Ecological site R042AC241TX
Clay Flat,
Desert Grassland

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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.

MLRA notes

Major Land Resource Area (MLRA): 042A–Trans-Pecos Mountains, Plateaus, and Basins

Ecological site concept

Tobosa dominated reference plant community occuring on basin floors, alluvial flats, and drainage ways within the Desert Grassland vegetation zone of MLRA 42. Soils are very deep and were formed in clayey alluvium weathered from igneous bedrock and/or sedimentary material.

Associated sites

R042AC244TX	**Gravelly, Desert Grassland** Can be adjacent to and in a higher position than the Clay Flat.
R042AC250TX	**Loamy, Desert Grassland** Can be adjacent to and in a higher position than the Clay Flat.

Similar sites

R042AE272TX	**Clay Flat, Mixed Prairie** The Clay Flat, Mixed Prairie is in a higher precipitation zone and varies in kinds and amounts of vegetation. It is correlated with the Phantom (moist) and Barlite soil components in Brewster and Presidio Counties.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Pleuraphis mutica* (2) *Panicum obtusum*

Physiographic features

The site occurs on nearly level basin floors, alluvial flats, and drainage ways. Slopes range from 0-2 percent. Rare to occasional and very brief flooding can occur April-October. Runoff potential is very low.

Figure 1. Typical landform setting for Clay Fat ecological s

Table 2. Representative physiographic features

Landforms	(1) Basin floor (2) Alluvial flat (3) Drainageway
Flooding duration	Very brief (4 to 48 hours)
Flooding frequency	Rare to occasional
Ponding frequency	None
Elevation	1,070 – 1,400 m
Slope	0 %
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation is 12 to 14 inches. Approximately 75 percent 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 fall in the form of sleet or snow.

The optimum growing season ranges from July through September, but is governed by the timing and amount of rainfall. Although frost-free days begin in April, sufficient moisture for growing plants to reach maturity is usually not available until late summer or early fall. Mean annual air temperature is 64° F. Daytime temperatures near 100º F are common from May through August. 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-pan evaporation is approximately 85 inches.

Table 3 Representative climatic features

Frost-free period (average)	240 days
Freeze-free period (average)	220 days
Precipitation total (average)	330 mm

Influencing water features

Soil features

The site consists of very deep, moderately well drained, slowly permeable soils formed in clayey alluvium weathered from igneous bedrock and/or sedimentary materials. Depth to bedrock is greater than 72 inches. The fine textured soils allows for increased water holding capacity. However, increased clay also makes small precipitation events ineffective as water does not penetrate deeply, but is retained near the surface where it is subject to evaporation. The site includes two Vertisols (Verhalen and Dalby soils) and one Mollisol (Phantom) with vertic properties. These clay rich soils shrink and swell with changes in soil moisture resulting in gilgai micro-relief in some areas. These are often seen as cracks or holes on the surface which extend to depths of 20 inches or greater. These cracks allow water to infiltrate deep into the soil profile. These soils have been mapped in Culberson, Hudspeth, Presidio, Jeff Davis, Brewster, Pecos, and Reeves Counties.

Figure 6. Natural cracks in the soil result from the high sh

Table 4. Representative soil features

Parent material	(1) Alluvium – rhyolite
Surface texture	(1) Clay (2) Silty clay (3) Clay loam
Family particle size	(1) Clayey
Drainage class	Well drained to moderately well drained
Permeability class	Very slow
Soil depth	180 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	12.7 – 22.86 cm
Calcium carbonate equivalent (0-101.6cm)	0 – 40 %

Electrical conductivity (0-101.6cm)	0 – 10 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0 – 10
Soil reaction (1:1 water) (0-101.6cm)	7.9 – 8.4
Subsurface fragment volume <=3" (Depth not specified)	0 – 10 %
Subsurface fragment volume >3" (Depth not specified)	Not specified

Ecological dynamics

The reference plant community for the Clay Flat, Desert Grassland, ecological site is a tobosa dominated grassland with a variety of perennial forbs and infrequent, isolated shrubs. Minor grasses include blue grama, vine mesquite, ear muhly, and burrograss. Common woody plants include western honey mesquite, lotebush, and pricklypear.

Inherent features of the site such as the size of the area contributing run-in water, varying landforms (basin floor vs. drainageway), fire frequency, and the timing and amount of annual precipitation are 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 velocity and amount of surface run-off following rain events is slower and less, respectively, on sites occurring on broad basin floors versus narrow drainageways. Narrow drainageways will be more susceptible to soil erosion especially in areas within a large watershed.

Natural disturbances contributing to the development and maintenance of the site in reference condition include lightening induced fire and wildlife grazing and browsing. The mean fire interval is about 10 years long in desert grassland communities of the southwest, with high variation due to drought, which reduces fire frequency and moist periods that increase fire frequency (LANDFIRE Rapid Assessment 2007). Bison bones were discovered on one Clay Flat site in the Trans-Pecos which indicates that bison did utilize the site to some degree historically. According to Brown et al. (2010) only light numbers of bison periodically grazed the Trans-Pecos region historically.

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 overutilization.

