USDA Natural Resources Conservation Service

Ecological site R083AY013TX
Loamy Bottomland

Last updated: 9/19/2023
Accessed: 05/10/2025

General information

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

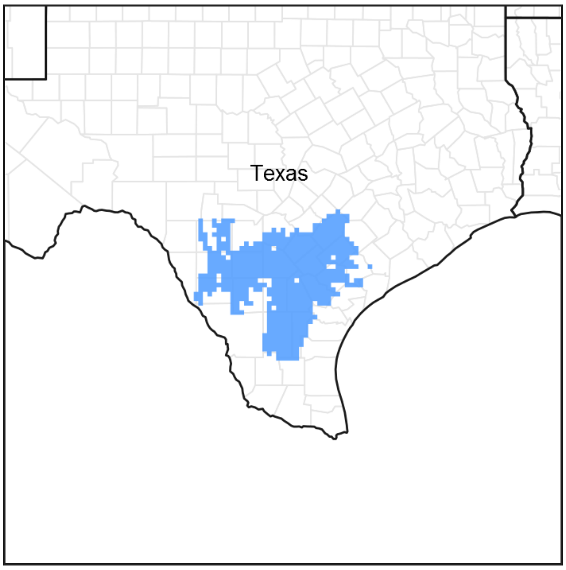


Figure 1. Mapped extent

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

MLRA notes

Major Land Resource Area (MLRA): 083A–Northern Rio Grande Plain

This area is entirely in Texas and south of San Antonio. It makes up about 11,115 square miles (28,805 square kilometers). The towns of Uvalde, Cotulla, and Hondo are in the western part of the area, and Beeville, Goliad, and Kenedy are in the eastern part. The town of Alice is just outside the southern edge of the area. Interstate Highways 35 and 37 cross this area. This area is comprised of inland, dissected coastal plains.

Classification relationships

USDA-Natural Resources Conservation Service, 2006.
-Major Land Resource Area (MLRA) 83A

Ecological site concept

Loamy Bottomlands occupy the lowest setting on the landscape. They are comprised of flood plains formed from loamy alluvium. Flooding can occur on these sites.

Associated sites

R083AY002TX	**Shallow Ridge**
R083AY009TX	**Clayey Bottomland**
R083AY019TX	**Gray Sandy Loam**
R083AY026TX	**Eastern Clay Loam**
R083AY027TX	**Western Clay Loam**

Similar sites

R083CY013TX	**Loamy Bottomland**
R083DY013TX	**Loamy Bottomland**
R083BY013TX	**Loamy Bottomland**

Table 1. Dominant plant species

Tree	(1) *Ulmus* (2) *Carya illinoinensis*
Shrub	(1) *Vitis* (2) *Smilax bona-nox*
Herbaceous	(1) *Schizachyrium scoparium var. scoparium* (2) *Panicum anceps*

Physiographic features

The sites are in flood plains of streams and rivers of the Coastal Plains. They carry sediments from Cretaceous limestone, shales, and calcareous sandstone. Flooding occurs frequently to occasionally for brief durations. Slope gradients are mainly less than one percent but range up to three percent in undulating areas. Elevation ranges from 200 to 1,000 feet. This area is comprised of inland, dissected coastal plains.

Table 2. Representative physiographic features

Landforms	(1) Coastal plain > Flood plain (2) River valley > Flood plain
Runoff class	Negligible to medium
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	None to frequent
Elevation	200–1,000 ft
Slope	0–3%
Aspect	Aspect is not a significant factor

Climatic features

MLRA 83A is subtropical, subhumid on the western boundary and subtropical humid on the eastern boundary. Winters are dry and mild and the summers are hot and humid. Tropical maritime air masses predominate throughout spring, summer, and fall. Modified polar air masses exert considerable influence during winter, creating a continental climate characterized by large variations in temperature. Average precipitation for MLRA 83A is 20 inches on the western boundary and 35 inches on the eastern boundary. Peak rainfall, because of rain showers, occurs late in spring and a secondary peak occurs early in fall. Heavy thunderstorm activities increase in April, May, and June. July is hot and dry with little weather variations. Rainfall increases again in late August and September as tropical disturbances increase and become more frequent. Tropical air masses from the Gulf of Mexico dominate during the spring, summer, and fall. Prevailing winds are southerly to southeasterly throughout the year except in December when winds are predominately northerly.

Table 3. Representative climatic features

Frost-free period (characteristic range)	223-251 days
Freeze-free period (characteristic range)	263-365 days
Precipitation total (characteristic range)	25-32 in
Frost-free period (actual range)	208-263 days
Freeze-free period (actual range)	254-365 days
Precipitation total (actual range)	24-37 in
Frost-free period (average)	235 days
Freeze-free period (average)	314 days
Precipitation total (average)	29 in

Climate stations used

- (1) CHARLOTTE 5 NNW [USC00411663], Charlotte, TX
- (2) MATHIS 4 SSW [USC00415661], Mathis, TX
- (3) PEARSALL [USC00416879], Pearsall, TX
- (4) TILDEN 4 SSE [USC00419031], Tilden, TX
- (5) UVALDE 3 SW [USC00419268], Uvalde, TX
- (6) CROSS [USC00412125], Tilden, TX
- (7) DILLEY [USC00412458], Dilley, TX
- (8) FLORESVILLE [USC00413201], Floresville, TX
- (9) LYTLE 3W [USC00415454], Natalia, TX
- (10) PLEASANTON [USC00417111], Pleasanton, TX
- (11) HONDO MUNI AP [USW00012962], Hondo, TX
- (12) BEEVILLE 5 NE [USC00410639], Beeville, TX
- (13) CHEAPSIDE [USC00411671], Gonzales, TX
- (14) CUERO [USC00412173], Cuero, TX
- (15) GOLIAD [USC00413618], Goliad, TX
- (16) NIXON [USC00416368], Stockdale, TX
- (17) CARRIZO SPRINGS 3W [USC00411486], Carrizo Springs, TX
- (18) FOWLERTON [USC00413299], Fowlerton, TX
- (19) HONDO [USC00414254], Hondo, TX
- (20) KARNES CITY 2N [USC00414696], Karnes City, TX
- (21) POTEET [USC00417215], Poteet, TX
- (22) CALLIHAM [USC00411337], Calliham, TX

Influencing water features

Flooding intervals vary in occurrence, primarily from May through September during the growing season.

Wetland description

This site may contain some small areas of hydric soils or wetlands, but an onsite investigation is needed to confirm when thought to exist.

