USDA Natural Resources Conservation Service

Ecological site R042AB738TX
Loamy, Hot Desert Shrub

Accessed: 05/20/2025

General information

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

Figure 1. Mapped extent

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

Associated sites

R042AC244TX	**Gravelly, Desert Grassland** Shallow limestone soils located upslope from the Loamy site.
R042AB264TX	**Igneous Hill and Mountain, Hot Desert Shrub** Igneous soils located upslope from the Loamy site.

Similar sites

R042BY266TX	**Loamy, Desert Shrub** Similar landscape position and soil morphology, however, the site is located in a drier, cooler climate. Soil temperature is thermic.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

The site is located on nearly level to very gently sloping soils are on broad valley floors

and alluvial flats. Slopes are mostly 1 to 2 percent but range from 0 to 3 percent. Very brief and occasional flooding occurs in some areas July through September.

Table 2. Representative physiographic features

Landforms	(1) Alluvial flat (2) Valley floor
Flooding duration	Very brief (4 to 48 hours)
Flooding frequency	Occasional
Ponding frequency	None
Elevation	549–1,189 m
Slope	0–3%
Aspect	Aspect is not a significant factor

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

None.

Soil features

The site consists of very deep, well drained, moderately permeable soils that formed in calcareous loam and silty alluvial materials from igneous and sedimentary sources. The soils receive outside runoff from areas higher on the landscape, and during high intensity rainstorms it is flooded by sheet flow several inches deep. The surface of the soils crust and seal over so that most of the rainfall runs off and water enters the soil very slowly. The soils are very erosive and have narrow, deep arroyos in many areas. Wind erosion is a moderate hazard and water erosion is a severe hazard.

Soil temperature regime is hyperthermic (mean annual soil temperature to a depth of 20 inches is greater than 72º Fahrenheit). The representative soils are Tornillo and Ninepoint.

Table 4. Representative soil features

Surface texture	(1) Loam (2) Silty clay loam (3) Fine sandy loam
Drainage class	Well drained
Permeability class	Slow to moderately slow
Soil depth	183 cm
Surface fragment cover <=3"	0–2%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	0–17.78 cm
Calcium carbonate equivalent (0-101.6cm)	2–35%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	5–10
Soil reaction (1:1 water) (0-101.6cm)	7.9–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–2%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The Historic Climax Plant Community (HCPC) on the Loamy (Hot Desert Shrub) 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, antelope, 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. Over grazing 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 cattle ceased. In 1944, most of the Loamy Hot Desert Shrub sites were probably degraded and dominated by woody shrubs. After 60 years of no grazing in the hyperthermic zone, 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 however are able to utilize slopes up to about 45 percent. 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.

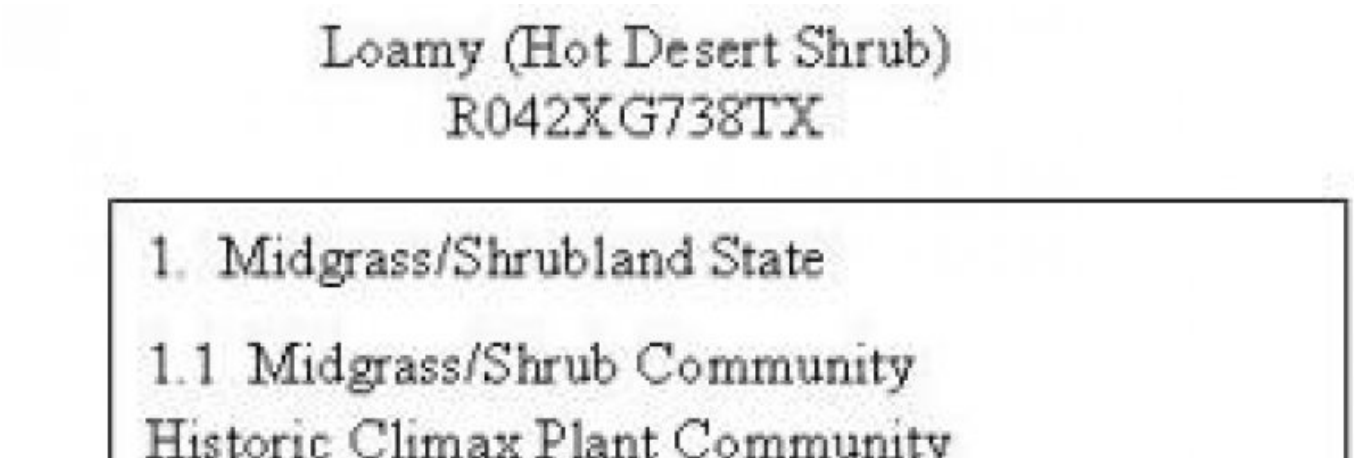
Due to a combination of soils and climate, the Loamy Hot Desert Shrub ecological site is highly susceptible to disturbances and management prescriptions, either alone or in combination. Because of accessibility to livestock, this site probably received more grazing concentration than adjacent sites that contain high slopes or surface rock. Disturbances may quickly cause one stable community to cross a compositional and functional threshold into an alternative and often nonreversible stable community.

