis jamesii</i>
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### Physiographic features

This range site occurs on footslopes, backslopes and canyon sides over shale bedrock. Slopes generally range from 15 to 60 percent, but there can be small areas with flatter or steeper slopes within the site. The soils are very shallow to shallow and well drained. It does not benefit from run-in moisture.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Valley side
Flooding frequency	None
Ponding frequency	None
Elevation	1,463–2,042 m
Slope	15–60%
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

The soil moisture on this ecological site comes from precipitation. The site does not benefit from run-on moisture. Shallow bedrock areas may concentrate water in deeper soil pockets, increasing production in those areas. Because of the shallow clayey soils and steep slopes, larger rainfall events will not be captured by the site, reducing the effective precipitation on this site for plant production. This site contributes runoff to other ecological sites.

### Soil features

Soils are very shallow to shallow (<20") over weathered shale, and well drained. Soil textures range from clay loam to clay throughout the profile. Soft shale fragments range from 15-75%. Commonly, thin seams of lime and gypsum-like fractures and faces of shale fragments occur. Available water holding capacity is moderate. Water and wind erosion hazard is moderate. Soils are moderately alkaline (pH 7.4-8.4).

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

SSA 713 Chinle Area: 50-Tekapo, 61-Eslendo

SSA 714 Hopi Area: 4-Cannonville,16-Zyme;

SSA 715 Fort Defiance Area AZ/NM: 99-Tekapo family;

SSA 717 Shiprock Area AZ/NM: 305 & 317-Eagleye.

**Table 4. Representative soil features**

Parent material	(1) Alluvium—shale
Surface texture	(1) Clay loam (2) Clay (3) Very channery clay loam
Family particle size	(1) Clayey
Drainage class	Moderately well drained to well drained
Permeability class	Slow
Soil depth	13–51 cm
Surface fragment cover <=3"	20–30%
Surface fragment cover >3"	0–15%
Available water capacity (0-101.6cm)	0–6.35 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%
Electrical conductivity (0-101.6cm)	4–16 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	5–13
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–15%
Subsurface fragment volume >3" (Depth not specified)	0–5%

