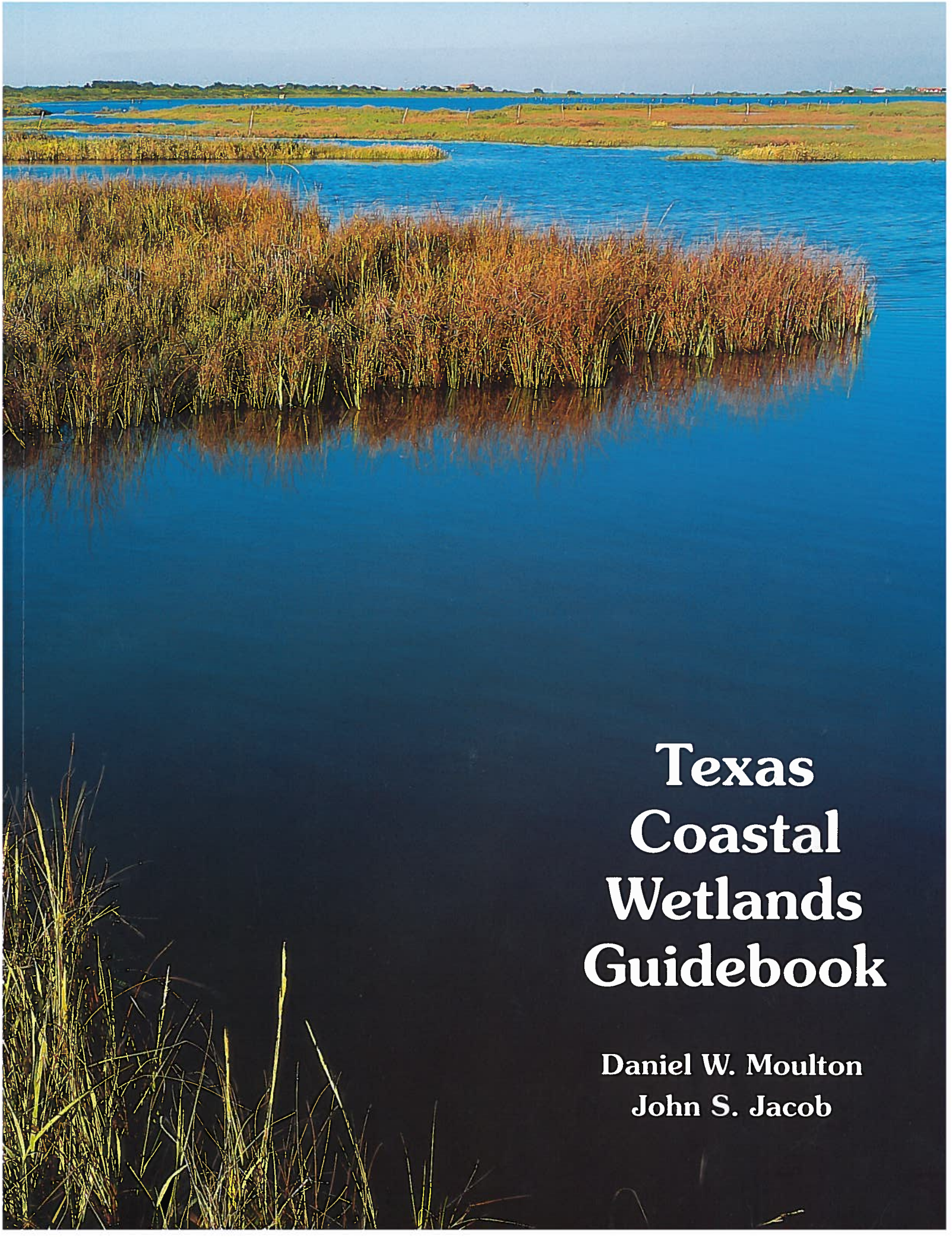
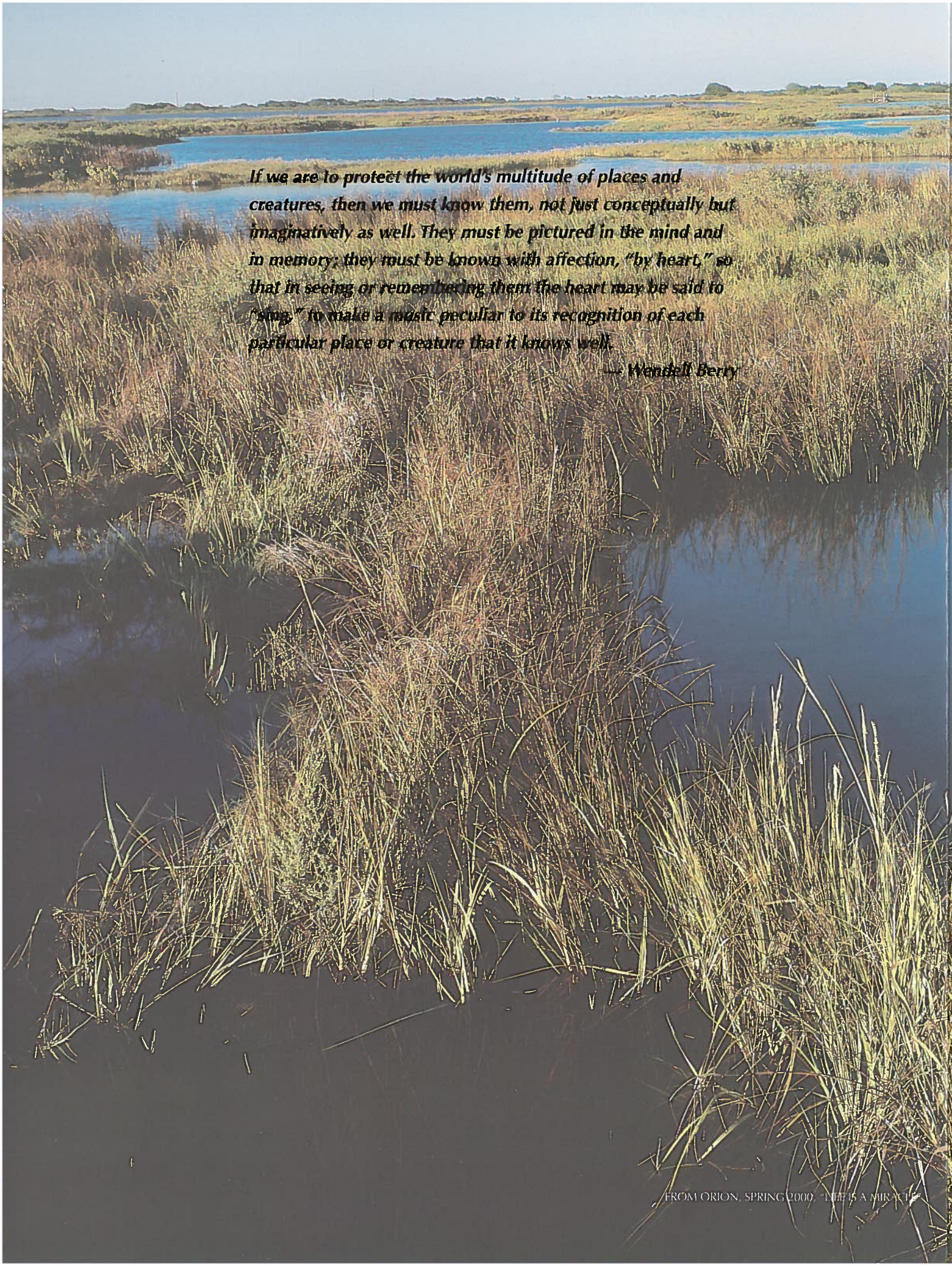


Texas Coastal Wetlands Guidebook

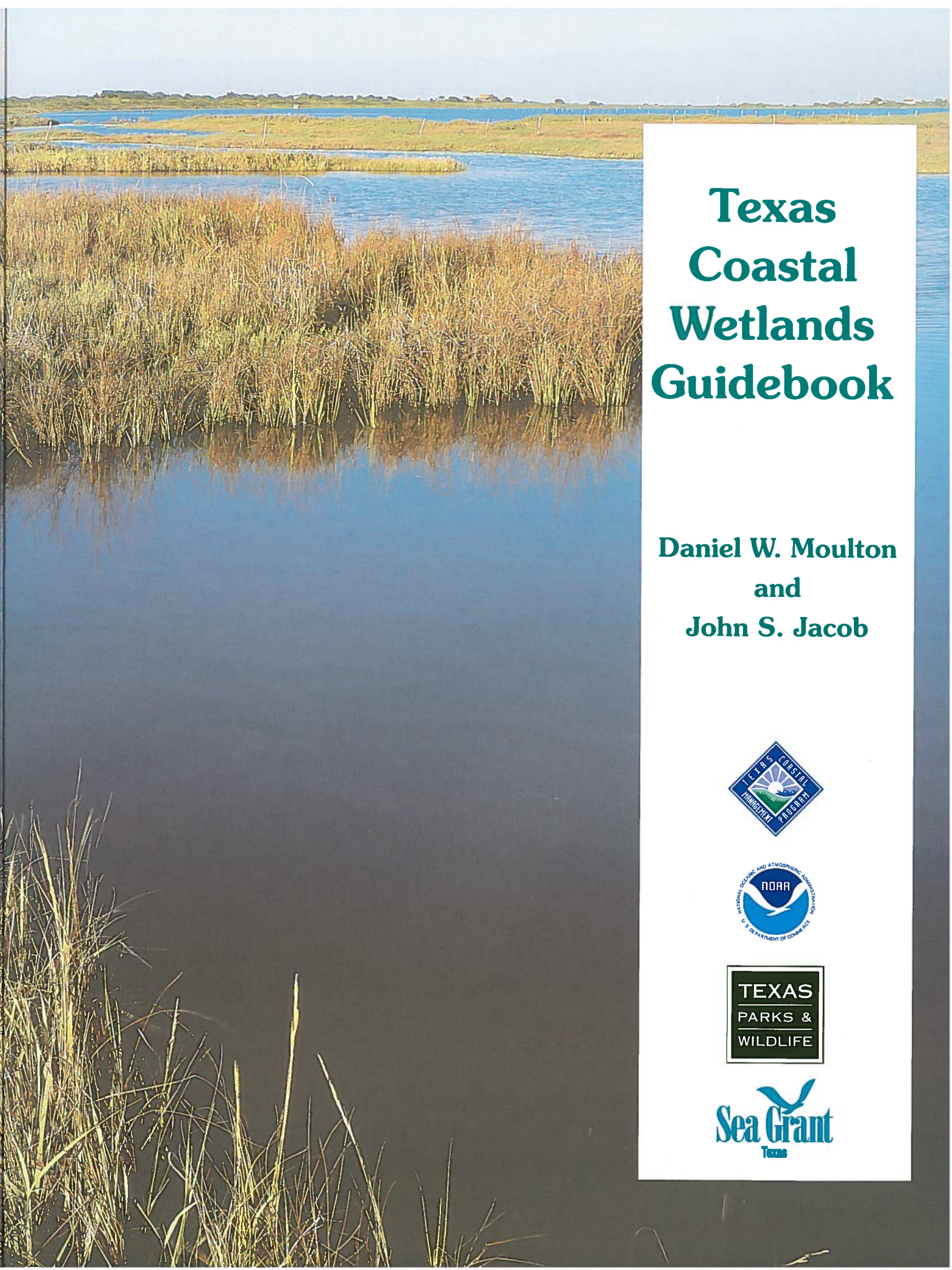
Daniel W. Moulton
John S. Jacob



If we are to protect the world's multitude of places and creatures, then we must know them, not just conceptually but imaginatively as well. They must be pictured in the mind and in memory; they must be known with affection, "by heart," so that in seeing or remembering them the heart may be said to "sing," to make a music peculiar to its recognition of each particular place or creature that it knows well.

— Wendell Berry

FROM ORION, SPRING 2000, "LIFE IS A MIRACLE"



Texas Coastal Wetlands Guidebook

Daniel W. Moulton
and
John S. Jacob

TEXAS COASTAL MANAGEMENT PROGRAM
NOAA
TEXAS PARKS & WILDLIFE
Sea Grant Texas

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Foreword

Texas, like most other Sunbelt states, is experiencing very rapid population growth, and there is no end in sight. The future will surely see our natural resources coming under increasing pressures related to growth and development. The continued existence of fish and wildlife habitats, such as wetlands, may well hinge on the concepts we are teaching our children today. These children, tomorrow's voters and leaders, will not be effective advocates for natural resources about which they have little knowledge or personal interest. So it's critically important that we instill in the minds and hearts of children both a "sense of place" and a commitment to enlightened stewardship for the natural resources in the areas where they live. This guidebook will help teachers and other leaders of youth to create that "sense of place" for the irreplaceable wetland habitats of the Texas coastal plain.

