USDA Natural Resources Conservation Service

Ecological site R081BY593TX
Limestone Hill 19-23 PZ

Last updated: 9/19/2023
Accessed: 04/28/2024

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.

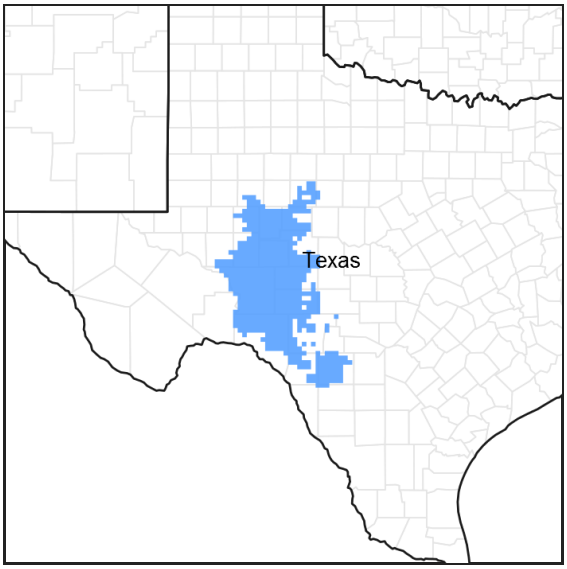


Figure 1. Mapped extent

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): 081B–Edwards Plateau, Central Part

This area is entirely in south-central Texas. It makes up about 11,125 square miles (28,825 square kilometers). The towns of Fredericksburg, Junction, Menard, Rocksprings, and Sonora are in this MLRA. Interstate 10 crosses the middle part of the area. A few State parks and State historic sites are in this MLRA.

Classification relationships

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

Ecological site concept

The Limestone Hills are comprised of shallow soils with lithic contact. The sites are filled with gravels, cobbles, and flagstones and occur on undulating hills with less than 20 percent slopes.

Associated sites

R081BY336TX	**Low Stony Hill 19-23 PZ** The Low Stony Hill site are on adjacent slopes.
R081BY342TX	**Shallow 19-23 PZ** The Shallow site can be found downslope.
R081BY353TX	**Very Shallow 19-23 PZ** The Very Shallow site can be found downslope.
R081BY325TX	**Clay Loam 19-23 PZ** The Clay Loam site is on adjacent slopes lower in the landscape.

Similar sites

R081BY336TX	**Low Stony Hill 19-23 PZ** The Low Stony Hill site are very similar.
R081BY353TX	**Very Shallow 19-23 PZ** The Very Shallow site are less than 10 inches to petrocalcic horizon.

Table 1. Dominant plant species

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

Physiographic features

The Limestone Hill site is classified as upland. Soils occur on nearly level to steep, generally convex hills, plateaus, ridges or plains. Slopes range from 1 to 20 percent. Some rock outcrops occur on slopes greater than 15 percent. Elevation of the site ranges from 1,600 to 2,800 feet above mean sea level. In most locations little or no runoff is received from other sites. Due to the usual sloping nature and slow moisture intake, most water from heavier rainfall events runs off of the site, providing extra moisture to lower, adjacent sites, but also furnishing the potential for damaging erosion. Abundant herbaceous ground cover prevents, or at least minimizes, erosion damage while the problem is compounded as vegetative cover diminishes.

Table 2. Representative physiographic features

Landforms	(1) Plateau > Ridge (2) Plateau > Hill (3) Plateau > Plain
Runoff class	Medium to high
Flooding frequency	None
Ponding frequency	None
Elevation	488–853 m
Slope	1–20%
Aspect	Aspect is not a significant factor

Climatic features

The climate in the MLRA 81B is subtropical subhumid on the eastern portion and subtropical steppe on the western portion of the MLRA. Winters are dry, and the summers are hot and humid. The precipitation increases from west to east and the temperatures increase from north to south. The area usually receives 65 to 70 percent sunshine each year. The majority of the rainfall occurs during the warm months of April to October. Most precipitation comes from thunderstorms that vary in the amount of water received and the areas covered. Spring is characterized by fluctuating patterns, but mild temperatures prevail. July and August are relatively dry and hot with little weather

variability day-to-day. As summer progresses through fall, an increase of precipitation usually occurs in the eastern portions while a decrease of precipitation occurs to the west. Winter temperatures are mild, but polar Canadian air masses bring rapid drops in temperature. These cold spells last 2 or 3 days. Prevailing winds are southerly with March and April the windiest months.

