Ecological site R081CY561TX
Loamy Bottomland 29-35 PZ

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Accessed: 05/13/2025

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.

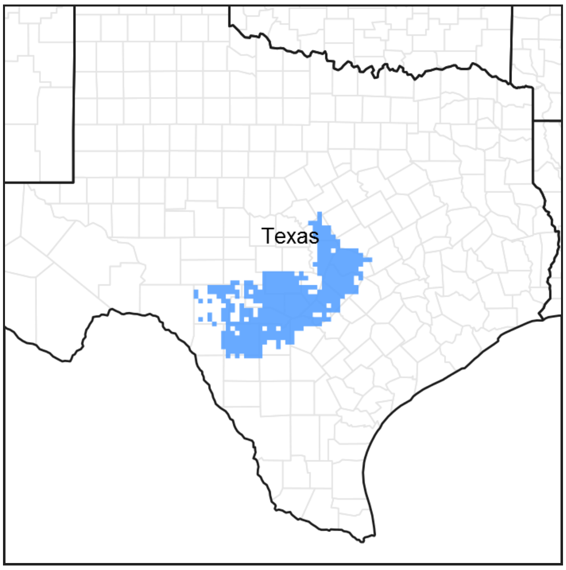


Figure 1. Mapped extent

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): 081C–Edwards Plateau, Eastern Part

This area represents the eastern part of the Edwards Plateau region. Limestone ridges and canyons and nearly level to gently sloping valley floors characterize the area. Elevation is 400 feet (120 meters) at the eastern end of the area and increases westward to 2,400 feet (730 meters) on ridges. This area is underlain primarily by limestones in the Glen Rose, Fort Terrett, and Edwards Formations of Cretaceous age. Quaternary alluvium is in river valleys.

Classification relationships

Major Land Resource Area (MLRA) and Land Resource Unit (LRU) (USDA-Natural Resources Conservation Service, 2006)
National Vegetation Classification/Shrubland & Grassland/2C Temperate & Boreal Shrubland and Grassland/M051 Great Plains Mixedgrass Prairie & Shrubland/ G133 Central Great Plains Mixedgrass Prairie Group.

Ecological site concept

These sites occur on drainages with deep alluvial soils. Reference vegetation includes a mixture of trees, shrubs and herbaceous plants. Overtime, without fire or brush management, woody species may dominate the site.

Associated sites

R081CY355TX	**Adobe 29-35 PZ** The Adobe ecological site is upslope with shallower soils and lower production.
R081CY357TX	**Clay Loam 29-35 PZ** The Clay Loam ecological site is upslope from the Loamy Bottomland ecological site.
R081CY360TX	**Low Stony Hill 29-35 PZ** The Low Stony Hill ecological site is upslope from the Loamy Bottomland ecological site.

Similar sites

R081CY357TX	**Clay Loam 29-35 PZ** The Clay Loam ecological site is upslope from the Loamy Bottomland ecological site, but is not flooded.

Table 1. Dominant plant species

Tree	(1) *Carya illinoinensis* (2) *Quercus fusiformis*
Shrub	Not specified
Herbaceous	(1) *Tripsacum dactyloides*

Physiographic features

This site is located in the 81C, Eastern Edwards Plateau Major Land Resource Area (MLRA). This site is well drained and has high water holding capacity. The site receives overflow from adjacent sites and from flooding creeks and rivers. These sites generally flood once every two years for periods of four hours to less than 48 hours.

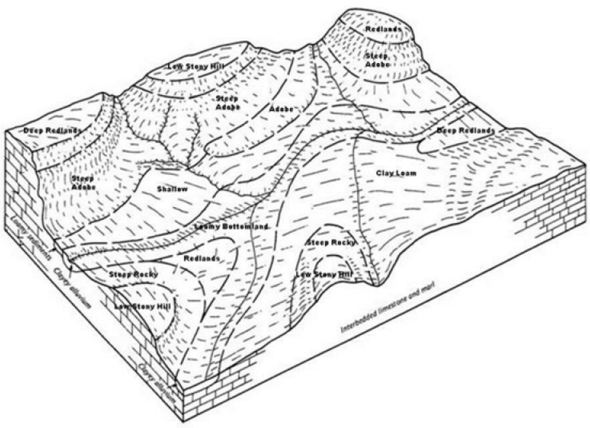


Figure 2. Diagram showing how the Loamy Bottomland occurs in

Table 2. Representative physiographic features

Landforms	(1) Plateau > Flood plain (2) River valley > Flood plain (3) Plateau > Draw
Runoff class	Negligible to low
Flooding duration	Very brief (4 to 48 hours)
Flooding frequency	Frequent
Ponding frequency	None
Elevation	122–442 m

Slope	0–3%
Aspect	Aspect is not a significant factor

Table 3. Representative physiographic features (actual ranges)

Runoff class	Not specified
Flooding duration	Not specified
Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	Not specified
Slope	0–5%

Climatic features

The climate is humid subtropical and is characterized by hot summers and relatively mild winters. The average first frost should occur around November 15 and the last freeze of the season should occur around March 19.

The average relative humidity in mid-afternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible during the summer and 50 percent in winter. The prevailing wind direction is southeast.

Drought is calculated as 75% below average rainfall. It should be noted that timing of rainfall may be more significant than average rainfall.

Approximately two-thirds of annual rainfall occurs during the April to September period. Rainfall during this period generally falls during thunderstorms, and fairly large amount of rain may fall in a short time. Hurricanes provide another source of extremely high rains in a short time. A review of the rainfall records suggest that rainfall is below “normal” at least 60 percent of the time. Therefore, the erratic nature of the rainfall should be considered when developing any land management plans.

The impact of droughts in the Edwards Plateau cannot be under-estimated. Not only are droughts devastating to the land but also to those that manage the land. Droughts occur roughly every 20 years but not always. A severe drought in 2012 coupled with extreme heat resulted in a die off of juniper over millions of acres as well as other native plants.

Table 4. Representative climatic features

Frost-free period (characteristic range)	220-260 days
Freeze-free period (characteristic range)	227-269 days
Precipitation total (characteristic range)	813-940 mm
Frost-free period (actual range)	187-270 days
Freeze-free period (actual range)	224-332 days
Precipitation total (actual range)	787-940 mm
Frost-free period (average)	235 days
Freeze-free period (average)	257 days
Precipitation total (average)	864 mm

Climate stations used

- (1) MEDINA 1NE [USC00415742], Medina, TX
- (2) SAN ANTONIO/SEAWORLD [USC00418169], San Antonio, TX

- (3) KERRVILLE 3 NNE [USC00414782], Kerrville, TX
- (4) BLANCO [USC00410832], Blanco, TX
- (5) CANYON DAM [USC00411429], Canyon Lake, TX
- (6) BURNET MUNI AP [USW00003999], Burnet, TX
- (7) AUSTIN GREAT HILLS [USC00410433], Austin, TX
- (8) GEORGETOWN LAKE [USC00413507], Georgetown, TX
- (9) PRADE RCH [USC00417232], Leakey, 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. Flooding of this site coupled with the dense tall grass vegetation would allow for sediment and nutrients to be trapped or held in place from the upslope watershed and keep them from being transported downstream.

Wetland description

This site may have inclusions of hydric soils or hydric soils that are wetlands that usually occur as oxbows or stream meanders.