The authors have identified 111 wetland sites of all types that are accessible to the general public on the coastal plain. This information, along with the other education and information resources identified throughout the guide, should prove invaluable to anyone interested in learning or teaching about coastal wetlands.

The guidebook strives to emphasize the relationship between wetland habitats and the economic benefits that accrue to communities that are fortunate enough to be near significant wetlands. Wetlands support recreational and commercial fishing, hunting, birdwatching and other types of nature tourism — the fastest growing segment of the tourism industry. This economic reality should provide a powerful incentive for protecting wetland habitats in the future. As our population grows and the demand for outdoor recreation increases, there will be even greater incentives to preserve the wetland habitats that support the fish and wildlife resources upon which these pursuits depend.

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We acknowledge Texas Parks and Wildlife Press' permission to use artwork from Charles D. Stutzenbaker "Aquatic and Wetland Plants of the Western Gulf Coast." His drawings, when combined with those of Regina Kulbeka, have proven to be a valuable addition to this guide.

We thank Ricardo Lopez, Environmental Institute of Houston, for his patience and skill in producing the Wetland Types Map.

—The Authors

Contents

About the Authors

Daniel W. Moulton contributes interdisciplinary, statewide wetland expertise to the Wetlands Conservation and Water Resources Teams and the Coastal Studies Program within the Resource Protection Division of the Texas Parks and Wildlife Department in Austin.

Moulton is a wildlife scientist with a B.A. in Biology (Colgate University), a M.S. in Wildlife Ecology (University of Wisconsin), and a Ph.D. in Wildlife Science (Utah State University). His 17 years of experience with Texas wetlands includes land acquisition and habitat development; identification, delineation and mapping of wetlands using photographic and remotely-sensed digital imagery; and the analysis of change in coastal habitats. He worked more than four years with the federal National Wetlands Inventory to coordinate the Coastal Texas Mapping Project that produced digital wetlands maps, as well as a status and trends report, for the entire Texas coastal plain. He is recognized as a Certified Wildlife Biologist by the Wildlife Society.

John Jacob holds a joint appointment with the Texas Sea Grant College Program and the Texas Agricultural Extension Service (Department of Soil and Crop Sciences). He has coastwide responsibility for inland environmental problems that have a direct impact on the quality of our bays, estuaries and coastal waters. Preeminent among these issues are the mitigation and abatement of nonpoint source pollution from both rural and urban sources, and the preservation and restoration of valuable natural habitats such as wetlands.

Jacob is trained as a soil scientist with B.S. and M.S. degrees from Texas Tech University, and a Ph.D. from Texas A&M University. He worked several years for the National Cooperative Soil Survey program in Texas, mainly in the coastal plain area. He is a recognized expert on Texas wetlands, having been active in consulting and research aspects of wetlands for more than 10 years. Jacob has participated in the development and refinement of wetland indicators on the Gulf Coast. He is recognized as a Professional Wetland Scientist by the Society of Wetland Scientists and a Certified Professional Soil Scientist by the American Society of Agronomy.

Introduction

The Texas Gulf Coast has some of the most abundant and diverse wetlands in the world. Unfortunately, very few of the more than 5 million people who live on or near the coast have any idea what kind of wetlands are near them and why they are important. Many people may actually know more about rainforests in the Amazon than they do about wetlands in their own backyards! The rainforests are important because they are part of the worlds "lungs" – they filter the air. But our coastal wetlands are just as important because they are part of the earth's "kidneys" – they filter the water! This book introduces readers to Texas' coastal wetlands by introducing the types of wetlands found here, explaining their importance, and describing where they are found.

This book is not intended as a comprehensive technical work, but rather a general introduction that will give the reader a better sense of Texas' coastal wetlands. Most of the guide is devoted to the section on regional wetland sites. This section should be useful to educators and others who would like to plan a visit to a regional wetland site. Many site descriptions include internet addresses that provide more detailed information. Additional references are provided on page 63.

Wetland education is a step toward wetland preservation. (TEXAS PARKS AND WILDLIFE)

This guide describes wetlands found on the ***Gulf Coastal Plain***, a low, flat plain more than 360 miles long and 50 to 100 miles wide that borders the Gulf of Mexico (see map on page 7). The area corresponds geologically to the Lissie and Beaumont Geological Formations, deposited during the Pleistocene Epoch starting about 1 million years ago, and the younger Holocene Epoch Formations (no older than 10,000 years), which include sediments adjacent to the coastline and on river floodplains and the Coastal Sand Sheet of South Texas.

Coastal Wetlands: What Are They and Why Should We Care?

Wetlands Definition

Simply put, wetlands are "in-between" areas that have something of both dry uplands and open water environments: they are neither "land" nor "water" – they are a ***transition zone***, which is what makes them so interesting. Wetlands have both upland and aquatic characteristics, and, thus, they often have a richer flora and fauna than other environments.

In practice, wetlands are hard to define, precisely because they are transition zones. It is important to recognize that an area does not have to be wet all year long to be considered a wetland – as few as two or three consecutive weeks of wetness a year is all it takes! The ***hydrology*** of a wetland (how much water it gets and how long it stays there) is the most important factor that determines its character. Because oxygen does not move very fast in water, water saturation very quickly results in a soil condition known as ***anaerobiosis***, which refers to very low oxygen content. A lack of oxygen kills most plants, and ***hydrophytic*** or ***wetland***

The high water line on these tupelo trees is an indication of the hydrology of this swamp — deep water for two to three months each year. (TEXAS PARKS AND WILDLIFE)

vegetation is the only kind of vegetation that can survive in these conditions. The reeds and rushes that are common in many wetlands can survive because they have hollow stems that allow them to push oxygen down into the saturated root zone. Other wetland plants have developed different strategies for surviving in the anaerobic environment. Waterlogged soils develop particular kinds of color patterns that make them recognizable as wetland or ***hydric soils***. Hydric soils are typically gray and may have reddish stains along root channels. Wetland scientists use wetland hydrology, hydrophytic vegetation, and hydric soils to help them determine whether a given area is a wetland and the kind of wetland it is. We will examine each of these characteristics when we describe each of the major wetland types that occur on the Texas coastal plain.

Why Are Wetlands Important?

There are many different kinds of wetlands and they all perform ecological functions, and produce certain goods and services that are valuable to humans. The most important functions wetlands perform on the Texas Gulf Coast are:

- Water Quality: Wetlands are one of nature's most efficient water filters. Wetland plants and soils clean the water before it goes into groundwater or into rivers.
- Nurseries: Coastal near-shore wetlands serve as important nurseries for fish, crab, and other shellfish. The total economic impact of commercial fishing at the wholesale level is more than $400 million annually, employing about 30,000 coastal residents, all dependent on the wetlands! The total economic impact of saltwater sport fishing in Texas is almost $2 billion annually, employing about 25,000 coastal residents.
- Wildlife Habitat: Our coastal plain wetlands are home to many different kinds of animals. Birds from all over North America use Texas coastal habitats during migration and many species spend the winter on the coast.
- Flood buffers: Wetlands reduce the severity of floods by acting as natural detention areas. Destruction of many wetlands has made downstream flooding much worse.
- Erosion control: Nearshore wetlands act as buffers to reduce shoreline erosion and stabilize banks.
- Recreation: In addition to fishing, hunting and bird-watching are also economically important. Wildlife watching is the fastest growing segment of the tourism industry. In 1996, 3.8 million U. S. residents spent $1.2 billion watching wildlife in Texas.

Pontederia cordata: pickerelweed

DRAWING: CHARLES D. STUTZENBAKER

Hydric soils frequently have reddish stains along the plant root channels. (JOHN JACOB)

Wetlands Protection

It is illegal to drain or fill a wetland without a permit from the U.S. Army Corps of Engineers. The entire Texas coast is under the jurisdiction of the Corps' Galveston District Office. Before a permit can be granted, the requestor must show that the project has considered all viable alternatives and minimized impacts as much as possible. Any wetland loss must be compensated for by constructing new wetlands or by restoring or enhancing existing wetlands. The Corps of Engineers considers all public comments before granting a permit. Knowledgeable comments about local wetlands are particularly valuable. The Regulatory Branch can be contacted at (409) 766-3930 for those who wish to be added to the permit mailing list.

Major Threats to Wetlands

Human activity has been the major threat to wetlands. Agriculture, industrial development, and urban and suburban sprawl have caused the greatest losses of freshwater wetlands. Agriculture is no longer expanding on the Gulf Coast, and very little of the current loss can be attributed to it. In fact, riceland agriculture, because of the flooding that goes with it, provides some additional wetland habitat not otherwise available. The biggest current source of loss for freshwater coastal wetlands is from urban sprawl. Land subsidence caused by the mining of oil, gas and groundwater has been the primary source of saltwater wetland loss. Subsidence causes the land surface to drop, which can then become flooded if the surface is already very near to sea level. Subsidence-induced flooding has drowned many wetlands, especially in and around large coastal cities such as Houston.

Estuarine wetlands are dependent upon freshwater inflow from rivers. In some estuaries, such as Corpus Christi Bay, there is not enough freshwater inflow to maintain maximum estuarine productivity. The Nueces River, which once flowed down through the marshes of the Nueces River Delta, has been diminished and rerouted and no longer provides much freshwater inflow to the deltaic wetlands.

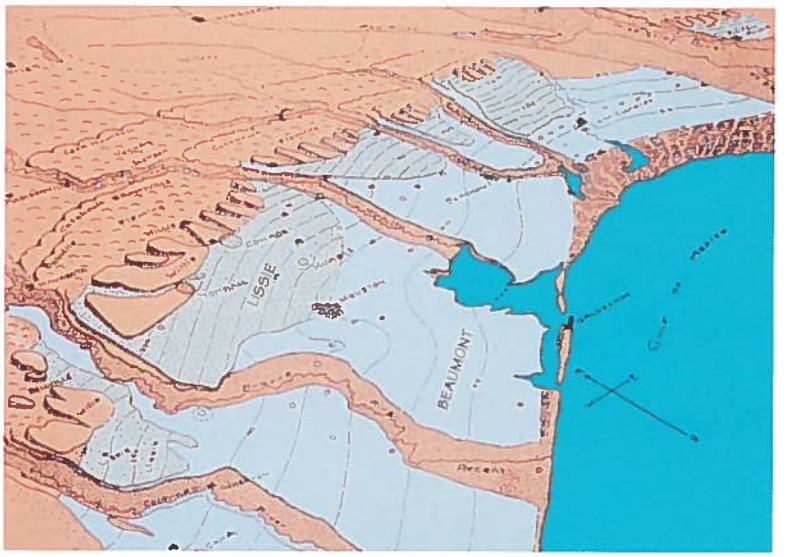
How Our Wetlands Came To Be

The Role of Water, Wind and Time

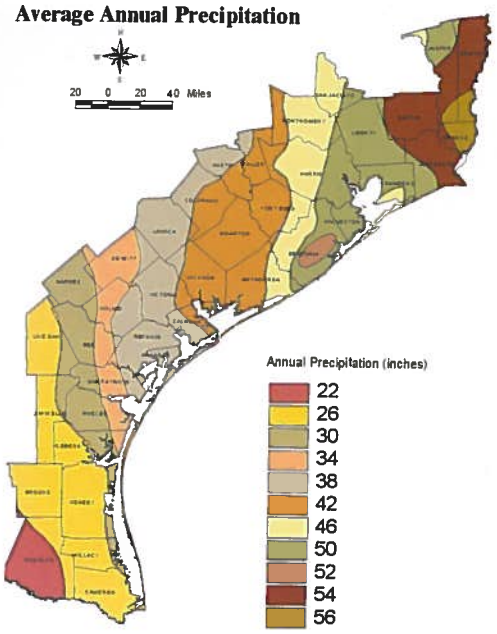
To understand the present pattern of wetlands we must go back about 60 to 100 million years ago, when the edge of the continent was about where Dallas, Austin, and San Antonio are now. The entire region that would become the Texas coastal plain was then at the bottom of the newly opening Gulf of Mexico. Since then, the Gulf has been continuously filling in with sediment carried by rivers. These layers of gravel, sand, silt and clay may be up to 40,000 feet thick, and have extended the edge of the continent some 250 miles into the Gulf. This process of sediment deposition continues today as Texas rivers add their sediment loads (the portion that is not trapped in man-made reservoirs) to their bays or directly to the Gulf. The Texas mainland shore, coastal plain, beaches, barrier islands and peninsulas, river deltas, and bays and estuaries are all products of the processes of erosion and deposition of water-borne (alluvial) sediments.

