

## Ecological site R086AY007TX Southern Clay Loam

Last updated: 9/21/2023  
Accessed: 04/29/2024

### General information

**Provisional.** A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

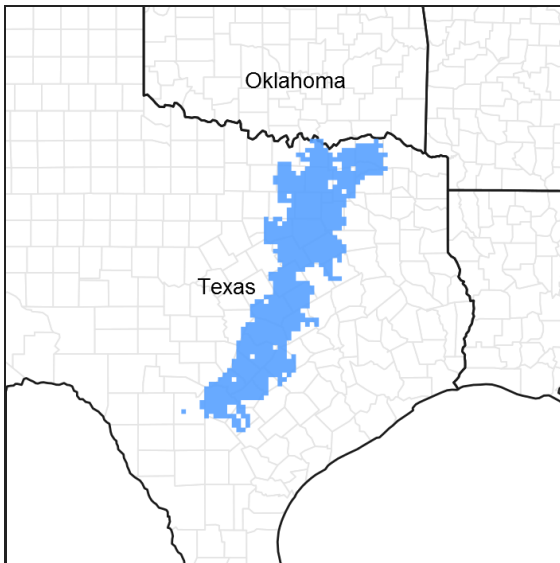


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

### MLRA notes

Major Land Resource Area (MLRA): 086A–Texas Blackland Prairie, Northern Part

MLRA 86A, The Northern Part of Texas Blackland Prairie is entirely in Texas. It makes up about 15,110 square miles (39,150 square kilometers). The cities of Austin, Dallas, San Antonio, San Marcos, Temple, and Waco are located within the boundaries. Interstate 35, a MLRA from San Antonio to Dallas. The area supports tall and mid-grass prairies, but improved pasture, croplands, and urban development account for the majority of the acreage.

### Classification relationships

USDA-Natural Resources Conservation Service, 2006.  
-Major Land Resource Area (MLRA) 86A

### Ecological site concept

The Clay Loam ecological site is a true tallgrass prairie, dominated by little bluestem. The soils are shallow to deep and characterized by their clay loam texture.

### Associated sites

R086AY002TX	<b>Southern Chalky Ridge</b> The Chalky Ridge site is often upslope from the Clay Loam site. It differs from the Clay Loam site by having shallow soils and low soil fertility.
R086AY005TX	<b>Sandy Loam</b> Sites have lighter textured soils.
R086AY004TX	<b>Southern Claypan Prairie</b> The Claypan Prairie site is often adjacent to the Clay Loam site. It differs from the Clay Loam site by only occurring along major rivers and their tributaries and having a fine sandy loam soil surface layer.
R086AY012TX	<b>Loamy Bottomland</b> The Loamy Bottomland site is often downslope from the Clay Loam site. It differs from the Clay Loam site by occurring on floodplains and having thin strata of varying textured soils in the soil profile from flooding events.
R086AY013TX	<b>Clayey Bottomland</b> The Southern Clay Loam site is often upslope from the Clayey Bottomland site. It differs from the Clayey Bottomland site by occurring in uplands, plains, and terraces and lacking thin stratas of varying textured soils in the soil profile from flooding events.

### Similar sites

R086BY003TX	<b>Clay Loam</b> Similar but different MLRA.
R086AY006TX	<b>Northern Clay Loam</b> The Northern Clay Loam site is similar to the Southern Clay Loam site by having similar physiographic features and representative soil features. It differs by receiving more effective precipitation.
R086AY005TX	<b>Sandy Loam</b> Sites have lighter textured soils.

**Table 1. Dominant plant species**

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) <i>Schizachyrium scoparium</i> (2) <i>Sorghastrum nutans</i>

### Physiographic features

The site consists of nearly level to moderately sloping soils with very low to medium runoff, with slopes ranging from 0 to 9 percent. The Clay Loam can be found on fluvial terraces and piedmont alluvial plains below limestone hills. The soils formed in alluvium high in calcium carbonate.

**Table 2. Representative physiographic features**

Landforms	(1) Plains > Terrace
Runoff class	Low to high
Flooding duration	Very brief (4 to 48 hours)
Flooding frequency	None to rare
Ponding frequency	None
Elevation	131–579 m
Slope	0–9%
Water table depth	145–203 cm
Aspect	Aspect is not a significant factor

## Climatic features

The climate for MLRA 86A is humid subtropical and is characterized by hot summers, especially in July and August, and relatively mild winters. Tropical maritime air controls the climate during spring, summer and fall. In winter and early spring, frequent surges of Polar Canadian air cause sudden drops in temperatures and add considerable variety to the daily weather. When these cold air masses stagnate and are overrun by moist air from the south, several days of cold, cloudy, and rainy weather follow. Generally, these occasional cold spells are of short duration with rapid clearing following cold frontal passages. The summer months have little variation in day-to-day weather except for occasional thunderstorms that dissipate the afternoon heat. The moderate temperatures in spring and fall are characterized by long periods of sunny skies, mild days, and cool nights. The average relative humidity in mid-afternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 75 percent of the time during the summer and 50 percent in winter. The prevailing wind direction is from the south and highest wind speeds occur during the spring months. Rainfall during the spring and summer months generally falls during thunderstorms, and fairly large amounts of rain may fall in a short time. High-intensity rains of short duration are likely to produce rapid runoff almost anytime during the year. The predominantly anticyclonic atmospheric circulation over Texas in summer and the exclusion of cold fronts from North Central Texas result in a decrease in rainfall during midsummer. The amount of rain that falls varies considerably from month-to-month and from year-to-year.

**Table 3. Representative climatic features**

Frost-free period (average)	244 days
Freeze-free period (average)	276 days
Precipitation total (average)	914 mm

## Climate stations used

- (1) CAMERON [USC00411348], Cameron, TX
- (2) LULING [USC00415429], Luling, TX
- (3) TAYLOR 1NW [USC00418862], Taylor, TX
- (4) TEMPLE [USC00418910], Temple, TX
- (5) SAN MARCOS [USC00417983], San Marcos, TX
- (6) AUSTIN-CAMP MABRY [USW00013958], Austin, TX
- (7) GRANGER DAM [USC00413686], Granger, TX
- (8) NEW BRAUNFELS [USC00416276], New Braunfels, TX
- (9) SAN ANTONIO 8NNE [USC00417947], San Antonio, TX
- (10) WACO DAM [USC00419417], Waco, TX
- (11) CEDAR CREEK 5 S [USC00411541], Cedar Creek, TX
- (12) RED ROCK [USC00417497], Red Rock, TX
- (13) SAN ANTONIO INTL AP [USW00012921], San Antonio, TX
- (14) AUSTIN BERGSTROM AP [USW00013904], Austin, TX

## Influencing water features

This site is not influenced by water from streams.

## Wetland description

Wetlands are not associated with this site.

