Ecological site R042AB739TX
Clay Hill, Hot Desert Shrub

Accessed: 05/17/2024

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

Associated sites

R042AB264TX	**Igneous Hill and Mountain, Hot Desert Shrub** This site is located on hilltops and summits above the Clay Hill site.
R042AB735TX	**Gravelly, Hot Desert Shrub** This site is located adjacent to and below the Clay Hill site.

Similar sites

R042AB734TX	**Salty Clay Hill, Hot Desert Shrub** This site is similar in landform and soil texture, but is saline and less productive.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

The site occurs on scarps, slopes, hills, and erosional uplands that are warmer than the surrounding landscapes. The scarps are located below Pleistocene pediments and stream terraces and above Holocene alluvial flats and floodplains. Slopes are convex and gradients range from 1 to 30 percent.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Erosion remnant (3) Scarp
Elevation	579–1,219 m
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)	330 mm

Influencing water features

Soil features

The site consists of fine textured soils that are very shallow and shallow to weathered tuff (compacted volcanic ash) bedrock. They are well drained soils that have moderately slowly permeable surface layers over slowly permeable tuffaceous bedrock of the Duff, Pruett, Chisos, and Devil's Graveyard Formations. They formed in residuum derived from tuff. The upper layers of the tuffaceous bedrock may contain up to 75 percent tuff fragments that slake in water. Clay content of top soil ranges from 35 to 50 percent. Eroded soils on mounds or hillsides lacking vegetation are a common feature associated with the site; however, they are not assigned to an ecological site.

Soil temperature regime is hyperthermic (mean annual soil temperature to a depth of 20 inches, or bedrock, is greater than 72º Fahrenheit). The representative soil series is Musgrave.

Table 4. Representative soil features

Parent material	(1) Residuum–tuff
Surface texture	(1) Silty clay loam (2) Silty clay
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Very slow
Soil depth	10–51 cm
Surface fragment cover <=3"	35–75%
Surface fragment cover >3"	5–20%
Available water capacity (0-101.6cm)	7.62 cm
Calcium carbonate equivalent (0-101.6cm)	0–15%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm

Sodium adsorption ratio (0-101.6cm)	0–2
Soil reaction (1:1 water) (0-101.6cm)	7.9–8.4
Subsurface fragment volume <=3" (Depth not specified)	35–75%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The Reference Plant Community on the 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 200-500 lbs/acre. Extended dry weather was likely the most influential factor affecting historic vegetative composition of the site. 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 and rough terrain were probably contributing factors to the lack of bison. 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.

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. Excessive removal of vegetative cover would have increased the amount of bare ground susceptible to erosion. It also would have reduced the amount of perennial grasses that provided a fine fuel source to sustain periodic fires.

The impact of improper grazing within this site specifically will lead to a decrease in 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 a 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