The building of the Coastal Plain through sedimentary deposition has taken place against a backdrop of rising and falling sea levels, and what we see on the surface today is the result of the last two million years (the Ice Ages of the Pleistocene Epoch). The younger the sediments are, the easier it is to see the remains of the depositional processes. For example, many of the freshwater wetlands on the Gulf Coast today have formed in old sediment-filled channels that once formed the deltas and floodplains of ancient rivers. The channel remnants consist of oxbow lakes, cutoff channels, and, in the lower Rio Grande valley, resacas.

At the height of the last Ice Age, about 18,000 years ago, sea level was 300 to 400 feet lower than it is today and the shoreline was at least 50 miles farther out in the Gulf. During this period the coastal rivers cut deep valleys into the coastal plain sediments, which flooded and filled with sediment once the climate warmed and sea level rose as a



Bird's eye view of the Upper Gulf Coast of Texas. The flat lying Beaumont and Lissie Geological Formations, laid down during past ice ages, are the location of Coastal Prairie potholes and marshes and coastal flatwood wetlands. (REDRAWN FROM DOERING, 1935)



The average rainfall drops from 55 inches at Port Arthur in Jefferson County to less than 29 inches along most of the lower coast.

result of the melting glaciers. Most of our fringing salt marsh wetlands have formed in the bays and estuaries that resulted from the flooding and filling of these river valleys.

Sea level rise also resulted in the formation of large sand bars along the coastline that developed into barrier islands, with Galveston Island and Padre Island among the most well known. As these islands have built seaward, a series of swales have been left behind the building sand ridges. These depressional swales are the location of prominent freshwater wetlands on these islands. Tidal fringe wetlands occur on the back or bay side of the islands.

Wind action has modified almost all of the wetland features, more so the older the landscape. Pimple mounds or small dunes, for example, are found in almost all undisturbed prairie potholes. But wind action has been the dominant landscape shaping force in the semi-arid area of the coastal plain known as the Coastal Sand Sheet. Here, coastal winds are constantly reshaping this dune-dominated landscape. Wetlands are found in the swales between the dunes, much in the same way as on the barrier islands. These wetlands often depend upon high groundwater levels.

The Role of Climate

Rainfall changes drastically from one end of the Texas Coast to the other. Average annual rainfall drops from 55 inches at Port Arthur in Jefferson County to less than 29 inches along most of the lower coast. The humid upper coast supports well-vegetated wetlands dominated by grasses and other temperate-climate plants.

In contrast, the lower coast becomes increasingly subtropical and more arid toward the Rio Grande. This climate does not support the lush wetland vegetation typical of the upper coast. The relatively sparsely vegetated sands of the lower coast are more susceptible to wind erosion, and dunes dominate many of the landscapes.

Rainfall amount also dictates how many wetlands occur in an area and where they are found. The upper coast, for example, has abundant wetlands. Almost any flat surface in the Beaumont area has slow-enough drainage to qualify as a wetland. This means that it is actually hard to find a natural area in this zone that does not have some kind of wetland characteristics. In contrast, wetlands on the lower coast are much less abundant and are confined to very distinct depressions.

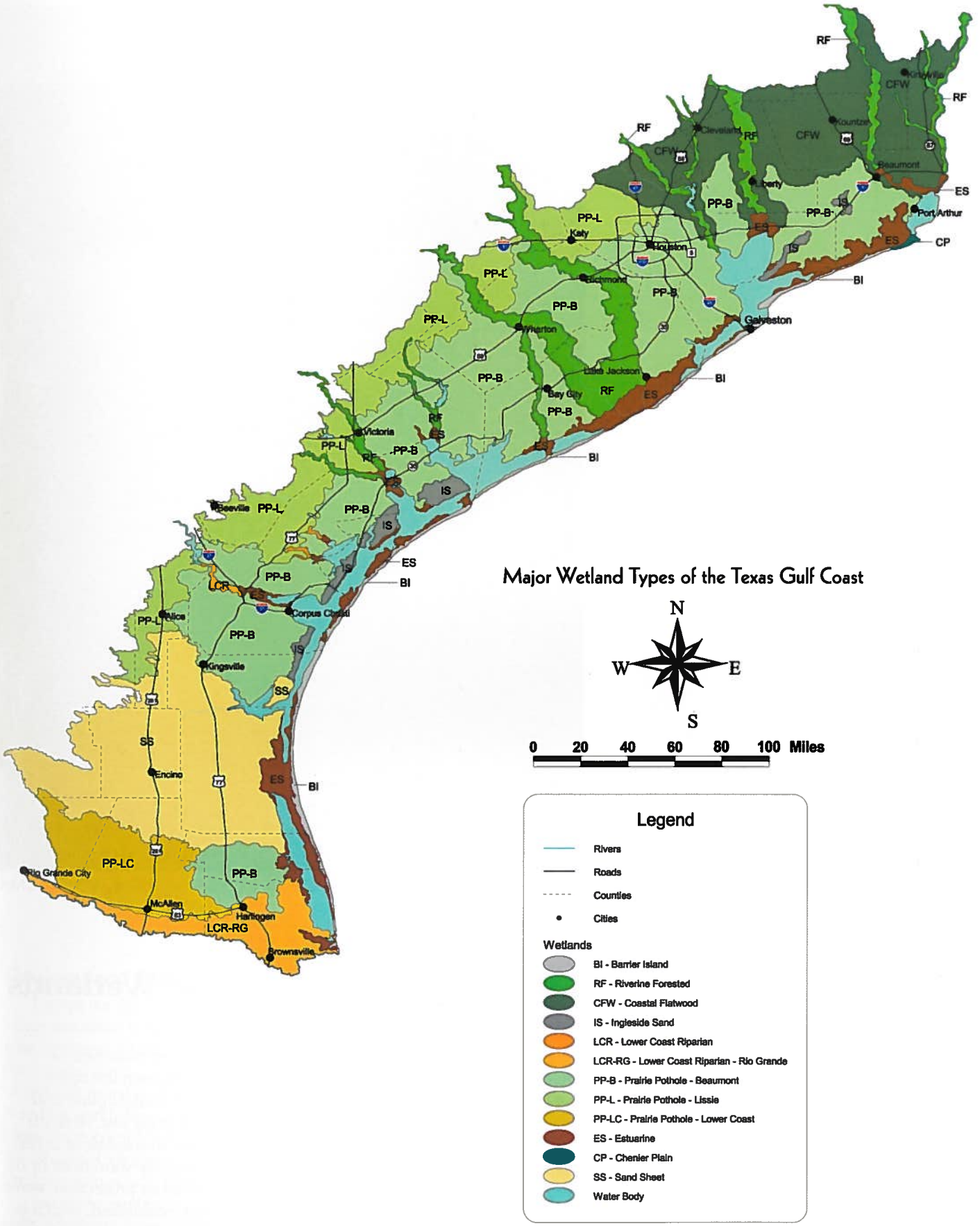
Less rainfall results in less freshwater inflow supplied by rivers to the bays and estuaries. From Sabine Lake to Corpus Christi Bay, major rivers supply freshwater to the bays. The upper and lower Laguna Madre, on the other hand, has no major sources of freshwater inflow due to low rainfall and the absence of major drainages between the Nueces River and the Rio Grande. The lack of freshwater, combined with high evaporation rates and restricted Gulf inlets, normally keeps the Laguna saltier than seawater. Barren or sparsely vegetated tidal flats are typical of the wetlands fringing the Laguna, in contrast to the rather lush marshes of the upper coast estuaries.

Marsh grasses such as these are most prevalent along the upper coast. (© STEPHAN MYERS)

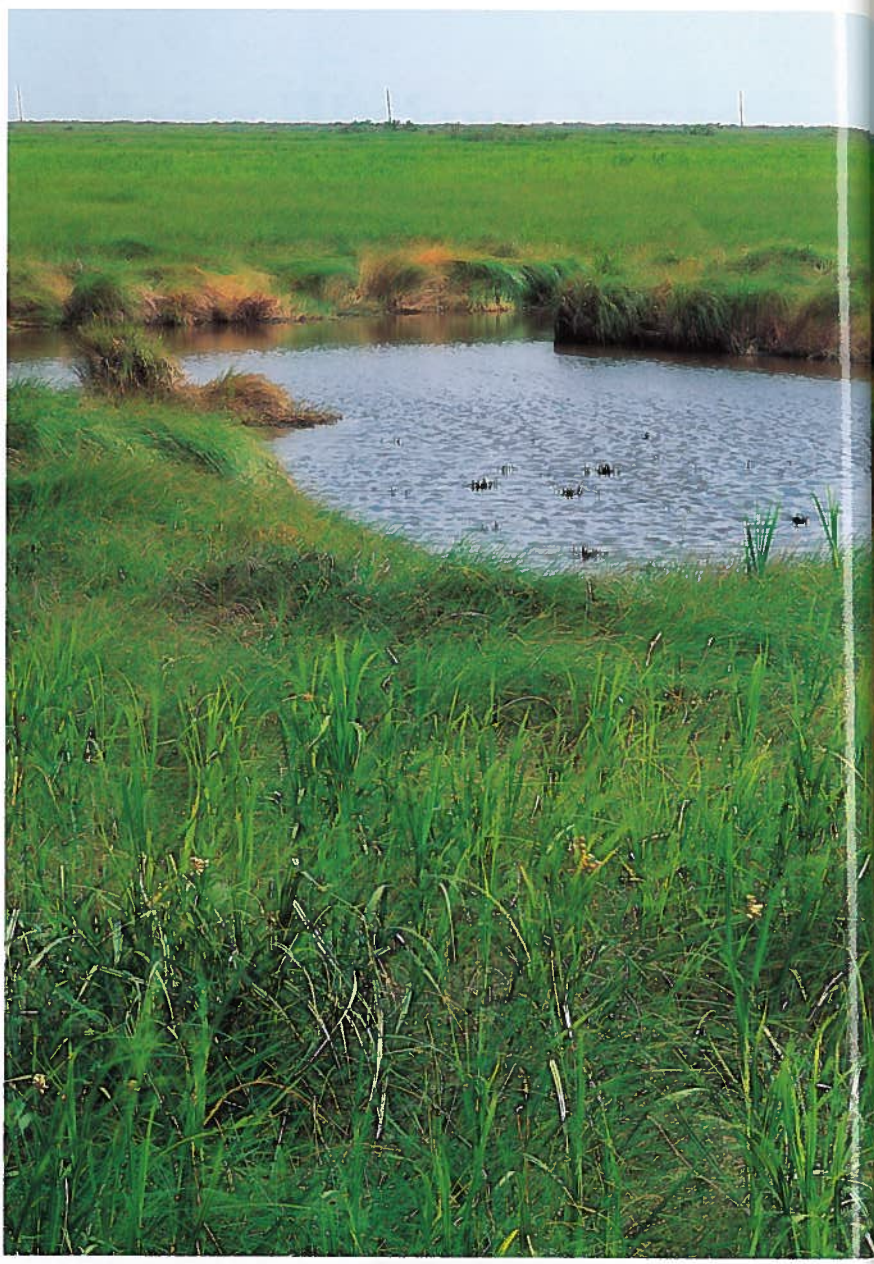
Major Wetland Types

We have identified seven major wetland categories for the Texas Gulf Coast. The map of major wetland types does not show actual wetlands, nor does it have any information about the amount of wetlands in each area. It shows where different types of wetlands are to be found on the Texas Gulf Coast. Finding undisturbed wetlands of certain types will be very difficult in some areas. Prairie potholes, for example, once covered vast expanses of the Gulf Coast, exceeding 30 percent coverage on the upper coast, but it is now difficult to find an undisturbed pothole complex anywhere in this area. Some areas, such as the Estuarine Wetlands and the eastern part of the Coastal Flatwoods, do have a rather high percentage of wetlands, often exceeding 50 to 80 percent of the land surface, while wetlands in the western areas of the Prairie Potholes-Lower Coast may occupy only 5 to 10 percent of the area, or less.

The wetland categories are based on geology, as this provides the basic template upon which wetlands have formed, following the discussion under "How Our Wetlands Came to Be." We subdivided these categories further based on climate and vegetation. As with any classification and map, considerable "lumping" of several possible wetland types had to take place, whereas a more detailed map and classification would allow much more "splitting." The categories presented here do provide a good framework for understanding the major types of wetlands found on the Gulf Coast.