Soil features

The soils in this site are deep to very deep, somewhat poorly drained to well drained, and have moderately rapid to slow permeability. They formed in loamy alluvium. Diagnostic horizons and horizons include ochric and mollic epipedons, and cambic and calcic horizons. Soil series correlated to this site include: Christine, Conalb, Divot, Meguin, Poteet, Winterhaven, Zavala, and Zunker.

Table 4. Representative soil features

Parent material	(1) Alluvium–sedimentary rock
Surface texture	(1) Loam (2) Clay loam (3) Silty clay loam (4) Fine sandy loam
Drainage class	Moderately well drained to well drained
Permeability class	Very slow to moderate
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0–2%
Available water capacity (0-40in)	3–7 in
Calcium carbonate equivalent (0-40in)	0–30%
Electrical conductivity (0-40in)	0–4 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	6.1–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–5%
Subsurface fragment volume >3" (Depth not specified)	0–2%

Ecological dynamics

The Loamy Bottomland is a fire-influenced Mixed Savannah Community interspersed with occasional perennial forbs. Reference sites show that an intact grass community without fire are rapidly invaded by woody species. Improper grazing management will result in a reduction of tallgrass dominance and an increase in composition of midgrasses, unpalatable forbs, and invaders. In the absence of fire, the site is occupied by dense stands of hardwoods, including pecan (Carya spp.) and oak (Quercus spp.). The two communities in the Savannah State shifted between one another depending on the frequency and intensity of fire, grazing, drought, and flooding events.

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 and hardwoods to increase in dominance.

Natural vegetation is predominantly tall, cool-season grasses, warm-season perennial bunchgrasses, and sedges (Carex spp.). Virginia wildrye (*Elymus virginicus*), eastern gamagrass (*Tripsacum dactyloides*), switchcane (*Arundinaria gigantea*), switchgrass (*Panicum virgatum*), little bluestem (*Schizachyrium scoparium*), and sedges decrease in abundance and are replaced by dallisgrass (*Paspalum dilatatum*), common bermudagrass (*Cynodon dactylon*), and carpetgrass (*Axonopus fissifolius*) if improper grazing continues. Shrubs and hardwood saplings invade the site in the absence of brush management. Prolonged lack of brush management or abandonment allows the site to become a hardwood forest dominated by water oak (*Quercus nigra*), willow oak (*Quercus phellos*), overcup oak (*Quercus lyrata*), and cedar elm (*Ulmus crassifolia*) on non-calcareous sites. Green ash (*Fraxinus pennsylvanica*), cottonwood (Populus spp.), and pecan (*Carya illinoinensis*) occur on sites that are more acidic.

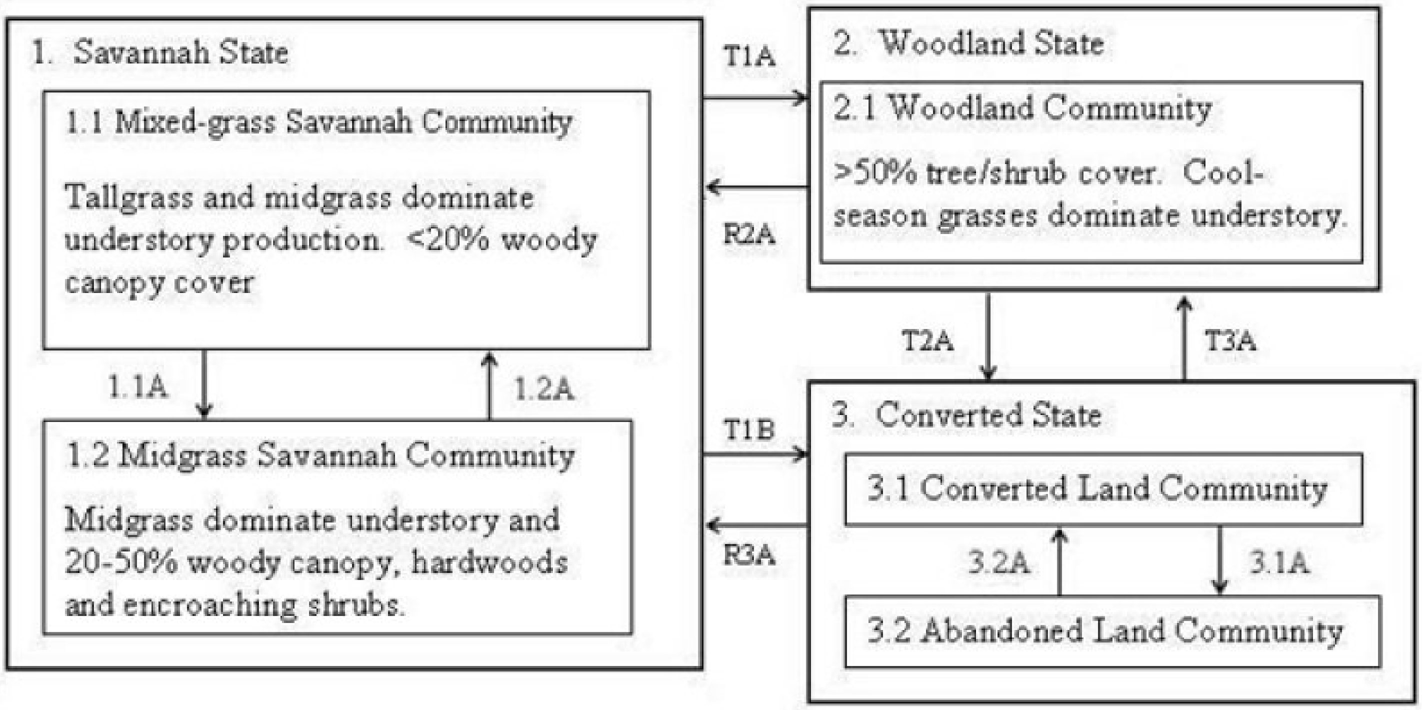
Much of this site was converted to cropland in the late 1800's to early 1900's, primarily to grow cotton. Much of the converted farmland has been planted to tame pastures once it was no longer farmed. Most areas where open native grassland remains have histories of long-term management as native hay pastures with brush control. Loamy Bottomland sites produce palatable and nutritious forage, have large shade trees, and are close to water. When not flooded, cattle prefer this site for grazing and loafing. Consequently, the site is frequently overgrazed.

