USDA Natural Resources Conservation Service

Ecological site R150AY540TX
Salty Prairie

Last updated: 9/22/2023
Accessed: 05/06/2024

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.

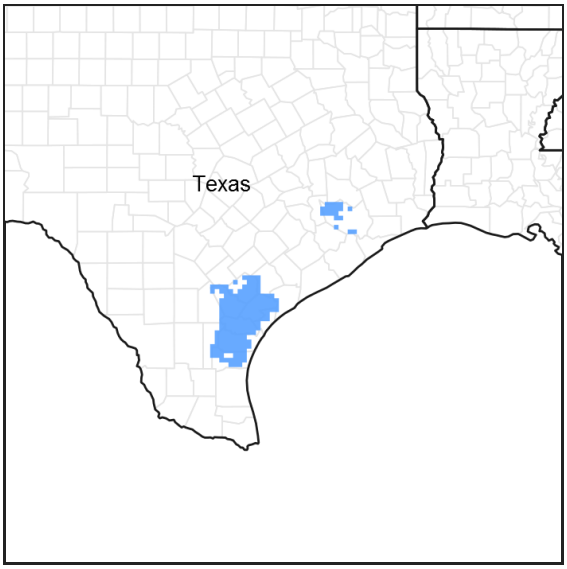


Figure 1. Mapped extent

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

The site is located on low lying flats. The soils have elevated levels of salts. This creates a vegetative community adapted to nutrient-poor and saline conditions. Vegetation is sparse with a few bare areas. This site is not similar in soils, landscape positions or vegetation to any other sites in MLRA 150A.

Associated sites

R150AY542TX	**Sandy Loam** The Sandy Loam ecological site typically has a fine sandy loam or very fine sandy loam surface. Sandy clay loam subsoil horizons are generally present 15 to 18 inches below the surface. This site is located in slightly higher positions on the landscape than the Salty Prairie.
R150AY639TX	**Clay Loam** The Clay Loam ecological site has very deep clay loam soils and has high vegetative production. This site is located in higher positions on the landscape than the Salty Prairie.
R150AY528TX	**Claypan Prairie** The Claypan Prairie is a grassland site that occurs on nearly level, lower lying areas. Drainage in this site varies. The soils are characterized by a thin layer of fine sandy loam topsoil underlain by dense deep clay and clay loam subsoils. This site is located in slightly higher positions on the landscape than the Salty Prairie.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Baccharis*
Herbaceous	(1) *Setaria* (2) *Cynodon dactylon*

Physiographic features

The site was formed in loamy fluviomarine deposits derived from Pleistocene age. These nearly level soils are on the Coastal Plain. Slope ranges from 0 to 1 percent. Elevation ranges from 20 to 150 feet. Runoff is negligible to high.

Table 2. Representative physiographic features

Landforms	(1) Coastal plain > Flat (2) Coastal plain > Depression
Runoff class	Negligible to high
Flooding duration	Very brief (4 to 48 hours)
Flooding frequency	None
Ponding frequency	None
Elevation	5–52 m
Slope	0–1%
Water table depth	10–61 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)	255-269 days
Freeze-free period (characteristic range)	365 days
Precipitation total (characteristic range)	864-991 mm
Frost-free period (actual range)	251-271 days
Freeze-free period (actual range)	365 days
Precipitation total (actual range)	838-1,016 mm
Frost-free period (average)	262 days
Freeze-free period (average)	365 days
Precipitation total (average)	914 mm

Climate stations used

- (1) BEEVILLE CHASE NAAS [USW00012925], Beeville, TX
- (2) REFUGIO 3 SW [USC00417530], Refugio, TX
- (3) REFUGIO 2 NW [USC00417533], Refugio, TX
- (4) VICTORIA FIRE DEPT #5 [USC00419361], Victoria, TX

Influencing water features

A perched water table will occur on top of the natric horizon for a period during late fall and winter in normal years. After high rainfall events, soils can become saturated with reducing conditions within the upper part.

Wetland description

The soils in this site are hydric except for the Greta series. The Greta soils are associated with hydric soils and in a few of these soils small areas of hydric soils may exist. Onsite investigation is necessary to determine exact local conditions.

