USDA Natural Resources
Conservation Service

Ecological site R081BY328TX
Deep Redland 23-31 PZ

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Accessed: 01/14/2025

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.

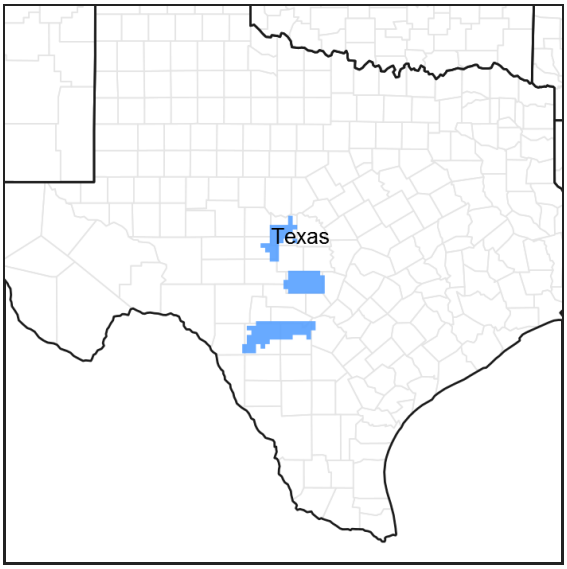


Figure 1. Mapped extent

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.

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

Deep 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.

Associated sites

R081BY337TX	**Low Stony Hill 23-31 PZ** The Low Stony Hill site is on adjacent slopes without red subsoil or Post oak trees.
R081BY340TX	**Redland 23-31 PZ** The Redland site has shallower soils.
R081BY343TX	**Shallow 23-31 PZ** The Shallow site is on adjacent slopes without the red subsoil or Post oak trees.
R081BY348TX	**Steep Adobe 23-31 PZ** The Steep Adobe site is on slopes greater than 20 percent.
R081BY320TX	**Adobe 23-31 PZ** The Adobe site is on adjacent slopes without the red subsoil or Post oak trees.

Similar sites

R081BY340TX	**Redland 23-31 PZ** The Redland site has shallower soils.
R081BY332TX	**Gravelly Redland 23-31 PZ** The Gravelly Redland site has more than 35 percent fragments in the soil profile.

Table 1. Dominant plant species

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

Physiographic features

The Deep Redland site is found on nearly level to gently sloping uplands. Slopes range from 0 to 5 percent. The elevation ranges from 1,000 to 2,250 feet. With deeper soils, the site is used for cropland, pasture, and rangeland. The landform is upland plains and on top of ridges.

Table 2. Representative physiographic features

Landforms	(1) Plateau > Plain (2) Plateau > Ridge
Runoff class	Very high
Flooding frequency	None
Ponding frequency	None
Elevation	305–686 m
Slope	0–5%
Aspect	Aspect is not a significant factor

Table 3. Representative physiographic features (actual ranges)

Runoff class	Not specified
Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	Not specified
Slope	0–8%

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 4. Representative climatic features

Frost-free period (characteristic range)	235-255 days
Freeze-free period (characteristic range)	240-280 days
Precipitation total (characteristic range)	635-711 mm
Frost-free period (actual range)	235-255 days
Freeze-free period (actual range)	240-280 days
Precipitation total (actual range)	610-762 mm
Frost-free period (average)	245 days
Freeze-free period (average)	260 days
Precipitation total (average)	686 mm

Climate stations used

- (1) BRADY [USC00411017], Brady, TX
- (2) EDEN [USC00412741], Eden, TX
- (3) FREDERICKSBURG [USC00413329], Fredericksburg, TX
- (4) FT MCKAVETT [USC00413257], Fort Mc Kavett, TX
- (5) HUNT 10 W [USC00414375], Hunt, TX
- (6) JUNCTION 4SSW [USC00414670], Junction, TX
- (7) JUNCTION KIMBLE CO AP [USW00013973], Junction, TX
- (8) MENARD [USC00415822], Menard, TX
- (9) ROCKSPRINGS 1S [USC00417706], Rocksprings, TX
- (10) SAN SABA [USC00417992], San Saba, 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 consist of moderately deep, well drained, very slowly permeable soils that formed in materials weathered from limestone. The surface layer is very dark gray to dark reddish gray, moderate fine and medium subangular blocky, and granular clay about four to seven inches thick. Depth to bedrock ranges from 21 to 40 inches and coarse fragments from a few to 15 percent by volume. Cracks up to 2 inches wide at the soil surface extend to 20 inches or more when the soil is dry. The upper layers of the soil have 0 to 5 percent calcium carbonate and the lower layer just above the limestone can have up to 25 percent calcium carbonate. Soil series correlated to this site

include: Lindy and Topia.

