USDA Natural Resources Conservation Service

Ecological site R086AY004TX
Southern Claypan Prairie

Last updated: 9/21/2023
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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.

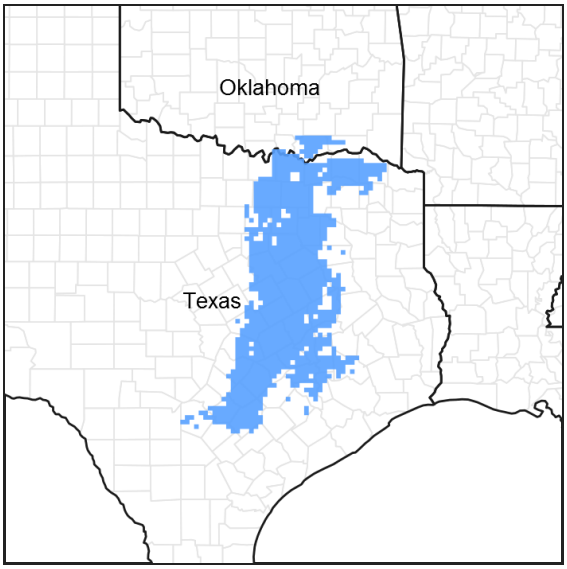


Figure 1. Mapped extent

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 major thoroughfare for commerce and travel, traverses the length of the MLRA from San Antonio to Dallas. The area supports tall and midgrass 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 Claypan Prairie is a true tallgrass prairie. The soils are characterized by loamy surface soils underlain by dense, hard, clays. This "claypan" restricts air and water movements, as well as root penetration.

Associated sites

R086AY002TX	**Southern Chalky Ridge** The Chalky Ridge site is often upslope from the Claypan Prairie site. It differs from the site by having shallow soils and low soil fertility.
R086AY011TX	**Southern Blackland** The Blackland site is often adjacent to the Claypan Prairie site. It differs from the site by having a deeper clay soils and higher production.
R086AY013TX	**Clayey Bottomland** The Southern Claypan site is often adjacent to the Clayey Bottomland site. It differs from the Clayey Bottomland site by forming on stream terraces and having a sandy loam surface soil layer and lower production potential due to low to moderate soil fertility.
R086AY009TX	**Southern Eroded Blackland** The Eroded Blackland site can occur adjacent to the Claypan Prairie site. It differs from the site by having areas with extensive erosion indicated by a partial or lost A horizon, active rills and/or gullies, and lower production.

Similar sites

R086AY003TX	**Northern Claypan Prairie** The Northern Claypan Prairie site is similar to the Southern Claypan Prairie site by having similar physiographic features and representative soil features. It differs from the site by receiving more effective precipitation.
R086BY002TX	**Claypan Prairie** Similar but different MLRA.

Table 1. Dominant plant species

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

Physiographic features

These sites are on strongly sloping soils on uplands and terraces. The slope gradients range from 0 to 10 percent but are usually less than 5 percent. There is no flooding or ponding associated with these sites. The runoff class is low to high and runoff increases with greater slope.

Table 2. Representative physiographic features

Landforms	(1) Plains > Terrace
Runoff class	Low to high
Flooding frequency	None
Ponding frequency	None
Elevation	76–183 m
Slope	0–5%
Ponding depth	0 cm
Water table depth	152 cm
Aspect	Aspect is not a significant factor

Table 3. Representative physiographic features (actual ranges)

Runoff class	Not specified

Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	Not specified
Slope	0–10%
Ponding depth	Not specified
Water table depth	Not specified

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

Influencing water features

No water features are influencing this site.

Wetland description

Wetlands are not associated with this site.

Soil features

The site consists of moderately deep to deep, moderately well to well drained soils that have slow to very slow permeability. The upland soils formed in calcareous weathered shale and the terraces formed in clayey alluvial sediments. In a representative profile, the surface layer is dark brown fine sandy loam about 8 inches thick. Below 8 inches and to depths of more than 40 inches, the subsoil is clay that grades from brown to olive as depth increases. The subsoil commonly contains pale yellow and light brownish gray mottles as well as calcium carbonate masses.

