USDA Natural Resources Conservation Service

Ecological site R085AY178TX Clayey Bottomland 30-38" PZ

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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): 085A–Grand Prairie

The Grand Prairie MLRA is characterized by predominately loam and clay loam soils underlain by limestone and shale. Topography transitions from steeper ridges and summits of the Lampasas Cut Plain on the southern end to the more rolling hills of the Fort Worth Prairie to the north. The Arbuckle Mountain area in Oklahoma is also within this MLRA.

Classification relationships

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

Ecological site concept

These sites occur over deep expansive clay soils on floodplains. The soils have good fertility and water holding capacity. The reference vegetation consists of native tallgrasses with forbs and some scattered woody species. Without fire or brush management, woody species may increase across the site. Many of these site have been converted to cropland and some have since been planted back to introduced pasture species.

Associated sites

R085AY177TX	**Blackland 30-38" PZ** The Blackland site is often upslope from the Clayey Bottomland site. It differs from the Clayey Bottomland site by its position on uplands, lack of high shrink-swell and hydric soil properties, and having clay soils and higher runoff.

Similar sites

R085AY181TX	**Loamy Bottomland 30-38" PZ** The Loamy Bottomland site is similar to the Clayey Bottomland site by occurring on floodplains and having similar production potential. It differs from the Clayey Bottomland site by forming in recent loamy alluvium and having higher permeability and no shrink-swell soil characteristics.

Table 1. Dominant plant species

Tree	(1) *Carya illinoinensis* (2) *Quercus stellata*
Shrub	Not specified
Herbaceous	(1) *Panicum virgatum* (2) *Sorghastrum nutans*

Physiographic features

This site occurs on flood plains in the Grand Prairie. Slopes are typically less than 2 percent.

Table 2. Representative physiographic features

Landforms	(1) Alluvial plain > Flood plain
Runoff class	Medium to high
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	Rare to frequent
Elevation	152–579 m
Slope	0–2%
Water table depth	102 cm
Aspect	Aspect is not a significant factor

Climatic features

The climate is subhumid subtropical and is characterized by hot summers and relatively mild winters. Tropical maritime air controls the climate during spring, summer and fall. In winter and early spring, frequent surges of Polar Canadian air cause sudden drops in temperatures and add considerable variety to the daily weather. The average first frost should occur around November 5 and the last freeze of the season should occur around March 19.

The average relative humidity in mid-afternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 75 percent of the time possible during the summer and 50 percent in winter. The prevailing wind direction is from the south and highest windspeeds occur during the spring months.

Approximately two-thirds of annual rainfall occurs during the April to September period. Rainfall during this period generally falls during thunderstorms, and fairly large amounts of rain may fall in a short time. The driest months are usually July and August.

Table 3. Representative climatic features

Frost-free period (characteristic range)	194-208 days
Freeze-free period (characteristic range)	216-243 days
Precipitation total (characteristic range)	813-965 mm
Frost-free period (actual range)	190-209 days
Freeze-free period (actual range)	209-245 days
Precipitation total (actual range)	787-991 mm
Frost-free period (average)	201 days
Freeze-free period (average)	230 days
Precipitation total (average)	889 mm

Climate stations used

- (1) DENTON MUNI AP [USW00003991], Ponder, TX
- (2) CLEBURNE [USC00411800], Cleburne, TX
- (3) WHITNEY DAM [USC00419715], Clifton, TX
- (4) BROWNWOOD 2ENE [USC00411138], Early, TX
- (5) EVANT 1SSW [USC00413005], Evant, TX
- (6) LAMPASAS [USC00415018], Lampasas, TX
- (7) BENBROOK DAM [USC00410691], Fort Worth, TX
- (8) DECATUR [USC00412334], Decatur, TX

Influencing water features

This site is adjacent to rivers and streams. It receives water from overflow from watercourses and runoff from higher adjacent sites. Some soils in this site are hydric and may be wetlands or the soils may contain inclusions of other hydric soils that usually occur as oxbows or stream meanders.

Wetland description

Site specific evaluations are recommended to determine presence of wetlands.

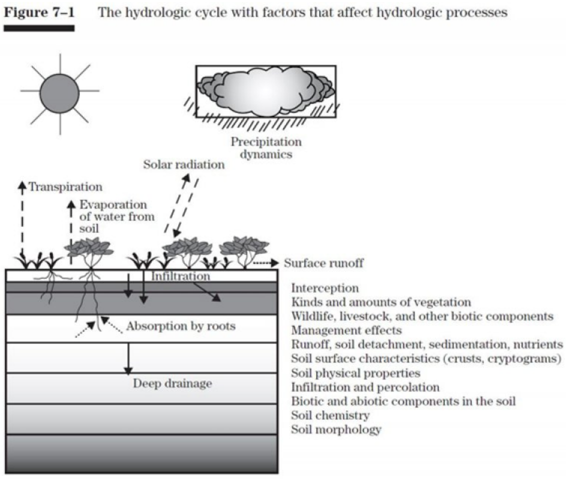


Figure 8.

Soil features

Representative soil components for this ecological site include: Deleon

The site is characterized by very deep clayey alluvial soils with very high shrink-swell potential.