Table 5. Representative soil features

Parent material	(1) Residuum–limestone
Surface texture	(1) Clay
Family particle size	(1) Very-fine (2) Fine
Drainage class	Well drained
Permeability class	Slow to very slow
Depth to restrictive layer	53–102 cm
Soil depth	53–102 cm
Surface fragment cover <=3"	0–15%
Surface fragment cover >3"	0–10%
Available water capacity (0-101.6cm)	6.6–12.95 cm
Calcium carbonate equivalent (0-101.6cm)	0–15%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	6.1–8.4
Subsurface fragment volume <=3" (10.2-101.6cm)	0–10%
Subsurface fragment volume >3" (10.2-101.6cm)	0–1%

Table 6. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Not specified
Depth to restrictive layer	Not specified
Soil depth	Not specified
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	Not specified
Calcium carbonate equivalent (0-101.6cm)	0–25%
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	Not specified
Soil reaction (1:1 water) (0-101.6cm)	Not specified
Subsurface fragment volume <=3" (10.2-101.6cm)	Not specified

Subsurface fragment volume >3" (10.2-101.6cm)	Not specified

Ecological dynamics

The Deep Redland is a midgrass and tallgrass oak savannah with scattered trees and numerous perennial forbs. Tall and midsize bunch grasses, perennial forbs, and some shortgrasses probably occupy most of the soil 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.

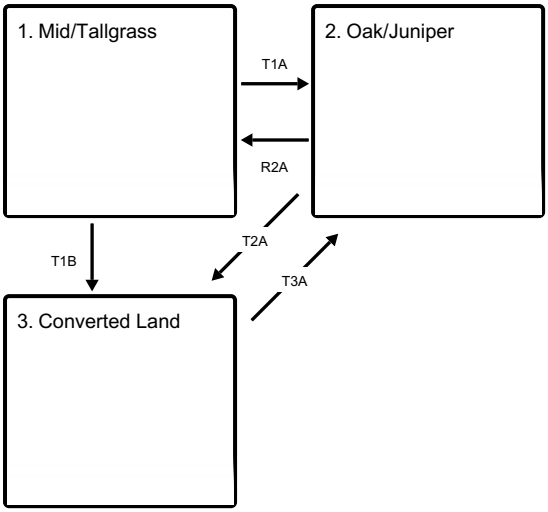
Extremes in climate exerted tremendous influence on the site long before European man arrived. Geologic formations, archeological findings and rainfall records since the mid-1900’s show wide variations in precipitation, with cycles of long, dry periods going back thousands of years. Reference community 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*), cane bluestem (*Bothriochloa barbinodis*), awnless bushsunflower (*Simsia calva*), and Maximilian sunflower (*Helianthus maximiliani*), were selected repeatedly and eventually began to disappear from the ecosystem to be replaced by lower successional, less palatable, and less productive species like buffalograss (*Bouteloua dactyloides*), curlymesquite (*Hilaria belangeri*), hairy grama (*Bouteloua hirsuta*), Hall's panicum (*Panicum hallii*), perennial three-awn (Aristida spp.), 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 Ashe juniper, algerita (Mahonia trifiolata), condalia (Condalia spp.), mesquite, and prickly pear (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

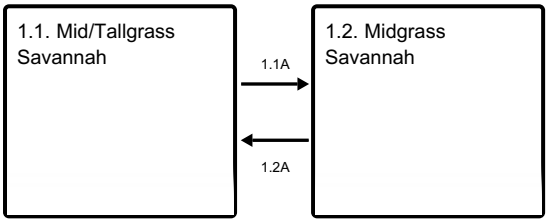
T1B - Extensive soil disturbance followed by seeding