## 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

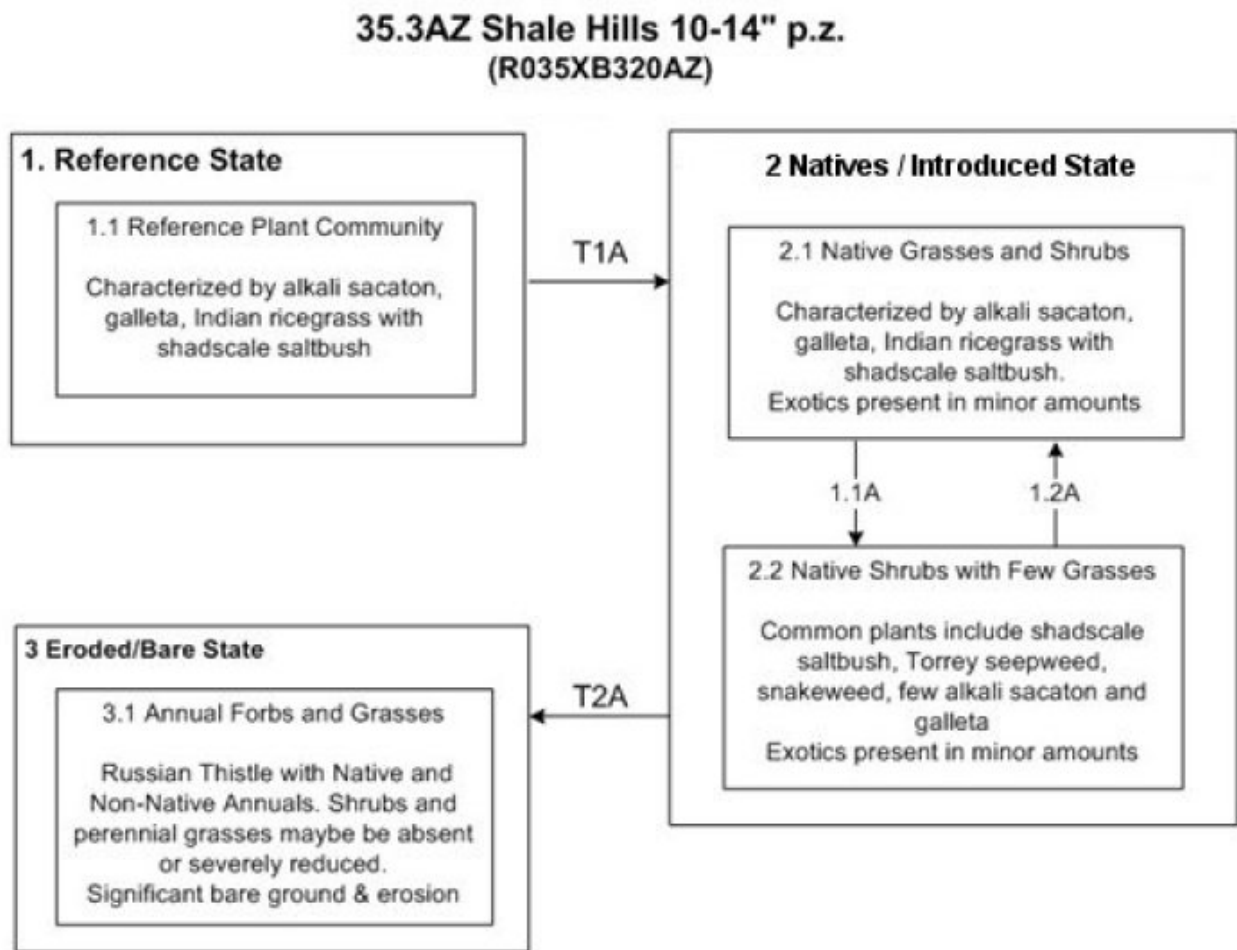


Figure 4. 353 ShaleHills S&T

### State 1 Reference State

### Community 1.1 Historic Cllimax Plant Community



Figure 5. 35.3 Shale Hills - Low Elevation Site



Figure 6. Shale Hills 10-14" p.z.

The plant community is made up of mid and short grasses with a fair percentage of forbs and shrubs. In the original plant community, there is a mixture of both cool and warm season plants. Plant species most likely to invade or increase on this site when it deteriorates are galleta, Torrey seepweed, Greene rabbitbrush, cheatgrass and annual forbs. Continuous livestock grazing use during winter and spring will decrease cool season grasses, which are replaced by lower forage value grasses and shrubs.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	235	258	275
Shrub/Vine	84	140	168
Forb	17	22	34
Tree	—	11	17
<b>Total</b>	<b>336</b>	<b>431</b>	<b>494</b>

Table 6. Ground cover

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

**Figure 8. Plant community growth curve (percent production by month).**  
**AZ3503, 35.3 10-14" p.z. galleta.** Growth begins in spring, most growth occurs during summer and early fall rainy season. Plants will green up again in the fall..

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

**Figure 9. Plant community growth curve (percent production by month).**  
**AZ3505, 35.3 10-14" p.z. Indian ricegrass.** Growth begins in spring, with semi-dormancy occurring during July through August. Plants will green up again in the fall..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	10	20	25	20	5	5	10	5	0	0

**Figure 10. Plant community growth curve (percent production by month).**  
**AZ3507, 35.3 10-14" p.z. alkali sacaton.** Growth begins in late spring, most growth occurs in summer and early fall..

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

**Figure 11. Plant community growth curve (percent production by month).**  
**AZ3509, 35.3 10-14" p.z. shadscale saltbush.** Growth begins in spring and extends through the summer. Seed set occurs in summer to early fall..

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

**Figure 12. 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

## State 2

### Natives / Introduced State

## Community 2.1

### Native Grasses and Shrubs

Introduced exotic annual grasses and forbs are present in minor amounts in the plant community, but the amount and proportions of native plants is similar to that found in plant community 1.1, Reference Plant Community.

## Community 2.2

### Native Shrubs with Few Grasses



Figure 13. Shrubs with Few Grasses

This plant community is characterized by a dominance of shadscale saltbush, Torrey Seepweed, snakeweed, with a few alkali sacaton and galleta. Introduced exotic annual grasses and forbs are present in minor amounts in the plant community.

## Pathway 1.1A

### Community 2.1 to 2.2

Improper grazing, drought

## Pathway 1.2a

### Community 2.2 to 2.1

Prescribed grazing/Rest, favorable moisture/climate

## State 3

### Eroded/Bare State

## Transition T1A

### State 1 to 2

Introduction of non-native annuals species creates an irreversible change in the plant community

## Transition T2A

### State 2 to 3

Continuous improper grazing, drought, loss of perennial plant cover results in significant erosion

