USDA Natural Resources Conservation Service

Ecological site R042AB734TX
Salty Clay Hill, Hot Desert Shrub

Accessed: 06/13/2025

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.

Associated sites

R042AB586TX	**Sandstone Hill and Mountain, Hot Desert Shrub** This site can be intermingled with the Salty Clay Hill site.
R042AB735TX	**Gravelly, Hot Desert Shrub** This site is located on hilltops and summits above the Salty Clay Hill site.
R042AB738TX	**Loamy, Hot Desert Shrub** This site is located on drainages and valleys below the Salty Clay Hill site.

Similar sites

R042AB735TX	**Gravelly, Hot Desert Shrub** This site is similar in landform and soil texture, but does not have salt and gypsum accumulations and is more productive and diverse.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

The site occurs on hillslopes, erosional desert basins and fan remnants that are frequently associated with “badlands”. Slope gradients range from 1 percent to about 30 percent.

Table 2. Representative physiographic features

Landforms	(1) Erosion remnant (2) Hill
Elevation	1,900–4,000 ft
Slope	1–30%
Aspect	N, S

Climatic features

The average annual precipitation ranges from 10 to 13 inches and highly variable from 2 to 21 inches. Most of the precipitation occurs as widely scattered thunderstorms of high intensity and short duration during the summer. Occasional precipitation occurs as light rainfall during the cool season. Negligible amounts of precipitation falls in the form of sleet or snow.

Mean annual air temperature is 70° F. Daytime temperatures exceeding 100° F are common from May through September. Frost free period ranges from 254 to 295 days.

The average relative humidity in mid-afternoon is about 25 percent. Relative humidity is higher at night, and the average at dawn is about 57 percent. The sun shines 81 percent of the time in summer and 75 percent in winter. The prevailing wind is from the southwest. Average wind speed is highest, around 11 miles per hour, in March and April.

The combination of low rainfall and relative humidity, warm temperatures, and high solar radiation creates a significant moisture deficit. The annual Class-A pan evaporation is approximately 94 inches.

Table 3. Representative climatic features

Frost-free period (average)	295 days
Freeze-free period (average)	334 days
Precipitation total (average)	13 in

Influencing water features

Soil features

The site consists of very shallow to shallow, well drained, and fine textured soils that formed from shale bedrock or clayey lacustrine deposits. Diagnostic features recognized in the soil profile include gypsum crystals and salt accumulations. Gravels cover about 50 percent of the soil surface. Permeability is very slow. Eroded soils on mounds or hillsides lacking vegetation are a common feature associated with the soils of the site; however, they are not correlated with an ecological site. A unique feature of the soils is the high shrink-swell potential which results in popcorn crusts that feel spongy when walking across.

Soil temperature regime is hyperthermic (mean annual soil temperature to a depth of 20 inches, or bedrock, is greater than 72º Fahrenheit). The representative soils are Changas and Geefour.

Table 4. Representative soil features

Parent material	(1) Lacustrine deposits–mudstone (2) Residuum–shale
Surface texture	(1) Clay (2) Very gravelly silty clay
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Very slow
Soil depth	2–20 in
Surface fragment cover <=3"	35–65%
Surface fragment cover >3"	5–20%
Available water capacity (0-40in)	3 in
Calcium carbonate equivalent (0-40in)	1–5%
Electrical conductivity (0-40in)	0–16 mmhos/cm
Sodium adsorption ratio (0-40in)	2–13
Soil reaction (1:1 water) (0-40in)	7.9–8.4
Subsurface fragment volume <=3" (Depth not specified)	3–25%

Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The Reference Plant Community on the Salty Clay Hill (Hot Desert Shrub) consists of bunch and stoloniferous mid/short grasses along with a variety of perennial forbs and shrubs.