The site has evolved with consistent water flow patterns, rills, and infrequent gullies because of its landscape position and soil properties. This has resulted in a shifting mosaic of banded vegetation within the site. Indication of vegetation change caused by overgrazing includes decreased grassland diversity, smaller bands or patches of vegetation, increased bare ground and more severe gully formation. Anthropogenic hydrologic changes such as water diversions, roads, and dams have altered the natural hydrologic function of the site in many areas. Consequently, shrubs have increased and these hydrological changed areas have practically lost their potential for recovery.

Intensive management including practices that mediate soil temperature, surface evaporation and enhance infiltration. Brush management and prescribed grazing are helpful to restore some structure and function. Additionally, favorable soil moisture conditions over a period of years is also needed.

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



Tobosa and alkali sacaton dominate in large patches. Bare ground <40%, infrequent rills and gullies, water flow patterns are short (<6 feet)

* Grasses 75%, Shrubs 15%, Forbs 10%

T1A

2. Creosotebush/Tarbush Shrubland State

2.1 Shrubs/Mid and Shortgrass Community

Creosotebush, tarbush, and mesquite increase with fragmented tobosa, burrograss and fluffgrass.

Bare ground 40-55%, rills and gullies common and moderately active, water flow patterns are moderate (6-12 feet).

* Grasses 35%, Shrubs 50%, Forbs 15%

2.2A

2.1A

2.2 Shrub/Annual Grasses Community

Creosotebush, tarbush, and mesquite with annual grasses, isolated burrograss and fluffgrass.

Bare ground >55%, rill formation severe, gullies common and active, water flow patterns extensive (>12 feet)

