Ecological site R150AY534TX
Loamy Bottomland

Last updated: 9/22/2023
Accessed: 04/29/2024

General information

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

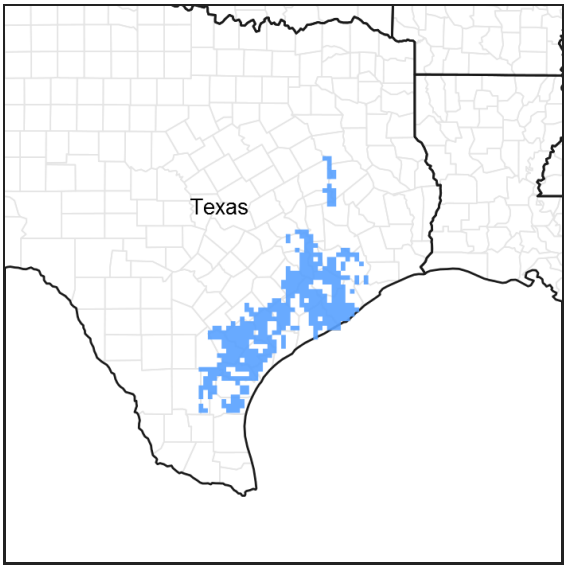


Figure 1. Mapped extent

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

MLRA notes

Major Land Resource Area (MLRA): 150A–Gulf Coast Prairies

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

Classification relationships

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

Ecological site concept

Loamy Bottomland is on river valley floodplains. In many cases, this site is on the lowest position on the landscape. The soils formed in loamy alluvium. The hazard of flooding occurs on these sites.

Associated sites

R150AY541TX	**Sandy Bottomland** The ecological site has very deep, somewhat excessively drained soils that are occasionally or frequently flooded. Flooding may occur at any time during the year but the winter and spring months are the most common. Due to the position on the landscape and coarse-textured soils, these sites drain quicker and do not stay flooded as long as the loamy and clayey bottomlands sites. The drainage patterns and sandy soils create their unique plant community.
R150AY527TX	**Clayey Bottomland** The Clayey Bottomland site has very deep, clayey surface textured soils that occur on flood plains. The areas can be flooded and ponded for lengthy durations throughout the year.

Similar sites

R150AY541TX	**Sandy Bottomland** The ecological site has very deep, somewhat excessively drained soils that are occasionally or frequently flooded. Flooding may occur at any time during the year but the winter and spring months are the most common. Due to the position on the landscape and coarse-textured soils, these sites drain quicker and do not stay flooded as long as the loamy and clayey bottomlands sites. The drainage patterns and sandy soils create their unique plant community.

Table 1. Dominant plant species

Tree	(1) *Celtis* (2) *Ulmus crassifolia*
Shrub	(1) *Ilex vomitoria*
Herbaceous	(1) *Schizachyrium scoparium var. divergens* (2) *Elymus virginicus*

Physiographic features

The Loamy Bottomland site formed in nearly level and very gently sloping floodplains of coastal plains and river valleys from loamy alluvium parent material. This site is almost always associated with a large stream or river system. Slope gradients are mainly 0 to 3 percent. Flooding ranges from rare to frequent; except where protected by levees. Elevation ranges from 10 to 250 feet.

Table 2. Representative physiographic features

Landforms	(1) River valley > Flood plain (2) River valley > Natural levee
Runoff class	Negligible to medium
Flooding duration	Very brief (4 to 48 hours) to long (7 to 30 days)
Flooding frequency	Rare to frequent
Ponding frequency	None
Elevation	3–76 m
Slope	0–3%
Water table depth	107–183 cm
Aspect	Aspect is not a significant factor

Climatic features

The climate of MLRA 150A is humid subtropical with mild winters. The average annual precipitation in the northern

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

Table 3. Representative climatic features

Frost-free period (characteristic range)	232-299 days
Freeze-free period (characteristic range)	365 days
Precipitation total (characteristic range)	889-1,245 mm
Frost-free period (actual range)	220-365 days
Freeze-free period (actual range)	296-365 days
Precipitation total (actual range)	838-1,346 mm
Frost-free period (average)	273 days
Freeze-free period (average)	352 days
Precipitation total (average)	1,092 mm

Climate stations used

- (1) HOUSTON-PORT [USC00414326], Houston, TX
- (2) PORT LAVACA [USC00417183], Port Lavaca, TX
- (3) VICTORIA FIRE DEPT #5 [USC00419361], Victoria, TX
- (4) BAY CITY WTR WKS [USC00410569], Bay City, TX
- (5) EL CAMPO [USC00412786], El Campo, TX
- (6) COLUMBUS [USC00411911], Columbus, TX
- (7) SEALY [USC00418160], Sealy, TX
- (8) THOMPSONS 3 WSW [USC00418996], Richmond, TX
- (9) HOUSTON NWSO [USC00414333], Dickinson, TX
- (10) ROBSTOWN [USC00417677], Robstown, TX
- (11) SINTON [USC00418354], Sinton, TX
- (12) BEEVILLE CHASE NAAS [USW00012925], Beeville, TX
- (13) REFUGIO 2 NW [USC00417533], Refugio, TX

Influencing water features

Loamy Bottomlands are on floodplains that flood throughout the year. Some areas may be inundated for several weeks. Correlated soils are considered hydric, but onsite delineations are needed to determine if the site meets wetland criteria as outlined by the US Army Corps of Engineers.

