USDA Natural Resources Conservation Service

Ecological site R081CY356TX
Blackland 29-35 PZ

Last updated: 9/19/2023
Accessed: 05/21/2025

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.

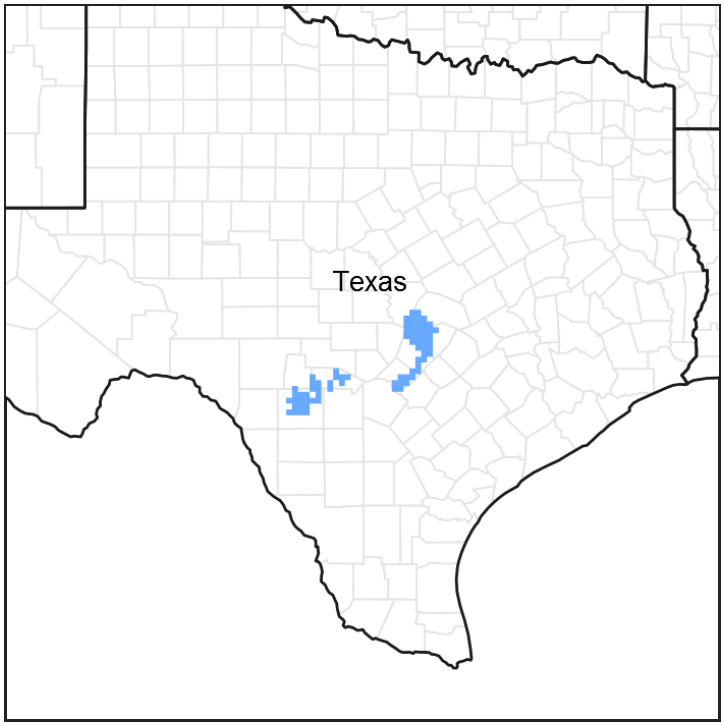


Figure 1. Mapped extent

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): 081C–Edwards Plateau, Eastern Part

This area represents the eastern part of the Edwards Plateau region. Limestone ridges and canyons and nearly level to gently sloping valley floors characterize the area. The

elevation is 400 feet (120 meters) at the eastern end of the area and increases westward to 2,400 feet (730 meters) on ridges. This area is underlain primarily by limestones in the Glen Rose, Fort Terrett, and Edwards Formations of Cretaceous age. Quaternary alluvium is in river valleys.

Classification relationships

This ecological site is correlated to soil components at the Major Land Resource Area (MLRA) level which is further described in USDA Ag Handbook 296.

Ecological site concept

These sites occur on moderately deep clay soils on uplands. The soils have a high shrink-swell potential and gilgai may be present. The reference vegetation includes tall and midgrass species with a variety of forbs and very few woody species. Without fire or brush management, woody species are likely to increase on the site. Many of these sites were cultivated in the past and some may still be in crop production.

Associated sites

R081CY359TX	**Gravelly Redland 29-35 PZ** They are both located on similar topography but has shallower soils and less production.
R081CY360TX	**Low Stony Hill 29-35 PZ** Low Stony Hill is located upslope from the Blackland site.

Similar sites

R086AY011TX	**Southern Blackland** The Southern Blackland ecological site from MLRA 86A is the most similar but has a higher yearly total rainfall.

Table 1. Dominant plant species

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

Physiographic features

These soils were formed in calcareous clayey sediments over hard limestone. These nearly level to gently sloping soils are on uplands. Soils are found along terraces, narrow stream divides or slopes along drainage ways. Slopes range from 0 to 20 percent.

Elevation ranges from 600 to 1500 feet above sea level. Runoff is high to very high.

Table 2. Representative physiographic features

Landforms	(1) Plateau > Ridge
Runoff class	High to very high
Flooding frequency	None
Ponding frequency	None
Elevation	183–457 m
Slope	1–20%
Aspect	Aspect is not a significant factor

Climatic features

The climate is humid subtropical and is characterized by hot summers and relatively mild winters. The average first frost should occur around November 15 and the last freeze of the season should occur around March 19.

The average relative humidity in mid-afternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible during the summer and 50 percent in winter. The prevailing wind direction is southeast.

Drought is calculated as 75% below average rainfall. It should be noted that timing of rainfall may be more significant than average rainfall.

Approximately two-thirds of annual rainfall occurs during the April to September period. Rainfall during this period generally falls during thunderstorms, and fairly large amount of rain may fall in a short time. Hurricanes provide another source of extremely high rains in a short time. A review of the rainfall records suggest that rainfall is below “normal” at least 60 percent of the time. Therefore, the erratic nature of the rainfall should be considered when developing any land management plans.

The impact of droughts in the Edwards Plateau cannot be under-estimated. Not only are droughts devastating to the land but also to those that manage the land. Droughts occur roughly every 20 years but not always. A severe drought in 2012 coupled with extreme heat resulted in a die off of juniper over millions of acres as well as other native plants.

Table 3. Representative climatic features

Frost-free period (characteristic range)	230-260 days
Freeze-free period (characteristic range)	227-269 days

Precipitation total (characteristic range)	813-940 mm
Frost-free period (actual range)	210-260 days
Freeze-free period (actual range)	224-332 days
Precipitation total (actual range)	787-940 mm
Frost-free period (average)	245 days
Freeze-free period (average)	257 days
Precipitation total (average)	864 mm

Climate stations used

- (1) MEDINA 1NE [USC00415742], Medina, TX
- (2) SAN ANTONIO/SEAWORLD [USC00418169], San Antonio, TX
- (3) KERRVILLE 3 NNE [USC00414782], Kerrville, TX
- (4) BLANCO [USC00410832], Blanco, TX
- (5) CANYON DAM [USC00411429], Canyon Lake, TX
- (6) BURNET MUNI AP [USW00003999], Burnet, TX
- (7) AUSTIN GREAT HILLS [USC00410433], Austin, TX
- (8) GEORGETOWN LAKE [USC00413507], Georgetown, TX
- (9) PRADE RCH [USC00417232], Leakey, TX

Influencing water features

These upland sites may shed some water via runoff during heavy rain events. The presence of good ground cover and deep-rooted grasses can help facilitate infiltration and reduce sediment loss.

