Ecological site R150AY639TX
Clay Loam

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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): 150A–Gulf Coast Prairies

MLRA 150A is in the West Gulf Coastal Plain Section of the Coastal Plain Province of the Atlantic Plain in Texas (83 percent) and Louisiana (17 percent). It makes up about 16,365 square miles (42,410 square kilometers). It is characterized by nearly level plains that have low local relief and are dissected by rivers and streams that flow toward the Gulf of Mexico. Elevation ranges from sea level to about 165 feet (0 to 50 meters) along the interior margin. It includes the towns of Crowley, Eunice, and Lake Charles, Louisiana, and Beaumont, Houston, Bay City, Victoria, Corpus Christi, Robstown, and Kingsville, Texas. Interstates 10 and 45 are in the northeastern part of the area, and Interstate 37 is in the southwestern part. U.S. Highways 90 and 190 are in the eastern part, in Louisiana. U.S. Highway 77 passes through Kingsville, Texas. The Attwater Prairie Chicken National Wildlife Refuge and the Fannin Battleground State Historic Site are in the part of the area in Texas.

Classification relationships

USDA-Natural Resources Conservation Service, 2006.
-Major Land Resource Area (MLRA) 150A

Ecological site concept

The Clay Loam ecological site has very deep clay loam soils and has high vegetative production.

Associated sites

R150AY537TX	**Lowland** As named, the Lowland ecological site occurs on the lowest part of the landscape. It receives excess water from surround landforms and may stay wet for extended periods throughout the year. This site is located within the Blackland site.
R150AY540TX	**Salty Prairie** The site is located on low lying flats. The soils have elevated levels of salts. This creates a vegetative community adapted to nutrient-poor and saline conditions. Vegetation is sparse with a few bare areas. This site is not similar in soils, landscape positions or vegetation to any other sites in MLRA 150A.
R150AY641TX	**Lakebed** Lakebeds are shallow depressions that support wet soil plant communities. These sites receive water from surrounding upland sites following heavy rainfall events and can remain ponded for long periods. This site is not similar in soils, landscape positions or vegetation to any other sites in MLRA 150A.
R150AY526TX	**Southern Blackland** The Southern Blackland ecological site shows an intact grass community with small clumped dispersal of woody species. The soils are very deep, richly black in color, and characterized by their shrink-swell nature. The sites are widely distributed across the uplands in areas with mean annual precipitation from 32 to 41 inches.

Similar sites

R150AY526TX	**Southern Blackland** The Southern Blackland ecological site shows an intact grass community with small clumped dispersal of woody species. The soils are very deep, richly black in color, and characterized by their shrink-swell nature. The sites are widely distributed across the uplands in areas with mean annual precipitation from 32 to 41 inches.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Trichloris crinita* (2) *Pappophorum bicolor*

Physiographic features

The nearly level sites formed in loamy fluviomarine sediments of Late Pleistocene age. They are found on slightly convex broad flats of the Coastal Plain. Slopes range from 0 to 2 percent. Elevation ranges from 20 to 150 feet.

Table 2. Representative physiographic features

Landforms	(1) Coastal plain > Flat (2) Coastal plain > Meander scroll
Runoff class	Negligible to medium
Flooding frequency	None
Ponding frequency	None
Elevation	20–150 ft
Slope	0–2%
Aspect	Aspect is not a significant factor

Climatic features

The climate of MLRA 150A is humid subtropical with mild winters. The average annual precipitation in the northern two-thirds of this area is 45 to 63 inches. It is 28 inches at the extreme southern tip of the area and 30 to 45 inches in the southwestern third of the area. The precipitation is fairly evenly distributed, but it is slightly higher in late summer and midsummer in the western part of the area and slightly higher in winter in the eastern part. Rainfall typically occurs as moderate intensity, tropical storms that produce large amounts of rain during the winter. The average annual temperature is 66 to 72 degrees F. The freeze-free period averages 325 days and ranges from 290 to 365 days, increasing in length to the southwest.

