USDA Natural Resources Conservation Service

Ecological site R081BY332TX
Gravelly Redland 23-31 PZ

Last updated: 9/19/2023
Accessed: 05/20/2024

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.

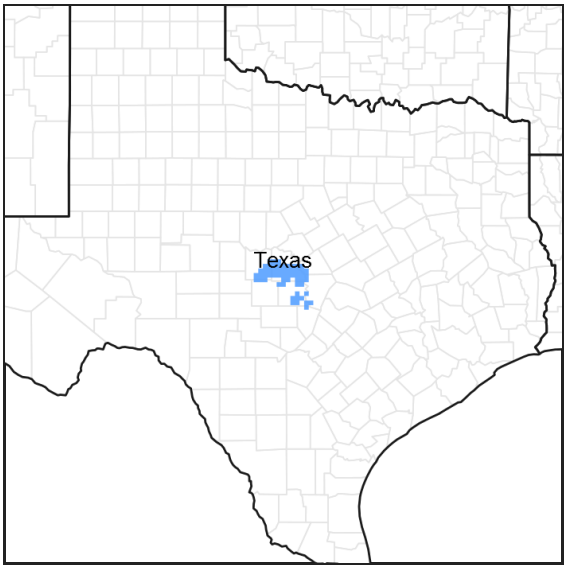


Figure 1. Mapped extent

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

Gravelly Redland sites occur on uplands with greater than 20 inches of soil. Their characteristic color has a hue redder than 5YR on the Munsell Soil Color Chart. The sites are considered skeletal because the gravels make up 35 percent or more of the soil volume.

Associated sites

R081BY340TX	**Redland 23-31 PZ** The Redland site is shallower and few fragments in the soil.
R081BY337TX	**Low Stony Hill 23-31 PZ** The Low Stony Hill site is shallower and does not have red subsoil.

Similar sites

R081BY328TX	**Deep Redland 23-31 PZ** The Deep Redland site has less than 15 percent fragments.

Table 1. Dominant plant species

Tree	(1) *Quercus virginiana*
Shrub	Not specified
Herbaceous	(1) *Schizachyrium scoparium* (2) *Sorghastrum nutans*

Physiographic features

Sites occur on undulating uplands. The landscape is characterized by low, rounded hills that have interconnecting saddles and shallow weakly concave valleys. Slopes are complex and vary from 1 to 8 percent, but are mainly about 1 to 4 percent. Areas are oval to irregular in shape and range from a 50 to over 1,000 acres. Runoff is high and the potential erosion is moderate. The elevation ranges from 1,000 to 2,000 feet. A few outcrops of limestone can be found on some of the ridges and low, rounded hills.

Table 2. Representative physiographic features

Landforms	(1) Plateau > Plain (2) Plateau > Hill
Runoff class	High
Flooding frequency	None
Ponding frequency	None
Elevation	305–610 m
Slope	1–8%
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)	220-240 days
Freeze-free period (characteristic range)	240-280 days
Precipitation total (characteristic range)	635-711 mm

Frost-free period (actual range)	220-240 days
Freeze-free period (actual range)	240-280 days
Precipitation total (actual range)	610-762 mm
Frost-free period (average)	230 days
Freeze-free period (average)	260 days
Precipitation total (average)	686 mm

Climate stations used

- (1) FT MCKAVETT [USC00413257], Fort Mc Kavett, TX
- (2) HUNT 10 W [USC00414375], Hunt, TX
- (3) JUNCTION KIMBLE CO AP [USW00013973], Junction, TX
- (4) MENARD [USC00415822], Menard, TX
- (5) ROCKSPRINGS 1S [USC00417706], Rocksprings, TX
- (6) SAN SABA [USC00417992], San Saba, TX
- (7) EDEN [USC00412741], Eden, TX
- (8) FREDERICKSBURG [USC00413329], Fredericksburg, TX
- (9) BRADY [USC00411017], Brady, TX
- (10) JUNCTION 4SSW [USC00414670], Junction, TX

Influencing water features

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

Wetland description

N/A

Soil features

The soils are moderately deep, well drained, moderately slow permeable surface with a very slow permeable subsoil formed over indurated limestone. The surface layer is brown to dark reddish-brown gravelly or cherty clay loam about 5 to 11 inches thick. Chert fragments of various sizes are found throughout, even imbedded in the limestone bedrock. Depth to bedrock ranges from 20 to 40 inches. The soils are not suited to cultivation and are used primarily as rangeland. They are poorly suited to most building/housing uses. Limitations include depth to bedrock, coarse fragments, high shrink-swell potential and corrosivity to uncoated steel. Soil series correlated to this site include: Rumple.