Wetland description

N/A

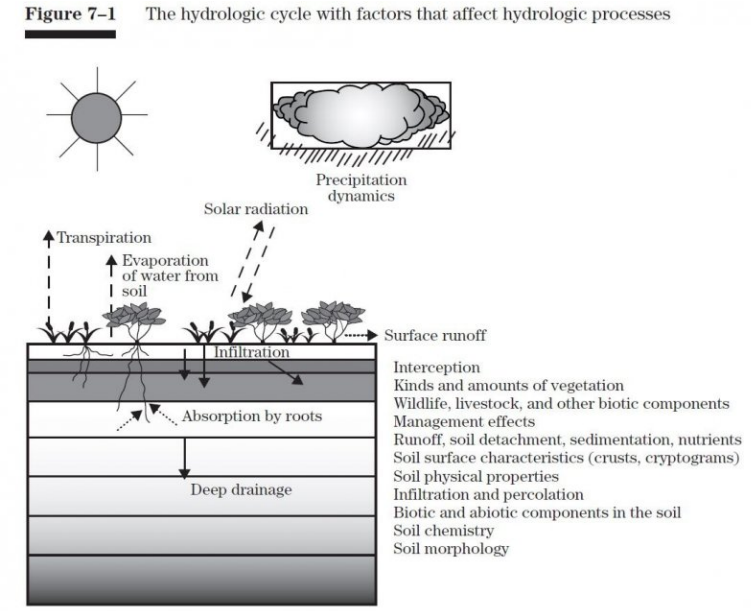


Figure 8.

Soil features

The representative soil features consist of moderately deep to very deep, moderately well drained, very slowly permeable soils. This soil is moderately well drained. Permeability is very slow when the soil is saturated and rapid when it is dry and cracked. These clayey soils have very high shrink-swell potential.

The associated soil series for the Blackland ecological site include:

Medlin
San Saba

Table 4. Representative soil features

Parent material	(1) Alluvium–limestone (2) Residuum–limestone (3) Residuum–claystone
Surface texture	(1) Clay (2) Stony clay
Drainage class	Moderately well drained to well drained
Permeability class	Very slow
Depth to restrictive layer	102–152 cm
Soil depth	102–152 cm
Surface fragment cover <=3"	0–20%
Surface fragment cover >3"	0–4%

Available water capacity (0-101.6cm)	7.87–18.03 cm
Calcium carbonate equivalent (0-101.6cm)	2–35%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–2
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.4
Subsurface fragment volume <=3" (10.2-101.6cm)	0–10%
Subsurface fragment volume >3" (10.2-101.6cm)	0–5%

Ecological dynamics

The Reference Plant Community of the Backland Ecological Site in MLRA 81C was developed under a sub-tropical humid climate over time, as did the soils of the site. Periodic droughts, fire and grazing or browsing by endemic and nomadic wildlife influenced the plant community as well. The considerable precipitation (28 to 38 inches per year) comes primarily from convective storms during the warm season that favors deep-rooted vegetation. Deep-rooted trees and fire resistant shrubs, however, occupied only draws and ridges where they were protected from frequently occurring fires (Bray 1904 and Foster 1917). Recent studies conclude that before European settlement in the 1800's fires occurred at 7 to 12 year intervals in the Eastern Edwards Plateau region (Frost 1998). Without frequent and intense recurring fires, the Blackland Ecological Site would likely have been woodland. To the contrary, the Plant Community found by early pioneers was an open prairie with mostly tallgrasses, forbs and scattered mottes of woody species, a community known as the Tallgrass Prairie Community (1.1). Fire was the dominant disturbance factor in shaping the Reference State.

The dominant grasses were little bluestem (*Schizachyrium scoparium*), big bluestem (Andrpogon gerardii), Indiangrass (Sorgastrum nutans) and switchgrass (*Panicum virgatum*). Secondary grasses were midgrasses, characteristically sideoats grama (*Bouteloua curtipendula*), and feathery bluestems (Bothriochloa spp.). Representative forbs were Maximilian sunflower (*Helianthus maximiliani*), dalea (Dalea spp.), bundleflower (Desmanthus spp.), and gayfeather (Liatris spp.). Live oak (*Quercus virginiana*), elbowbush (*Forestiera pubescens*) and sumacs (Rhus spp.) were characteristic woody species. The endemic woody plants, historically, shaded less than 5 percent of the soil surface either as small mottes or individual trees that were either resistant to fire or occupied areas where fires were less frequent or intense.

The demise of the Native American Indians, the onset of livestock husbandry and the cessation of periodic intense fires changed the ecological dynamics of the vegetation on the Blackland site. Although recent climatic warming trends and increases in atmospheric carbon dioxide may be enhancing vegetation change, the major forces influencing transition from the historic climax plant community to a woodland state are long term overgrazing by livestock and the decrease in frequency and intensity of fire (Archer 1994).

The overstocking by cattle, sheep and goats in the late 1800's began a change in the plant composition of the Tallgrass Prairie Community towards a mixed-grass savannah with increasing woody species. As livestock numbers increased and grazing use exceeded the preferred plants ability to sustain defoliation year after year, the most palatable species gave way to less palatable or more grazing resistant species. Because of selective grazing, the more palatable tallgrasses decreased, giving way to secondary species such as sideoats grama, dropseeds (Sporobolus spp.), lovegrasses (Eragrostis spp.), feathery bluestems and Texas wintergrass (*Nassella leucotricha*). The better quality forbs were replaced with less palatable species such as orange zexmenia (Wedelia hispida), scurfpea (*Pediomelum cuspidatum*) and annuals. The woody species that had been kept in check by fire and grass competition, such as oak (Quercus spp.), Ashe juniper (*Juniperus ashei*) and mesquite (*Prosopis glandulosa*) increased in size and density. Less palatable shrubby species, such as prickly pear (Opuntia spp.) and algerita (*Mahonia trifoliolata*), also increased in density and stature. The site became vulnerable to invasion of species from adjacent sites. The composition and structure change brought about a new plant community, the Mixed-grass Oak Savannah Community (2). The vegetation type had shifted toward a woodland state but herbaceous vegetation was still the dominant primary production component. This phase was recognized for its advantage to browsers, so historically, goat and sheep numbers increased along with cattle. The continuous overstocking and the simultaneous decrease in frequency and intensity of fires caused the grassland community to continue the transition toward a woodland plant community.

In the Mixed-Grass Oak Savannah Community (1.2), ecological processes have changed slightly, but the pathway back to the reference community can be accomplished without costly accelerating conservation practices. Good grazing management alone will not reverse retrogression, however. Some form of woody plant control, such as prescribed burning, must accompany it.

If the combination of overgrazing and decrease in fires continue, oaks, junipers, and mesquite along with unpalatable shrubs become dominant to the detriment of the herbaceous species. Understory shrubs, such as algerita and pricklypear, increase. Grazing resistant grasses, such as buffalograss (*Bouteloua dactyloides*) and Texas wintergrass (*Nassella leucotricha*), replace the tallgrasses and less preferred forbs replace the palatable climax forbs.

The decrease in herbaceous cover and increase in bare ground precludes effective prescribed burning and accommodates soil erosion. Soil organic matter and soil structure decline as less vegetative matter is added to the soil. Soil and litter movement will occur

during flood producing rains and water infiltration rate decreases as soil structure deteriorates. When woody plant canopy reaches 30 to 35 percent and grasses provide less than 50 percent of the annual total production, the transition from the Tallgrass Prairie Community (1) to the Oak/Mixed-Brush Woodland Plant Community (2.1) is complete. At this point, there is generally not enough fine fuel produced by the grass component to control the woody plants during normal prescribed burning. Once this threshold is reached in the transition, proper grazing management and prescribed burning cannot reverse the transition toward the woodland state. Intensive and usually expensive brush control practices must be applied to reverse the transition to a more open grassland state.

