Ecological site R081AY296TX
Gravelly 14-19 PZ

Last updated: 9/19/2023
Accessed: 05/06/2024

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.

MLRA notes

Major Land Resource Area (MLRA): 081A–Edwards Plateau, Western Part

This area is entirely in Texas. It makes up about 16,550 square miles (42,885 square kilometers). The cities of San Angelo and Fort Stockton and the towns of Big Lake, McCamey, Ozona, and Sheffield are in this MLRA. Interstate 20 crosses the northern part of the area, and Interstate 10 crosses the middle of the area. The eastern part of Amistad National Recreation Area is in this MLRA.

Classification relationships

USDA-Natural Resources Conservation Service, 2006.
-Major Land Resource Area (MLRA) 81A

Ecological site concept

The Gravelly sites get their name from the high amount of gravels that reside in the soil profile. Sites are shallow to very deep and located on uplands.

Associated sites

R081AY311TX	**Shallow 14-19 PZ** The Shallow ecological site are shallow soils with less gravels.
R081AY303TX	**Loamy 14-19 PZ** The Loamy ecological site are lower in the landscape with no gravels.

Similar sites

R081AY309TX	**Low Stony Hill 14-19 PZ** The Low Stony Hill are shallow soils with more cobbles and stones over indurated limestone bedrock.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Bouteloua eriopoda* (2) *Tridens muticus*

Physiographic features

These nearly level to moderately sloping soils occur on fans and footslopes of ridges on dissected plateaus. Slope ranges from 0 to 8 percent.

Table 2. Representative physiographic features

Landforms	(1) Plateau > Fan (2) Plateau > Ridge (3) Plateau > Mesa
Runoff class	Low to high
Flooding frequency	None
Ponding frequency	None
Elevation	335–1,539 m
Slope	0–8%
Aspect	Aspect is not a significant factor

Climatic features

The climate is semiarid and is characterized by hot summers and dry, relatively mild winters. The average relative humidity in mid-afternoon ranges from 25 to 50 percent. Humidity is higher at night, and the average at dawn is around 70 to 80 percent. The sun shines 80 percent of the time during the summer and 60 percent in winter. The prevailing wind is from the south-southwest. Approximately two-thirds of annual rainfall occurs during the May to October period. Rainfall during this period generally falls during thunderstorms, and fairly large amounts of rain may fall in a short time. The climate is one of extremes, which exert much more influence on plant communities than averages. Timing and amount of rainfall are critical. High temperatures and dry westerly winds have a tremendously negative impact on precipitation effectiveness, as well as length of time since the last rain. Records since the mid-1900's, as well as geological and archaeological findings, indicate wet and dry cycles going back many thousands of years and lasting for various lengths of time with enormous influence on the flora and fauna of the area.

Table 3. Representative climatic features

Frost-free period (characteristic range)	210-240 days
Freeze-free period (characteristic range)	240-280 days
Precipitation total (characteristic range)	381-483 mm
Frost-free period (actual range)	210-240 days

Freeze-free period (actual range)	240-280 days
Precipitation total (actual range)	381-584 mm
Frost-free period (average)	225 days
Freeze-free period (average)	255 days
Precipitation total (average)	457 mm

Climate stations used

- (1) BAKERSFIELD [USC00410482], Iraan, TX
- (2) BIG LAKE 2 [USC00410779], Big Lake, TX
- (3) COPE RCH [USC00411974], Big Lake, TX
- (4) GARDEN CITY [USC00413445], Garden City, TX
- (5) MCCAMEY [USC00415707], Mc Camey, TX
- (6) PAINT ROCK [USC00416747], Paint Rock, TX
- (7) PANDALE 1 N [USC00416780], Comstock, TX
- (8) PANDALE 11 NE [USC00416781], Comstock, TX
- (9) SANDERSON [USC00418022], Dryden, TX
- (10) SHEFFIELD [USC00418252], Sheffield, TX

Influencing water features

This site is an upland and not influenced by water from a wetland or stream.

Wetland description

N/A

Soil features

The soils are shallow to very deep, well drained, and moderately permeable formed in gravelly, calcareous loamy alluvium and/or colluvium derived from limestone. Soil series correlated include: Upton and Sanderson.