Wetland description

The soils in this site are non-hydric. At some sites, there are a few small areas that have hydric soils. These areas tend to be in depressional landforms that pond for long periods of time. Onsite investigation is necessary to determine exact local conditions.

Soil features

The Loamy Bottomlands consist of very deep, well drained, slow to moderately permeable, neutral to moderately alkaline soils that formed in loamy alluvium of recent age. Surface textures are mainly silty clay loam, silt loam, and loam but can include clay loam and sandy clay loam. The diagnostic horizons for the representative series include a mollic or ochric epipedon followed by a cambic epipedon. Soils correlated to this site include: Asa, Clemville, Mohat, Norwood, Odem, Rydolph, Sinton, and Snakecreek.

Table 4. Representative soil features

Parent material	(1) Alluvium–igneous, metamorphic and sedimentary rock
Surface texture	(1) Loam (2) Silt loam (3) Silty clay loam
Family particle size	(1) Fine-loamy (2) Fine-silty
Drainage class	Somewhat poorly drained to well drained
Permeability class	Slow to moderate
Soil depth	203 cm
Surface fragment cover <=3"	0–1%
Surface fragment cover >3"	0%
Available water capacity (0-152.4cm)	22.86–27.94 cm
Calcium carbonate equivalent (0-101.6cm)	0–15%
Electrical conductivity (0-152.4cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-152.4cm)	0
Soil reaction (1:1 water) (0-152.4cm)	6.6–8.4
Subsurface fragment volume <=3" (50.8-152.4cm)	0–4%
Subsurface fragment volume >3" (50.8-152.4cm)	0–2%

Ecological dynamics

The plant community of this site varies considerably in composition and structure depending on interactions of the flooding regime, fire, grazing, and weather variation. Historical references present two relatively clear pictures of this site when early explorers came through. Prior to European settlement, the site supported an open tallgrass savannah of scattered trees, and mottes, with a canopy cover of 20 percent or less. There were also areas of nearly closed canopy with a sparse understory. In some instances, this site had an abundance of giant cane (*Arundinaria gigantea*), which often grew in conjunction with the woody canopy component and excluded most other grassy vegetation. In 1838, W. B. Dewees described the extent of the woodland as, “minor bodies of water, but they flow through the most extensive body of excellent land in Texas. This is a district about 40 miles in width and 50 or 60 miles in length covered almost entirely with cane break and forests.” Another anonymous writer in 1831, states “what renders the danger still greater, is the frequency of cane brakes, or tracts of land overgrown with the long reeds of which we make fishing poles in the Northern States. These canes there grow in some places among the forest trees, so thick as to render a passage through them inconvenient.”

The differences between these communities would largely have been a function of the frequency and intensity of fires. Areas that burned frequently would have been a more open savannah. Areas protected from fire due to landscape position, frequency of flooding, and standing water would have developed into a woodland community. Historically, the savannah and giant cane communities would have been grazed by free-roaming herds of bison. When present, grazing was intense, but long periods of rest would permit recovery of herbaceous vegetation thus providing fuel for fires to constrain development of the woody component. Both lightning-caused fires and fires set by Native Americans and early European man contributed to potentially high fire frequencies. Lehmann indicates intense fires occurred on approximate 3 to 8-year intervals.

Flooding exerts a major influence on the plant communities of this site. Flooding is a natural process and as such it

creates active geomorphic surfaces. High peak flows of floodwater can periodically cause trees to be knocked down and carried downstream, which reduce woody canopy cover. These downed trees also form natural dams both within the stream channel and adjacent to it causing stream channels to change course and/or retain flood waters for longer periods of time. Floods deposit sediments on herbaceous vegetation and cause disturbance to the plant community; this will create heterogeneity of composition and structure. The long-term flooding action and river meanders across the floodplain contribute to variation in topography and soil texture within this site.

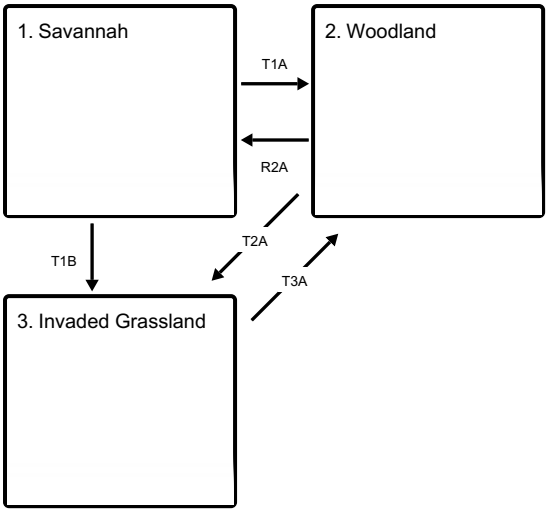
The Tallgrass Savannah State (1) has between 20 and 40 percent woody canopy cover of hackberry (*Celtis laevigata*), live oak (*Quercus virginiana*), pecan (*Carya illinoinensis*), cedar elm (*Ulmus crassifolia*), and other tree species in the floodplain overstory. Along stream banks green ash (*Fraxinus pennsylvanica*), black willow (*Salix nigra*), cottonwood (*Populus deltoides*), sycamore (*Platanus occidentalis*), and bald cypress (*Taxodium distichum*) occur. A minimal shrub and vine layer exist within the tree overstory. As previously noted, there were some areas where tree cover and giant cane (*Arundinaria gigantea*) are dominant and other areas where a true savannah landscape is evident. The herbaceous layer consists of primarily tallgrasses such as eastern gamagrass (*Tripsacum dactyloides*), big bluestem (*Andropogon gerardii*), yellow Indiangrass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*), little bluestem (*Schizachyrium scoparium*), and in some instances giant cane. A variety of perennial forbs occur as interstitial plants within the grass matrix and include sensitive briar (*Mimosa aculeaticarpa*), snoutbean (Rhynchosia spp.), western ragweed (*Ambrosia psilostachya*), and trailing wildbean (Strophostyles helvula). In disturbance areas (sediment deposition), annual forbs will be abundant for short periods.