Table 3. Representative climatic features

Frost-free period (characteristic range)	210-270 days
Freeze-free period (characteristic range)	240-290 days
Precipitation total (characteristic range)	483-610 mm
Frost-free period (actual range)	210-270 days
Freeze-free period (actual range)	240-290 days
Precipitation total (actual range)	483-635 mm
Frost-free period (average)	230 days
Freeze-free period (average)	260 days
Precipitation total (average)	559 mm

Climate stations used

- (1) BIG LAKE 2 [USC00410779], Big Lake, TX
- (2) SONORA [USC00418449], Sonora, TX
- (3) OZONA [USC00416734], Ozona, TX
- (4) CARTA VALLEY [USC00411492], Rocksprings, TX
- (5) ELDORADO [USC00412809], Eldorado, TX

Influencing water features

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

Wetland description

N/A

Soil features

The soils consist of very shallow or shallow, well drained, moderately permeable uplands. They are composed of grayish-brown to dark grayish-brown loams, clay loams, and silty clay loams formed in residuum from limestone and, lying over limestone bedrock, usually unfractured or with fractures sealed with calcium carbonate. Gravel, cobbles, and stones are found on the surface. Available water capacity is very low. Shrink-swell potential is low. Soil series correlated to this site include: Ector and Noelke.

Table 4. Representative soil features

Parent material	(1) Residuum–limestone
Surface texture	(1) Very gravelly loam (2) Very cobbly clay loam (3) Gravelly silty clay loam
Family particle size	(1) Loamy-skeletal
Drainage class	Well drained
Permeability class	Moderate
Depth to restrictive layer	10–51 cm
Soil depth	10–51 cm

Surface fragment cover <=3"	20–40%
Surface fragment cover >3"	5–15%
Available water capacity (0-50.8cm)	0.51–2.79 cm
Calcium carbonate equivalent (0-50.8cm)	25–85%
Electrical conductivity (0-50.8cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-50.8cm)	0
Soil reaction (1:1 water) (0-50.8cm)	7.4–8.4
Subsurface fragment volume <=3" (10.2-50.8cm)	15–40%
Subsurface fragment volume >3" (10.2-50.8cm)	30–60%

Ecological dynamics

The Limestone Hill site is a mid and short grassland with scattered small shrubs and numerous perennial forbs. Mid-size bunchgrasses, shortgrasses, and perennial forbs probably covered most of the surface. This plant community was greatly influenced by grazing, climate (including periodic extended periods of drought) and, to a lesser degree, fire.

Extensive herds of pronghorns as well as smaller populations of white-tailed deer were present and had an impact on the plant community. Bison grazing on most of this site was intermittent. Bison, a migratory herd animal, would come through an area, grazed on the move, and not come back for many months or even years. This long deferment period allowed the more palatable grasses and forbs to recover from the heavy grazing. Fire has a strong influence on plant community structure and was a factor in maintaining the original grassland vegetation. Species such as Ashe juniper (*Juniperus ashei*), redberry juniper (*Juniperus pinchotii*), and mesquite (*Prosopis glandulosa*) were very likely present on the site, but not at the level we see today. On the average, fires occurred every 7 to 12 years and helped keep woody species under control. Grazing patterns by native herbivores and climate were also significant factors in maintaining a well-balanced plant community.

