Ecological site R042AC249TX
Limestone Hill and Mountain, Desert Grassland

Last updated: 8/10/2020
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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.

Associated sites

R042AB737TX	**Limestone Hill and Mountain, Hot Desert Shrub** Limestone Hill & Mtn – Hot Desert Shrub will be encountered at lower elevations than Desert Grassland site.

Similar sites

R042AC247TX	**Igneous Hill and Mountain, Desert Grassland** Igneous Hill & Mountain Desert Grassland site is similar to the Limestone Hill and Mountain Desert Grassland, but is formed from igneous (volcanic) parent materials instead of limestone parent material.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

The Limestone Hill & Mountain (Desert Grassland) was formed in colluvium and residuum weathered from limestone. These soils are on undulating to very steep hills. Slopes range from 3 to 60 percent, mainly 5 to 60 percent slopes. The elevation ranges from 3,600 to 4600 feet.

Table 2. Representative physiographic features

Landforms	(1) Escarpment (2) Hill (3) Ridge
Flooding frequency	None

Ponding frequency	None
Elevation	1,100 – 1,400 m
Slope	0 – 60 %
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation ranges from 12 to 14 inches and highly variable from 3 to 32 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 falls in the form of sleet or snow.

The optimum growing season ranges from July 1 through September, but is governed by time 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-A pan evaporation is approximately 85 inches.

Table 3 Representative climatic features

Frost-free period (average)	230 days
Freeze-free period (average)	260 days
Precipitation total (average)	360 mm

Influencing water features

None.

Soil features

The Bissett series consists of very shallow and shallow, well drained soils with moderately slow permeability. They formed in colluvium and residuum weathered from limestone Runoff is high on 3 to 5 percent slopes, and very high on slopes greater than 5 percent. The associated soil series is Bissett.

Table 4. Representative soil features

Parent material	(1) Residuum – limestone
Surface texture	(1) Very gravelly loam
Family particle size	(1) Loamy

Drainage class	Well drained
Permeability class	Very slow
Soil depth	10 – 50 cm
Surface fragment cover <=3"	10 – 40 %
Surface fragment cover >3"	10 – 30 %
Available water capacity (0-101.6cm)	0 – 5.08 cm
Calcium carbonate equivalent (0-101.6cm)	40 – 80 %
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	Not specified
Soil reaction (1:1 water) (0-101.6cm)	7.9 – 8.4
Subsurface fragment volume <=3" (Depth not specified)	30 – 40 %
Subsurface fragment volume >3" (Depth not specified)	0 – 20 %

Ecological dynamics

The historic climax plant community (HCPC) on the Limestone Hill & Mountain (Desert Grassland) site consists of bunch and stoloniferous grasses along with a variety of perennial forbs and woody shrubs.

Probably the factor that most influenced the historic vegetative composition of the site was extended dry weather. High rainfall events did occur but were episodic. However, insects and grazers such as rodents, deer, and infrequent fire certainly played a part. Bison were not documented in the historical record as being present in any significant amount. A lack of water was probably a contributing factor. 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.

Early historical records do not always provide information specific to a site but can provide insight as to conditions existing in a general vicinity. Accounts suggest cattle, sheep, and horses were introduced into the southwest from Mexico in the mid-1500's. However, extensive ranching did not begin in the Trans-Pecos region until the 1880s. Early explorers described the vegetation as they traveled over parts of the Trans-Pecos. For instance, Captain John Pope in 1854 described a portion of the Trans-Pecos area as "…destitute of wood and water, except at particular points, but covered with a luxuriant growth of the richest and most nutritious grasses known to this continent…". Other early travelers describe the scattered springs and water sources that were found in the region. Wagon travel could only be accomplished, along trails that had both water and forage sufficient for overnight stops. Livestock numbers peaked in the late 1880's following the arrival of railroads. Some historical accounts document ranches with stocking rates as high as one animal unit per four acres; however, this was far from sustainable in this environment.

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 livestock ceased. For example, in 1944, most of the Igneous Hill and Mountain Desert Grassland sites accessible to livestock were probably degraded and dominated by woody shrubs. After 60 years of no grazing, the majority of 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 large livestock herds brought in during the favorable years, mainly sheep, could not be sustained during the drought. Overgrazing became a major issue as the extended dry weather was a harsh taskmaster to the early stock growers.

Cattle use on rangeland declines significantly on slopes steeper than 15 percent, however cattle numbers were never very large. Sheep and goats are however able to utilize slopes up to about 45 percent and can negotiate the surface rock cover better than cattle. 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.