With time and continued overgrazing by livestock and deer, oaks and juniper and/or mesquite eventually become so dominant in the Oak/Mixed-Brush Woodland Community (2.1) that only remnants of grassland vegetation remain in the interspaces. The understory and interspaces support remnants of reference vegetation which are generally in low vigor and productivity due to shading and competition for water and nutrients. Very little grassland herbage is produced.

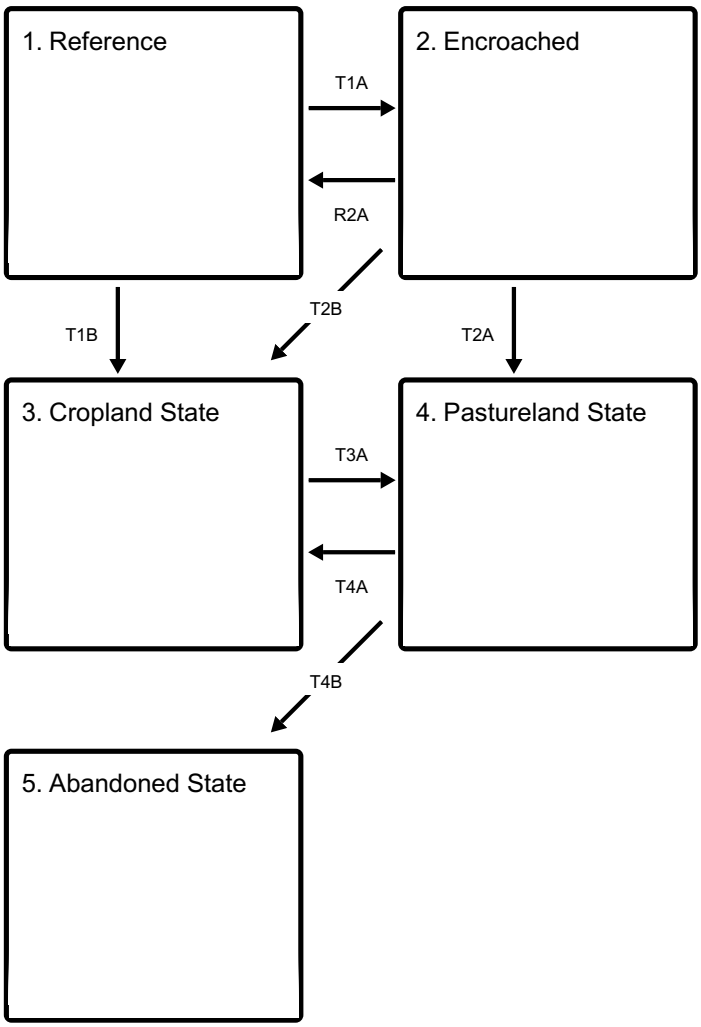
Desertification including erosion, loss of soil organic matter and more xeric microclimate conditions prevail in the woody plant interspaces until the woodland matures. Once the Oak/Mixed-Brush Woodland reaches potential ground cover, hydrologic functions, energy flow and nutrient cycling stabilize with the climate. Restoring the Oak/Mixed-Brush Woodland Community (2.1) to a grassland community suited for livestock requires extensive brush control, range planting, prescribed grazing management and prescribed burning. Intended land use will dictate the guidance for modifying the plant community.

The Blackland site is suitable for crop and pasture production. Much of the site was once cultivated and cropped for food, fiber and hay is known as the Cropland State (3). Although some acres are still cultivated today, most of the fields in the site, not under housing developments, are planted in native or non-native grasses such as bermudagrass (*Cynodon dactylon*), Gordo bluestem (Bothriochloa spp.) or Kleingrass (*Panicum coloratum*), which is known as a Pastureland State (4). Some areas originally planted to crops and pastureland have been abandoned, or left idled, and returned to the “go back” community in native pasture. The resulting plant communities are commonly referred to as the “Go Back Land” Community (5). If this community is not managed with prescribed grazing management and brush control, woody species from adjacent areas will eventually dominate the site.

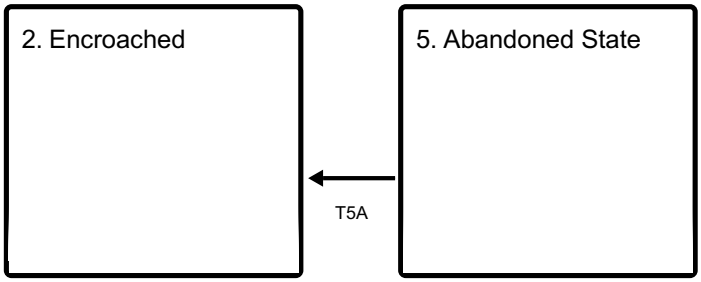
The following State and Transition Model depicts the plant communities and transitions for the Blackland Ecological Site described in the ecological dynamics narrative.

State and transition model

Ecosystem states



States 2 and 5 (additional transitions)



T1A - Absence of disturbance and natural regeneration over time

T1B - Removal of native species, extensive soil disturbance, and conversion to cropland

R2A - Reintroduction of natural disturbance regimes

T2B - Removal of native species, extensive soil disturbance, and conversion to cropland

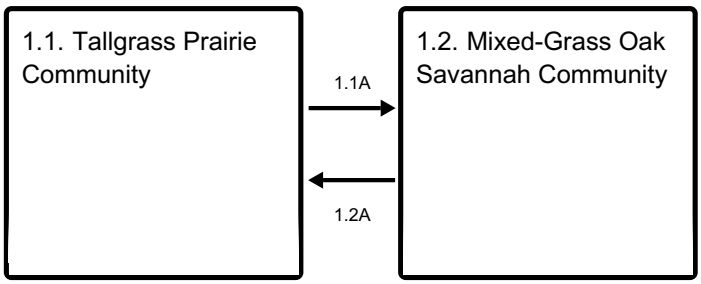
T2A - Removal of woody species and seeding with improved forage species

T3A - Seeding with improved forage species

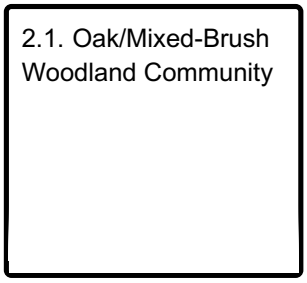
T4A - Extensive soil disturbance and conversion to cropland