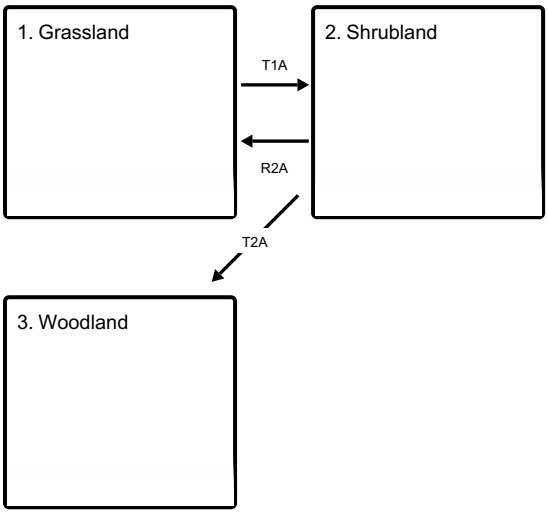
While grazing is a natural component of this ecosystem, overstocking and thus overgrazing by domesticated animals has had a tremendous impact on the site. Early settlers, accustomed to farming and ranching in more temperate zones of the eastern United States or even Europe, misjudged the capacity of the site for sustainable production and expected more of the site than it could deliver. 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 such as little bluestem (*Schizachyrium scoparium*), cane bluestem (*Bothriochloa barbinodis*), and awnless bushsunflower (*Simsia calva*) were selected repeatedly and eventually began to disappear from the ecosystem being replaced by lower successional, less palatable species such as curlymesquite (*Hilaria belangeri*), hairy grama (*Bouteloua hirsuta*), Hall's panicum (*Panicum hallii* var. hallii), and annual forbs. As overgrazing continued, overall production of grasses and forbs declined, more bare ground appeared, soil erosion increased, and woody and succulent increasers such as algerita (Mahonia trifiolata), condalia (Condalia spp.) species and prickly pear (Opuntia spp.) species began to multiply. The elimination of fire due to the lack of fine fuel or by human interference assisted the rapid encroachment by herbaceous and woody increasers/invaders with a concurrent reduction of usable forage and growing danger from toxic plants.

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. Although the limestone hill site has shallow soils with low moisture holding capacity, it can make good use of small rainfall events. 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

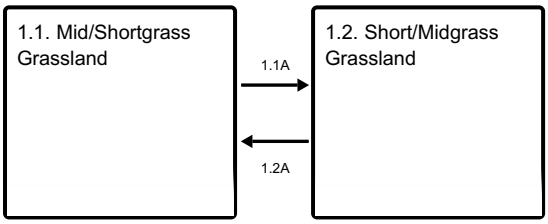


T1A - Absence of disturbance and natural regeneration over time, may be coupled with excessive grazing pressure

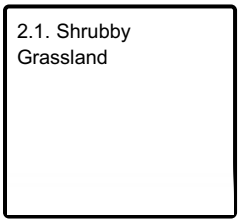
R2A - Reintroduction of historic disturbance return intervals

T2A - Absence of disturbance and natural regeneration over time, may be coupled with excessive grazing pressure

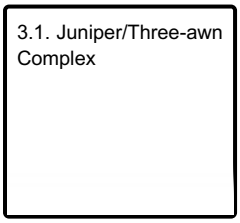
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1

Grassland

Dominant plant species

- sideoats grama (*Bouteloua curtipendula*), grass
- black grama (*Bouteloua eriopoda*), grass