MAP COMPILED BY JOHN JACOB, DRAFTED BY RICARDO LOPEZ



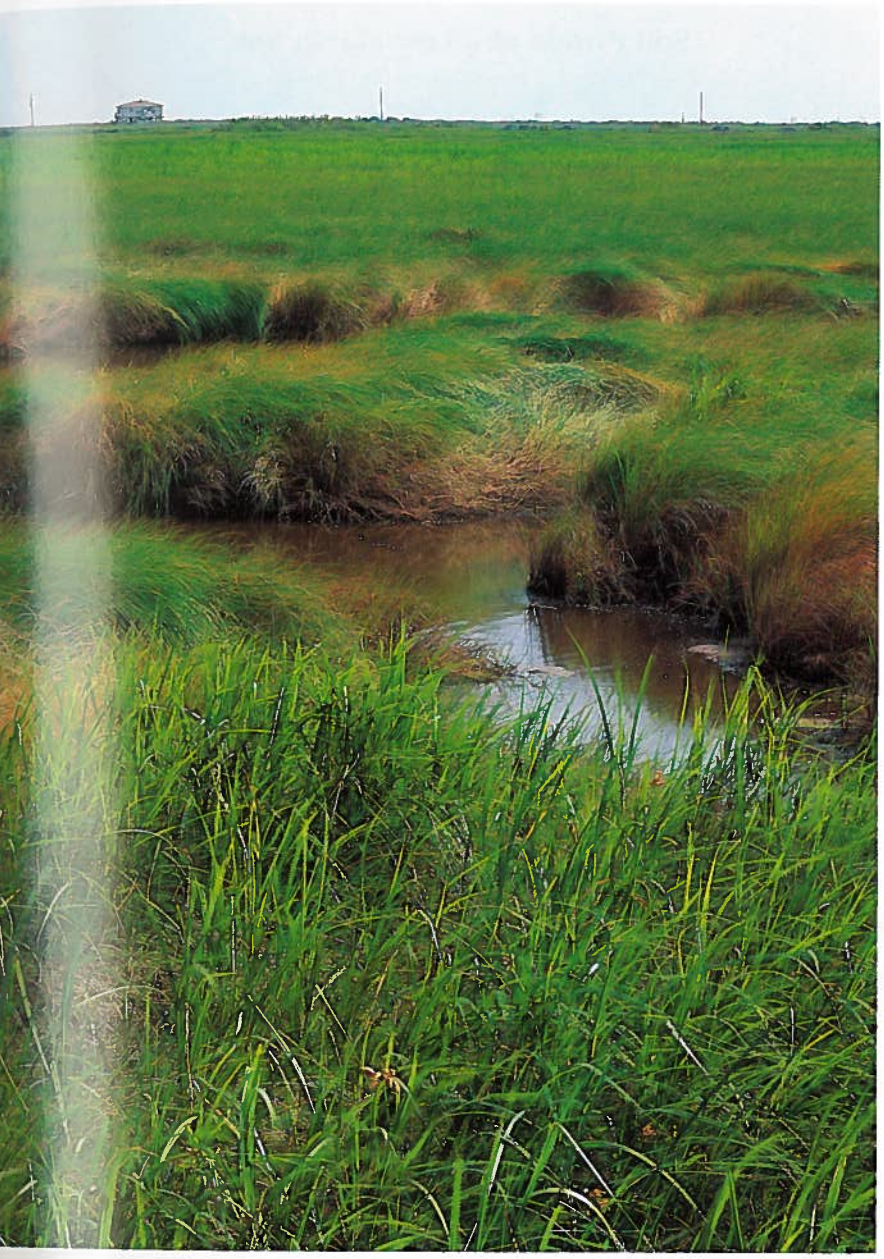
A tidal fringe wetland near Sea Rim State Park in Jefferson County. (© Stephan Myers)

Estuarine or Tidal Fringe Wetlands

Where Are They?

Estuarine or tidal fringe wetlands can be vegetated (marshes) or unvegetated (mud and sand flats), and are found between the open saltwater of the bays or Gulf and the uplands of the coastal plain and barrier islands. These wetlands may occur in small strips just 10 to 20 feet wide or may be several miles wide and occupy thousands of acres. Marshes are almost always in protected areas along bay shorelines or on the bay sides of barrier islands and peninsulas. Without protection, wave energy is too great for salt marsh vegetation to get established, which is why we seldom see salt marshes on Gulf-facing beaches.

These marshes are also found on the back or bay sides of barrier islands, and also may extend inland a few miles along some of the major and minor streams that drain into the Gulf.



Geology and Soils

Except for the Chenier Plain and Laguna Madre (see below), most Texas estuarine wetlands are in river valleys that flooded when sea level rose between 18,000 and 4,000 years ago. When sea level was lower, the coastal rivers cut deep valleys into the coastal plain sediments. Most of our salt marshes have formed around the bays that resulted from the flooding and filling of these ancient river valleys. Some of these valleys have since completely filled in with sediment (for example, the bays of the Brazos, Colorado and Rio Grande). The other rivers have yet to fill in the bays into which they flow.

Estuarine wetland soils can range from clayey to sandy, but clayey soils dominate most marshes. These young soils are alluvium (carried by moving water) deposited mostly during the Holocene during the last 10,000 years.

Soil Profile of a Low Marsh Soil

(Tracosa Soil Series, near Bastrop and Christmas Bays, Brazoria County)

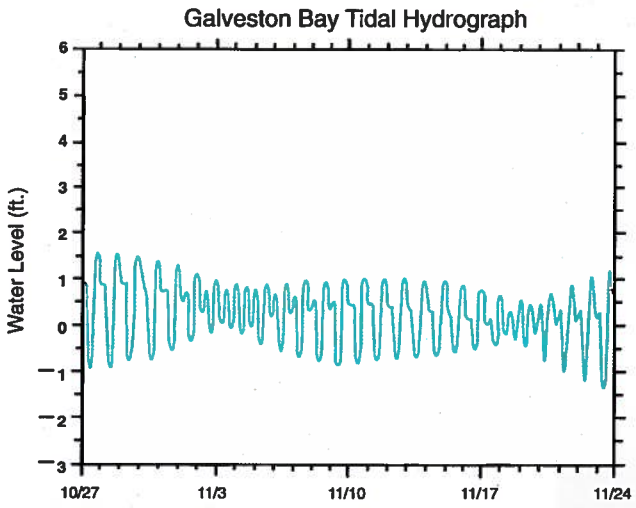
The surface soil to a depth of 4 inches is a dark gray mucky (organic-rich) clay that flows easily between the fingers, leaving a slight residue. It is strongly saline with a pH of 7.5.

The subsoil to a depth of 62 inches is a very sticky and plastic (moldable) gray clay. It is strongly saline with a pH of about 8.0.

This soil is inundated with 2-12 inches of water during the daily high tides. One or two inches of water usually remain on the surface during low tides.

(from the Soil Survey of Brazoria County)

Salt marsh soils have the most organic matter of any Texas wetland soils. They are still considered mineral soils because the organic matter is never more than 20 percent in the surface horizon, and usually much less. This is in contrast to the highly organic soils that occur in the salt marshes of the Mississippi Delta in Louisiana.



Daily and monthly fluctuations in tide levels in Galveston Bay. (Re-drawn by Regina Kubelka based on material from the Texas A&M University-Corpus Christi Blucher Institute's website.)

Hydrology

Salt marshes are flooded by tides and their salinity and plant communities depend upon how much freshwater is delivered to the wetlands by the rivers that flow into the bays. The **high marsh** is only irregularly flooded by tides, and may go for extended periods without flooding. The **low marsh**, on the other hand, is subject to regular flooding, at least once a day. Areas that are continuously flooded are outside the salt marsh zone, but may still have some submerged vegetation near the shore (seagrass, for example).

Terminology to describe the estuarine marshes is quite varied and far from standardized. In reality, there is both a hydrologic as well as a salinity continuum, with the frequency of flooding varying as well as whether the area is flooded with salt or fresh water. Freshwater backing up against high tides floods some fresh marshes along coastal rivers.

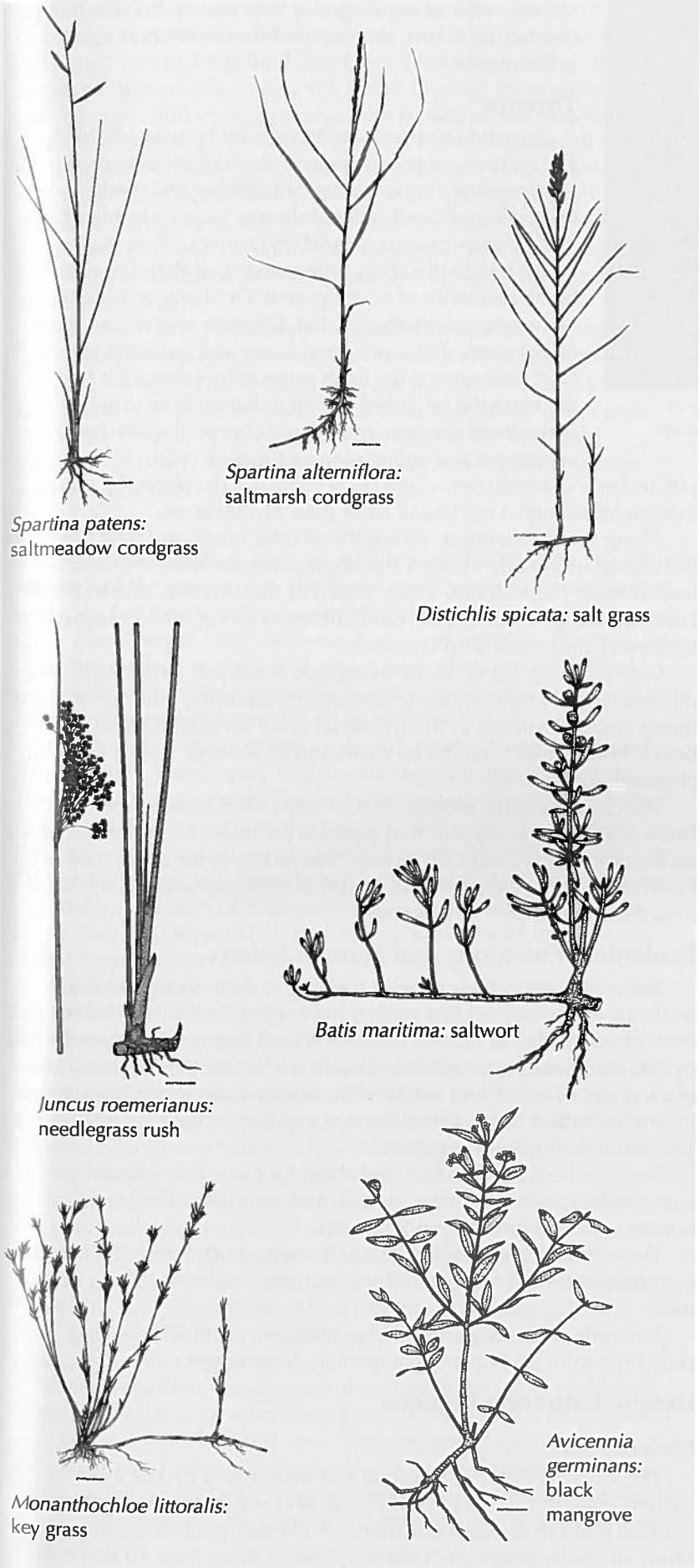
Gulf Coast tides do not vary much in elevation, typically only about 1 foot in vertical difference between low and high tide. We often see larger tidal ranges due to the wind, particularly if the wind is in the same direction as the tide. For example, some of our lowest tides occur at low tide in the winter with a strong northwest wind. There are many tidal flats that are exposed only at this time of year. And the highest tides often occur at high tide with a southeasterly storm.

Vegetation

Cordgrasses of the *Spartina* genus are the most prominent salt marsh vegetation. Flooding frequency (how often) and duration (for how long) (see Hydrology) and the salinity level are the most important variables that control the kinds of plants that occur in the salt marsh. In the high marsh, saltmeadow cordgrass might be the most common grass, whereas in the lower marsh, saltmarsh cordgrass is more common. Additional vegetation includes saltgrass, saltmarsh bulrush, and needlegrass rush among others.

Animals

Typical animals include herons, egrets, ibises and other wading birds that feed on the fish, shrimp, crabs and other invertebrates found in the wetlands. Shorebirds and waterfowl are abundant. The American alligator feeds on fish, snakes, turtles, frogs, muskrats, nutria, swamp



Spartina patens: saltmeadow cordgrass

Spartina alterniflora: saltmarsh cordgrass

Distichlis spicata: salt grass

Juncus roemerianus: needlegrass rush

Batis maritima: saltwort

Monanthochloe littoralis: key grass

Avicennia germinans: black mangrove

DRAWINGS BY CHARLES D. STUTZENBAKER

New developments to accommodate the rapid increase in population may be the greatest threat to estuarine wetlands. (©Stephan Myers)

rabbits, rats and anything else it can catch. Bobcats, coyotes, raccoons, skunks, mink and river otters also hunt in the marshes.