Prior to European settlement (pre-1825), fire and grazing were the two primary forms of disturbance. Grazing by large herbivores included antelope, deer, and small herds of bison. The infrequent but intense, short-duration grazing by these species suppressed woody species and invigorated herbaceous species (Eidson and Smeins 1999). The herbaceous savannah species adapted to fire and grazing disturbances by maintaining belowground perennating tissues. A natural fire frequency of three to seven years seems reasonable for this site, as fires would need to be frequent enough that trees did not grow above a height were they are susceptible to fire kill. Fire frequency on the savannah sites was likely to have been highly variable. Indigenous humans likely set frequent fires to maintain open grasslands. Once the tree canopy was closed, fires would have been infrequent and the result of carryover from the adjoining sites with enough heat to create crown fires.

These sites have also been influenced by the construction of dams upstream, ranging from small ponds to large flood control projects designed to reduce flooding and downstream damages. Collectively, they have had the impact of altering the natural flushing of the channels and the natural deposition of sediments depending upon the distance from a dam and other watershed characteristics. This may contribute to more rapid establishment of woody vegetation due to the reduction in natural scouring.

Introduced pasture has been established on many acres of old cropland and in areas with deeper soils. Typical introduced species planted for tame pastures and haylands the most common are buffelgrass, bermudagrass varieties (Cynodon spp.), bahiagrass (*Paspalum notatum*), annual ryegrass (*Lolium perenne*), and white clover (*Trifolium repens*). Some former cropland has been seeded to native species, including switchgrass, dallisgrass, and eastern gamagrass. Hay has also been harvested from prairie remnants, where long-term mowing at the same time of year has possibly changed the ecological 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.

State and transition model



Legend

1.1A Improper Grazing Management, Lack of Fire, Lack of Brush Control, Long-term Droughts, or Other Growing Season Stress
1.2A Proper Grazing Management, Fire (Natural or Prescribed), Brush Management
T1A Improper Grazing Management, Lack of Fire, and Lack of Brush Management
T1B Transition to Converted State
T2A Transition to Converted State
R2A Brush Management, Prescribed Burning, Proper Grazing Management
R3A Restoration Pathway from Converted State
T3A Brush Invasion, No Brush Management, No Prescribed Burning
3.1A Brush Invasion, No Brush Management, No Prescribed Burning
3.2A Brush Management, Prescribed Grazing, Prescribed Burning, possible Range Planting

Figure 8. STM

State 1
Savannah

Dominant plant species

- water oak (*Quercus nigra*), tree
- sedge (*Carex*), grass
- Virginia wildrye (*Elymus virginicus*), grass

Community 1.1
Mixed-grass Savannah

The Mixed-grass Savannah Community (1.1) is the reference community and is characterized as a hardwood savannah with up to 20 percent tree and shrub canopy cover. Historic records from the 1700's indicate that early settlers and explorers found portions of this site to be heavily wooded. Other reports (Mann 2004) discuss the importance of human caused fire as an important factor in keeping open grasslands prior to European settlement. It is assumed the Mixed-grass Savannah Community (1.1) occurred over the majority of this ecological site in a dynamically shifting mosaic over time with the other two communities in the Savannah State. Little bluestem, Virginia wildrye, Canada wildrye, sedges, switchgrass, Indiangrass, beaked panicum (*Panicum anceps*), and rustyseed paspalum (*Paspalum langei*) dominate the herbaceous component of the site. Forbs commonly found on the site include tickclover (Desmodium spp.), wildbeans (Strophostyles spp.), lespedezas (Lespedeza spp.), and partridge pea (*Chamaecrista fasciculata*). Shrub and tree species found in the Mixed-grass Savannah Community (1.1) include species of oaks, pecan, hackberry (Celtis spp.), and elm (Ulmus spp.). Vines include greenbrier (Smilax spp.), grape (Vitis spp.), honeysuckle (Lonicera spp.), and peppervine (Ampelopsis spp.). The reference savannah community will shift to the Midgrass Savannah Community (1.2) under the stresses of improper grazing. The first species to decrease in dominance will be the most palatable grasses and forbs. This will initially result in an increase in composition of little bluestem and paspalums. If improper grazing continues, little bluestem will decrease and midgrasses such as broomsedge bluestem (*Andropogon virginicus*), and Vasey's grass (*Paspalum urvillei*). Less palatable forbs will also increase at this stage. Without fire and/or brush control, woody species on the site will increase and transition the site to the Woodland State (2). This can occur with or without the understory transitioning to the Midgrass community. This transition can occur without degradation of the herbaceous community from dominance by tallgrasses and palatable midgrasses to dominance by midgrasses. Brown and Archer (1999) concluded that even with a healthy and dense stand of grasses, woody species will populate the site and eventually dominate the community. Because the dominant woody species in the Woodland State are native species that occur as part of the Savannah State, the transition to the Woodland State is a linear process, with shrubs increasing soon after fire or brush control ceases. Unless some form of brush control takes place, woody species will increase to the 50 percent canopy cover that indicates a state change. This is a continual process. Managers need to detect the increase in woody species when canopy is less than 50 percent and take management action before the state change occurs. There is not a 10-year window before shrubs begin to increase followed by a rapid transition to the Woodland State. The drivers of the transition (lack of fire and lack of brush control) constantly pressure the system towards the Woodland State. The soils of this site are deep, loamy textured, and moderately permeable. The site generally receives additional water from outside the site. Infiltration is moderate and runoff is low. There is essentially no bare soil in this community. Plant basal cover and litter comprise all of the ground cover. Soils are highly fertile and hold moderately large amounts of soil moisture. This is a very productive site with high yields of good quality forage.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	2600	3300	4800
Shrub/Vine	350	450	650
Tree	350	450	650
Forb	175	225	325
Total	**3475**	**4425**	**6425**

Figure 10. Plant community growth curve (percent production by month). TX4527, Mixed-Grass Savannah with 5-20% Woodies. Mixed-Grass Savannah Community with the woody canopy cover may be as high as 20%..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2	2	5	10	18	15	5	9	15	9	5	5