Available water capacity to a depth of 60 inches is moderate and the shrink-swell potential can be a limitation. The Claypan Prairie soils can be highly productive for improved pasture or rangeland however, when dry, the surface layer of these soils can be massive and hard. The site is used primarily for improved pasture or rangeland, however, a few small areas are used for cropland.

The dominant associated soil series include: Crockett, Davilla, Mabank, Payne, and Wilson.

Table 5. Representative soil features

Parent material	(1) Residuum–shale (2) Alluvium
Surface texture	(1) Fine sandy loam (2) Clay loam (3) Loam
Family particle size	(1) Clayey
Drainage class	Moderately well drained to well drained
Permeability class	Slow to very slow
Soil depth	61–203 cm
Surface fragment cover <=3"	0–30%
Surface fragment cover >3"	0–5%
Available water capacity (0-101.6cm)	7.62–20.32 cm
Calcium carbonate equivalent (0-101.6cm)	0–35%
Electrical conductivity (0-101.6cm)	0–8 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–13
Soil reaction (1:1 water) (0-101.6cm)	5.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–20%
Subsurface fragment volume >3" (Depth not specified)	0–5%

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.

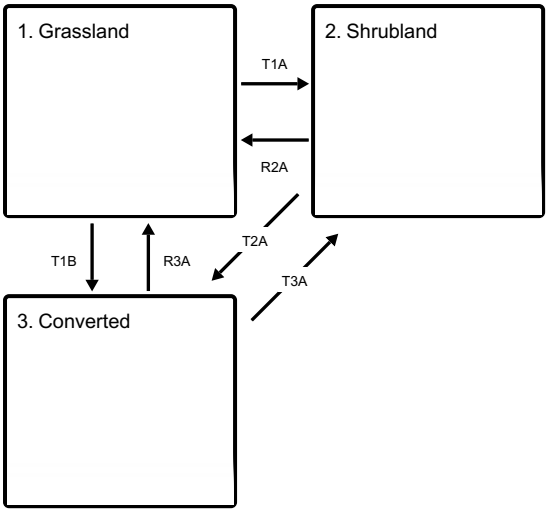
Introduced pasture has been established on many acres of old cropland and in areas with deeper soils. Coastal bermudagrass (*Cynodon dactylon*) and kleingrass (*Panicum coloratum*) are by far the most frequently used introduced grasses for forage and hay. Hay has also been harvested from a majority of 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

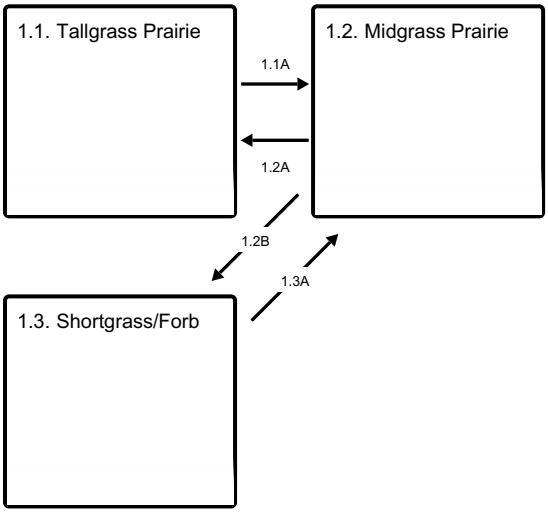
R2A - Fire, brush management, proper grazing, range planting

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



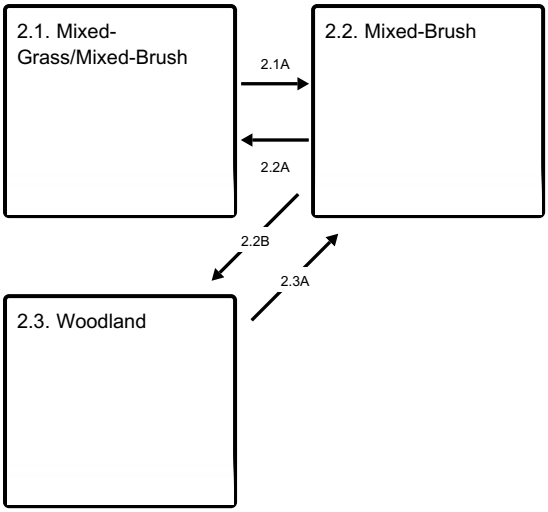
1.1A - No fire, no brush management, improper grazing management, drought