Soil features

The site consists of very deep, somewhat poorly drained, moderate to very slowly permeable soils. Soil reaction is slightly acid to moderately alkaline. Salinity and sodicity levels increase with depth. Diagnostic horizons and features include an ochric epipedo and natric horizon. Soils correlated to this site include: Greta, Warrenlake, and Woodsboro.

Table 4. Representative soil features

Parent material	(1) Fluviomarine deposits–igneous, metamorphic and sedimentary rock
Surface texture	(1) Fine sandy loam (2) Loam (3) Very fine sandy loam
Family particle size	(1) Fine (2) Fine-loamy (3) Coarse-loamy
Drainage class	Somewhat poorly drained
Permeability class	Moderate to very slow
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%

Available water capacity (0-152.4cm)	15.24–17.78 cm
Calcium carbonate equivalent (76.2-152.4cm)	0–15%
Electrical conductivity (0-152.4cm)	4–20 mmhos/cm
Sodium adsorption ratio (0-76.2cm)	2–45
Soil reaction (1:1 water) (0-76.2cm)	5.6–7.8
Subsurface fragment volume <=3" (76.2-152.4cm)	0–5%
Subsurface fragment volume >3" (0-152.4cm)	0%

Ecological dynamics

The Gulf Coast Prairies are a disturbance-maintained system. Prior to European settlement fire and infrequent but intense, short-duration grazing by bison were important natural disturbances that suppressed woody species and invigorated herbaceous species. The herbaceous savannah species adapted to fire and grazing disturbances by maintaining below-ground perennating tissues. A natural fire frequency of 2 to 5 years seems reasonable for this site.

The Salty Prairie is a fire-influenced gulf cordgrass/little bluestem dominated community, interspersed with other perennial grasses and forbs. Woody plants are sparse or absent. Precipitation patterns are highly variable. Long-term droughts occur three to four times a century. Droughts reduce biomass production and create open space, which is colonized by opportunistic, often invasive, species when precipitation increases. Wet periods allow gulf cordgrass, little bluestem and associated species to return to its pre-drought condition. Because of the proximity to the Gulf of Mexico, tropical storms and hurricanes and periodically inundated both by fresh water from heavy rains, and by saline storm surges associated with hurricanes.

With the introduction of wild longhorn cattle in the late 1700’s and domestic cattle in the 1820’s, an era of heavy grazing began. During the Spanish Mission era of 1600 to 1700’s in the San Antonio, Refugio, and Goliad areas, vast herds of cattle, horses, sheep, and goats were used for meat production for the missions. With no fences, these were free-roaming herds and only the increase was harvested allowing vast herds of these animals to run free and escape. Some portion of these herds took the place of bison once the bison herds were extirpated. This heavy grazing was exacerbated with the introduction of barbed wire and windmills in the 1880’s. Today, grazing is primarily beef cattle on rangeland and pastureland. However, horse numbers are increasing on small acreage properties in the region. Whitetail deer, wild turkey, bobwhite quail, and dove are major wildlife species, and hunting leases are a major source of income for many landowners in this area.

Little bluestem (*Schizachyrium scoparium*) shares vegetative dominance with gulf cordgrass (*Spartina spartinae*). Switchgrass (*Panicum virgatum*), Hartweg’s paspalum (*Paspalum hartwegianum*), and marshhay cordgrass (*Spartina patens*) make up a portion of the reference community. High plant production contributed to an almost continuous cover of litter over the soil, resulting in good soil organic matter conditions. Plant communities at this southerly latitude often lack cool-season species, however, gulf cordgrass continues to grow throughout the year and provides green forage during the winter for livestock and some wildlife species.

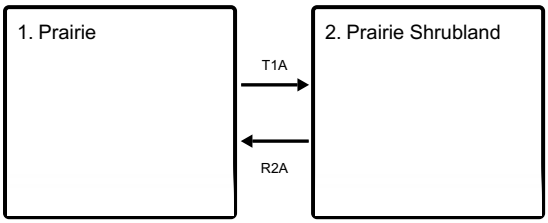
A striking difference exhibited by this community as compared to most prairie communities is the relative unpalatability of gulf cordgrass. Gulf cordgrass is a long-lived, perennial warm-season bunchgrass resistant to grazing because of its tough, spiny leaves and high lignin content. Community degradation occurs initially in the interspaces between the gulf cordgrass plants where the more palatable little bluestem grows. Palatable plants (little bluestem, seacoast bluestem, switchgrass) are grazed before gulf cordgrass and are frequently overgrazed to the point they lose vigor and decrease in the community.