Table 3. Representative climatic features

Frost-free period (characteristic range)	230-265 days
Freeze-free period (characteristic range)	365 days
Precipitation total (characteristic range)	33-47 in
Frost-free period (actual range)	216-312 days
Freeze-free period (actual range)	321-365 days
Precipitation total (actual range)	31-51 in
Frost-free period (average)	255 days
Freeze-free period (average)	356 days
Precipitation total (average)	41 in

Climate stations used

- (1) COLUMBUS [USC00411911], Columbus, TX
- (2) SEALY [USC00418160], Sealy, TX
- (3) THOMPSONS 3 WSW [USC00418996], Richmond, TX
- (4) ANGLETON 2 W [USC00410257], Angleton, TX
- (5) NEW GULF [USC00416286], Boling, TX
- (6) BAY CITY WTR WKS [USC00410569], Bay City, TX
- (7) DANEVANG 1 W [USC00412266], El Campo, TX
- (8) POINT COMFORT [USC00417140], Port Lavaca, TX
- (9) VICTORIA RGNL AP [USW00012912], Victoria, TX
- (10) PORT LAVACA [USC00417183], Port Lavaca, TX
- (11) REFUGIO 2 NW [USC00417533], Refugio, TX
- (12) BEEVILLE CHASE NAAS [USW00012925], Beeville, TX
- (13) SINTON [USC00418354], Sinton, TX
- (14) C C BOTANICAL GARDENS [USC00412013], Corpus Christi, TX
- (15) ROBSTOWN [USC00417677], Robstown, TX
- (16) KINGSVILLE NAAS [USW00012928], Kingsville, TX

Influencing water features

Clay Loam sites are located on uplands and therefore do not have any flooding or are considered a wetland. The water table, when present, is greater than 6 feet.

Wetland description

The soils associated with this site are non-hydric. Some sites have a small areas of hydric soils. These hydric soils are typically in low lying or depressional areas that stay wet for long periods. Onsite investigation is necessary to determine exact local conditions.

Soil features

The Clay Loam ecological site consists of very deep, well drained, moderately slow to moderately permeable soils.

Soil reaction ranges from slightly acid to slightly alkaline with percent calcium carbonate increasing with depth. Diagnostic horizons and features recognized are a mollic epipedon and an argillic horizon. Soils correlated to this site include: Calallen.

Table 4. Representative soil features

Parent material	(1) Fluviomarine deposits–igneous, metamorphic and sedimentary rock
Surface texture	(1) Clay loam (2) Sandy clay loam
Family particle size	(1) Fine-loamy (2) Fine
Drainage class	Moderately well drained to well drained
Permeability class	Slow to moderate
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-60in)	8–10 in
Calcium carbonate equivalent (24-60in)	0–15%
Electrical conductivity (0-24in)	0–2 mmhos/cm
Sodium adsorption ratio (0-24in)	0–4
Soil reaction (1:1 water) (0-24in)	6.1–7.8
Subsurface fragment volume <=3" (24-60in)	0–3%
Subsurface fragment volume >3" (0-60in)	0%

Ecological dynamics

The Gulf Coast Prairies are a disturbance-maintained system. Prior to European settlement fire and infrequent but intense, short-duration grazing by bison were important natural disturbances that suppressed woody species and invigorated herbaceous species. The herbaceous savannah species adapted to fire and grazing disturbances by maintaining below-ground perennating tissues. Because savannah grassland is typically of level or rolling topography, a natural fire frequency of 2 to 5 years was probably reasonable.

The Clay Loam ecological site is a fire-influenced Tall/Midgrass Savannah Community, interspersed with occasional perennial forbs and woody species. Not many remnant reference communities exist to empirically determine the plant community, so much of the interpretations are based on professional judgment from experience with other similar sites. Moreover, this site represents a transition between the MLRA 83A sites to the south and west and the northern portions of the 150A MLRA to the north. Accordingly, the plant population resembles somewhat of a blending of the two. Improper grazing management will result in a reduction of tallgrass dominance and an increase in composition of mid and shortgrasses, unpalatable forbs, and woody species. Lack of brush control will result in a shift in composition until shrubs and trees dominate and reach a near closed canopy woodland.

The reference plant community is composed of predominantly of species like multi-flower false Rhodesgrass (Chloris pluriflora), little bluestem (*Schizachyrium scoparium*), Arizona cottontop (*Digitaria californica*), and sideoats grama (*Bouteloua curtipendula*). Other species include a small percentage of woodies such as mesquite (*Prosopis glandulosa*), whitebrush (*Aloysia gratissima*), snakewood (Condalia spp.), and wolfberry (*Lycium carolinianum*), and numerous perennial forbs. Tallgrasses such as big bluestem (Andopogon gerardii), Indiangrass (*Sorghastrum nutans*) and switchgrass (*Panicum virgatum*) probably existed in small amounts due to the frequent burning and rainfall. More would have existed in the northern portion of the site range than the southern portion. Historically, the site was maintained by periodic grazing by roaming herds of wildlife and numerous fires that were set by lightning and Native Americans.