## Soil features

The soils are shallow to very deep, well drained soils that have moderate to slow permeability. The the parent material is calcareous alluvium weathered from limestone hills. In a representative profile, the surface layer is dark grayish-brown, calcareous clay loam about 10 to 18 inches thick over a brown calcareous clay loam subsoil. Depth to bedrock ranges from 22 to more than 60 inches below the surface. The available water capacity is low to

moderate.

The following dominant soil series are: Altoga, Austin, Krum, Lewisville, Lott, McLennan, Seawillow, Shep, Sunev, Venus, and Whitewright.

**Table 4. Representative soil features**

Parent material	(1) Alluvium–mudstone (2) Residuum–chalk
Surface texture	(1) Clay loam (2) Silty clay loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderate to slow
Soil depth	51–203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	3.05–7.62 cm
Calcium carbonate equivalent (0-101.6cm)	0–68%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	2–20%
Subsurface fragment volume >3" (Depth not specified)	0–11%

## Ecological dynamics

Introduction – The Northern Blackland Prairies are a temperate grassland ecoregion contained wholly in Texas, running from the Red River in North Texas to San Antonio in the south. The region was historically a true tallgrass prairie named after the rich dark soils it was formed in. Other vegetation included deciduous bottomland woodlands along rivers and creeks.

Background – Natural vegetation on the uplands is predominantly tall warm-season perennial bunchgrasses with lesser amounts of midgrasses. This tallgrass prairie was historically dominated by big bluestem (*Andropogon gerardii*), Indiangrass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*), eastern gamagrass (*Tripsacum dactyloides*), and little bluestem (*Schizachyrium scoparium*). Midgrasses such as sideoats grama (*Bouteloua curtipendula*), Virginia wildrye (*Elymus virginicus*), Florida paspalum (*Paspalum floridanum*), Texas wintergrass (*Nassella leucotricha*), hairy grama (*Bouteloua hirsuta*), and dropseeds (*Sporobolus* spp.) are also abundant in the region. A wide variety of forbs add to the diverse native plant community. Mottes of live oak (*Quercus virginiana*) and hackberry (*Celtis* spp.) trees are also native to the region. In some areas, cedar elm (*Ulmus crassifolia*), eastern red cedar (*Juniperus virginiana*), and honey locust (*Gleditsia triacanthos*) are abundant. In the Northern Blackland Prairie oaks (*Quercus* spp.) are common increasers, but in the Southern Blackland Prairie oaks are less prevalent. Junipers are common invaders, particularly in the northern part of the region.

During the first half of the nineteenth century, row crop agriculture lead to over 80 percent of the original vegetation lost. During the second half, urban development has caused even an even greater decline in the remaining prairie.

Today, less than one percent of the original tallgrass prairie remains. The known remaining blocks of intact prairie range from 10 to 2,400 acres. Some areas are public, but many are privately owned and have conservation easements.

**Current State** – Much of the area is classified as prime farmland and has been converted to cropland. Most areas where native prairie remains have histories of long-term management as native hay pastures. Tallgrasses remain dominant when haying of warm-season grasses is done during the dormant season or before growing points are elevated, meadows are not cut more than once, and the cut area is deferred from grazing until frost.

Due to the current-widespread farming, the Northern Blackland Prairie is still relatively free from the invasion of brush that has occurred in other parts of Texas. In contrast, many of the more sloping have experienced heavy brush encroachment, and the continued increase of brush encroachment is a concern. The shrink-swell and soil cracking characteristics of the soils favor brush species with tolerance for soil movement.

**Current Management** – Rangeland and pastureland are grazed primarily by beef cattle. Horse numbers are increasing rapidly in the region, and in recent years goat numbers have increased significantly. There are some areas where dairy cattle, poultry, goats, and sheep are locally important. Whitetail deer, wild turkey, bobwhite quail, and dove are the major wildlife species, and hunting leases are a major source of income for many landowners in this area.

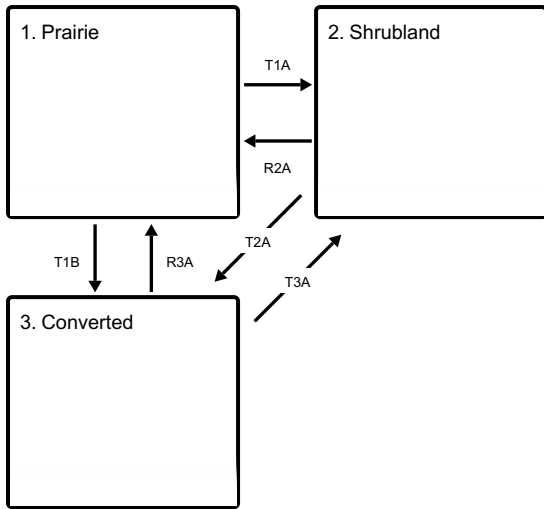
Introduced pasture has been established on many acres of old cropland and in areas with deeper soils. Coastal bermudagrass (*Cynodon dactylon*) and kleingrass (*Panicum coloratum*) are by far the most frequently used introduced grasses for forage and hay. Hay has also been harvested from a majority of the prairie remnants, where long-term mowing at the same time of year has possibly changed the relationships of the native species. Cropland is found in the valleys, bottomlands, and deeper upland soils. Wheat (*Triticum* spp.), oats (*Avena* spp.), forage and grain sorghum (*Sorghum* spp.), cotton (*Gossypium* spp.), and corn (*Zea mays*) are the major crops in the region.

**Fire Regimes** – The prairies were a disturbance-maintained system. Prior to European settlement (pre-1825), fire and infrequent, but intense, short-duration grazing by large herbivores (mainly bison and to a lesser extent pronghorn antelope) were important natural landscape-scale disturbances that suppressed woody species and invigorated herbaceous species (Eidson and Smeins 1999). The herbaceous prairie species adapted to fire and grazing disturbances by maintaining below-ground penetrating tissues. Wright and Bailey (1982) report that there are no reliable records of fire frequency occurring in the Great Plains grasslands because there are no trees to carry fire scars from which to estimate fire frequency. Because prairie grassland is typically of level or rolling topography, a natural fire frequency of 5 to 10 years seems reasonable.

**Disturbance Regimes** - Precipitation patterns are highly variable. Long-term droughts, occurring three to four times per century, cause shifts in species composition by causing die-off of seedlings, less drought-tolerant species, and some woody species. Droughts also reduce biomass production and create open space, which is colonized by opportunistic species when precipitation increases. Wet periods allow tallgrasses to increase in dominance. These natural disturbances cause shifts in the states and communities of the ecological sites.