Table 4. Representative soil features

Parent material	(1) Alluvium–limestone (2) Alluvium–mudstone
Surface texture	(1) Clay (2) Silty clay
Drainage class	Moderately well drained
Permeability class	Very slow to slow
Soil depth	152 cm
Surface fragment cover <=3"	0–2%
Surface fragment cover >3"	0–2%
Available water capacity (0-101.6cm)	25.4–30.48 cm

Calcium carbonate equivalent (0-101.6cm)	1–20%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–6
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–5%
Subsurface fragment volume >3" (Depth not specified)	0–2%

Ecological dynamics

The Clayey Bottomland 30-38” PZ reference site was a fire-influenced tallgrass/Hardwood Bottomland Community interspersed with occasional perennial forbs. Reference sites show that an intact grass community without fire is 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 Hardwood Bottomland Community dominated the site with dense stands of hardwoods, including pecan (*Carya illinoinensis*) and oak (Quercus spp). The three communities in the Bottomland 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.

Reference vegetation on the Bottomlands is predominantly tall warm-season and cool-season perennial bunchgrasses and sedges (Carex spp.) with lesser amounts of midgrasses. Warm-season grasses dominate the open spaces between groups of trees. Warm-season tall grasses include big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), Indiangrass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*), and eastern gamagrass (*Tripsacum dactyloides*). Cool-season tall grasses dominate the moist, shaded areas where groups of trees create nearly closed canopy. These include Virginia wildrye (*Elymus virginicus*), Canada wildrye (*Elymus canadensis*), and sedges. A variety of forbs occur in the herbaceous component both in the open and under tree canopy. Shrubs and trees make up a part of the reference community having about 25% canopy cover. Trees tend to be denser adjacent to water courses. Dominant woody species include live oak (*Quercus virginiana*), post oak (*Quercus stellata*), elm (Ulmus spp.), and hackberry (Celtis spp.).

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 live oak, post oak, elm (Ulmus spp.), hackberry, ash (Fraxinus spp.), cottonwood (Populus spp.), and pecan.

The Clayey Bottomland 30-38” PZ site is fertile farmland. Much of this site was converted to cropland in the late 1800s to early 1900s, 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 remain have histories of long-term management as native hay pastures with brush control.

The Clayey Bottomland 30-38” PZ produces palatable and nutritious forage, has large shade trees, and is close to water. When not flooded, cattle prefer this site for grazing and loafing. Consequently, the site is frequently overgrazed.

The northernmost portion of the Grand Prairie MLRA is still relatively free from the widespread invasion of brush that has occurred in other parts of the state, including the southern part of the MLRA. Juniper (cedar) (Juniperus spp.), and honey mesquite (*Prosopis glandulosa*) have increased to the point of dominance in some locations, especially on shallow, rocky slopes.

Prior to European settlement (pre-1825), fire and infrequent but intense, short-duration grazing by large herbivores (mainly bison and to a lesser extent pronghorn antelope) were important natural landscape-scale disturbances that suppressed woody species and invigorated herbaceous species (Eidson and Smeins 1999). The herbaceous prairie species adapted to fire and grazing disturbances by maintaining below-ground perennating tissues. Wright and Bailey (1982) report that there are no reliable records of fire frequency in the Great Plains grasslands because there are no trees to carry fire scars from which to estimate fire frequency. Because the surrounding savannah has level or rolling topography, a natural fire frequency of 5 to 10 years seems reasonable. Fire frequency on the bottomland sites was likely to have been highly variable. When the site was in the Bottomland State with large expanses of grass, fires were likely to be frequent. It is likely that indigenous humans set frequent fires to maintain open grasslands for improved wildlife habitat. Once the tree canopy was closed, fires would have been infrequent and most likely resulted when fires carried from the adjoining prairie with enough heat to create crown fires in dominant tree cover.