Threats

Estuarine wetlands are threatened by land subsidence and relative sea level rise that causes marshes to drown and be converted to open water. Subsidence and dredged channels and canals allow saltwater to intrude inland into fresher areas causing vegetation changes. There is direct marsh loss to dredging, filling, and spoil deposition caused by various kinds of development. Dredging activities cause increased water turbidity that threatens seagrasses. Dams on the rivers that supply freshwater and sediment to the bays have altered the fresh water inflow processes that maintain the estuaries. Runoff pollution from urban and agricultural sources, and oil and chemical spills damage vegetation and animals. Since the mid-1950s, the area of salt and brackish marshes on the Texas coast has decreased by more than eight percent; a net loss of more than 31,000 acres.

Along the entire coast, unvegetated tidal mud/sand flats have decreased in area by about 13 percent since the mid-1950s; a net loss of more than 30,000 acres. Much of the loss was due to the construction of dredge-spoil compartments along the Intracoastal Waterway and other ship channels.

Even in south Texas, black mangrove is subject to periodic severe dieback caused by freezing temperatures. Another, more permanent threat is development in the intertidal zone for resorts, marinas, beach houses and boat docks, roads and causeways, canals and ship channels, and so on.

The Laguna Madre is being filled in with wind-blown sand from Padre Island. The sandy flats that separate the upper and lower Laguna is an area called the Land-Cut; a name that relates to the excavation of the Gulf Intracoastal Waterway. This region of the Laguna filled with wind-blown sand perhaps 150 years ago.

Shrimp are just one species of fish and shellfish that are dependent on estuarine habitats for at least part of their life cycle. (Jamey Tidwell)

Ecological Functions and Human Values

Many economically important finfish and shellfish use estuarine wetlands during at least part of their life cycles. The wetland habitats are used for spawning, as nursery areas, and for foraging. Shrimp, crabs and oysters all depend upon estuarine habitats. Predatory fish like red and black drum, seatrout, and southern flounder are supported by estuarine invertebrates and forage fishes like bay anchovy, striped mullet, bay silversides, killifishes and gobies.

Seagrass beds provide feeding habitat for game fish, migratory waterfowl (especially redhead ducks), and sea turtles. They serve as nursery areas for fish, crabs and shrimp.

These fish and wildlife habitats help support economically important commercial and recreational fishing, hunting and birdwatching industries.

Estuarine wetlands perform other functions such as protecting shorelines from erosion and dampening storm surges.

Unique Estuarine Regions

Chenier Plain

The Chenier Plain is a unique salt marsh area on the extreme eastern edge of the Texas Gulf Coast, and is part of a much larger chenier plain in western Louisiana. A chenier plain is a series of sandy or shelly ridges or "cheniers," many more than 10 feet high,

separated by clayey or silty marsh deposits. The distance from chenier to chenier may be as much as 1 or 2 miles or more. "Chenier" comes from the French word for oak, which is the dominant tree on the ridges. The Texas Chenier Plain started to form about 3,000 years ago when the mouth of the Mississippi River shifted to the west bringing an increase in sediment to southwestern Louisiana and extreme southeast Texas. These sediments built marshes out into the Gulf. During periods of low sediment input, wave action reworked the Gulf-facing sediments into ridges or cheniers, until the next pulse of sediment built marsh further out into the Gulf again, resulting in the characteristic series of ridges.

The mouth of the Mississippi has shifted repeatedly during the last 3,000 years causing alternating slow beach deposition and rapid marsh building into the Gulf. In this way, the once broad bay of the Sabine and Neches Rivers was cut off from the Gulf by the deposition of the Chenier Plain wetlands. Wetlands in the low areas between the beach ridges are estuarine salt and brackish marshes connected by tidal channels to Sabine Pass.

Black mangrove in South Bay in Cameron County. (DAN MOULTON)

Laguna Madre

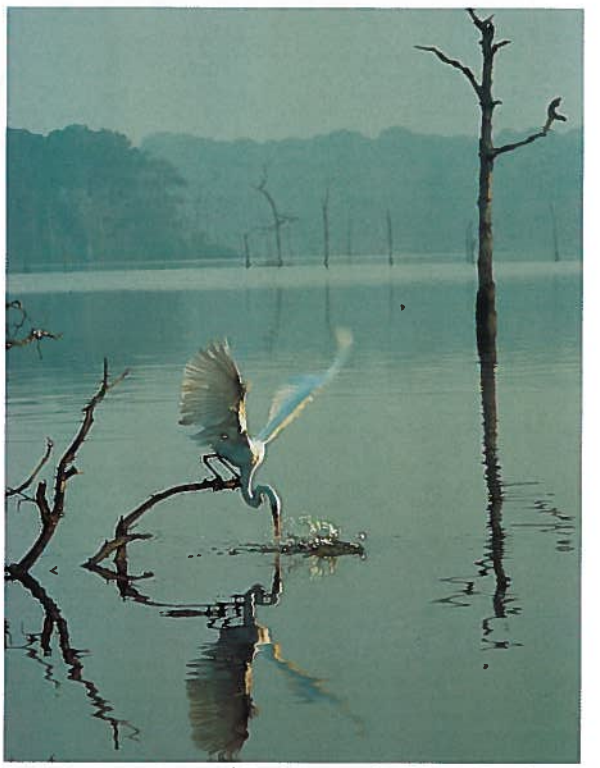
The Laguna Madre is the very salty lagoon that supports the estuarine wetlands of the lower coast. The lower coast has extensive estuarine wetlands, but they bear little resemblance to the lush emergent marshes of the humid upper coast. Saltwort, glassworts, saltgrass, keygrass, sea-purslane, sea-oxeye, and a few other plants dominate the limited emergent salt marshes fringing the Laguna. Saltmarsh cordgrass is only a minor component of lower coast salt marshes.

Fringing the Laguna Madre are broad, nearly unvegetated **wind-tidal salt flats**. These sandy flats are not regularly flooded by tides. They are only occasionally flooded when strong winds push shallow water from the Laguna onto the low flats. The cycle of irregular flooding and drying causes salt to build up on the surface of the flats. These salt flats are inhospitable to most vascular plants, but are often covered by vast mats of blue-green algae. These habitats may look barren, but they support rich invertebrate populations that, in turn, attract large numbers of shorebirds and wading birds.

Black mangrove, a tropical species, forms shrub wetlands in the intertidal fringe of the Laguna Madre. Four species of tropical mangroves occur around the Gulf of Mexico, but only black mangrove is found north of the Rio Grande. Mangrove wetlands can be seen along the causeway between Port Isabel and South Padre Island, and fringing South Bay, just south of the Brownsville Ship Channel near Brazos Santiago Pass. Mangroves also occur near Harbor Island in Aransas Bay near Aransas Pass.

Mangrove wetlands support many invertebrates such as snails, crabs, mussels and amphipods. On high tides, shrimp and fish enter the mangal to feed. These animals attract wading birds like the reddish egret, other egrets and herons, ibises, night-herons, roseate spoonbills, and wood storks. Almost all the shorebirds, gulls and terns found on the lower coast also use the mangals, as do the predators mentioned above.

Seagrass beds are much more abundant in the upper and lower Laguna Madre than in other Texas bays. This is because the waters of the Laguna are shallow and clear, allowing good light penetration to the grass beds. The waters are clear because the Laguna bottoms are sandy and generally lack clayey sediments. There are no rivers feeding clayey sediments into the Laguna and the Rio Grande flows directly into the Gulf.



Great egret at Armand Bayou near Galveston Bay. (JACK LEWIS FOR TEXAS DEPARTMENT OF TRANSPORTATION)

Prairie Pothole and Marsh Wetlands

Where Are They?

The term "pothole" is used up and down the coast to refer rather loosely to any freshwater depression. The difference between a pothole and a marsh is mostly size—marshes occur in larger and generally less well-defined depressions than potholes. This section is limited to freshwater depressions that occur on the Lissie and Beaumont Geological Formations, and the Ingleside Sand (see below and wetland types map)." Pothole" appears to be the most common term on the coast for these depressions, but usage varies widely. In the Beaumont outcrop in Willacy County, for example, the depressions are commonly referred to as lagunas or lagunillas.

A prairie pothole complex on the Ingleside Sand in Calhoun County. (Wayne Wentworth, Texas Parks and Wildlife)

Prairie potholes and marshes occur on the prairie from just west of Beaumont to the Rio Grande. These wetlands once covered vast expanses of prairie before urbanization and agriculture destroyed most of them. Approximately 30 percent of the prairies was once wetlands. On the upper coast, potholes and marshes occur in complexes with pimple mounds (small hummocks 1-2 feet tall) and intermound flats. The pattern of mounds and wetlands is often quite intricate with abundant interfingering of uplands and wetlands. Pothole/marsh complexes in the Coastal Bend and lower coast regions have somewhat less relief than those of the upper coast.

This complex pattern, formed thousands of years ago by ancient rivers and bayous, and modified through time by climatic (especially wind) and biotic forces, is an irreplaceable geological legacy. Once these complexes are gone, there is no replacing them. The chance confluence of the many unique factors responsible for the evolution of these wetland complexes is unique to them, and makes them a "chance-medley" we cannot repeat. We understand very little about the complex role this wetland pattern plays in coastal prairie ecology.

Because of extensive land leveling for agriculture, there are very few intact complexes left with the full range of relief, from high pimple mounds to deep potholes. Some of the best remaining complexes are in urban fringe areas. Unfortunately the same areas are now under greatest threat from development.

An example of a prairie pothole in Matagorda County. The small knoll is a pimple mound. (John Jacob)

Geology and Soils

The most extensive prairie potholes and marshes are found on the Lissie and Beaumont Geological Formations. These potholes are remnants of the rivers that laid down the great floodplain and delta sediment deposits that make up most of the coastal plain, but the original morphology has been greatly modified by wind and other agents. The riverine nature of these scars is sometimes quite obvious, while in other places it is more obscure. The wetlands with the most obvious riverine features are found on the Beaumont Formation and range in age from 15,000 to more than 30,000 years old, while the potholes on the Lissie Formation are for the most part more than 100,000 years old. The Katy Prairie west of Houston is one of the more

DRAWINGS: REGINA KUBELKA

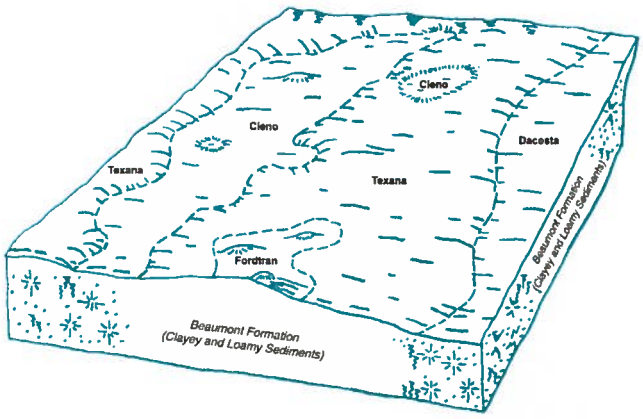
well known prairies on the Lissie Formation with abundant pothole wetlands.

Soil Profile of a Prairie Pothole Wetland
(Cieno Soil Series, Prairie Pothole, Jackson County)

The surface soil to a depth of about 25 inches is a dark grayish brown sandy clay loam with brownish iron coatings along old root channels and cleavage faces. The subsoil from 25 to 60 inches is a light brownish gray sandy clay loam with brown iron stains. The soil is neutral in the upper part and moderately alkaline in the lower part.

This soil is ponded with water for periods ranging from a few weeks to several months in the winter and early spring.

(from the Jackson County Soil Survey)

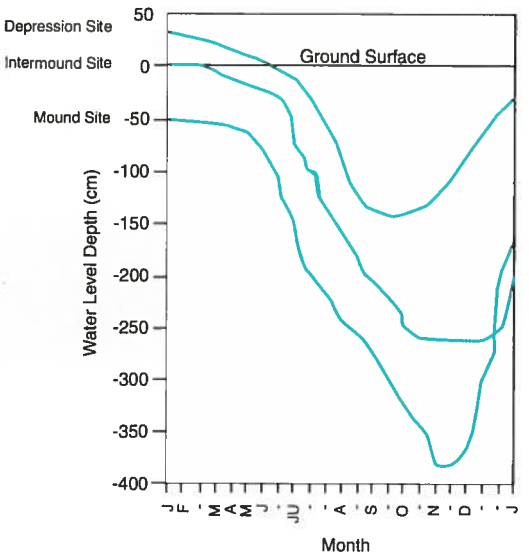


Soil-landscape diagram from the Jackson County Soil Survey. The Cieno (pothole) and Texana (ridge) soils represent a prairie pothole complex. Pimple mounds (Fordtran soils) occur on ridges or in the potholes. (REDRAWN FROM THE JACKSON COUNTY SOIL SURVEY)

Hydrology

Prairie potholes and marshes are inundated by direct precipitation and by runoff from surrounding flats. Groundwater may be a factor in many potholes, particularly those on the Ingleside Sand (see below), but its role is not well understood. Hydrology in pothole complexes is very diverse, with pronounced changes occurring within just a few feet. Deeper potholes can remain saturated for more than 6 months out of the year, while adjacent pimple mounds may be nearly semi-arid for most of the year. Almost every intermediate hydrologic state will be found associated with potholes and marshes of varying depths and surrounding elevations. This hydrologic complexity translates into high habitat and biological diversity.