Existing plant species composition and production varies with the interaction of yearly weather conditions, location, aspect, elevation, geologic attributes, and the natural variability of the soils. Total above ground annual plant production ranges from 100-300 lbs/acre. Probably the factors that most influenced the historic vegetative composition of the site were extended dry weather and inherent soil features such as accumulations salt and gypsum. High rainfall events did occur but were episodic. The perennial grasses dominating the site could survive the periodic droughts as long as the density of woody plants did not become excessive, and top-removal of the grass plants did not occur too frequently. Overgrazing amplifies the effects of drought. Insects, rodents, infrequent fire, and herbivores such as mule deer were also present. Bison were not documented in the historical record as being present in any significant amount. A lack of water, insufficient grass production and steep, rough terrain were probably contributing factors.

Present climatic and vegetation regimes of the region were established about 8000 years ago when a trend of increased aridity developed and may possibly be continuing today. Overutilization of rangelands during the past 150 years by early settlers may have accentuated a trend toward greater aridity already in existence. Early records suggest cattle, sheep, goats and horses were introduced into the southwest from Mexico in the mid-1500's. However, extensive ranching began in the Trans-Pecos region in the 1880s. Livestock numbers peaked in the late 1880’s following the arrival of railroads. Historical accounts document ranches with stocking rates as high as one animal unit per four acres; this was far from sustainable in this environment.

Cattle use on rangeland declines significantly on slopes steeper than 15 percent; however, cattle numbers were never very large. Sheep and goats, however, are able to utilize steeper slopes. It should be noted that abusive grazing by different kinds and classes of livestock will result in different impacts on the site. One effect of the removal of vegetated cover was to expose bare ground to erosion. Another effect was the deterioration of perennial grasses which removed the source of fine fuel to sustain periodic fires. More than likely, fires were not very frequent and when they did occur, the burn pattern was a mosaic governed by terrain and vegetative features.

The impact of improper grazing within this site specifically will lead to the loss of mostly grasses, reduction of fine litter, and the slow increase of some woody plants. Vegetation will shift from a midgrass to a shortgrass plant community and ultimately to nonreversible shrub dominated state with isolated shortgrasses.

Decades of overgrazing with loss of vegetation and erosion make it a slow process to return to the HCPC community. For example, in 1944 the southernmost portion of the Trans-Pecos area was set aside as Big Bend National Park. Grazing activities with cattle ceased. In 1944, most of the Clay Hill Hot Desert Shrub sites were probably degraded and dominated by woody shrubs. After 60 years of no grazing in the hyperthermic zone, the many of these sites have not recovered to the historic plant community which provides insight into the length of time it takes for recovery in this environment.

The following diagram suggests general pathways that the vegetation on this site might follow. There may be other states not shown on the diagram. This information is intended to show what might happen in a given set of circumstances; it does not mean that this would happen the same way in every instance. Local professional guidance should always be sought before pursuing a treatment scenario.

State and Transition Model:

