USDA Natural Resources Conservation Service

Ecological site R042AE272TX
Clay Flat, Mixed Prairie

Accessed: 05/03/2024

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

R042AE275TX	**Gravelly, Mixed Prairie** Can be adjacent to and in a higher position than the Clay Flat.
R042AE279TX	**Loamy Swale, Mixed Prairie** Can be adjacent to and in a higher position than the Clay Flat.

Similar sites

R042AC241TX	**Clay Flat, Desert Grassland** The Clay Flat (Desert Grassland) is in a lower precipitation zone and is slightly less productive. It is correlated with Phantom (non moist phase), Verhalen, Dalby, Martillo, and Butcherknife soil series.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

The site occurs on nearly level valley floors and drainages. Slopes range from 0-2 percent. Rare to occasional and very brief flooding can occur April-October. Runoff potential is very low.

Table 2. Representative physiographic features

Landforms	(1) Alluvial flat (2) Valley floor (3) Drainageway
Flooding duration	Very brief (4 to 48 hours)
Flooding frequency	Rare to occasional
Elevation	1,067–1,524 m
Slope	0–2%
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation ranges from 15 to 17 inches and the annual total is highly variable from 8 to 30 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. Annual snowfall ranges from 1-3 inches.

Mean annual air temperature is 61° F. Frost-free period ranges from 199 to 215 days (April-October). However, the optimal growing season occurs July through September as this period coincides with greater rainfall.

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 annual Class-A pan evaporation is approximately 82 inches.

Table 3. Representative climatic features

Frost-free period (average)	215 days
Freeze-free period (average)	230 days
Precipitation total (average)	432 mm

Influencing water features

Soil features

The site consists of very deep, well drained, slowly permeable soils formed in clayey alluvium weathered from both igneous bedrock and sedimentary materials. Depth to bedrock is greater than 72 inches. The fine to moderately fine textured soils allows for increased water holding capacity. Surface cracking is common within the Barlite soil series because of its shrink-swell potential. The representative soils and associated map units are:

Brewster Main Part and Presidio County Soil Surveys:
Phantom clay loam, moist, 0 to 2 percent slopes
Barlite clay (proposed)

Table 4. Representative soil features

Surface texture	(1) Clay loam (2) Silty clay (3) Clay
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Slow
Soil depth	183 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	12.7–17.78 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%
Electrical conductivity (0-101.6cm)	0 mmhos/cm

Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–3%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The reference plant community for the Clay Flat (Mixed Prairie) ecological site is a tobosa grass dominated grassland interspersed with a variety of perennial forbs. Shrubs are scarce on this site, in part because their root systems are not always adapted to the shrinking and swelling of the clay soils. Tobosa grass is highly correlated with fine textured soils within the semiarid grasslands of west Texas. The size of the area contributing run-in water and the timing and amount of annual precipitation are probably the most influential factors affecting productivity and species composition. According to Canfield 1939, one inch of rainfall concentrated in a week period is needed to initiate growth of tobosa.

The Clay Flat site is located in a water receiving position with a relatively high water holding capacity. Because of these favorable conditions, the site can be rather resistant and resilient to disturbances. However, the plant community's ability to resist grazing pressure and recover from disturbances (resiliency) is maximized in sites that inherently receive extra water (larger area of contributing water) when compared to sites that receive less.

Natural disturbances most likely contributing to the development of the site include periodic fire and wildlife grazing and browsing. There is a lack of sufficient evidence to determine whether large herbivores such as bison played a significant role in shaping the plant community.

Extensive ranching activity by settlers began in the Trans-Pecos region in the late 1800s. The majority of the domestic livestock grazing during this time were cattle, sheep, and goats. Some historical accounts document ranches with stocking rates as high as one animal unit per four acres, which is far from sustainable in this environment. Continuous grazing with high stocking rates deteriorated the condition of rangelands in many parts of the Trans-Pecos region. Multiyear droughts exacerbate the effect of overgrazing.

Prolonged high grazing intensity will initially decrease the more palatable grasses such as blue grama and vine mesquite and slowly transition the reference community to a patchy tobosa plant community. Continued high intensity grazing over long periods of time will eventually transition the tobosa grassland to an annual forb and bare ground community (State 2). The site can be suitable for irrigated crops or forages.