Within this site, prolonged high grazing intensity by cattle will decrease the more palatable grasses such as blue grama and vine mesquite and slowly allow tobosa to increase. Continued very high intensity grazing over long periods of time will eventually transition the tobosa grassland to an annual forb and bare ground community, or if mesquite is introduced, a mesquite shrubland. Continued overutilization will eventually accelerate the site into an eroded state. Hydrologic alterations such as dams, diversions, canals, levees, and roads will impact the vegetation dynamics.

Prescribed fire is commonly used in tobosa grasslands with one or more of the following objectives: 1) removing accumulated litter; 2) increasing tobosa and other grass production; 3) increasing accessibility and palatability of tobosa and other grasses for livestock and wildlife; 4) reducing shrub, succulent, and tree (especially mesquite) cover; and 5) reducing cool-season herbaceous annuals such as annual broomweed (Xanthocephalum dracunculoides) (Wright 1973, Wright 1974, Innes 2012). Post-fire productivity of tobosa and other grasses is highly dependent on amount of rainfall received during the year of the burn. Fire will help drive community change within states. Additionally, the Clay Flat site can be converted into irrigated cropland or pastureland.

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

Figure 7. State and Transition Model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Grass/Grasslike					
1	**Dominant rhizomatous**			572-1905	
	tobosagrass	PLMU3	*Pleuraphis mutica*	572-1905	–
2	**Bunchgrasses**			40-179	
	blue grama	BOGR2	*Bouteloua gracilis*	17-84	–
	alkali sacaton	SPAI	*Sporobolus airoides*	17-84	–
	sand muhly	MUAR2	*Muhlenbergia arenicola*	2-6	–
	Hall's panicgrass	PAHA	*Panicum hallii*	2-6	–
3	**Stoloniferous**			11-39	
	vine mesquite	PAOB	*Panicum obtusum*	6-22	–
	burrograss	SCBR2	*Scleropogon brevifolius*	6-17	–
4	**Minor rhizomatous**			2-6	
	ear muhly	MUAR	*Muhlenbergia arenacea*	2-6	–
5	**Annuals**			0-6	
	feather fingergrass	CHVI4	*Chloris virgata*	0-6	–
	Madagascar dropseed	SPPY2	*Sporobolus pyramidatus*	0-6	–
	Arizona signalgrass	URAR	*Urochloa arizonica*	0-6	–
Shrub/Vine					
6	**Shrubs**			1-6	
	escobilla butterflybush	BUSC	*Buddleja scordioides*	0-3	–
	western honey mesquite	PRGLT	*Prosopis glandulosa var. torreyana*	1-3	–
	lotebush	ZIOB	*Ziziphus obtusifolia*	0-3	–
	longleaf jointfir	EPTR	*Ephedra trifurca*	0-2	–
7	**Succulent**			6-17	
	tree cholla	CYIM2	*Cylindropuntia imbricata*	2-11	–
	pricklypear	OPUNT	*Opuntia*	3-11	–
Forb					
8	**Perennial**			27-84	
	Forb, perennial	2FP	*Forb, perennial*	11-50	–
	croton	CROTO	*Croton*	6-17	–
	silverleaf nightshade	SOEL	*Solanum elaeagnifolium*	6-17	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	6-11	–
	Indian rushpea	HOGL2	*Hoffmannseggia glauca*	2-7	–
	Davis Mountain mock vervain	GLBIC	*Glandularia bipinnatifida var. ciliata*	0-7	–
	whitemargin sandmat	CHAL11	*Chamaesyce albomarginata*	2-7	–
9	**Annual**			0-6	

	prairie broomweed	AMDR	*Amphiachyris dracunculoides*	0-6	–
	bladderpod	LESQU	*Lesquerella*	0-1	–

Table 6. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 7. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Grass/Grasslike					
1	**Dominant rhizomatous**			112-897	
	tobosagrass	PLMU3	*Pleuraphis mutica*	112-897	–
2	**Stoloniferous**			6-17	
	burrograss	SCBR2	*Scleropogon brevifolius*	6-17	–
3	**Bunchgrass**			11-45	
	alkali sacaton	SPAI	*Sporobolus airoides*	11-45	–
4	**Annual**			0-6	
	feather fingergrass	CHVI4	*Chloris virgata*	0-6	–
	Arizona signalgrass	URAR	*Urochloa arizonica*	0-6	–
Shrub/Vine					
5	**Succulent**			7-28	
	tree cholla	CYIM2	*Cylindropuntia imbricata*	3-28	–
	pricklypear	OPUNT	*Opuntia*	3-28	–
6	**Shrub**			224-1009	
	western honey mesquite	PRGLT	*Prosopis glandulosa var. torreyana*	168-897	–
	catclaw acacia	ACGR	*Acacia greggii*	28-112	–
	lotebush	ZIOB	*Ziziphus obtusifolia*	28-84	–
	longleaf jointfir	EPTR	*Ephedra trifurca*	11-56	–
Forb					
7	**Perennial**			28-84	
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	11-50	–
	Forb, perennial	2FP	*Forb, perennial*	6-22	–
	croton	CROTO	*Croton*	11-22	–
	silverleaf nightshade	SOEL	*Solanum elaeagnifolium*	6-17	–
	whitemargin sandmat	CHAL11	*Chamaesyce albomarginata*	2-7	–
8	**Annuals**			0-22	
	Forb, annual	2FA	*Forb, annual*	0-17	–
	bladderpod	LESQU	*Lesquerella*	0-6	–
9	**Invaders**			0-28	
	prickly Russian thistle	SATR12	*Salsola tragus*	0-28	–
	bitter rubberweed	HYOD	*Hymenoxys odorata*	0-11	–
	thickleaf drymary	DRPA3	*Drymaria pachyphylla*	0-1	–