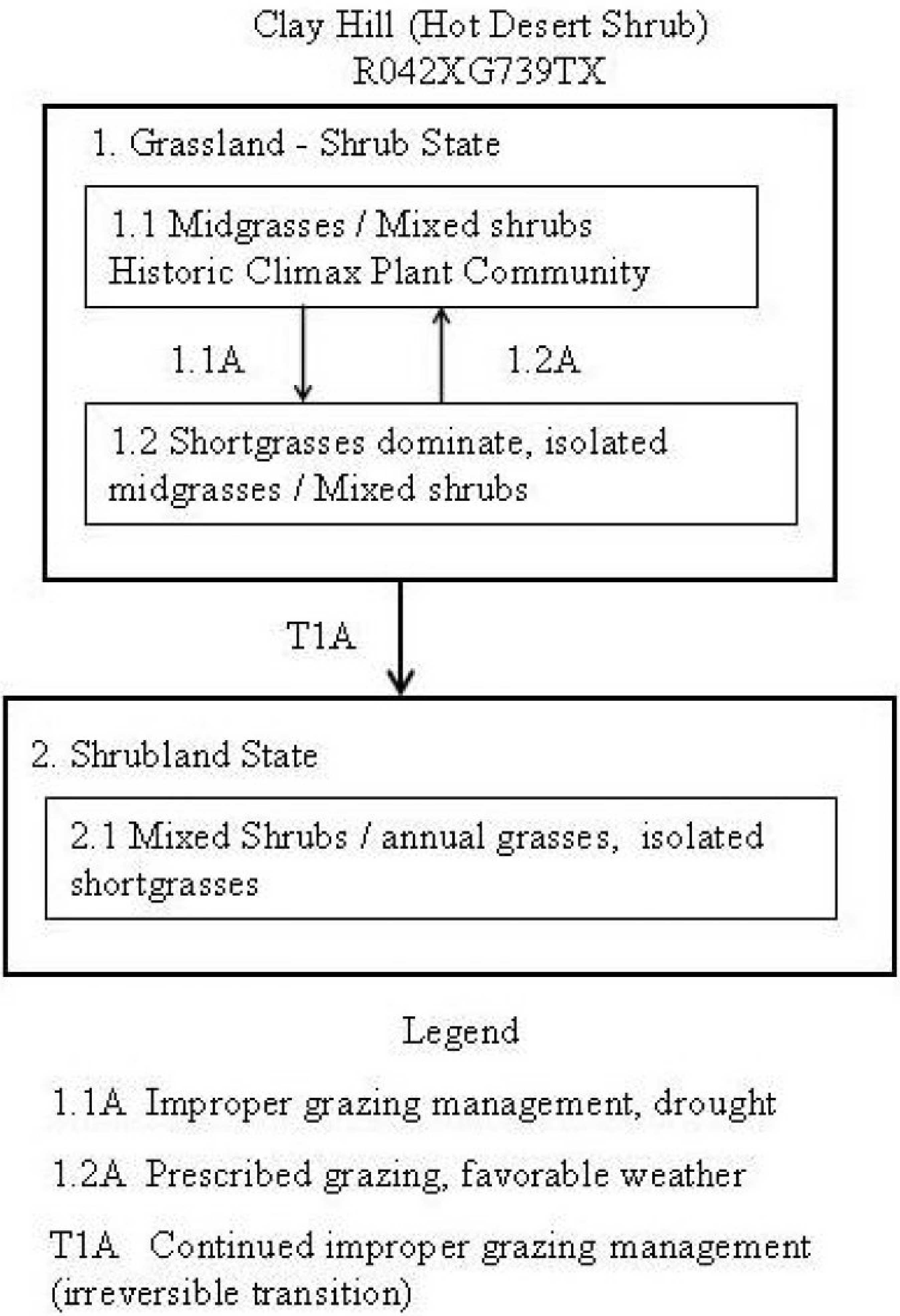

Figure 4. Clay Hill (Hot Desert Shrub) - State & Transition

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 mesquite, lechuguilla, and leatherstem are dominant shrubs. The clayey soil allows for favorable water holding capacity following rain events. Surface fragments slow water runoff and provide protection for some plants from total herbivory. Ecological process (water cycle, nutrient cycle, and energy flow) are functioning with optimum efficiency due to the adequate amount of organic materials 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 eventual eradication of the most palatable plants such as Arizona cottontop, sideoats grama, and menodora. Improper grazing management will transition the site to a shortgrass dominated plant community (2.1). Conservation practices such as prescribed grazing can help maintain ecological integrity within the reference plant community. Stocking rates need to be flexible and adjusted to carrying capacity because of sporadic rainfall.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	157	275	392
Shrub/Vine	49	86	123
Forb	18	31	45
Tree	–	–	–
Total	**224**	**392**	**560**

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

Community 1.2
Shortgrass Dominant Community

Figure 8. 1.2 Shortgrass Dominant Community

This plant community is the result of improper grazing management. Shortgrasses such as false grama and annual grasses dominate. Midgrasses are present, but mostly protected within woody plants. Lechuguilla and creosotebush begin slowly increasing. Hydrologic function is not optimized. With prescribed grazing the plant community can still return to a community similar to the reference community.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	135	235	336
Shrub/Vine	72	126	179
Forb	18	31	45
Tree	–	–	–
Total	**225**	**392**	**560**

Figure 10. 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

Pathway 1.1A
Community 1.1 to 1.2

Midgrasses / Mixed Shrubs Community

Shortgrass Dominant Community

Improper Grazing Management and Drought Conditions would lead to Shortgrass Dominant Community.

Pathway 1.2A
Community 1.2 to 1.1

Shortgrass Dominant Community

Midgrasses / Mixed Shrubs Community

Prescribed Grazing and favorable weather conditions can revert back to Midgrass/Mixed Shrubs Community.

Conservation practices

Prescribed Grazing

State 2
Shrubland State

Community 2.1
Mixed 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 with isolated shortgrasses, annual grasses and forbs. An irreversible compositional and functional threshold has been crossed. Climatic limitations, loss of historic species, and possibly some soil degradation prevent recovery of the reference plant community.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	81	161	242
Grass/Grasslike	17	34	50
Forb	15	29	44
Tree	–	–	–
Total	**113**	**224**	**336**

Transition T1A
State 1 to 2

Due to continued improper grazing management, the Grass-Shrub State irreversibly transitions to the Shrubland State.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous**			67–213	
	tobosagrass	PLMU3	*Pleuraphis mutica*	67–213	–
2	**Stoloniferous**			45–95	
	false grama	CAER2	*Cathestecum erectum*	45–95	–
	low woollygrass	DAPU7	*Dasyochloa pulchella*	0–6	–
3	**Bunchgrasses**			34–78	
	Arizona cottontop	DICA8	*Digitaria californica*	17–39	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	11–34	–