T4B - Absence of disturbance and natural regeneration over time

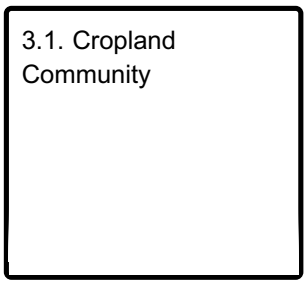
State 1 submodel, plant communities



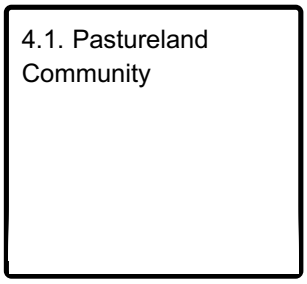
State 2 submodel, plant communities



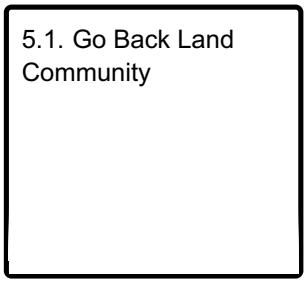
State 3 submodel, plant communities



State 4 submodel, plant communities



State 5 submodel, plant communities



State 1
Reference

The reference state is considered to be representative of the natural range of variability

under pre-Euro settlement conditions. This state was dominated by warm-season, deep-rooted, vegetation. Community phase changes are primarily driven by wildfire, grazing, and climatic fluctuations. The overstocking by cattle, sheep and goats in the late 1800s began a change in the plant composition of the Tallgrass Prairie Community towards a mixed-grass savannah with increasing woody species. As livestock numbers increased and grazing use exceeded the preferred plants' ability to sustain defoliation year after year, the most palatable species gave way to less palatable or more grazing resistant species. Because of selective grazing, the more palatable tall grasses decreased, giving way to secondary midgrass species.

Characteristics and indicators. The considerable precipitation (28 to 38 inches per year) comes primarily from convective storms during the warm season that favors deep-rooted vegetation. Deep-rooted trees and fire resistant shrubs, however, occupied only draws and ridges where they were protected from frequently occurring fires (Bray 1904 and Foster 1917). Recent studies conclude that before European settlement in the 1800s fires occurred at 7 to 12 year intervals in the Eastern Edwards Plateau region (Frost 1998). Without frequent and intense recurring fires, the Blackland Ecological Site would likely have been woodland.

Dominant plant species

- live oak (*Quercus virginiana*), tree
- little bluestem (*Schizachyrium scoparium*), grass
- big bluestem (*Andropogon gerardii*), grass

Community 1.1
Tallgrass Prairie Community

The reference plant community for the Blackland Ecological Site was a tallgrass prairie composed of true prairie grassland vegetation that evolved under the influence of grazing, periodic fire and a humid subtropical climate. Woody plants, primarily live oak trees and mottes, were widely scattered on ridges and along draws. Shrubs such as sumac, elbowbush, ephedra (Ephedra spp.), algerita, bumelia (*Sideroxylon lanuginosum*) and prickly pear were likely present but were kept suppressed by periodic fires and grass competition. The grassland component accounted for 85 to 90 percent of the site’s primary annual production, with little bluestem accounting for 40 to 65 percent of the herbage production. Big bluestem and Indiangrass were confined to areas with deeper soils and were locally dominant. Secondary grasses were switchgrass (*Panicum virgatum*), sideoats grama, Arizona cottontop (*Digitaria californica*), feathery bluestems, tall dropseed (*Sporobolus compositus* var. compositus), Texas cupgrass (*Eriochloa sericea*) and Texas wintergrass. Shortgrasses like buffalograss and fall witchgrass (*Digitaria cognata*) were present in small amounts. Maximilian sunflower, Mexican sagewort (Artemesia ludoviciana), catclaw sensitivebriar (*Mimosa aculeaticarpa* var. biuncifera), bundleflower, western indigo (*Indigofera miniata*) and orange zexmenia (*Wedelia acapulcensis* var. hispida) were a few of the small (5-10 percent) but important forb component of the plant community (See Plant Community Composition and Annual Production table below). Soil

erosion was low due to the abundant plant cover, litter, good soil structure and rapid infiltration. Runoff from the reference community was reduced due to grass cover and fissures in the limestone parent material. The vegetative ground cover helped disperse and slow down runoff thus holding soil in place and enhancing infiltration. Concentrated water flow patterns were rare. Without proper grazing management, that adjusts animal numbers, including deer, to annual forage production and judicious prescribed burning, the Tallgrass Prairie will transition (regress) to the Mixed-Grass Oak Savannah Plant Community (2).

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	3335	5240	6193
Forb	392	616	729
Tree	118	185	219
Shrub/Vine	78	123	146
Total	**3923**	**6164**	**7287**

Figure 10. Plant community growth curve (percent production by month). TX3775, Tall and Midgrass Prairie Community. Tall and Midgrass Prairie Community.

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
Mixed-Grass Oak Savannah Community

The Mixed-Grass Oak Savannah Community (2) is midgrass dominated grassland being encroached by indigenous or invading woody species that had been held at low densities by high frequency and intensity of fires and competition from a vigorous grass component. Numerous woody species, including juniper and mesquite, are increasing in density because heavy continuous grazing by livestock has reduced grass cover, exposed some soil and reduced fine fuel loads that are necessary for an effective fire. The woody canopy varies between 10 and 30 percent depending on severity of grazing, time since burned and availability of invading species. Typically, oaks increase in size and mesquite and/or juniper increase in density. Less preferred brush species such as bumelia, Texas persimmon (*Diospyros texana*), sumacs, condalia, elbowbush and feather dalea (Dalea spp.) also increase. The preferred tall grasses are being replaced by the more grazing resistant midgrasses. Characteristic grasses are little bluestem, sideoats grama, tall and meadow dropseed (Sporobolus asper var. asper), vine mesquite (*Panicum obtusum*), plains lovegrass (*Eragrostis intermedia*), Texas cupgrass and feathery bluestems. Most of the perennial forbs found in the historic climax remain in this plant community. In this

phase, the increasing woody species are generally less than five feet tall and are subject to control by proper grazing management that allows effective prescribed burning. In the initial phase, individual plant treatments (IPT) may also be cost effective. Annual primary production ranges from 3,000 to 6,000 pounds per acre depending on precipitation amounts and soil series. Forage production is still predominantly from the grassland component. Heavy continuous grazing has reduced plant cover, litter and mulch and has increased bare ground exposing the soil to slight erosion. There could be some mulch and litter movement during rainstorms but due to gentle slopes and relatively good grass cover, little soil movement would take place in this vegetation type. The changes in species composition are small initially, but unless proper grazing and prescribed burning are applied the woody species continue to increase in size and density. As grazing continues, the tall and midgrasses give way to buffalograss and Texas wintergrass. When the canopy of the woody plants becomes dense enough (> 35 % canopy) and tall enough (> 5 feet height) to suppress grass growth and resist fire damage, a threshold in ecological succession is crossed. The Mixed-Grass Oak Savannah Community (2) transitions into the Oak/Mixed-Brush Community (3). Once this threshold is passed, normal range management practices, such as prescribed grazing and prescribed burning, cannot reverse the transition to woody plant dominance.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	2354	3923	4708
Tree	504	841	1009
Shrub/Vine	336	560	673
Forb	168	280	336
Total	**3362**	**5604**	**6726**

Figure 12. Plant community growth curve (percent production by month). TX3779, Mid and Tallgrass Prairie Community. Warm-season rangeland with most production April to October.