With disturbance, particularly continuous heavy grazing, taller grasses would decrease in volume and abundance and be replaced by less productive midgrasses. Some of these include bushy beard bluestem (*Andropogon glomeratus*), rustyseed paspalum (*Paspalum langei*), Texas wintergrass (*Nassella leucotricha*), longspike tridens (*Tridens strictus*), beaked panicum (*Panicum anceps*), and sedges (Carex spp.). This opening of the tallgrass community would lead to an increase of perennial forbs such as western ragweed, spiny aster (Aster spinosus), and giant ragweed (*Ambrosia trifida*). With reduced cover and biomass of the herbaceous layer, fires will be less intense which favor increases of shrub, vine, and tree seedlings. This sequence of changes can be reversed by applying prescribed grazing and prescribed fire. Continued reduction of tall and midgrasses will result in increases of shortgrasses such as common carpetgrass (Axonopus affinis) and buffalograss (*Bouteloua dactyloides*) along with unpalatable forbs, grasses and a greater canopy of larger shrubs and trees.

With continued overgrazing a threshold will be crossed that shifts the community into a woodland trajectory which has a high percentage canopy cover of trees with a midstory of shrubs and woody vines and a relatively sparse herbaceous layer. To return across this threshold would require chemical and mechanical woody plant treatment along with prescribed grazing and prescribed fire. In some cases, the savannah state may be invaded by weedy shrubs and forbs as well as tree seedlings. Following woody plant control in the woodland state, invasive introduced grasses such as common bermudagrass (*Cynodon dactylon*), smutgrass (*Sporobolus indicus*), bahiagrass (*Paspalum notatum*) and introduced bluestems (Bothriochloa) may invade and totally dominate. Although these species may provide good forage for cattle, they are aggressive invaders and most often prevent re-establishment of native grasses. Once the woodland state is in place, following mechanical and herbicidal control of woody plants, continual use of brush management will be necessary to maintain an open canopy as a woody seed source is on-site and more seed are dispersed with each additional overflow event.

State and transition model

Ecosystem states



T1A - Absence of disturbance and natural regeneration over time

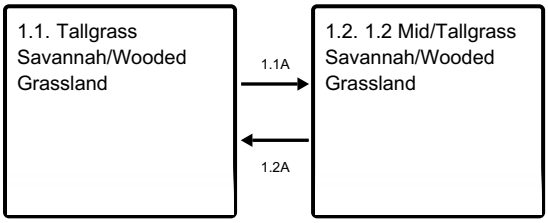
T1B - Introduction of non-native species coupled with prolonged, excessive grazing

R2A - Reintroduction of fire and regular disturbance return intervals

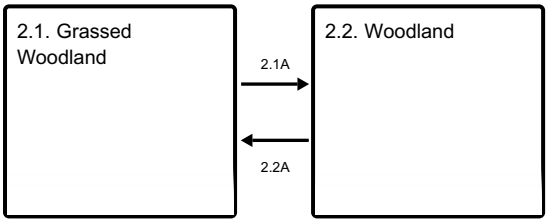
T2A - Introduction of non-native species coupled with prolonged, excessive grazing

T3A - Absence of disturbance that reduces woody species and natural regeneration over time

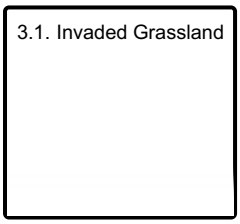
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Savannah

Dominant plant species

- sugarberry (*Celtis laevigata*), tree
- live oak (*Quercus virginiana*), tree
- giant cane (*Arundinaria gigantea*), grass