1.2A - Fire, brush management, proper grazing

1.2B - No fire, no brush management, improper grazing management, drought

1.3A - Fire, brush management, proper grazing

State 2 submodel, plant communities



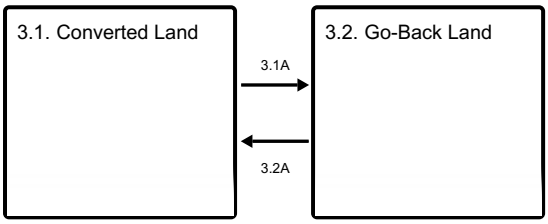
2.1A - No fire, no brush management, improper grazing management, drought

2.2A - Fire, brush management, proper grazing, range planting

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

2.3A - Fire, brush management, proper grazing, range planting

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
Grassland

Three communities exist in the Grassland State: the 1.1 Tallgrass Prairie Community, the 1.2 Midgrass Prairie Community, and the 1.3 Shortgrass/Forb Community. Community 1.1 is characterized by tallgrasses dominating the understory and comprising greater than 50 percent of the annual production, with woody cover less than 10 percent. Community 1.2 is characterized by midgrasses and forbs combining for greater than 50 percent of the annual production, with woody cover between 10 and 35 percent. Community 1.3 is characterized by shortgrasses and forbs totaling greater than 50 percent of the annual production with 10 to 30 percent woody cover.

Community 1.1
Tallgrass Prairie

The Tallgrass Prairie Community (1.1) is the reference community. It is characterized by deeper soils underlain at rather shallow depths by dense, hard, clayey material. This “claypan” restricts air and water movements, as well as root penetration. This site is 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, five percent or less. Little bluestem dominates the site. Indiangrass, big bluestem, and switchgrass act as decreasers on this site and are the first species to be removed by improper grazing management. Other important grasses include Virginia wildrye, Canada wildrye (Elymus Canadensis), and Florida paspalum. Important midgrasses include sideoats grama, hairy dropseed (*Sporobolus compositus* var. drummondii), silver bluestem (*Bothriochloa laguroides*), and Texas wintergrass. Forbs commonly found on the site

include: Maximilian sunflower (*Helianthus maximiliani*), Engelmann's daisy (*Engelmannia peristenia*), blacksamson (*Echinacea angustifolia*), scurfpea (Psoralidium), halfshrub sundrop (*Calylophus serrulatus*), sensitive-briar (Mimosa spp.), and yellow neptunia (*Neptunia lutea*). Typical shrub and tree species found in the reference community (1.1) include species of oak, elm (Ulmus spp.), hackberry, coralberry (*Symphoricarpos orbiculatus*), and bumelia (Sideroxylon spp.). The reference grassland 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 (e.g., switchgrass, Indiangrass, big bluestem, and Engelmann's daisy). If improper grazing management continues, little bluestem will decrease and midgrasses such as silver bluestem and sideoats grama will increase in composition. Forbs, particularly less palatable species, will increase at this stage. This site can have dramatic increases in forbs, particularly following a fire. This plant community has very little bare ground. Plant basal cover and litter make up almost 100 percent ground cover. Infiltration is moderate and runoff is very low when the soils are dry and open. However, once soils have sealed shut, infiltration is slow and runoff may be rapid. Soils are high in organic matter and the heavy plant cover contributes to increasing organic matter and soil building.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	2858	3811	4764
Forb	336	448	560
Shrub/Vine	168	224	280
Total	**3362**	**4483**	**5604**

