

# Ecological site R150AY537TX Lowland

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## General information

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

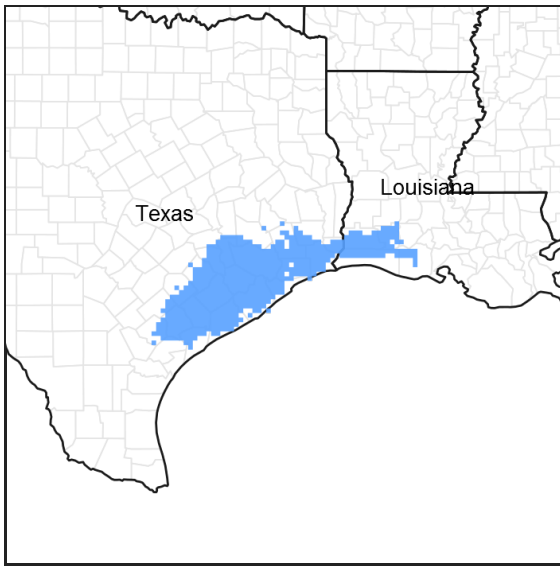


Figure 1. Mapped extent

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

## MLRA notes

Major Land Resource Area (MLRA): 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

As named, the Lowland ecological site occurs on the lowest part of the landscape. It receives excess water from surround landforms and may stay wet for extended periods throughout the year.

### Associated sites

R150AY535TX	<b>Southern Loamy Prairie</b> The loamy prairie site has similar surface textures and not in a depressed landform.
R150AY526TX	<b>Southern Blackland</b> The blackland site has a heavier surface texture and is higher in the landscape.
R150AY543TX	<b>Sandy Prairie</b> The sandy prairie site has a coarser surface texture and not in a depressed landform.
R150AY740TX	<b>Northern Blackland</b> The blackland site has a heavier surface texture and is higher in the landscape.

### Similar sites

R150AY641TX	<b>Lakebed</b> The lakebed site is located in a depressed landform but has a heavier surface texture.
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**Table 1. Dominant plant species**

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

### Physiographic features

The site was formed in loamy alluvial deposits of the Beaumont and Lissie Formation from the Pleistocene age. These soils are in relic stream meander depressions on the coastal prairie. Landform shapes are round, oval, or linear depressions 6 to 18 inches deep. Slope is usually less than 0.5 percent but range up to 1 percent. Elevation is 10 to 250 feet.

**Table 2. Representative physiographic features**

Landforms	(1) Depression
Flooding frequency	None
Ponding duration	Brief (2 to 7 days) to very long (more than 30 days)
Ponding frequency	Occasional to frequent
Elevation	10–250 ft
Slope	0–1%
Ponding depth	0–18 in
Water table depth	60 in
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)	234-255 days
Freeze-free period (characteristic range)	273-365 days
Precipitation total (characteristic range)	45-60 in
Frost-free period (actual range)	225-266 days
Freeze-free period (actual range)	223-365 days
Precipitation total (actual range)	42-61 in
Frost-free period (average)	244 days
Freeze-free period (average)	324 days
Precipitation total (average)	52 in

### Climate stations used

- (1) VICTORIA FIRE DEPT #5 [USC00419361], Victoria, TX
- (2) PORT LAVACA [USC00417183], Port Lavaca, TX
- (3) BAY CITY WTR WKS [USC00410569], Bay City, TX
- (4) DANEVANG 1 W [USC00412266], El Campo, TX
- (5) EL CAMPO [USC00412786], El Campo, TX
- (6) NEW GULF [USC00416286], Boling, TX
- (7) COLUMBUS [USC00411911], Columbus, TX
- (8) SEALY [USC00418160], Sealy, TX
- (9) HOUSTON CLOVER FLD [USW00012975], Pearland, TX
- (10) HOUSTON HOOKS MEM AP [USW00053910], Tomball, TX
- (11) HOUSTON SAN JACINTO DA [USC00414328], Houston, TX
- (12) ANAHUAC [USC00410235], Anahuac, TX
- (13) BEAUMONT CITY [USC00410611], Vidor, TX
- (14) PORT ARTHUR SE TX AP [USW00012917], Port Arthur, TX
- (15) LAKE CHARLES [USW00003937], Lake Charles, LA
- (16) JENNINGS [USC00164700], Jennings, LA
- (17) EUNICE [USC00162981], Eunice, LA
- (18) CROWLEY 2 NE [USC00162212], Crowley, LA