Community 1.1

Tallgrass Savannah/Wooded Grassland

The reference plant community is a fire climax tallgrass savannah. Composition of this community includes a 20 to 40 percent canopy of individual trees or clumps of trees. The major tree species include hackberry, pecan, cedar elm, green ash, bald cypress, and black willow (*Salix nigra*). Dominant grasses are yellow Indiangrass, big bluestem, little bluestem, switchgrass, eastern gamagrass and Florida paspalum (*Paspalum floridanum*). Cool-season species present in small amounts include Canada wildrye (*Elymus canadensis*), Virginia wildrye (*Elymus virginicus*), Texas wintergrass, and sedges. Historically, large areas of giant cane appeared on this site. The giant cane would be the dominant grass species in the plant community. This type of community most likely waxed and waned depending upon grazing and fire events and eventually disappeared under the influence of European settlement, land clearing, and grazing. This bottomland community is very productive and has a reasonable diversity of grasses, forbs, and woody plants. Removal of fire from this ecosystem tends to increase woody plants. Continuous heavy grazing by livestock leads to a reduction of tallgrasses and an increase in midgrasses, shortgrasses, and forbs. These changes in the herbaceous community reduce fire intensity and possibly frequency, making fire less effective in woody plant control and woody species tend to increase.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	3363	6389	8406
Forb	448	673	897
Tree	224	392	560
Shrub/Vine	224	392	448
Total	**4259**	**7846**	**10311**

Figure 9. Plant community growth curve (percent production by month). TX7618, Tallgrass Savannah/Wooded Grassland Community . Primarily warm-season perennial tallgrasses and forbs along with some woody production and limited amounts of perennial forbs..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	2	5	10	20	20	3	6	15	10	6	2

Community 1.2
1.2 Mid/Tallgrass Savannah/Wooded Grassland

This plant community is still highly productive with very little to no increase in woody plants. Tallgrasses such as eastern gamagrass, big bluestem, switchgrass, and Indiangrass have decreased significantly and been replaced by little bluestem, purpletop (*Tridens flavus*), silver bluestem (*Bothriochloa laguroides*) and other similar midgrasses. Uncontrolled grazing has caused this shift in species composition and production. The cool-season component consisting of Canada wildrye, Virginia wildrye, Texas wintergrass, and sedges usually increases in this state as well. Because of reduced competition for sunlight, perennial forbs will also be more common. This community is still within the reference state as all the herbaceous components are still present, just at differing frequencies. This community can easily be transitioned to Community 1.1 through the application of prescribed grazing and judicious use of prescribed burning.

Pathway 1.1A
Community 1.1 to 1.2

Heavy continuous grazing and lack of fire will transition the site to Community 1.2.

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing and prescribed burning will transition the site back to Community 1.1.

State 2
Woodland

Dominant plant species

- sugarberry (*Celtis laevigata*), tree

Community 2.1
Grassed Woodland

Continued heavy grazing and reduction in fire frequency and intensity have combined to produce this state. Woody plants have begun to increase, and woody saplings and seedlings are common. Tallgrasses, though still present, are greatly reduced. Eastern gamagrass, big bluestem, and Indiangrass are most likely absent, only occasional clumps of switchgrass are scattered but present. Little bluestem, brownseed paspalum (*Paspalum plicatulum*), sideoats grama (*Bouteloua curtipendula*), and silver bluestem may make up a high percentage of the annual production. Shortergrasses such as rustyseed paspalum, longtom (*Paspalum denticulatum*), knotroot bristlegrass (*Setaria parviflora*), low panicums, paspalums, and common carpetgrass are common and increasing. Sedges and flat sedges along with other cool-season species increase with the increasing canopy and shading. This community can be restored to the reference state (1) but not without major inputs of labor and capital. Brush management systems must be utilized to reduce the woody component. Typically, individual plant treatments are still feasible in utilizing mechanical (tree shearing) and herbicide applications. The window of opportunity for use of individual plant treatment is quite short (3 to6 years) as woody plant increase will be rapid. If brush management is not utilized, this state will transition to the Woodland Community (2.2) quite rapidly. In addition to brush management, prescribed grazing must be utilized to begin to recover the tallgrass component within the community. If brush management is utilized without prescribed grazing, the Invaded Grassland State (3) will be the result.

Community 2.2
Woodland

This community is heavily wooded with both overstory and understory with canopies ranging from 50 to 90 percent. Trees and vines include sugar hackberry (*Celtis laevigata* var. laevigata), cedar elm, green ash, pecan, and honey locust (*Gleditsia triacanthos*) while vines include mustang grape (*Vitis mustangensis*), poison ivy (*Toxicodendron radicans*), and Virginia creeper (*Parthenocissus quinquefolia*). In this community, there may be two different scenarios in the understory. There may be almost a total lack of herbaceous vegetation with only scattered sedges and rushes with only decaying leaves and rotting woody detritus. The other situation, especially with lighter canopies, may encourage additional sedges and rushes and such shade tolerant species as broadleaf seaoats (Uniola spp.), Canada and Virginia wildrye, and Texas wintergrass. This site can be manipulated with brush management to state 2.1. It may be possible to take this state back to state 1.2 but not without extensive outlays of capital and labor over long periods of time. Both initial and continual brush management must be applied along with prescribed grazing, prescribed fire, and possibly range planting.

Pathway 2.1A
Community 2.1 to 2.2

Abusive grazing, lack of fire, and lack of brush management will cause more unabated growth by trees. The shift is evident when the canopy cover is greater than 50 percent.

Pathway 2.2A
Community 2.2 to 2.1

Prescribed grazing, prescribed burning, and brush management will transition this community back to 2.1.