* Grasses 25%, Shrubs 50%, Forbs 15%

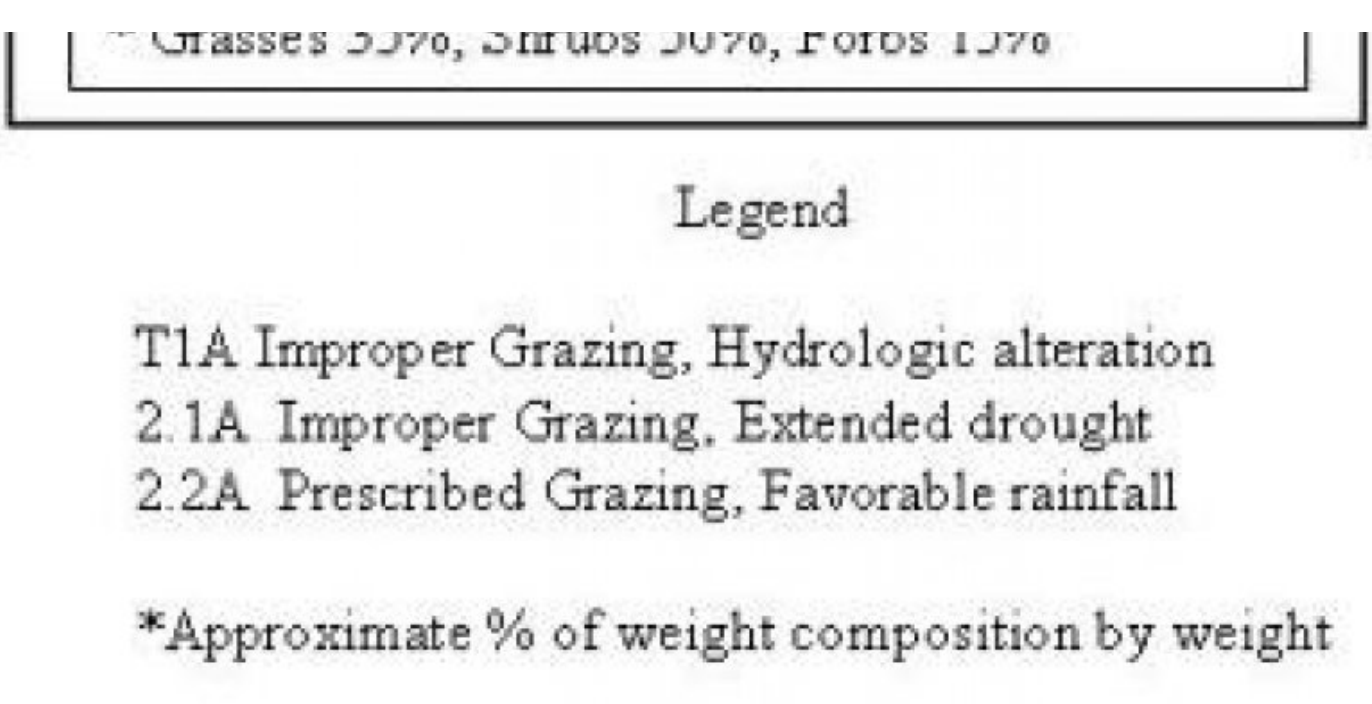


Figure 4. MLRA 42 - Loamy (Hot Desert Shrub) State & Transit

State 1
Midgrass/Shrubland State

Community 1.1
Midgrass / Shrub Community

Figure 5. 1.1 Midgrass / Shrub Community

The Midgrass Shrubland State is the reference plant community for the Loamy (Hot Desert Shrub) Ecological Site. Grasses in the HCPC total approximately 75% of the species composition by air dry weight, while shrubs and forbs account for 15% and 10% respectively. Grasses occur as a shifting mosaic of banded vegetation governed mostly by water flow patterns. Infrequent rills, a few small gullies, and bare ground are natural features of this site. Tobosa and alkali sacaton are the dominant grasses midgrasses and can form in large patches or bands. Black grama is a minor component and can be found

in areas that have coarser textures soils. Various mid and shortgrasses subdominate. Woody vegetation concentrates in depressions and drainages that receive run in water. Fourwing saltbush, tarbush, and western honey mesquite are common shrubs. Extended dry weather causes an overall decline in grass cover and production and can cause some retrogression. However, the HCPC evolved with plants that have drought tolerance. Long term retrogression is triggered primarily by abusive grazing which causes an immediate decrease and eradication of the most palatable plants alkali sacaton, plains bristlegrass, bush muhly, and black grama. Percent of bare ground will increase and size of grass patches will decrease. The site will be more susceptible to soil erosion and the formation of large gullies. Creosotebush, tarbush, and mesquite will begin to increase. Conservation practices such as prescribed grazing can help maintain ecological integrity in the HCPC. 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	168	336	504
Shrub/Vine	34	67	101
Forb	22	45	67
Tree	–	–	–
Total	**224**	**448**	**672**

Figure 7. Plant community growth curve (percent production by month). TX0018, Mixed Shrub Dominated Community (Mid & Shortgrasses/Shrubs). Drought tolerant mixed shrubs dominate with mid and shortgrasses..