## **State and transition model**

**Ecosystem states**



**T1A** - No fire, no brush management, improper grazing management, drought

**T1B** - Brush management, crop cultivation, pasture planting, nutrient management, pest management

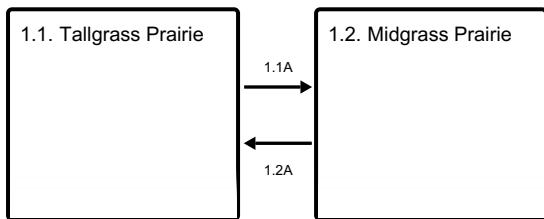
**R2A** - Fire, brush management, proper grazing, range planting

**T2A** - Brush management, crop cultivation, pasture planting, nutrient management, pest management

**R3A** - Fire, brush management, proper grazing, range planting

**T3A** - No fire, no brush management, heavy continuous grazing, no pest management

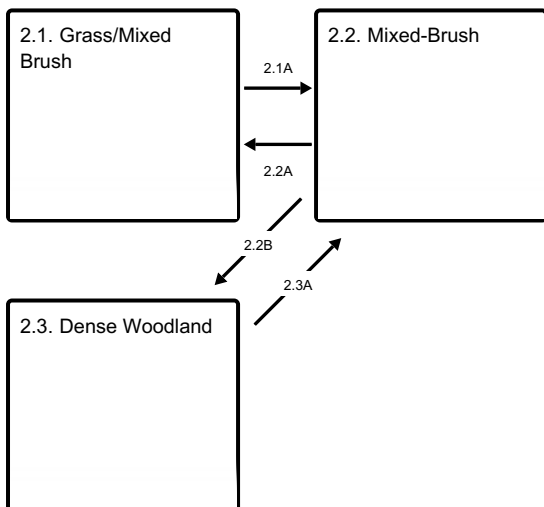
**State 1 submodel, plant communities**



**1.1A** - No fire, no brush management, improper grazing management, drought

**1.2A** - Fire, brush management, proper grazing

**State 2 submodel, plant communities**



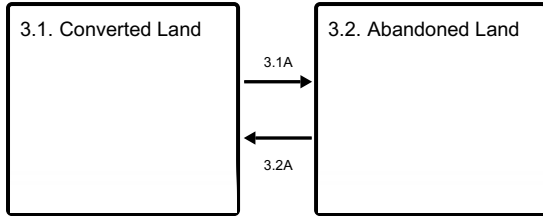
**2.1A** - No fire, no brush management, improper grazing management, drought

**2.2A** - Fire, brush management, proper grazing

**2.2B** - No fire, no brush management, improper grazing management, drought

**2.3A** - Fire, brush management, proper grazing

### State 3 submodel, plant communities



**3.1A** - No fire, no brush management, heavy continuous grazing, no pest management

**3.2A** - Fire, brush management, proper grazing, pest management

## State 1 Prairie

Two communities exist in the Prairie State: the 1.1 Tallgrass Prairie Community and the 1.2 Midgrass Prairie Community. Community 1.1 is characterized by tallgrasses comprising more than 50 percent of the composition. The site is colonized by less than 10 percent woody plants and ranges from 3,500 to 6,000 pounds per acre of biomass. Community 1.2 is characterized by a decrease in tallgrass abundance and an increase in midgrasses. The woody canopy cover has increased from 10 to 35 percent, with some attaining heights of three feet.

### Community 1.1 Tallgrass Prairie



The Tallgrass Prairie Community (1.1) is a true prairie with a few large live oak, elm (*Ulmus* spp.), and hackberry trees along the draws and in occasional mottes. It is characterized by deeper soils dominated by warm-season, perennial tallgrasses, with warm-season, perennial midgrasses filling most of the remaining species composition. The warm-season, perennial forb component varies between 5 and 15 percent depending on climatic patterns and local precipitation. Woody species make up a minor component of the community, 5 percent by weight, even in the short-term absence of fire (two to five years). Little bluestem, Indiangrass, and big bluestem dominate the site. Other important grasses include Canada wildrye (*Elymus canadensis*), eastern gamagrass (*Tripsacum dactyloides*), switchgrass, sideoats grama, silver bluestem (*Bothriochloa laguroides*), Texas wintergrass, and Florida paspalum. Forbs commonly found on the site include Engelmann's daisy (*Engelmannia peristenia*), Maximilian sunflower (*Helianthus maximiliani*), blacksamson (*Echinacea angustifolia*), halfshrub sundrop (*Calylophus serrulatus*), sensitive-briar (*Mimosa* spp.), and yellow neptunia (*Neptunia lutea*). Typical, but infrequent, shrub and tree species found in the reference community (1.1) include species of oak, hackberry, pecan (*Carya illinoensis*), and elm, along with bumelia (*Sideroxylon* spp.) and coralberry (*Symphoricarpos orbiculatus*). The reference prairie community will transition to a midgrass-dominated community under the stresses of improper grazing management. The first species to decrease in dominance will be the most palatable and/or least grazing tolerant grasses and forbs (i.e. eastern gamagrass, switchgrass, Indiangrass, big bluestem, and Engelmann's daisy). This will initially result in an increase in composition of little bluestem and sideoats grama. If improper grazing management continues, little bluestem and Florida paspalum will decrease and midgrasses such as silver bluestem and Texas wintergrass will increase in composition. Less palatable forbs will increase at this stage.

Because the woody species that dominate in the Shrubland State are native species that occur as part of the Prairie State, the transition to the Shrubland State is a linear process with shrubs starting to increase soon after fire or brush control. Unless some form of brush control takes place, woody species will increase to the 35 percent canopy cover level that indicates a state change. This is a continual process that is always in effect. Managers need to detect the increase in woody species when canopy is less than 35 percent and take management action before the state change occurs. There is not a 10-year window before shrubs begin to increase followed by a rapid transition to the Shrubland State. The drivers of the transition (lack of fire and lack of brush control) constantly pressure the system towards the Shrubland State. Canopy cover drives the transitions between community and states because of the influence of shade and interception of rainfall. This plant community has very little bare ground. Plant basal cover and litter make up almost 100 percent ground cover. Soils are fertile with good permeability and produce abundant high quality palatable forage.

**Table 5. Annual production by plant type**

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	3727	5044	6389
Forb	140	179	202
Shrub/Vine	56	101	135
<b>Total</b>	<b>3923</b>	<b>5324</b>	<b>6726</b>