State 3
Invaded Grassland

Dominant plant species

- Bermudagrass (*Cynodon dactylon*), grass

- beardgrass (*Bothriochloa*), grass

Community 3.1
Invaded Grassland

When savannah communities have been overgrazed for long periods of time the site may be invaded by exotic or native weedy grasses. Common bermudagrass, King Ranch (Bothriochloa ishaemum), Gordo and Kleberg bluestems (*Dichanthium annulatum*), smutgrass, Johnsongrass (*Sorghum halepense*), and carpetgrass are primary invaders. Once they gain dominance, and if heavy grazing is continued, the site will remain in this community almost indefinitely. If grazing pressure is reduced woody species will eventually invade and the community will shift to the tree/weed/shrub state with the invasive grasses in the understory. The site may also be converted to tame grass pastureland by removal of the woody species, plowing and pasture planting. In the pastureland community, continued application of agronomic practices such as prescribed grazing, nutrient management, pest management, and brush control will be needed to maintain it. Native plants, especially switchgrass and eastern gamagrass, can be established and managed as tame pasture or hayland.

Transition T1A
State 1 to 2

Continued heavy overgrazing, lack of fire, and lack of brush management will transition the site to State 2.

Transition T1B
State 1 to 3

Invasion of the site by exotic plant species causes the site to transition to State 3.

Restoration pathway R2A
State 2 to 1

Prescribed grazing, prescribed fire, and brush management will restore the site to State 1. Overstory canopies need to be below 40 percent to reestablish the reference community.

Transition T2A
State 2 to 3

Invasion of the site by exotic plant species causes the site to transition to State 3.

Restoration pathway T3A
State 3 to 2

Controlling exotic grasses by use of chemical, mechanical, or biological means will transition the site back to State 2. Removing exotic species is very difficult with full elimination almost impossible.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
0	**Tallgrass**			0–3363	
1	**Tallgrasses**			1345–5941	
	switchgrass	PAVI2	*Panicum virgatum*	560–2018	–
	big bluestem	ANGE	*Andropogon gerardii*	448–1793	–
	Indiangrass	SONU2	*Sorghastrum nutans*	336–1681	–
	eastern gamagrass	TRDA3	*Tripsacum dactyloides*	112–1681	–

	little bluestem	SCSC	*Schizachyrium scoparium*	673–785	–
	Florida paspalum	PAFL4	*Paspalum floridanum*	56–560	–
2	**Cool-season grasses**			504–673	
	Canada wildrye	ELCA4	*Elymus canadensis*	112–336	–
	Virginia wildrye	ELVI3	*Elymus virginicus*	112–336	–
	Texas wintergrass	NALE3	*Nassella leucotricha*	56–224	–
	sedge	CAREX	*Carex*	28–224	–
	Indian woodoats	CHLA5	*Chasmanthium latifolium*	56–224	–
	flatsedge	CYPER	*Cyperus*	28–224	–
	rush	JUNCU	*Juncus*	11–112	–
3	**Midgrasses**			392–785	
	brownseed paspalum	PAPL3	*Paspalum plicatulum*	224–448	–
	beaked panicgrass	PAAN	*Panicum anceps*	112–280	–
	longtom	PADE24	*Paspalum denticulatum*	56–280	–
	rustyseed paspalum	PALA11	*Paspalum langei*	112–224	–
4	**Midgrasses**			280–673	
	bushy bluestem	ANGL2	*Andropogon glomeratus*	56–168	–
	silver beardgrass	BOLAT	*Bothriochloa laguroides ssp. torreyana*	22–168	–
	southwestern bristlegrass	SESC2	*Setaria scheelei*	56–112	–
	white tridens	TRAL2	*Tridens albescens*	56–112	–
	longspike tridens	TRST2	*Tridens strictus*	56–112	–
	marsh bristlegrass	SEPA10	*Setaria parviflora*	56–84	–
	purpletop tridens	TRFL2	*Tridens flavus*	11–56	–
5	**Tall/Midgrasses**			112–168	
	Pan American balsamscale	ELTR4	*Elionurus tripsacoides*	56–224	–
	broomsedge bluestem	ANVI2	*Andropogon virginicus*	56–112	–
	cylinder jointtail grass	COCY	*Coelorachis cylindrica*	56–84	–
6	**Shortgrasses**			56–168	
	panicgrass	PANIC	*Panicum*	11–56	–
	crowngrass	PASPA2	*Paspalum*	11–56	–
	buffalograss	BODA2	*Bouteloua dactyloides*	11–56	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	6–28	–
	twoflower melicgrass	MEMU	*Melica mutica*	6–28	–
	nimblewill	MUSC	*Muhlenbergia schreberi*	6–28	–
Forb					
7	**Forbs**			448–897	
	jimsonweed	DAST	*Datura stramonium*	56–168	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	34–112	–
	great ragweed	AMTR	*Ambrosia trifida*	56–112	–
	least snoutbean	RHMI4	*Rhynchosia minima*	56–112	–
	white crownbeard	VEVI3	*Verbesina virginica*	34–112	–
	Baldwin's ironweed	VEBA	*Vernonia baldwinii*	34–56	–