### Influencing water features

These soils receive water from surrounding soils and are ponded for periods of several days to more than a month in duration. The ponding commonly occurs during the winter and spring in most years. These sites may be wetlands, but onsite delineations are required to determine official status.

### Soil features

The site consists of very deep, poorly drained, very slowly permeable soils. The soil profile characteristically consists of an ochric horizon and then an argillic horizon. The ochric can measure 3 to 20 inches thick with an average of 10 inches. Crayfish krotovinas are found within the upper 60 inches. Surface horizon reaction ranges from strongly acid to neutral. Soil correlated to this site include: Aris, Cieno, Clodine, Edgerly, Gessner, Leton, Prairieland, Rexville, and Tomball.

**Table 4. Representative soil features**

Surface texture	(1) Sandy clay loam (2) Loam (3) Fine sandy loam
Family particle size	(1) Loamy

Drainage class	Poorly drained
Permeability class	Very slow
Soil depth	80 in
Available water capacity (0-40in)	7–10 in
Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0–2
Soil reaction (1:1 water) (0-40in)	5.1–7.3

## Ecological dynamics

The Coastal Prairie was historically described as being covered by tall and coarse grasses. The land was noted as a level prairie with open grasslands by travelers in the 1800's. The Lowland site is distinct from surrounding prairie because of its wetness. However, it developed as part of the mid/tallgrass complex on the coastal prairie. The reference community is a mid/tallgrass/sedge-dominated grassland, heavily influenced by fluctuating water regimes, as well as grazing and fire. During wet cycles, more wet-tolerant species dominate, while during dry cycles species adapted to drier conditions dominate.

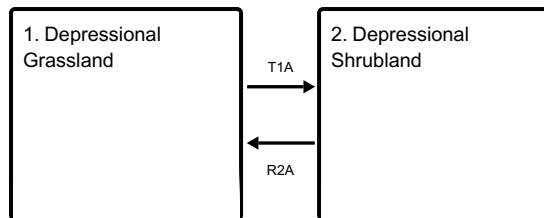
The tallgrass species common throughout the site are switchgrass (*Panicum virgatum*), eastern gamagrass (*Tripsacum dactyloides*), maidencane (*Panicum hemitomon*), giant cutgrass (*Zizaniopsis miliacea*), and Florida paspalum (*Paspalum floridanum*). Midgrasses, flat sedges, and sedges are important species, making up as much as 50 percent of herbaceous production during wet cycles. These include longtom paspalum (*Paspalum denticulatum*), knotroot bristlegrass (*Setaria parviflora*), green flatsedge (*Cyperus virens*), jointed flatsedge (*Cyperus articulatus*), and spikerush (*Eleocharis* spp.). Perennial forbs such as bundleflower (*Desmanthus* spp.) and button snakeroot (*Liatris* spp.) are a minor component of the vegetation. Annual forbs like sumpweed (*Iva* spp.) and ragweed (*Ambrosia* spp.) are seasonally abundant in response to drought-cycles. During wet cycles, species like arrowhead (*Sagittaria longiloba*), water clover (*Marsilea macropoda*), dock (*Rumex* spp.) and other wet-tolerant forbs become more prevalent.