State and transition model

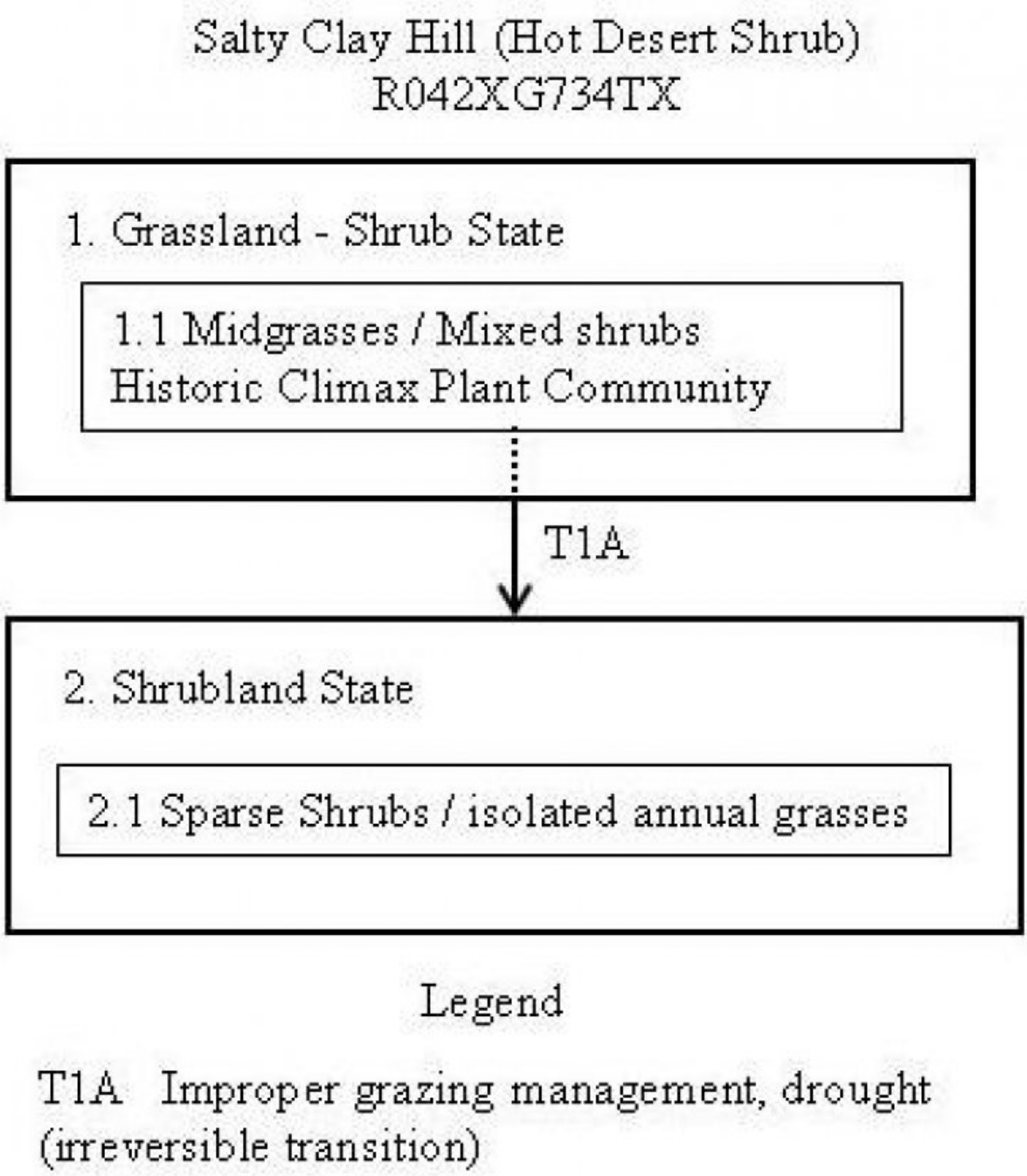

Figure 4. Salty Clay Hill (Hot Desert Shrub) - State & Trans

State 1
Grassland - Shrub State

Community 1.1
Midgrasses/ Mixed Shrubs Community

Figure 5. 1.1 Midgrasses/ Mixed Shrubs Community

Grasses within this plant community total approximately 70% of the total species composition by weight, while woody plants and forbs account for 22% and 8%, respectively. Tobosa and false grama are the dominant grasses while tubercled and mound saltbush, mesquite, and lechuguilla, are dominant shrubs. The clayey soil allows for favorable water holding capacity following rain events. However, salt and gypsum accumulations within the soil most likely limit species richness on the site. Consequently, vegetative canopy cover is inherently low on this site. The site is intermingled with eroded soils lacking vegetation. Surface fragments slow water runoff and provide protection for some plants from total utilization by herbivory. Ecological processes (water cycle, nutrient cycle, and energy flow) are functioning with optimum efficiency for the site due to the adequate amount of organic materials, grasses, and surface fragments that cover the soil surface. Extended dry weather causes an overall decline in grass cover and production and can cause some retrogression. However, the HCPC evolved with plants that have drought tolerance. Long term retrogression is triggered primarily by abusive grazing which causes an immediate decrease and eradication of the most palatable plants such as tobosa and false grama. Improper grazing management will transition the site to a shrub dominated plant community (2.1). The reference plant community alone is very limited for sustaining livestock grazing because of the inherently low production potential and sporadic rainfall.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	112	188	262
Shrub/Vine	30	50	70
Forb	8	12	18
Tree	0	0	0
Total	**150**	**250**	**350**

Figure 7. Plant community growth curve (percent production by month). TX0011, Grassland/Shrub Community. Grass Dominant with Shrubs Community..