Community 1.2
Midgrass Prairie

The Midgrass Prairie Community (1.2) is the result of improper cattle grazing management or improper haying practices over a long period of time. Tallgrasses in the reference 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 Prairie Community (1.2) is continually overgrazed and fire is excluded, the community transitions to the Shortgrass/Forb Community (1.3). Important grasses include: little bluestem, silver bluestem, sideoats grama, paspalums, Texas wintergrass, and tridens (Tridens spp.). Some of the reference perennial forbs persist, but less palatable forbs will increase. Forbs can increase to as high as 40 percent in this community, particularly following fire. This woody canopy may be as high as 30 percent, depending on the type of grazing animal, fire interval, brush control, and/or availability of increaser shrub species. While shrub canopy will generally be less than 30 percent, the transition to the Shrubland State (2) does not occur until shrubs exceed 30 percent canopy cover or herbaceous species make up less than 60 percent of species composition by weight. 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 honey mesquite (*Prosopis glandulosa*), bumelia, coralberry, and honey

locust will increase in density. Aggressive, introduced pasture species may begin to invade the Midgrass Prairie Community, particularly if they have been seeded in nearby pastures. These include introduced Bermudagrass (Cynodon spp.) and paspalums, such as bahiagrass (*Paspalum notatum*). 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. If improper grazing management continues but shrubs are held in check through fire, brush control, browsing, or mowing, the Midgrass Prairie Community (1.2) will transition (1.2B) to the Shortgrass/Forb Community (1.3). Increasing woody dominants are oak, hackberry, elm, juniper, and honey mesquite. Once shrubs reach a height of about three feet, they become more resistant to being killed by fires. Tall grasses will continue to decrease in species composition, and midgrasses will begin to decrease. Grazing-resistant shortgrasses and forbs will represent more of species composition. These species may increase in production due to release from competition with more robust grasses or increase in relative composition due to the loss of tall and midgrasses. Until the Midgrass Prairie Community (1.2) transitions into the Shortgrass/Forb Community (1.3), this community can be managed back toward the reference community (1.1) through the use of cultural practices including prescribed grazing, prescribed burning, and strategic brush control. It may take several years to achieve this state, depending upon climate and the aggressiveness of the manager. Once woody species begin to establish, returning fully to the reference community is difficult, but it is possible to return to a similar plant community.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1821	2550	3278
Shrub/Vine	560	785	1009
Forb	420	588	757
Total	**2801**	**3923**	**5044**

Community 1.3
Shortgrass/Forb

The Shortgrass/Forb Community (1.3) is the result of improper grazing management or improper haying practices over a long period of time. This community is generally a “weedy” community. Midgrasses in the Midgrass Prairie Community decrease in vigor and production, allowing shortgrasses, annual grasses, 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. However, this community tends to occur on areas where some form of brush control is in place, either mowing, or heavy browsing due to animals being forced to a low quality diet, otherwise the community would have shifted to the Shrubland State (2). This community often occurs in pastures with abusive horse grazing or “barnyard” pastures. The site may take on a “weedy” appearance. Important grasses include vine mesquite (*Panicum obtusum*), low panicums (Panicum spp.), and threeawns (Aristida spp.). Grazing-resistant, introduced species and invasive species can make up a substantial portion of species composition. Few reference perennial forbs persist, while less palatable forbs increase, such as broomweed (*Amphiachyris dracunculoides*), croton (Croton spp.), and silverleaf nightshade (*Solanum elaeagnifolium*). Forbs may become the dominant vegetation, making up 40 to 60 percent of species composition. Woody canopy may be as high as 30 percent, depending on the type of grazing animal, fire interval, brush control, and/or availability of increaser shrub species, but tends to be lower. Heavy continuous grazing will reduce plant cover, litter, and mulch. Bare ground will increase and expose more soil to crusting and erosion. Increasing woody dominants are oak, hackberry, elm, juniper, and honey mesquite. Once shrubs reach a height of about three feet, they become more resistant to being killed by fires. The indicator that the site has crossed the threshold (T1A) into the Shrubland State (2) is when woody species exceed 30 percent canopy cover. Until the Shortgrass/Forb Community (1.3) crosses the threshold into the Shrubland State, this community can be managed back toward the Midgrass Prairie Community (1.2) through the use of cultural practices including prescribed grazing, prescribed burning, weed control, and strategic brush control. It may take several years to achieve this state, depending upon climate and the aggressiveness of the manager. Seeding of desirable native species can accelerate this process.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1121	1625	2018
Shrub/Vine	785	1121	1513
Forb	336	616	953
Total	**2242**	**3362**	**4484**