Hydrology changes markedly in these wetlands as one moves down the coast. Many potholes on the upper coast remain inundated for several months out of the year, with six months of wetness not uncommon in the deeper potholes. Most Coastal Bend and lower coast potholes, on the other hand, may remain saturated for only a few weeks to perhaps a month or so at a time.



Soil water table hydrographs for a prairie pothole site in Harris County, Texas. The lines represent the depth of the water table (or depth of inundation) throughout the year. (ADAPTED FROM GRIFFIN ET AL 1998)

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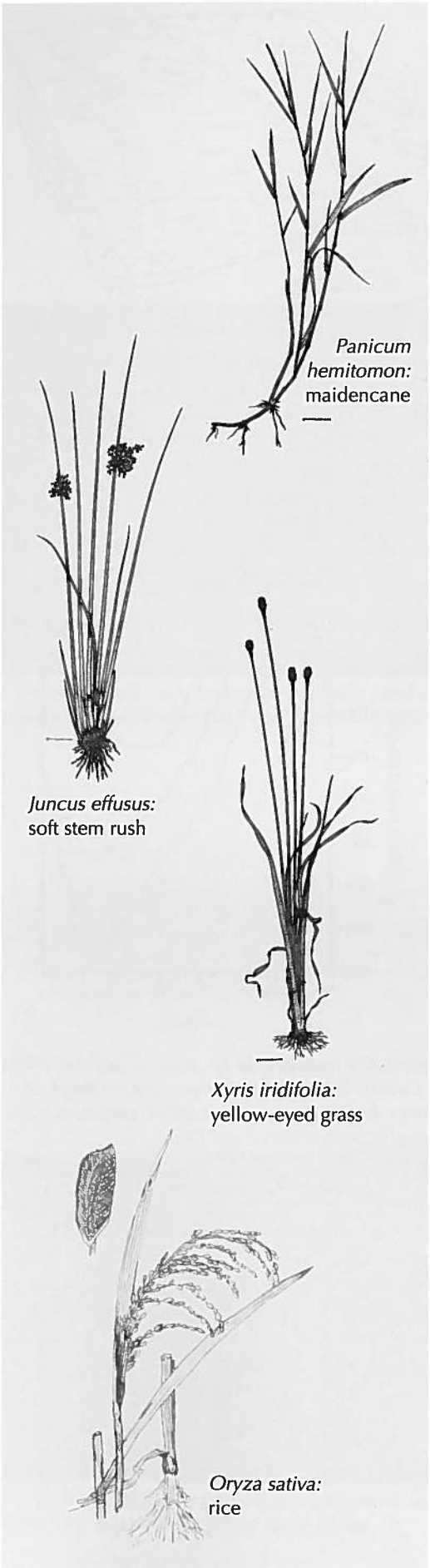


Vegetation

Potholes and marshes typically have concentric zones or belts of different habitat types. These habitats are determined by elevation and hydrology; that is, the amount and permanence of the water in each zone. The more permanent potholes may have floating and submerged plants like water lilies, pondweeds, southern naiad, and duckweed in the open water zone. The emergent zone might include cattails, bulrushes, burheads, arrowheads, and common reed. A still higher woody zone may include trees and shrubs like black willow, buttonbush, rattlebush and coffee bean, baccharis, Chinese tallow-tree (an introduced invader) on the upper and mid-coast, and retama on the mid- and lower coast.

The edges of less permanently flooded potholes and marshes might have bushy bluestem and various other grasses, spikerushes, rushes, and sedges as well as the shrubs and trees mentioned above.

Animals

Pothole/marsh wetlands and wetland/upland complexes play host to a very diverse fauna because of the great variety of habitats. Reptiles and amphibians include alligators, Gulf Coast ribbon snakes, cottonmouth moccasins, red-eared sliders, southern leopard frogs, bullfrogs, and green treefrogs. Birds include rails, cranes, all wading birds, dabbling ducks, coots, common moorhens, snipe, blackbirds and grackles, shorebirds like killdeer, marsh and sedge wrens, swamp sparrows, and most all migrating songbirds. Almost all resident animals use the ponds to drink. During drought, all wildlife concentrates near the more permanent potholes.

Threats

Agriculture was once the greatest cause of the loss of prairie potholes and marshes. Urban sprawl is probably the cause of greatest loss today. Federal wetland regulatory protection has not prevented the loss of these wetlands. The cumulative loss has been significant. On the Texas coastal plain, freshwater marshes have decreased by 29 percent since the mid-1950s, a net loss of more than 235,000 acres!

Ecological Functions and Human Values

In the spring, pothole/marsh wetlands are especially important to birds migrating across the western Gulf of Mexico. These habitats are the first source of freshwater encountered by migrants and are heavily used by songbirds, shorebirds and waterfowl and other waterbirds. These birds represent an important economic resource for coastal cities and towns. Birdwatching is a rapidly growing segment of the nature tourism industry. Coastal communities with the foresight to protect and promote these habitats will reap great long-term economic benefits. To destroy these wetlands is to "kill the goose that lays the golden egg."

These habitats are also important to resident wildlife, particularly in the semiarid coastal regions and in times of drought. They also provide water and forage for livestock.

Special Pothole and Marsh Areas

Rice Fields

Most of the prairie potholes and marshes have been greatly modified by farming, principally for rice from Victoria to Beaumont. While rice farming has greatly modified the wetlands through land-leveling, many of the potholes remain, even if somewhat shallower than before modification. Rice is farmed only 1 year out of 3, with the other two years fallow or resting. Because of the flooding that accompanies rice cultivation and the rest or fallow period, these farmed potholes retain much of their wetland character, with a moderate soil seed bank of native

ORYZA SATIVA: REGINA KUBELKA; ALL OTHERS: CHARLES D. STUTZENBAKER

wetland plants. More recent practices involving laser and water leveling, unfortunately, level the potholes completely.

Rice fields can themselves be considered a type of wetland because the fields remain flooded for significant periods. Rice fields are by far, at about 1.5 million total acres, the most abundant type of wetlands on the Texas coast. In addition to the grain, rice fields also provide other benefits to wildlife and people. The huge wintering waterfowl populations, particularly geese, enjoyed by Texas hunters and bird watchers are quite dependent on the rice farming industry. Rice fields also provide habitats for large numbers of invertebrates such as insects and crayfish. These attract herons, egrets and other wading birds, sandpipers, plovers and other shorebirds, gulls and terns, mammals, reptiles, and amphibians.

An aerial view of a coastal rice field. (DAN MOULTON)

Even rice field wetlands face threats. Urban and suburban sprawl eliminates farmland of all kinds as developmental pressures drive up land values. However, the most serious threat to rice farming now seems to be the changing markets and subsidies that rice farmers have come to rely on. Much rice acreage will probably be converted to other crops that will not provide wetlands or support waterfowl. This does not bode well for a large segment of North American ducks and geese.

Ingleside Sand Freshwater Depressions

The Ingleside Sand is a remnant of an ancient barrier island or strandplain system that faced the coast during a previous period of high sea level (about 50,000 to 75,000 years ago). A strandplain is a mainland shoreline built seaward by a series of accumulated sandy beach ridges. During this period, this strandplain was somewhat analogous to the barrier islands that line the coast today, but the effects of wind and other geomorphic agents have greatly modified the original ridge and swale topography. Highs and lows are found on the Ingleside Sand, but they are much less elongate than those found on the barrier islands today.

The Ingleside Sand is especially evident along the Coastal Bend region from south of Corpus Christi Bay north to Matagorda Bay. The Encinal (Flour Bluff), Live Oak (Aransas Pass and Rockport), Blackjack and Lamar (Aransas National Wildlife Refuge), and Calhoun (Seadrift-Port O'Conner Ridge) Peninsulas are the remnants of the ancient barrier sands.

Ingleside Sand pothole in the Aransas National Wildlife Refuge (JOHN JACOB)

Vegetation in the Ingleside depressions is frequently similar to the vegetation found in nearby prairie potholes. The soils as a rule are much sandier, very similar to the present-day barrier island complexes, except that the Ingleside soils frequently have a layer with more clay below 30-40 inches. Groundwater may be a more important factor in these wetlands than in nearby prairie potholes of the Beaumont Geological Formation. Rainwater rapidly penetrates the sandy soils, and the claypan acts to hold the water much as a cistern would.

Lower Coast Potholes and Marshes

Lower coast pothole and marsh depressions occur in a semi-arid environment. A complex geologic unit that includes some Sand Sheet wetlands and Beaumont and Lissie-aged potholes has been lumped into one map unit, the Prairie Potholes-Lower Coast. Very little descriptive work has been done on these wetlands. The hydroperiod or time that these wetlands are wet is less than that of potholes to the north and east, but is definitely long enough for wetland vegetation to have developed in these depressions.

The interdune swales are particularly apparent in this aerial of Matagorda Island. The Matagorda Lighthouse is visible in the left foreground. (Earl Nottingham for Texas Parks and Wildlife)

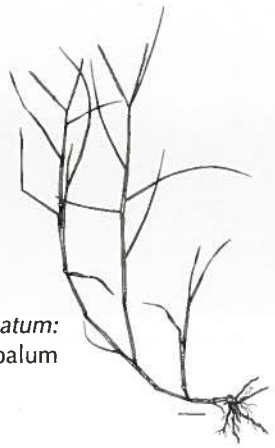
Barrier Island Interior Wetlands

Where are they?

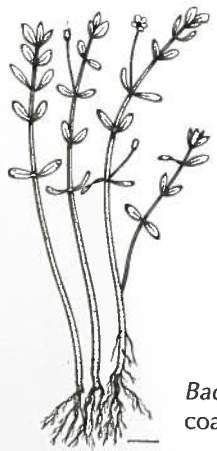
Barrier island nontidal, freshwater wetlands are found in interdune swales (troughs between dune ridges) and on the larger, interior wind-eroded flats on the barrier islands that line the Texas coast. Tidally influenced wetlands on the bay margins of the islands are included with the Tidal Fringe wetlands.

Geology and Soils

The Gulf-fringing barrier islands are about 4,000 years old. The barrier islands formed as a result of wave action that reworked sands delivered to the Gulf by the coastal rivers and creeks. The Gulfward advance of successive beach ridges over time has resulted in a series of ridges and troughs. The dunes of the wet upper coast barriers are better vegetated and less subject to wind and water erosion than dunes on the semiarid lower coast barriers.



Paspalum vaginatum: seashore paspalum



Bacopa monnieri: coastal water-hyssop

Soil Profile of a Barrier Island Trough

(Mustang Soil Series, Mustang Island, Nueces County)

From 0 to 6 inches the surface soil is a loose, single-grained, brownish gray fine sand, with many fine roots and few shell fragments.

The subsoil from 6 to 72 inches is a single grained, light gray fine sand, with few fine faint yellowish brown iron coatings along root channels in upper 20 inches. The soil is neutral throughout.

(from the Nueces County Soil Survey)

DRAWINGS BY CHARLES D. STUTZENBAKER

Hydrology

Water in the nontidal barrier island troughs is derived from a combination of runoff from the adjacent dunes and from groundwater. Water percolates through the sandy dunes very easily, and generally comes to the surface in the swales between the dunes. Many of these swales in fact rarely have ponded water on the surface, but because groundwater is found just under the surface for extended periods of time, only wetland vegetation can survive.

On the barrier islands, fresh groundwater, which is less dense (lighter) than saltwater, forms a freshwater lens, which sits atop the underlying saltwater. As the sediment layers of the coastal plain subside under their own weight, there is a relative rise in sea level and the freshwater lens rises closer to the surface. This natural subsidence is greatly magnified in regions where people have pumped massive quantities of groundwater or oil and gas. On North Padre Island, within the Padre Island National Seashore, this process has caused an apparent increase in freshwater wetlands.

Panicum hians: gaping panicum

Vegetation

Wetland plants are similar to those found in other freshwater marshes, but may include some brackish-water species due to elevated soil salinity in some areas. Typical species include saltmeadow cordgrass, southern cattail, bulrushes, coastal water-hyssop, coastal plain pennywort, spikerushes, flatsedges, sedges, burhead, marsh fimbry, white-topped sedge, frogfruit, coffee bean, seashore paspalum, bushy bluestem, and other grasses.