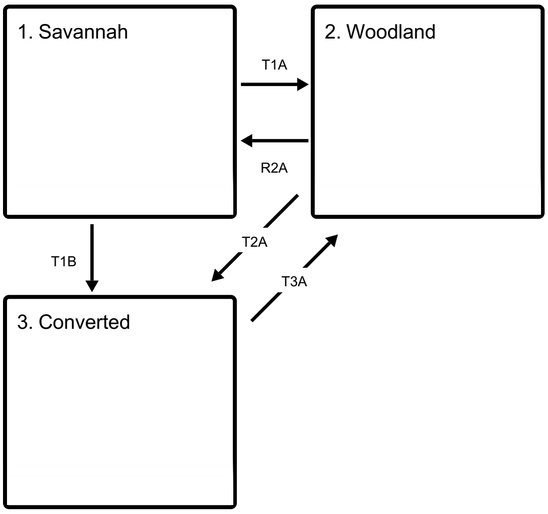
Continued overuse of the site will result in the site crossing a threshold to a mid/shortgrass community with unpalatable grasses and shrubs. Bare ground, erosion, and water-flow patterns will increase, and forage production will decline, especially in heavily abused areas. If the A horizon erodes, these small areas of bare ground will persist until the area recovers through ecological processes. Precipitation patterns are highly variable. Long-term droughts occur three to four times per century and cause shifts in species composition by seedling die-offs of 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 midgrasses to increase in dominance.

With the introduction of wild longhorn cattle in the late 1700's and domestic cattle in the 1820's, an era of heavy grazing began. During the Spanish Mission era of the 1600 to 1700's in the San Antonio, Refugio, and Goliad areas, vast herds of cattle, horses, sheep, and goats were used for meat production for the missions. With no fences, these were free-roaming herds and only the increase was harvested allowing vast herds of these animals to run free and escape. Some portion of these herds took the place of bison once the bison herds were extirpated. This heavy grazing was exacerbated with the introduction of barbed wire and windmills in the 1880's. Excessive grazing reduced or eliminated desirable midgrasses of the of the Midgrass Savannah state such as multi-flower false Rhodesgrass, little bluestem Arizona cottontop, and sideoats grama. With overuse, less palatable species like hooded windmillgrass, fall witchgrass, plains lovegrass, knotroot bristlegrass (*Setaria parviflora*), and other shortgrasses increased.

During the late 1800s, settlers plowed much of this site due to its fertile, productive soils. Introduced pasture has been established on many acres of old cropland and in areas with deeper soils. Coastal bermudagrass (*Cynodon dactylon*) and Old World bluestems (Bothriochloa spp.) are by far the most frequently used introduced grasses for forage and hay. Hay has also been harvested from a majority of the savannah remnants, where long-term mowing at the same time of year has possibly changed the species composition of 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. Introduced, invasive grass species are common. Some of the common species include buffelgrass, guineagrass, and bermudagrass. These plants are highly adapted to this area and are highly productive. However, these invasive plants become a monoculture and reduce the native vegetation component. The site is still able to function from a production standpoint, but once an herbaceous invasive plant has established or naturalized to a site controlling it becomes highly unlikely.

State and transition model

Ecosystem states



T1A - Absence of disturbance and natural regeneration over time

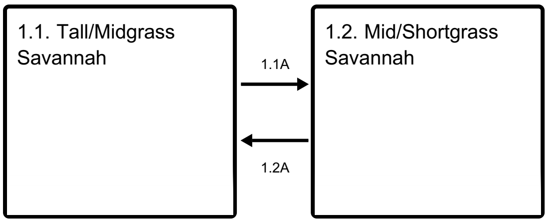
T1B - Excessive soil disturbance following by introduction of forage species

R2A - Reintroduction of fire and regular disturbance return intervals

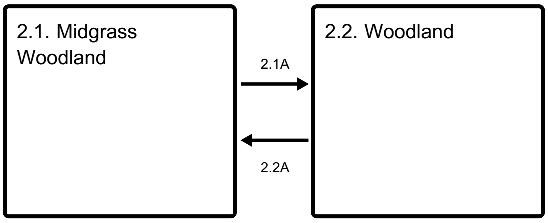
T2A - Excessive soil disturbance following by introduction of forage species