Continued drought and overgrazing bring an increase in lechuguilla (Agave lechuguilla), ocotillo (Fouquieria splendens), and other woody and weedy species that initially occupied the site in small amounts. More than likely, fires were infrequent and when they did occur, the burn pattern was a mosaic governed by terrain and vegetative features. This site would have had higher anticipated fire frequency than the Limestone Hill & Mountain (Desert Shrub) due to the greater amount of grass for fine fuel. But, fires were still infrequent. The woody increasers begin to compete with the mid and short grasses for sunlight, nutrients, water, and space. In this stage, herbaceous production begins to give way to shade tolerant species and shrubby vegetation. Bare ground and soil erosion continue to increase as the site transitions into a shrub dominated community with over 40% woody vegetation.

State and transition model

Figure 3. State & Transition Model - Limestone Hill & Mtn (D

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Grass/Grasslike					
1	**Midgrasses**			191-247	
	cane bluestem	BOBA3	*Bothriochloa barbinodis*	56-179	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	56-179	–
	tanglehead	HECO10	*Heteropogon contortus*	56-179	–
2	**Midgrasses**			95-123	
	Arizona cottontop	DICA8	*Digitaria californica*	34-112	–
	plains lovegrass	ERIN	*Eragrostis intermedia*	34-112	–
	green sprangletop	LEDU	*Leptochloa dubia*	34-112	–
	streambed bristlegrass	SELE6	*Setaria leucopila*	34-112	–
3	**Shortgrasses**			78-101	
	black grama	BOER4	*Bouteloua eriopoda*	45-101	–
	blue grama	BOGR2	*Bouteloua gracilis*	34-67	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	34-67	–

	Chino grama	BORA4	*Bouteloua ramosa*	34-67	–
4	**Shortgrasses**			78-101	
	threeawn	ARIST	*Aristida*	34-67	–
	fall witchgrass	DICO6	*Digitaria cognata*	22-56	–
	bush muhly	MUPO2	*Muhlenbergia porteri*	22-56	–
5	**Shortgrasses**			34-45	
	hairy woollygrass	ERPI5	*Erioneuron pilosum*	11-22	–
	slim tridens	TRMU	*Tridens muticus*	11-22	–
6	**Tallgrass**			6-11	
	little bluestem	SCSCS	*Schizachyrium scoparium var. scoparium*	6-11	–
7	**Shortgrasses**			6-11	
	red grama	BOTR2	*Bouteloua trifida*	6-11	–
	low woollygrass	DAPU7	*Dasyochloa pulchella*	6-11	–
Forb					
8	**Forbs**			34-45	
	sundrops	CALYL	*Calylophus*	11-22	–
	purple dalea	DALA4	*Dalea lasiathera*	11-22	–
	blackfoot	MELAM	*Melampodium*	11-22	–
	menodora	MENOD	*Menodora*	11-22	–
	awnless bushsunflower	SICA7	*Simsia calva*	11-22	–
9	**Forbs**			34-45	
	croton	CROTO	*Croton*	11-22	–
	buckwheat	ERIOG	*Eriogonum*	11-22	–
	Gregg's tube tongue	JUPI5	*Justicia pilosella*	11-22	–
	bladderpod	LESQU	*Lesquerella*	11-22	–
	polygala	POLYG	*Polygala*	11-22	–
	greenthread	THELE	*Thelesperma*	11-22	–
Shrub/Vine					
10	**Shrubs/Vines**			22-34	
	desert myrtlecroton	BEOB	*Bernardia obovata*	11-22	–
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	11-22	–
	featherplume	DAFO	*Dalea formosa*	11-22	–
	black prairie clover	DAFR2	*Dalea frutescens*	11-22	–
	Texas kidneywood	EYTE	*Eysenhardtia texana*	11-22	–
	littleleaf ratany	KRER	*Krameria erecta*	11-22	–
	resinbush	VIST	*Viguiera stenoloba*	11-22	–
11	**Shrubs/Vines**			22-34	
	whitethorn acacia	ACCO2	*Acacia constricta*	11-22	–
	catclaw acacia	ACGR	*Acacia greggii*	11-22	–
	lechuguilla	AGLE	*Agave lechuguilla*	11-22	–
	javelina bush	COER5	*Condalia ericoides*	11-22	–
	Christmas cactus	CYLE8	*Cylindropuntia leptocaulis*	11-22	–
	jointfir	EPHED	*Ephedra*	11-22	–
	ocotillo	FOSP2	*Fouquieria splendens*	11-22	–
	pricklypear	OPUNT	*Opuntia*	11-22	–
	mariola	PAIN2	*Parthenium incanum*	11-22	–