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

State 2
Creosotebush/Tarbush Shrubland State

Community 2.1
Shrub/Mid & Shortgrass Community

Figure 8. 2.1 Shrub/Mid-Shortgrass Community

A combination of improper grazing (high stocking rates) and hydrologic alteration (e.g. roads, diversions, and dams) have transitioned this plant community to a shrub dominated community. A compositional and functional threshold has been crossed. Creosotebush, tarbush, and mesquite, burrograss, and fluffgrass are the major increasers and the exclusion of many grasses. Fragmented bands or patches of tobosa are commonly observed. Bare ground patches are large and interconnected. Physical crusts on bare ground decreases infiltration and increases runoff. Patches of vegetation can be productive because of the extra run in water. Rills and gullies are more common than HCPC and moderately active in eroding top soil. Climate, soil temperatures, loss of top soil, and hydrologic changes are major factors limiting the restoration of the HCPC. Continued overgrazing will transition this plant community to a Shrubland/Annual Grasses community (2.2).

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	112	168	224
Grass/Grasslike	90	135	179
Forb	22	34	45
Tree	–	–	–
Total	**224**	**337**	**448**

Figure 10. Plant community growth curve (percent production by month). TX0019, Grassland/Shrub/Tree. Majority of production is from warm season grasses and deciduous shrubs/trees during late summer to early fall..

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

Community 2.2
Shrubs/Annuals Community

Plant community 2.1 is the result of a combination of excessive overutilization of plant resources and hydrologic alteration. Creosotebush, tarbush, and mesquite dominate the plant community. Isolated burrograss and fluffgrass patches can be observed. Percent bare ground is greater than 55 percent and interconnected. Rill formation is severe, gullies are common in places, and water flow patterns are extensive. Annual grasses and forbs are common after rains. With several years of prescribed grazing and favorable rainfall, some areas of this plant community have the potential to return to a Shrub mid/shortgrass community (2.1). Other areas may be too eroded and/or hydrologically altered and may not be able to return to plant community 2.1.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	34	50	67
Grass/Grasslike	17	22	34
Forb	6	11	11
Tree	–	–	–
Total	**57**	**83**	**112**

Pathway 2.1A
Community 2.1 to 2.2

With improper grazing and extended drought conditions, the Shrubs/Mid-Shortgrass Community shifts to the Shrub/Annual Grasses Community.

Pathway 2.2A
Community 2.2 to 2.1

Prescribed Grazing and favorable rainfall can allow the community to revert back to Shrubs/Mid-Shortgrass Community.

Conservation practices

Prescribed Grazing

Transition T1A
State 1 to 2

Improper Grazing and Hydrologic alteration leads to irreversible transition to

Creosotebush/Tarbush 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	**Midgrasses**			90–269	
	alkali sacaton	SPAI	*Sporobolus airoides*	34–129	–
	spike dropseed	SPCO4	*Sporobolus contractus*	11–28	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	11–28	–
	pink pappusgrass	PABI2	*Pappophorum bicolor*	11–28	–
	whiplash pappusgrass	PAVA2	*Pappophorum vaginatum*	11–28	–
	streambed bristlegrass	SELE6	*Setaria leucopila*	11–22	–
	threeawn	ARIST	*Aristida*	6–11	–
2	**Midgrasses**			56–168	
	tobosagrass	PLMU3	*Pleuraphis mutica*	56–168	–
3	**Mid/Shortgrasses**			15–34	
	burrograss	SCBR2	*Scleropogon brevifolius*	11–22	–
	black grama	BOER4	*Bouteloua eriopoda*	3–13	–
	bush muhly	MUPO2	*Muhlenbergia porteri*	3–13	–
4	**Shortgrass**			7–20	
	low woollygrass	DAPU7	*Dasyochloa pulchella*	7–20	–
5	**Annuals**			1–13	
	Forb, annual	2FA	*Forb, annual*	1–13	–
Shrub/Vine					
6	**Shrubs**			27–81	
	fourwing saltbush	ATCA2	*Atriplex canescens*	11–34	–
	woolly butterflybush	BUMA	*Buddleja marrubiifolia*	3–11	–
	American tarwort	FLCE	*Flourensia cernua*	3–11	–
	catclaw acacia	ACGR	*Acacia greggii*	3–11	–
	western honey mesquite	PRGLT	*Prosopis glandulosa var. torreyana*	3–11	–
	lotebush	ZIOB	*Ziziphus obtusifolia*	3–11	–