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

Without proper grazing management that adjusts animal numbers, including deer, to annual forage production and judicious prescribed burning, the Tallgrass Prairie (1.1) will transition (regress) to the Mixed-Grass Oak Savannah Plant Community (1.2).

Pathway 1.2A

Community 1.2 to 1.1

In this phase, the increasing woody species are generally less than five feet tall and are subject to control by proper grazing management that allows effective prescribed burning. In the initial phase, individual plant treatments (IPT) may also be cost effective.

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing
Planned Grazing System
Invasive Plant Species Control

State 2
Encroached

This state is characterized by a shift in the dominant functional and structural groups. Understory is reduced due to shading from woody species (oak, mesquite and/or juniper). Cool-season, shortgrasses and annual and perennial forbs occupy the tree interspaces.

Dominant plant species

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

Community 2.1
Oak/Mixed-Brush Woodland Community

Figure 13. 3. Oak/Mixed-Brush Woodland Community

Oak, mesquite and/or juniper dominate the Oak/Mixed-Brush Woodland Community (3). Mesquite was the early understory brush species but Ashe juniper has increased tremendously in the past few decades. Common understory shrubs are pricklypear, algerita, condalia, yucca (Yucca spp.), Texas persimmon, elbowbush, pricklyash (Zanthoxylum spp.), and catclaw acacia (*Acacia greggii*). Shortgrasses, cool-season grasses and low quality annual and perennial forbs occupy the tree interspaces. Characteristic grasses found in this plant community are Texas wintergrass, curlymesquite, buffalograss and cedar sedge (*Carex planostachys*) initially. Representative forbs include dotted gayfeather (*Liatris punctata* var. punctata), orange zexmenia, croton (Croton spp.), western ragweed (*Ambrosia psilostachya*), prairie coneflower (*Ratibida columnifera*), snow-on-the-mountain (*Euphorbia marginata*) and broomweed (Gutierrezia spp.). With continued heavy grazing, either by livestock or deer, the brush canopy increases in density while shortgrasses, such as threeawns (Aristida spp.), red grama (*Bouteloua trifida*), Texas grama (*Bouteloua rigidiseta*), hairy tridens (*Erioneuron pilosum*) and cedar sedge replace the more palatable mid and short grasses. Grasses and forbs make up 25 percent or less of the annual herbage production. The tree and shrub canopy acts to intercept rainfall and increase evapotranspiration losses, creating a more xeric microclimate. Soil fauna and litter are reduced exposing more soil surface to erosion in the woody plant interspaces. Surface crusting is common where plant cover and soil conditions deteriorate in the grassland areas. However within the woody canopy, hydrologic processes stabilize and soil organic matter and mulch begin to increase and eventually stabilize under the mature woodland. Without major brush control and management inputs, this plant community cannot be reversed. The brush species will continue to thicken until the community stabilizes with the climate and soil. The oak/mixed-brush overstory can reach 80 to 90 percent ground cover with less than 25 percent of the herbage being produced by the weakened grassland component. With continued livestock grazing, the mature phase of the Oak/Mixed-Brush Woodland Community (3) provides cover for wildlife, but only limited preferred forage or browse is available for livestock or wildlife. Returning the Oak/Mixed-Brush Woodland Community (3) back to the grassland state requires extensive and expensive reclamation practices. Range planting, prescribed grazing and prescribed burning, must follow mechanical and/or chemical brush control. Land use other than livestock production might dictate alternative reclamation approaches to create the plant community that best fits the intended use.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Tree	1121	1569	2242
Shrub/Vine	841	1177	1681
Grass/Grasslike	701	757	1401
Forb	140	196	280
Total	**2803**	**3699**	**5604**

Figure 15. Plant community growth curve (percent production by month). TX3763, Oak/Juniper Woodland. Oak/Juniper Woodland.

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

State 3
Cropland State

Throughout MLRA 81C, many early settlers, having a farming background, cultivated small fields on the Blackland site for vegetable crops, grain, forage sorghum and winter cereals for livestock forage. Many of the Blackland sites have been converted to cropland in the past. Cropping of the site is still common for food and fiber production, livestock grazing, grain harvesting or planting for wildlife food plots on many ranches. Many fields, however, have been abandoned and let ‘go back’ to native rangeland or planted into introduced grasses for pastureland use.

Community 3.1
Cropland Community

Figure 16. 3. Cropland Community

Throughout MLRA 81C, many early settlers, having farming background, cultivated small fields on the Blackland site for vegetable crops, grain, forage sorghum and winter cereals for livestock forage. Many of the Blackland sites have been converted to cropland in the past. Cropping of the site is still common for food and fiber production, livestock grazing, grain harvesting or planting for wildlife food plots on many ranches. Many fields, however, have been abandoned and let ‘go back’ to native rangeland or planted into introduced grasses for pastureland use.

Figure 18. Plant community growth curve (percent production by month). TX3903, Warm-Season Cropland . Forage Sorghum, Haygrazer.

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 19. Plant community growth curve (percent production by month). TX3904, Cool-Season Cropland. Cool-season crops such as 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

State 4
Pastureland State

Abandoned cropland areas, or cleared areas, are often seeded to native grass species or introduced grass species such as Kleingrass (*Panicum coloratum*), Gordo bluestem (Bothriochloa spp.) or bermudagrass (Cynodon spp.). Herbage production for adapted introduced grasses or native grasses can reach peak production within a few years after a full stand is established.

Dominant plant species

- kleingrass (*Panicum coloratum*), grass
- beardgrass (*Bothriochloa*), grass
- Bermudagrass (*Cynodon dactylon*), grass

Community 4.1
Pastureland Community

Figure 20. 5. Pastureland Community

Abandoned cropland areas, or cleared areas, are often seeded to climax native grass

species or introduced grass species such as Kleingrass (*Panicum coloratum*), Gordo bluestem (Bothriochloa spp.) or bermudagrass (Cynodon spp.). Herbage production for adapted introduced grasses or native grasses can reach peak production within a few years after a full stand is established. In this case, herbage production will equal the reference state if species such as big bluestem or Indiangrass are seeded. Adapted introduced species plantings such as bermudagrass may surpass reference production with the use of inputs. However, production may be dependent upon the degree of soil degradation, loss of structure and compaction. The practice of including adapted legumes or other forbs will enhance productivity and usefulness, especially for wildlife. Kept in a brush free condition with brush management, this plant community provides excellent forage for livestock and big game but poor cover habitat for big game. Invasion of pastureland by brush such as mesquite, huisache (Acacia smallii), baccharis (Baccharis spp.) and juniper is common in this MLRA. Drought and reduced soil cover due to cropping and grazing and a nearby seed source trigger the invasions. The shrub ‘seedlings’ that appear in seeded or abandoned fields are true seedlings established by seeds brought in by animals, water or wind. The invading brush must be controlled with grazing management, prescribed burning or other brush management methods or the woody invaders will again dominate.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	3475	5380	6725
Forb	448	785	1121
Total	**3923**	**6165**	**7846**