R2A - Reintroduction of historic disturbance return intervals

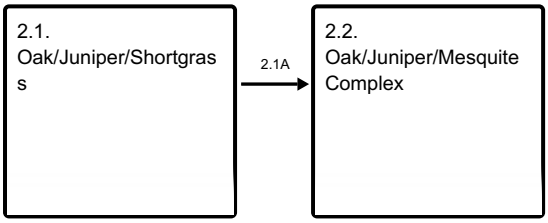
T2A - Extensive soil disturbance followed by seeding

T3A - Absence of disturbance and natural regeneration over time, may be coupled with excessive grazing pressure

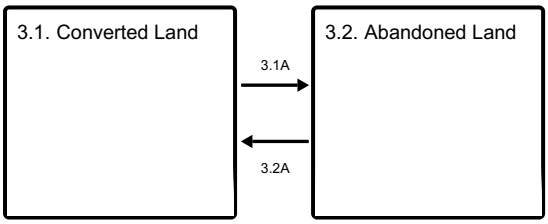
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Mid/Tallgrass

Dominant plant species

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

Community 1.1

Mid/Tallgrass Savannah

Figure 8. 1.1 Mid/Tallgrass Savannah Community

This community is a savannah composed of mid and tallgrasses with scattered trees that evolved under the influence of grazing, periodic fire, and climate. The overstory shades less than 10 percent of the site and consists primarily of scattered post oak (*Quercus stellata*), live oak (*Quercus virginiana*), blackjack oak (*Quercus marilandica*), and several other species. Also present are occasional shrubs such as algerita, bumelia (Sideroxylon spp.), elbowbush (*Forestiera pubescens*), ephedra (Ephedra spp.), and littleleaf sumac (*Rhus microphylla*). Mid and tallgrasses such as big bluestem, little bluestem, Indiangrass (Sorgastrum nutans), cane bluestem, plains lovegrass (*Eragrostis intermedia*), and sideoats grama (*Bouteloua curtipendula*) dominate the site. Perennial forbs such as awnless bushsunflower, Maximilian sunflower, Engelmann's daisy (*Engelmannia peristenia*), and bundleflower (Desmanthus spp.) are a smaller but important component of the plant community. In wet years, annual forbs produce significant herbaceous vegetation, particularly when precipitation follows a long dry spell. Plants are vigorous, and reproduction is rapid during wet weather. Interspaces between plants are moderately covered with litter. The soil surface is relatively cool, rich in humus, and hosts a microbe population actively decomposing organic matter. Soil erosion is insignificant. Infiltration is slow due to the high clay content of the soil but enhanced by the deep root systems of the taller grasses and perennial forbs. Runoff only occurs during heavier rainfall but is dispersed and slowed by vegetative ground cover. Concentrated water-flow patterns are rare. Recurrent periodic fire, climatic patterns, and grazing by herbivores are natural processes that maintain this plant community. Interruption of the ecological processes of a site brings about change. The reference plant community includes large populations of high successional grasses and smaller, but highly important, numbers of perennial forbs. Extended drought, continued overuse, and elimination of fire result in their 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 (*Aristida purpurea* var. wrightii), slim tridens (*Tridens muticus*), fall witchgrass (*Digitaria cognata*), Scribner's panicum (*Dichanthelium oligosanthes*) ,and shortgrasses like buffalograss, red grama (*Bouteloua trifida*), and curlymesquite (*Hilaria belangeri*) along with lower successional forbs such as croton (Croton spp.), globemallow (Sphaeralcea spp.) and annuals begin to increase. Ashe juniper, mesquite, algerita, condalia and prickly pear begin to appear. More bare ground is evident. If the process is not halted or reversed, the community shifts toward the Midgrass Savannah Community (1.2).