## Community 1.2 Midgrass Prairie



The Midgrass Community (1.2) is the result of long-term improper cattle grazing management. Tallgrasses in the reference prairie community decrease in vigor and production, allowing midgrasses and forbs to increase to the point that they make up more than 50 percent of species composition. Indigenous or invading woody species may increase on the site depending on fire and brush control methods. In the Tallgrass Prairie Community (1.1), repeated fires and competition from a vigorous grass component keep woody canopy cover low. When the Midgrass Community (1.2) is continually overgrazed and fire is excluded, the community crosses a threshold to a state that is dominated by woody plants, the Grass/Mixed-Brush Community (2.1). Important grasses include little bluestem, sideoats grama, silver bluestem, Texas wintergrass, and low panicums. Some of the reference community perennial forbs persist, but less palatable forbs will increase. Woody canopy may be as high as 35 percent, depending on the type of grazing animal, fire interval, brush control, and/or availability of increaser shrub species. Numerous shrub and tree species will encroach because overgrazing by livestock has reduced grass cover, exposed more soil, and reduced grass fuel for fire. Typically, trees such as oak, elm, and hackberry will increase in size, while other woody species such as bumelia, coralberry, honey locust, elbowbush (*Forestiera pubescens*), and sumac (*Rhus* spp.) species will increase in density. Aggressive, introduced pasture species may begin to invade the Midgrass Plant Community, particularly if they have been seeded in nearby pastures. These include introduced paspalums, such as bahiagrass (*Paspalum notatum*), Old World bluestems (*Bothriochloa* spp.), and Bermudagrass. Increasing woody dominants are oak, hackberry, elm, and juniper. Once shrubs reach a height of about three feet, they become more resistant to being killed by fires. When woody species exceed 35 percent canopy cover, the site crosses a threshold (T1A) into the Shrubland State (2) and the Grass/Mixed-Brush Plant Community (2.1). Heavy continuous grazing

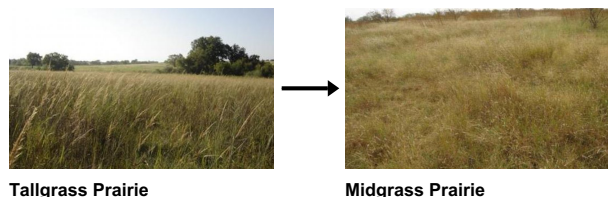


will reduce plant cover, litter, and mulch. Bare ground will increase and expose the soil to crusting and erosion. Some mulch and litter movement may occur during rainstorms, but little soil movement occurs due to gentle slopes in this vegetation type. Litter and mulch will move off site as plant cover declines. Until the Midgrass Prairie Community (1.2) crosses the threshold into the Grass/Mixed-Brush Community (2.1), this community can be managed back toward the reference community (1.1) through the use of prescribed grazing, prescribed burning, and strategic brush control. It may take several years to achieve this state, depending upon climate and the aggressiveness of management. Once woody species begin to establish, returning fully to the reference is difficult, but it is possible to return to a similar plant community. If improper grazing management continues but shrubs are held in check through fire, brush control, browsing, or mowing, the Midgrass Plant Community will continue to degrade. Tallgrasses will continue to decrease in species composition, and midgrasses will begin to decrease. Grazing-resistant shortgrasses, annuals, and forbs will represent more of species composition. These species may increase in relative composition due to the loss of tall and midgrasses. The site will have reduced production and poor ecological processes. Brush control in this community will be more cost effective than after the transition has been made to the Shrubland State.

**Table 6. Annual production by plant type**

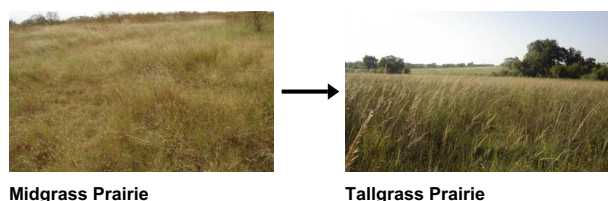
Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	2018	2690	3363
Forb	673	897	1121
Shrub/Vine	673	897	1121
<b>Total</b>	<b>3364</b>	<b>4484</b>	<b>5605</b>

### Pathway 1.1A Community 1.1 to 1.2



The Tallgrass Prairie Community will shift to the Midgrass Prairie Community when there is continued growing season stress on reference grass species. These stresses include improper grazing management that creates insufficient critical growing season deferment, excess intensity of defoliation, repeated, long-term growing season defoliation, long-term drought, and/or other repeated critical growing season stress. Increaser species (midgrasses and woody species) are generally endemic species released by disturbance. Woody species canopy exceeding 10 percent and/or dominance of tallgrasses falling below 50 percent of species composition indicate a transition to the Midgrass Prairie Community. The reference community can be maintained through implementation of brush management combined with properly managed grazing that provides adequate growing season deferment to allow establishment of tallgrass propagules and/or the recovery of vigor of stressed plants. The driver for community shift 1.1A for the herbaceous component is improper grazing management, while the driver for the woody component is lack of fire and/or brush control.

### Pathway 1.2A Community 1.2 to 1.1



The Midgrass Prairie Community will return to the Tallgrass Prairie Community under grazing management that provides sufficient critical growing season deferment in combination with proper grazing intensity. Favorable moisture conditions will facilitate or accelerate this transition. The understory component may return to dominance

by tallgrasses in the absence of fire or brush control. However, reduction of the woody component to 10 percent or less canopy cover will require inputs of fire or brush control. The understory and overstory components can act independently when canopy cover is less than 35 percent, meaning, an increase in shrub canopy cover can occur while proper grazing management creates an increase in desirable herbaceous species. The driver for community shift 1.2A for the herbaceous component is proper grazing management, while the driver for the woody component is fire and/or brush control.

## **State 2 Shrubland**

The Shrubland State has three communities: 2.1 Grass/Mixed-Brush Community, 2.2 Mixed-Brush Community, and 2.3 Woodland Community. The 2.1 community has a woody species overstory canopy of 35 to 50 percent, the 2.2 community over 50 percent, and the 2.3 community has a closed canopy. As tree and brush canopy increases, the herbaceous understory production decreases due to lack of light availability.