Table 4. Representative soil features

Parent material	(1) Residuum–limestone
Surface texture	(1) Gravelly clay loam (2) Gravelly loam
Family particle size	(1) Clayey-skeletal
Drainage class	Well drained
Permeability class	Very slow to moderately slow
Depth to restrictive layer	51–102 cm
Soil depth	51–102 cm
Surface fragment cover <=3"	20–30%
Surface fragment cover >3"	0–6%

Available water capacity (0-101.6cm)	1.27–6.35 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–1
Soil reaction (1:1 water) (0-101.6cm)	6.1–8.4
Subsurface fragment volume <=3" (10.2-101.6cm)	35–60%
Subsurface fragment volume >3" (10.2-101.6cm)	0–5%

Ecological dynamics

The Gravelly Redland site is a midgrass and tallgrass prairie with scattered mottes of trees, predominantly live oak (*Quercus virginiana*), and numerous perennial forbs. Midsize and tall bunchgrasses, perennial forbs, and shortgrasses covere most of the surface. This plant community was greatly influenced by grazing, climate (including periodic extended periods of drought) and fire.

Historically, extensive herds of pronghorns, as well as substantial populations of white-tailed deer, were present and had an impact on the plant community. Colonies of black-tailed prairie dogs lived on the site. They kept woody shrubs cut down around their town to avoid predators. Bison grazing was mostly intermittent. Bison, a migratory herd animal, would come through an area, graze 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*) and mesquite (*Prosopis glandulosa*) were probably present on the site, but not at the level we usually see today. On the average, fires occurred every 7 to 12 years and helped keep woody species under control, maintaining an open savannah community. Grazing patterns by native herbivores and climate were also significant factors in maintaining a well-balanced plant community.

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. Reference community plants developed ways to withstand periods of drought. The grasses and forbs shaded the ground, reduced soil temperature, improved infiltration and maintained soil moisture. Roots of midgrass, tallgrass, and perennial forbs reached deeper into the soil, utilizing deep soil moisture no longer available to short-rooted plants. In extreme periods of drought, many species could go virtually dormant, preserving the energy stored in underground bases and roots until wetter weather arrived. Their seeds could stay viable in the soil for long periods, sprouting when conditions improved.

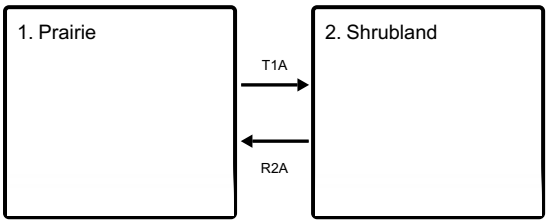
While periodic grazing is a natural component of this ecosystem, overstocking and thus overgrazing by domesticated animals has had a tremendous impact. Arriving in numbers in the 1840’s and 50’s, most early settlers were accustomed to ranching in more temperate zones of the eastern United States or even Europe and misjudged the capacity of the site for sustainable production, expecting more than the land could deliver. Overgrazing, usually in the form of heavy continuous grazing by cattle, sheep, and goats, and fire suppression disrupted ecological processes that took hundreds or thousands of years to develop. Instead of grazing and moving on, domestic livestock was present on the site most of the time. Steep Adobe is often in close proximity to streams and so was particularly hard-hit by livestock traveling to and from water, bedding down, or just being held close to water during roundups. The arrival of barbed wire fencing in the late 1870’s could have been used as a conservation tool, but for the most part was just used to contain livestock. Another influence on grazing patterns was the advent of windmills during the same period. The windmills allowed large areas to be grazed that were previously unused by livestock due to lack of natural surface water.