Figure 22. Plant community growth curve (percent production by month). TX3905, Pastureland Community. Depends on planted species, but most production will be in April, May and June with a lesser peak in September and October..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	2	3	18	22	15	7	4	16	6	4	2

State 5
Abandoned State

Go Back Land’ is a local name used to describe cropland fields that have been abandoned and are undergoing secondary succession. The plant community consists of a mixture of native grasses, forbs and shrubs. The ‘Go Back Land’ Community (6) results from abandoning cropland and leaving the land idle without implementing conservation practices such as range planting or brush management. Weeds and brush from the adjacent rangeland will invade the abandoned cropland. The initial invaders in abandoned fields on the Blackland site are annual, biennial and weak perennial grasses and forbs.

Community 5.1
Go Back Land Community

Figure 23. 5. Go Back Land Community

‘Go Back Land’ is a local name used to describe cropland fields that have been abandoned and are undergoing secondary succession. The plant community consists of a mixture of native grasses, forbs and shrubs. The ‘Go Back Land’ Community results from abandoning cropland and leaving the land idle without implementing conservation practices such as range planting or brush management. Weeds and brush from the adjacent rangeland will invade the abandoned cropland. The initial invaders in abandoned fields on the Blackland site are annual, biennial and weak perennial grasses and forbs. The species found on the site depends on the availability of seed sources from adjacent rangeland. The rate of succession depends on grazing management and drought frequency, but reestablishment of reference conditions can take many years. Biomass production will be limited in the early seral stage and may increase as the site recovers from cultivation. Without grazing management and brush management, brush species such as huisache, baccharis mesquite and juniper will dominate before a climax grass community can be established.

Table 9. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1569	2354	3138
Forb	336	504	673
Shrub/Vine	224	336	448
Tree	112	168	224
Total	**2241**	**3362**	**4483**

Figure 25. Plant community growth curve (percent production by month).

TX3781, GoBack Land Community. Shortgrass/Mixed-brush summer growth with some cool-season grass growth. Weed and brush species may invade the site from adjacent areas..

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

Transition T1A
State 1 to 2

The changes in species composition are small initially, but unless proper grazing and prescribed burning are applied the woody species continue to increase in size and density. As grazing continues, the tall and midgrasses give way to buffalograss and Texas wintergrass. When the canopy of the woody plants becomes dense enough (> 35 % canopy) and tall enough (> 5 feet height) to suppress grass growth and resist fire damage, a threshold in ecological succession is crossed. The Mixed-Grass Oak Savannah Community (1.2) transitions into the Oak/Mixed-Brush Community (2.1). Once this threshold is passed, normal range management practices, such as prescribed grazing and prescribed burning, cannot reverse the transition to woody plant dominance.

Transition T1B
State 1 to 3

Many early settlers, having a farming background, cultivated small fields on the Blackland site for vegetable crops, grain, forage sorghum and winter cereals for livestock forage. Many of the Blackland sites have been converted to cropland in the past. Cropping of the site is still common for food and fiber production, livestock grazing, grain harvesting or planting for wildlife food plots on many ranches.

Restoration pathway R2A
State 2 to 1

Returning the Oak/Mixed-Brush Woodland Community (2.1) back to the Grassland State (1.0) requires extensive and expensive reclamation practices. Range planting, prescribed grazing and prescribed burning, must follow mechanical and/or chemical brush control.

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing
Range Planting
Planned Grazing System
Invasive Plant Species Control

Transition T2B
State 2 to 3

Land use other than livestock production such as cropland might dictate alternative reclamation approaches to create the plant community that best fits the intended use. Cropland species such as small grains and forage annual crops are planted.

Transition T2A
State 2 to 4

Land use other than livestock production such as pastureland might dictate alternative reclamation approaches to create the plant community that best fits the intended use. Forage pasture species such as bermudagrass and kleingrass are planted.

Transition T3A
State 3 to 4

Cropping of the site is still common for food and fiber production, livestock grazing, grain harvesting or planting for wildlife food plots on many ranches. Many fields, however, have been planted into introduced grasses for pastureland use.

Transition T4A
State 4 to 3

Pastureland converted into cropland fields.

Transition T4B
State 4 to 5

Invasion of pastureland by brush such as mesquite, huisache (Acacia smallii), baccharis (Baccharis spp.) and juniper is common in this MLRA. Drought and reduced soil cover due to cropping and grazing and a nearby seed source trigger the invasions. The shrub ‘seedlings’ that appear in seeded or abandoned fields are true seedlings established by seeds brought in by animals, water or wind. The invading brush must be controlled with grazing management, prescribed burning or other brush management methods or the woody invaders will again dominate.

Transition T5A
State 5 to 2

In the absence of fire or brush management, abandoned fields may become dominated by woody species and resemble the woody state (2).

Conservation practices

Brush Management
Nutrient Management
Integrated Pest Management (IPM)
Planned Grazing System
Invasive Plant Species Control

Additional community tables

Table 10. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tallgrass**			1569–2914	
	little bluestem	SCSC	*Schizachyrium scoparium*	1569–2914	–
2	**Tallgrasses**			785–1457	
	big bluestem	ANGE	*Andropogon gerardii*	785–1457	–
	switchgrass	PAVI2	*Panicum virgatum*	785–1457	–
	Indiangrass	SONU2	*Sorghastrum nutans*	785–1457	–
3	**Midgrasses**			588–1093	
	cane bluestem	BOBA3	*Bothriochloa barbinodis*	588–1093	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	588–1093	–
	silver beardgrass	BOLAT	*Bothriochloa laguroides ssp. torreyana*	588–1093	–
	Arizona cottontop	DICA8	*Digitaria californica*	588–1093	–
	plains lovegrass	ERIN	*Eragrostis intermedia*	588–1093	–
	Texas cupgrass	ERSE5	*Eriochloa sericea*	588–1093	–
	green sprangletop	LEDU	*Leptochloa dubia*	588–1093	–
	vine mesquite	PAOB	*Panicum obtusum*	588–1093	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	588–1093	–
	dropseed	SPORO	*Sporobolus*	588–1093	–
	white tridens	TRAL2	*Tridens albescens*	588–1093	–
4	**Shortgrasses**			196–364	
	buffalograss	BODA2	*Bouteloua dactyloides*	196–364	–