Community 1.1
Mid/Shortgrass Grassland

The reference plant community for this site is a grassland composed of mid and short grasses with scattered shrubs that evolved under the influence of grazing, periodic fire and climate. The overstory shades less than 10 percent and consists of occasional shrubs such as catclaw acacia (Acacia gregii), Roemer's acacia (*Acacia roemeriana*), Texas kidneywood (*Eysenhardtia texana*), ephedra (Ephedra), and skunkbush sumac (*Rhus trilobata*). The site has few trees due to its shallow nature and impermeable underlying material. About 65 percent of the canopy is grass. Midgrasses such as sideoats grama (*Bouteloua curtipendula*), black grama (*Bouteloua eriopoda*), cane bluestem (*Bothriochloa barbinodis*), green sprangletop (*Leptochloa dubia*), and plains bristlegrass (*Setaria vulpiseta*), along with shortgrasses such as buffalograss (*Bouteloua dactyloides*), Hall's panicum (*Panicum hallii*), and Reverchon bristlegrass (*Setaria reverchonii*) dominate the site. Other important grasses include vine mesquite (*Panicum obtusum*), three-flower melic (*Melica nitens*), Texas wintergrass (*Nassella leucotricha*), Canada wildrye (*Elymus canadensis*), slim tridens (*Tridens muticus*), rough tridens (*Tridens muticus* var. muticus), and Wright's three-awn (*Aristida purpurea* var. wrightii). Perennial forbs such as awnless bushsunflower (*Simsia calva*), orange zexmenia (Wedelia hispida), Mexican sagewort (Aretmesia ludoviciana var. mexicana), and Indian mallow (Abutilon spp.) are a small (5 to 10 percent canopy), but important, component of the plant community. In wet years annual forbs produce significant herbaceous vegetation. Plants are vigorous, and reproduction is rapid during wet weather. Bare ground is less than 25 percent. Interspaces between plants are moderately covered with litter. The soil surface is rich in humus and hosts a microbe population actively decomposing organic matter. Soil erosion is insignificant. Infiltration is slow to moderate. Runoff occurs during heavier rainfall but is slowed down and dispersed by vegetative ground cover. Concentrated water-flow patterns are rare. Recurrent periodic fire, climatic patterns, and grazing are natural processes that maintain this plant community. Interruption of the ecological processes brings about change. The reference plant community includes large populations of quality grasses and smaller numbers of perennial forbs. Extended drought, continued overuse, and elimination of fire result in vegetative decline or disappearance from large portions of the site. The more dominant, palatable forage grasses decrease as do palatable perennial forbs. Less palatable or productive midgrasses such as Wright's three-awn, slim tridens, rough tridens, hairy grama (*Bouteloua hirsuta*); and shortgrasses like buffalograss, red grama (*Bouteloua trifida*), and curlymesquite (*Hilaria belangeri*) along with lower quality forbs such as croton (Croton spp.), globemallow (Sphaeralcea spp.), verbena (Verbena spp.), and annuals begin to increase. Small juniper (Juniperus spp.), mesquite (*Prosopis glandulosa*), algerita (*Mahonia trifoliolata*), condalia (Condalia spp.), and prickly pear (Opuntia spp.) begin to appear. More bare ground is evident. If the process is not halted or reversed, the community shifts to the Short/Midgrass Grassland Community (1.2).

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1048	1334	1715
Forb	123	157	202
Shrub/Vine	62	78	101
Total	**1233**	**1569**	**2018**

Figure 9. Plant community growth curve (percent production by month). TX3615, Midgrass Dominant with Shortgrass and Scattered Shrubs. Midgrass dominant vegetation with shortgrasses and scattered shrubs..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2	3	5	13	23	15	4	5	15	7	5	3

Community 1.2

Short/Midgrass Grassland

This community still resembles the reference community (1.1) to casual observation. However, due to the measurable decline of dominant midgrasses and perennial forbs caused by overstocking, elimination of fire, lack of brush management and, possibly, changes in weather patterns, the population of juniper and other woody species begins to increase. Vigor and reproduction of the dominant grass species decline, and they are starting to be replaced by buffalograss, slim tridens, rough tridens, Hall's panicum and other short grasses. Less palatable annual and perennial forbs increase. Shrub canopy is between 10 and 20 percent with a higher proportion of less palatable species. Invading small junipers are apparent, as are scrubby mesquite seedlings in deeper soil. Ground cover by litter decreases. Up to 40 percent of the ground is bare. Soil organic matter is decreasing. Infiltration begins to drop off and runoff increases. Signs of erosion begin to appear. Encroachment by brush species, replacement of midgrasses with less palatable grasses, loss of topsoil, and loss of soil organic matter make it difficult for these abused areas to return to the reference plant community even is stressors are removed. However, the retrogression at this point can be reversed with relatively small labor and cost input if measures are taken soon enough. Application of prescribed grazing is essential to stop the decline of high-quality midgrasses and forbs. Prescribed burning can be used in some areas to control small woody plants and their seedlings. These can also be controlled through individual plant treatment mechanically or with appropriate chemical application. If the trend is not reversed, the community will eventually shift to the Shrubby Grassland Community (2.1), which will require higher investment of labor and financial resources to restore to the reference community.