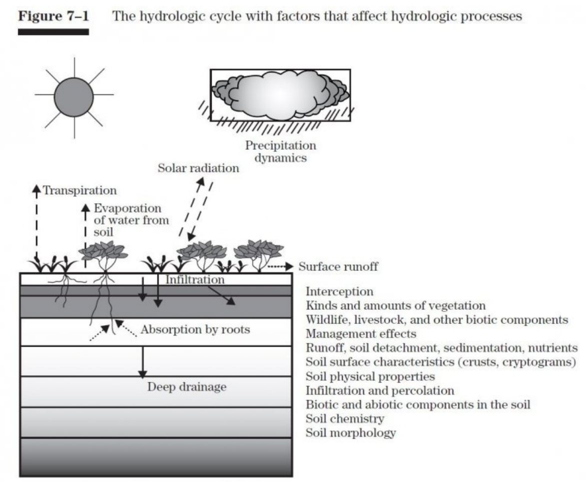


Figure 9.

Soil features

In a representative profile for the Loamy Bottomland ecological site, the soils are very deep, loamy, and calcareous. They are well drained, and permeability is moderate to rapid. The site receives extra water from stream flooding and as runoff from adjacent higher sites. Surface runoff is slow and some areas are flooded for short periods. The soils have a high water holding capacity for plant use and are naturally fertile. The soil maybe underlain with material comprised of 65 to 90 percent rounded alluvial gravels, cobbles, and stones at depths of 12 to greater than 80 inches. The site produces high yields of palatable and nutritious forage.

Due to the scale of mapping, there are inclusions of minor components of other soils within these mapping units. Before performing any inventories, conduct a field evaluation to ensure the soils are correct for the site. Riverwash is a miscellaneous minor component which is found in or next to the stream channel.

The following representative soils associated with the Loamy Bottomland ecological site are Oakalla and Orif. These are the representative map units associated with the Loamy Bottomland ecological site:

Oakalla silty clay loam, flooded
Oakalla silty clay loam, occasionally flooded
Oakalla silty clay, occasionally flooded
Oakalla silty clay loam, occasionally flooded
Orif-Riverwash complex, 0 to 3 percent slopes, frequently flooded

Table 5. Representative soil features

Parent material	(1) Alluvium–limestone
Surface texture	(1) Silty clay loam (2) Very gravelly clay loam (3) Fine sandy loam (4) Very gravelly loam
Drainage class	Well drained
Permeability class	Moderately slow to moderately rapid
Soil depth	203 cm
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0–3%
Available water capacity (0-101.6cm)	4.32–18.03 cm
Calcium carbonate equivalent (0-101.6cm)	20–90%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.4
Subsurface fragment volume <=3" (10.2-101.6cm)	5–55%
Subsurface fragment volume >3" (10.2-101.6cm)	0–5%

Ecological dynamics

The reference plant community is perceived as a mixture of tall grasses and hardwood trees. The site is typical of the first level of bottomland near a river and perennial creek. Also included are the riparian plants growing at the juncture of the stream and the first bottomland that are directly influenced by subsurface water. The site evolved under a natural wildfire regime. The anticipated result is an ecological site that is variable but generally was an open savannah. At any given point in time, depending upon the last fire or possibly flood, there could exist open savannah as well as some overstory with dense understory. The high fuel loads of this site coupled with wildfire kept woody vegetation at a low level.

The deep soils with high organic matter stored a large amount of water for plant growth. The production of the tall grasses kept soil erosion to a minimum. During flood events, these grasses would bend over and protect the soils much the same as shingles protect the roof of a house. Flooding of this site would bring in new soil and nutrients from the upslope watershed. Flooding could also re-work the channel depending upon severity. Severe droughts increase this vulnerability.

The dominant grasses were big bluestem (*Andropogon gerardii*), Indiangrass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*), eastern gamagrass (*Tripsacum dactyloides*), little bluestem (*Schizachyrium scoparium*), sideoats grama (*Bouteloua curtipendula*), Indian woodoats, (*Chasmanthium latifolium*), wildryes (Elymus spp.), three-flowered melicgrass (*Melica nitens*), and feathery bluestems (Bothriochloa spp.). Major forbs include Maximilian sunflower (*Helianthus maximiliani*), Illinois bundleflower (*Desmanthus illinoensis*), Engelmann's daisy (*Engelmannia peristenia*), gaura (Gaura spp.), western indigo (*Indigofera miniata* var. leptosepala), and blazing star (Liatris spp.). Shrubs included elbowbush (*Forestiera pubescens*), Mexican buckeye (*Ungnadia speciosa*), buttonbush (*Cephalanthus occidentalis*), and willow Baccharis (*Baccharis salicina*). Major trees included pecan (*Carya illinoinensis*), walnut species (Juglans spp.), Texas live oak (*Quercus fusiformis*), Sycamore (*Platanus occidentalis*), and cottonwood (Populus deltoids). Cypress (*Taxodium distichum*) occurred in some watersheds of the MLRA. The endemic woody plants historically shaded 10 to 20 percent of the soil surface, either as small mottes or individual trees that were either resistant to fire or occupied areas where fires were less frequent or intense.

Natural plant mortality is very low with the major species producing seeds and vegetative structure each year in normal years. Litter cover is 100 percent. Physical soil crust is largely absent.

A study of early photographs of this region reveals that today these sites are much denser with woody cover and less covered with grass-like vegetation. Early accounts consistently describe this region as a vast expanse of hills covered with "cedar" from San Antonio to Austin. Accounts also describe an abundance of clean, flowing water and abundant wildlife. These accounts seem to describe heavy wooded areas in mosaic patterns occurring along the highs and lows of the landscape.

The plant communities of this site are dynamic and vary in relation to grazing, fire, and rainfall. Studies of the pre-European vegetation of the general area suggested 47 percent of the area was wooded (Wills, 2006). Historical records do reflect area observations but are not specific on the Loamy bottomland site except in anecdotal references from early travelers. The loamy bottomland was utilized for camping and travel routes. From the Teran expedition in 1691, “great quantities of buffaloes” were noted in the area. By 1840 the Bonnell expedition reflected that “buffalo rarely range so far to the south” (Inglis, 1964). Another example is an early settler, Arnold Gugger, who wrote in his journal about the mid to late 1800s in the Helotes, Texas area, “in those days buffaloes were in droves by the hundreds…..and antelopes were three to four hundred in a bunch….and deer and turkeys at any amount” (Massey, 2009). Many research studies document the interaction of bison grazing and fire (Fuhlendorf and et al., 2008). Bison would come into an area, graze it down, leave and then not come back for many months or even years. Many times this grazing scheme by buffalo was high impact and followed fire patterns and available natural water. This usually long deferment period allowed the taller grasses and forbs to recover from the high impact bison grazing. This relationship created a diverse landscape both in structure and composition.

Historical fire frequencies for the region are suggested to be 13 to 25 years (Frost, 1998). When fires did occur, they were set either by Native Americans or by lighting. Woody plant control would vary in accordance with the intensity and severity of the fire encountered, which resulted in a mosaic of vegetation types within the same site.

Ashe juniper (*Juniperus ashei*) will increase regardless of grazing. Juniper will establish with grazing and without unless goats are utilized. Goats and sheep will eat young juniper and when properly used, are an effective tool to maintain juniper (Taylor, 1997; Anderson, et al., 2013). The main role of excessive grazing relative to juniper is the removal of the fine fuel needed to carry an effective burn.

Ashe juniper, because of its dense low growing foliage, has the ability to retard grass and forb growth. Grass and forb growth can become nonexistent under dense juniper canopies. Many times there is a resurgence of the better grasses such as little bluestem when Ashe juniper is controlled and followed by proper grazing management. Seeds and dormant rootstocks of many plant species are contained in the leaf mulch and duff under the junipers.