	lespedeza	LESPE	*Lespedeza*	11–56	–
	Engelmann's daisy	ENPE4	*Engelmannia peristenia*	11–56	–
	woodsorrel	OXALI	*Oxalis*	11–45	–
	velvet bundleflower	DEVE2	*Desmanthus velutinus*	11–45	–
	American snoutbean	RHAM	*Rhynchosia americana*	17–34	–
	swamp sunflower	HEAN2	*Helianthus angustifolius*	11–34	–
	littleleaf sensitive-briar	MIMI22	*Mimosa microphylla*	22–34	–
	yellow puff	NELU2	*Neptunia lutea*	11–34	–
	amberique-bean	STHE9	*Strophostyles helvola*	17–34	–
	blue mistflower	COCO13	*Conoclinium coelestinum*	11–22	–
	wild petunia	RUELL	*Ruellia*	17–22	–
	swamp smartweed	POHY2	*Polygonum hydropiperoides*	11–17	–
	evening primrose	OENOT	*Oenothera*	0–11	–
	whitemouth dayflower	COER	*Commelina erecta*	6–11	–
	ticktrefoil	DESMO	*Desmodium*	6–11	–
	purple poppymallow	CAIN2	*Callirhoe involucrata*	6–11	–
	Forb, annual	2FA	*Forb, annual*	6–11	–
	Forb, perennial	2FP	*Forb, perennial*	6–11	–
	hoe nightshade	SOPH	*Solanum physalifolium*	6–11	–
	Texas vervain	VEHA	*Verbena halei*	6–11	–
	big yellow velvetleaf	WIAM	*Wissadula amplissima*	6–11	–
Shrub/Vine					
8	**Shrubs/Vines**			224–448	
	mustang grape	VIMU2	*Vitis mustangensis*	56–224	–
	eastern poison ivy	TORA2	*Toxicodendron radicans*	28–140	–
	Virginia creeper	PAQU2	*Parthenocissus quinquefolia*	56–112	–
	southern dewberry	RUTR	*Rubus trivialis*	6–112	–
	trumpet creeper	CARA2	*Campsis radicans*	34–84	–
	Munson's grape	VIROM	*Vitis rotundifolia var. munsoniana*	45–78	–
	Alabama supplejack	BESC	*Berchemia scandens*	22–45	–
	yaupon	ILVO	*Ilex vomitoria*	28–45	–
	Texas hawthorn	CRTE2	*Crataegus texana*	6–45	–
	possumhaw	ILDE	*Ilex decidua*	11–34	–
	common buttonbush	CEOC2	*Cephalanthus occidentalis*	11–34	–
	saw greenbrier	SMBO2	*Smilax bona-nox*	6–22	–
	coralberry	SYOR	*Symphoricarpos orbiculatus*	6–17	–
Tree					
9	**Trees**			224–448	
	green ash	FRPE	*Fraxinus pennsylvanica*	34–168	–
	cedar elm	ULCR	*Ulmus crassifolia*	56–168	–
	bald cypress	TADI2	*Taxodium distichum*	11–112	–
	pecan	CAIL2	*Carya illinoinensis*	22–112	–
	black willow	SANI	*Salix nigra*	45–90	–

	sugarberry	CELAL	*Celtis laevigata var. laevigata*	56–84	–
	eastern cottonwood	PODE3	*Populus deltoides*	11–84	–
	honeylocust	GLTR	*Gleditsia triacanthos*	22–78	–
	western soapberry	SASAD	*Sapindus saponaria var. drummondii*	22–56	–
	live oak	QUVI	*Quercus virginiana*	6–56	–
	American sycamore	PLOC	*Platanus occidentalis*	11–45	–
	gum bully	SILA20	*Sideroxylon lanuginosum*	11–34	–
	water oak	QUNI	*Quercus nigra*	6–28	–
	netleaf hackberry	CELAR	*Celtis laevigata var. reticulata*	6–28	–
	sweet acacia	ACFA	*Acacia farnesiana*	0–22	–

Animal community

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

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

Hydrological functions

The reference state allows flood waters to spread out over the floodplain and be absorbed into the soil profile very slowly. This site also acts as a trap for sediments. Woody plants that were uprooted or fell over on the site often formed dams both within the channel and on the adjacent floodplain thus acting as natural barriers to reduce the velocity of flood waters and release water slowly into bays and estuaries. The natural wetlands associated with the site filter the runoff waters.

Recreational uses

This site is often used for camping and picnicking and in fact, many portions have been set aside as state parks and recreational areas. The site is used extensively for hunting purposes, especially white-tailed deer, feral hogs, and waterfowl.

Wood products

Early settlers obtained many wood products from the site. One example is the use of bald cypress for water troughs and cisterns. The wood products were also used to make handles for farm implements, corn cribs, household utensils, and other necessary products. At the present time, some firewood is harvested.

Inventory data references

This site was examined in five different plots over four counties in areas associated with major perennial stream channels. Extensive use was made of comments by ranchers who have a long history of ranching the site. Expertise from range specialists and district conservationists with the NRCS who have knowledge of the site was used extensively. Two Range Site Descriptions existed for this site and were referenced.

Other references

Allain, L., L. Smith, C. Allen, M. Vidrine, and J. B. Grace. 2006. A floristic quality assessment system for the Coastal Prairie of Louisiana. North American Prairie Conference, 19.

Allain, L., M. Vidrine, V. Grafe, C. Allen, and S. Johnson. 2000. Paradise lost: The coastal prairie of Louisiana and Texas. U.S. Fish and Wildlife Service, Layfayette, LA.