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	2477	3004	4192
Forb	202	247	347
Tree	146	174	247
Shrub/Vine	90	106	146
Total	**2915**	**3531**	**4932**

Figure 10. Plant community growth curve (percent production by month). TX3605, Midgrass/Oak Savannah with less 10% canopy. Warm season rangeland with peaks in annual production from herbaceous layer in May and in September..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	3	5	13	22	15	5	3	15	7	5	4

Community 1.2
Midgrass Savannah

Figure 11. 1.2 Midgrass Savannah Community

This community still resembles a Mid/Tallgrass Savannah Community (1.1) plant structure to casual observation. There has been a measurable decline of dominant midgrasses, tallgrasses and perennial forbs. This decline is caused by overstocking, elimination of fire, lack of brush management, and possibly changes in weather patterns. These changes have allowed the population of juniper and other woody species to increase. Vigor and reproduction of the dominant grass species decline and they begin to be replaced by buffalograss, slim tridens, fall witchgrass, Hall’s panicum, and other shortgrasses. 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 Ashe juniper regrowth seedlings are apparent, as are a few scrubby mesquite seedlings. Ground cover by litter decreases. Soil organic matter is decreasing. Infiltration begins to drop off and runoff increases. Signs of erosion begin to appear. Encroachment by brush, replacement of mid and tallgrasses, loss of topsoil, and loss of soil organic matter make the reversal difficult for these abused areas to return to the reference plant community even if 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 plants. Prescribed burning can be used to control small woody plants and their seedlings, especially Ashe juniper that is up to four feet tall. These species can also be controlled through individual plant treatment (IPT), mechanically, or with appropriate chemical application. If the trend is not reversed, the community will eventually shift to the Oak/Juniper State (2), which will require higher investment of labor and financial resources.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1984	2399	3351
Tree	247	303	420
Forb	151	179	252
Shrub/Vine	101	118	168
Total	**2483**	**2999**	**4191**

Figure 13. Plant community growth curve (percent production by month). TX3606, Midgrass/Oak/Mixedbrush Savannah. Warm season species begin growth in late April. Their peak growth is in late May with a lesser peak in September. Cool season species initiate fall/winter growth after September solstice and rains..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	3	5	13	22	15	5	3	15	7	5	4

Pathway 1.1A
Community 1.1 to 1.2

Mid/Tallgrass Savannah **Midgrass Savannah**

With heavy abusive grazing and no fires, the Mid/Tallgrass Savannah Community would shift to the Midgrass Savannah Community.

Pathway 1.2A
Community 1.2 to 1.1

Midgrass Savannah **Mid/Tallgrass Savannah**

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 (IPT) and prescribed burning is key to any attempt to return to the reference community.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 2
Oak/Juniper

Dominant plant species

- oak (*Quercus*), tree
- juniper (*Juniperus*), tree

Community 2.1
Oak/Juniper/Shortgrass

Figure 14. 2.1 Oak/Juniper/Shortgrass Community

This community represents a significant vegetation shift, crossing the threshold from the Mid/Tallgrass Savannah State (1) to the Oak/Juniper State (2). The major woody increaser species (live oak, post oak, and Ashe juniper) have multiplied until they comprise about 20 percent of the overstory canopy and exert strong influence on the site. The reference mid and tallgrasses are scarce, heavily grazed, or shaded out. Shortgrasses and three-awn species (Aristida spp.) are predominant. Texas wintergrass (*Nassella leucotricha*) also increases. Palatable perennial forbs are nearly gone. Toxic plants to livestock appear such as groundsel (Senecio spp.) and twoleaf senna (*Senna roemeriana*). The site contains juniper over four feet tall as well as major increases in shrubs such as condalia, algerita, catclaw acacia, and Hercules-club pricklyash (*Zanthoxylum clava-herculis*). Much 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 species such as Texas filaree (*Erodium texanum*), California filaree (*Erodium cicutarium*), and redseed plantain (*Plantago rhodosperma*), provide a certain amount of high-quality forage for sheep, goats, and deer during winter and early spring, but quickly dry up when summer arrives. Plant litter is scarce and organic matter is low. Less water infiltrates while surface runoff increases. Topsoil loss through erosion accelerates, evidenced by plants on pedestals, rills, and stunted growth. Sheet erosion, though not easily detected, is high. If proper management is not planned and implemented, the site will continue to degrade and the community site will shift toward an Oak/Juniper/Mesquite Complex Community (2.2). By implementing conservation practices such as brush management, prescribed grazing and prescribed burning, this community can possibly be shifted back toward the Mid/Tallgrass State (1).