Currently, cattle, goats, white-tailed deer, sheep, and exotic animals are the primary large herbivores. At settlement, large numbers of deer occurred, but as human populations increased (with unregulated harvest) their numbers declined substantially. Eventually, laws and restrictions on deer harvest were put in place which assisted in the recovery of the species. Females were not harvested for several decades following the implementation of hunting laws, which allowed population booms. In addition, suppression of fire favored woody plants which provided additional browse and cover for the deer. Because of their impacts on livestock production, large predators such as red wolves (Canis rufus), mountain lions (Felis concolor), black bears (Ursus americanus), and eventually coyotes (Canis latrins) were reduced in numbers or eliminated (Schmidly, 2002).

The screwworm fly (Cochilomyia hominivorax) was essentially eradicated by the mid-1960s, and while this was immensely helpful to the livestock industry, this removed a significant control on deer populations (Teer, Thomas, and Walker 1965; Bushland, 1985).

Currently, due to the increased land ownership for recreational purposes and a corresponding reduction in livestock production, predator populations are on the increase. This includes feral hogs (Sus scrofa).
Progressive management of the deer herd, because of their economic importance through lease hunting, has the objective of improving individual deer quality and improving habitat. Managed harvest based on numbers, sex ratios, condition, and monitoring of habitat quality has been effective on individual properties. However, across the

Edwards Plateau, excess numbers still exist which may lead to habitat degradation and significant die-offs during stress periods such as extended droughts.

The Edwards Plateau is home to a variety of exotic ungulates, mostly introduced for hunting (Schmidly, 2002). These animals are important sources of income to some landowners, but as with the white-tailed deer, their populations must be managed to prevent degradation of the habitat for themselves as well as for the diversity of native wildlife in the area. Many other species of medium- and small-sized mammals, birds, and insects can have significant influences on the plant communities in terms of pollination, herbivory, seed dispersal, and creation of local disturbance patches, all of which contribute to the plant species diversity.

The plants and topography aided in increasing the infiltration of rainfall into the moderately slowly permeable soil. Any loss of soil organic matter and plant cover has a negative effect on infiltration. More rainfall is directed to overland flow, which causes increased soil erosion and flooding. Soils are also more prone to drought stress since organic matter acts like a sponge aiding in moisture retention for plant growth. Mulch buildup under the Ashe juniper canopy, following brush management and incorporation into the soil, can have a positive effect on increasing infiltration.
This site contains a large diversity of plants and this document does not attempt to cover them all. The intent of this document is to describe ecological processes on representative plants.

European settlement occurred in the mid to late 1800s (Raunick, 2007). This time period also coincided with a stoppage of fire. It was during this time that large-scale fencing was initiated to help the introduction of livestock. Predators were also reduced to protect livestock. In many cases sheep and goats heavily utilized the site. Low successional, unpalatable grasses, forbs, and shrubs have taken the place of the more desirable plant species. Non-preferred browse, such as juniper, fared well at the expense of the palatable browse.

This site was a favored grazing site for the many species that inhabited the site. This site would be one of the first to be overgrazed once early settlers began controlling grazing. It was also their main source of water.

Continued abusive grazing caused little bluestem, big bluestem, Indiangrass, switchgrass, and eastern gamagrass to decline or completely disappear from the site. Sideoats grama, Texas wintergrass, silver bluestem, pinhole bluestem, purpletop, southwestern bristle, and buffalograss would have increased once the tall grasses were removed from the ecosystem. Elimination of the tall and mid grasses from the site lead to decreased production, decreased organic matter, increased erosion, and decreased water holding capacity. Overharvest of the site removed the fuel supply so that fire became almost nonexistent on the site. Woody species, such as mesquite and Ashe juniper increased accordingly.
The species composition of the site changed from a warm season tall grass-hardwood site to a cool season mid grass-hardwood site and if retrogression continued, the site would become a woodland with a shrub and vine understory with very limited cool season grass and forb production. Sunlight becomes one of the most limiting factors for warm-season grass growth once the canopy cover exceeds 30 percent.

During the post-settlement years, land managers become knowledgeable of the soil quality of this site. Areas were cleared of woody and grass species and some of the sites were tilled and planted to crops. Eventually, permanent grasses were planted on some of the cropland.

It should be noted that the management of the Loamy Bottomland is linked and related to the adjacent upland sites. The management of these adjacent uplands is critical to any improvement efforts done on the Loamy Bottomland site.
Plant Communities and Transitional Pathways (diagram)

A State and Transition Model for the Loamy Bottomland Ecological Site (R081CY561TX) is depicted in this report. Descriptions of each state, transition, plant community, and pathway follow the model. Experts base this model on available experimental research, field observations, professional consensus, and interpretations. It is likely to change as knowledge increases. The major plants in the riparian zone are also included although, at some future time, the riparian zone deserves individual description.

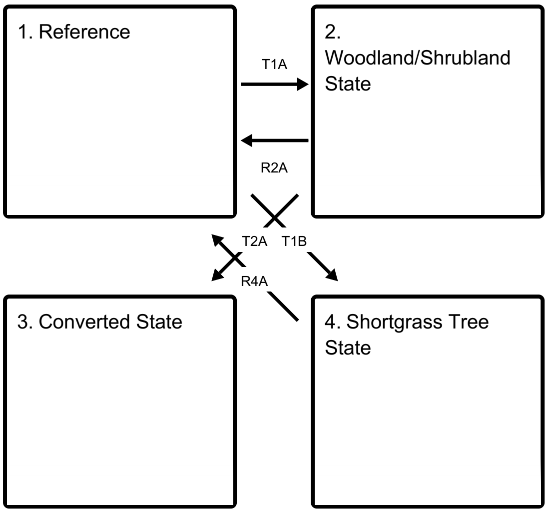
Plant communities will differ across the MLRA because of the naturally occurring variability in weather, soils, and aspect. The Reference Plant Community is not necessarily the management goal; other vegetative states may be desired plant communities as long as the Range Health assessments are in the moderate and above category. 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.

Both percent species composition by weight and percent canopy cover are described as are other metrics. Most observers find it easier to visualize or estimate percent canopy for woody species (trees and shrubs). Canopy cover can drive the transitions between communities and states because of the influence of shade and interception of rainfall. Species composition by dry weight is used for describing the herbaceous community and the community as a whole. Woody species are included in species composition for the site. Calculating the similarity index requires the use of species composition by dry weight.

The following diagram suggests some pathways that the vegetation on this site might take. There may be other states not shown in the diagram. This information is intended to show what might happen in a given set of circumstances. It does not mean that this would happen the same way in every instance. Local professional guidance should always be sought before pursuing a treatment scenario.

State and transition model

Ecosystem states



T1A - Absence of wildfire and other disturbance and natural regeneration over time

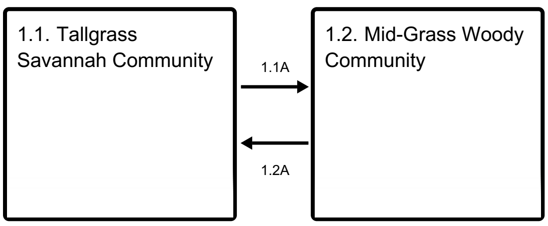
T1B - Prolonged excessive grazing pressure

R2A - Native vegetation is removed and site is planted with improved forage species

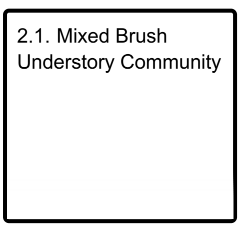
T2A - Removal of woody species coupled with seeding of improved forage species

R4A - Reintroduction of natural disturbance regime, seeding of native species may also be required

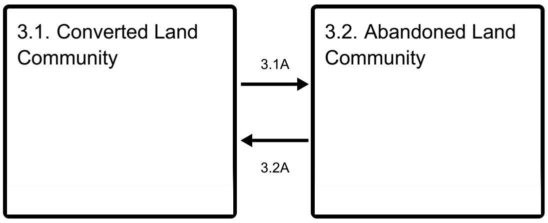
State 1 submodel, plant communities



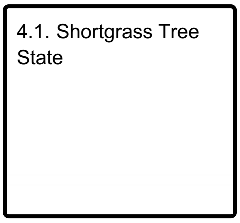
State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 submodel, plant communities



State 1
Reference

The reference state is considered to be representative of the natural range of variability under pre-European settlement conditions. This state consists of a mosaic of plant groupings and structures but over time was typically trees with an understory of herbaceous vegetation. Community phase changes are primarily driven by periodic wildfire and flooding.