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

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

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

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

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

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

Baldwin, H. Q., J. B. Grace, W. C. Barrow, and F. C. Rohwer. 2007. Habitat relationships of birds overwintering in a managed coastal prairie. The Wilson Journal of Ornithology, 119(2):189-198.

Beasom, S. L, G. Proudfoot, and J. Mays. 1994. Characteristics of a live oak-dominated area on the eastern South Texas Sand Plain. In the Caesar Kleberg Wildlife Research Institute Annual Report, 1-2.

Berlandier, J. L. 1980. Journey to Mexico during the years 1826 to 1834: translated. Texas State Historical Associated and the University of Texas. Austin, TX.

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

Bollaert, W. 1956. William Bollaert's Texas. Edited by W. E. Hollon and R. L. Butler. University of Oklahoma Press, Norman, OK.

Bonnell, G. W. 1840. Topographical description of Texas: To which is added, an account of the Indian tribes. Clark, Wing, and Brown, Austin, TX.

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

Box, T. W. and A. D. Chamrad. 1966. Plant communities of the Welder Wildlife Refuge.

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

Brite, T. R. 1860. Atascosa County. The Texas Almanac for 1861. Richardson and Co., Galveston, TX.

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.

Chamrad, A. D. and J. D. Dodd. 1972. Prescribed burning and grazing for prairie chicken habitat manipulation in the

Texas coastal prairie. Tall Timbers Fire Ecology Conference Proceedings, 12:257-276.

Crawford, J. T. 1912. Correspondence from the British archives concerning Texas, 1837-1846. Edited by E. D. Adams. The Southwestern Historical Quarterly, 15:205-209.

Davis, R. B. and R. L. Spicer. 1965. Status of the practice of brush control in the Rio Grande Plain. Texas Parks and Wildlife Department Bulletin, 46.

Davis, W. B. 1974. The Mammals of Texas. Texas Parks and Wildlife Department Bulletin, 41.

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

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

Drawe, D. L., A. D. Chamrad, and T. W. Box. 1978. Plant communities of the Welder Wildlife Refuge.

Drawe, D. L. and T. W. Box. 1969. High rates of nitrogen fertilization influence Coastal Prairie range. Journal of Range Management, 22:32-36.

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

Everitt, J. H. and M. A. Alaniz. 1980. Fall and winter diets of feral pigs in south Texas. Journal of Range Management, 33:126-129.

Everitt, J. H. and D. L. Drawe. 1993. Trees, shrubs and cacti of South Texas. Texas Tech University Press, Lubbock, TX.

Everitt, J. H., D. L. Drawe, and R. I. Lonard. 1999. Field guide to the broad-leaved herbaceous plants of South Texas used by livestock and wildlife. Texas Tech University Press, Lubbock, TX.

Foster, J. H. 1917. Pre-settlement fire frequency regions of the United States: A first approximation. Tall Timbers Fire Ecology Conference Proceedings, 20.

Foster, W. C. 2010. Spanish Expeditions into Texas 1689-1768. University of Texas Press, Austin, TX.

Frost, C. C. 1995. Presettlement fire regimes in southeastern marshes, peatlands, and swamps. Tall Timbers Fire Ecology Conference Proceedings, 19:39-60.

Frost, C. C. 1998. Presettlement fire frequency regimes of the United States: A first approximation. Fire in ecosystem management: Shifting the paradigm from suppression to prescription. Tall Timbers Fire Ecology Conference Proceedings, 20:70-81.

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

Fulbright, T. E., D. D. Diamond, J. Rappole, and J. Norwine. 1990. The Coastal Sand Plain of Southern Texas. Rangelands, 12:337-340.

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

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

Grace, J. B., T. M. Anderson, M. D. Smith, E. Seabloom, S. J. Andelman, G. Meche, E. Weiher, L. K. Allain, H.

Jutila, M. Sankaran, J. Knops, M. Ritchie, and M. R. Willig. 2007. Does species diversity limit productivity in natural grassland communities? Ecology Letters, 10(8):680-689.

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

Grace, J. B., L. Allain, C. Allen. 2000. Factors associated with plant species richness in a coastal tall-grass prairie. Journal of Vegetation Science, 11:443-452.

Graham, D. 2003. Kings of Texas: The 150-year saga of an American ranching empire. John Wiley & Sons, New York, NY.

Hamilton, W. and D. Ueckert. 2005. Rangeland woody plant control: Past, present, and future. Brush management: Past, present, and future, 3-16.

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

Harcombe, P. A. and J. E. Neaville. 1997. Vegetation types of Chambers County, Texas. The Texas Journal of Science, 29:209-234.

Hatch, S. L., J. L. Schuster, and D. L. Drawe. 1999. Grasses of the Texas Gulf Prairies and Marshes. Texas A&M University Press, College Station, TX.

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

Hughes, G.U. 1846. Memoir Description of a March of a Division of the United States Army under the Command of Brigadier General John E. Wool, From San Antonio de Bexar, in Texas to Saltillo, in Mexico. Senate Executive Document, 32.

Inglis, J. M. 1964. A history of vegetation of the Rio Grande Plains. Texas Parks and Wildlife Department Bulletin, 45.