Table 9. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1485	1805	2516
Tree	291	347	493
Forb	151	185	263
Shrub/Vine	106	129	174
Total	**2033**	**2466**	**3446**

Figure 16. Plant community growth curve (percent production by month). TX3611, Oak/Juniper Grassland. Oak/Juniper grassland with 20% canopy of oaks, junipers and shrubs..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	5	8	13	18	12	5	3	12	10	7	4

Community 2.2
Oak/Juniper/Mesquite Complex

Figure 17. 2.2 Oak/Juniper/Mesquite Complex Community

The Oak/Juniper/Mesquite Complex Community (2.2) is the result of an extreme shift of site characteristics from the original Mid/Tallgrass Savannah Community (1.1). Overstory species like Ashe juniper, mesquite, and live oak dominate the site and can reach heights of 20 feet. Species found in the midstory include shrubs like algerita, condalia, elbowbush, and littleleaf sumac. Woody canopy cover exceeds 30 percent. This strong competition for water, sunlight, and nutrients has severely limited or eliminated shortgrass populations, let alone the original mid/tallgrass community. Three-awns, hairy tridens (*Erioneuron pilosum*), red grama (*Bouteloua trifida*), Texas grama (*Bouteloua rigidiseta*), and annuals dominate the grass plant population of this plant community. The forb component consists predominantly of annuals or unpalatable perennials. Up to 60 percent is bare ground which is void of grasses and forbs. Most of the original, fertile topsoil has been eroded away. The top soil can be cemented and is relatively impermeable by water. 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/tallgrass savannah have negatively impacted soil properties, species diversity, site integrity, and hydrological processes. It can, however, be manipulated toward a community similar in composition and function through extensive mechanical and chemical brush management, range planting, and implementation of intensive grazing management. Before beginning, planning may be necessary by the land manager to review the relative value of livestock and wildlife to the ranch and plan the desired methods of brush management that will effectively benefit goals and objectives of the land manager.

Table 10. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	622	751	1048
Tree	583	695	986
Shrub/Vine	179	247	347
Forb	101	123	174
Total	**1485**	**1816**	**2555**

Figure 19. Plant community growth curve (percent production by month). TX3612, Oak/Juniper Complex. Yearlong green forage due to shrubs and cool-season species growth in winter and spring. Peak rainfall period from April through September provides most productivity during summer growing season. Ashe Juniper, oaks, and shrub dominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5	7	8	12	15	10	5	4	12	10	7	5

Pathway 2.1A
Community 2.1 to 2.2

Oak/Juniper/Shortgrass

Oak/Juniper/Mesquite Complex

With heavy abusive grazing, no fire, no brush management, and brush invasion, the Oak/Juniper/Shortgrass Community shifts to the Oak/Juniper/Mesquite Complex Community.

State 3
Converted Land

Dominant plant species

- panicgrass (*Panicum*), grass

Community 3.1
Converted Land

This community is the product of endeavors to reclaim the Oak/Juniper/Mesquite Complex Community (2.2) or, less frequently, the Oak/Juniper/Shortgrass Community (2.1). The Converted Land Community can be planted into cropland, pastureland, or reclaimed land. Depending on the goals of the land manager, reclamation efforts might involve the whole site or only portions. A land manager involved primarily with livestock operations might prefer more open, grassy areas, whereas one interested mostly in wildlife operations may want to leave substantial brushy areas. Reclaimed land or pastureland can be achieved through brush management involving heavy equipment, reseeding of native species (both grasses and forbs), prescribed grazing, and re-introduction of fire. The manager can possibly manipulate this site successfully towards a reference community appearance. A very high treatment cost should be expected. The site will not be able to mirror exactly the original plant community; however, utilizing natives as the reseeding source will greatly benefit most wildlife. This plant community may also be comprised of seeded species which are introduced to the area and are most effective as a monoculture plant community. This type of community may contain less cover or food for wildlife which leads to native grasses and forbs being practically devoid. The site's capacity to produce vegetation must be determined over time under careful management. Maintenance through prescribed grazing, prescribed burning, and individual plant treatment (IPT) with appropriate chemicals can preserve the annual production. Without these measures, encroachment of woody species is inevitable.