T3A - Absence of disturbance and natural regeneration over time

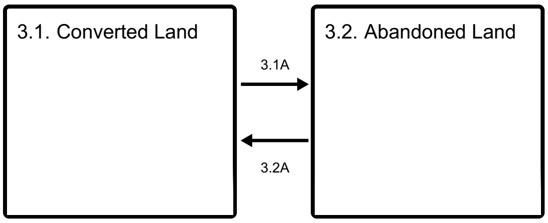
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Savannah

Dominant plant species

- little bluestem (*Schizachyrium scoparium*), grass
- multiflower false Rhodes grass (*Trichloris pluriflora*), grass

Community 1.1
Tall/Midgrass Savannah

Composition of this community includes less than 15 percent canopy of individual trees or clumps of trees. Dominant warm-season grasses included little bluestem, multi-flower Rhodesgrass, Arizona cottontop, and plains bristlegrass. Cool-season species, present in small amounts, include Texas wintergrass (*Nassella leucotricha*) and sedges (Carex spp). The major woody species include mesquite, blackbrush, huisache, and whitebrush. Historic accounts indicate that early settlers found broad expanses of this community. Currently, this community is found in small areas within the Tall/Midgrass Woodland Community (2.1). Long-term heavy grazing allowed the spread of aggressive species to the point that this community is rarely found as a stable community. In 2004, Mann discusses the human-caused fire as an important factor in keeping open grasslands and savannahs prior to European settlement. It is assumed that prior to European settlement, the Tall/Midgrass Savannah Community (1.1) occurred over the majority of this ecological site in a dynamically shifting mosaic over time. This savannah community is very productive and has a diversity of grasses, forbs, and woody plants. Removal of fire from this ecosystem tends to increase woody plants. Continuous heavy grazing by livestock leads to reduction of the midgrasses and increase in less desirable midgrasses, shortgrasses, and forbs. These changes in the herbaceous community reduce fire intensity and possibly frequency, making fire less effective in woody plant control and woody species tend to increase. The Tall/Midgrass Savannah Community (1.1) can be maintained through the implementation of brush management combined with properly managed grazing that provides adequate growing season deferment to allow establishment of desirable midgrass propagules and/or the recovery of vigor of stressed plants. Regardless of grazing management, without some form of brush control, the Tall/Midgrass Savannah Community (1.1) will transition to the Tall/Midgrass/Woodland Community (2.1), even if the understory component does not shift to dominance by mixed-grasses. Because the woody species are native, the transition to the Woodland State (2) is a linear process with shrubs starting to increase soon after fire or brush control ceases. Unless some form of brush control takes place, woody species will increase to the 15 percent canopy cover level that indicates a state change. This is a continual process. Managers need to detect the increase in woody species when canopy is less than 15 percent and take management action before the threshold is crossed. The drivers of the transition (lack of fire and lack of brush control) constantly pressure the system to cross threshold T1A.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	3150	3920	4690
Shrub/Vine	100	150	325
Forb	175	225	325
Tree	0	0	0
Total	**3425**	**4295**	**5340**

Figure 9. Plant community growth curve (percent production by month). TX7606, Tall/Midgrass Prairie Community. Prairie Community composed of warm-season tall and midgrasses..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	2	4	12	24	23	8	5	12	4	3	2

Community 1.2
Mid/Shortgrass Savannah

The Mid/Shortgrass Savannah Community retains the savannah plant structure with the woody species canopy being high as 15 percent, but majority are less than 3 feet tall and not yet capable of reproduction. The increase in woody canopy results from lack of fire or effective brush control. The shift in the herbaceous component typically results from heavy continuous grazing which removes many midgrasses and are replaced by shortgrasses, such as buffalograss, curlymesquite, threeawn, tumblegrass (*Schedonnardus paniculatus*), and red grama. Other common increasers are huisache (*Acacia farnesiana*), ragweed (Ambrosia spp.), and tasajillo (*Cylindropuntia leptocaulis*). Implementation of proper grazing management in combination with brush management will shift the Mid/Shortgrass Savannah Community (1.2) back to the Tall/Midgrass Savannah Community (1.1). Since most shrubs and trees are younger than reproductive age in this state, use of fire can be effective in maintaining the open portions of the savannah. A sound grazing management plan will be essential to reverse the trend toward shortgrass dominance. Continued abusive grazing can reduce vigor and cover of midgrasses and shortgrasses, which will result in an increase of bare soil. Heavy continuous grazing will reduce plant cover, litter, and mulch. Bare ground will increase and expose the soil to erosion. Litter and mulch will move off-site as plant cover declines.