Pathway 1.1A
Community 1.1 to 1.2

The Tallgrass Prairie Plant Community will shift to the Midgrass Prairie Plant Community when there is continued growing season stress on reference grass species. These stresses include insufficient critical growing season deferment, excess defoliation intensity, repeated longterm growing season defoliation, and/or long-term drought. Increaser species (midgrasses, forbs, and woody species) are frequently endemic species released from competition. Woody species canopy is less than five percent in the reference community. Although woody canopy is generally less than five percent, the community transition does not occur until woody canopy exceeds 10 percent. Woody canopy exceeding 10 percent and/or dominance of tallgrasses falling below 50 percent of species composition indicate a transition to the Midgrass Prairie Plant Community. The reference community can be maintained through the implementation of managed grazing that provides adequate growing season deferment to allow establishment of tallgrass propagules and/or the recovery of the vigor of stressed individual plants. Proper grazing management may be combined with fire and/or brush management to create a shift towards or maintain the reference community. The driver for community shift 1.1A for the herbaceous component is improper grazing management. 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 Plant Community will return to the Tallgrass Prairie Plant 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 reference conditions of 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, i.e., 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. The driver for the woody component is fire and/or brush control.

Pathway 1.2B
Community 1.2 to 1.3

The Midgrass Prairie Plant Community will shift to the Shortgrass/Forb Plant Community when there is continued growing season stress on reference and midgrass species. This transition usually results from heavy, long-term continuous (or growing season long) grazing. Other stresses include: insufficient critical growing season deferment, excess defoliation intensity, improper haying, and/or long-term drought. Increaser species include grazing tolerant or unpalatable grasses and forbs. Shortgrasses and forbs exceeding 50 percent of species composition indicate a transition to the Shortgrass/Forb Plant Community. Transition to the Shortgrass/Forb Plant Community usually requires brush control in some form, either through browsing, mowing, or herbicide. Without brush control, woody species canopy will exceed 30 percent, indicating a shift across a threshold to the Shrubland State. The driver for community shift 1.2B for the herbaceous component is severe, long-term overgrazing or abusive haying practices. The driver for the woody component is lack of fire and/or brush control.

Pathway 1.3A
Community 1.3 to 1.2

The Shortgrass/Forb Plant Community will return to the Midgrass Prairie Plant Community under grazing

management that provides sufficient critical growing season deferment in combination with proper grazing intensity. This will require the recovery of the vigor of stressed individual reference/midgrass plants, reference plants remaining in the seedbank, and/or introduction of reference seeds. Favorable moisture conditions will facilitate or accelerate this transition. The understory component may return to dominance by midgrasses in the absence of fire or brush control. However, without brush control the site will eventually cross the threshold to the Shrubland State. Proper grazing management may be combined with fire and/or brush management to create a shift towards or maintain the reference community. The driver for community shift 1.3A for the herbaceous component is proper grazing management combined with weed control. The driver for the woody component is fire and/or brush control.

State 2
Shrubland

The Shrubland State has three communities: 2.1 Midgrass/Mixed-Brush Community, 2.2 Mixed-Brush Community, and 2.3 Woodland Community. The 2.1 community has a woody species overstory canopy of 30 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
Mixed-Grass/Mixed-Brush

The Grass/Mixed-Brush Community (2.1) presents a 30 to 50 percent woody plant canopy, with oak, hackberry, elm, mesquite, 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 reference (1.1) 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 the reference (1.1) 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 (1.1) 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, dropseeds, and dotted gayfeather (*Liatris punctata*). Tumblegrass (*Schedonnardus paniculatus*), Texas grama (*Bouteloua rigidiseta*), western ragweed (*Ambrosia psilostachya*), Indian paintbrush (Castilleja spp.), Texas bluebonnet (*Lupinus texensis*), and annual species are persistent increasers until shrub density reaches maximum canopy. As the grassland vegetation declines, more soil is exposed, leading to crusting and erosion. 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.