### **Community 2.1 Grass/Mixed Brush**

The Grass/Mixed-Brush Community (2.1) presents a 35 to 50 percent woody plant canopy, with oak, hackberry, elm, or juniper as dominant woody species. This community can occur as a result of continuous improper grazing management combined with lack of fire or brush control. It can also occur where there has been proper grazing management without brush control or fire. Improper grazing management speeds the process. Although it is rarely found, it is possible for the herbaceous component to include substantial production from tallgrasses. Palatable woody species tend to decrease and unpalatable woody species tend to increase, particularly where there is heavy browsing from deer or goats. Honey mesquite is an early increaser throughout the MLRA. Ashe juniper (*Juniperus ashei*) invaded from the south, and eastern red cedar is found more frequently in the northern portion of the MLRA. Many of the tallgrass community shrubs are still present. Sideoats grama and other reference (1.1) midgrasses decrease, but still remain the dominant component of composition, while shortgrasses such as buffalograss (*Bouteloua dactyloides*) increase. Remnants of reference grasses and forbs along with unpalatable invaders occupy the interspaces between shrubs. Cool-season species such as Texas wintergrass and sedges (*Carex* spp.), plus other grazing-resistant reference species, can be found under and around woody plants. Plant vigor and productivity of the grassland component is reduced due to grazing pressure and competition for sunlight, nutrients, and water from woody plants. Common herbaceous species include threeawns (*Aristida* spp.), dropseeds, and dotted gayfeather (*Liatris punctata*). Tumblegrass (*Schedonnardus paniculatus*), Texas grama (*Bouteloua rigidisetata*), western ragweed (*Ambrosia psilostachya*), broomweed (*Amphiachyris dracunculoides*), nightshades (*Solanum* spp.), curlycup gumweed (*Grindelia squarrosa*), and annual species are persistent increasers until shrub density reaches maximum canopy. This community can be dominated by a mix of forbs and short stature shrubs when there is continued growing season stress on reference and midgrass species. This transition usually results from heavy, long-term continuous grazing and is often associated with farm lots and horse pastures. Invasive species often dominate the site, including invasive forbs, shrubs, and grasses. As the grassland vegetation declines, more soil is exposed, leading to crusting and erosion. In this vegetation type, erosion can be severe. Higher rainfall interception losses by the increasing woody canopy combined with evaporation and runoff can reduce the effectiveness of rainfall. Soil organic matter and soil structure decline within the interspaces, but soil conditions improve under the woody plant cover. Some soil loss can occur during rainfall events. Annual primary production is approximately 2,000 to 4,500 pounds per acre. In this plant community, annual production is balanced between herbaceous plants and woody species, with herbaceous production still the dominant component of annual production. Browsing animals such as goats and deer can find fair food value if browse plants have not been grazed excessively. Forage quantity and quality for cattle is low. Unless brush management and good grazing management are applied at this stage, woody species canopy will exceed 50 percent, causing the community to convert to the Mixed-Brush Community (2.2). The trend cannot be reversed with proper grazing management alone. Extensive brush management and range planting may be needed to manage the site towards the Prairie State. Soil erosion may prevent the site from recovering. Brush control and range planting can help restore fuel loads to provide the option of reintroducing prescribed fire into the ecosystem. Without fire, the manager will need to be diligent in the use of individual plant treatment of woody species.

**Table 7. Annual production by plant type**

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	897	1457	2018
Grass/Grasslike	897	1457	2018
Forb	448	729	1009
<b>Total</b>	<b>2242</b>	<b>3643</b>	<b>5045</b>

## Community 2.2 Mixed-Brush

The Mixed-Brush Community (2.2) has 50 to 80 percent woody canopy cover and is the result of many years of improper grazing, lack of periodic fires, and/or a lack of proper brush management. Reference woody species or increasers, such as juniper, dominate the Mixed-Brush Community (2.2). The site can now have the appearance of a dense shrubland or savannah of interspersed shrubland and grassland areas. Common understory shrubs are pricklypear (*Opuntia* spp.) and sumac. Woody shrubs seem to increase more rapidly in the southern portion of the MLRA. With continued lack of brush control, the trees and shrubs can exceed 80 percent canopy cover, which indicates the transition to the Woodland Community (2.3). Remnant midgrasses and opportunistic shortgrasses, annuals, and perennial forbs occupy the woody plant interspaces. Characteristic grasses are curly-mesquite (*Hilaria belangeri*), buffalograss, and tumblegrass. Texas wintergrass and annuals are found in and around tree/shrub cover. Grasses and forbs make up 50 percent or less of the annual herbage production. Common forbs include dotted gayfeather, halfshrub sundrop, croton (*Croton* spp.), western ragweed, verbena (*Verbena* spp.), snow-on-the-prairie (*Euphorbia bicolor*), Mexican sagewort (*Artemisia ludoviciana* ssp. *mexicana*), and sensitive-briar. The shrub canopy acts to intercept rainfall and increase evapotranspiration losses, creating a more xeric microclimate. Soil fauna and organic mulch are reduced, exposing more of the soil surface to erosion in interspaces. The exposed soil crusts readily. However, within the woody canopy, hydrologic processes stabilize and soil organic matter and mulch begin to increase and eventually stabilize under the shrub canopy. The Mixed-Brush Community (2.2) can provide good cover habitat for wildlife, but only limited forage or browse is available for livestock or wildlife. At this stage, highly intensive restoration practices are needed to return the shrubland to prairie. Alternatives for restoration include brush control and range planting with proper stocking, prescribed grazing, and prescribed burning following restoration to maintain the desired community.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	1177	1569	1961
Grass/Grasslike	252	336	420
Forb	252	336	420
<b>Total</b>	<b>1681</b>	<b>2241</b>	<b>2801</b>

## Community 2.3 Dense Woodland

The Dense Woodland Community (2.3) has more than 80 percent woody canopy cover as the result of lack of periodic fires, and/or a lack of proper brush management. Reference condition woody species or increasers such as honey mesquite and/or juniper dominate the Dense Woodland Community (2.3) with little herbaceous understory. The site has the appearance of a dense shrubland or woodland. Herbaceous understory plants are limited to shade-tolerant grasses, sedges, and forbs. Under the woody canopy, hydrologic processes stabilize, and soil organic matter and mulch begin to increase and eventually stabilize under the shrub canopy. Ashe juniper, because of its dense low growing foliage, has the ability to retard grass and forb growth. Grass and forb growth can become nonexistent under dense juniper canopies. The Dense Woodland Community (2.3) can provide good habitat for wildlife that favor woodland habitat. Highly intensive restoration practices are needed to return the woodland to prairie. Alternatives for restoration include brush control and range planting with proper stocking, prescribed grazing, and prescribed burning following restoration to maintain the desired community. Prescribed burning may be difficult due to lack of fine fuels.

**Table 9. Annual production by plant type**

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	2018	3026	4035
Forb	168	252	336
Grass/Grasslike	56	84	112
<b>Total</b>	<b>2242</b>	<b>3362</b>	<b>4483</b>

**Pathway 2.1A  
Community 2.1 to 2.2**

Without some form of brush control, woody density and canopy cover will increase in the Grass/Mixed-Brush Community until it converts into the Mixed-Brush Community. Improper grazing management and/or long-term drought (or other growing season stress) will accelerate this transition. Woody species canopy exceeding 50 percent indicates this transition. Herbaceous understory may be similar to any of the Prairie State Communities. Improper grazing or other long-term growing season stress can increase the composition of less productive grasses and low-growing (or unpalatable) forbs in the herbaceous component. Even with proper grazing, in the absence of fire the woody component will increase to the point that the herbaceous component will decline in production and shift in composition toward sedges, grasses, and forbs suited to growing in shaded conditions with reduced available soil moisture. The driver for community shift 2.1A is lack of fire and/or brush control.

**Pathway 2.2A  
Community 2.2 to 2.1**

Brush management and/or fire can reduce the woody component of the Mixed-Brush Community to below the transition level of 50 percent brush canopy. Continued fire and/or brush management will be required to maintain woody density and canopy below 50 percent. If the herbaceous component has transitioned to shortgrasses and low forbs, proper grazing management (combined with favorable moisture conditions and adequate seed source) will be necessary to facilitate the shift of the understory component in the Mixed-Brush Community to a midgrass-dominated Grass/Mixed-Brush Community. Range planting may accelerate the transition of the herbaceous community, particularly when combined with favorable growing conditions. The driver for community shift 2.2A is fire and/or brush control.