Community 1.2
Midgrass Savannah

The Midgrass Savannah Community (1.2) typically results from improper cattle grazing management over a long period of time combined with a lack of brush control. Indigenous or invading woody species increase on the site (with or without fire). Growing-season stress, usually from overgrazing, causes reduction in vigor and survival of tallgrasses and palatable midgrasses, which allows less palatable midgrasses and less palatable forbs to increase in the herbaceous community. Important grasses are bushy bluestem and Vasey's grass. Unpalatable, shade-tolerant grasses and forbs begin replacing the midgrasses. Examples of forbs include cocklebur (Xanthium spp.), sumpweed (*Iva annua*), and beebalm (Monarda spp.). Shaded conditions favor cool-season grasses such as Texas wintergrass (*Nassella leucotricha*) and woodoats (Chasmanthium spp.). Woody canopy varies between 20 and 50 percent, depending on the severity of grazing, fire interval, amount of brush control, and availability of increaser species. Numerous shrub and tree species will encroach because overgrazing by livestock has reduced grass cover, exposed more soil, and reduced grass fuel for fire. Typically, trees such as oaks and ash (Fraxinus spp.) will increase in size, while other tree and shrub species such as bumelia (Sideroxylon spp.), sumacs (Rhus spp.), honey locust (Robinia rusbyi), winged elm (*Ulmus alata*), and Osage orange (*Maclura pomifera*) will increase in density. To control woody species populations, prescribed grazing and/or browsing and fire can be used to control smaller shrubs and trees, and mechanical removal of larger shrubs and trees may be necessary in older stands. Until the Midgrass Savannah Community (1.2) crosses the threshold into the Woodland Community (2.1), this community can be managed back toward the Savannah State (1.1) using management practices including prescribed grazing, prescribed burning, and strategic brush control. It may take several years to achieve this state, depending upon the climate and the aggressiveness of the treatment. Once invasive woody species begin to establish, returning fully to the native community is difficult, though it is possible to return to a similar plant community. Potential exists for soils to erode to the point that irreversible damage may occur. If soil-holding herbaceous cover decreases to the point that soils are no longer stable, the shrub overstory will not prevent erosion of the A and B soil horizons. This is a critical shift in the ecology of the site. Once the A-horizon has eroded, the hydrology, soil chemistry, soil microorganisms, and soil physics are altered to the point where intensive restoration is required to restore the site to another state or community. Simply changing management (improving grazing management or controlling brush) is not sufficient to restore the site within a reasonable period.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1500	2400	3000
Shrub/Vine	750	1200	1500
Forb	250	400	500
Tree	0	0	0
Total	**2500**	**4000**	**5000**

Figure 12. Plant community growth curve (percent production by month). TX4541, Midgrass Dominant Community, 15-30% Canopy. Midgrasses dominate the site with 15-30% woody canopy..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2	2	5	10	18	15	5	9	15	9	5	5

Pathway 1.1A
Community 1.1 to 1.2

The Mixed grass Savannah Plant Community (1.1) requires fire and/or brush control to maintain woody species cover below 20 percent. This community will shift to the Midgrass Savannah Community (1.2) when there is continued growing-season stress on tallgrasses. 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 (midgrasses and woody species) are generally endemic and released by disturbance. Woody species canopy exceeding 20 percent and/or dominance of tallgrasses and desirable midgrasses falling below 50 percent of species composition indicate a transition to the Midgrass Savannah Plant Community (1.2). The Mixed Grass Savannah Community can be maintained through the implementation of brush management combined with properly managed grazing that provides adequate growing-season deferment to allow establishment of tallgrass propagules and/or the recovery of vigor of stressed plants. Regardless of grazing management, without some form of brush control, the Mixed Grass Savannah Community will transition to the Woodland State (2), even if the understory component does not shift to dominance by mixed grasses. The driver for community shift 1.1A for the herbaceous component is improper grazing management, while the driver for the woody component is lack of fire and/or brush control.

Pathway 1.2A
Community 1.2 to 1.1

The Midgrass Savannah Plant Community (1.2) will return to the Mixed Grass Savannah Plant 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 tall grasses and desirable 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

- water oak (*Quercus nigra*), tree
- willow oak (*Quercus phellos*), tree

Community 2.1
Woodland

The Woodland Community (2.1) has an over 50 percent woody plant canopy, dominated by hardwoods such as pecan and oaks. The community loses its savannah appearance with native shrubs beginning to fill the open grassland portion of the savannah. Shade from overstory is the driving factor. This community results from the lack of effective brush control. Annual herbage production decreases due to a decline in soil structure and organic matter. Production of the overstory canopy has increased by a similar amount to the decrease in herbaceous production. Unpalatable woody species have increased in size and density. Common understory and midstory species that grow under a dense canopy include panicums, paspalums, tridens, woodoats, wildryes, Texas wintergrass, bristlegrass (Setaria), sedge, flatsedge (Cyperus spp.), rush (Juncus spp.), and fimbry (Fimbristylis spp.). Forbs include western ragweed (*Ambrosia psilostachya*), blood ragweed (*Ambrosia trifida* var. texana), sumpweed, cocklebur, mare’s tail (Equisetum spp.), and cattail (*Typha latifolia*). Trees, shrubs, and vines include elm, bumelia sumacs, hawthorn, grape , greenbriar, and ivy treebine (Cissus incisa). Texas wintergrass, threeawns (Aristida spp.) and annuals increase in the shade of the trees. Unpalatable invaders may occupy the interspaces between trees and shrubs. Plant vigor and productivity of grass species is reduced due to shade. Shade is a driving factor for the understory plant community. Without brush control, tree canopy will continue to increase until canopy cover approaches 80 percent. In this plant community, annual production is dominated by woody species. 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. Prescribed fire is not a viable treatment option for conversion of this site back to a semblance of the Savannah State (1). Chemical brush control on a large scale may not a treatment option; however, individual plant treatment with herbicides on small acreages may be a viable option. Mechanical treatment of this site, along with seeding, is the most viable treatment option although it may not be economical. 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 (2.1) 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 three to five years.

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	2500	3800	5000
Forb	250	350	500
Grass/Grasslike	250	350	500
Tree	0	0	0
Total	**3000**	**4500**	**6000**

Figure 14. Plant community growth curve (percent production by month).