Jenkins, J. H. 1973. The Papers of the Texas Revolution, 1835-1836. Presidential Press, Austin, TX.

Johnson, M. C. 1963. Past and present grasslands of southern Texas and northeastern Mexico. Ecology 44(3):456-466.

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

Kennedy, W. 1841. Texas: The rise, progress, and prospects of the Republic of Texas. Lincoln's Inn, London, England.

Kimmel, F. 2008. Louisiana's Cajun Prairie: An endangered ecosystem. Louisiana Conservationist, 61(3):4-7.

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

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

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

Lusk, R. M. 1917. A history of Constantine Lodge, No. 13, ancient free, and accepted Masons, Bonham, Texas.

Favorite Printing Co., Hilbert, WI.

McDanield, H. F. and N. A. Taylor. 1877. The coming empire, or, two thousand miles in Texas on horseback. A. S. Barnes & Company, New York, NY.

McGinty A. and D. N. Ueckert. 2001. The brush busters success story. Rangelands, 23:3-8.

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

Mutz, J. L., T. J. Greene, C. J. Scifres, and B. H. Koerth. 1985. Response of Pan American balsamscale, soil, and livestock to prescribed burning. Texas Agricultural Experiment Station Bulletin, B-1492.

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

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

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

Palmer, G. R., T. E. Fulbright, and G. McBryde. 1995. Inland sand dune reclamation on the Coastal Sand Plain of Southern Texas. Caesar Kleberg Wildlife Research Institute Annual Report, 30-31.

Pickens, B., S. L. King, B. Vermillion, L. M. Smith, and L. Allain. 2009. Conservation Planning for the Coastal Prairie Region of Louisiana. A final report from Louisiana State University to the Louisiana Department of Wildlife and Fisheries and the U.S. Fish and Wildlife Service.

Prichard, D. 1998. Riparian area management: A user guide to assessing proper functioning condition and the supporting science for lotic areas. Bureau of Land Management, Denver, CO.

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

Rappole, J. H. and G. W. Blacklock. 1985. Birds of the Texas Coastal Bend: Abundance and distribution. Texas A&M University Press, College Station, TX.

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

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

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

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

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

Scifres, C. J. and W. T. Hamilton. 1993. Prescribed burning for brushland management: The South Texas example. Texas A&M Press, College Station, TX.

Shelby, C. 1933. Letters of an early American traveler: Mary Austin Holley, her life and her works, 1784-1846. Southwest Press, Dallas, TX.

Siemann, E., and W. E. Rogers. 2007. The role of soil resources in an exotic tree invasion in Texas coastal prairie. Journal of Ecology, 95(4):689-697.

Smith, L. M. 1996. The rare and sensitive natural wetland plant communities of interior Louisiana. Louisiana Natural Heritage Program, Baton Rouge, LA.

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

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

Stutzenbaker, C. D. 1999. Aquatic and wetland plants of the Western Gulf Coast. University of Texas Press, Austin, TX.

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

Urbatsch, L. 2000. Chinese tallow tree Triadica sebifera (L.) Small. USDA-NRCS, National Plant Center, Baton Rouge, LA.

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

Vidrine, M. F. 2010. The Cajun Prairie: A natural history. Cajun Prairie Habitat Preservation Society, Eunice, LA.

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

Vines, R. A. 1977. Trees of Eastern Texas. University of Texas Press, Austin, TX.

Warren, W. S. 1998. The La Salle Expedition to Texas: The journal of Henry Joutel, 1684-1687. Edited by W. C. Foster. Texas State Historical Association, Austin, TX.

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

Weaver, J. E. and F. E. Clements. 1938. Plant ecology. McGraw-Hill, New York, NY.

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

Wilbarger, J. W. 1889. Indian depredation in Texas. CreateSpace Independent Publishing Platform, Scotts Valley, CA.

Williams, L. R. and G. N Cameron. 1985. Effects of removal of pocket gophers on a Texas coastal prairie. The American Midland Naturalist Journal, 115:216-224.

Woodin, M. C., M. K. Skoruppa, and G. C. Hickman. 2000. Surveys of night birds along the Rio Grande in Webb County, Texas. Final Report, U.S. Fish and Wildlife Service, Corpus Christi, TX.

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

Contributors

Stan Reinke, SR Ecological Services, Victoria, TX
Dr. Fred Smeins, Professor, Texas A&M University, College Station, TX
Dan Caudle, DMS Natural Resources Management, Weatherford, TX

Approval

Bryan Christensen, 9/22/2023

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)	
Contact for lead author	
Date	04/29/2024
Approved by	Bryan Christensen
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

   _____

2. **Presence of water flow patterns:**

   _____

3. **Number and height of erosional pedestals or terracettes:**

   _____

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

   _____

5. **Number of gullies and erosion associated with gullies:**

   _____

6. **Extent of wind scoured, blowouts and/or depositional areas:**

   _____

7. **Amount of litter movement (describe size and distance expected to travel):**

   _____

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of**

values):

---

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

---

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

---

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

---

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:

    Sub-dominant:

    Other:

    Additional:

---

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

---

14. **Average percent litter cover (%) and depth (in):**

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

---

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:**

---

17. **Perennial plant reproductive capability:**