The introduction of domestic livestock and subsequent heavy grazing reduces the preferred tallgrass component allowing midgrasses and sedges to dominate. The midgrass community may be dominated by longtom paspalum. The Lowland site is preferred by cattle over adjacent upland areas and tends to be heavily used. Heavy forage removal also removes fuel for fire. This reduces the incidence and intensity of wildfire allowing more change in the vegetative composition. Continued heavy grazing and reduction of fire over time remove the tall and midgrass components. A shortgrass/forb/woody plant community develops. Invasive exotic grasses such as smutgrass (*Sporobolus indicus*), bahiagrass (*Paspalum notatum*), and common bermudagrass (*Cynodon dactylon*) are likely occupants of this community. A few woody species like sennabeen (*Sesbania drummondii*), mesquite (*Prosopis glandulosa*), huisache (*Acacia farnesiana*), baccharis (*Baccharis* spp.), wax myrtle (*Myrica cerifera*), and Chinese tallow tree (*Sapium sebiferum*) make up a substantial part of annual production.

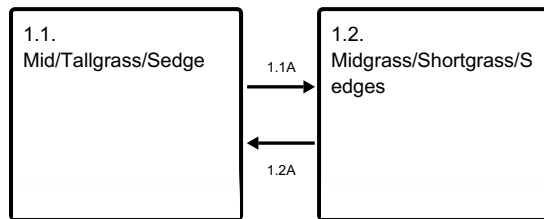
Grassland community trends may be reversed through prescribed grazing and the judicious use of fire. Since the site is preferred by cattle, prescribed grazing is necessary to protect the site and rest the grasses from overuse. Once the grassland to brushland threshold is crossed, a combination of practices will be necessary to restore the grassland state. Brush management and seeding are possibilities. Animal impact can cause compaction layers to develop disrupting the water cycle so ripping, aerating, and disking may also be necessary to repair the system. Combining these with prescribed grazing and fire are necessary for restoration processes to proceed.

## State and transition model

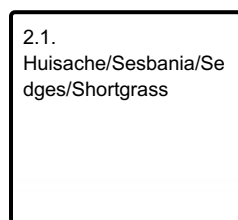
### Ecosystem states



### State 1 submodel, plant communities



### State 2 submodel, plant communities



## State 1 Depressional Grassland

### Community 1.1 Mid/Tallgrass/Sedge

This site is interspersed within the upland prairie sites on the Coastal Prairie. It is part of the tall/midgrass prairie complex that developed under intermittent grazing by bison and frequent winter and summer fires. The potential plant community on the site is a wet prairie dominated by tall and midgrasses. However, it varies between wet and dry cycles. During dry periods, tallgrasses such as switchgrass, eastern gamagrass, maidencane, and Florida paspalum can make up as much as 50 percent of the total herbaceous vegetation with the remainder composed of various mid and shortgrass species. During wet cycles, the tallgrasses decrease except around the edges of the site, while longtom paspalum, sedges, and knotroot bristlegrass dominate. Maidencane and giant cutgrass can be common, depending on the depth of the depression. Forbs are a small component, but annual forbs may be seasonally abundant in response to drought sequences. Abusive grazing by domestic livestock removes the tallgrass components, reduces fire and allows species such as longtom paspalum to increase. Woody plants are absent in the reference community.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	4950	6075	7200
Forb	550	700	800
Shrub/Vine	0	0	0
Tree	0	0	0
<b>Total</b>	<b>5500</b>	<b>6775</b>	<b>8000</b>

Figure 9. Plant community growth curve (percent production by month). TX7611, Mid/Tallgrass/Sedge Community. Warm-season midgrasses, tallgrasses, and sedges occupy the plant community..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2	2	6	10	18	18	3	6	15	10	6	4