One overriding factor exists in this community; the periodic inundations by either fresh or salt water. The excess

salinity resulting from salt-water inundations can completely remove the historic species other than gulf cordgrass. Growth can also be severely limited due to plants drowning during flooding or burial with sediment and plant material. Under continued heavy grazing, lack of fire, and partial reduction of gulf cordgrass, marsh elder (*Iva frutescens*), Chinese tallow (*Triadica sebifera*) and baccharis (*Baccharis halimifolia*) will increase on the northern portion of the site while mesquite (*Prosopis glandulosa*) and huisache (*Acacia farnesiana*) may increase on the southern portion of the site. Once established, extensive brush management may be required to restore the site back to a Mid/Tallgrass Prairie State.

State and transition model

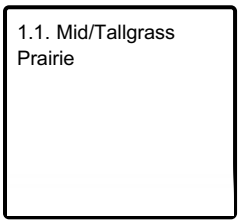
Ecosystem states



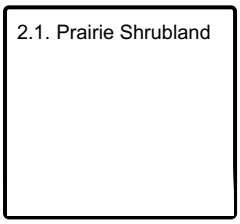
T1A - Absence of disturbance and natural regeneration over time, may be coupled with introduction of non-native species

R2A - Reintroduction of fire and regular disturbance return intervals and removal on non-native species

State 1 submodel, plant communities



State 2 submodel, plant communities



State 1
Prairie

Dominant plant species

- little bluestem (*Schizachyrium scoparium*), grass
- gulf cordgrass (*Spartina spartinae*), grass

Community 1.1
Mid/Tallgrass Prairie

The reference plant community is a fire maintained, open grassland with gulf cordgrass and little bluestem accompanied by lesser amounts of switchgrass, Hartweg's paspalum, seashore saltgrass, marshhay cordgrass and traces of bushy sea oxeye. Warm-season grasses are prolific throughout. Forbs and woody species make up a minor component of this community. Variations in salinity and soil moisture cause local variations in the plant community. In low-lying, highly saline areas, gulf cordgrass may occur in pure stands. Areas with less salinity in the soil will have higher plant diversity. Cordgrasses reproduce vegetatively by rhizomes and are resilient to disturbance. However, once gulf cordgrass is eliminated, it is hard to reestablish. Reseeding is not an option for this site because most of the native species found on this site produce sterile seeds. To reestablish these species transplanting is possible for reestablishment. Heavy grazing pressure will quickly suppress little bluestem leading to

a dominance of Gulf cordgrass. Gulf cordgrass becomes highly palatable to livestock when burned; however, it is unpalatable when not burned frequently. Not only does fire help to control woody plant species within this plant community, but it also helps to maintain a significant component of little bluestem when properly grazed.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	7218	9281	11343
Forb	392	504	616
Shrub/Vine	235	303	370
Tree	–	–	–
Total	**7845**	**10088**	**12329**