Dominant plant species

- pecan (*Carya illinoinensis*), tree
- walnut (*Juglans*), tree
- Texas live oak (*Quercus fusiformis*), tree
- big bluestem (*Andropogon gerardii*), grass
- Indiangrass (*Sorghastrum nutans*), grass

Community 1.1
Tallgrass Savannah Community

Figure 10. Representative aspect of the Loamy Bottomland Ecol

Figure 11. Loamy Bottomland Ecological Site in near reference

Figure 12. Loamy Bottomland Ecological Site in near reference

Figure 13. Notice the southwestern bristlegrass, eastern gama

Figure 14. Loamy Bottomland riparian zone in near reference c

This plant community is a Tallgrass Savannah Bottomland with high plant diversity and structure. The information for this plant community is interpolated from historical writings, NRCS range site descriptions, limited clipping studies, and professional consensus. This is the diagnostic or reference plant community for the Loamy Bottomland site. Pecan, live oak, walnut, sycamore, cypress, hackberry (Celtis spp.), cedar elm (*Ulmus crassifolia*.), western soapberry (*Sapindus saponaria*), cottonwood, and willow (Salix spp.) shade 10 to 30 percent of the ground. This is the preferred site for pecan. The understory is composed principally of little bluestem, Indiangrass, switchgrass, eastern gamagrass, southwestern bristlegrass, Virginia wildrye, and perennial forbs, with smaller amounts of shrubs and woody vines. Estimated community composition by weight is 70 percent grasses, 10 percent forbs, 5 percent shrubs, and 15 percent trees. Overstory canopy is typically less than 10 percent. Switchgrass and eastern gamagrass, along with numerous forbs and browse species occur immediately adjacent to watercourses. These species have a positive effect on streambank stabilization during flooding events. Removal of these species by over-harvesting and other effects leads to increased streambank erosion and drainage of the water table in some instances. Plants growing at the edge of the stream such as spikerush (Eliocharis spp.) and knotgrass (*Paspalum distichum*) can exhibit above ground production levels of 6,198 pounds per acre with root biomass of 27, 667 and 24,527 pounds per acre respectively. Root lengths of these plants have been recorded as high as 22 and 18.8 miles per square foot respectively (Cornwall, 1998).

Resilience management. Any impact that excessively removes leaf material of the grasses over long periods of time will force a vegetational shift from tallgrass to midgrass then eventually to a cool season grass community. Birds import seeds from numerous tree and shrub species, the major one being Ashe juniper. Left unmanaged, the site will transition to a woodland of hardwood species with a dense understory of juniper and other shrubby species. Canopy cover can then be as high as 100 percent.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	2354	3732	5100
Tree	504	801	1093
Forb	336	532	729
Shrub/Vine	168	269	364
Total	**3362**	**5334**	**7286**

Table 7. Ground cover

Tree foliar cover	5-20%
Shrub/vine/liana foliar cover	3-15%
Grass/grasslike foliar cover	10-35%
Forb foliar cover	1-8%
Non-vascular plants	0%

Biological crusts	0%
Litter	75-100%
Surface fragments >0.25" and <=3"	1-5%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0-10%

Table 8. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	–	1-3%	0-1%
>0.15 <= 0.3	–	1-3%	3-5%	1-3%
>0.3 <= 0.6	–	3-5%	10-35%	0-8%
>0.6 <= 1.4	–	3-15%	10-25%	–
>1.4 <= 4	5-15%	–	–	–
>4 <= 12	5-20%	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Figure 16. Plant community growth curve (percent production by month). TX3760, Warm Season Native Grasses. Native warm season grasses on rangeland with scattered oaks/junipers..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	3	5	13	22	15	5	3	15	7	5	4

Community 1.2
Mid-Grass Woody Community

This plant community is a result of overharvesting of tallgrass leaf material and subsequent loss of fire with no brush management. The tallgrasses will start to disappear from the plant community. Invader/increaser brush species such as mesquite, juniper, and prickly pear cactus become established. Cedar, elm, bumelia, and hackberry also start to increase. Texas wintergrass (*Nassella leucotricha*) increases as brush canopy increases. It is more shade tolerant since most of the growth occurs during the cool season when the brush has lost its leaves. The plant community consists of 25 to 40 percent canopy of woody plants with several layers of canopy. The structure of the plant community is typically one of predominately grasses with shrubs and trees. Visual obstruction is about 150 feet. Shannon-Weiner Diversity is 20 to 30. If overharvest has been severe for a long time, there may be a lack of understory. Estimated community composition by weight is 45 percent grass, 15 percent forbs, 20 percent shrubs, and 20 percent trees. Overstory canopy is ranges from 15 to 30 percent.

Resilience management. This plant community can recover to the Tallgrass Savannah Community (1.1) by restoring the ecological process such as sunlight capture by tall grasses instead of woody plants and midgrasses. This may take prescribed grazing which will allow prescribed burning coupled with Individual Plant Control (IPT). Unless the energy flow is changed which will restore the water cycle, increase nutrient capture and soil capture, this plant community is at risk of transitioning to the Woodland Shrubland State (2). In the recovery stage, shrubs may increase quicker than the herbaceous plants. Selective brush management, targeted grazing, or fire may be utilized to restore the desired plant community.

Table 9. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1513	2399	3278
Shrub/Vine	673	1065	1457
Tree	673	1065	1457
Forb	504	801	1093
Total	**3363**	**5330**	**7285**

Table 10. Ground cover

Tree foliar cover	5-25%
Shrub/vine/liana foliar cover	3-5%
Grass/grasslike foliar cover	10-30%
Forb foliar cover	1-5%
Non-vascular plants	0%
Biological crusts	0%
Litter	75-100%
Surface fragments >0.25" and <=3"	1-5%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0-10%

Table 11. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	–	1-3%	0-1%
>0.15 <= 0.3	–	1-3%	3-5%	1-3%
>0.3 <= 0.6	–	3-5%	10-40%	0-5%
>0.6 <= 1.4	0-10%	3-5%	10-30%	–
>1.4 <= 4	5-25%	–	–	–
>4 <= 12	5-20%	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Figure 18. Plant community growth curve (percent production by month). TX6016, Tallgrass Prairie with Woody Encroachment. Tallgrasses with increasing amounts of woody species..

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 1.1A
Community 1.1 to 1.2

A shift in the composition of the plant community is primarily driven by the lack of managing woody plants, juniper in particular. Juniper and other woody species are introduced from the site primarily through wildlife fecal deposits and from plants native to the site increasing in density and stature. Grazing that removes fuel loading for fire is a contributing factor. However juniper can increase regardless of grazing pressure unless goats and possibly sheep are utilized. Long term droughts will hasten the change of any of the plant communities.

Pathway 1.2A
Community 1.2 to 1.1

This recovery pathway consist of some method of brush management such as fire, mechanical or hand cutting or targeted grazing with goats and/or possibly sheep. Prescribed grazing is essential.