The following diagram suggests general pathways that the vegetation on this site might follow. There are other plant communities and 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

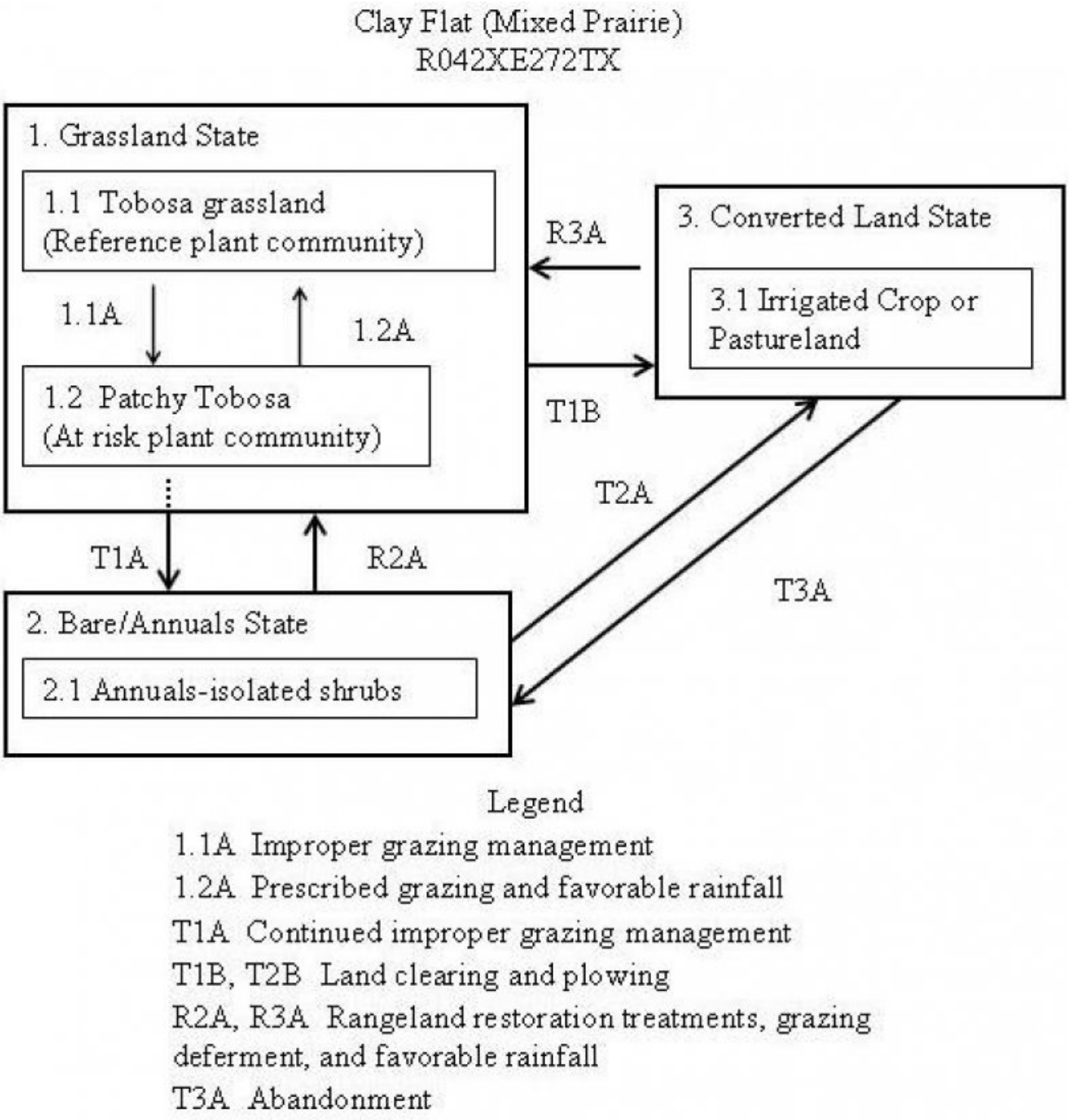

Figure 4. Clay Flat (Mixed Prairie) – State & Transition Dia

State 1
Grassland State

Community 1.1
Tobosa Grassland Community

Figure 5. 1.1 Tobosa Grassland Community

The Tobosa-grassland is the reference plant community for the site. Grasses account for approximately 96 percent of plant community by air dry weight, while forbs account for the remaining 4 percent. Shrubs are rare on this site. The site is characterized by high perennial grass cover, minimal soil movement, and small, unconnected bare patches. Tobosa is the dominant grass while other grasses such as vine mesquite, blue grama, alkali sacaton, and sand muhly occur in association. In sites less subject to run-in water or flooding and contain a higher proportion of coarser soil textures such as clay loams (Phantom series), tobosa grass still dominates but a combination of other associated grasses mentioned above make up a greater percentage of the composition when compared to vegetation occurring on tighter clay soils (Barlite series). Tobosa is a highly productive species until it accumulates large amounts of litter then productivity subsequently drops and it becomes low quality forage (Neuenschwander et al. 1975). Prescribed fire is an effective management practice that can remove litter and stimulate production when soil moisture is adequate. In addition, prescribed fire has been shown to help expedite the recovery of more palatable grasses such as blue grama and increase forage quality for tobosa grass. According to Paulsen and Ares 1962, intermediate grazing intensity increased basal area of tobosa grass when compared to an ungrazed pasture over a period of 15 years. Under continuous heavy grazing, palatable grasses decrease and stands of tobosa grass begins to deteriorate and the community eventually transitions to the Patchy Tobosa phase (1.2).

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1087	1950	2690
Forb	34	67	84
Shrub/Vine	–	–	11
Tree	–	–	–
Total	**1121**	**2017**	**2785**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0.5-1.0%
Grass/grasslike foliar cover	75-90%
Forb foliar cover	1-5%
Non-vascular plants	0%
Biological crusts	0%
Litter	50-60%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%

Water	0%
Bare ground	8-25%

Table 7. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	0%
Grass/grasslike basal cover	25-35%
Forb basal cover	0.5-1.0%
Non-vascular plants	0%
Biological crusts	0%
Litter	50-60%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	8-25%

Table 8. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	–	1-3%	1-2%
>0.15 <= 0.3	–	0-1%	75-85%	1-2%
>0.3 <= 0.6	–	–	3-5%	–
>0.6 <= 1.4	–	0-1%	–	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Figure 7. Plant community growth curve (percent production by month). TX0027, Tobosa Grassland Community - Mixed Prairie. Tobosa is the dominant grass while other grasses may occur and is characterized by high perennial grass cover, minimal soil movement, and small, unconnected bare patches..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2	2	3	4	8	12	18	18	17	10	3	3