Table 8. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 9. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 10. Community 4.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Grass/Grasslike					
1	**Dominant rhizomatous**			0-112	
	tobosagrass	PLMU3	*Pleuraphis mutica*	0-112	–
2	**Stoloniferous**			6-17	
	burrograss	SCBR2	*Scleropogon brevifolius*	6-17	–
3	**Annuals**			0-6	
	feather fingergrass	CHVI4	*Chloris virgata*	0-6	–
	Arizona signalgrass	URAR	*Urochloa arizonica*	0-6	–
Shrub/Vine					
4	**Succulent**			6-17	
	tree cholla	CYIM2	*Cylindropuntia imbricata*	2-11	–
	pricklypear	OPUNT	*Opuntia*	3-11	–
Forb					
5	**Perennial**			28-67	
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	11-45	–
	Forb, perennial	2FP	*Forb, perennial*	11-28	–
6	**Annual**			0-73	
	prickly Russian thistle	SATR12	*Salsola tragus*	0-50	–
	prairie broomweed	AMDR	*Amphiachyris dracunculoides*	0-28	–
	Forb, annual	2FA	*Forb, annual*	0-11	–
7	**Invaders**			0-22	
	thickleaf drymary	DRPA3	*Drymaria pachyphylla*	0-11	–
	bitter rubberweed	HYOD	*Hymenoxys odorata*	0-11	–

Table 11. Community 5.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 12. Community 6.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Animal community

Livestock Interpretations: 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 amount of grass, forbs, and browse. Mature tobosa grass is coarse and not 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. If all native species are to be managed on this site a rotational 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 tobosa grass has become highly lignified and large amounts of litter have accumulated. 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 (Hart et al. 2003). 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 Interpretations: Wildlife that use this site for at least a portion of their overall habitat needs include, pronghorn antelope, mule deer, javelinas, bobcats, coyotes, black-tailed jackrabbits, cottontails, raccoons, ringtails, gray foxes, mice, cotton rats, and ground squirrels. According to Tucker and Garner (1983), tobosa was the 2nd most frequent plant providing cover around pronghorn fawn bed sites in the Trans-Pecos. Cholla fruit is an important staple in a pronghorn's winter diet as well as the numerous forbs that occur on this site. The Clay Flat site provides limited browse for mule deer. Many grassland birds, particularly ground-nesting birds, use tobosa communities as cover. Birds that use this site for at least a portion of their lifecycle include scaled quail, mourning doves, western meadowlarks, lesser nighthawks, raptors, and numerous song birds. The encroachment of shrubs into tobosa grasslands may act as a corridor for a diversity of bird species historically not associated with desert grasslands to occupy or move through an area, increasing vulnerability to nest predation (Mason et al 2005). Grassland nesting birds' food items include insects and invertebrates such as grasshoppers, crickets, beetles, caterpillars, ants, spiders and seeds from grasses and forbs (USDA 1999). Annual broomweed is an important seed source for scaled quail. Harvester ants can be found in tobosa communities and are known to consume and disperse tobosa seeds (Whitford 1978).

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. This can result in variability among species composition and abundance across the range of sites. Additionally, sites occurring in narrow drainageways compared to sites occurring in wide basin floors will have higher concentrated surface flow which can make these areas more susceptible to erosion. Plant communities with high canopy cover of perennial grasses, provide the optimum hydrologic function for the site by minimizing surface runoff and maximizing water infiltration as well as moderating soil temperatures. Soil cracks can be found in areas that allow extra water to penetrate 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, cracks, and sinkholes, a kind of patterned ground referred to as gilgai micro-relief. Gilgai affects water movement and spatial distribution of plants within the site. In addition, Gilgai is usually associated with Vertisols (Verhalen and Dalby soils) and can pose hazards for horses galloping or running across the site. A reduction in grass and ground cover will impair the hydrologic function of the site by increasing surface runoff and decreasing infiltration. Exposed soil surfaces can be subject to raindrop-impact-induced erosion as soil particles are detached from the surfaced from raindrop energy (Kinnell 2005). This can lead to soil surface crusting which can impede infiltration and the natural recovery of some plants. The establishment of water diversions, stock ponds, canals, levees, 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 that develop down-slope from the structures.

Recreational uses

The holes and cracks caused by the shrink-swell soil properties make the site very uneven and difficult to traverse, thereby limiting the recreational uses such as hiking, camping, or horseback riding.

Wood products

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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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	02/06/2012
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.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil 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):** 600-2000 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.**

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