Pathway 1.1A
Community 1.1 to 1.2

The Tall/Midgrass Savannah Community (1.1) requires fire and/or brush control to maintain woody species cover below 15 percent. This community will shift to the Shortgrass Savannah Community (1.2) when there is continued growing season stress on tallgrasses and palatable midgrasses. These stresses include improper grazing management that creates insufficient critical growing season deferment, excess intensity of defoliation, repeated, long-term growing season defoliation, and long-term drought. Increaser species (less palatable midgrasses, shortgrasses, and woody species) are generally endemic species released by disturbance. Woody species canopy exceeding 15 percent and/or dominance of tallgrasses and palatable midgrasses falling below 50 percent of species composition indicate a shift (1.1A) to the Shortgrass Savannah Community (1.2). 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 Shortgrass Savannah Community (1.2) will return to the Tall/Midgrass Savannah Community (1.1) with brush control and proper 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 midgrasses in the absence of fire (at least until shrub canopy cover reaches 50 percent). Reduction of the woody component will require inputs of fire and/or brush control. The understory and overstory components can act independently when canopy cover is less than 50 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
Woodland

Dominant plant species

- whitebrush (*Aloysia gratissima*), shrub
- spiny hackberry (*Celtis ehrenbergiana*), shrub

Community 2.1
Midgrass Woodland

Proper grazing and stocking rates maintain the herbaceous layer in this community. However, lack of fire and/or brush management allows for an increase in woody canopy cover between 30 and 50 percent of mesquite, whitebrush, spiny hackberry, and brasil. Midgrasses will increase as a proportion of the composition. If properly managed and maintain the understory and overstory will continue to work independently of each other. This is the most common community found on well-managed rangelands on this ecological site. Long-term, widespread, high-density brush populations have created a high density of propagules favoring woody species. To convert this community back to a Tall/Midgrass Savannah Community (1.1), extensive brush management and energy is required to reduce the canopy cover to less than 15 percent. Because reference grass species are present, reseeding of tallgrasses and midgrasses is not necessary. Fire may be used to maintain the canopy cover less than 50 percent and increase vigor of the herbaceous layer. Continuous fuel loads are common, which will help to maintain the openness of this state. However, due to canopy, fuel amounts become reduced which limits fire intensity. Prescribed fire will help control mesquite less than 3 feet tall. This will help in preventing the site from transitioning to a Woodland Community (2.2). Fire must be conducted every 3 to 5 years to maintain the woody canopy cover. Winter and summer fires will benefit this plant community. A winter prescribed fire will help to remove shrubs less than 3 feet tall, while a summer fire will tend to burn hotter and possibly open the canopy layer. Grazing management alone will not maintain this community or drive the site to move back to reference conditions. Extensive brush management will be needed to manage the site towards the Savannah State. Continued lack of fire and brush management, along with abusive grazing, results in vegetation loss and an increase of bare ground. If the fertile A-horizon erodes, the site is dominated by low-producing annual forbs and grasses. The decline may be exacerbated by extended drought conditions. Annual forbs such as broomweed are abundant. There may be isolated mature mesquite trees or stunted mesquite, lotebush (*Ziziphus obtusifolia*), and pricklypear scattered across the site. In the lowest stages of overuse, there is a significant amount of bare ground, and scalded areas are obvious. Some of the scalds are the result of geologic erosion while others are the result of long-term abuse and mismanagement.