Community 1.2
Patchy Tobosa Community

Figure 8. 1.2 Patchy Tobosa Community

The patchy tobosa plant community is a response to intensive grazing pressure. Drought will only exacerbate the situation. Perennial grass cover is low and patchy with decadent tobosa plants and large interconnected areas of bare ground. On some soils, shrubs such as mesquite and tarbush will slowly increase. Due to landscape position, Clay Flat sites vary in the amount of run-on water received. Clay Flat sites that inherently receive less run in water when compared to other Clay Flat sites are more susceptible to intense grazing and most likely transition to the patchy tobosa plant community sooner. The site can be predisposed to soil erosion and gully formation following high intensity rain events. Continued intense grazing within this plant community and soil erosion can trigger the site to transition to the Bare/Annuals State 2. A combination of favorable rainfall and conservation practices such as prescribed grazing can help facilitate the recovery of perennial grasses. On sites that do not have a high shrink swell potential, the patchy bare areas may be candidates for a practice like grazing land mechanical treatment (ripping on the contour at predetermined spacing) this may accelerate recovery by allowing runoff water to enter the soil profile. These ripped lines may be seeded with adapted species to accelerate recovery; however tobosa grass seed may not be readily available.

Pathway 1.1A
Community 1.1 to 1.2

Tobosa Grassland Community **Patchy Tobosa Community**

With Improper Grazing Management, the Tobosa Grassland Community converts to Patchy Tobosa Community.

Pathway 1.2A
Community 1.2 to 1.1

Patchy Tobosa Community **Tobosa Grassland Community**

With Prescribed Grazing and favorable rainfall, the Patchy Tobosa Community converts to Tobosa Grassland Community.

Conservation practices

Prescribed Grazing

State 2
Bare/Annuals State

Community 2.1
Annuals-Isolated Shrubs Community

This plant community 2.1 is the result of prolonged and extensive overutilization of plant resources by livestock. Annual forbs and grasses dominate with isolated shrubs and grasses. Since the reference plant community 1.1 is very resistant to change, this annual forb plant community 2.1 is very uncommon. It occurs near high use or staging areas such as near stock pens, feeding areas, or sources of drinking water. This plant community can be prone to invasions from nonnative plants in some areas such as Lehmann's lovegrass (*Eragrostis lehmanniana*). The site can also be susceptible to toxic plants such as inkweed (*Drymaria pachyphylla*) and western bitterweed (*Hymenoxys odorata*). A combination of deferred livestock grazing, rangeland restoration techniques, and favorable rainfall over several decades can facilitate grass recolonization. The presence of nearby surface water diversions or stock ponds can affect recovery efforts by reducing the amount of run in water.