Table 11. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1905	2326	3250
Forb	224	252	364
Tree	56	56	84
Shrub/Vine	–	–	–
Total	**2185**	**2634**	**3698**

Figure 21. Plant community growth curve (percent production by month). TX3600, Cool Season Crops. Cool season species are planted in the fall for winter and spring growth. Species include wheat and oats..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5	5	10	10	5	0	0	0	20	25	15	5

Figure 22. Plant community growth curve (percent production by month). TX3601, Warm Season Crops. Warm season species are planted in early spring. Their peak growth is in late May with a lesser peak in September. Forage and Grain sorghum that are planted during the warm season months..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	8	20	25	20	10	10	5	2	0	0

Figure 23. Plant community growth curve (percent production by month). TX3613, Reclaimed Land. Reclaimed Land seeded with native or introduced species..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	3	5	13	22	15	5	3	15	7	5	4

Community 3.2
Abandoned Land

The Abandoned Land Community results from leaving the land idle without seeding or brush management. Brush invasion from adjacent seed sources is common. The initial composition of abandoned and idled fields is composed of annuals, biennials, and weak perennials. The species depends on the seed source from adjacent rangeland. The rate of vegetative succession depends on grazing management and drought frequency, but reestablishment of reference conditions takes many years. Without grazing management and brush management, brush species such as pricklypear, mesquite, and juniper will dominate before a grass community can establish. Biomass production will be limited in the early seral stage and increase. Due to soil changes, such as compaction and reduced structure, it is unlikely that production levels will achieve pre- plowed conditions for a long time.

Table 12. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	616	1110	1480
Forb	336	605	807
Shrub/Vine	112	202	269
Tree	56	101	135
Total	**1120**	**2018**	**2691**

Figure 25. Plant community growth curve (percent production by month). TX3619, Midgrass/Mixedbrush Community. Midgrass and Mixedbrush summer growth with some cool season grass growth..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	3	7	13	20	15	7	5	10	7	5	5

Pathway 3.1A
Community 3.1 to 3.2

Due to land abandonment or idling and no brush management, the Converted Land Community would shift to the Abandoned Land Community.

Pathway 3.2A
Community 3.2 to 3.1

With prescribed grazing, brush management, prescribed burning, crop cultivation, and range/pasture planting, the Abandoned Land Community shifts to the Converted Land Community.

Conservation practices

Brush Management
Prescribed Burning
Range Planting

Prescribed Grazing

Transition T1A
State 1 to 2

With heavy abusive grazing, no fires, no brush management, and invasion of brush species, the Mid/Tallgrass State would shift to the Oak/Juniper State.

Transition T1B
State 1 to 3

With brush management and crop cultivation, the Mid/Tallgrass State can shift to the Converted Land State.

Restoration pathway R2A
State 2 to 1

With the implementation of various conservation practices such as prescribed grazing, brush management, and prescribed burning, the Oak/Juniper State could revert back to the Mid/Tallgrass State.

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing

Transition T2A
State 2 to 3

With prescribed grazing, brush management, range planting, and prescribed burning, the Oak/Juniper State can shift to the Converted Land State.

Transition T3A
State 3 to 2

With heavy abusive grazing, no fires, no brush management, and brush invasion, the Converted Land State will revert back to the Oak/Juniper State.