Animals

Many of the same animals found in mainland marshes are also present in the barrier island wetlands, although the diversity of species is less than on the mainland. Reptiles and amphibians include several species of frogs and toads, mud and red-eared slider turtles, Gulf Coast ribbonsnake, and alligators. Mammals include rice rats, raccoons, and feral pigs. Birds include ducks such as the mottled duck, and teals; and other water birds like coots, rails, gallinules, and grebes. Wading birds include herons, egrets and ibises. Shorebirds include sandpipers, long-billed curlew, whimbrel, willet, yellowlegs, snipe, black-bellied plover, killdeer, and dowitchers. Perching birds include the sedge wren and red-winged blackbird.

Threats

The major threat is draining and filling for development of beach houses, condos, hotels, marinas, boat docks, and their supporting infrastructure. The destruction of dune-stabilizing vegetation by human activities can cause dunes to migrate and fill wetlands.

Ecological Functions and Human Values

In times of ample rainfall, these depressions provide scarce freshwater and wetland habitats for island fauna. In dry years, when these depressions are dry, biological diversity on the barriers is depleted.

The depressional wetlands play a role in regulating the fresh groundwater levels; many acting as recharge areas when the groundwater level declines.

The major threat to barrier island interior wetlands continues to be development — houses, condos, hotels, marinas — and the supporting infrastructure. (© Stephan Myers)

DRAWING BY REGINA KUBELKA

Texas Coastal Sand Sheet Wetlands

A depressional wetland on the Texas Sand Sheet. All of the greener grass is wetland, with the deepest part of the wetland inundated with water. A dune complex is in the background. (Dennis Brezina, NRCS)

Where Are They?

The Texas Coastal Sand Sheet is a large sheet of wind-blown sand and silt covering most of Kenedy and Brooks Counties, and parts of Kleberg, Starr, Hidalgo, and Willacy Counties in South Texas. Wetlands seem out of place in this desert-like landscape of dunes and blow-outs, but they are a common part of the interdune depressions.

Geology and Soils

The Coastal Sand Sheet is a very young and dynamic geological feature. Wind erosion is an active process that has been shaping this landscape for at least the past 10,000 years. Many parts of the Sand Sheet are somewhat "stable" in that blowouts have not occurred for hundreds and possibly a few thousand years, but much of the sheet is covered with active dune complexes that are migrating northwestward.

Wind shapes the landscape by creating convex dunes. But for every convex dune, a concave trough or deflation depression is also created, and if these depressions are close enough to the water table, a wetland will be formed.

The soils are very sandy. A slightly more clayey layer may be found at depth. Many of the wetland soils are fairly saline because sea spray is blown inland by the onshore winds. Evaporation then concentrates salts in the soil.

Profile of the Topo Soil Series, Kenedy Ranch. The vertical "streaks" are filled-in crawfish burrows. (John Jacob)

Soil Profile of a Sand Sheet Wetland

(Topo Soil Series, Deflation Hollow of Banner Dune Complex, Kenedy County)

The surface soil to 10 inches is a slightly saline grayish brown fine sandy loam with a few iron stains on old root channels and pores. The subsoil to 50 inches is a slightly saline light gray fine sandy loam with few reddish brown iron stains on channels and pores. About 15 to 20 percent of the subsoil volume is composed of filled-in and fresh crawfish burrows. The subsoil below about 50 inches is a moderately saline greenish gray fine sandy loam with olive and greenish gray stains. The soil is moderately alkaline throughout. The soil ponds water in places for a few weeks at a time, and is saturated in the upper part for periods of several weeks through the fall and spring seasons.

(from Kleberg-Kenedy Soil Survey)

Hydrology

Water is generally in short supply in this semi-arid environment, but enough of it collects often enough to support a complex wetland ecosystem. Much of the water in the depressional wetlands is from the groundwater that percolates through the sandy dune complexes. Groundwater can be locally quite saline due to soil salinity . The Sand Sheet is an effective water collector because water easily percolates through the sand and is not lost to evaporation. A clay pan or restrictive layer keeps the water from percolating too deep, and it comes to or very near the surface in some interdune swales. The clay pan may have only slightly more clay than the overlying layers, but it is sufficient to slow

water movement down. Runoff may also play a role, particularly in the more stabilized areas without large dune complexes.

Vegetation

These wetlands support plant assemblages that reflect the range of salinity found in these depressions. The fresher ponds have species like California bulrush and common three-square bulrush, spikerushes, flatsedges, cattails, white-topped sedge, paspalums, Gulf cordgrass, and other water-tolerant grasses.

The more saline wetlands have more salt-tolerant species like keygrass, saltgrass, sea oxeye, Carolina wolfberry, seablight, and Gulf cordgrass.

Animals

Many of the same animals that are found in the barrier island interior wetlands are also found here. Alligators would not be expected on the Sand Sheet. The wetlands support nesting birds including fulvous and black-bellied whistling ducks, mottled duck, American coot, common moorhen, pied-billed and least grebes, and ruddy duck. Of course, in this semiarid climate, all wildlife and livestock rely on the ponds for drinking water.

Threats

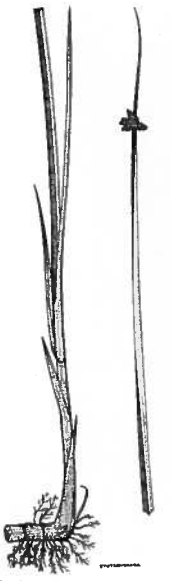
As long as these wetlands remain part of a rangeland dedicated to livestock grazing, they probably will be fairly safe from development. If and when the large ranches are divided into smaller tracts of land, development could threaten these wetlands.

Ecological Functions and Human Values

Many of the fresher ponds are above the salty groundwater and help to recharge the shallow aquifers with freshwater runoff.

These wetlands are like magnets for birds and other wildlife in this semiarid climate. These ponds and wetlands provide drinking water and food for all animals including livestock.

The King and Kenedy Ranches own a large part of this region. Both ranches are incorporating nature tourism, as well as hunting, into their operations.



Scirpus pungens:
three-square bulrush

Lycium carolinianum:
Carolina wolfberry

DRAWINGS BY CHARLES STUTZENBAKER

Hiking through cypress in the Big Thicket. (John Suhrstedt, Texas Department of Transportation)

Riverine Forested Wetlands

Where are they?

Riverine forested wetlands are found on the floodplains of rivers and streams that cross the middle and upper coastal plain. The larger rivers of the wet upper coast, such as the Sabine, Neches, Trinity, and Brazos Rivers, have broad floodplains that support extensive forested wetlands. Smaller rivers and streams of the semi-arid lower coast do not flood for long enough periods to support extensive forested wetlands.

Swamps are the wettest type of riverine forested wetland in Texas. True swamps are found mostly in East Texas, from Houston east to the Sabine River. **Bottomland hardwood forests,** the most common type of riverine forested wetlands on the upper and mid-coast, are not as wet as swamps.

Geology and Soils

The floodplain soils of the riverine wetlands are all relatively young compared to the adjacent upland soils. Floodplain soils are constantly renewed by continual sedimentation, such that sedimentary stratification is still evident in many of these soils. Nearly all floodplain surfaces on the Texas coast are well under 10,000 years in age, and most are under 1000 years old. Clayey soils predominate. Organic soils are rare.

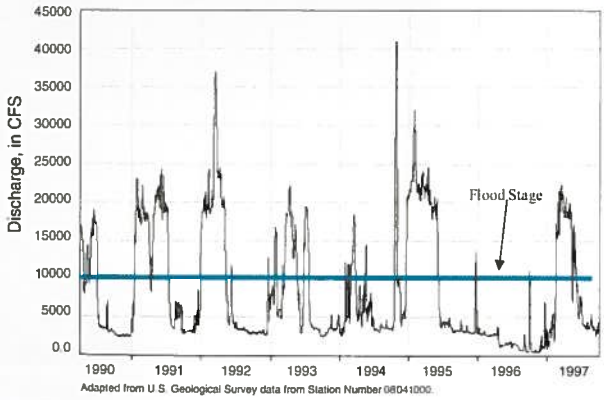
Soil Profile of a Bottomland Hardwood Forest

(Fausse Soil Series, slough in low terrace of Trinity bottom, Liberty County)

The surface soil to about 5 inches is a slightly acid dark grayish brown clay with many fine iron stains along old root channels. The subsoil to 60 inches is a dark gray clay which grades from neutral in the upper part to slightly alkaline in the lower part. Iron stains are common throughout the subsoil. The clay is very sticky and very firm throughout the profile.

The soil is continously saturated below a depth of 18 inches in most years, and is flooded or ponded several times a year for brief to very long periods.

(from the Liberty County Soil Survey)



Hydrograph of the Neches River at Evadale. The river floods almost every year from January through April-May (flood stage occurs above about 10,000 cfs). Source: USGS, http://waterdata.usgs.gov/

Hydrology

Overbank river flooding is the primary source of water for forested wetlands. On floodplains with distinctive wetland character, flooding occurs in most years and the flooding persists for at least several weeks at a time. Only the larger rivers have large-enough watersheds to maintain this kind of flooding. Most bottomland hardwood forests have flooding periods that range from a few weeks to several months. Swamps, on the other hand, stay flooded for much longer periods of time, and in fact may only dry out occasionally. The swamp forests occur in sloughs and other depressional features of floodplains, and occasionally in low floodplain terraces where runoff from rainfall may be the dominant source of water. Flooding periods decrease as one moves south along the coast and the climate becomes more arid.

Vegetation

The dominant trees of most swamps are bald cypress and water tupelo. Water hickory, water locust, black tupelo, planertree and

many others are also commonly found in the swamps.

On the upper coast, bottomland hardwood forests are dominated by willow oak, water oak, overcup oak, cherrybark oak, laurel oak, green ash, red maple, black willow, water tupelo, and others. Understory vegetation often consists of dwarf palmetto, Cherokee sedge, deciduous holly, yaupon, and many others. On the mid-coast, pecan hickory, American elm, cedar elm, water oak, live oak, green ash, hackberry/sugarberry, and sycamore often dominate the forests. The understory is similar to that of the upper coast.

Animals

Animals found in forested wetlands include bald eagles, wading birds, ducks, woodpeckers, warblers, frogs, salamanders, turtles, snakes, alligators, bats, rabbits, beaver, squirrels, bobcats, foxes, river otters, raccoons, and deer. Many river fishes such as gars, suckers, minnows and shiners, catfishes, bass, and sunfishes use flooded swamps and bottomland forests as feeding and breeding habitats.

Threats

Forested wetlands are perhaps the most rapidly disappearing wetland type in the United States. Agriculture and silviculture (pine plantations) are the major continuing threats to these wetlands. The character of a forested wetland is destroyed if all of the trees are cut down, even if the hydrology is not otherwise altered, and the wetland may require a hundred or more years to recover. Most of the swamp forests underwent severe deforestation in the early part of this century as high-quality cypress was over-harvested. These swamps are still in a recovery mode today. Many forested wetlands can be logged on a sustainable basis and still retain their major ecological functions.

Another major threat is the construction of dams and reservoirs on the rivers that supply water to these wetlands. In addition to the clearing or drowning of forested wetlands within reservoir floodpools, there is a long-term threat that results from the flood-control function of most dams. Once annual flooding is removed, the wetlands begin to dry out and become more susceptible to development pressures. Since the mid-1950s, forested wetlands on the Texas coast have decreased in area by about 11 percent, a net loss of more than 96,000 acres.

Ecological Functions and Human Values

In addition to providing timber and habitats for plants and animals, forested wetlands provide other valuable goods and services. These wetlands store floodwaters and dampen river flood crests, helping to control flood damage and erosion. They also improve human water supplies by filtering out sediments, nutrients, and pollutants; and by stabilizing river flows and groundwater levels. The fish and wildlife habitats help support fishing, nature tourism, hunting, and other recreational uses.

Taxodium distichum: bald cypress

Nyssa aquatica: water tupelo

Quercus michauxii: swamp chestnut oak

TOP AND MIDDLE DRAWINGS: CHARLES D. STUTZENBAKER; BOTTOM: REGINA KUBELKA

Coastal flatwoods wetland at the Armand Bayou Nature Center inundated in mid-late spring. The dominant tree is willow oak. (Andrew Sipocz, Texas Parks and Wildlife)

Coastal Flatwoods Wetlands

Where are they?

Coastal flatwoods occur on poorly drained flats between rivers (interfluvial zones) on the coastal plain. The flatwoods wetlands stretch from the Louisiana border west to about the Houston area, and they are extensive.

Geology and Soils

Most of the wet flatwood areas are on low Pleistocene terraces of the major rivers and streams of the Upper Texas Gulf Coast. The geological formations are the Lissie, Beaumont, and Deweyville Formations.

Flatwood wetlands are underlain by mineral soils, and most have a claypan within 20 to 30 inches below the soil surface.