## **Community 1.2**

### **Midgrass/Shortgrass/Sedges**

Abusive grazing removes the tallgrass component from the reference community driving a shift to mid and shortgrasses. Once again, wet and dry cycles play a major role in which plant community dominates the site. During wet cycles, longtom paspalum, giant cutgrass, or maidencane becomes the dominant midgrass as sedges and knotroot bristlegrass increase. During prolonged dry periods in the southwestern range of the site, the plant community changes with a reduction in longtom paspalum and increasing numbers of flatsedge, spikerush, low panicums, paspalums, brownseed paspalum, broomsedge (*Andropogon virginicus*), bushy bluestem (*Andropogon glomeratus*), and longspike tridens (*Tridens strictus*). Removal of herbage by grazing shifts the composition to less productive grasses. Cessation of fire, combined with drought, followed by wet sequences encourages the invasion of forbs. Increases in forb composition further weaken the grass components driving further site change. Community dynamics can be reversed and close to reference community vegetation restored by prescribed grazing and fire if a seed source is still present. Fencing may be required to properly graze.

### **Pathway 1.1A**

#### **Community 1.1 to 1.2**

Abusive grazing and lack of fire will cause the community to shift to 1.2.

### **Pathway 1.2A**

#### **Community 1.2 to 1.1**

Prescribed grazing and the return of fire will transition the community back to 1.1.

## **State 2**

### **Depressional Shrubland**

### **Community 2.1**

#### **Huisache/Sesbania/Sedges/Shortgrass**

As the mid and shortgrass community deteriorates the site is occupied by needlegrass rush (*Juncus roemerianus*) and common carpetgrass (*Axonopus affinis*). Introduced species that often invade include vaseygrass (*Paspalum urville*), smutgrass (*Sporobolus indicus*), and torpedograss (*Panicum repens*). Seasonal aspects of cool-season annual grasses such as canary grass (*Phalaris* spp.) and aquatic forbs occur. Grass cover is usually lacking with large amounts of exposed soil surface. Hardpans and compaction layers are generally present. Woody plants like sennabeen, baccharis, wax myrtle, and Chinese tallow tree will invade as conditions allow. Scattered huisache (*Acacia smallii*) trees may be present. The current range of huisache is west of Houston. Restoration of this site will generally require brush and weed management practices. Prescribed grazing and rest are necessary. Seeding may also be required if a natural seed source is not available. Once adequate fuel has accumulated, prescribed fire should be used.

### **Transition T1A**

#### **State 1 to 2**

Continued heavy grazing, lack of fire, and no brush management will transition the reference state to State 2.

### **Restoration pathway R2A**

#### **State 2 to 1**

Prescribed grazing, brush management, and return of fire can restore State 2 back to the reference state.

## Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
0	<b>Midgrass</b>			2200–3200	
	longtom	PADE24	<i>Paspalum denticulatum</i>	1540–2240	–
1	<b>Tallgrasses</b>			3025–4400	
	switchgrass	PAVI2	<i>Panicum virgatum</i>	1540–2240	–
	eastern gamagrass	TRDA3	<i>Tripsacum dactyloides</i>	1540–2240	–
	giant cutgrass	ZIMI	<i>Zizaniopsis miliacea</i>	1540–2240	–
	Florida paspalum	PAFL4	<i>Paspalum floridanum</i>	800–1500	–
	maidencane	PAHE2	<i>Panicum hemitomon</i>	800–1500	–
2	<b>Grass/Grasslikes</b>			550–800	
	sedge	CAREX	<i>Carex</i>	0–500	–
	jointed flatsedge	CYAR4	<i>Cyperus articulatus</i>	0–500	–
	green flatsedge	CYVI2	<i>Cyperus virens</i>	0–500	–
	spikerush	ELEOC	<i>Eleocharis</i>	0–500	–
	marsh bristlegrass	SEPA10	<i>Setaria parviflora</i>	0–500	–
	gaping grass	STHI3	<i>Steinchisma hians</i>	0–500	–
3	<b>Midgrasses</b>			275–400	
	bushy bluestem	ANGL2	<i>Andropogon glomeratus</i>	0–250	–
	broomsedge bluestem	ANVI2	<i>Andropogon virginicus</i>	0–250	–
	brownseed paspalum	PAPL3	<i>Paspalum plicatulum</i>	100–250	–
	longspike tridens	TRST2	<i>Tridens strictus</i>	100–250	–
4	<b>Midgrasses</b>			275–400	
	panicgrass	PANIC	<i>Panicum</i>	150–300	–
	crowgrass	PASPA2	<i>Paspalum</i>	150–300	–
<b>Forb</b>					
5	<b>Forbs</b>			275–400	
	spiny chloracantha	CHSP11	<i>Chloracantha spinosa</i>	150–300	–
	southern annual saltmarsh aster	SYDI2	<i>Symphyotrichum divaricatum</i>	150–300	–
6	<b>Forbs</b>			330–480	
	Cuman ragweed	AMPS	<i>Ambrosia psilostachya</i>	50–100	–
	bundleflower	DESMA	<i>Desmanthus</i>	50–100	–
	button eryngo	ERYU	<i>Eryngium yuccifolium</i>	50–100	–
	blue mudplantain	HELI2	<i>Heteranthera limosa</i>	50–100	–
	bigfoot waterclover	MAMA9	<i>Marsilea macropoda</i>	50–100	–
	yellow puff	NELU2	<i>Neptunia lutea</i>	50–100	–
	Pennsylvania smartweed	POPE2	<i>Polygonum pensylvanicum</i>	50–100	–
	dock	RUMEX	<i>Rumex</i>	50–100	–
	violet wild petunia	RUNU	<i>Ruellia nudiflora</i>	50–100	–
	longbarb arrowhead	SALO2	<i>Sagittaria longiloba</i>	50–100	–