TX4529, Shrub Woodland Community with >50% Woodies. Shrub Woodland Community with >50% Woodies.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2	2	5	10	18	15	5	9	15	9	5	5

State 3
Converted

Dominant plant species

- buffelgrass (*Pennisetum ciliare*), grass
- Bermudagrass (*Cynodon*), grass

Community 3.1
Converted Land

The Converted Land Community (3.1) occurs when the site, either the Savannah State (1) or Woodland State (2), is cleared and plowed for planting to cropland, hayland, native grasses, tame pasture, or use as non-agricultural land. The Converted State includes cropland, tame pasture, hayland, rangeland, and go-back land. Agronomic practices are used with non-native forages in the Converted State and to make changes between the communities in the Converted State. The native component of the prairie is usually lost when seeding non-natives. Even when reseeding with natives, the ecological processes defining the past states of the site can be permanently changed. The Loamy Bottomland site is frequently converted to cropland or tame pasture sites because of its deep fertile soils, favorable soil/water/plant relationships, and level terrain. Hundreds of thousands of acres have been plowed up and converted to cropland, pastureland, or hayland. Small grains are the principal crop, and buffelgrass and bermudagrass are the primary introduced pasture species on loamy soils in this area. The Loamy Bottomland site can be an extremely productive forage producing site with the application of optimum amounts of fertilizer. Cropland, pastureland, and hayland are intensively managed with annual cultivation and/or frequent use of herbicides, pesticides, and commercial fertilizers to increase production. Both crop and pasturelands require weed and shrub control because seeds remain present on the site, either by remaining in the soil or being transported to the site. Converted sites require continual fertilization for crops or tame pasture (particularly bermudagrass) to perform well. Common introduced species include buffelgrass, coastal bermudagrass, kleingrass, and Old World bluestems (Bothriochloa spp.) 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. The site is considered go-back land during the period between active management for pasture or cropland and the return to a native state.

Figure 15. Plant community growth curve (percent production by month). TX4531, Converted Land - Introduced Grass Seeding. Seeding Coverted Land into Introduced grass species..

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

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 when subjected to improper grazing management (typically long-term overgrazing). Heavily disturbed soils allowed to go-back return to the Woodland State. Long-term cropping can create changes in soil chemistry and structure that make restoration to the reference state very difficult and/or expensive. Return to native prairie communities in the Savannah 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, or near reference conditions. Restoration to native prairie will require seedbed preparation and seeding of native species. Protocols and plant materials for restoring prairie communities is a developing portion of restoration science. Sites can be restored to the Savannah State in the short-term by seeding mixtures of commercially available native grasses. With proper management (prescribed grazing, weed control, brush control), these sites can come close to the diversity and complexity of Mixed-grass 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. The native component of the prairie is usually lost when seeding non-natives. Even when reseeding with natives, the ecological processes defining the past states of the site can be permanently changed.

Figure 16. Plant community growth curve (percent production by month). TX4534, Converted Land - Woody Seedlings Encroachment. Woody seedling encroachment on converted lands such as abandoned cropland, native seeded land, and introduced seeding lands..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2	2	5	10	18	15	5	9	15	9	5	5

Pathway 3.1A
Community 3.1 to 3.2

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

Pathway 3.2A
Community 3.2 to 3.1

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

Transition T1A
State 1 to 2

Shrubs and trees make up a portion of the plant community in the Savannah State (1), hence woody propagules are present. Therefore, the Savannah State is always at risk for shrub dominance and the transition to the Woodland State in the absence of fire. The driver for Transition T1A is lack of fire and/or brush control. Most fires will burn only the understory. Even with proper grazing and favorable climate conditions, lack of fire for years will allow trees and shrubs to increase in canopy to reach the 50 percent threshold level. The introduction of aggressive woody invader species increases the risk and accelerates the rate at which this transition state 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 brush control. Improper grazing and prolonged drought will provide a competitive advantage to shrubs, which will accelerate this process. Tallgrasses will decrease to less than five percent species composition.

Transition T1B
State 1 to 3

The transition to the Converted State from the Savannah State occurs when the site is cleared and plowed for planting to cropland or hayland. The threshold for this transition is the plowing of the prairie soil and removal of the woody 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 R2A
State 2 to 1

Restoration of the Woodland State to the Savannah State requires substantial energy input. The driver for this restoration pathway is removal of woody species, restoration of native herbaceous species, and ongoing management of invasive species. Without maintenance, woody and invasive species are likely to return (probably rapidly) due to presence of propagules in the soil.

Transition T2A
State 2 to 3

The transition to the Converted State from the Woodland State (T2A) occurs when the site is cleared and plowed for planting to cropland or hayland. The size and density of brush in the Woodland State 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 prairie soil and removal of the woody 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 likely to occur with tame pasture) the site can be restored to the Savannah 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 Savannah State) or T3A (a return to the Woodland State). Return to native prairie communities in the Savannah 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, or near reference conditions as does remnant seed sources. Converted sites can return to the Savannah State through active restoration, including seedbed preparation and seeding of native grass and forb species. Protocols and plant materials for restoring prairie communities is 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 from the Converted State can occur in the short-term through 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 likely to occur with tame pasture) the site can be restored to the Savannah 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 Savannah State) or T3A (a return to the Woodland State).

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Tallgrasses**			875–1800	
	little bluestem	SCSCS	*Schizachyrium scoparium var. scoparium*	875–1600	–
	eastern gamagrass	TRDA3	*Tripsacum dactyloides*	400–1500	–
	switchgrass	PAVI2	*Panicum virgatum*	400–1500	–
2	**Midgrasses**			875–1800	

	beaked panicgrass	PAAN	*Panicum anceps*	500–1200	–
	rustyseed paspalum	PALA11	*Paspalum langei*	500–1200	–
	panicgrass	PANIC	*Panicum*	500–1200	–
	vine mesquite	PAOB	*Panicum obtusum*	500–1200	–
	gaping grass	STHI3	*Steinchisma hians*	500–1200	–
	white tridens	TRAL2	*Tridens albescens*	500–1200	–
	purpletop tridens	TRFL2	*Tridens flavus*	500–1200	–
	longspike tridens	TRST2	*Tridens strictus*	500–1200	–
	nimblewill	MUSC	*Muhlenbergia schreberi*	300–675	–
	cylinder jointtail grass	COCY	*Coelorachis cylindrica*	100–375	–
3	**Cool-season grasses**			350–800	
	Canada wildrye	ELCA4	*Elymus canadensis*	350–650	–
	Virginia wildrye	ELVI3	*Elymus virginicus*	350–650	–
	Texas wintergrass	NALE3	*Nassella leucotricha*	350–650	–
	Indian woodoats	CHLA5	*Chasmanthium latifolium*	200–425	–
	longleaf woodoats	CHSE2	*Chasmanthium sessiliflorum*	200–425	–
4	**Grasslikes**			175–400	
	sedge	CAREX	*Carex*	175–325	–
	flatsedge	CYPER	*Cyperus*	175–325	–
Forb					
5	**Forbs**			175–325	
	Texan great ragweed	AMTRT	*Ambrosia trifida var. texana*	150–275	–
	partridge pea	CHFA2	*Chamaecrista fasciculata*	150–275	–
	ticktrefoil	DESMO	*Desmodium*	150–275	–
	lespedeza	LESPE	*Lespedeza*	150–275	–
	dotted blazing star	LIPU	*Liatris punctata*	150–275	–
	snoutbean	RHYNC2	*Rhynchosia*	150–275	–
	fuzzybean	STROP	*Strophostyles*	150–275	–
	ironweed	VERNO	*Vernonia*	150–275	–
	white crownbeard	VEVI3	*Verbesina virginica*	150–275	–
Shrub/Vine					
6	**Shrubs, Vines and Trees**			700–1300	
	elm	ULMUS	*Ulmus*	500–1125	–
	pecan	CAIL2	*Carya illinoinensis*	500–1125	–
	hackberry	CELTI	*Celtis*	500–1125	–
	ash	FRAXI	*Fraxinus*	500–1125	–
	American sycamore	PLOC	*Platanus occidentalis*	500–1125	–
	eastern cottonwood	PODE3	*Populus deltoides*	500–1125	–
	oak	QUERC	*Quercus*	500–1125	–
	black willow	SANI	*Salix nigra*	500–1125	–
	hawthorn	CRATA	*Crataegus*	200–375	–
	grape	VITIS	*Vitis*	200–375	–
	saw greenbrier	SMBO2	*Smilax bona-nox*	200–375	–