	whitebrush	ALGR2	*Aloysia gratissima*	2–9	–
	crown of thorns	KOSP	*Koeberlinia spinosa*	2–9	–
	creosote bush	LATR2	*Larrea tridentata*	2–9	–
	whitethorn acacia	ACCO2	*Acacia constricta*	2–9	–
7	**Succulents**			7–20	
	Christmas cactus	CYLE8	*Cylindropuntia leptocaulis*	3–11	–
	pricklypear	OPUNT	*Opuntia*	3–9	–
Forb					
8	**Forbs**			22–45	
	Forb, perennial	2FP	*Forb, perennial*	11–22	–
	croton	CROTO	*Croton*	6–11	–
	globemallow	SPHAE	*Sphaeralcea*	1–3	–
	vervain	VERBE	*Verbena*	1–3	–
	dwarf desertpeony	ACNA2	*Acourtia nana*	1–3	–
	Drummond's clematis	CLDR	*Clematis drummondii*	1–3	–
9	**Annuals**			0–22	
	Forb, annual	2FA	*Forb, annual*	0–3	–
	Davis Mountain mock vervain	GLBIC	*Glandularia bipinnatifida var. ciliata*	0–3	–
	bladderpod	LESQU	*Lesquerella*	0–3	–
	lineleaf whitepuff	OLLI	*Oligomeris linifolia*	0–3	–
	lemonscent	PEAN	*Pectis angustifolia*	0–3	–

Animal community

The Historic Climax Plant Community and the Shrub/Mid and Shortgrass community (2.1) are suited for a prescribed grazing system for the production of livestock, including cattle, sheep, and goats. Over stocking causes a decline in range health with reduced livestock nutrition and reduced habitat quality for wildlife. Continuous grazing can cause grazing distribution problems. Livestock should be stocked at carrying capacity in proportion to the grazeable grass, forbs, and browse. Vegetative growth is episodic mirroring the rainfall. 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, and many nocturnal mice. 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:
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 Loamy (Hot Desert Shrub) site is a well-drained, deep upland. This site receives run-on water from sites located higher in the landscape. Its soils are nearly level or gently rolling and infiltrate water moderately fast. Under historic climax condition the vegetation intercepted and utilized much of the incoming rainfall. Having a moderate ground cover kept runoff clear and slow as well as protecting the site. When the site changes from grassland to shrub community there is a structural change resulting in faster runoff that carries soil particles away. Less of the rainfall is intercepted to infiltrate into the soil. Without protective grasses, concentrated flow can cut gullies.

Recreational uses

The Loamy (Hot Desert Shrub) site is well suited for many outdoor recreational uses including hunting, hiking, and bird watching. Its scenic beauty makes it a unique site and colorful forbs can be found on or near the site throughout the spring and summer.

Wood products

None.

Other products

None.

Other information

None.

Inventory data references

The information in this ESD is based on prior range site descriptions coupled with local field observations by range trained employees.

Type locality

Location 1: Brewster County, TX	
UTM zone	N
UTM northing	3256865
UTM easting	680482
General legal description	Big Bend National Park - Tornillo Flats, along U.S. Highway 385

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.

Author(s)/participant(s)	
Contact for lead author	
Date	
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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

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

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

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

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

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

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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):**

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

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

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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):

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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:**