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

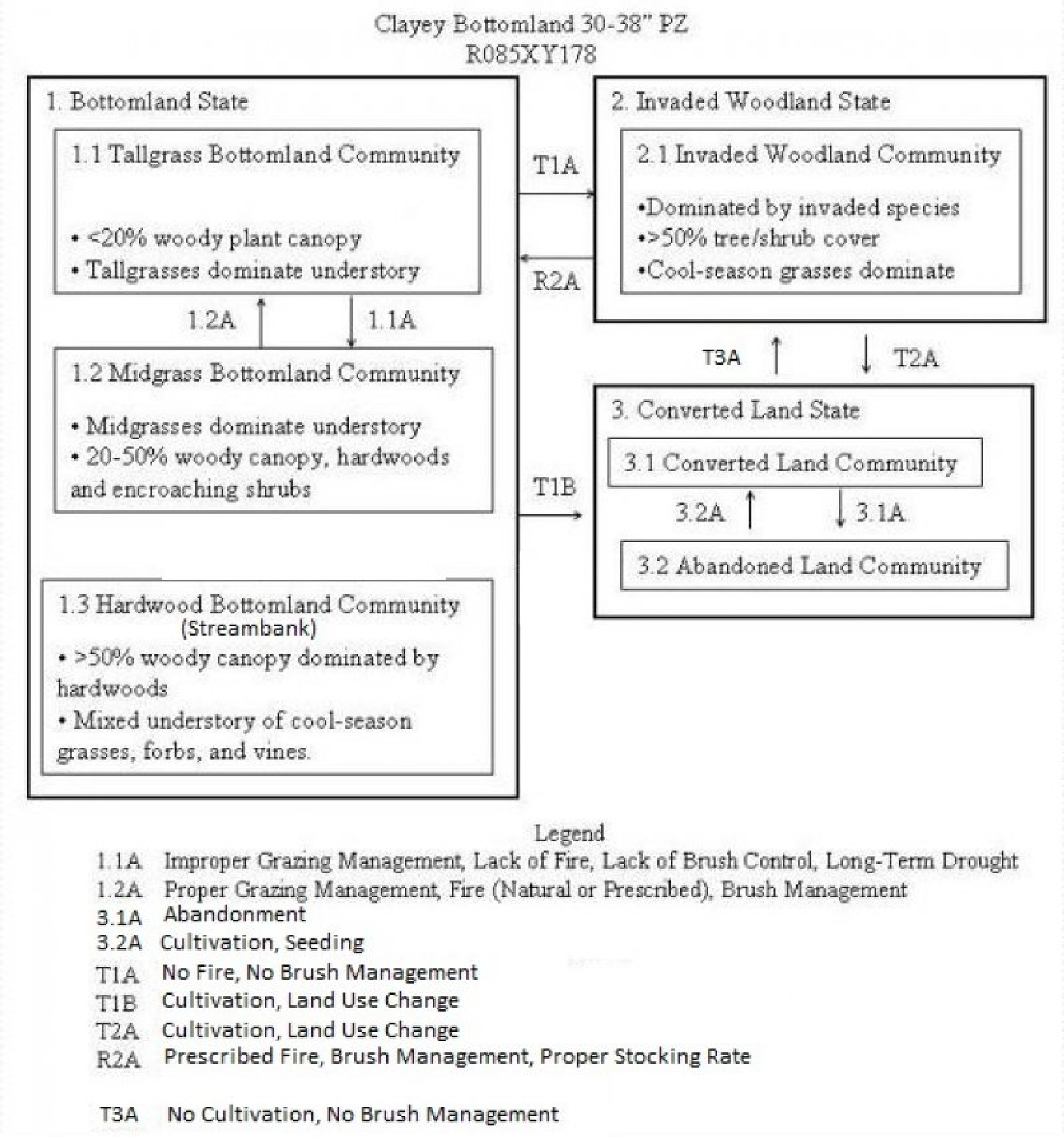
Introduced pasture has been established on many acres of old cropland and in areas with deeper soils. Typical introduced species planted for tame pastures and haylands include improved bermudagrass varieties (Cynodon spp.), dallisgrass (*Paspalum dilatatum*), annual ryegrass (*Lolium perenne*), and white clover (*Trifolium repens*). Some former cropland has been seeded to native species including switchgrass 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.

Rangeland Health Reference Worksheets have been posted for this site on the Texas NRCS website (www.tx.nrcs.usda.gov) in Section II of the eFOTG under (F) Ecological Site Descriptions (ESD's).

Plant Communities and Transitional Pathways
A state and transition model for the Clayey Bottomland 30-38” PZ ecological site is depicted in Figure 1. Thorough descriptions of each state and transition and of each plant community and pathway follow the model. This model is based on available experimental research, field observations, and interpretations by experts. It is likely to change as knowledge increases.

The plant communities will differ across the MLRA due to the naturally occurring variability in weather, soils, and aspect. The biological processes on this site are complex. Therefore, representative values are presented in a land management context. The species lists are representative and are not botanical descriptions of all species occurring, or potentially occurring, on this site. They are not intended to cover every situation or the full range of conditions, species, and responses for the site.