Table 9. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1009	1233	1765
Shrub/Vine	897	1384	1569
Forb	336	465	588
Total	**2242**	**3082**	**3922**

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 honey mesquite and/or juniper dominate the Mixed-Brush Community (2.2). The site can now have the appearance of a dense shrubland or savannah of dense shrubland interspersed with open grassland areas. Common understory shrubs are pricklypear (Opuntia spp.), and sumac (Rhus spp.). 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 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, croton, 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 grassland. Alternatives for restoration include: brush control and range planting, with proper stocking; prescribed grazing; and prescribed burning following restoration to maintain the desired community. Excessive cattle grazing tends to create a different response and structure to the community than does excessive deer or goat grazing. Unrestricted cattle grazing tends to accelerate invasion of shrubs because it creates conditions where young shrubs increase in vigor and size while palatable grasses decrease in vigor and abundance. Excess deer or goat grazing tends to create a dominance of large trees by removing both young shrubs and the young growth that grow below the browse line on larger shrubs and trees. While large trees will continue to increase in size, they will have very little production below the browse line. The site becomes dominated by large trees with little forage available for livestock or wildlife. Large trees with little understory provide much less soil protection than do dense stands of grass. As soils erode, understory species have reduced potential to revegetate the site. The bare area under the browse line creates a situation that provides poor forage conditions and poor visual cover for wildlife. If irreversible soil damage has occurred, it may be possible to remove brush and seed the site to a grassland community. The resulting grassland will not look or function like the reference communtity (1.1). Instead, it is likely to be dominated by few introduced midgrasses and produce less biomass. However, it is very difficult and expensive to restore the site to reference conditions due to the loss of organic matter, soil horizons, soil microbes, and soil structure necessary to maintain the reference community (1.1). Rangeland health functions will depart substantially from reference conditions.

Table 10. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	1749	1961	2522
Grass/Grasslike	135	420	560
Forb	135	420	560
Total	**2019**	**2801**	**3642**

Community 2.3
Woodland

The 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 woody species or increasers such as honey mesquite and/or juniper dominate the Woodland Community (2.3) with little herbaceous understory. The site has the appearance of a dense shrubland or forest. 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. The Woodland Community (2.3) can provide good habitat for wildlife that favor forest environment. Highly intensive restoration practices are needed to return the woodland to grassland. 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 11. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	1513	2018	2522
Grass/Grasslike	84	112	140
Forb	84	112	140
Total	**1681**	**2242**	**2802**

Pathway 2.1A
Community 2.1 to 2.2

Without fire (natural or human-caused) and/or brush control, woody density and canopy cover will increase in the Grass/Mixed-Brush Plant Community until it converts into the Mixed-Brush Plant 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 Grassland State Plant Communities. Improper grazing or other long-term growing season stress can increase the composition of shortgrasses 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 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 to a midgrass-dominated Grass/Mixed-Brush Plant Community. Range planting may accelerate the transition of the herbaceous community, particularly when combined with favorable growing conditions. Range planting is more commonly associated with Restoration Pathway R2A. 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 Plant Community until it converts into the Woodland Plant 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 2.2B 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 Woodland Plant 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. Managers may chose to leave some brush for wildlife habitat objectives. 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 Go-Back 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 State (3) occurs when the prairie, either the Grassland State (1) or Shrubland State (2), is plowed for planting to cropland, hayland, or tame pasture, or use as non-agricultural land. The Converted State includes cropland, tame pasture, and go-back land. Agronomic practices are used to convert rangeland to the Converted State and to make changes between the communities in the Converted State. Many or all native species are replaced by seeding crops or introduced species into the plowed soil. The native component of the prairie is usually lost in this state, and even with reseeding, the ecological processes defining the past states of the site can be permanently changed. Common introduced species include coastal Bermudagrass and kleingrass, 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 Grassland or Shrubland State. Weed and shrub control will be required because seeds remain in the soil or are transported to the site. Return to native prairie communities in the Grassland State is more likely to be successful if soil chemistry and structure have not been severely altered. Preservation of favorable soil microbes increases the likelihood of a return to reference (or near reference) conditions. Restoration to native prairie will require seedbed preparation and seeding of native species. Without active restoration the site is not likely to return to reference conditions due to the presence of introduced forbs and grasses. Protocols and plant materials for restoring prairie communities is a developing portion of restoration science.