**Pathway 2.2B  
Community 2.2 to 2.3**

Without fire (natural or human-caused) and/or brush control, woody density and canopy cover will increase in the Mixed-Brush Community until it converts into the Dense Woodland Community. Woody species canopy exceeding approaching closed canopy (greater than 80 percent) and a decline of herbaceous understory species composition of less than 20 percent indicate this transition. Herbaceous understory will be sparse and comprised of sedges, grasses, and forbs suited to growing in shaded conditions with reduced available soil moisture. The driver for community shift 2.2A is lack of fire and/or brush control.

**Pathway 2.3A  
Community 2.3 to 2.2**

Brush management and/or fire can reduce the woody component of the Dense Woodland Community below the transition level of 80 percent woodland canopy. Continued fire and/or brush management will be required to maintain woody density and canopy below 80 percent. Due to limited understory of fine fuels, prescribed fires will be difficult to use. The site may carry crown fires or fires carried by the shrubby understory. Range planting may accelerate the transition of the herbaceous community, particularly when combined with favorable growing conditions. Transition Pathway 2.3A is more likely to accompany small fires or tree disease than be a part of a management plan. The driver for community shift 2.3A is removal of canopy cover to allow limited recovery of understory species.

## **State 3 Converted**

Two communities exist in the Converted State: 3.1 Converted Land Community and the 3.2 Abandoned Land Community. The 3.1 Community is characterized by agricultural production. The site may be planted to improved pasture for hay or grazing. The site may otherwise be planted to row crops. The 3.2 community represents an agricultural state that has not been managed. The land is colonized by first successional species.

### **Community 3.1 Converted Land**



The Converted Land Community (3.1) occurs when the site, either the Prairie State (1) or Shrubland State (2), is cleared and plowed for planting to cropland, hayland, native grasses, tame pasture, or use as non-agricultural land. The Converted State includes cropland, tame pasture, hayland, rangeland, and go-back land. Agronomic practices are used with non-native forages in the Converted State and to make changes between the communities in the Converted State. The native component of the prairie is usually lost when seeding non-natives. Even when reseeding with natives, the ecological processes defining the past states of the site can be permanently changed. The Clay Loam site is frequently converted to cropland or tame pasture sites because of its deep fertile soils, favorable soil/water/plant relationship, and level terrain. Hundreds of thousands of acres have been plowed up and converted to cropland, pastureland, or hayland. Small grains are the principal crop, and Bermudagrass is the primary introduced pasture species on loamy soils in this area. The Clay Loam site can be an extremely productive forage producing site with the application of optimum amounts of fertilizer. Cropland, pastureland, and hayland are intensively managed with annual cultivation and/or frequent use of herbicides, pesticides, and commercial fertilizers to increase production. Both crop and pasturelands require weed and shrub control because seeds remain present on the site, either by remaining in the soil or being transported to the site. Converted sites require continual fertilization for crops or tame pasture (particularly Bermudagrass) to perform well. Common introduced species include coastal Bermudagrass, kleingrass, and Old World bluestems which are used in hayland and tame pastures. Wheat, oats, forage sorghum, grain sorghum, cotton, and corn are the major crop species. Cropland and tame pasture require repeated and continual inputs of fertilizer and weed control to maintain the Converted State. Without agronomic inputs, the site will eventually return to either the Prairie or Shrubland state. The site is considered go-back land during the period between active management for pasture or cropland and the return to a native state.

### **Community 3.2 Abandoned Land**

The Abandoned Land Community (3.2) occurs when the Converted Land Community (3.1) abandoned or mismanaged. Mismanagement can include poor crop or haying management. Pastureland can transition to the Abandoned Land Community when subjected to improper grazing management (typically long-term overgrazing). Heavily disturbed soils left alone will eventually “go-back” to the Shrubland State. These sites may become an eastern red cedar brake over time. Long-term cropping can create changes in soil chemistry and structure that make restoration to the reference state very difficult and/or expensive. Return to native prairie communities in the Clay Loam State is more likely to be successful if soil chemistry, microorganisms, and structure are not heavily disturbed. Preservation of favorable soil microbes increases the likelihood of a return to reference conditions.

Restoration to native prairie will require seedbed preparation and seeding of native species. Protocols and plant materials for restoring prairie communities is a developing portion of restoration science. Sites can be restored to the Prairie State in the short-term by seeding mixtures of commercially-available native grasses. With proper management (prescribed grazing, weed control, brush control) these sites can come close to the diversity and complexity of Tallgrass Prairie Community (1.1). It is unlikely that abandoned farmland will return to the Prairie State without active brush management because the rate of shrub increase will exceed the rate of recovery by desirable grass species. Without active restoration the site is not likely to return to reference conditions due to the introduction of introduced forbs and grasses. The native component of the prairie is usually lost when seeding non-natives. Even when reseeding with natives, the ecological processes defining the past states of the site can be permanently changed.

### **Pathway 3.1A** **Community 3.1 to 3.2**

The Converted Land Community (3.1) will transition to the Abandoned Land Community (3.2) if improperly managed as cropland, hayland, or pastureland. Each of these types of converted land is unstable and requires constant management input for maintenance or improvement. This community requires inputs of tillage, weed management, brush control, fertilizer, and reseeding of annual crops. The driver of this transition is the lack of management inputs necessary to maintain cropland, hayland, or pastureland.

### **Pathway 3.2A** **Community 3.2 to 3.1**

The Abandoned Land Community (3.2) will transition to the Converted Land Community (3.1) with proper management inputs. The drivers for this transition are weed control, brush control, tillage, proper grazing management, and range or pasture planting.

### **Transition T1A** **State 1 to 2**

Shrubs make up a portion of the plant community in the Prairie State, hence woody propagules are present. Therefore, the Prairie State is always at risk for shrub dominance and the transition to the Shrubland State in the absence of fire. The driver for Transition T1A is lack of fire and/or brush control. Maintenance of the Prairie State will require prescribed fire every three to five years. Even with proper grazing and favorable climate conditions, lack of fire or brush control for 10 to 15 years will allow woody species to increase in canopy to reach the 35 percent threshold level. Improper grazing management, prolonged drought, and a warming climate will provide disturbance conditions which will accelerate this process. Introduction of aggressive woody invader species (i.e. juniper) also increase the risk and accelerate the rate at which this transition state is likely to occur. This transition can occur from any of the Prairie State Communities.

### **Transition T1B** **State 1 to 3**

The transition to the Converted State from the Grassland State occurs when the prairie is plowed for planting to cropland or hayland. The threshold for this transition is the plowing of the prairie soil and removal of the prairie plant community. The Converted State includes cropland, tame pasture, and go-back land. The site is considered go-back land during the period between cessation of active cropping, fertilization, and weed control and the return to States 1 or 2. Agronomic practices are used to convert rangeland to the Converted State and to make changes between the communities in the Converted State. The driver for these transitions is management's decision to farm the site.