State and transition model



State 1
Reference State

Dominant plant species

- pecan (*Carya illinoinensis*), tree
- switchgrass (*Panicum virgatum*), grass

Community 1.1
Tallgrass Bottomland Community

The Tallgrass Bottomland Community (1.1) is the reference community and is characterized as a hardwood savannah with up to 20 percent tree and shrub canopy cover. Both percent species composition by weight and percent canopy cover are used in this ESD. Most observers find it easier to visualize or estimate percent canopy for woody species (trees and shrubs). Canopy cover drives the transitions between plant communities and states because of the influence of shade and interception of rainfall. Species composition by weight remains an important descriptor of the herbaceous community and of the community as a whole. Woody species are included in species composition for the site. Calculating Similarity Index requires use of species composition. The herbaceous community in the drier, open areas is dominated by switchgrass, Indiangrass, big bluestem, little bluestem, eastern gamagrass, vine-mesquite (*Panicum obtusum*), sideoats grama (*Bouteloua curtipendula*), and silver bluestem (*Bothriochloa laguroides*). Sedges, Virginia wildrye, and Canada wildrye dominate the herbaceous plant community in shaded and wet areas. The balance of warm- and cool-season tallgrasses will be driven by the amount of canopy cover from large trees, particularly the amount and size of stands with closed canopy. When the site is open and tree cover is less than 10%, warm-season tallgrasses will approach 40% species composition by weight, while the cool-season grasses will approach 10%. As tree cover approaches the upper limit of the reference community (30%), cool-season grasses and grasslikes will approach 30% species composition by weight and warm-season tallgrasses will approach 20%. Live oak, post oak, elm, hackberry, cottonwood, ash, willow (Salix spp.), pecan, and other large trees create 20% canopy cover. The overstory canopy is densest adjacent to watercourses. Woody understory species include hawthorn (Crataegus spp.), greenbriar (Smilax spp.), and grape (Vitis spp.). Continuous yearlong grazing that exceeds the carrying capacity for a succession of years will tend to move the reference herbaceous plant community towards a herbaceous community of buffalograss (*Bouteloua dactyloides*) and other shortgrasses. The reference Tallgrass Bottomland Community (1.1) will shift to the Midgrass Bottomland Community (1.2) under the stresses of improper grazing. The first species to decrease in dominance will be the most palatable and/or least grazing tolerant grasses and forbs (namely, eastern gamagrass, Indiangrass, big bluestem). This will initially result in an increase in composition of little bluestem and sideoats grama. If improper grazing continues, little bluestem will decrease and midgrasses such as silver bluestem and vine mesquite will increase in composition. Less palatable forbs will also increase at this stage. Without fire and/or brush control, woody species on the site will increase and the site will transition to the Woodland State. This can occur with or without the understory transitioning to the midgrass community through shift of dominance by tallgrasses to dominance by midgrasses. Continuous abusive grazing with no fire or brush management, or abandoning the site for several years, will allow shrub saplings to establish. Once woody shrubs and saplings invade the site, brush management in some form must be used to maintain the Tallgrass Bottomland Community (1.1). The soils of this site are deep, dark gray to black, calcareous clays. The site receives additional water from outside the site as overflow or as runoff from adjacent sites. The soils have high shrink-swell characteristics. They crack profusely when dry and the cracks take in water rapidly. Once wet, the cracks close and permeability becomes very slow. Surface runoff and permeability are very slow. Soils are highly fertile and hold large amounts of soil moisture. However, the soils have a high wilting point, which reduces plant production in very dry years. In very wet years the site is subject to flooding, which reduces plant production and desirability of the site for grazing. This is a very productive site with high yields of palatable, high quality forage. There is essentially no bare soil in this community. Plant basal cover and litter comprise all of the ground cover. Multiple layer canopy cover approaches 100%.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	3363	5044	6305
Shrub/Vine	897	1345	1681
Forb	224	336	420
Total	**4484**	**6725**	**8406**

Figure 10. Plant community growth curve (percent production by month). TX6020, Tallgrass Oak Savannah Community. The plant community is a fire climax savannah composed of warm-season perennial tallgrasses and scattered post oaks..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	2	2	18	23	17	6	4	16	6	3	2

Community 1.2
Midgrass Bottomland Community

The Midgrass Bottomland Community (1.2) typically results from improper cattle grazing management over a long period of time combined with a lack of brush management and fire. It can also be the result of abandoned cropland. Indigenous or invading woody species increase on the site. Growing season stress, usually from overgrazing, causes reduction in vigor and survival of tallgrasses, which allows midgrasses and less palatable forbs to increase in the herbaceous community. Prescribed burning becomes less effective to maintain this community or return it to the Tallgrass Bottomland Community (1.1) due to the moisture content and lack of quantity of the herbaceous fine fuel. Mechanical or chemical brush control as well as prescribed grazing must be applied to move this vegetative state back towards the Tallgrass Bottomland Community. Remnants of Virginia wildrye and big bluestem may still occur but the herbaceous component of the community becomes dominated by lesser producing grasses and forbs. Shade tolerant species such as Texas wintergrass (*Nassella leucotricha*) and shade tolerant forbs such as grape and greenbriar become more abundant species as canopy cover increases. Trees and shrubs begin to replace the grassland component of the community. The naturally occurring live oak, post oak, elm, hackberry, ash, pecan, and cottonwood will increase. Invasive woody species such as honey locust (Robinia rusbyi) and also increase in density until canopy cover reaches 50 percent. Species whose seeds are windblown (elm, cottonwood, and ash) or animal dispersed (pecan) readily colonize and dominate the site. 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 (Quercus spp.) and ash will increase in size, while other tree and shrub species such as bumelia (Sideroxylon spp.), sumacs (Rhus spp.), honey locust, winged elm (*Ulmus alata*), and Osage orange (*Maclura pomifera*) will increase in density. 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 until removal by fire or brush control. 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. The Midgrass Bottomland Community (1.2) can be managed back toward the Tallgrass Bottomland Community (1.1) through the use of management practices including prescribed grazing 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, but 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) cannot create sufficient change to restore the site within a reasonable time frame.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1233	2018	2802
Shrub/Vine	1121	1793	2242
Forb	560	897	1121
Total	**2914**	**4708**	**6165**

Figure 12. Plant community growth curve (percent production by month). TX6021, Tall & Midgrass/Oak Savannah Community. The tallgrasses will start to disappear and be replaced by midgrasses. Invader brush species appears and becomes established..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	2	2	18	23	17	6	4	16	6	3	2