Table 4. Representative soil features

Parent material	(1) Alluvium–limestone (2) Colluvium–limestone
Surface texture	(1) Very gravelly loam (2) Gravelly loam
Family particle size	(1) Loamy-skeletal
Drainage class	Well drained
Permeability class	Moderate
Depth to restrictive layer	18–203 cm
Soil depth	18–203 cm
Surface fragment cover <=3"	40–60%
Surface fragment cover >3"	25–40%
Available water capacity (0-101.6cm)	1.52–16 cm
Calcium carbonate equivalent (0-101.6cm)	35–75%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm

Sodium adsorption ratio (0-101.6cm)	0–2
Soil reaction (1:1 water) (0-101.6cm)	7.9–8.4
Subsurface fragment volume <=3" (10.2-101.6cm)	20–40%
Subsurface fragment volume >3" (10.2-101.6cm)	0–5%

Ecological dynamics

The plant communities are dynamic entities. In pre-settlement times, the site would most likely be a savannah dotted with mesquite trees, occasional shrubs and, in some areas, live oaks. The surface would be mostly covered by mid-size bunch grasses and perennial forbs. This reference plant community was greatly influenced by grazing, climate (including periodic extended periods of drought) and, to a lesser degree, fire. Reference community plants developed ways to withstand periods of drought. The midgrasses and forbs shaded the ground, reduced soil temperature, improved infiltration of what little moisture might fall and maintained soil moisture longer. Their roots reached deeper into the soil, utilizing deep soil moisture no longer available to short-rooted plants. In extreme cases many species could go virtually dormant, preserving the energy stored in underground roots, crowns and stems until wetter weather arrived. Their seeds could stay viable in the soil for long periods, sprouting when conditions improved.

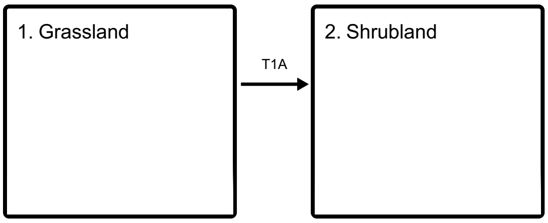
Extensive herds of pronghorns, large towns of black-tailed prairie dogs, as well as smaller populations of elk, white-tailed deer, and desert mule deer were present and had an impact on the plant community. Bison, a migratory herd animal, would come into an area, graze on the move, and not come back for many months or even years. This long deferment period allowed the plants to recover from the heavy grazing. Bison grazing on this site was probably intermittent, occurring during wetter periods. Very few bison were reported in the area after 1830. There were no recorded sightings after 1860. Fire has an influence on plant community structure and was probably a factor in maintaining the original savannah vegetation. Mesquite were present on the site, but not at the level seen today. Periodic fires may have helped keep mesquite as a scattered savannah and other woody species a small part of the composition. Grazing patterns by native herbivores and prairie dog activities were probably more significant factors in maintaining a well-balanced plant community.

While grazing is a natural component of this ecosystem, overstocking and thus overgrazing by domesticated animals has had a tremendous impact on the site. Early settlers, accustomed to farming and ranching in more temperate zones of the eastern United States or even Europe, misjudged the capacity of the site for sustainable production and expected more than could be delivered. Moreover, there was a gap of time between the extirpation of bison and the introduction of domestic livestock which resulted in an accumulation of plant material. This may have given the illusion of higher production than was actually being produced. Overgrazing and fire suppression disrupted ecological processes that took hundreds or thousands of years to develop. Instead of grazing and moving on, domestic livestock were present on the site most of the time, particularly after the practice of fencing arrived. Another influence on grazing patterns was the advent of wells and windmills. They opened up large areas that were previously unused by livestock due to lack of natural surface water. The more palatable plants were selected repeatedly and eventually began to disappear from the ecosystem to be replaced by lower successional, less palatable species. As overgrazing continued, overall production of grasses and forbs declined, more bare ground appeared, soil erosion increased, and woody and succulent increasers began to multiply. The elimination of fire due to the lack of fine fuel or by human interference assisted the rapid encroachment of mesquite and other woody increasers and a concurrent reduction of usable forage.

Extremes in climate exerted tremendous influence on the site long before European man arrived. Geologic formations, archeological findings, and rainfall records since the mid-1900’s show wide variations in precipitation with cycles of long, dry periods going back thousands of years with corresponding variations in kind and amount of flora and fauna species. The mineral content and reaction of the soils enable the site to produce diverse, highly nutritious forage. Loss of cover and soil robs the site the site of this capability and promotes rapid water shed, erosion and crusting. Pedestalling, terracetes, and water flow patterns are range health indicators that will be present if the site begins to deteriorate.