Community 2.2
Woodland

The Woodland Community (2.2) has greater than 50 percent canopy cover with many woody species more than 3 feet tall and of reproductive height. The understory may be dominated by woody species with an overstory of trees. This community may be the result of many years of improper grazing, lack of periodic fires, and/or a lack of proper brush management. Reference community woody species or increasers, such as mesquite, dominate the Woodland Community (2.2). The site can now have the appearance of a dense woodland. Common understory shrubs are pricklypear (Opuntia spp.), sumac, and white brush. Woody shrubs seem to increase more rapidly in the southern portions of the MLRA. Remnant midgrasses and opportunistic shortgrasses, annuals, and perennial forbs occupy the woody plant interspaces. Characteristic grasses are curly-mesquite, buffalograss, and tumblegrass. Texas wintergrass and annuals are found in and around tree/shrub cover. Grasses and forbs make up less than half of the annual production. Common forbs include croton (Croton spp.), western ragweed, verbena (Verbena spp.), and snow-on-the-prairie (*Euphorbia marginata*). This community is highly resilient. Intensive treatment is required to return to communities with less woody cover. Brush treatment tends to be short-lived. Treated areas rapidly return to the Woodland Community (2.2) due to the presence of propagules on and adjacent to treated areas. Observation shows that even effective treatment will require constant maintenance to suppress brush reestablishment. Without maintenance, canopy cover may exceed 50 percent in 3 to 5 years. The Woodland 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 Woodland to a Savannah. Alternatives for restoration include brush control and range planting with proper stocking, prescribed grazing, and prescribed burning following restoration to maintain the desired community. Proper grazing or fire is no longer an option in reducing the canopy cover in this community. The understory composition is reduced to sedges, grasses, and forbs suited to growing in shaded conditions with reduced available soil moisture. Chemical brush control may be necessary for large-scale treatments. Individual plant treatment with herbicides on small patches may be a viable economic option and may help restore the savannah appearance. Mechanical treatment combined with seeding of native species may have the greatest chance of success in returning the reference community, although it may not be economical. Range planting may accelerate the transition of the herbaceous community, particularly when combined with favorable growing conditions.

Pathway 2.1A
Community 2.1 to 2.2

Without some form of brush control or fire, woody density and canopy cover will increase in the Midgrass Woodland Community (2.1). Improper grazing or other long-term growing season stress can reduce the vigor and percent composition of grasses in the herbaceous layer. Improper grazing management and/or long-term drought (or other growing-season stress) will accelerate this transition. Woody canopy cover greater than 50 percent and species composition indicates this community shift (2.1A). 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 can reduce the woody component of the Woodland Community (2.2) to below the threshold level of 50 percent woody canopy cover. Continued fire and/or brush management will be required to maintain the woody canopy layer less than 50 percent. It may be difficult to shift back to the Tall/Midgrass/Woodland Community (2.1) with fire alone. Once woody species become tall enough to be unaffected by understory fires, fire is likely to only remove small woody plants. This will increase the savannah effect and leave the site in the Woodland Community (2.2). Large trees will dominate over an herbaceous understory. Proper grazing management is needed to increase the composition of desirable midgrasses.

State 3
Converted

Dominant plant species

- Bermudagrass (*Cynodon dactylon*), grass

Community 3.1
Converted Land

The Converted Land Community (3.1) occurs when either the Savannah State (1) or Woodland State (2), is cleared and plowed for planting to cropland, hayland, native grasses, or tame pasture. Agronomic practices are used with non-native forages in the Converted State (3) and to make changes between the communities. The native component of the savannah is usually lost when seeding non-natives. Even when reseeding with natives, the ecological processes defining the past states 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. The Clay Loam site can be extremely productive 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 (3). Without agronomic inputs, the site will transition to the Abandoned Land Community (3.2).

Community 3.2
Abandoned Land

The Abandoned Land Community (3.2) occurs when the Converted Land Community (3.1) is abandoned or mismanaged. Mismanagement can include poor crop or haying management. Pastureland can transition to the Abandoned Land Community (3.2) when subjected to improper grazing management (typically long-term overgrazing). Heavily disturbed soils allowed to “Go Back” transition to the Woodland State (2). Long-term cropping can create changes in soil chemistry and structure that make restoration to the reference state very difficult, expensive, and maybe impossible depending on the damage to the soil health. Return to native savannah 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 savannah will require seedbed preparation and seeding of native species. Protocols and plant materials for restoring savannah communities is a developing restoration science. Sites can be restored to the Savannah State (1) 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 Tall/Midgrass Savannah Community (1.1). It is unlikely that abandoned farmland will return to the Savannah State (1) 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 savannah 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 shift 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 shift to the Converted Land Community (3.1) with proper management inputs. The drivers for this shift 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 in the Savannah State (1), hence woody propagules are present. Therefore, the Savannah State (1) is always at risk for shrub and tree dominance and the transition to the Woodland State (2) in the absence of fire and brush management. The driver for Transition T1A is lack of fire and/or brush control. The mean fire return interval in the Savannah State (1) is 2 to 5 years. Most fires will burn only the understory. Even with proper grazing and favorable climate conditions, lack of fire for 8 to 15 years will allow trees and shrubs to increase in canopy to reach the 40 percent threshold level to produce enough fuel for a burn. The introduction of aggressive woody invader species increases the risk and accelerates the rate at which this transition is likely to occur. This transition can occur from any community within the Savannah State (1). It is not dependent on degradation of the herbaceous community, but on the lack of some form of brush control. The trigger for this transition is that shrubs are reaching 3 feet of height; the height most shrubs start reproducing. Improper grazing, prolonged drought, and a warming climate will provide a competitive advantage to shrubs, which will accelerate this process.