Conservation practices

Brush Management
Prescribed Burning
Fence
Livestock Pipeline
Watering Facility
Controlled Stream access for Livestock Watering
Prescribed Grazing

State 2
Woodland/Shrubland State

The Woodland/Shrubland State reflects a maturing overstory of trees with increasing percentages of cool-season grasses and shade tolerant herbaceous species understory.

Dominant plant species

- juniper (*Juniperus*), tree
- honey mesquite (*Prosopis glandulosa*), tree
- pecan (*Carya illinoinensis*), tree
- Texas wintergrass (*Nassella leucotricha*), grass
- cedar sedge (*Carex planostachys*), grass

Community 2.1
Mixed Brush Understory Community

Figure 19. Mixed Brush Understory Community. Loamy Bottomland

Figure 20. 2. Hardwood Woodland Community

The Mixed Brush Understory Community (2.1) consists of mixed grasses with a canopy of woody plants greater than 30-40 percent. Most of the herbaceous species are shade tolerant cool season plants. The woody plant community will have layering of canopies with multiple species represented. As this community ages, the woody canopy continues to increase and rise. Texas wintergrass, cedar sedge (*Carex planostachys*), threeawn (Aristida spp), and annuals continue to increase. Shade is a driving factor in the understory plant community. Warm-season perennial tallgrasses such as Indiangrass and switchgrass have all but disappeared. An occasional eastern gamagrass may be present. A lack of brush management has facilitated this transition. Grazing management alone will not restore this site. The plant community is characterized by an increase in woody species (juniper, mesquite, persimmon and picklypear), short-grasses and annuals, as well as a decline in mid-grasses. Estimated community composition is 20 percent grass, 10 percent forbs, and 40 percent trees. There are still some reference community trees and shrubs in the overstory. But juniper has significantly invaded and the shrubs native to the site have greatly increased. The structure of the plant community is one of an overstory of woody plant and little understory. Visual obstruction averages 80 feet and densiometer readings are between 80 and 90 percent.

Resilience management. To restore this state to near reference condition will involve some means of high energy input brush suppression, usually coupled with seeding, and good grazing management. Fire is usually not a tool in this community because of the lack of fine fuel and size of woody plants. (Under extremely dry conditions wildfires can occur and sustain with the amount of juniper and greenbriar “ladder fuels” that transfer fire from the soil surface to the crowns. If wildfires occur in this plant community, it most likely would be catastrophic and be a stand replacement type of fire. Most of the reference community plants would resprout but the reference structure would not exist for many years). Without this treatment, the site will continue to shift toward more dense stands of brush and canopy closure. Once the plant community is restored, then fire becomes a management tool for maintenance.

Table 12. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Tree	1345	2130	2914
Grass/Grasslike	673	1065	1457
Shrub/Vine	673	1065	1457
Forb	673	532	729
Total	**3364**	**4792**	**6557**

Table 13. Ground cover

Tree foliar cover	5-60%
Shrub/vine/liana foliar cover	5-20%
Grass/grasslike foliar cover	0-10%
Forb foliar cover	0-5%
Non-vascular plants	0%

Biological crusts	0%
Litter	75-100%
Surface fragments >0.25" and <=3"	1-5%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0-10%

Table 14. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	–	0-3%	0-1%
>0.15 <= 0.3	–	1-3%	0-5%	0-3%
>0.3 <= 0.6	–	3-10%	0-10%	0-5%
>0.6 <= 1.4	10-25%	5-20%	–	–
>1.4 <= 4	40-60%	–	–	–
>4 <= 12	5-20%	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Figure 22. 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 State

The Converted State has typically been plowed, farmed, then replanted to grasses or just abandoned. In most cases introduced species have been planted.

Dominant plant species

- yellow bluestem (*Bothriochloa ischaemum*), grass
- kleingrass (*Panicum coloratum*), grass
- Bermudagrass (*Cynodon dactylon*), grass

Community 3.1
Converted Land Community

Figure 23. Loamy Bottomland has been seeded to a mixture of n

Figure 24. Open Grassland Community

Extensive conversion of the Loamy Bottomland ecological site to cropland (primarily cotton and corn) occurred from the middle 1800s to the early 1900s. These would have been the phases of the site less susceptible to flooding. Land clearing of the woody plants and some form of tillage were needed to complete the conversion. Some remains in cropland today. This site is currently used as cropland, pecan orchards, native grasses, and exotic grasses. This history of farming makes this a highly variable plant community depending upon the length and severity of the cultivation, the degree of erosion, amount of compaction, and loss of soil health. While restoration of this site to a semblance of the tallgrass prairie is possible with range planting, prescribed grazing, and prescribed burning; a complete restoration of the reference community in a reasonable time is very unlikely because of deterioration of the soil structure and organisms. Many times exotic grasses are seeded along with the native species. In time, the exotics may eventually dominate. It should be noted that the exotic grasses share similar hydrologic, energy, nutrient, and mineral qualities with the natives. Native plants replanted on the site are what was in the market place at the time of planting and not necessarily representative of the reference plant community. Production will be below that of the reference plant community because of soil health reasons and because the woody shrubs, which have been removed, many times had root systems that exploited soil moisture below that of grasses. If managerial objectives are exotic grasses, these usually consist of introduced bluestems (*Bothriochloa ischaemum*) such as 'WW Spar' or 'WB Dahl', kleingrass (*Panicum coloratum*), and bermudagrass (*Cynodon dactylon*). The production of these species is highly variable depending upon grazing management, soil health, fertility program, and undesirable plant management. More detailed information is available in Forage Suitability Groups for exotic plants. The structure of the plant community is dominantly grasses with occasional shrubs/trees. Visual obstruction over 300 feet. Shannon-Weiner Diversity about 45. There is no appreciable overstory canopy. Prescribed grazing will be needed to maintain a desirable species composition. Prescribed burning and/or individual plant treatment of woody species will be needed to maintain the community as an open grassland. Without some form of brush management, the community will transition to the Mixed Brush Woodland Community (3.1).

Table 15. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	2018	4259	5604
Shrub/Vine	28	56	112
Forb	56	84	112
Total	**2102**	**4399**	**5828**

Table 16. Ground cover

Tree foliar cover	0-5%
Shrub/vine/liana foliar cover	0-5%
Grass/grasslike foliar cover	10-60%
Forb foliar cover	1-5%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%
Surface fragments >0.25" and <=3"	1-5%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0-1%

Table 17. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	–	10-15%	0-1%
>0.15 <= 0.3	–	–	10-25%	1-3%
>0.3 <= 0.6	–	–	40-60%	0-5%
>0.6 <= 1.4	0-5%	0-5%	10-20%	0-5%
>1.4 <= 4	0-5%	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Figure 26. Plant community growth curve (percent production by month). TX3764, Open Grassland. Warm season grasses with minor cool season influence on open grassland..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1	5	15	25	20	7	5	13	5	2	1

Community 3.2
Abandoned Land Community

If abandoned land is not seeded and left to natural recovery, it will be doubtful the land will ever recover to any resemblance of the reference plant community. Much of the soil health has been degraded and unless remedial efforts to restore the living portions of the soil, the organic matter and the humus, restoration will be difficult. Depending upon the cropping history and the length of cropping, very few remnant seeds persist. Once abandon, early successional plants that are annuals and weak perennials establish. Over time and with the introduction of some seeds from adjacent areas, higher successional plants establish. However, the plant succession, without intervention with range plantings will in all probability terminate in a mesquite/baccharis/juniper woody component with prickly pear and small shrubs and Texas wintergrass as the majority of the plant component. This will be a stable community over time. This community does stabilize the soil and provide the basic building blocks of nutrients, organic matter, and soil organisms needed to restore health. This process is estimated to take over 30 years to manifest. To accelerate the recovery, range planting along with maintenance brush management, prescribed grazing, and possibly fire are needed to restore the ecological process to heal the land.