Table 6. Community 2.1 plant community composition

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

Table 7. Community 3.1 plant community composition

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

Animal community

The historic Midgrass Grassland with Shrubs Community (1.1) was habitat for mule deer, songbirds, birds of prey, small mammals, and predators such as coyote, bobcat, and mountain lion. As the site changes through the Shortgrass Dominant Community (2.1) toward the Shrub Dominant Community (3.1), it becomes less suitable to some species due to the loss of habitat components and changes in structure. Cattle, sheep, and goats can use this site, but the rocky ground and slopes make it difficult for livestock, especially cattle, to reach some forage areas. Cattle find the best forage in the Midgrass Community (1.1). Once this site reaches the Shrub Dominant Community (3.1), grazing opportunities for cattle are limited. An assessment of vegetation is needed to determine the site's current carrying capacity in order to avoid overgrazing. Carrying capacity in the Trans-Pecos will vary greatly from year to year depending on the episodic precipitation. Many species of wildlife utilize this site for at least a portion of their habitat needs. It is also important to balance wildlife populations with carrying capacity. Mule deer find good overall habitat on the Limestone Hill and Mountain Desert Grassland ecological site. They need high protein forbs and browse. They cannot utilize the lower protein grasses. Bighorn sheep are present on Limestone Hill and Mountain Desert Grassland site, at least for a portion of their habitat. They generally eat a wide variety of browse and forbs and small amounts of grass. Quail and dove prefer a combination of low shrubs, bunch grass, bare ground, and forbs. Game bird species such as mourning and white dove and scaled and bobwhite quail are usually present on the site. Smaller mammals present include rodents, jackrabbit, cottontail rabbit, raccoon, skunk, possum, and armadillo. Mammalian predators like coyote, bobcat, and mountain lion are likely to be found at the site. Wolves were common in earlier times and an occasional jaguar was encountered. Numerous species of snakes and lizards are native to the site. Non-game species of birds found on this site include songbirds and birds of prey. Habitat on this site that provides a large diversity of grasses, forbs, and shrubs will support a variety and abundance of songbirds. Birds of prey are important to keep the numbers of rodents, rabbits, and snakes in balance. Plant Preference by Animal: These preferences are somewhat general in nature as the preference for a plant is dependent upon animals grazing experience, time of year, availability of choices, and total forage supply. 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. Plants are only consumed when other forages are 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 Limestone Hill and Mountain Desert Grassland site is a well-drained, shallow, stony upland. Its soils are moderately to very slowly permeable. Because of the permeability and the surface rock, significant amounts of rainfall run off the site to sites located down slope. Rock outcrops in the limestone allowed limited deep percolation to ground water. The presence of stones and rock outcrops enhance the effectiveness of rainfall, especially small rainfall events, by concentrating it on a smaller surface area and reducing evaporation. When the site changes from Grasses to Shrub community, there is a vegetative structural group change resulting in increased runoff.

Recreational uses

The Limestone Hill and Mountain Desert Grassland site is well suited for many outdoor recreational uses including hunting, hiking, and bird watching. Its scenic beauty and topography make it a unique site, and colorful forbs can be found on or near the site throughout the spring and summer. Big Bend National Park is found in the southern portion of MLRA 42. It is well known for its scenic mountain desert grass and shrub lands, including the Limestone Hill and Mountain Desert Grassland.

Wood products

None.

Other products

None.

Other information

None.

Type locality

Location 1: Presidio County, TX	
UTM zone	N
UTM northing	3263948.28
UTM easting	615135.874
General legal description	Along a dirt road within the Solitario Rim at Big Bend Ranch State Park.

Other references

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4. Hardy, Jean Evans. 1997. Flora and Vegetation of the Solitario Dome, Brewster and Presidio Counties, Texas. A Thesis Presented to the Graduate Council Sul Ross State University.
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10. http://www.tpwd.state.tx.us/landwater/land/habitats/trans_pecos/

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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.

Author(s)/participant(s)	

Contact for lead author	
Date	07/09/2026
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

   _____

2. **Presence of water flow patterns:**

   _____

3. **Number and height of erosional pedestals or terracettes:**

   _____

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

   _____

5. **Number of gullies and erosion associated with gullies:**

   _____

6. **Extent of wind scoured, blowouts and/or depositional areas:**

   _____

7. **Amount of litter movement (describe size and distance expected to travel):**

   _____

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

   _____

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

   _____

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

    _____

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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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:

    Sub-dominant:

    Other:

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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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):**

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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:**

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17. **Perennial plant reproductive capability:**