	Chino grama	BORA4	*Bouteloua ramosa*	6–22	–
	threeawn	ARIST	*Aristida*	6–17	–
	Hall's panicgrass	PAHA	*Panicum hallii*	4–11	–
	slim tridens	TRMU	*Tridens muticus*	3–9	–
	nineawn pappusgrass	ENDE	*Enneapogon desvauxii*	3–9	–
4	**Annuals**			0–6	
	Grass, annual	2GA	*Grass, annual*	0–6	–
Shrub/Vine					
5	**Shrubs/Vines**			29–73	
	western honey mesquite	PRGLT	*Prosopis glandulosa var. torreyana*	11–45	–
	catclaw acacia	ACGR	*Acacia greggii*	6–17	–
	creosote bush	LATR2	*Larrea tridentata*	6–17	–
	desert-thorn	LYCIU	*Lycium*	4–11	–
	Texas lignum-vitae	GUAN	*Guaiacum angustifolium*	4–11	–
	whitethorn acacia	ACCO2	*Acacia constricta*	4–11	–
	jointfir	EPHED	*Ephedra*	2–9	–
	resinbush	VIST	*Viguiera stenoloba*	2–9	–
	lotebush	ZIOB	*Ziziphus obtusifolia*	2–9	–
	crown of thorns	KOSP	*Koeberlinia spinosa*	1–6	–
6	**Half Shrubs**			11–28	
	leatherstem	JADI	*Jatropha dioica*	2–11	–
	lechuguilla	AGLE	*Agave lechuguilla*	2–9	–
	showy menodora	MELO2	*Menodora longiflora*	2–7	–
	rough menodora	MESC	*Menodora scabra*	2–7	–
	plumed crinklemat	TIGR	*Tiquilia greggii*	2–6	–
	candelilla	EUAN3	*Euphorbia antisyphilitica*	1–4	–
	tubercled saltbush	ATAC	*Atriplex acanthocarpa*	0–3	–
7	**Succulents**			9–22	
	pricklypear	OPUNT	*Opuntia*	4–11	–
	Christmas cactus	CYLE8	*Cylindropuntia leptocaulis*	2–7	–
	Big Bend pricklypear	GRSC6	*Grusonia schottii*	2–7	–
Forb					
8	**Perennial Forbs**			11–28	
	Forb, perennial	2FP	*Forb, perennial*	2–6	–
	croton	CROTO	*Croton*	2–6	–
	narrowleaf moonpod	SEAN	*Selinocarpus angustifolius*	1–6	–
	globemallow	SPHAE	*Sphaeralcea*	1–3	–
	pricklyleaf dogweed	THAC	*Thymophylla acerosa*	1–3	–
	vervain	VERBE	*Verbena*	1–3	–
	evening primrose	OENOT	*Oenothera*	1–3	–
	pelotazo	ABIN	*Abutilon incanum*	1–3	–
	New Mexico silverbush	ARNE2	*Argythamnia neomexicana*	1–3	–
9	**Annual Forbs**			0–6	

	Forb, annual	2FA	*Forb, annual*	0–2	–
	bladderpod	LESQU	*Lesquerella*	0–2	–
	naked turtleback	PSSC14	*Psathyrotopsis scaposa*	0–2	–

Animal community

The reference plant community is suited for a prescribed grazing system for the production of livestock, including cattle, sheep, and goats. Areas with lower relief are more suited for cattle grazing. Steep mountain slopes are more accessible to sheep and goats. High stocking rates and lack of deferment during droughts are some of the leading causes of unhealthy rangelands. Livestock should be stocked at carrying capacity in proportion to the grazeable grass, forbs, and browse. Vegetative growth is episodic, reflecting rainfall events. For this reason, stocker type livestock operations may be more suitable than year-round stocking.

Many types of wildlife use the HCPC of this site. Invertebrates, reptiles, birds, and mammals either use the site as their primary habitat or visit from adjacent sites. Common mammals include mule deer, black-tailed jackrabbit, cottontail rabbit, javelina, coyote, skunk, woodrats, many nocturnal mice, and occasionally mountain lions. Historically, desert bighorn sheep may have grazed this site. Game birds include scaled quail and dove. Numerous songbirds and raptors also occur in the area. Diversity in both plant species and plant communities over short distances is important for healthy wildlife populations.

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 adequate vegetative cover and dominance of deep-rooted midgrasses 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 midgrasses to isolated shortgrasses (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.

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	03/04/2011
Approved by	Mark Moseley, ESD Specialist, NRCS, Boerne, Texas
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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.

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

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 5-10% bare ground.

5. **Number of gullies and erosion associated with gullies:** None.

6. **Extent of wind scoured, blowouts and/or depositional areas:** None.

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 inche thick, light brownish gray surface horizon with a weak moderate fine and medium subangular blocky structure. Data from Musgrave soil series description.

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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 70% of total plant compostion by weight. Shrubs will comprise about 22% 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 = Mid/Tall Shrubs >

    Other: Subshrubs = Semi-succulent/Succulent = 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):** None.

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 200 to 500 lbs/acre.

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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: None.

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17. **Perennial plant reproductive capability:** All species should be capable of reproducing.