Pathway 3.1A
Community 3.1 to 3.2

This transition is driven by land clearing and farming or ground disturbance brush management with the replanting of exotic grasses, either as a mixture or single species. Exotic plants can also be introduced from hay brought to the site or from livestock and wildlife. Hydrologic characteristics are anticipated to be similar to the Mixed Grass Woody Community.

Pathway 3.2A
Community 3.2 to 3.1

Restoration includes some form of brush management and many times an integrated approach utilizing several methods. Prescribed burning is an option once the fine fuel load has recovered so prescribed grazing will be essential.

Conservation practices

Brush Management
Prescribed Burning
Fence
Livestock Pipeline
Prescribed Grazing

State 4
Shortgrass Tree State

The Shortgrass Tree State is formed with long-term heavy removal of understory herbaceous vegetation leaving an overstory of trees.

Community 4.1
Shortgrass Tree State

Figure 27. Excessive harvest of the understory plants over lo

The Shortgrass/Tree Community (4.1) consists of mixed short-grasses with a overstory of hardwoods, >20feet tall, with canopy between 15 to 30 percent. The information for this plant community is estimated from field observations and estimations from trained personnel. During early settlement, the creeks and rivers were the only sources of water for livestock unless there were springs in the upper landscape. Typically livestock used this site for grazing, watering and loafing. If mixed classes of sheep, cattle, goats, and wildlife were not managed, this site lost much of the protective covering of grasses, shrubs and forbs. Sunlight energy in this plant community serves the overstory canopy of hardwood trees and the short grasses. Because of the excessive loss of leaf material in the understory vegetation, the grasses have very short root systems and very reduced root biomass to hold the soil. Subsequently, the infiltration rate is much reduced with very little rainfall or floodwaters soaking into the soil profile. This condition reduces the “sponge” capability of the soil to store water that could restore shallow water tables. Springs are reduced. This reduction of subsoil moisture may contribute to the loss of larger trees that depend upon stable soil moisture. With this weakened plant community and little protective groundcover, floodwaters containing stones and other debris can easily gouge the soil and open it up to severe erosion. Very little if any soil contained in the floodwaters is retained to build new soil. In severe cases, floodwaters can rip the topsoil away causing the formation of gravel bars and gullies. Recovery of this plant community is done with managed grazing and possibly selective brush management. It is likely the first plants to re-establish are the woody shrubs. These shrubs, and the grasses that also recover, will begin to restore the hydrology by trapping sediment and the dead fall of limbs and other plant material transported in flood waters. These form the building blocks of recovery. Monitoring is essential to make determinations of the timing and methodology used in brush management and prescribed grazing. Prescribed fire may be useful depending upon the setting and the recovery of fine fuel needed to carry an effective fire. Once a herbaceous plant community exists, fire can be used as a maintenance tool. This site, because of the water afforded by landscape position, has the potential to recover much faster than adjacent uplands. However it will still take several years for a satisfactory recovery. Any efforts to recover this plant community should also consider the proper management of the adjacent upland sites as they are interdependent.

Table 18. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Tree	1233	1849	2466
Forb	448	673	897
Grass/Grasslike	448	673	897
Shrub/Vine	112	168	224
Total	**2241**	**3363**	**4484**

Figure 29. Plant community growth curve (percent production by month). TX3772, Hardwood/Grass Community. Hardwood trees with declining grass species..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4	5	7	12	20	13	5	4	13	7	5	5

Transition T1A
State 1 to 2

A transition occurs because of a long term lack of brush management with mechanical means, fire, or targeted goat/sheep grazing. Grazing deferment alone will not halt the increase of woody species. Hydrologic characteristics are altered by increased woody species. Now, energy flows more through woody plants than herbaceous plants.

Transition T1B
State 1 to 4

This transition is driven by the severe, long-term, overharvesting of the desired plants. This condition results in a loss of hydrologic function. Most sunlight energy is utilized by overstory hardwood species and weakened grasses and forbs.

Restoration pathway R2A
State 2 to 1

Restoration includes some form of brush management and many times an integrated approach utilizing several methods. In some cases of severe long-term overharvesting of the desired plants, replanting may be necessary. Prescribed burning is an option once the fine fuel load has recovered so prescribed grazing will be essential.

Conservation practices

Brush Management
Fence
Livestock Pipeline
Range Planting
Watering Facility
Controlled Stream access for Livestock Watering
Prescribed Grazing

Restoration pathway R2A
State 2 to 1

Restoration includes some form of brush management and many times an integrated approach utilizing several methods. In some cases of severe long-term overharvesting of the desired plants, replanting may be necessary. Prescribed burning is an option once the fine fuel load has recovered so prescribed grazing will be essential.

Conservation practices

Brush Management
Fence
Livestock Pipeline
Range Planting
Watering Facility
Controlled Stream access for Livestock Watering
Prescribed Grazing

Transition T2A
State 2 to 3

This transition is driven by land clearing and farming or ground disturbance brush management with the replanting of exotic grasses, either as a mixture or single species. Exotic plants can also be introduced from hay brought to the site or from livestock and wildlife. Hydrologic characteristics are anticipated to be similar to the Mixed Grass Woody Community.

Transition T2A
State 2 to 3

This transition is driven by land clearing and farming or ground disturbance brush management with the replanting of exotic grasses, either as a mixture or single species. Exotic plants can also be introduced from hay brought to the site or from livestock and wildlife. Hydrologic characteristics are anticipated to be similar to the Mixed Grass Woody Community.

Restoration pathway R4A
State 4 to 1

Restoration of this community includes allowing the herbaceous plants and woody shrubs to recover their root systems. It also includes monitoring the site to prevent dominance of the woody shrub community in the understory. Prescribed grazing and selective brush management are tools to manage this recovery. Prescribed fire may be an option as well and will be useful for maintenance.

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing

Restoration pathway R4A
State 4 to 1

Restoration of this community includes allowing the herbaceous plants and woody shrubs to recover their root systems. It also includes monitoring the site to prevent dominance of the woody shrub community in the understory. Prescribed grazing and selective brush management are tools to manage this recovery. Prescribed fire may be an option as well and will be useful for maintenance.

Conservation practices

Brush Management
Prescribed Burning
Fence
Livestock Pipeline
Watering Facility
Controlled Stream access for Livestock Watering
Native Plant Community Restoration and Management
Prescribed Grazing

Additional community tables

Table 19. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tallgrass**			1821–2914	
	eastern gamagrass	TRDA3	*Tripsacum dactyloides*	897–1345	–
	switchgrass	PAVI2	*Panicum virgatum*	785–1233	–
	Indiangrass	SONU2	*Sorghastrum nutans*	560–1121	–
	big bluestem	ANGE	*Andropogon gerardii*	560–1121	–
	little bluestem	SCSC	*Schizachyrium scoparium*	532–1065	–
2	**Midgrasses**			252–532	
	sideoats grama	BOCU	*Bouteloua curtipendula*	168–532	–
	southwestern bristlegrass	SESC2	*Setaria scheelei*	112–224	–
	purpletop tridens	TRFL2	*Tridens flavus*	28–112	–
	Arizona cottontop	DICA8	*Digitaria californica*	56–112	–
	plains lovegrass	ERIN	*Eragrostis intermedia*	56–112	–
	vine mesquite	PAOB	*Panicum obtusum*	56–112	–