Pathway 1.1A
Community 1.1 to 1.2

With heavy abusive grazing, no brush management, brush invasion, and no fires, the reference community will transition to the community 1.2.

Pathway 1.2A
Community 1.2 to 1.1

With institution of sound management practices, this trend can usually be reversed and productivity restored. Understanding the effects of climate, fire, and grazing on the ecology of the site combined with use of sound grazing management, individual plant treatment, and prescribed burning is key to any attempt to return to the reference plant community.

State 2
Shrubland

Dominant plant species

- juniper (*Juniperus*), tree

Community 2.1
Shrubby Grassland

This community represents a significant vegetation shift, crossing the threshold from the Grassland State (1) to the Shrubland State (2). The major woody increaser species, primarily juniper, have multiplied until they comprise about 20 percent of the overstory canopy and exert strong influence on the site, with total grass production severely restricted. The reference midgrasses are almost gone, either grazed or shaded out. Shortgrasses and three-awn species are predominant. The Texas wintergrass population increases. Palatable perennial forbs are scarce. The proportion of toxic plants increases and some of the more common ones include Groundsel (Senecio spp.) species, twoleaf senna (*Senna roemeriana*), and sacahuista (*Nolina texana*). Junipers have increased in size over three feet tall, as well as major increases in shrubs such as condalia, algerita, catclaw acacia, and sacahuista. Up to 60 percent of the ground is bare, which lends itself to a proliferation of annual forbs in some years, particularly when a wet fall/winter follows a dry spring/summer. Some forbs such as filaree (Erodium spp.) or redseed plantain (*Plantago rhodosperma*) provide a certain amount of high-quality forage for sheep, goats, and deer during winter and early spring, but can quickly dry up when summer arrives. Litter is scarce. Organic matter is low. Less water infiltrates. Runoff increases. Topsoil loss through erosion accelerates, evidenced by plants on pedestals, rills, and stunted growth. Sheet erosion, though not easily detected visually, is high. If proper management is not planned

and implemented, the site will continue to degrade, and the community will shift toward a Juniper/Three-awn Complex Community (3.1).

State 3
Woodland

Dominant plant species

- juniper (*Juniperus*), tree

Community 3.1
Juniper/Three-awn Complex

The Juniper/Three-awn Complex community (3.1) is the result of an extreme shift of site characteristics from the original midgrass grassland. Juniper, catclaw acacia, cenizo (*Leucophyllum frutescens*), and other woody increasers dominate the slopes. Mesquite, prickly pear, and other woody/succulent invaders are established on benches and plateau tops. Woody canopy cover ranges from 20 percent upward. Their strong competition for water, sunlight, and nutrients has severely limited or eliminated shortgrass populations, let alone the original midgrass community. Various three-awns, hairy tridens, red grama, Texas grama, hairy grama, and annuals make up the grasses of this site. The forb component consists predominantly of annuals or unpalatable perennials. Up to 80 percent of the ground can be bare of grasses and forbs. Often most of the original, fertile topsoil has eroded away. Bare soil has crusted and is relatively impermeable. Very little rainfall infiltrates and runoff is rapid. This community very likely cannot be restored to the reference plant community. Decades of transition from a midgrass grassland community have negatively impacted soil properties, species diversity, site integrity, and hydrology features. It can, however, be manipulated toward a community similar in composition and function through mechanical and chemical brush management and implementation of intensive grazing management. Before beginning, the land manager should decide the relative value of livestock and wildlife to the ranch and plan brush management accordingly.