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

State 2
Shrubland State

Community 2.1
Sparse Shrubs/Annual Grasses Community

Figure 8. 2.1 Sparse Shrubs/Annual Grasses Community

This plant community is the result of excessive overutilization of plant resources. Improper grazing management causes a shift to a shrub dominated state annual grasses and forbs. Tubercled and mound saltbush are the most dominant shrubs. Mesquite and lechuguilla subdominate. An irreversible compositional and functional threshold has been crossed. Climatic and soil limitations prevent recovery of the reference plant community. This plant community is not suitable for livestock grazing and provides limited wildlife habitat.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	36	52	73
Forb	9	14	20
Grass/Grasslike	0	4	7
Tree	0	0	0
Total	**45**	**70**	**100**

Figure 10. Plant community growth curve (percent production by month). TX0022, Shrubs/Annual Grasses Community. Shrubs dominant with annual grasses and isolated mid/shortgrasses..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1	2	2	2	8	8	20	25	15	15	1

Transition T1A
State 1 to 2

Improper grazing management and droughts leads to an irreversible transition to the Shrubland State.

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Mid, Bunchgrasses**			60–140	
	tobosagrass	PLMU3	*Pleuraphis mutica*	55–140	–
	alkali sacaton	SPAI	*Sporobolus airoides*	0–75	–
	threeawn	ARIST	*Aristida*	5–15	–
2	**Stoloniferous Shortgrasses**			28–63	
	false grama	CAER2	*Cathestecum erectum*	25–55	–
	low woollygrass	DAPU7	*Dasyochloa pulchella*	3–10	–
3	**Short, Bunchgrasses**			24–52	
	Madagascar dropseed	SPPY2	*Sporobolus pyramidatus*	12–25	–
	Hall's panicgrass	PAHA	*Panicum hallii*	8–20	–
	nineawn	ENDE	*Enneapogon desvauxii*	4–15	–

	pappusgrass				
4	**Annuals**			0–7	
	Grass, annual	2GA	*Grass, annual*	0–7	–
Shrub/Vine					
5	**Shrubs**			12–28	
	western honey mesquite	PRGLT	*Prosopis glandulosa var. torreyana*	5–10	–
	whitethorn acacia	ACCO2	*Acacia constricta*	2–8	–
	creosote bush	LATR2	*Larrea tridentata*	2–8	–
	desert-thorn	LYCIU	*Lycium*	3–8	–
6	**Subshrubs**			12–28	
	tubercled saltbush	ATAC	*Atriplex acanthocarpa*	2–10	–
	mound saltbush	ATOB	*Atriplex obovata*	2–8	–
	showy menodora	MELO2	*Menodora longiflora*	2–4	–
	rough menodora	MESC	*Menodora scabra*	2–4	–
	plumed crinklemat	TIGR	*Tiquilia greggii*	2–4	–
	lechuguilla	AGLE	*Agave lechuguilla*	2–4	–
7	**Succulents**			6–14	
	pricklypear	OPUNT	*Opuntia*	2–10	–
	Big Bend pricklypear	GRSC6	*Grusonia schottii*	2–6	–
	Christmas cactus	CYLE8	*Cylindropuntia leptocaulis*	2–5	–
Forb					
8	**Perennial Forbs**			8–18	
	Forb, perennial	2FP	*Forb, perennial*	6–8	–
	Chinese lantern	QULO2	*Quincula lobata*	1–3	–
	globemallow	SPHAE	*Sphaeralcea*	1–3	–
9	**Annual Forbs**			0–5	
	Forb, annual	2FA	*Forb, annual*	0–2	–
	Arizona poppy	KAGR	*Kallstroemia grandiflora*	0–1	–
	bladderpod	LESQU	*Lesquerella*	0–1	–

Animal community

The reference plant community is very limited for sustaining livestock grazing because of the inherently low production potential and sporadic rainfall. Any livestock utilizing this site

should be stocked in proportion to the grazeable grass, forbs, and browse.