7	<b>Forbs</b>			55–80	
	prairie broomweed	AMDR	<i>Amphiachyris dracunculoides</i>	25–50	–
	sneezeweed	HEAM	<i>Helenium amarum</i>	25–50	–
	annual marsh elder	IVAN2	<i>Iva annua</i>	25–50	–

## 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

This site is part of the extensive wetland systems of the Gulf Coast Prairie which functions in both flood control and aquifer recharge. These sites, when dry, serve as reservoirs to capture excessive precipitation during high-intensity rainfall events. When in pristine condition this site is important in aquifer recharge. In impaired condition (low organic matter, compaction layers, etc.) the site loses more water through evaporation and transpiration than it delivers to aquifer recharge.

## Recreational uses

This site is frequently used for hunting ducks and geese during wet cycles in winter months. The site is also extensively used for bird watching.

## Inventory data references

Information presented here has been derived from former range site descriptions for Lowland and Lakebed Sites and from the current draft of the Lakebed Ecological Site Description. Field visits were done in Victoria, Refugio, Jefferson, Chambers, Harris, Waller, and San Patricio Counties. Personal contacts and communications with range-trained personnel were used extensively.

## 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, Lafayette, 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 Association 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-

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.
- McDaniel, 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	
Date	06/08/2004
Approved by	
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:** Water flow patterns should not be evident on this depressional site.

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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 15 percent bare ground randomly distributed throughout.

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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.

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

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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):** Soil surface is resistant to erosion. Stability class range is expected to be 5 to 6.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface structure is about 8 inches thick with dark grayish brown clay loam subangular blocky structure. SOM is 1 to 4 percent.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Little effect in this depressional landscape position.
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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 tallgrasses/grass-likes
- Sub-dominant: Forbs
- Other: Cool-season grasses/grass-likes
- Additional:
- 
13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Some plant mortality can be expected for perennial warm-season grasses (FACU, UP) or perennial warm-season forbs (FAC, FW, OB) depending on the length of ponding during the growing season.
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14. **Average percent litter cover (%) and depth ( in):**
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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 4,000 pounds per acre for below average moisture years to 7,000 pounds per acre 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 bahiagrass, bermudagrass, and Chinese tallow tree.
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17. **Perennial plant reproductive capability:** All perennial plants should be capable of reproducing, except for periods of prolonged drought conditions, heavy herbivory, or intense wildfires.
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