The more palatable plants such as big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*),

Indiangrass (Sorgastrum nutans), sideoats grama (*Bouteloua curtipendula*), Arizona cottontop (*Digitaria californica*), awnless bushsunflower (*Simsia calva*), Engelmann's daisy (*Engelmannia peristenia*),and Orange zexmenia (Wedelia texana) were selected repeatedly and eventually began to disappear from the ecosystem to be replaced by lower successional, less palatable and productive species such as buffalograss (*Bouteloua dactyloides*), curlymesquite (*Hilaria belangeri*), Halls panicum (*Panicum hallii*), perennial three-awns (Aristida), 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/invaders such as Ashe juniper (*Juniperus ashei*), algerita (Mahonia trifiolata), condalia (Condalia spp.), mesquite (*Prosopis glandulosa*), catclaw acacia (*Acacia greggii*), and pricklypear (Opuntia spp.) 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.

State and transition model

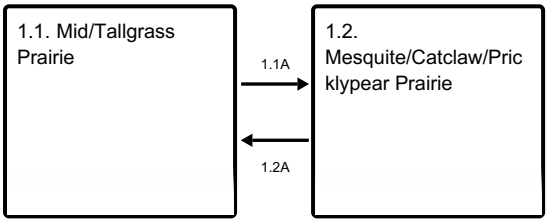
Ecosystem states



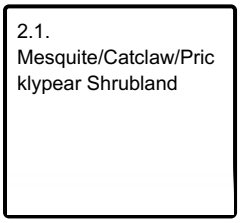
T1A - Absence of disturbance and natural regeneration over time, may be coupled with excessive grazing pressure

R2A - Reintroduction of historic disturbance return intervals

State 1 submodel, plant communities



State 2 submodel, plant communities



State 1
Prairie

Dominant plant species

- live oak (*Quercus virginiana*), tree
- little bluestem (*Schizachyrium scoparium*), grass
- Indiangrass (*Sorghastrum nutans*), grass

Community 1.1
Mid/Tallgrass Prairie

The community for this site is a prairie composed of mid and tallgrasses with scattered trees and shrubs that evolved under the influence of grazing, periodic fire, and climate. The overstory shades about 10 to 15 percent of the site and consists of trees such as live oak (*Quercus virginiana*), post oak (*Quercus stellata*), blackjack oak (*Quercus marilandica*), hackberry (Celtis), mesquite, and shrubs such as littleleaf sumac (*Rhus microphylla*),

elbowbush (*Forestiera pubescens*), ephedra (Ephedra), algerita (Mahonia trifiolata), and bumelia (Sideroxylon). Pricklypear can be present but is usually suppressed by periodic fires and healthy vegetative ground cover. Grasses account for about 85 percent of the site production, with big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), Indiangrass (Sorgastrum nutans), and sideoats grama (*Bouteloua curtipendula*) being the most dominant species. Midgrasses present include Arizona cottontop (*Digitaria californica*), silver bluestem (*Bothriochloa laguroides* var. torreyana), green sprangletop (*Leptochloa dubia*), Texas cupgrass (*Eriochloa sericea*), and Texas wintergrass (*Nassella leucotricha*). Shortgrasses like buffalograss and curlymesquite are found in the interspaces and open areas. Perennial forbs such as awnless bushsunflower, catclaw sensitivebriar (*Mimosa nuttallii*), Engelmann's daisy, and orange zexmenia has a small (around five to seven percent) component of the plant community, particularly for browsers like deer. In wet years, annual forbs may produce significant herbaceous vegetation. Plant vigor and reproduction is relatively high in favorable weather. Soil erosion, particularly on the flatter slopes, is controlled. With medium runoff rates and slow to very slow infiltration, the vegetative ground cover helps disperse and slow down runoff, thus holding soil in place and enhancing infiltration. Concentrated water flow patterns are rare. Recurrent fire, climate patterns, and grazing by herbivores are natural processes that maintain this plant community. Change occurs when ecological processes are interrupted. Continued overuse, elimination of fire, and extended drought can result in the decline or disappearance of reference grasses and forbs. More dominant, palatable grasses and perennial forbs decrease while the less palatable or productive midgrasses, shortgrasses, forbs, and woody species begin to increase and fill in the void left by the declining species. More prominent in the landscape are grasses like Wright's three-awn (*Aristida purpurea* var. wrightii), slim tridens (*Tridens muticus*), rough tridens (*Tridens muticus* var. elongatus), fall witchgrass (*Digitaria cognata*), and Hall's panicum. The woody component is expanding, with noticeable increases in live oak, mesquite, and catclaw acacia production. The decrease in vegetative ground cover facilitates lower infiltration, higher runoff rates, and concentration of water flow, thus promoting soil erosion and loss of organic matter. If the process is not reversed, the plant community will shift toward the Mesquite/Catclaw/Pricklypear Prairie Community (1.2). This trend can 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, judicious brush management, and prescribed burning is the key to restoration.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1670	2477	3430
Forb	135	202	280
Shrub/Vine	95	146	202
Tree	62	90	123
Total	**1962**	**2915**	**4035**