Transition T1B
State 1 to 3

The transition to the Converted State from the Savannah State occurs when the savannah is plowed for planting to cropland or hayland. The size and density of brush will require heavy equipment and energy-intensive practices (i.e. rootplowing, raking, rollerchopping, or heavy disking) to prepare a seedbed. The threshold for this transition is the plowing of the savannah soil and removal of the woody plant community. The Converted State (3) 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 (3). The driver for these transitions is management’s decision to farm.

Restoration pathway R2A
State 2 to 1

Restoration of the Woodland State (2) to the Savannah State (1) requires substantial energy input. The driver for this restoration pathway is removal of woody species, restoration of native herbaceous species, and ongoing management of woody species. Without maintenance, woody species are likely to increase again.

Transition T2A
State 2 to 3

The transition to the Converted State from the Woodland State occurs when the savannah is plowed for planting to cropland or hayland. The size and density of brush will require heavy equipment and energy-intensive practices (i.e. rootplowing, raking, rollerchopping, or heavy disking) to prepare a seedbed. The threshold for this transition is the plowing of the savannah soil and removal of the woody plant community. The Converted State (3) 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 (3). The driver for these transitions is management’s decision to farm.

Transition T3A
State 3 to 2

Without crop or pasture management, the Abandoned Land Community (3.2) will transition to the Woodland State (2). Woody species are transported naturally through wind, water, and animals.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**warm-season mid/tallgrasses**			2650–3530	
	little bluestem	SCSCS	*Schizachyrium scoparium var. scoparium*	1500–2750	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	500–1800	–

	silver beardgrass	BOLAT	*Bothriochloa laguroides ssp. torreyana*	1000–1800	–
	hooded windmill grass	CHCU2	*Chloris cucullata*	750–1250	–
	plains bristlegrass	SEVU2	*Setaria vulpiseta*	750–1250	–
	southwestern bristlegrass	SESC2	*Setaria scheelei*	400–750	–
	Indiangrass	SONU2	*Sorghastrum nutans*	0–500	–
	multiflower false Rhodes grass	TRPL3	*Trichloris pluriflora*	0–500	–
	plains lovegrass	ERIN	*Eragrostis intermedia*	0–500	–
	switchgrass	PAVI2	*Panicum virgatum*	0–500	–
	big bluestem	ANGE	*Andropogon gerardii*	0–500	–
	cane bluestem	BOBA3	*Bothriochloa barbinodis*	336–432	–
	Arizona cottontop	DICA8	*Digitaria californica*	336–432	–
	pink pappusgrass	PABI2	*Pappophorum bicolor*	336–432	–
2	**warm-season shortgrasses**			375–870	
	buffalograss	BODA2	*Bouteloua dactyloides*	300–750	–
	curly-mesquite	HIBE	*Hilaria belangeri*	300–750	–
	threeawn	ARIST	*Aristida*	200–350	–
	fall witchgrass	DICO6	*Digitaria cognata*	200–350	–
	Texas grama	BORI	*Bouteloua rigidiseta*	100–300	–
3	**cool-season grasses**			75–175	
	Texas wintergrass	NALE3	*Nassella leucotricha*	75–175	–
4	**grass-likes**			50–115	
	sedge	CAREX	*Carex*	50–100	–
	flatsedge	CYPER	*Cyperus*	50–100	–
Forb					
5	**forbs**			125–325	
	Forb, annual	2FA	*Forb, annual*	125–250	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	125–250	–
	croton	CROTO	*Croton*	125–250	–
	bundleflower	DESMA	*Desmanthus*	125–250	–
	sensitive plant	MIMOS	*Mimosa*	125–250	–
	awnless bushsunflower	SICA7	*Simsia calva*	125–250	–
Shrub/Vine					
6	**Shrubs/Vines**			125–325	
	whitebrush	ALGRG	*Aloysia gratissima var. gratissima*	100–250	–
	spiny hackberry	CEEH	*Celtis ehrenbergiana*	100–250	–
	snakewood	CONDA	*Condalia*	100–250	–
	Texan hogplum	COTET	*Colubrina texensis var. texensis*	100–250	–
	vine jointfir	EPPE	*Ephedra pedunculata*	100–250	–
	Texas lignum-vitae	GUAN	*Guaiacum angustifolium*	0–250	–
	Berlandier's wolfberry	LYBEB	*Lycium berlandieri var. berlandieri*	100–250	–
	mesquite	PROSO	*Prosopis*	100–250	–
	oak	QUERC	*Quercus*	100–250	–