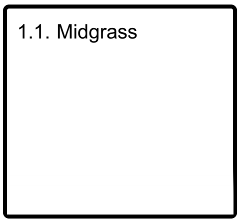
State and transition model

Ecosystem states

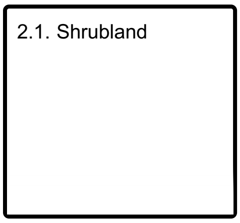


T1A - Absence of disturbance with natural regeneration over time coupled with excessive grazing pressure

State 1 submodel, plant communities



State 2 submodel, plant communities



State 1
Grassland

Dominant plant species

- black grama (*Bouteloua eriopoda*), grass
- slim tridens (*Tridens muticus*), grass

Community 1.1
Midgrass

The Midgrass Community (1.1) is the reference plant community with grasses composing approximately 70 percent of the species composition. Shrubs and forbs account for the remaining 30 percent. The characteristically high surface cover of gravels of the site helps reduce soil erosion. The diversity of plants provides necessary food and cover for native wildlife. Extended dry weather causes an overall decline in grass cover and production and can cause some retrogression. However, the reference community 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. Resulting from the inherently low production potential of the site, shrub encroachment following grass removal is slow. Annual forbs, grasses, and succulents are the first to increase following a decrease in perennial grass cover. Conservation practices such as prescribed grazing can help maintain ecological integrity. Stocking rates need to be flexible and adjusted to stocking capacity because of sporadic rainfall.

State 2
Shrubland

Dominant plant species

- mesquite (*Prosopis*), shrub

Community 2.1
Shrubland

The Shrubland Community 2.1 is the result of heavy abusive grazing, lack of brush management, and no prescribed fires. The transition is evident once the woody canopy cover is greater than 20 percent. The vast majority of the most palatable grasses, forbs, and shrubs have been eradicated from the plant community. Some midgrasses may still exist from the reference community, but the grasses have reduced vigor and abundance. Instead, shortgrasses and annual forbs are the largest part of the herbaceous component. Because of the inherently low productivity of the site, woody encroachment may be slower than associated sites. Restoration to the reference community requires substantial brush management to remove the shrub and tree species. Long-term changes to soil properties may prevent the full recovery. Range planting, return of fire, and prescribed grazing are necessary in attempting to replicate the reference community.

Transition T1A
State 1 to 2

Heavy abusive grazing, no brush management, and lack of fire will transition the Grassland State (1) to the Shrubland State (2).

Additional community tables

Animal community

This site is suitable to produce domestic livestock and to provide habitat for native wildlife. Cow-calf, stocker cattle, sheep, and goats can utilize this site. Carrying capacity has declined drastically over the past 100 years due to deterioration of the reference plant community. An assessment of vegetation is needed to determine the site's current carrying capacity. Calculations used to determine livestock stocking rate should be based on forage production remaining after determining use by resident wildlife, then refined by frequent and careful observation of the plant community's response to animal foraging.

A large diversity of wildlife is native to this site. In the historic plant community, migrating bison, grazing primarily during wetter periods, resident pronghorns and smaller populations of white-tailed deer, desert mule deer, quail, and prairie chickens were the more predominant species. With the subsequent transformation of the plant community, due primarily to the influence of man and climate change, the kind and proportion of wildlife species have been altered.

With the eradication of the screwworm fly, increase in woody vegetation and man-suppressed natural predation, deer numbers have increased and are often in excess of carrying capacity. Where deer numbers are excessive, overbrowsing and overuse of preferred forbs causes deterioration of the plant community. Progressive management of deer populations through hunting can keep populations in balance and provide an economically important ranching enterprise. Achieving a balance between brushy cover and more open plant communities on this and adjacent sites is important to deer management. Competition among deer, sheep, and goats must be a consideration in livestock and wildlife management to prevent damage to preferred vegetation.

Smaller mammals include many kinds of rodents, jackrabbit, cottontail rabbit, raccoon, skunks, possum, and armadillo. Mammalian predators include coyote, red fox, gray fox, bobcat, and mountain lion. Wolves were common in earlier times, bears resided in some areas, and an occasional jaguar was encountered. Many species of snakes and lizards are native to the site.

Many species of birds are found on this site including game birds, songbirds, and birds of prey. Major game birds that are economically important are bobwhite quail, scaled (blue) quail, and mourning dove. Quail prefer a combination of low shrubs, bunch grass (critical for nesting cover), bare ground, and low successional forbs. Turkeys visit the site to feed. The different species of songbirds vary in their habitat preferences. Habitat on this site that provides a large diversity of grasses, forbs, and shrubs will support a good variety and abundance of songbirds. Birds of prey are important to keep the numbers of rodents, rabbits, and snakes in balance.

Inventory data references

Information provided here has been derived from limited NRCS clipping data, and from field observations of range trained personnel.

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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	05/06/2024
Approved by	Bryan Christensen
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):**

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:**