	peppervine	AMPEL3	*Ampelopsis*	200–375	–

Animal community

As a historic tall/midgrass prairie, this site was occupied by bison, antelope, deer, quail, turkey, and dove. This site was also used by many species of grassland songbirds, migratory waterfowl, and coyotes. This site now provides forage for livestock and is still used by quail, dove, migratory waterfowl, grassland birds, coyotes, and deer.

Feral hogs (Sus scrofa) can be found on most ecological sites in Texas. Damage caused by feral hogs each year includes, crop damage by rutting up crops, destroyed fences, livestock watering areas, and predation on native wildlife, and ground-nesting birds. Feral hogs have few natural predators, thus allowing their population to grow to high numbers.

Wildlife habitat is a complex of many different plant communities and ecological sites across the landscape. Most animals use the landscape differently to find food, shelter, protection, and mates. Working on a conservation plan for the whole property, with a local professional, will help managers make the decisions that allow them to realize their goals for wildlife and livestock.

Savannah State (1): This state provides the maximum amount of forage for livestock such as cattle. It is also utilized by deer, quail and other birds as a source of food. When a site is in the reference plant community phase (1.1) it will also be used by some birds for nesting, if other habitat requirements like thermal and escape cover are near.

Woodland State (2): This state can be maintained to meet the habitat requirements of cattle and wildlife. Land managers can find a balance that meets their goals and allows them flexibility to manage for livestock and wildlife. Forbs for deer and birds like quail will be more plentiful in this state. There will also be more trees and shrubs to provide thermal and escape cover for birds as well as cover for deer.

Converted Land State (3): The quality of wildlife habitat this site will produce is extremely variable and is influenced greatly by the timing of rain events. This state is often manipulated to meet landowner goals. If livestock production is the main goal, it can be converted to pastureland. It can also be planted to a mix of grasses and forbs that will benefit both livestock and wildlife. A mix of forbs in the pasture could attract pollinators, birds and other types of wildlife. Food plots can also be planted to provide extra nutrition for deer.

This rating system provides general guidance as to animal preference for plant species. It also indicates possible competition between kinds of herbivores for various plants. Grazing preference changes from time to time, especially between seasons, and between animal kinds and classes. Grazing preference does not necessarily reflect the ecological status of the plant within the plant community. For wildlife, plant preferences for food and plant suitability for cover are rated. Refer to habitat guides for a more complete description of a species habitat needs.

Hydrological functions

Under the Mixed Grass Savannah Community (1.1), site infiltration is rapid, soil organic matter is high, soil structure is good, sediments are trapped, and porosity is high. The site will have high quality surface runoff with low erosion and sedimentation rates. During periods of heavy rainfall, the high infiltration rates will allow water to fill the soil profile. Larger trees will dissipate flood energy and the root masses will bind the soil. The Mixed Grass Savannah Community should be absent of rills and gullies. Drainageways should be vegetated and stable. This site is often in a flood plain with occasional out-of-bank flow.

Under the Woodland Community (2.1) leaf litter can build up to the point that herbaceous vegetation can be suppressed. Shading also suppresses warm-season grasses. The large wood can dissipate flood energy, trap sediments, and the root masses bind the soil. This is a stable community with no rills or gullies.

Improper grazing management reduces composition of bunchgrasses and reduces ground cover (resulting in a transition to the Midgrass Savannah Plant Community, 1.2). This decreases the function of the water cycle: infiltration declines and runoff increases due to poor ground cover, rainfall splash, soil capping, low organic matter and poor structure. Combining sparse ground cover with intensive rainfall creates conditions that increase the frequency and severity of flooding. The decline in the quality of the understory component and the increase in shrub canopy cover cause soil erosion to accelerate, surface runoff quality to decline, and sedimentation to increase. Streambank stability will decline and erosion of waterways will increase.

Under domination by woody species, especially oaks and pecan, interception of rainfall by tree canopies increases. This reduces the amount of rainfall reaching the soil surface. The funneling effect of the canopy increases stemflow and soil moisture at tree bases. Trees have increased transpiration compared to grasses, especially evergreen species such as live oak. The increased transpiration reduces the amount of water available for other plants to use. An increase in woody canopy creates a decline in grass cover, which has similar impacts as those described for improper grazing above.

Recreational uses

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

Wood products

Hardwoods are used for posts, firewood, charcoal, and other specialty wood products.

Other products

Jams and jellies are made from many fruit bearing species, such as wild grape. 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. This is a very good site for pecan production.

Inventory data references

Information presented was derived from the revised Range Site, literature, limited NRCS clipping data (417s), field observations, and personal contacts with range-trained personnel.

Other references

AgriLife. 2009. Managing Feral Hogs Not a One-shot Endeavor. AgNews, April 23, 2009. http://agnews.tamu.edu/showstory.php?id=903.

Archer, S. 1995. Herbivore mediation of grass-woody plant interactions. Tropical Grasslands, 29:218-235.

Archer, S. 1995. Tree-grass dynamics in a Prosopis-thornscrub savanna parkland: reconstructing the past and predicting the future. Ecoscience, 2:83-99.

Archer, S. 1994. Woody plant encroachment into southwestern grasslands and savannas: rates, patterns and proximate causes. Ecological implications of livestock herbivory in the West, 13-68.