Animal community

The Coastal Prairie communities support a wide array of animals. Cattle and many species of wildlife make extensive use of the site. White-tailed deer may be found scattered across the prairie and are found in heavier concentrations where woody cover exists. Feral hogs are present and at times abundant. Coyotes are abundant and fill the mammalian predator niche. Rodent populations rise during drier periods and fall during periods of inundation. Attwater's pocket gophers are abundant and have an important impact on the ecology of the site. The badger is present but not abundant in locations at the southern extent of the site. Locally unique species alligators and bullfrogs.

The region is a major flyway for waterfowl and migrating birds. Hundreds of thousands of ducks, geese, and sandhill cranes abound during winter. Two important endangered species occur in the area, the whooping crane and Attwater's prairie chicken. Many other species of avian predators including northern harriers, ferruginous hawks, red-tailed hawks, white-tailed kites, kestrels, and, occasionally, swallow-tailed kites utilize the vast grasslands. Many species of grassland birds use the site, including blue grosbeaks, dickcissels, eastern meadowlarks, several sparrows, including, vesper sparrow, lark sparrow, savannah sparrow, grasshopper sparrow, and Le Conte's sparrow.

Hydrological functions

The water cycle functions well with good infiltration and deep percolation of rainfall. The water cycle functions best in the Tall/Midgrass Savannah Community (1.1) and degrades as the vegetation community transitions. Rapid water 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 Mid/Shortgrass Savannah 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 further degrades the water cycle in the Woodland State (2). Interception of rainfall by tree canopies increases, which reduces the amount of rainfall reaching the surface and being available to understory plants. Increased stemflow, due to the funneling effect of the canopy, will increases soil moisture at the base of trees, especially on mesquite. Increases in woody canopy create declines in grass cover, which creates similar causes impacts as those described for improper grazing above. Return of the Woodland State (2) to the Reference Plant Community (1.1) through brush management and good grazing management can help improve the hydrologic function.

Recreational uses

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

Wood products

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

Other products

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

This site description was developed as part of the provisional ecological site initiative using historic soil survey manuscripts, available range site descriptions, and low intensity field sampling.

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Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	Vivian Garcia, RMS, NRCS Corpus Christi, TX
Contact for lead author	361-241-0609
Date	03/18/2009
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:** None.

3. **Number and height of erosional pedestals or terracettes:** None.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Less than 20 percent bare ground randomly distributed throughout.

5. **Number of gullies and erosion associated with gullies:** None.

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

7. **Amount of litter movement (describe size and distance expected to travel):** Small to medium-sized litter may 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):** Stability class ranges 4 to 6 at surface. Soil surface is resistant to erosion.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** 0 to 6 inches; gray (10YR 5/1) clay loam, very dark gray (10YR 3/1) moist; structureless; hard, friable; calcareous; moderately alkaline; abrupt smooth boundary.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** This reference community has an adequate litter and little bare ground would 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 midgrasses

    Sub-dominant: Warm-season tallgrasses Warm-season shortgrasses Forbs Shrubs/Vines

    Other:

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Grasses due to their growth habit will exhibit some mortality and decadence, though very slight.

14. **Average percent litter cover (%) and depth (in):** Litter is primarily herbaceous.

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 3,500 to 6,500 pounds per acre.

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: Mesquite, huisache, retama, other thorny shrubs.

17. **Perennial plant reproductive capability:** All species should be capable of reproducing except for periods of prolonged drought conditions, heavy natural herbivory, and intense wild fires.