Transition T1A
State 1 to 2

Heavy abusive grazing, lack of fire, and absence of brush control will shift the Grassland State to the Shrubland State.

Restoration pathway R2A
State 2 to 1

By implementing conservation measures such as brush management, prescribed grazing and prescribed burning, this community can possibly be shifted back toward a Grassland State (1).

Transition T2A
State 2 to 3

Continued heavy abusive grazing, lack of fire, and absence of brush control will shift the Shrubland State to the Woodland State.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tallgrasses**			224–404	
	little bluestem	SCSC	*Schizachyrium scoparium*	224–404	–
	Indiangrass	SONU2	*Sorghastrum nutans*	224–404	–
2	**Midgrasses**			325–504	

2	**Midgrasses**			325–504	
	cane bluestem	BOBA3	*Bothriochloa barbinodis*	325–504	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	325–504	–
	black grama	BOER4	*Bouteloua eriopoda*	325–504	–
	silver beardgrass	BOLAT	*Bothriochloa laguroides ssp. torreyana*	325–504	–
3	**Midgrasses**			112–202	
	green sprangletop	LEDU	*Leptochloa dubia*	112–202	–
	vine mesquite	PAOB	*Panicum obtusum*	112–202	–
	plains bristlegrass	SEVU2	*Setaria vulpiseta*	112–202	–
4	**Midgrasses**			112–202	
	Wright's threeawn	ARPUW	*Aristida purpurea var. wrightii*	112–202	–
	bush muhly	MUPO2	*Muhlenbergia porteri*	112–202	–
	Reverchon's bristlegrass	SERE3	*Setaria reverchonii*	112–202	–
	slim tridens	TRMU	*Tridens muticus*	112–202	–
	slim tridens	TRMUE	*Tridens muticus var. elongatus*	112–202	–
5	**Shortgrasses**			112–202	
	buffalograss	BODA2	*Bouteloua dactyloides*	112–202	–
	fall witchgrass	DICO6	*Digitaria cognata*	112–202	–
	curly-mesquite	HIBE	*Hilaria belangeri*	112–202	–
	Hall's panicgrass	PAHA	*Panicum hallii*	112–202	–
6	**Cool Season Grasses**			22–101	
	Canada wildrye	ELCA4	*Elymus canadensis*	22–101	–
	threeflower melicgrass	MENI	*Melica nitens*	22–101	–
	Texas wintergrass	NALE3	*Nassella leucotricha*	22–101	–
7	**Shortgrasses**			22–101	
	Grass, annual	2GA	*Grass, annual*	22–101	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	22–101	–
	red grama	BOTR2	*Bouteloua trifida*	22–101	–
	hairy woollygrass	ERPI5	*Erioneuron pilosum*	22–101	–
Forb					
8	**Forbs**			123–202	
	Indian mallow	ABUTI	*Abutilon*	123–202	–
	white sagebrush	ARLUM2	*Artemisia ludoviciana ssp. mexicana*	123–202	–
	croton	CROTO	*Croton*	123–202	–
	bundleflower	DESMA	*Desmanthus*	123–202	–
	Engelmann's daisy	ENGEL	*Engelmannia*	123–202	–
	beeblossom	GAURA	*Gaura*	123–202	–
	Chalk Hill hymenopappus	HYTE2	*Hymenopappus tenuifolius*	123–202	–
	trailing krameria	KRLA	*Krameria lanceolata*	123–202	–
	menodora	MENOD	*Menodora*	123–202	–
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	123–202	–
	Texas sage	SATE3	*Salvia texana*	123–202	–