### **Restoration pathway R2A** **State 2 to 1**

Restoration of the Shrubland State to the Prairie State requires substantial energy input. Mechanical or herbicidal brush control treatments can be used to remove woody species. A long-term prescribed fire program may sufficiently reduce brush density to a level below the threshold of the Prairie State, particularly if the woody

component is dominated by species that are not re-sprouters following top removal. However, fire may not be sufficient to remove mature trees. A mixed program consisting of mechanical, chemical, and fire measures may be used. Brush control in combination with prescribed fire, proper grazing management, and favorable growing conditions may be the most economical means of creating and maintaining the desired plant community. Proper grazing management will be required to promote recovery of the understory towards a tallgrass community. If remnant populations of tallgrasses, midgrasses, and desirable forbs are not present at sufficient levels, range planting will be necessary to restore the prairie plant community. Depending on the understory community and inputs of seed, the restoration pathway can result in return to any of the Prairie State Communities.

## Transition T2A State 2 to 3

The transition to the Converted State from either the Grassland State (T1B) or Shrubland State (T2A) occurs when the prairie is plowed for planting to cropland or hayland. The size and density of brush in the Shrubland State will require heavy equipment and energy-intensive practices (e.g. rootplowing, raking, rollerchopping, or heavy disking) to prepare a seedbed. The threshold for this transition is the plowing of the prairie soil and removal of the prairie plant community. The Converted State includes cropland, tame pasture, and go-back land. The site is considered “go-back land” during the period between cessation of active cropping, fertilization, and weed control and the return to the “native” states. Agronomic practices are used to convert rangeland to the Converted State and to make changes between the communities in the Converted State. The driver for these transitions is management’s decision to farm the site.

## Restoration pathway R3A State 3 to 1

Restoration from the Converted State can occur in the short-term through active restoration or over the long-term due to cessation of agronomic practices. Cropland and tame pasture require repeated and continual inputs of fertilizer and weed control to maintain the Converted State. If the soil chemistry and structure have not been overly disturbed (which is most likely to occur with tame pasture) the site can be restored to the Prairie State. Heavily disturbed soils are more likely to return to the Shrubland State. Without continued disturbance from agriculture the site can eventually return to either the Prairie or Shrubland State. The level of disturbance while in the converted state determines whether the site restoration pathway is likely to be R3A (a return to the Prairie State) or T3A (a return to the Shrubland State). Return to native prairie communities in the Prairie State is more likely to be successful if soil chemistry and structure are not heavily disturbed. Preservation of favorable soil microbes increases the likelihood of a return to reference conditions. Converted sites can be returned to the Prairie State through active restoration, including seedbed preparation and seeding of native grass and forb species. Protocols and plant materials for restoring prairie communities are a developing part of restoration science. The driver for both of these restoration pathways is the cessation of agricultural disturbances.

## Transition T3A State 3 to 2

Transition to the Shrubland State (2) occurs with the cessation of agronomic practices. The site will move from the Abandoned Land Community when woody species begin to invade. After shrubs and trees have established over 35 percent, and reached a height greater than three feet, the threshold has been crossed. The driver for the change is lack of agronomic inputs, improper grazing, no brush management, and no fire.

## Additional community tables

Table 10. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Tallgrasses</b>			3138–5380	
	little bluestem	SCSCS	<i>Schizachyrium scoparium</i> var. <i>scoparium</i>	1961–3363	–
	Indiangrass	SONU2	<i>Sorghastrum nutans</i>	1177–2018	–

	eastern gamagrass	TRDA3	<i>Tripsacum dactyloides</i>	224–2018	–
	big bluestem	ANGE	<i>Andropogon gerardii</i>	1177–2018	–
	switchgrass	PAVI2	<i>Panicum virgatum</i>	224–1681	–
2	<b>Midgrasses</b>			392–673	
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	392–673	–
	silver beardgrass	BOLAT	<i>Bothriochloa laguroides</i> ssp. <i>torreyana</i>	392–673	–
	Canada wildrye	ELCA4	<i>Elymus canadensis</i>	392–673	–
	Texas wintergrass	NALE3	<i>Nassella leucotricha</i>	392–673	–
	Drummond's dropseed	SPCOD3	<i>Sporobolus compositus</i> var. <i>drummondii</i>	392–673	–
3	<b>Mid/Shortgrasses</b>			196–336	
	sedge	CAREX	<i>Carex</i>	196–336	–
	fall witchgrass	DICO6	<i>Digitaria cognata</i>	196–336	–
	mourning lovegrass	ERLU	<i>Eragrostis lugens</i>	196–336	–
	panicgrass	PANIC	<i>Panicum</i>	196–336	–
	purpletop tridens	TRFL2	<i>Tridens flavus</i>	196–336	–
	longspike tridens	TRST2	<i>Tridens strictus</i>	196–336	–
<b>Forb</b>					
4	<b>Forbs</b>			118–202	
	Cuman ragweed	AMPS	<i>Ambrosia psilostachya</i>	118–202	–
	yellow sundrops	CASE12	<i>Calylophus serrulatus</i>	118–202	–
	partridge pea	CHFA2	<i>Chamaecrista fasciculata</i>	118–202	–
	prairie clover	DALEA	<i>Dalea</i>	118–202	–
	bundleflower	DESMA	<i>Desmanthus</i>	118–202	–
	ticktrefoil	DESMO	<i>Desmodium</i>	118–202	–
	blacksamson echinacea	ECAN2	<i>Echinacea angustifolia</i>	118–202	–
	Engelmann's daisy	ENPE4	<i>Engelmannia peristenia</i>	118–202	–
	snow on the prairie	EUBI2	<i>Euphorbia bicolor</i>	118–202	–
	Maximilian sunflower	HEMA2	<i>Helianthus maximiliani</i>	118–202	–
	coastal indigo	INMI	<i>Indigofera miniata</i>	118–202	–
	dotted blazing star	LIPU	<i>Liatris punctata</i>	118–202	–
	sensitive plant	MIMOS	<i>Mimosa</i>	118–202	–
	yellow puff	NELU2	<i>Neptunia lutea</i>	118–202	–
	beardtongue	PENST	<i>Penstemon</i>	118–202	–
	woolly plantain	PLPA2	<i>Plantago patagonica</i>	118–202	–
	prairie parsley	POLYT	<i>Polytaenia</i>	118–202	–
	scurfpea	PSORA2	<i>Psoralegium</i>	118–202	–
	snoutbean	RHYNC2	<i>Rhynchosia</i>	118–202	–
	fuzzybean	STROP	<i>Strophostyles</i>	118–202	–
	vetch	VICIA	<i>Vicia</i>	118–202	–
<b>Shrub/Vine</b>					
5	<b>Shrubs/Vines/Trees</b>			78–135	



pecan	CAILZ	<i>Carya illinoensis</i>	78-135	-
hackberry	CELTI	<i>Celtis</i>	78-135	-
stretchberry	FOPU2	<i>Forestiera pubescens</i>	78-135	-
oak	QUERC	<i>Quercus</i>	78-135	-
sumac	RHUS	<i>Rhus</i>	78-135	-
bully	SIDER2	<i>Sideroxylon</i>	78-135	-
western snowberry	SYOC	<i>Symphoricarpos occidentalis</i>	78-135	-
elm	ULMUS	<i>Ulmus</i>	78-135	-

## Animal community

The animal community differs depending on what state the site is currently in. Northern Bobwhite prefer the reference state. They require dense bunchgrasses for nesting and cover. As the site transitions into State 2, white-tailed deer will become more prevalent. Deer are woodland and edge species, with their primary diet consisting of browse. Mourning dove need open areas with semi-clear ground and forbs with desirable seed sources. Go-back land and communities with shortgrasses and forbs provide the best habitat for dove.