Community 3.2
Go-Back Land

Without agronomic inputs, the site will eventually return to either the Grassland or Shrubland State. The site is considered go-back land when active management for pasture or ceases. Heavily disturbed soils usually return to the Shrubland State but could return to a Grassland State if shrub seeds are not present. Long-term cropping creates changes in soil chemistry, microflora and structure that make restoration to the reference state very difficult and/or expensive. Moreover, the residual seedbank is usually depleted depending upon the length of time the site has been in the converted state. Restoration to near native prairie is possible. It will nearly always require seedbed preparation, suppression of shrubs and seeding of native species. Otherwise, it would take a very long time to reestablish from natural processes. Protocols and plant materials for restoring prairie communities are a developing portion of restoration science.

Pathway 3.1A
Community 3.1 to 3.2

The driver for this transition is lack of agricultural management. Without practices to suppress forbs and woody species, the land will eventually grow first successional species. Annual forbs and grasses are common colonizers and first provide ground cover and soil stability. Eventually, woody species will encroach and begin rapid expansion.

Pathway 3.2A
Community 3.2 to 3.1

The driver for this transition is a reestablishment of agricultural management. Depending on what the Go-Back Land looks like depends on the prescription. Proper grazing, brush management, herbicides, and/or fire are all potential practices the landowner can use to create more agricultural production on the site.

Transition T1A

State 1 to 2

The Grassland State is resistant to shrub dominance. However, shrubs make up a portion of the plant community in the Grassland State, therefore propagules are present. Even with proper grazing and favorable climate conditions, lack of fire or brush control for over 25 years will allow woody species to increase in canopy to reach the 30 percent threshold level. Improper grazing management, prolonged drought, and a warming climate will provide a competitive advantage to shrubs, which will accelerate this process. This transition can occur from any of the Grassland State Communities. The driver for Transition T1A is lack of fire and/or brush control. The Grassland State is always at risk for this transition because woody species are present in the grassland plant community. Introduction of aggressive woody invader species (i.e. juniper) increase the risk that this state transition will occur and accelerate the rate at which it is likely to occur.

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 Grassland 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 Grassland State, particularly if the woody component is dominated by species that are not re-sprouters. However, fire may not be sufficient to remove mature trees. An integrated 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. If remnant populations of tallgrasses, midgrasses, and desirable forbs are not present at sufficient levels, range planting will be necessary to restore the reference plant community. Depending on the understory community and inputs of seed, the restoration pathway can result in a return to any of the Grassland State Communities. The driver for Restoration Pathway R2A is fire and/or brush control combined with restoration of the herbaceous community and proper grazing management. Restoration may require aggressive treatment of invader species.

Transition T2A
State 2 to 3

The transition to the Converted State from the 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 Grassland 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 Grassland 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 Grassland State) or T3A (a return to the Shrubland State). Return to native prairie communities in the Grassland 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 Grassland 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 Go-Back Land Community when woody species begin to invade. After shrubs and trees have established over 30 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 12. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tallgrass**			1681–2802	
	little bluestem	SCSCS	*Schizachyrium scoparium var. scoparium*	1681–2802	–
2	**Tallgrasses**			504–841	
	big bluestem	ANGE	*Andropogon gerardii*	448–785	–
	Indiangrass	SONU2	*Sorghastrum nutans*	448–785	–
	switchgrass	PAVI2	*Panicum virgatum*	224–392	–
3	**Tall/Midgrasses**			336–560	
	sideoats grama	BOCU	*Bouteloua curtipendula*	280–504	–
	silver beardgrass	BOLAT	*Bothriochloa laguroides ssp. torreyana*	224–420	–
	Canada wildrye	ELCA4	*Elymus canadensis*	224–420	–
	Virginia wildrye	ELVI3	*Elymus virginicus*	224–420	–
	Drummond's dropseed	SPCOD3	*Sporobolus compositus var. drummondii*	224–420	–
	Texas cupgrass	ERSE5	*Eriochloa sericea*	168–280	–
	Texas wintergrass	NALE3	*Nassella leucotricha*	168–280	–
	vine mesquite	PAOB	*Panicum obtusum*	168–280	–
4	**Mid/Shortgrasses**			336–560	
	brownseed paspalum	PAPL3	*Paspalum plicatulum*	224–392	–
	purpletop tridens	TRFL2	*Tridens flavus*	224–392	–
	longspike tridens	TRST2	*Tridens strictus*	224–392	–
	purple threeawn	ARPU9	*Aristida purpurea*	168–280	–
	buffalograss	BODA2	*Bouteloua dactyloides*	168–280	–
	sedge	CAREX	*Carex*	168–280	–
	fall witchgrass	DICO6	*Digitaria cognata*	168–280	–