Community 1.3
Hardwood Bottomland Community

The Hardwood Bottomland Community (1.3) has over 50% woody plant canopy, dominated by hardwoods such as oaks and elms. The community loses its savannah appearance with native shrubs filling the open grassland portion of the savannah. This community occurs along the stream channel of the drainageway. While total net primary production is similar to the Tallgrass Bottomland Community (1.1), annual herbage production decreases due to a decline in soil structure and organic matter and has shifted toward the woody component. All unpalatable woody species have increased in size and density. This plant community is a closed (or nearly closed) overstory (50 to 80%) woodland dominated by oaks, elm, hackberry, ash, pecan, and cottonwood. Understory shrubs include hawthorn and willows. Woody vines also occur and include grape and greenbrier. An herbaceous understory is almost nonexistent but shade tolerant species including Uniola spp., sedges, ironweed (*Vernonia baldwinii*), switchcane (*Arundinaria gigantea*), eastern gamagrass, and goldenrod (Solidago spp.) may occur in small amounts. 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 100%. Large-scale prescribed fire is generally not a viable treatment option for conversion of this site back to a semblance of the Tallgrass Bottomland Community. 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.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Tree	4035	6053	7005
Forb	224	336	420
Grass/Grasslike	224	336	420
Total	**4483**	**6725**	**7845**

Figure 14. Plant community growth curve (percent production by month). TX6014, Mesquite/Juniper/Brushland Community. Consist of mixed grasses with greater than 50 percent canopy of woody plants..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	3	8	20	25	19	5	3	10	4	1	1

Pathway 1.1A
Community 1.1 to 1.2

The Tallgrass Bottomland Community requires fire and/or brush control to maintain woody species cover below 20%. This community will shift to the Midgrass Bottomland Community 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 species released by disturbance. Woody species canopy exceeding 20% and/or dominance of tallgrasses falling below 50% of species composition indicate a transition to the Midgrass Bottomland Community. The Tallgrass Bottomland Community can be maintained through the implementation of fire, 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 and/or fire, the Tallgrass Bottomland Community will transition to the Woodland State even if the understory component does not shift to dominance by midgrasses. 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 Bottomland Community will return to the Tallgrass Bottomland Community 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 tallgrasses in the absence of fire (at least until shrub canopy cover reaches 50%). 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%, i.e., 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.

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing

State 2
Invaded Woodland State

Dominant plant species

- Ashe's juniper (*Juniperus ashei*), tree
- wildrye (*Elymus*), grass

Community 2.1
Invaded Woodland Community

The Invaded Woodland State (2) has over 50% woody plant canopy cover, dominated by invaded woody species such as honey mesquite and Ashe juniper. The appearance is similar to that of the Hardwood Bottomland Community (1.3) but native shrubs being replaced by invaded species. The herbaceous understory is almost non-existent. Cool-season grasses dominate this sparse understory. 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 be close to 100%. Prescribed fire is not a viable treatment option for conversion of this site back to a semblance of the Tallgrass Bottomland Community. Chemical brush control on a large scale may not be a treatment option; however, individual plant treatment with herbicides on small acreages may be a viable option. Mechanical removal of invasive woody species, along with seeding and ongoing management of invasives, is the most viable treatment option although it may not be economical. Without maintenance, invasive species are likely to return (probably rapidly) due to presence of propagules in the soil.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	3026	4539	6053
Forb	168	252	336
Grass/Grasslike	168	252	336
Total	**3362**	**5043**	**6725**

Figure 16. Plant community growth curve (percent production by month). TX6014, Mesquite/Juniper/Brushland Community. Consist of mixed grasses with greater than 50 percent canopy of woody plants..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	3	8	20	25	19	5	3	10	4	1	1

State 3
Converted Land State

Dominant plant species

- Bermudagrass (*Cynodon dactylon*), grass

Community 3.1
Converted Land Community

The Converted Land Community (3.1) occurs when the site, either the Bottomland State (1) or Invaded Woodland State (2), is cleared and plowed for planting to cropland, hayland, native grasses, tame pasture, and used as non-agricultural land and restored native Prairie or Woodland. 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 Clayey Bottomland site is frequently converted to cropland or tame pasture sites because of its deep fertile soils, favorable soil/water/plant relationship, and level terrain. Hundreds of thousands of acres have been plowed up and converted to cropland, pastureland, or hayland. Small grains are the principal crop, and Bermudagrass is the primary introduced pasture species on loamy soils in this area. The Clayey Bottomland site can be an extremely productive forage producing site with the application of optimum amounts of fertilizer. Refer to Forage Suitability Group Descriptions for specific management recommendations, estimated production potentials, and species adaptation. 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. NRCS Forage Suitability Group Descriptions describe adapted species, management, and production potentials on pasturelands and haylands. Common introduced species include 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. Without agronomic inputs, the site will eventually return to either the Bottomland or Invaded Woodland 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 17. Plant community growth curve (percent production by month). TX6104, Introduced Pasture Seeding. Grass species such as bermudagrass, kleingrass, old world bluestems and other introduced grassland species are planted..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	2	2	18	23	17	6	4	16	6	3	2