State 3
Converted Land State

Community 3.1
Irrigated Crop or Pastureland Community

The Converted Land State is created by land clearing and plowing. Cultivated cropland and pastureland is a common land use practice only if irrigation is available. Abandoned crop or pastureland will eventually transition to the Bare/Annuals State 2. Under favorable conditions, abandon areas can potentially be replanted to perennial grasses. Some limitations to reseeding include seed availability, drought, loss of topsoil, and improper seedbed preparation.

Transition T1A
State 1 to 2

With Continued Improper Grazing Management, the Grassland State converts to Bare/Annuals State.

Transition T1B
State 1 to 3

With land clearing and plowing, the Grassland State converts to Converted Land State.

Restoration pathway R2A
State 2 to 1

Rangeland Restoration Treatments, Grazing Deferment, and Favorable rainfall can restore state back to Grassland State.

Conservation practices

Prescribed Grazing
Grazing Land Mechanical Treatment

Transition T2A
State 2 to 3

With Land Clearing and Plowing, the Bare/Annuals State converts to Converted Land State.

Restoration pathway R3A
State 3 to 1

With Rangeland Restoration Treatments, Grazing Deferment, and favorable rainfall, the Converted Land State can be restored to Grassland State.

Conservation practices

Prescribed Grazing
Grazing Land Mechanical Treatment

Transition T3A
State 3 to 2

With Abandonment, the Converted Land State will convert back to Bare/Annuals State.

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Midgrass**			841–2102	
	tobosagrass	PLMU3	*Pleuraphis mutica*	841–2102	–
2	**Midgrasses**			112–280	
	blue grama	BOGR2	*Bouteloua gracilis*	112–224	–
	vine mesquite	PAOB	*Panicum obtusum*	112–224	–
3	**Midgrasses**			56–140	
	cane bluestem	BOBA3	*Bothriochloa barbinodis*	28–112	–
	alkali sacaton	SPAI	*Sporobolus airoides*	28–112	–
4	**Midgrasses**			34–84	
	sand muhly	MUAR2	*Muhlenbergia arenicola*	11–28	–
	streambed bristlegrass	SELE6	*Setaria leucopila*	11–28	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	6–17	–
	Arizona cottontop	DICA8	*Digitaria californica*	6–17	–
5	**Shortgrasses**			22–56	
	Hall's panicgrass	PAHA	*Panicum hallii*	11–28	–
	burrograss	SCBR2	*Scleropogon brevifolius*	6–17	–
	threeawn	ARIST	*Aristida*	6–17	–
6	**Shortgrasses**			11–28	
	buffalograss	BODA2	*Bouteloua dactyloides*	6–17	–
	creeping muhly	MURE	*Muhlenbergia repens*	6–17	–
Shrub/Vine					
7	**Shrubs**			0–11	
	pricklypear	OPUNT	*Opuntia*	0–4	–
	western honey mesquite	PRGLT	*Prosopis glandulosa var. torreyana*	0–2	–
	lotebush	ZIOB	*Ziziphus obtusifolia*	0–2	–
	javelina bush	COER5	*Condalia ericoides*	0–2	–
	tree cholla	CYIMI	*Cylindropuntia imbricata var. imbricata*	0–2	–
	desert-thorn	LYCIU	*Lycium*	0–2	–
Forb					
8	**Forbs**			34–84	
	Forb, perennial	2FP	*Forb, perennial*	17–28	–
	Forb, annual	2FA	*Forb, annual*	0–17	–
	rushpea	HOFFM	*Hoffmannseggia*	6–13	–
	bladderpod	LESQU	*Lesquerella*	6–13	–
	croton	CROTO	*Croton*	3–7	–
	spreading fleabane	ERDI4	*Erigeron divergens*	3–7	–

Animal community

The reference plant community is suited for grazing livestock such as cattle, horses, burros, and sheep. However, the site provides marginal amounts of browse for livestock, especially domestic goats. Livestock should be stocked

in proportion to the grazeable grass, forbs, and browse. Tobosa grass is somewhat coarse and not as palatable as the associated native grasses, generally this grass needs to be grazed when it is green and actively growing to achieve optimum livestock performance, and thus effectively managing this site can present problems. If all native species are to be managed on this site a prescribed grazing system may need to be implemented for grazing during the growing season. Prescribed fire can be used to improve forage quality on this site, especially if the area has been undergrazed and the tobosa grass has become highly lignified and mostly unpalatable.