	Texas grama	BORI	*Bouteloua rigidiseta*	196–364	–
	red grama	BOTR2	*Bouteloua trifida*	196–364	–
	fall witchgrass	DICO6	*Digitaria cognata*	196–364	–
	hairy woollygrass	ERPI5	*Erioneuron pilosum*	196–364	–
	curly-mesquite	HIBE	*Hilaria belangeri*	196–364	–
	Hall's panicgrass	PAHA	*Panicum hallii*	196–364	–
	slim tridens	TRMU	*Tridens muticus*	196–364	–
	slim tridens	TRMUE	*Tridens muticus var. elongatus*	196–364	–
5	**Cool-season grasses**			196–364	
	cedar sedge	CAPL3	*Carex planostachys*	196–364	–
	wildrye	ELYMU	*Elymus*	196–364	–
	Texas wintergrass	NALE3	*Nassella leucotricha*	196–364	–
Forb					
6	**Forbs**			392–729	
	Indian mallow	ABUTI	*Abutilon*	392–729	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	392–729	–
	white sagebrush	ARLUM2	*Artemisia ludoviciana ssp. mexicana*	392–729	–
	wild indigo	BAPTI	*Baptisia*	392–729	–
	yellow sundrops	CASE12	*Calylophus serrulatus*	392–729	–
	prairie clover	DALEA	*Dalea*	392–729	–
	zarzabacoa comun	DEIN3	*Desmodium incanum*	392–729	–
	bundleflower	DESMA	*Desmanthus*	392–729	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	392–729	–
	milkpea	GALAC	*Galactia*	392–729	–
	ratany	KRAME	*Krameria*	392–729	–
	trailing krameria	KRLA	*Krameria lanceolata*	392–729	–
	blazing star	LIATR	*Liatris*	392–729	–
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	392–729	–
	yellow puff	NELU2	*Neptunia lutea*	392–729	–
	narrowleaf Indian breadroot	PELI10	*Pediomelum linearifolium*	392–729	–
	beardtongue	PENST	*Penstemon*	392–729	–

	beardtongue	PENST	*Penstemon*	392–729	
	snoutbean	RHYNC2	*Rhynchosia*	392–729	–
	white rosinweed	SIAL	*Silphium albiflorum*	392–729	–
	compassplant	SILA3	*Silphium laciniatum*	392–729	–
	fuzzybean	STROP	*Strophostyles*	392–729	–
Shrub/Vine					
7	**Shrubs/Vines**			78–146	
	catclaw acacia	ACGR	*Acacia greggii*	78–146	–
	jointfir	EPHED	*Ephedra*	78–146	–
	stretchberry	FOPU2	*Forestiera pubescens*	78–146	–
	algerita	MATR3	*Mahonia trifoliolata*	78–146	–
	pricklypear	OPUNT	*Opuntia*	78–146	–
	littleleaf sumac	RHMI3	*Rhus microphylla*	78–146	–
	bully	SIDER2	*Sideroxylon*	78–146	–
	greenbrier	SMILA2	*Smilax*	78–146	–
	Hercules' club	ZACL	*Zanthoxylum clava-herculis*	78–146	–
Tree					
8	**Trees**			118–219	
	hackberry	CELTI	*Celtis*	118–219	–
	Ashe's juniper	JUAS	*Juniperus ashei*	118–219	–
	honey mesquite	PRGL2	*Prosopis glandulosa*	118–219	–
	live oak	QUVI	*Quercus virginiana*	118–219	–
	western soapberry	SASAD	*Sapindus saponaria var. drummondii*	118–219	–
	elm	ULMUS	*Ulmus*	118–219	–

Animal community

Many types of grassland insects, reptiles, birds and mammals frequented the HCPC of the site, either as their base habitat or from the adjacent sites. Pronghorned antelope, white-tailed deer and migrating bison utilized the site. Small mammals included many kinds of rodents, jackrabbit, cottontail rabbit, raccoon, skunk, opossum and armadillo. Mammalian predators included coyote, red fox, gray fox and bobcat. Game birds, songbirds, and birds of prey were indigenous or frequent users. Most are still plentiful. Bison and pronghorn antelope, however, are no longer present. Native white-tailed deer and many species of exotic deer utilize the Blackland site in its various states. Various species of exotic wildlife have been introduced on the site including: deer, such as axis, sika and fallow; antelope,

such as sable, oryx, blackbuck and nilgai; and sheep such as Barbados (mouflon) and aoudad. Their numbers must be included along with livestock and native wildlife, primarily white-tailed deer, for any management decisions or conservation planning. Feral hogs may also be present on the site. They can be damaging to the plant community if their numbers are not managed. Deer, turkey and quail particularly favor the habitat provided by the Mixed-Grass Oak Savannah Community (2).

The site is suitable for production of livestock including cattle, sheep and goats. The site in HCPC was suitable to primary grass eaters such as bison and cattle due to the open prairie of tall grasses with limited canopy cover. As retrogression occurs and woody plants invade, the site becomes better habitat for sheep, goats, deer and other wildlife because of the browse and cool-season grasses. Cattle, sheep and goats should be stocked in proportion to the available grass, forb and browse forage, keeping deer competition for forbs and browse in mind. Deer populations must also be kept within limits of the habitat sustainability even if the site is managed exclusively for deer. If the animal numbers are not kept in balance with herbage and browse production through grazing management and good wildlife population management, the late Oak/Mixed-Brush (3) phase will have little to offer as habitat except cover.

Hydrological functions

The climate affecting the hydrology of the Blackland Ecological Site is humid subtropical, with approximately two-thirds of annual rainfall occuring during the April to September period suitable for growing warm season vegetation and deep rooted plants. Rainfall during this period generally falls as thunderstorms and large amounts of rain may fall in a short time. Due to mostly gentle topography and vegetation quality, surface runoff is moderate with low erosion and sedimentation levels along with good levels of plant cover.

Cracks in dry soil and crevices in underlying limestone facilitate water movement to deeper root zones and contributing to the recharge of aquifers and sustained stream flow below the root zones. Soil exposed by grazing or cultivation will readily crust, accelerating erosion. The site is a well drained and slowly permeable. Runoff is moderate with good cover, but due to slope erosion could be a hazard with excessive defoliation of vegetation. Some of the soils of the Blackland Ecological Site developed on limestone ridges, or terraces, and consequently are low in fertility, store smaller amounts of water and are somewhat droughty. Herbage yields on limestone terraces, or benches, on the site can be low and inclusion of benches within the site can significantly reduce herbage production overall, especially during droughty years. Areas of the site not including limestone shelves can yield as much as 7,000 pounds herbage in good years, however.

Under historic climax condition, the grassland vegetation intercepted and utilized much of the incoming rainfall in the soil solum. Only during extended rains or heavy thunderstorms was there much runoff. Litter and soil movement was slight. Standing plant cover, duff and organic matter decrease and surface runoff increase as the Tallgrass Prairie Community (1) transitions to the Mixed-grass Oak Savannah Community (2). These processes

continue in the interstitial spaces in the Oak/Mixed-Brush Community (3) phase. The woody plants compete for moisture with the remaining grasses and forbs; further reducing annual production and ground cover in openings. Decreased litter and more bare ground in the woody plant interspaces allow erosion from soils in openings between trees. Interception and evaporation losses increase with increasing woody plant canopy.