Community 3.2
Abandoned Land Community

The Abandoned Land Community (3.2) occurs when the Converted Land Community (3.1) abandoned or mismanaged. Mismanagement can include poor crop or haying management. Pastureland can transition to the Abandoned Land Community when subjected to improper grazing management (typically long-term overgrazing). Heavily disturbed soils allowed to “Go Back” return to the Invaded Shrubland State. These sites may become woodland thicket over time. Long-term cropping can create changes in soil chemistry and structure that make restoration to the Bottomland state (1) very difficult and/or expensive. Return to native Bottomland 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 Bottomland 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 Bottomland State in the short-term by seeding mixtures of commercially-available native grasses. With proper management (prescribed grazing, weed control, brush control) these sites can come close to the diversity and complexity of Tallgrass Bottomland Community (1.1) it is unlikely that abandoned farmland will return to the Bottomland State without active brush management because the rate of shrub increase will exceed the rate of recovery by desirable grass species. Without active restoration the site is not likely to return to reference conditions due to the introduction of introduced forbs and grasses. The native component of the Bottomland 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 18. Plant community growth curve (percent production by month). TX6105, Abandoned Land Community. Mix of perennial and annual weedy species mixed with native and invasive woody species with peak biomass production in April, May, and June and a lesser peak in September and October..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	2	2	18	23	17	6	4	16	6	3	2

Pathway 3.1A
Community 3.1 to 3.2

The shift from the Converted Land Community to the Abandoned Land Community occurs due to land being abandoned or idled from crop and pastureland production.

Pathway 3.2A
Community 3.2 to 3.1

Restoration from the Abandoned Land Community can be accomplished through the use of brush management, prescribed grazing, and crop cultivation.

Conservation practices

Brush Management
Conservation Crop Rotation
Prescribed Burning
Prescribed Grazing
Range Planting

Transition T1A
State 1 to 2

The introduction of aggressive woody invader species creates risk for transition to the Invaded Woodland State. This transition can occur from any community within the Bottomland State, it is not dependant on degradation of the herbaceous community, but on introduction of aggressive woody species. Risk of invasives increases on poorly managed or Go-back Land. Improper grazing, prolonged drought, and a warming climate will provide a competitive advantage to shrubs adapted to warmer, drier conditions which will accelerate this process. Without control, invasive woody species can dominate the site. Invasive introduced to a healthy Bottomland Community will be mixed with native over and understory. The driver for this transition is the introduction of invasive species.

Transition T1B
State 1 to 3

The transition to the Converted State from the Bottomland State (T1B) occurs when the bottomland is 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 R2A
State 2 to 1

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

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing
Range Planting

Transition T2A
State 2 to 3

The transition to the Converted State from the Woodland State (T2A) occurs when the bottomland is 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.

Transition T2A
State 2 to 3

The transition to the Converted State from the Woodland State (T2A) occurs when the bottomland is 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.

Transition T3A
State 3 to 2

Transition 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. Heavily disturbed soils are more likely to return to the Invaded Woodland State. Without continued disturbance from agriculture the site can eventually return to the Invaded Woodland state. The level of disturbance while in the converted state determines the direction of the site restoration pathway. Return to the Invaded Woodland State is more likely to be successful if soil chemistry and structure are heavily disturbed. Converted sites can be returned to the Invaded Woodland 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.

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Warm-season Tallgrasses**			1345–2522	
	big bluestem	ANGE	*Andropogon gerardii*	269–2102	–
	switchgrass	PAVI2	*Panicum virgatum*	269–2102	–
	little bluestem	SCSC	*Schizachyrium scoparium*	269–2102	

	little bluestem	SCSC	*Schizachyrium scoparium*	269–2102	–
	Indiangrass	SONU2	*Sorghastrum nutans*	269–2102	–
	eastern gamagrass	TRDA3	*Tripsacum dactyloides*	269–1261	–
2	**Cool-season Tallgrasses/Grasslikes**			897–1681	
	sedge	CAREX	*Carex*	179–1681	–
	Virginia wildrye	ELVI3	*Elymus virginicus*	179–1681	–
	Canada wildrye	ELCA4	*Elymus canadensis*	179–1345	–
	beaked panicgrass	PAAN	*Panicum anceps*	179–841	–
	Texas wintergrass	NALE3	*Nassella leucotricha*	179–420	–
3	**Warm-season Midgrasses**			1121–2102	
	cane bluestem	BOBA3	*Bothriochloa barbinodis*	157–1065	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	157–1065	–
	silver beardgrass	BOLAT	*Bothriochloa laguroides ssp. torreyana*	157–1065	–
	Drummond's dropseed	SPCOD3	*Sporobolus compositus var. drummondii*	157–1065	–
	white tridens	TRAL2	*Tridens albescens*	157–1065	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	157–532	–
	vine mesquite	PAOB	*Panicum obtusum*	157–532	–
4	**Other grasses**			224–420	
	buffalograss	BODA2	*Bouteloua dactyloides*	0–420	–
	Indian woodoats	CHLA5	*Chasmanthium latifolium*	0–420	–
	longleaf woodoats	CHSE2	*Chasmanthium sessiliflorum*	0–420	–
	panicgrass	PANIC	*Panicum*	0–420	–
	marsh bristlegrass	SEPA10	*Setaria parviflora*	0–420	–
Forb					
5	**Forbs**			224–420	
	partridge pea	CHFA2	*Chamaecrista fasciculata*	0–420	–
	bundleflower	DESMA	*Desmanthus*	0–420	–
	ticktrefoil	DESMO	*Desmodium*	0–420	–
	Engelmann's daisy	ENPE4	*Engelmannia peristenia*	0–420	–
	lespedeza	LESPE	*Lespedeza*	0–420	–
	sensitive plant	MIMOS	*Mimosa*	0–420	–
	snoutbean	RHYNC2	*Rhynchosia*	0–420	–
	fuzzybean	STROP	*Strophostyles*	0–420	–
	ironweed	VERNO	*Vernonia*	0–224	–
	white crownbeard	VEVI3	*Verbesina virginica*	0–224	–
	cocklebur	XANTH2	*Xanthium*	0–224	–
	Texan great ragweed	AMTRT	*Ambrosia trifida var. texana*	0–224	–
Shrub/Vine					
6	**Shrubs/Vines/Trees**			897–1681	
	elm	ULMUS	*Ulmus*	0–1261	–
	hackberry	CELTI	*Celtis*	0–1261	–
	post oak	QUST	*Quercus stellata*	0–1261	–