Figure 9. Plant community growth curve (percent production by month). TX3626, Midgrass/Tallgrass/Oak Prairie - 10 percent canopy. Midgrass Prairie with tallgrasses, oaks, and ten percent tree/shrub canopy..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2	2	2	10	20	24	10	5	10	10	3	2

Community 1.2
Mesquite/Catclaw/Pricklypear Prairie

This plant community is the result of a significant shift across the threshold from the reference plant community. Overall total annual production has declined. Grasses represent only about 65 percent of total production, with fewer tallgrasses and palatable midgrasses. More prominent in the plant community are secondary mid and shortgrasses like Wright's three-awn, rough tridens, hairy tridens, buffalograss, curlymesquite, and Texas wintergrass. Forbs still make up about 5 percent, but more are unpalatable perennials or annuals. Mesquite, Ashe juniper and catclaw acacia are beginning to appear. Pricklypear is spreading rapidly. More ground is bare, and signs of erosion begin to appear. The human-induced stressors, primarily heavy abusive grazing, can be removed with no other management and the community will perpetuate within the limitations imposed by climate. Or it can continue to be subjected to the same treatment and the trend toward trees, shrubs, and low-producing mid and

shortgrasses. This will continue until it crosses another threshold to an entirely different plant community. Through a good grazing management prescription, judicious brush management, and prescribed burning, the trend that created the Mesquite/Catclaw/Pricklypear Prairie Community (1.2) can be reversed.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	998	1608	2253
Tree	308	493	689
Shrub/Vine	151	247	347
Forb	78	123	174
Total	**1535**	**2471**	**3463**

Figure 11. Plant community growth curve (percent production by month). TX3624, Mesquite/Catclaw/Pricklypear Community. Mesquite/Catclaw/Pricklypear and other mixed brush species dominating the prairie with 15-20 percent canopy..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2	2	2	10	20	24	10	5	10	10	3	2

Pathway 1.1A
Community 1.1 to 1.2

Heavy abusive grazing, no brush management, no fire, and long-term drought conditions have led to the shift from the Mid/Tallgrass Prairie Community to the Mesquite/Catclaw/Pricklypear Prairie Community.

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing, prescribed burning, and brush management are some conservation practices that are required to revert back to the Mid/Tallgrass Prairie Community from the Mesquite/Catclaw/Pricklypear Prairie Community.