Archer, S. and F. E. Smeins. 1991. Ecosystem-level Processes. In Grazing Management: An Ecological Perspective. Edited by R.K. Heischmidt and J.W. Stuth. Timber Press, Portland, OR.

Baen, J. S. 1997. The growing importance and value implications of recreational hunting leases to agricultural land investors. Journal of Real Estate Research, 14:399-414.

Bailey, V. 1905. North American Fauna No. 25: Biological Survey of Texas. United States Department of Agriculture Biological Survey. Government Printing Office, Washington D. C.

Bestelmeyer, B. T., J.R. Brown, K. M. Havstad, R. Alexander, G. Chavez, and J. E. Herrick. 2003. Development and use of state-and-transition models for rangelands. Journal of Range Management, 56(2):114-126.

Box, T. W. 1960. Herbage production on four range plant communities in South Texas. Journal of Range Management, 13:72-76.

Briske, B B, B. T. Bestelmeyer, T. K. Stringham, and P. L. Shaver. 2008. Recommendations for development of resilience-based State-and-Transition Models. Rangeland Ecology and Management, 61:359-367.

Brown, J. R. and S. Archer. 1999. Shrub invasion of grassland: recruitment is continuous and not regulated by herbaceous biomass or density. Ecology, 80(7):2385-2396.

Diamond, D. D. and T. E. Fulbright. 1990. Contemporary plant communities of upland grasslands of the Coastal Sand Plain, Texas. Southwestern Naturalist, 35:385-392.

Dillehay T. 1974. Late quaternary bison population changes on the Southern Plains. Plains Anthropologist, 19:180-96.

Edward, D. B. 1836. The history of Texas; or, the immigrants, farmers, and politicians guide to the character, climate, soil and production of that country. Geographically arranged from personal observation and experience. J. A. James and Co., Cincinnati, OH.

Everitt, J. H., D. L. Drawe, and R. I. Leonard. 2002. Trees, Shrubs, and Cacti of South Texas. Texas Tech University Press, Lubbock, TX.

Everitt, J. H., D. L. Drawe, and R. I. Lonard. 1999. Field Guide to the Broad-Leaved Herbaceous Plants of South Texas. Texas Tech University Press. Lubbock, TX.

Foster, J. H. 1917. Pre-settlement fire frequency regions of the United States: a first approximation. Tall Timbers Fire Ecology Conference Proceedings No. 20.

Foster, W. C., ed. 1998. The La Salle Expedition to Texas: The Journal of Henry Joutel, 1684-1687. Texas State Historical Association, Austin, TX.

Frost, C. C. 1995. Presettlement fire regimes in southeastern marshes, peatlands, and swamps. In: Prodeedings, 19th Tall Timbers fire ecology conference, 39-60. Tall Timbers Research Station, Tallahassee, FL.

Fulbright, T. E. and S. L. Beasom. 1987. Long-term effects of mechanical treatment on white-tailed deer browse. Wildlife Society Bulletin, 15:560-564.

Fulbright, T. E., J. A. Ortega-Santos, A. Lozano-Cavazos, and L. E. Ramirez-Yanez. 2006. Establishing vegetation on migrating inland sand dunes in Texas. Rangeland Ecology and Management, 59:549-556.

Fulbright, T. E., D. D. Diamond, J. Rappole, and J. Norwine. The Coastal Sand Plain of Southern Texas. Rangelands, 12:337-340.

Gould, F. W. 1975. The Grasses of Texas. Texas A&M University Press, College Station, TX.

Grace, J. B., L. K. Allain, H. Q. Baldwin, A. G. Billock, W. R. Eddleman, A. M. Given, C. W. Jeske, and R. Moss. 2005. Effects of prescribed fire in the coastal prairies of Texas. USGS Open File Report 2005-1287.

Hamilton, W. and D. Ueckert. 2005. Rangeland Woody Plant Control: Past, Present, and Future. In: Brush Management: Past, Present, and Future, 3-16. Texas A&M University Press. College Station, TX.

Hansmire, J. A., D. L. Drawe, B. B. Wester and C.M. Britton. 1988. Effect of winter burns on forbs and grasses of the Texas Coastal Prairie. The Southwestern Naturalist, 33(3):333-338.

Heitschmidt R. K., Stuth J. W., eds. 1991. Grazing management: an ecological perspective. Timberline Press, Portland, OR.

Inglis, J. M. 1964. A history of vegetation of the Rio Grande Plains. Texas Parks and Wildlife Department Bulletin No. 45, Austin, TX.

Kneuper, C. L., C. B. Scott, and W. E. Pinchak. 2003. Consumption and dispersion of mesquite seeds by ruminants. Journal of Range Management, 56:255-259.

Kramp, B., R. Ansley, and D. Jones. 1998. Effect of prescribed fire on mesquite seedlings. Texas Tech University Research Highlights - Range, Wildlife and Fisheries Management, 29:13.

Le Houerou, H. N. and J. Norwine. 1988. The ecoclimatology of South Texas. In Arid lands: today and tomorrow. Edited by E. E. Whitehead, C. F. Hutchinson, B. N. Timmesman, and R. G. Varady, 417-444. Westview Press, Boulder, CO.

Lehman, V. W. 1965. Fire in the range of Attwater's prairie chicken. Tall Timbers Fire Ecology Conference, 4:127-143.

Lehman, V. W. 1969. Forgotten Legions: Sheep in the Rio Grande Plain of Texas. Texas Western Press, El Paso, TX.

Mann, C. 2004. 1491. New Revelations of the Americas before Columbus. Vintage Books, New York City, NY.

Mapston, M. E. 2009. Feral Hogs in Texas. Rep. Texas Cooperative Extension. 23 Apr. 2009 http://icwdm.org/Publications/pdf/Feral%20Pig/Txferalhogs.pdf

McClendon, T. 1991. Preliminary description of the vegetation of South Texas exclusive of the Coastal Saline Zones. Texas Journal of Science, 43:13-32.

McGinty A., D. N. Ueckert. 2001. The Brush Busters success story. Rangelands, 23:3-8.

McLendon, T. 1991. Preliminary description of the vegetation of south Texas exclusive of coastal saline zones. Texas Journal of Science, 43:13-32.

Norwine, J. 1978. Twentieth-century semiarid climates and climatic fluctuations in Texas and northeastern Mexico. Journal of Arid Environments, 1:313-325.