Additional community tables

Table 13. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tallgrasses**			353–701	
	little bluestem	SCSC	*Schizachyrium scoparium*	353–701	–
2	**Tallgrasses**			706–1373	
	big bluestem	ANGE	*Andropogon gerardii*	706–1373	–
	Indiangrass	SONU2	*Sorghastrum nutans*	706–1373	–
	eastern gamagrass	TRDA3	*Tripsacum dactyloides*	706–1373	–
3	**Midgrasses**			353–919	
	cane bluestem	BOBA3	*Bothriochloa barbinodis*	353–919	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	353–919	–
	silver bluestem	BOLAT	*Bothriochloa laguroides* ssp. *torreyana*	353–919	–

	silver beardgrass	BOLA1	*Bothriochloa laguroides ssp. torreyana*	353–919	–
	plains lovegrass	ERIN	*Eragrostis intermedia*	353–919	–
	Texas cupgrass	ERSE5	*Eriochloa sericea*	353–919	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	353–919	–
4	**Secondary Midgrasses**			179–448	
	Wright's threeawn	ARPUW	*Aristida purpurea var. wrightii*	179–448	–
	vine mesquite	PAOB	*Panicum obtusum*	179–448	–
	white tridens	TRAL2	*Tridens albescens*	179–448	–
5	**Cool Season Grasses**			179–448	
	cedar sedge	CAPL3	*Carex planostachys*	179–448	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	179–448	–
	Canada wildrye	ELCA4	*Elymus canadensis*	179–448	–
	Texas wintergrass	NALE3	*Nassella leucotricha*	179–448	–
6	**Shortgrasses**			34–241	
	buffalograss	BODA2	*Bouteloua dactyloides*	34–241	–
	fall witchgrass	DICO6	*Digitaria cognata*	34–241	–
	curly-mesquite	HIBE	*Hilaria belangeri*	34–241	–
	Hall's panicgrass	PAHA	*Panicum hallii*	34–241	–
7	**Secondary Shortgrasses**			11–84	
	Grass, annual	2GA	*Grass, annual*	11–84	–
	Texas grama	BORI	*Bouteloua rigidiseta*	11–84	–
	red grama	BOTRB	*Bouteloua trifida var. burkii*	11–84	–
	hairy woollygrass	ERPI5	*Erioneuron pilosum*	11–84	–
Forb					
8	**Forbs**			168–280	
	Indian mallow	ABUTI	*Abutilon*	168–280	–
	zarzabacoa comun	DEIN3	*Desmodium incanum*	168–280	–
	bundleflower	DESMA	*Desmanthus*	168–280	–
	Engelmann's daisy	ENPE4	*Engelmannia peristenia*	168–280	–
	milkpea	GALAC	*Galactia*	168–280	–
	beeblossom	GAURA	*Gaura*	168–280	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	168–280	–
	lespedeza	LESPE	*Lespedeza*	168–280	–
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	168–280	–
	snoutbean	RHYNC2	*Rhynchosia*	168–280	–
	awnless bushsunflower	SICA7	*Simsia calva*	168–280	–
	creepingoxeye	WEDEL	*Wedelia*	168–280	–
9	**Annual Forbs**			34–67	
	Forb, annual	2FA	*Forb, annual*	34–67	–
Shrub/Vine					
10	**Shrubs**			90–146	
	snakewood	CONDA	*Condalia*	90–146	–

	jointfir	EPHED	*Ephedra*	90–146	–
	stretchberry	FOPU2	*Forestiera pubescens*	90–146	–
	algerita	MATR3	*Mahonia trifoliolata*	90–146	–
	littleleaf sumac	RHMI3	*Rhus microphylla*	90–146	–
	bully	SIDER2	*Sideroxylon*	90–146	–
	greenbrier	SMILA2	*Smilax*	90–146	–
	Hercules' club	ZACL	*Zanthoxylum clava-herculis*	90–146	–
Tree					
11	**Trees**			146–247	
	hackberry	CELTI	*Celtis*	146–247	–
	blackjack oak	QUMA3	*Quercus marilandica*	146–247	–
	post oak	QUST	*Quercus stellata*	146–247	–
	live oak	QUVI	*Quercus virginiana*	146–247	–
	elm	ULMUS	*Ulmus*	146–247	–

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 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

This site usually has a scenic setting, bordered by rolling hills or steep bluffs. The abundant mid and tall grasses and scattered oaks produce beautiful fall colors variations. The area is also popular for hunting, birding, hiking, and other eco-tourism related activities.

Wood products

Mesquite and oaks can be used for firewood and the specialty wood industry. Ashe juniper is often used for fence posts. A type of oil can be extracted from dry Ashe juniper wood to be used commercially.

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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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	01/14/2025
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:**