	live oak	QUVI	*Quercus virginiana*	0–1261	–
	willow	SALIX	*Salix*	0–420	–
	western soapberry	SASAD	*Sapindus saponaria var. drummondii*	0–420	–
	bully	SIDER2	*Sideroxylon*	0–420	–
	greenbrier	SMILA2	*Smilax*	0–420	–
	hawthorn	CRATA	*Crataegus*	0–420	–
	ash	FRAXI	*Fraxinus*	0–420	–
	mulberry	MORUS	*Morus*	0–420	–
	eastern cottonwood	PODE3	*Populus deltoides*	0–420	–
	pecan	CAIL2	*Carya illinoinensis*	0–420	–
	grape	VITIS	*Vitis*	0–420	–

Animal community

This ecological site provides habitat which supports a resident animal community that is inhabited by deer, turkey, and squirrels. Dove and quail use this site when it is not too wet. The riparian vegetation provides good cover for wildlife and produces browse, mast, tender grazing, and seeds for a year-round supply.

Hydrological functions

The water cycle on the Clayey Bottomland site functions best under the Tallgrass Bottomland Community. When tallgrasses dominate the site infiltration is moderate, soil organic matter is high, soil structure is good, and porosity is low. The site will have high quality surface runoff with low erosion and sedimentation rates. The Tallgrass Bottomland Community should have no rills and no gullies present. Drainageways should be vegetated and stable. This site is often in a flood plain with occasional out of bank flow.

Improper grazing management reduces composition of bunchgrasses and reduces ground cover (resulting in a transition to the Midgrass Bottomland Community, 1.2). This decreases the quality 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 juniper, (i.e. the Hardwood Bottomland Community (1.3) or Invaded Woodland State (2.1)) interception of rainfall by tree canopies increases. This reduces the amount of rainfall reaching the surface. Stemflow increases due to the funneling effect of the canopy, which increases soil moisture at tree bases. Trees have increased transpiration compared to grasses, especially evergreen species such as juniper. The increased transpiration reduces the amount of water available for deep percolation. An increase in woody canopy creates a decline in grass cover, which has similar impacts as those described for improper grazing above. The return of the Invaded Woodland State to the Tallgrass Bottomland Community through brush management and good grazing management can help improve the hydrologic function of the site.

Under the dense canopy of a mature woodland, leaf litter builds up. This increases soil organic matter, builds structure, improves infiltration, and reduces surface erosion. These conditions improve the function of the water cycle compared to lower levels of canopy cover. However, too much leaf litter can suppress herbaceous vegetation.

Site specific information showed that the reference state has no rills or gullies. Water flow patterns are common and follow old stream meanders. Deposition and erosion is uncommon for normal rainfall but may occur during intense rainfall events. Pedestals and terracettes are not common in the reference state. There is generally less than 20% bare ground which is randomly distributed throughout the site. The soil surface is resistant to erosion and the soil stability class range is expected to be 5-6. This bottomland site is dominated by tallgrasses and forbs, having adequate litter and little bare ground which can provide for maximum infiltration and little runoff under normal rainfall events.

Peak rainfall periods occur in May and June from frontal passage thunderstorms and in September and October from tropical systems as well as frontal passages. Rainfall amounts may be high (3 to 5 inches per event) and events may be intense. The site is subject to erosion along adjacent stream banks where adequate herbaceous cover is not maintained and on heavy use areas such as roads and livestock trails. Extended periods (60 days) of little to no rainfall during the growing season are common. The site may be periodically inundated from overflow water from adjacent watercourses and may be ponded or saturated for long periods. This site may be a wetland or contain wetland inclusions as oxbows or stream meanders.

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 agarito (Mahonia trifoliolata) and wild grape. Seeds are harvested from many plants for commercial sale. Many grasses and forbs are harvested by the dried-plant industry for sale in dried flower arrangements. Honeybees are utilized to harvest honey from many flowering plants, such as honey mesquite. Fruit from blackberries, grapes, and plums and nuts from pecans are harvested.

Other information

None.

Inventory data references

Information presented was derived from the revised Clayey Bottomland PE 40-54 Range Site, NRCS clipping data, literature, field observations, and personal contacts with range-trained personnel.

References

. 2021 (Date accessed). USDA PLANTS Database. http://plants.usda.gov.

Bailey, V. 1905. Biological Survey of Texas. North American Fauna 25:1–222.