	Texas sage	SATE2	*Salvia texana*	123–202	
	awnless bushsunflower	SICA7	*Simsia calva*	123–202	–
	greenthread	THELE	*Thelesperma*	123–202	–
	vervain	VERBE	*Verbena*	123–202	–
	creepingoxeye	WEDEL	*Wedelia*	123–202	–
9	**Annual Forbs**			17–34	
	Forb, annual	2FA	*Forb, annual*	17–34	–
Shrub/Vine					
10	**Shrubs/Vines**			62–101	
	catclaw acacia	ACGR	*Acacia greggii*	62–101	–
	roundflower catclaw	ACRO	*Acacia roemeriana*	62–101	–
	snakewood	CONDA	*Condalia*	62–101	–
	featherplume	DAFO	*Dalea formosa*	62–101	–
	jointfir	EPHED	*Ephedra*	62–101	–
	Texas kidneywood	EYTE	*Eysenhardtia texana*	62–101	–
	stretchberry	FOPU2	*Forestiera pubescens*	62–101	–
	Texas barometer bush	LEFR3	*Leucophyllum frutescens*	62–101	–
	algerita	MATR3	*Mahonia trifoliolata*	62–101	–
	Texas sacahuista	NOTE	*Nolina texana*	62–101	–
	littleleaf sumac	RHMI3	*Rhus microphylla*	62–101	–
	skunkbush sumac	RHTR	*Rhus trilobata*	62–101	–
	evergreen sumac	RHVI3	*Rhus virens*	62–101	–

Animal community

This site is used to produce domestic livestock and to provide habitat for native wildlife. Cow-calf operations are the primary livestock enterprise, although stocker cattle are also grazed. Sheep, Angora goats, and Spanish goats were formerly raised in large numbers. Sheep are still present in reduced numbers, while meat goats are now present in fairly high numbers. Boer goats have been introduced, either purebred or crossed with Spanish goats, to obtain a larger meat animal. Reports indicate that Boers do not browse as heavily as earlier breeds.

Sustainable stocking rates have declined drastically over the past 100 years due to the 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 careful observation of the plant community's response to animal foraging.

A large diversity of wildlife is native to this site. In the reference plant community, migrating bison, grazing primarily during wetter periods, pronghorn, white-tailed deer and turkey were the more predominant herbivore 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.

Except for a few domestic herds, bison have been eliminated. 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 the plant community.

Various species of exotic wildlife have been introduced on the site, including deer such as axis, sika, fallow, and red; antelope such as sable, oryx, blackbuck, and nilgai, and sheep such as barbados (mouflon) and aoudad with various degrees of success. Their numbers must be included along with livestock and native wildlife, primarily white-tailed deer, in any management plan. Feral hogs may feed on the site. They can be damaging to the plant community if their numbers are not managed. Smaller mammals include many kinds of rodents, jackrabbit, cottontail, raccoon, ringtail, skunk, 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 or ocelot 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 turkey, bobwhite quail, scaled (blue) quail, and mourning dove. Turkeys prefer plant communities with substantial amounts of shrubs and trees interspersed with grassland. Quail prefer a combination of low shrubs, bunch grass (critical for nesting cover), bare ground, and low successional forbs. 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. Different species of raptors benefit from a diverse plant community as well.

Hydrological functions

The site is well drained with low water-holding capacity but is able to make use of small rainfall events. It does not lend itself to aquifer recharge. The site is located at higher elevations with steeper slopes, so the potential for rapid runoff is high, particularly when in a denuded state during heavy rainfall. Erosion can be quite high on this site, and as the erosion process continues the hydrologic characteristics worsen.

Recreational uses

This site has the appeal of the wide-open spaces and a wide variety of plant and animal life. When winter and early spring moisture is available, colorful annual and perennial forbs create scenic beauty. The area is also used for hunting, birding, and other eco-tourism related enterprises.

Inventory data references

Information presented here is derived from literature, limited NRCS clipping data (417s), field observations, and personal contacts with 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	04/28/2024
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:

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

14. **Average percent litter cover (%) and depth (in):**

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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:**