## 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>Grasses</b>			163–404	
	alkali sacaton	SPAI	<i>Sporobolus airoides</i>	84–140	–
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	56–112	–
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	22–67	–
	squirreltail	ELELE	<i>Elymus elymoides</i> ssp. <i>elymoides</i>	6–22	–
	Grass, perennial	2GP	<i>Grass, perennial</i>	6–22	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	0–17	–
	needle and thread	HECO26	<i>Hesperostipa comata</i>	0–11	–
	saline wildrye	LESA4	<i>Leymus salinus</i>	0–11	–
<b>Forb</b>					
2	<b>Forbs</b>			17–34	
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	66–82	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	11–22	–
	Forb, annual	2FA	<i>Forb, annual</i>	6–11	–
	milkvetch	ASTRA	<i>Astragalus</i>	0–6	–
	rose heath	CHER2	<i>Chaetopappa ericoides</i>	0–6	–
	princesplume	STANL	<i>Stanleya</i>	0–6	–
<b>Shrub/Vine</b>					
3	<b>Shrubs</b>			84–168	
	shadscale saltbush	ATCO	<i>Atriplex confertifolia</i>	56–84	–
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	17–49	–
	longflower rabbitbrush	CHDE2	<i>Chrysothamnus depressus</i>	11–22	–
	Greene's rabbitbrush	CHGR6	<i>Chrysothamnus greenei</i>	0–11	–
	Torrey's jointfir	EPTO	<i>Ephedra torreyana</i>	0–11	–
	slenderleaf buckwheat	ERLE10	<i>Eriogonum leptophyllum</i>	0–11	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	0–11	–
	Mojave seablite	SUMO	<i>Suaeda moquinii</i>	0–11	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	0–11	–
	Bigelow sage	ARBI3	<i>Artemisia bigelovii</i>	0–11	–
<b>Tree</b>					
4	<b>Trees</b>			0–17	
	Utah juniper	JUOS	<i>Juniperus osteosperma</i>	0–17	–
	squirreltail	ELELE	<i>Elymus elymoides</i> ssp. <i>elymoides</i>	3–17	–
	twoneedle pinyon	PIED	<i>Pinus edulis</i>	0–11	–

## Animal community

Steep slopes, sparse vegetation and lack of water developments restrict proper use and distribution of livestock on



this site. The site will seldom be used as a key management area for livestock.

Fair diversity of plants provides adequate forage for grassland wildlife species. Deterioration of the site will cause a change in wildlife species which are able to utilize annual grasses and shrubs of lower forage value.

## Recreational uses

Site consists of steep hillsides that are somewhat bare. Sparse plant cover of the site provides an interesting scene. The exposed geologic formation is interesting. Winters are cold; spring is usually windy. Summers are warm. Late spring, summer and fall are the most pleasant seasons for hiking, rock hounding and photography on the site.

## Type locality

Location 1: Navajo County, AZ	
Township/Range/Section	T27N R19E S10
General legal description	SW 1/4, 5 mi. southeast of Polacca, AZ on the Hopi Indian Reservation

## 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.

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Date	08/06/2012
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

## Indicators

1. **Number and extent of rills:** Rills are somewhat common and cover up to 10 percent of the site. Rills are up to 20 feet long. Areas with significant rock cover will have shorter and fewer rills
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2. **Presence of water flow patterns:** Somewhat common throughout site. Flow patterns may be long, narrow and connected on steepest slopes. On sites with significant amounts of coarse fragments will have less evident water flow patterns.

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3. **Number and height of erosional pedestals or terracettes:** Some long-lived plants may show some slight pedestals of less than a 1 inch. Terracettes are common along water flow patterns where obstruction or plant bases occur.

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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 30-50 percent.

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5. **Number of gullies and erosion associated with gullies:** None to very few. When site is well vegetated and covered with rock fragments, gullies are stable and will only show minor signs of active erosion. Gullies should be shallow due to depth to shale fragments, weathered bedrock and/or armored with larger rock fragments (medium gravels and channers).

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6. **Extent of wind scoured, blowouts and/or depositional areas:** Deposition and blowouts by wind are not expected.

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7. **Amount of litter movement (describe size and distance expected to travel):** Due to steepness of the site, litter redistribution by water is common and expected in water flow patterns. Woody litter will travel short distances away from canopies.

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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):** The expected soil site stability range is 4-5 under canopies and 1-2 in the interspaces. Surface rock fragments, litter, and vegetation cover aid in reducing raindrop impact and splash erosion.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface horizon is 1 to 4 inches deep. Structure is mostly moderate medium platy structure over strong fine granular to moderate or strong fine granular structure. Surface color mostly yellowish brown (10YR 6/4) to light yellowish brown (10YR 6/4).

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Due to steepness and moderate amounts of rock fragments of this site, vegetation only has minimum effect on infiltration and runoff. This site is characterized by a dominance of grasses over low shrubs with an occasional sparse scattered canopy of trees. When well vegetated the cover lends to slowing runoff and allowing for some infiltration.

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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. There may be a subsurface layer of platy structure or weathered shale on very shallow sites that should not be confused as a compaction layer.

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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: Warm season grasses (alkali sacaton, galleta and sand dropseed) > Salt tolerant shrubs (shadscale and seepweed)>

Sub-dominant: Cool season grasses (Indian ricegrass and squirreltail) > Other shrubs >

Other: Forbs > Trees > Annual grasses

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 the shrubs the most. Severe summer droughts affect grasses the most.
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14. **Average percent litter cover (%) and depth ( in):** Litter depth can range from 1 leaf thickness to ¼ inch.
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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** The expected total annual production is 350 – 450 lbs/ac in a normal precipitation year.
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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:** Shadscale saltbush, broom snakeweed and rabbitbrush are all native to the site, but may have the potential to increase with continued disturbance. Cheatgrass, annual wheatgrass, and Russian thistle are non-native annuals that have 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 during the most severe droughts.
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