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing

State 2
Shrubland

Dominant plant species

- Ashe's juniper (*Juniperus ashei*), shrub
- honey mesquite (*Prosopis glandulosa*), shrub

Community 2.1
Mesquite/Catclaw/Pricklypear Shrubland

The Mesquite/Catclaw/Pricklypear Shrubland Community (2.1) is the result of an extreme shift of site characteristics from the original Mid/Tallgrass Prairie Community (1.1). Live oak, post oak, blackjack oak, western soapberry, and hackberry are present in numbers, but heavy mesquite, catclaw acacia, and pricklypear now dominate the site. The more palatable shrubs like elbowbush, littleleaf sumac, and bumelia are rare. More common are shrubs such as algerita, condalia, wolfberry, and Hercules-club pricklyash ((*Zanthoxylum clava-herculis*). Canopy may consist primarily of mesquite, catclaw, pricklypear, tasajillo (*Cylindropuntia leptocaulis*) or any combination of shrubby

species. Canopy cover ranges up to 40 percent or more. This strong competition for water, sunlight, and nutrients by shrubs has severely limited or eliminated grass populations. Various three-awns, Texas wintergrass, hairy tridens (*Erioneuron pilosum*), red grama (*Bouteloua trifida*), Texas grama (*Bouteloua rigidiseta*), and annuals dominate the plant population of this site. The forb component consists predominantly of annuals or unpalatable perennials. Often most of the original, fertile topsoil has eroded away. Bare soil has been capped 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 mid and tallgrass prairie 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, range planting, and implementation of intensive grazing management. Before beginning, the land manager should review the relative value of livestock and wildlife to the ranch and plan brush management accordingly.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	381	616	863
Shrub/Vine	325	527	740
Tree	269	437	611
Forb	106	174	241
Total	**1081**	**1754**	**2455**

Figure 13. Plant community growth curve (percent production by month). TX3625, Mesquite/Catclaw/Pricklypear Shrubland Community. Mesquite, Catclaw, and prickly pear are dominating the site with greater than 40 percent canopy cover..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2	3	5	10	20	23	10	5	10	7	3	2

Transition T1A
State 1 to 2

Heavy abusive grazing, no brush management, no fires, and long-term drought conditions have shifted the Prairie State to the Shrubland State.

Restoration pathway R2A
State 2 to 1

Prescribed grazing, brush management, range planting, and prescribed burning are some conservation practices that must be applied to revert from the Shrubland State to the Prairie State.

Conservation practices

Brush Management
Prescribed Burning
Range Planting
Prescribed Grazing

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	**Tallgrasses**			437–757	

	little bluestem	SCSC	*Schizachyrium scoparium*	437–757	–
2	**Tallgrasses**			291–757	
	big bluestem	ANGE	*Andropogon gerardii*	291–757	–
	Indiangrass	SONU2	*Sorghastrum nutans*	291–757	–
3	**Midgrasses**			583–942	
	Wright's threeawn	ARPUW	*Aristida purpurea var. wrightii*	583–942	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	583–942	–
	silver beardgrass	BOLAT	*Bothriochloa laguroides ssp. torreyana*	583–942	–
	Texas cupgrass	ERSE5	*Eriochloa sericea*	583–942	–
	green sprangletop	LEDU	*Leptochloa dubia*	583–942	–
	vine mesquite	PAOB	*Panicum obtusum*	583–942	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	583–942	–
	white tridens	TRAL2	*Tridens albescens*	583–942	–
4	**Shortgrasses**			146–375	
	buffalograss	BODA2	*Bouteloua dactyloides*	146–375	–
	curly-mesquite	HIBE	*Hilaria belangeri*	146–375	–
5	**Shortgrasses**			28–196	
	fall witchgrass	DICO6	*Digitaria cognata*	28–196	–
	Hall's panicgrass	PAHA	*Panicum hallii*	28–196	–
	slim tridens	TRMU	*Tridens muticus*	28–196	–
	slim tridens	TRMUE	*Tridens muticus var. elongatus*	28–196	–
6	**Cool Season Grasses**			146–375	
	cedar sedge	CAPL3	*Carex planostachys*	146–375	–
	Texas wintergrass	NALE3	*Nassella leucotricha*	146–375	–
7	**Secondary Shortgrasses**			0–28	
	Grass, annual	2GA	*Grass, annual*	0–28	–
	Texas grama	BORI	*Bouteloua rigidiseta*	0–28	–
	red grama	BOTR2	*Bouteloua trifida*	0–28	–
	hairy woollygrass	ERPI5	*Erioneuron pilosum*	0–28	–
Forb					
8	**Forbs**			106–224	
	Indian mallow	ABUTI	*Abutilon*	106–224	–
	zarzabacoa comun	DEIN3	*Desmodium incanum*	106–224	–
	bundleflower	DESMA	*Desmanthus*	106–224	–
	Engelmann's daisy	ENPE4	*Engelmannia peristenia*	106–224	–
	trailing krameria	KRLA	*Krameria lanceolata*	106–224	–
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	106–224	–
	snoutbean	RHYNC2	*Rhynchosia*	106–224	–
	awnless bushsunflower	SICA7	*Simsia calva*	106–224	–
	creepingoxeye	WEDEL	*Wedelia*	106–224	–
9	**Annual Forbs**			28–56	