The site is limited as primary habitat for wildlife. Most likely, wildlife utilize the site from adjacent ecological sites. Plants such has mesquite and lechuguilla, tobosa, provide food and shelter but the abundance of these plants is limited. The spatial distribution of the vegetation is inherently scattered over relatively wide spaces. Consequently, small wildlife is more vulnerable to predation.

Plant Preference by Animal Kind:

These preferences are somewhat general in nature as the preferences for plants is dependent upon grazing experience, time of year, availability of choices, and total forage supply.

Legend: P=Preferred D=Desirable U=Undesirable N=Not Consumed T=Toxic X=Used, but not degree of utilization unknown
Preferred – Percentage of plant in animal diet is greater than it occurs on the land
Desirable – Percentage of plant in animal diet is similar to the percentage composition on the land
Undesirable – Percentage of plant in animal diet is less than it occurs on the land
Not Consumed – Plant would not be eaten under normal conditions. Only consumed when other forages not available.
Toxic – Rare occurrence in diet and, if consumed in any tangible amounts results in death or severe illness in animal

Hydrological functions

The existing plant community with representative plant species, current soil conditions (soil health), current management, climate, and geomorphology, and slope gradient determine the dynamics of the water cycle. Plant, litter, and rock cover are important factors, which protect the site from erosion. Total production and the types of plant species present also have great impact on hydrologic dynamics (infiltration capacity, runoff, and soil losses).

With reference to the transitional pathway diagram, the reference plant community is associated with optimum hydrologic function within this site. The high degree of hydrologic function in State 1 is due to the vegetative cover and dominance of deep-rooted midgrasses (tobosa and alkali sacaton) compared to more shallow rooted shortgrasses. When properly managed, these species provide adequate cover that will minimize runoff. One of the key concepts to high hydrologic function is the structure and morphology of the root system and other biotic and abiotic factors as explained above.

A shift from a tobosa dominated community to shrubland with isolated annual grasses (Shrubland State) will cause a decline in hydrologic function. Loss of significant vegetative cover will allow for increased run-off and soil erosion. The inherently high amount of

surface fragments does limit the effects of vegetative loss and helps protect the soil surface from erosion.

Recreational uses

Loose surface fragments and slope gradients limit the suitability for hikers and campers.

Wood products

None.

Other products

None.

Other information

None.

Inventory data references

Information presented here has been developed from NRCS clipping, composition, plant cover, and soils data.

Other references

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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	03/14/2011
Approved by	Mark Moseley, ESI Specialist, NRCS, Texas
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None.

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2. **Presence of water flow patterns:** None, except following high intesity storms, when short (less than 1 m) and discontinuous flow patterns may appear. Flow patterns in drainages are linear and continuous.

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3. **Number and height of erosional pedestals or terracettes:** None.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 5-10 % 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:** None.

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7. **Amount of litter movement (describe size and distance expected to travel):** In drainages, there can be significant amounts of litter moved long distances. On most of the site, minimal and short distance (<5ft) of litter movement associated with high intense rainfall.

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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):** Stability values anticipated to be 4-5 in the interspaces and 5-6 under plant canopies. Values need verification at reference sites.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** 0-2 inches thick, light brownish gray surface horizon with a moderate medium subangular structure. Data from Geefour soil series description (OSD).

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** A high canopy cover of bunch, rhizomatous, and stoliniferous grasses will help minimize runoff and maximize infiltration. Grasses should comprise approximately 75% of total plant compostion by weight. Shrubs will comprise about 20% by weight.

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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.

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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: Rhizomatous grasses >

    Sub-dominant: Stoloniferous grasses = Bunchgrasses = Shrubs >

    Other: semi-succulent/succulents = perennial forbs > annual forbs = 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 grasses will show some mortality and decadence in addition to annual forbs. Mid/tall perennial shrubs will show some mortality or decadence only after prolonged and severe droughts. Subshrubs will be less resistant to severe droughts than mid/tall perennial shrubs.

14. **Average percent litter cover (%) and depth (in):** Litter is primarily herbaceous.

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 150 - 350 pounds per acre

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:** None.

17. **Perennial plant reproductive capability:** All species should be capable of reproduction except during periods of extreme drought conditions, heavy natural herbivory and intense wildfires.