	large-spike bristlegrass	SEMA5	*Setaria macrostachya*	56–112	–
3	**Midgrasses**			252–532	
	cane bluestem	BOBA3	*Bothriochloa barbinodis*	84–168	–
	silver beardgrass	BOLA2	*Bothriochloa laguroides*	22–112	–
	crowngrass	PASPA2	*Paspalum*	56–112	–
	white tridens	TRAL2	*Tridens albescens*	28–56	–
4	**Shortgrasses**			6–56	
	buffalograss	BODA2	*Bouteloua dactyloides*	6–56	–
	fall witchgrass	DICO6	*Digitaria cognata*	6–22	–
5	**Cool Season Grasses**			252–532	
	cedar sedge	CAPL3	*Carex planostachys*	56–168	–
	Canada wildrye	ELCA4	*Elymus canadensis*	56–168	–
	Virginia wildrye	ELVI3	*Elymus virginicus*	56–168	–
	threeflower melicgrass	MENI	*Melica nitens*	56–168	–
	Texas wintergrass	NALE3	*Nassella leucotricha*	56–168	–
	Indian woodoats	CHLA5	*Chasmanthium latifolium*	56–112	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	56–112	–
	Texas bluegrass	POAR	*Poa arachnifera*	28–84	–
Forb					
6	**Forbs**			56–280	
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	56–112	–
	prairie clover	DALEA	*Dalea*	56–112	–
	beeblossom	GAURA	*Gaura*	28–112	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	56–112	–
	dotted blazing star	LIPU	*Liatris punctata*	28–112	–
	wax mallow	MAAR14	*Malvaviscus arboreus*	28–112	–
	Engelmann's daisy	ENPE4	*Engelmannia peristenia*	28–112	–
	awnless bushsunflower	SICA7	*Simsia calva*	28–112	–
	eastern milkpea	GARE2	*Galactia regularis*	28–84	–
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	28–84	–
	yellow puff	NELU2	*Neptunia lutea*	28–84	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	28–84	–
	snoutbean	RHYNC2	*Rhynchosia*	28–84	–
	zarzabacoa comun	DEIN3	*Desmodium incanum*	28–84	–
	aster	ASTER	*Aster*	28–84	–
	amberique-bean	STHE9	*Strophostyles helvola*	28–84	–
	coastal indigo	INMI	*Indigofera miniata*	28–56	–
	Gregg's tube tongue	JUPI5	*Justicia pilosella*	28–56	–
7	**Annual Forbs**			0–1	
	prairie broomweed	AMDR	*Amphiachyris dracunculoides*	0–1	–
Shrub/Vine					
8	**Shrubs and Vines**			56–280	

	roughleaf dogwood	CODR	*Cornus drummondii*	28–196	–
	Bush oak	QUBU	*Quercus ×bushii*	56–112	–
	mustang grape	VIMU2	*Vitis mustangensis*	56–112	–
	greenbrier	SMILA2	*Smilax*	56–112	–
	Eve's necklacepod	STAF4	*Styphnolobium affine*	28–84	–
	Mexican buckeye	UNSP	*Ungnadia speciosa*	28–84	–
	rusty blackhaw	VIRU	*Viburnum rufidulum*	28–84	–
	dwarf palmetto	SAMI8	*Sabal minor*	0–84	–
	eastern redbud	CECA4	*Cercis canadensis*	28–84	–
	hawthorn	CRATA	*Crataegus*	28–84	–
	stretchberry	FOPU2	*Forestiera pubescens*	28–84	–
	possumhaw	ILDE	*Ilex decidua*	28–84	–
	western white honeysuckle	LOAL	*Lonicera albiflora*	28–84	–
	plum	PRUNU	*Prunus*	28–84	–
	common hoptree	PTTR	*Ptelea trifoliata*	28–84	–
	Ohio buckeye	AEGL	*Aesculus glabra*	0–84	–
	Lindheimer's silktassel	GAOVL	*Garrya ovata ssp. lindheimeri*	0–56	–
	sycamoreleaf snowbell	STPL3	*Styrax platanifolius*	0–56	–
	American beautyberry	CAAM2	*Callicarpa americana*	0–28	–
Tree					
9	**Trees**			252–532	
	black walnut	JUNI	*Juglans nigra*	112–224	–
	pecan	CAIL2	*Carya illinoinensis*	112–224	–
	Texas live oak	QUFU	*Quercus fusiformis*	112–224	–
	bald cypress	TADI2	*Taxodium distichum*	0–168	–
	little walnut	JUMI	*Juglans microcarpa*	56–168	–
	Texas mulberry	MOMI	*Morus microphylla*	56–112	–
	American sycamore	PLOC	*Platanus occidentalis*	56–112	–
	cottonwood	POPUL	*Populus*	56–112	–
	hackberry	CELTI	*Celtis*	56–112	–
	elm	ULMUS	*Ulmus*	56–112	–
	bur oak	QUMA2	*Quercus macrocarpa*	56–112	–
	chinquapin oak	QUMU	*Quercus muehlenbergii*	28–112	–
	western soapberry	SASAD	*Sapindus saponaria var. drummondii*	56–112	–
	gum bully	SILA20	*Sideroxylon lanuginosum*	56–112	–
	Carolina buckthorn	FRCA13	*Frangula caroliniana*	28–84	–
	black cherry	PRSE2	*Prunus serotina*	28–84	–

Animal community

This site is used for the production of domestic livestock and to provide habitat for native wildlife and certain species of exotic wildlife. Cow-calf operations are the primary livestock enterprise although stocker cattle are also grazed. Sheep and goats were formerly raised in large numbers and are still present in reduced numbers. Sustainable stocking rates have declined drastically over the past 100 years because of the deterioration of the reference plant community. An assessment of vegetation is needed to determine initial safe starting stocking rates. Implementing a monitoring protocol will be needed to fine-tune the carrying capacity over time. Calculations used to determine an initial starting stocking rate should be based on forage production and grazeable acreage.

Grazing can be useful to refresh decadent accumulated plant material and recycle their nutrients. Grazing can also improve plant diversity and sculpt the structure of the vegetation. However, grazing animals must be managed to prevent overuse of the areas adjacent to streams. Unmanaged grazing is very detrimental to streambanks. Not only can unmanaged grazing remove protective plant cover but streambanks can be physically damaged starting a chain reaction leading to the loss of the streambank and unnecessary steep cut-banks (some may be natural). Prescribed grazing, offsite mineral and feeding areas, offsite water, and retraining of grazing behavior all contribute to healthy streambanks. Fencing is also an option to manage animal access unless maintenance is a limiting issue.

A large diversity of wildlife is native to this site. In the historic plant community, large migrating herds of bison, resident herds of pronghorn, and large numbers of prairie chickens (Tympanuchus spp.) and wild turkeys (Meleagris gallopavo var. intermedia) were the more dominant species. With the demise of these species and the changes in the plant community, the kinds of wildlife have changed.

With the eradication of the screwworm fly, the increase in woody vegetation, and insufficient natural predation, white-tailed deer numbers have increased drastically and are often in excess of carrying capacity. Where deer numbers are excessive, overbrowsing and overuse of preferred forbs causes deterioration of the plant community. Progressive management of deer populations and exotics through hunting can keep populations in balance and provide an economically important ranching enterprise. Achieving a balance between woodland and more open plant communities on this site is an important key to deer management. Competition among deer, sheep, and goats is an important consideration in livestock and wildlife management and can cause damage to preferred vegetation.

Smaller mammals include many kinds of rodents, jackrabbit, cottontail rabbit, raccoon, skunks, opossum, and armadillo. Mammalian predators include coyote, red fox, gray fox, bobcat, and mountain lion. Many species of snakes and lizards are native to the site.