	Forb, annual	2FA	*Forb, annual*	28–56	–
Shrub/Vine					
10	**Shrubs/Vines**			95–202	
	catclaw acacia	ACGR	*Acacia greggii*	95–202	–
	snakewood	CONDA	*Condalia*	95–202	–
	jointfir	EPHED	*Ephedra*	95–202	–
	stretchberry	FOPU2	*Forestiera pubescens*	95–202	–
	desert-thorn	LYCIU	*Lycium*	95–202	–
	algerita	MATR3	*Mahonia trifoliolata*	95–202	–
	pricklypear	OPUNT	*Opuntia*	95–202	–
	littleleaf sumac	RHMI3	*Rhus microphylla*	95–202	–
	bully	SIDER2	*Sideroxylon*	95–202	–
	greenbrier	SMILA2	*Smilax*	95–202	–
	Hercules' club	ZACL	*Zanthoxylum clava-herculis*	95–202	–
Tree					
11	**Tree**			62–123	
	hackberry	CELTI	*Celtis*	62–123	–
	honey mesquite	PRGL2	*Prosopis glandulosa*	62–123	–
	blackjack oak	QUMA3	*Quercus marilandica*	62–123	–
	post oak	QUST	*Quercus stellata*	62–123	–
	live oak	QUVI	*Quercus virginiana*	62–123	–
	western soapberry	SASAD	*Sapindus saponaria var. drummondii*	62–123	–
	elm	ULMUS	*Ulmus*	62–123	–

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 hydrology functions according to the existing plant community and its management. The water cycle functions most effectively when the site is dominated by mid and tall bunchgrasses. Rapid rainfall infiltration, high soil organic matter, good soil structure, and good porosity exist with a good cover of bunchgrass. Quality of surface runoff is high with low erosion and sedimentation levels. The higher infiltration rates facilitate water movement to deeper root zones and below, contributing to the recharge of aquifers and sustained streamflow.

In case of loss of bunchgrass and ground cover, the hydrologic cycle is impaired. Infiltration is decreased and runoff is increased due to poor ground cover, rainfall splash, soil capping, low organic matter, and poor structure. Some infiltration can still occur due to surface cracking of the soil when dry. A sparse ground cover combined with heavy rainfall contributes to increased frequency of flooding in a watershed, accelerated soil erosion, poor surface runoff, and increased sedimentation.

As the site becomes dominated by woody species the water cycle is further altered. An increase of woody species is matched by a decline in grass cover, duplicating some of the results of heavy abusive grazing. Increased interception of rainfall by tree canopies and its subsequent evaporation reduces the amount of water reaching the surface. The funneling effect of the canopy produces higher stemflow, concentrating more soil moisture at tree bases. Increased transpiration reduces deep percolation. Brush management combined with good grazing management can help restore the natural hydrology of the site.

Recreational uses

The area is pleasantly scenic with its low, rounded hills, scattered trees, and tallgrasses, especially when in fall colors. The area is popular for hunting as well as activities such as hiking and birding.

Inventory data references

Information presented was derived from literature, limited NRCS clipping data (417s), field observations, and personal contacts with range-trained personnel.

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Acknowledgments

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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	05/20/2024
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:**

17. **Perennial plant reproductive capability:**