Improper grazing management causes a gradual decline in range health, reducing livestock nutrition and habitat quality for wildlife. Western bitterweed (*Hymenoxys odorata*), a native annual, can occur in disturbed areas within the Clay Flat site and can be toxic to sheep when consuming 1.3 percent of an animal's weight. Inkweed (*Drymaria pachyphylla*) is also known to occur in disturbed areas within the site and can be poisonous to cattle, sheep, and goats. Inkweed and western bitterweed poisoning usually occurs when other forage is limiting.

Wildlife that use this site for at least a portion of their overall habitat needs include mule deer, pronghorn antelope, javelinas, bobcats, coyotes, black-tailed jackrabbits, cottontails, raccoons, ringtails, gray foxes, mice, and ground squirrels. Because of the few and isolated shrubs, the site provides limited amounts of cover for medium to large mammals such as mule deer, cottontails, and jackrabbits. Birds that use this site for at least a portion of their lifecycle include scaled quail, doves, raptors, and numerous song birds. The site provides very good nesting sites for quail. Insects, amphibians, and reptiles also frequent the area.

Plant Preference by Animal Kind:
These preferences are general because plant preference 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 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 unavailable.
Toxic – Rare occurrence in diet and, if consumed in any tangible amounts, results in death or severe illness in animal.

Hydrological functions

The site is located low in the landscape and thereby receives run in water, during the rainy season, from the surrounding watershed. Runoff potential is very low because of the nearly level slopes. Watershed size largely controls the amount of surface run in water a site may receive. Even within watersheds, the amount of contributing surface water may vary among Clay Flat sites.

The reference plant community 1.1, with its high canopy cover of perennial grasses, provides the optimum hydrologic function for the site by minimizing surface runoff and maximizing water infiltration. Soil cracks can be found in some soils (Barlite series) that allow extra water to get below the surface very quickly especially after large rain events. Because of the shrink-swell nature of the clayey soils, the topography of the soil surface may have natural depressions, mounds, or sinkholes, referred to as patterned ground or gilgai relief. Gilgai relief is often associated with Vertisols. Gilgai relief affects water movement and spatial distribution of plants within the site. In addition, gilgai relief can pose hazards for horses galloping or running across the site.

A reduction in grass and ground cover, as in plant community 2.1, will impair the hydrologic function of the site by increasing surface runoff and decreasing water infiltration. Exposed soil surfaces can be subject to raindrop-impact-induced erosion as soil particles are detached from the surfaced from raindrop energy. This can lead to soil surface crusting which can impede water infiltration and the natural recovery of some plants. The establishment of water diversions, stock ponds, or roads in the surrounding area can affect the amount of run in water the site receives and potentially increase the number of undesirable plants better adapted to drier conditions.

Recreational uses

The site can be used for hiking, camping, and hunting.

Wood products

N/A

Other products

N/A

Other information

N/A

Inventory data references

Information presented here has been developed from NRCS clipping, composition, plant cover, soils data, and ecological interpretations gained by field observation.

Other references

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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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Contact for lead author	Zone RMS, San Angelo, Texas, 325-944-0147
Date	04/16/2012
Approved by	
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:** Uncommon for this site under reference conditions.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Under reference conditions, bare ground usually ranges from 2-5%.

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):** On most of the site, minimal and short distance (<5ft) of litter movement associated with high intense rainfall.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of**

values): Soil stability values ranging from 5 to 6.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Typically, surface horizon about 10 inches thick, very dark grayish brown with a weak, very fine granular structure. Soil organic matter about 2 percent.

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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 midgrass bunch and stoliniferous grasses will help minimize runoff and maximize infiltration. Grasses should comprise at least 90% of total plant compostion 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 (tobosa)

    Sub-dominant: Stoloniferous = bunchgrasses

    Other: Forbs > annuals >> shrubs

    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.

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14. **Average percent litter cover (%) and depth (in):** Majority of litter cover will occur under plants.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 1000-2500 lbs/ac

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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:** Invasive plants in this site include western honey mesquite, western bitterweed, and broomweed.

17. **Perennial plant reproductive capability:** All species should be capable of reproducing except during severe droughts.