Once the Oak/Mixed-Brush Woodland Community (3) canopy surpasses 50 percent, the hydrology and ecological processes, nutrient cycling and energy flow, stabilize within the woody plant community. Evaporation and interception losses are higher, however, resulting in less moisture reaching the soil. The deeper-rooted woody plants are then able to extract water from greater depths than grasses so less water will be available for down-slope movement except through crevices.

Recreational uses

The Blackland Ecological Site is well suited for many outdoor recreational uses including recreational hunting, hiking, camping, equestrian and bird watching. This site, along with adjacent upland sites, provides diverse scenic beauty and many opportunities for recreation and hunting.

Wood products

Posts and specialty wood products are made from juniper, mesquite, oak and many shrubs. Mesquite and oak are used for firewood, charcoal lumber and furniture.

Other products

Jams and jellies are made from many fruit bearing species, such as algerita. Seeds are harvested from many HCPC plants for commercial sale. Grasses and forbs are harvested by the dried-plant industry for sale in dried flower arrangements. Honeybees are utilized to harvest honey from the many flowering plants, such as mesquite.

Other information

None.

Inventory data references

Information presented was derived from the Blackland Range Site guide, literature, field observations and personal contacts with range-trained personnel. Photos by J.L. Schuster.

Other references

1. Archer S. 1994. Woody plant encroachment into southwestern grasslands and savannas: rates, patterns and proximate causes. In Ecological implications of livestock

herbivory in the West, pp.13-68. Edited by M. Vavra, W. Laycock, R. Pieper, Society for Range Management Publication. , Denver, CO.
2. Archer, Steve and F.E. Smeins.1991. Ecosystem-level Processes, Chapter 5 in: Grazing Management: an Ecological Perspective edited by R. K. Heitschmidt and J.W. Stuth. Timber Press, Portland, Oregon.
3. Bray, W.T. 1904. The Timber of the Edwards Plateau of Texas. Bureau of forestry Bull. 49. U S Government Printing Office, Washington, D.C.
4. Foster, J.H. 1917. The spread of timbered areas in central Texas. Journal of Forestry 15:442-445.
5. Frost, C. C. 1998. Pre-settlement fire frequency regions of the United States: A first approximation. Tall Timbers Fire Ecology Conference Proceedings No. 20
6. Scifres, C. J. and W.T. Hamilton.1993. Prescribed Burning for brush Management: The South Texas Example. Texas A & M University Press, 245 pp.
7. Smeins, Fred, Sam Fuhlendorf and Charles Taylor, Jr. 1997. Environmental and Land Use Changes: A Long Term Perspective. Chapter 1 in: Juniper Symposium 1997. Texas Agricultural Experiment Station. Pp 1-21.
8. Thurow T.L., 1991. Hydrology and erosion. Chapter 6 in: Grazing Management: An Ecological Perspective Edited by: R.K. Heitschmidt and J.W. Stuth. Timber Press, Portland, Oregon.
9. USDA/NRCS Soil Survey Manuals for Comal and Hays Counties.
10. Vines, RA. 1984. Trees of Central Texas. University of Texas Press. Austin, Texas.
11. Plant symbols, common names and scientific names according to USDA/NRCS Texas Plant List (Unpublished)
12. Bestelmeyer, B. T., J.R. Brown, K. M. Havsted, R. Alexander, G. Chavez and J. E. Hedrick. 2003. Development and use of state-and-transition models for rangelands. J. Range Management. 56(2): 114-126.
13. Hamilton W. and D.Ueckert. 2005. Rangeland Woody Plant Control--Past, Present, and Future.Ch 1 in: Brush Management-Past, Present, and Future. Texas A & M University Press. Pp.3-16.

Contributors

Dr. Joseph Schuster
Travis Waiser, MLRA Leader, NRCS, Kerrville, TX

Approval

Bryan Christensen, 9/19/2023

Acknowledgments

Site Development and Testing Plan:

Future work, as described in a Project Plan, to validate the information in this Provisional Ecological Site Description is needed. This will include field activities to collect low,

medium and high-intensity sampling, soil correlations, and analysis of that data. Annual field reviews should be done by soil scientists and vegetation specialists. A final field review, peer review, quality control, and quality assurance reviews of the ESD will be needed to produce the final document. Annual reviews of the Project Plan are to be conducted by the Ecological Site Technical Team.

Special thanks to the following NRCS personnel for assistance and guidance with development of this ESD: Charles Anderson, NRCS San Angelo, Texas, Homer Sanchez and Justin Clary, NRCS Temple, Texas.

QC/QA completed by:
Bryan Christensen, SRESS, NRCS, Temple, TX
Erin Hourihan, ESDQS, NRCS, Temple, TX

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	Joseph Schuster, Range & Wildlife Habitat Consultants, Bryan, Texas, 979-822-2992
Date	02/02/2006
Approved by	Bryan Christensen
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None to slight.

---

2. **Presence of water flow patterns:** Uncommon. Minimal presence of past or current erosion. Those present are short and stabilized.

---

3. **Number and height of erosional pedestals or terracettes:** Uncommon. Minimal presence of erosional pedestals or terracettes. Those present are stabilized.

---

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 0-5 percent bare ground. Small and non-connected areas.

---

5. **Number of gullies and erosion associated with gullies:** Uncommon. Minimal presence of gullies. Those present after disturbance such as fire or prolonged drough healed over within a few years.

---

6. **Extent of wind scoured, blowouts and/or depositional areas:** None.

---

7. **Amount of litter movement (describe size and distance expected to travel):** Moderate movement of fine litter for short distances.

---

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Erosion stability values estimated at 5-6. Water erosion hazard of bare soil is severe.

---

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Characteristic soil is Medlin series and surface layer is grayish brown clay about 9 inches thick. Structure is moderate fine subangular blocky. Fine roots common. SOM is high.

---

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Climax tallgrasses with good distribution and cover provided excellent infiltration and control of runoff. Water runoff is rapid but generally free of erosive action.

---

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None.

---

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: Warm-season tallgrasses >>

    Sub-dominant: Warm-season midgrasses > Forbs >

    Other: Cool-season grasses > Warm-season shortgrasses > Trees > Shrubs

    Additional: Forbs make up 10% species composition while trees and shrubs compose of 5% species composition.

---

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Minimal. Grasses will almost always show some mortality and decadence, especially during drought conditions.

---

14. **Average percent litter cover (%) and depth (in):** Interspaces between plant canopies essentially covered with various sizes of litter and mulch.

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 3500# in years with below average moisture, 5500# in average moisture years and 6500# in above average moisture years.

---

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:** Ashe juniper, mesquite, western soapberry, prickly pear and baccharis.

17. **Perennial plant reproductive capability:** Good. All species should be capable of reproducing except during periods of prolonged drought, heavy natural herbivory or intense fire. Recovery from these disturbances should take 2-5 years.