Many species of birds are found on this site including game birds, songbirds, and birds of prey. Major game birds that are economically important are Rio Grande turkey, bobwhite quail, and mourning dove. Turkey prefers plant communities with substantial amounts of shrubs and trees interspersed with grassland. Quail prefer plant communities with a combination of low shrubs, bunch grass, bare ground, and low successional forbs. The different species of songbirds vary in their habitat preferences. In general, a habitat that provides a large variety of grasses, forbs, shrubs, vines, and trees and a complex of grassland, savannah, shrubland, and woodland will support a good variety and abundance of songbirds. Birds of prey are important to keep the numbers of rodents, rabbits, and snakes in balance. The different plant communities of the site will sustain different species of raptors.

Turkeys, in particular, utilize this site for much of their life cycle. The dense grasses are utilized for nesting, the creeks for water, and the trees for roosting. For roosting, turkeys prefer large trees with a relatively open understory from which to spot approaching predators.

Various kinds of exotic wildlife utilize the site including axis, sika, fallow and red deer, aoudad sheep, and blackbuck antelope. Some exotic species, such as axis deer, can switch their diets between plant groups which renders them more competitive to the native white-tailed deer. Their numbers should be managed in the same manner as livestock and white-tailed deer to prevent damage to the plant community. Feral hogs are present and can cause damage when their numbers are not managed.

This rating system provides general guidance as to animal forage preference for plant species. It also indicates possible competition and diet overlap between kinds of herbivores. Grazing preference changes from time to time, especially between seasons, and between animal kinds and classes. An animal's preference or avoidance of certain plants is learned over time through grazing experience and maternal learning (http://extension.usu.edu/behave). Preference does not necessarily reflect the ecological status of the plant within the plant community. For wildlife, plant preferences for food are rated in the following tables. Refer to detailed habitat guides for a more complete description of a species habitat needs.

Legend
Rating Preference Description
P Preferred Percentage of plant in animal diet is greater than it occurs on the land

D Desirable Percentage of plant in animal diet similar to the percentage composition on the land
U Undesirable Percentage of plant in animal diet is less than it occurs on the land
N Not Consumed Plant would not be eaten under normal conditions. It is only consumed when other forages are not available
T Toxic Rare occurrence in diet and, if consumed in any tangible amounts results in death or severe illness in animal
X Used Degree of utilization unknown

Hydrological functions

The water cycle on this site functions according to the management of not only the existing plant community but to an extent of the surrounding plant communities. The water cycle is most functional when the site is dominated by tall bunchgrass and native trees as the site functions much the same as a sponge. Rapid rainfall infiltration, high soil organic matter, good soil structure, and good porosity are present with a good cover of bunchgrass. Quality of surface runoff will be high and erosion and sedimentation rates will be low. With high rates of infiltration and periods of heavy rainfall, some water will move below the root zone of grasses and into the fractures in the limestone. As this water moves downward it contributes to the recharge of some aquifers. A majority of the recharge on this site comes through fractures and cavities in the streambed.

When unmanaged grazing causes loss or reduction of bunchgrass and ground cover, the water cycle becomes impaired. Infiltration is decreased and runoff is increased because of poor ground cover, rainfall splash, soil capping, low organic matter, and poor structure. With a combination of a sparse ground cover and intensive rainfall, this site can contribute to an increased frequency and severity of flooding within a watershed. Soil erosion is accelerated, quality of surface runoff is poor and sedimentation increased.

As the site becomes dominated by woody species, especially oaks and juniper, the water cycle is further altered. Interception of rainfall by tree canopies is increased which reduces the amount of rainfall reaching the surface (Thurow and Hester, 1997). Stem flow is increased, however, because of the funneling effect of the canopy, especially on the oaks. This increases soil moisture at the base of the tree. Increased transpiration, especially when evergreen species such as live oak and juniper dominate, provides less chance for deep percolation into aquifers. As woody species increase, grass cover declines, which causes some of the same results as heavy grazing.

Various brush management components can help restore the natural hydrology of the site. Also critical to the overall health of the Loamy Bottomland is the existence of healthy streamside or riparian vegetation. These small but very important vegetative communities exist in the transition zone between the upland portion of the site and the creeks or streams.

Many important functions come from a healthy riparian plant community. These communities protect the streambanks during flooding much the same as shingles protect a roof. They also trap sediments, deadfall, and nutrients fostering the building of soils and nutrients. Another function is that of a sponge, absorbing water and slowly releasing it over time leading to a more sustained flow. These small areas also provide diverse grazing for livestock.

If a mature woodland canopy develops, a buildup of leaf litter occurs which increases the organic matter of the soil, builds structure, improves infiltration, and retards erosion. Some, but not all values of a properly functioning water cycle are restored on this site when a woodland plant community persists.

Recreational uses

This site has the appeal of the wide open spaces. The abundant tall and midgrasses and scattered oaks produce beautiful fall color variations. The area is also used for hunting, birding, and other eco-tourism related enterprises.

Wood products

Honey mesquite and oaks can be used for firewood and the specialty wood industry.

Inventory data references

Information provided here has been derived from limited NRCS clipping data, and from field observations of range trained personnel.

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Contributors

Carl Englerth
Joe Franklin
Mark Moseley
Travis Waiser, MLRA Leader, NRCS, Kerrville, TX

Approval

Bryan Christensen, 9/19/2023

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.

Reviewers and Technical Contributors:
Joe Franklin, Zone Range Management Specialist, NRCS, San Angelo Zone Office, Texas
Ryan McClintock, Biologist, NRCS, San Angelo Zone Office, Texas
Jessica Jobes, Project Leader, Kerrville Soil Survey Office, NRCS, Kerrville, Texas
Travis Waiser, Soil Scientist, NRCS, Kerrville Soil Survey Office, Texas
Bryan Hummel, Natural Resources Technician, Joint Base San Antonio - Camp Bullis, Texas
Ann Graham, Editor, NRCS, Temple, Texas

QC/QA completed by:
Bryan Christensen, SRESS, NRCS, Temple, TX
Erin Hourihan, ESDQS, NRCS, Temple, TX

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)	Charles Anderson
Contact for lead author	325.944.0147
Date	06/27/2005
Approved by	Colin Walden
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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2. **Presence of water flow patterns:** Most water flow patterns are expected to pass through the site. Some deposition will occur from out of bank flooding.

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3. **Number and height of erosional pedestals or terracettes:** None except for a few near the stream or drainageway.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 0-5%, small non connected areas. Some bare areas right after flooding.

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

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None to slight. Wind erosion hazard of soil is slight.

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7. **Amount of litter movement (describe size and distance expected to travel):** Minimal movement of fine litter< 1 foot. Large woody debris will accumulate at the base of trees as will other plant debris.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Erosion stability values estimated at 5-6. Water erosion hazard of soil is slight.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Oakalla soil is dark grayish brown silty clay loam and brown clay loam to 50 inches. The surface layer is subangular blocky. Many fine roots and worm casts. SOM: High

   Refer to specific description for component sampled.

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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 make raindrop impact negligible. Flexible grasses lean over during flooding. The grassed capture sediment, When rainfall exceeds sites ability to hold water the runoff is free of erosive action.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None.

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

Dominant: Warm season tallgrass (D)

Sub-dominant: warm-season midgrass (S) cool season grasses shortgrass (S) trees (S)

Other: forb (M) shrub/vine (M) warm season short grasses.

Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Minimal. Grasses will almost always show some mortality and decadence, especially under drought conditions. There is some deadfall of limbs from mature trees.

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

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 3000 # in years with below average moisture, 4700# in "average" and 6500# in above average moisture years. Site may receive extra moisture from upslope sites and be highly productive in wet years.

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** mesquite, pricklypear, juniper, broom snakeweed, algerita, acacia and condalia, introduced bluestems and annual brooweed.

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17. **Perennial plant reproductive capability:** Good. All species should be capable of reproducing except during peroids of of prolonged drought, heavy natural herbivory or intense fire. Recovery from these disturbances will take 2-5 years.