## Hydrological functions

The tallgrass community water cycle functions well with good infiltration and deep percolation of rainfall. The water cycle functions best in the Tallgrass Prairie Community (1.1) and degrades as the vegetation community declines. Rapid rainfall infiltration, high soil organic matter, good soil structure and good porosity accompany high bunchgrass cover. Surface runoff quality will be high and erosion and sedimentation rates will be low. High rates of infiltration will allow water to move below the rooting zone during periods of heavy rainfall.

A shift to the Midgrass Community (1.2) means reduced plant and litter cover, which impairs the water cycle. Infiltration will decrease and runoff will increase due to reduced ground cover, rainfall splash, soil capping, reduced organic matter, and poor structure. With a combination of a sparse ground cover and intensive rainfall, this site can contribute to an increased frequency and severity of flooding within a watershed. Soil erosion is accelerated, quality of surface runoff is poor and sedimentation increases.

Domination of the site by woody species, especially oaks and juniper, further degrades the water cycle. Interception of rainfall by tree canopies increases, which reduces the amount of rainfall reaching the surface and being available to understory plants. Increased flow, due to the funneling effect of the canopy, will increase soil moisture at the base of trees, especially on mesquite. Evergreen species, such as live oak and juniper, create increased transpiration, which provides less water for deep percolation. Increases in woody canopy create declines in grass cover, which creates similar causes impacts as those described for improper grazing above. Return of the Shrubland State to the Tallgrass Plant Community through brush management and good grazing management can help improve hydrologic function of the site.

Under the dense canopy of a mature woodland, leaf litter builds up. This increases soil organic matter, builds structure, improves infiltration, and reduces surface erosion. These conditions improve the function of the water cycle compared to lower levels of canopy cover. Site specific information showed that the reference has no rills or gullies. Water flow patterns are common and follow old stream meanders. Deposition and erosion is uncommon for normal rainfall but may occur during intense rainfall events. Pedestals and terracettes are not common in the reference community. There is generally less than 20 percent bare ground which is randomly distributed throughout. Soil surface is resistant to erosion and the soil stability class range is expected to be 5 to 6. Under reference conditions, this Clay Loam site is dominated by tallgrasses and forbs, having adequate litter and little bare ground which can provide for maximum infiltration and little runoff under normal rainfall events.

## Recreational uses

Recreational uses include recreational hunting, hiking, camping, equestrian, and bird watching.

## Wood products

Honey mesquite, eastern red cedar, and some oak are used for posts, firewood, charcoal, and other specialty wood products.

## Other products

Jams and jellies are made from many fruit-bearing species, such as agarito (*Mahonia trifoliolata*). Seeds are harvested from many reference plants for commercial sale. Many grasses and forbs are harvested by the dried-plant industry for sale in dried flower arrangements. Honeybees are utilized to harvest honey from many flowering plants.

## Inventory data references

These site descriptions were developed as part a Provisional Ecological Site project using historic soil survey manuscripts, available site descriptions, and low intensity field traverse sampling. Future work to validate the information is needed. This will include field activities to collect low, medium, and high-intensity sampling, soil correlations, and analysis of that data. A final field review, peer review, quality control, and quality assurance review of the will be needed to produce the final document.

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## Approval

Bryan Christensen, 9/21/2023

## Acknowledgments

Special thanks to the following personnel for assistance and/or guidance with development of this ESD: Justin Clary, NRCS, Temple, TX; Mark Moseley, NRCS, San Antonio, TX; Monica Purviance, NRCS, Greenville, TX; Jim Eidson, The Nature Conservancy, Celeste, TX; and Gary Price (Rancher) and the 77 Ranch, Blooming Grove, TX.

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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.

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Contact for lead author	817-596-2865
Date	01/17/2008
Approved by	Bryan Christensen
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

## Indicators

1. **Number and extent of rills:** None.
- 

2. **Presence of water flow patterns:** Water flow patterns are common and follow old stream meanders. Deposition or erosion is uncommon for normal rainfall but may occur during intense rainfall events.
- 

3. **Number and height of erosional pedestals or terracettes:** Pedestals or terracettes are uncommon.
- 

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Essentially none. Site has litter filling interspaces between plant bases.
- 

5. **Number of gullies and erosion associated with gullies:** No gullies should be present on side drains into perennial and intermittent streams. Drainageways should be vegetated and stable.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None.
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7. **Amount of litter movement (describe size and distance expected to travel):** This site is a flood plain with occasional out of bank flow. Under normal rainfall, little litter movement should be expected; however, litter of all sizes may move long distances under flood conditions.
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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil surface is resistant to erosion. Soil stability class range is expected to be 5 to 6.
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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** 0 to 53 inches thick with colors from dark reddish brown clay to very dark gray clay with generally weak very fine subangular blocky structure. SOM is approximately 1 to 6 percent. See soil survey for specific soils.
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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** This site is dominated by tallgrasses and forbs and trees having adequate litter and little bare ground can provide for maximum infiltration and little runoff under normal rainfall events.
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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None.
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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 > Cool-season grasses > Trees >
- Other: Forbs > Shrubs/Vines
- Additional:
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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Grasses and forbs due to their growth habit will exhibit some mortality and decadence, though very slight. Open spaces from disturbance are quickly filled by new plants through seedlings and vegetative reproduction (tillering).
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14. **Average percent litter cover (%) and depth ( in):** Litter is primarily herbaceous.
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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-**

**production):** 3,500 pounds per acre for below average moisture years to 6,000 pounds per acre for above average moisture years.

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16. **Potential invasive (including noxious) species (native and non-native).** List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site: Potential invasive species include yellow bluestems, mesquite, Bermudagrass, elm, huisache, eastern red cedar, osage orange and Chinese tallow.
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17. **Perennial plant reproductive capability:** All perennial plants should be capable of reproducing, except during periods of prolonged drought conditions, heavy natural herbivory and intense wildfires.
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