Norwine, J. and R. Bingham. 1986. Frequency and severity of droughts in South Texas: 1900-1983, 1-17. In Livestock and wildlife management during drought. Edited by R. D. Brown. Caesar Kleberg Wildlife Research Institute, Kingsville, TX.

Olmsted, F. L. 1857. A journey through Texas, or a saddle trip on the Southwest frontier: with a statistical appendix. Dix, Edwards, and co., New York, London.

Prichard, D. 1998. A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lentic Areas. Bureau of Land Management. National Applied Resource Sciences Center, CO.

Rappole, J. H. and G. W. Blacklock. 1994. A field guide: Birds of Texas. Texas A&M University Press, College Station, TX.

Rhyne, M. Z. 1998. Optimization of wildlife and recreation earnings for private landowners. M. S. Thesis, Texas A&M University-Kingsville, Kingsville, TX.

Schindler, J. R. and T. E. Fulbright. 2003. Roller chopping effects on Tamaulipan scrub community composition. Journal of Range Management, 56:585-590.

Schmidley, D. J. 1983. Texas mammals east of the Balcones Fault zone. Texas A&M University Press, College Station, TX.

Scifres C. J., W. T. Hamilton, J. R. Conner, J. M. Inglis, and G. A. Rasmussen. 1985. Integrated Brush Management Systems for South Texas: Development and Implementation. Texas Agricultural Experiment Station, College Station, TX.

Scifres, C. J. and W. T. Hamilton. 1993. Prescribed burning for brushland management: the South Texas example.

Texas A&M Press, College Station, TX.

Scifres, C. J. 1975. Systems for improving McCartney rose infested coastal prairie rangeland. Texas Agricultural Experiment Station Bulletin MP 1225.

Smeins, F. E., S. Fuhlendorf, and C. Taylor, Jr. 1997. Environmental and Land Use Changes: A Long Term Perspective. In Juniper Symposium, 1-21. Texas Agricultural Experiment Station.

Smeins, F. E., D. D. Diamond, and W. Hanselka. 1991. Coastal prairie, 269-290. In Ecosystems of the World: Natural Grasslands. Edited by R. T. Coupland. Elsevier Press, Amsterdam, Netherlands.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Soil Survey Geographic (SSURGO) Database.

Snyder, R. A. and C. L. Boss. 2002. Recovery and stability in barrier island plant communities. Journal of Coastal Research, 18:530-536.

Stiles, H. R., ed. 1906. Joutel's journal of La Salle's last voyage, 1686-1687. Joseph McDonough, Albany, NY.

Stringham, T. K., W. C. Krueger, and P. L. Shaver. 2001. State and transition modeling: and ecological process approach. Journal of Range Management, 56(2):106-113.

Texas A&M Research and Extension Center. 2000. Native Plants of South Texas http://uvalde.tamu.edu/herbarium/index.html.

Texas Agriculture Experiment Station. 2007. Benny Simpson's Texas Native Trees http://aggie-horticulture.tamu.edu/ornamentals/natives/.

Texas Parks and Wildlife Department. 2007. List of White-tailed Deer Browse and Ratings. District 8.

Tharp, B. C. 1926. Structure of Texas Vegetation east of the 98th meridian. Bulletin 2606. University of Texas, Austin. TX.

Thurow, T. L. 1991. Hydrology and Erosion. In: Grazing Management: An Ecological Perspective. Edited by R.K. Heitschmidt and J.W. Stuth. Timber Press, Portland, OR.

Urbatsch, L. 2000. Chinese tallow tree (Triadica sebifera (L.) Small. USDA-NRCS Plant Guide.

USDA-NRCS Plant Database. 2018. https://plants.usda.gov/.

Van't Hul, J. T., R. S. Lutz and N. E. Mathews. 1997. Impact of prescribed burning on vegetation and bird abundance on Matagorda Island, Texas. Journal of Range Management, 50:346-360.

Vines, R. A. 1984. Trees of Central Texas. University of Texas Press, Austin, TX.

Wade, D. D., B. L. Brock, P. H. Brose, J. B. Grace, G. A. Hoch, and W. A. Patterson III. 2000. Fire in Eastern ecosystems. In Wildland fire in ecosystems: effects of fire on flora. Edited by. J. K. Brown and J. Kaplers. United States Forest Service, Rocky Mountain Research Station, Ogden, UT.

Weltz, M. A. and W. H. Blackburn. 1995. Water budget for south Texas rangelands. Journal of Range Management, 48:45-52.

Whittaker, R. H., L. E. Gilbert, and J. H. Connell. 1979. Analysis of a two-phase pattern in a mesquite grassland, Texas. Journal of Ecology, 67:935-52.

Wright, B. D., R. K. Lyons, J. C. Cathey, and S. Cooper. 2002. White-tailed deer browse preferences for South Texas and the Edwards Plateau. Texas Cooperative Extension Bulletin B-6130.

Wright, H.A. and A.W. Bailey. 1982. Fire Ecology: United States and Southern Canada. John Wiley & Sons, Inc., Hoboken, NJ.

Approval

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Acknowledgments

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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	05/06/2009
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:** Large water flow patterns are expected as this is a bottomland site. Large volume of water can occur during high rainfall events.

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):** 0 to 5 percent bare ground. Small and non-connected areas due to highly productive site.

5. **Number of gullies and erosion associated with gullies:** Gullies can occur in areas along stream banks where poor vegetative cover occurs.

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

7. **Amount of litter movement (describe size and distance expected to travel):** Minimal and long under normal rainfall intensity.

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 anticipated to be 5 to 6 at the surface. These values need to be verified.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Dark grayish brown clay loam; moderate, fine, subangular blocky/medium granular structure; hard/slightly firm; common fine roots; few fine calcium carbonate concretions; few snail shells; calcareous; moderately alkaline; Soil organic matter is three to five percent.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** High canopy, basal cover and density with small interspaces should make rainfall impact negligible. This site has well drained soils, deep with 0 to 1 percent slopes should not have detrimental runoff and erosion.

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: Cool-season midgrasses > Warm-season tallgrasses > Trees >

    Other: Forbs

    Additional: Forbs make up 5 percent of species composition, shrubs and trees compose up to 15 percent species composition.

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Perennial grasses will naturally exhibit a minor amount (less than 5%) of senescence and some mortality every year.

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:** Huisache, buffelgrass, King Ranch bluestem, bermudagrass, and Old World bluestems.

17. **Perennial plant reproductive capability:** All perennial species should be capable of reproducing every year unless disrupted by extended drought, overgrazing, insect damage, or other events occuring immediately prior to, or during the reproductive phase.