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

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

State 2
Prairie Shrubland

Dominant plant species

- Jesuit's bark (*Iva frutescens*), shrub
- baccharis (*Baccharis*), shrub

Community 2.1
Prairie Shrubland

Once woody invasive plants increase to a canopy cover greater than 15 percent, a threshold has been crossed to the Prairie Shrubland Community (2.1). Honey mesquite and huisache are the most common invaders in the southern portion of the MLRA, while marsh elder, Chinese tallow, and baccharis occur in the northern portion. This community results from the lack of effective brush control such as fire or mechanical treatment. Improper grazing management can accelerate this transition. Once it has crossed into this community, extensive energy output is required to transition this state back to the Mid/Tallgrass Prairie Community (1.1). Understory species are dominated by gulf cordgrass and forbs. Forbs may increase along with shrub species. The understory of this transition in the early stages will be gulf cordgrass. As the canopy cover increases, the understory gradually decreases in production and bare ground increases underneath the canopy. Browsing animals, such as goats and deer can find fair food value if browse plants have not been grazed excessively and are within reach. Forage quantity and quality for cattle is low due to the decline in understory forage production. An integrated approach of mechanical and/or chemical treatment of brush species followed with a regular prescribed burn schedule is a viable treatment option for restoring to reference conditions. Before woody plant density becomes excessive, individual plant treatment may be a viable option. Reseeding with little bluestem, switchgrass, and yellow Indiangrass may be an option if Gulf cordgrass has been eliminated from the site. It will be difficult to restore this community once it has been overly degraded. Cordgrass will need to repopulate from remnant plants or adjacent communities.

Transition T1A
State 1 to 2

Introduction of invasive species propagules triggers the transition towards the Prairie Shrubland State (2). Species composition of invasive shrub species of more than 15 percent indicates the transition. Inappropriate grazing management combined with lack of fire and brush management drives this transition, especially during extended drought periods.

Restoration pathway R2A
State 2 to 1

Treatment of invasive species combined with proper grazing management can drive restoration of the Mid/Tallgrass Prairie Community (1.1). This will require substantial energy input. Mechanical and/or chemical vegetation treatments will be required in conjunction with brush control. The driver of this restoration pathway is proper grazing management combined with fire and brush management.

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					
1	**Mid/Tallgrasses**			5884–9247	
	little bluestem	SCSCS	*Schizachyrium scoparium var. scoparium*	2802–6725	–
	gulf cordgrass	SPSP	*Spartina spartinae*	2802–6725	–
2	**Mid/Tallgrasses**			785–1121	
	switchgrass	PAVI2	*Panicum virgatum*	785–1121	–
	saltmeadow cordgrass	SPPA	*Spartina patens*	785–1121	–
	Hartweg's paspalum	PAHA3	*Paspalum hartwegianum*	224–560	–
3	**Shortgrasses**			549–975	
	saltgrass	DISP	*Distichlis spicata*	224–560	–
	shoregrass	MOLI	*Monanthochloe littoralis*	224–560	–
	annual rabbitsfoot grass	POMO5	*Polypogon monspeliensis*	224–560	–
	marsh bristlegrass	SEPA10	*Setaria parviflora*	224–560	–
Forb					
4	**Forbs**			392–616	
	aster	ASTER	*Aster*	392–616	–
	bushy seaside tansy	BOFR	*Borrichia frutescens*	392–616	–
	ragweed	AMBRO	*Ambrosia*	0–112	–
Shrub/Vine					
5				224–370	
	willow baccharis	BASA	*Baccharis salicina*	224–370	–
	Berlandier's wolfberry	LYBE	*Lycium berlandieri*	224–370	–

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.

Inventory data references

Information presented was derived from the Range Site Descriptions, NRCS clipping data, literature, field observations, and personal contacts with range-trained personnel.

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.

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Rangeland health reference sheet

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

Author(s)/participant(s)	Mike Stellbauer, Zone RMS, NRCS, Bryan, TX
Contact for lead author	979-846-4814
Date	01/23/2006
Approved by	Bryan Christensen
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:** Not uncommon.

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

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

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

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

7. **Amount of litter movement (describe size and distance expected to travel):** Small to medium-sized litter may move short distances during intense storms.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil surface is resistant to erosion. Stability class range is expected to be 4 to 6.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface structure is 40 to 80 inches with colors from very dark gray to dark gray and generally subangular blocky structure. SOM is less than 1 percent.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** This coastal prairie site has high canopy, basal cover and density with small interspaces should make rainfall impact negligible. This site has well-drained soils, deep with level to gently sloping (0 to 3 percent).

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

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

    Dominant: Warm-season tallgrasses

    Sub-dominant: Warm-season midgrasses Perennial Forbs

    Other: Warm-season annual grasses Annual Forbs

    Additional:

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

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

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 7,000 pounds for below average moisture years and 11,000 pounds for above average moisture 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:** Potential invasive species include honey mesquite and huisache.

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