Other references

Other References:
1. Archer, S. 1994. Woody plant encroachment into southwestern grasslands and savannas: rates, patterns and proximate causes. In: Ecological implications of livestock herbivory in the West, pp. 13-68. Edited by M. Vavra, W. Laycock, R. Pieper. Society for Range Management Publication, Denver, CO.
2. Archer, S. and F.E. Smeins. 1991. Ecosystem-level Processes. Chapter 5 in: Grazing Management: An Ecological Perspective. Edited by R.K. Heitschmidt and J.W. Stuth. Timber Press, Portland, OR.
3. 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. J. Range Manage. 56(2): 114-126.
4. 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.
5. Eidson, J.A. and F.E. Smeins. 1999. Texas Blackland Prairies. In: T. Ricketts, E. Dinerstein, D. Olson, C. Loucks (contributing editors), Terrestrial Ecoregions of North America: a Conservation Assessment. World Wildlife Fund. Island Press, Washington, D.C.
6. Foster, J.H. 1917. Pre-settlement fire frequency regions of the United States: a first approximation. Tall Timbers Fire Ecology Conference Proceedings No. 20.

7. Gould, F.W. 1975. The Grasses of Texas. Texas A&M University Press, College Station, TX. 653p.
8. Hamilton, W. and D. Ueckert. 2005. Rangeland Woody Plant Control: Past, Present, and Future. Chapter 1 in: Brush Management: Past, Present, and Future. pp. 3-16. Texas A&M University Press.
9. Scifres, C.J. and W.T. Hamilton. 1993. Prescribed Burning for Brush Management: The South Texas Example. Texas A&M University Press, College Station, TX. 245 p.
10. Smeins, F., S. Fuhlendorf, and C. Taylor, Jr. 1997. Environmental and Land Use Changes: A Long Term Perspective. Chapter 1 in: Juniper Symposium 1997, pp. 1-21. Texas Agricultural Experiment Station.
11. Stringham, T.K., W.C. Krueger, and P.L. Shaver. 2001. State and transition modeling: and ecological process approach. J. Range Manage. 56(2):106-113.
12. Texas Agriculture Experiment Station. 2007. Benny Simpson's Texas Native Trees (http://aggie-horticulture.tamu.edu/ornamentals/natives/).
13. Texas A&M Research and Extension Center. 2000. Native Plants of South Texas (http://uvalde.tamu.edu/herbarium/index.html).
14. Thurow, T.L. 1991. Hydrology and Erosion. Chapter 6 in: Grazing Management: An Ecological Perspective. Edited by R.K. Heitschmidt and J.W. Stuth. Timber Press, Portland, OR.
15. USDA/NRCS Soil Survey Manuals for appropriate counties in MLRA85.
16. USDA, NRCS. 1997. National Range and Pasture Handbook.
17. USDA, NRCS. 2007. The PLANTS Database (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.
18. Vines, R.A. 1984. Trees of Central Texas. University of Texas Press, Austin, TX.
19. Vines, R.A. 1977. Trees of Eastern Texas. University of Texas Press, Austin, TX. 538 p.
20. Wright, H.A. and A.W. Bailey. 1982. Fire Ecology: United States and Southern Canada. John Wiley & Sons, Inc.

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Approval

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Acknowledgments

Site Development and Testing Plan:

Future work, as described in a Project Plan, to validate the information in this Provisional Ecological Site Description is needed. This will include field activities to collect low, medium and high intensity sampling, soil correlations, and analysis of that data. Annual field reviews should be done by soil scientists and vegetation specialists. A final field review, peer review, quality control, and quality assurance reviews of the ESD will be needed to produce the final document. Annual reviews of the Project Plan are to be conducted by the Ecological Site Technical Team.

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)	Lem Creswell, RMS, NRCS, Weatherford, Texas
Contact for lead author	817-596-2865
Date	09/17/2007
Approved by	Bryan Christensen
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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

3. **Number and height of erosional pedestals or terracettes:** Pedestals or terracettes are uncommon for this site.

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

5. **Number of gullies and erosion associated with gullies:** Essentially none.

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

7. **Amount of litter movement (describe size and distance expected to travel):** Little litter movement except under extreme rainfall events. Litter will move within water courses that occur within site.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Site very stable. Soil stability scores of 5-6.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Deep, dark gray to black, calcareous clay soils. They receive extra water from stream flooding and as runoff from adjacent sites. The soils have a high shrink-swell properties and crack profusely when dry.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** The savannah of tallgrasses, midgrasses, and forbs have adequate plant and litter cover with little bare ground to provide for high infiltration and low 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):** No evidence of compaction.

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant: Warm-season tallgrasses >>

    Sub-dominant: Warm-season midgrasses > Cool-season midgrasses > Trees >

    Other: Warm-season shortgrasses > Forbs > Shrubs/Vines

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Grasses, trees, and forbs due to their growth habit will exhibit some mortality and decadence, though very slight due to long-lived nature of plants. Open spaces from disturbance are quickly filled by new plants through seedlings and vegetative reproduction (tillering).

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):** 4000 - 7500 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, lotebush, bermudagrass, juniper.

17. **Perennial plant reproductive capability:** All perennial plants should be capable of reproducing, except during periods of prolonged drought conditions, heavy herbivory, and wildfires.