	plains lovegrass	ERIN	*Eragrostis intermedia*	168–280	–
	panicgrass	PANIC	*Panicum*	168–280	–
Forb					
5	**Forbs**			336–560	
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	336–560	–
	Engelmann's daisy	ENPE4	*Engelmannia peristenia*	336–560	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	336–560	–
	yellow sundrops	CASE12	*Calylophus serrulatus*	224–364	–
	dotted blazing star	LIPU	*Liatris punctata*	224–364	–
	sensitive plant	MIMOS	*Mimosa*	224–364	–
	beardtongue	PENST	*Penstemon*	224–364	–
	scurfpea	PSORA2	*Psoralidium*	224–364	–
	snoutbean	RHYNC2	*Rhynchosia*	112–280	–
	fuzzybean	STROP	*Strophostyles*	112–280	–
	vetch	VICIA	*Vicia*	112–280	–
	yellow puff	NELU2	*Neptunia lutea*	112–280	–
	partridge pea	CHFA2	*Chamaecrista fasciculata*	112–280	–
	prairie clover	DALEA	*Dalea*	112–280	–
	bundleflower	DESMA	*Desmanthus*	112–280	–
	ticktrefoil	DESMO	*Desmodium*	112–280	–
	coastal indigo	INMI	*Indigofera miniata*	112–280	–
	beeblossom	GAURA	*Gaura*	112–280	–
Shrub/Vine					
6	**Shrubs/Vines/Trees**			168–280	
	live oak	QUVI	*Quercus virginiana*	168–280	–
	bully	SIDER2	*Sideroxylon*	112–224	–
	coralberry	SYOR	*Symphoricarpos orbiculatus*	112–224	–
	elm	ULMUS	*Ulmus*	112–224	–
	common hackberry	CEOC	*Celtis occidentalis*	112–224	–

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

Rills and gullies are rare in the reference community. This site has potential for gullies to heal when in functioning condition. Drainage ways should be vegetated and stable. Water flow patterns are very short (less than two feet) if visible. Pedestals or terracettes do not occur in the reference community. Bare ground is essentially nonexistent. Soils on this site are permeable until saturated, when dry infiltration is rapid, and runoff is slight. Soils become saturated quickly due to the impermeable layer that forms the claypan. Once soils are saturated, infiltration is slow to very slow, and runoff is likely. Due to density of vegetation, even on sloping sites, small to medium-sized litter will move very little during intense storms. The soil surface under reference conditions is highly resistant to erosion; the soil stability class range is expected to be 5 to 6. This prairie 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. 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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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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Date	09/17/2007
Approved by	Bryan Christensen
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Essentially none.

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2. **Presence of water flow patterns:** Water flow patterns are common and follow old stream meanders. Water flow patterns are very short (less than two feet) if visible. Deposition or erosion is uncommon for normal rainfall but may occur during intense rainfall events.

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3. **Number and height of erosional pedestals or terracettes:** Pedestals or terracettes are uncommon for this site when occupied by the reference community.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is essentially nonexistent.

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.

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

7. **Amount of litter movement (describe size and distance expected to travel):** This site has slowly permeable soils. On sloping sites, small to medium size-litter will move short distances during intense storms.

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. Stability class range is expected to be 5 to 6.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Less than 10 inches thick with colors from dark brown loam to dark grayish brown loam and generallly weak fine and fine subangular blocky structure. SOM is approximately 0.5 to 2 percent. See soil survey for specific soils.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** This prairie site is dominated by tallgrasses and forbs and trees having adequate litter and little bare ground which can provide for maximum infiltration and little runoff under normal rainfall events.

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 > Cool-season grasses > Forbs >

    Other: Trees > Shrubs/Vines

    Additional:

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 reproductive 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):** 3,000 pounds per acre for below average moisture years to 5,000 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 bluestem, Bermudagrass, mesquite, 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, or intense wildfires.