Profile of the Waller soil. The "tongues" of gray soil in the reddish subsoil indicate paths of water flow and/or crawfish burrows. (Jon Wiedenfeld, Natural Resources Conservation Service)

Soil Profile of a Coastal Flatwood Wetland

(Waller Soil Series, in a hardwood wet flatwood)

The surface soil to a depth of 8 inches is an acid brownish gray loam; to about 22 inches it is an acid light brownish gray loam, with many yellowish brown mottles. To a depth of 60 inches, the subsoil is an acid grayish brown clay loam with yellowish brown mottles, with many tongues and pockets of light brownish gray loam.

This soil remains saturated for most of the winter and early spring months.

(From the Liberty County Soil Survey)

Hydrology

Inundation in the coastal flatwoods is primarily from local precipitation, and is a result of the very slow runoff that characterizes these flats. The flatwoods are often confused with bottomland hardwoods, but flatwoods are not inundated with overbank flooding from local streams or rivers. The wet flatwoods are typically wet during the winter and early spring months. The soils will be saturated, and shallow standing water will be present in many places. Most of the wetness appears to be derived from precipitation, although groundwater may play a role in the eastern flatwoods near Beaumont.

Vegetation

Coastal flatwoods can be dominated by either pine or hardwoods.

Common trees of the drier pine wet flatwoods are longleaf, shortleaf, and loblolly pines. The wetter hardwood flatwoods include willow and laurel oaks, swamp chestnut oak, cherrybark oak, and sweetgum, with dwarf palmetto common in the understory.

The southern extension of the Piney Woods region of East Texas once was occupied by poorly drained longleaf pine woodlands that extended south into eastern Harris County. This community was a matrix of beakrushes, sedges, and grasses with scattered longleaf pines and was maintained by frequent burning. As fire was suppressed by humans, trees and shrubs like black tupelo, sweetgum, wax-myrtle, and yaupon increased. Loblolly pine is now dominant and has been favored by the commercial timber industry.

Pinus palustris: long-leaf pine

DRAWING BY REGINA KUBELKA

The hardwood flatwoods occur on the Coastal Prairies and Marshes region of the upper coast. The suppression of fire may have favored hardwoods in some areas that were longleaf pine savanna.

Animals

The endangered red-cockaded woodpecker favors the open longleaf pine woodlands described above. Other animals of wet flatwoods include bald eagles, other woodpeckers, warblers and many other songbirds, amphibians and reptiles, bats, rabbits, squirrels and other rodents, bobcats, foxes, raccoons, and deer.

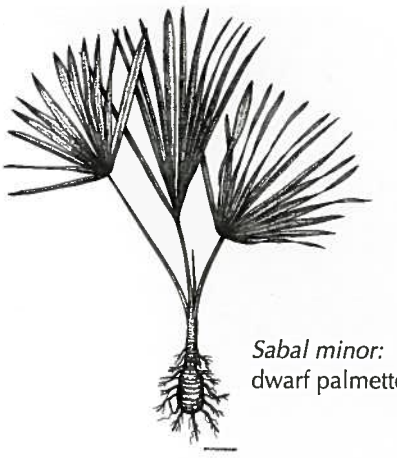
Threats

Major threats are similar to those for riverine-forested wetlands.

Since the mid-1950s, the area of commercial pine plantations (loblolly and nonnative slash pine) on the upper coast has increased by about 322,000 acres; an increase of about 390 percent! Some of this area was originally native pine or mixed pine-hardwood flatwoods.

Ecological Functions and Human Values

In addition to the timber and wildlife habitat values, flatwood wetlands perform most of the same water quality and flood control functions as riverine-forested wetlands.



Sabal minor:
dwarf palmetto

Quercus phellos
willow oak

Pileated woodpecker (Texas Parks and Wildlife)

TOP: CHARLES D. STUTZENBAKER; BOTTOM: REGINA KUBELKA

Gum Hollow in Nueces Bay (DAVE BUZAN FOR TEXAS PARKS AND WILDLIFE)

Lower Coast Riparian Wetlands

Where are they?

Lower coast riarian wetlands are river bottom wetlands and river-associated habitats from about the San Antonio River south to the Rio Grande. In this subhumid to semiarid region, some of these habitats are perhaps better called riparian corridors. Riparian habitats are usually transitional between uplands and wetlands.

Geology and Soils

Riverine wetlands on the middle and lower coast are limited to depressions on the floodplains of rivers and major creeks. For the most part, these depressions are scour features left by the rivers: oxbows, cut-off channels, etc. Most of the depressions, but not all, have fairly clayey soils because the slack water that fills the depressions tends to deposit clay rather than sand. The depressional soils may be quite stratified, and buried surface soils that represent periods of stability with little deposition are frequently found in the profile.

The lower Rio Grande Valley is by far the largest of the riverine systems of the lower coast. This broad valley is a riverine-deltaic plain laid down by the ancestral Rio Grande, and the oxbow features in this valley are locally known as **resacas**.

Soil Profile of a Depressional Riverine Wetland

(Grulla Soil Series, Rio Grande Floodplain, partially filled resaca, Cameron County)

The surface soil from 0 to 7 inches is a grayish brown clay that is extremely hard when dry.

The subsoil from 7 to 30 inches is a stratified light brownish gray clay, with many large reddish brown iron coatings in the horizontal cleavage planes; very hard when dry, sticky and plastic, moderately alkaline.

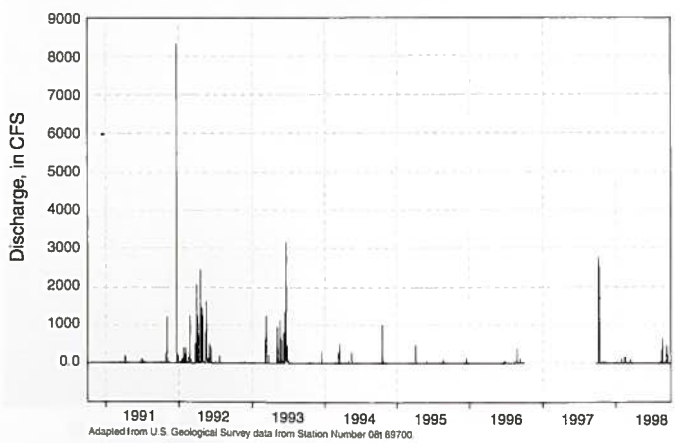
A buried, dark grayish brown surface soil is found from 30 to 36 inches with few fine yellowish brown iron stains. The subsoil from 36 to 62 inches is a stratified grayish brown clay with many distinct fine yellowish brown iron coatings along interfaces of bedding planes.

(From the Cameron County Soil Survey)

Hydrology

Overbank flooding and runoff from the adjacent floodplain are the main sources of water for the lower coast riparian wetlands. The lower coast rivers flood much less frequently than do the rivers on the upper coast, and the rivers stay flooded for shorter periods of time. Consequently, the floodplains outside of the depressions do not stay wet long and often enough to be classified as wetlands. It is important to recognize, however, that the scarce and valuable habitats found in the riparian corridors are dependent upon the surface and subsurface hydrology of the floodplains.

Rivers such as the Aransas may flood most years, but may go several years without significant floods. The smaller rivers and creeks may flood only once every 3 to 5 years. Hydrology has been greatly modified in most rivers in this area by dams.



Aransas River hydrograph near Skidmore, Texas. Flood events are short duration. Only the largest peaks represent floods. No data were available for the flood stage.

GRAPH: REGINA KUBELKA

Vegetation

The depressional wetlands are often freshwater marshes dominated by plants like southern cattail and California bulrush in the wetter areas grading into various grasses and sedges and brush such as Drummond's rattlebush, retama, and salt cedar. The still higher and drier riparian zone vegetation depends primarily on the groundwater level associated with the river or stream. Trees and shrubs that dominate these riparian zones include mesquite, huisache, salt cedar, hackberry/sugarberry, retama, cedar elm, Chinese tallow-tree, green ash, black and sandbar willow, and rattlebush. In the lower Rio Grande Valley, evergreen subtropical riparian woodlands can also include brush like brasil, anacua, granjeno, tepeguaje, Texas ebony, and locally, remnant groves of Texas palmetto (sabal palm trees).

Animals

Riparian habitats support many of the same animals found in riverine forested wetlands. On the lower coast, riparian woodlands and the associated water provide important fish and wildlife habitats in areas that may have little else to offer many species. Some animals found in these habitats, for example the green and ringed kingfishers, Mexican treefrog, Rio Grande chirping frog, Rio Grande river cooter, ocelot, and jaguarundi are seldom seen in other regions of Texas.

Threats

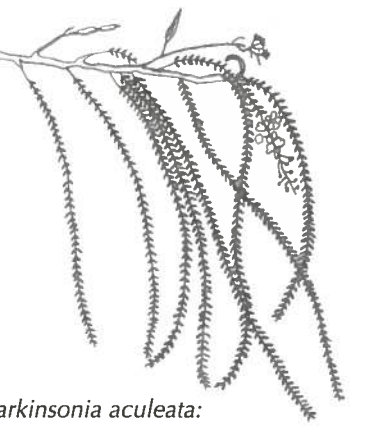
Narrow riparian corridors, because they are so limited in size to begin with, are very susceptible to disturbances such as overgrazing, channel dredging (such as is done to stabilize the international boundary), and brush control programs. Many of these habitats are now dominated by introduced or disturbance types such as salt cedar and mesquite. These two species use a lot of water and are often targeted by brush control programs related to water conservation efforts. Salt cedar and mesquite dominated riparian zones are not as desirable as a mixture of native tree and brush species, but they are better than no riparian habitat at all. They do provide habitats for birds and other animals and help stabilize stream banks and floodplain soils.

Ecological Functions and Human Values

Riparian corridors perform many of the functions mentioned for riverine forested wetlands. In semiarid climates, riparian corridors provide exceptionally valuable wildlife habitat since woodlands not associated with rivers and streams may be absent. In the lower Rio Grande Valley, many birds that are not found elsewhere in the U.S. make heavy use of riparian woodlands. Birdwatching is a prime reason so many winter Texans and others are attracted to the area. The money they spend is important to the regional economy.

Forested riparian habitat on the Rio Grande. (Bob Parvin, Texas Department of Transportation)

Sabal mexicana: sabal palm



Parkinsonia aculeata: retama

DRAWINGS: REGINA KUBELKA

Wetland Site Descriptions

We hope the reader is now interested enough in coastal Texas wetlands to want to visit some of them. This part of the guide is designed to help you do that. There are a few basic rules that should be followed when you visit a wetland.

- Always protect yourself from the sun with a hat, sunglasses and a good sunscreen.
- Always take insect repellent — wetlands are productive ecosystems that support lots of invertebrates, such as mosquitoes.
- Take other essential gear such as rubber boots (if you want to keep your feet dry), binoculars and field guides for wildlife viewing, and plenty of drinking water.
- Take food and anything else you might need if you go to remote, undeveloped areas.
- Always treat wildlife with the respect it deserves. Never approach or harass alligators and be aware that rattlesnakes are present on the Texas coast.
- Never trespass on private property without permission from the landowner.

Wetlands make for good birdwatching, and most of the sites described in this guide are also official stops on the Great Texas Coastal Birding Trail (see References/Suggested Reading).

The wetland sites are grouped geographically into upper, mid- and lower coast sites. The upper coast segment runs from the Texas-Louisiana border to the Brazoria-Matagorda County line. The mid-coast segment continues to the Nueces-Kleberg County line. The lower coast segment continues to the mouth of the Rio Grande. Each region has a general locator map at the beginning of the regional site descriptions.

Wetland Sites Available to the Public

Upper Gulf Coast

The Big Thicket

Cypress knees in a bottomland hardwood forest. Freshwater wetlands like these have disappeared more quickly than any other type of wetland in Texas. (© Stephan Myers)

1 Tony Houseman Wildlife Management Area

Owner: Texas Parks & Wildlife Dept. 409/736-2551
Nearest Town: Orange **Size**: 3,313 acres
http://www.tpwd.state.tx.us/wma/wmarea/housemann.htm
Wetlands: Riverine forested-cypress-tupelo swamp, bottomland hardwoods
Recreation: wildlife viewing, hiking, primitive camping, fishing, hunting, canoeing
Description: Known as Blue Elbow Swamp, this Sabine River wetland is one of the largest remaining blocks of swamp on the Texas coast. Water-tolerant trees and shrubs dominate this wetland; soils are saturated or flooded by water during much of the year. Pedestrian access at the Texas Dept. of Transportation Travel Information Center on the I-10 north service road. An extensive boardwalk system goes into the swamp. Facilities at the Info. Center. Commercial airboat tours on the Sabine River available through Super Gator Tours (1-800-241-6390, http://www.pnx.com/gator/airtour50.htm) or Texas Marshland Tours (409/736-3023, http://www.marshland.com/marshland.html).
Directions: On I-10 north service road at the Sabine River in Orange, TX.

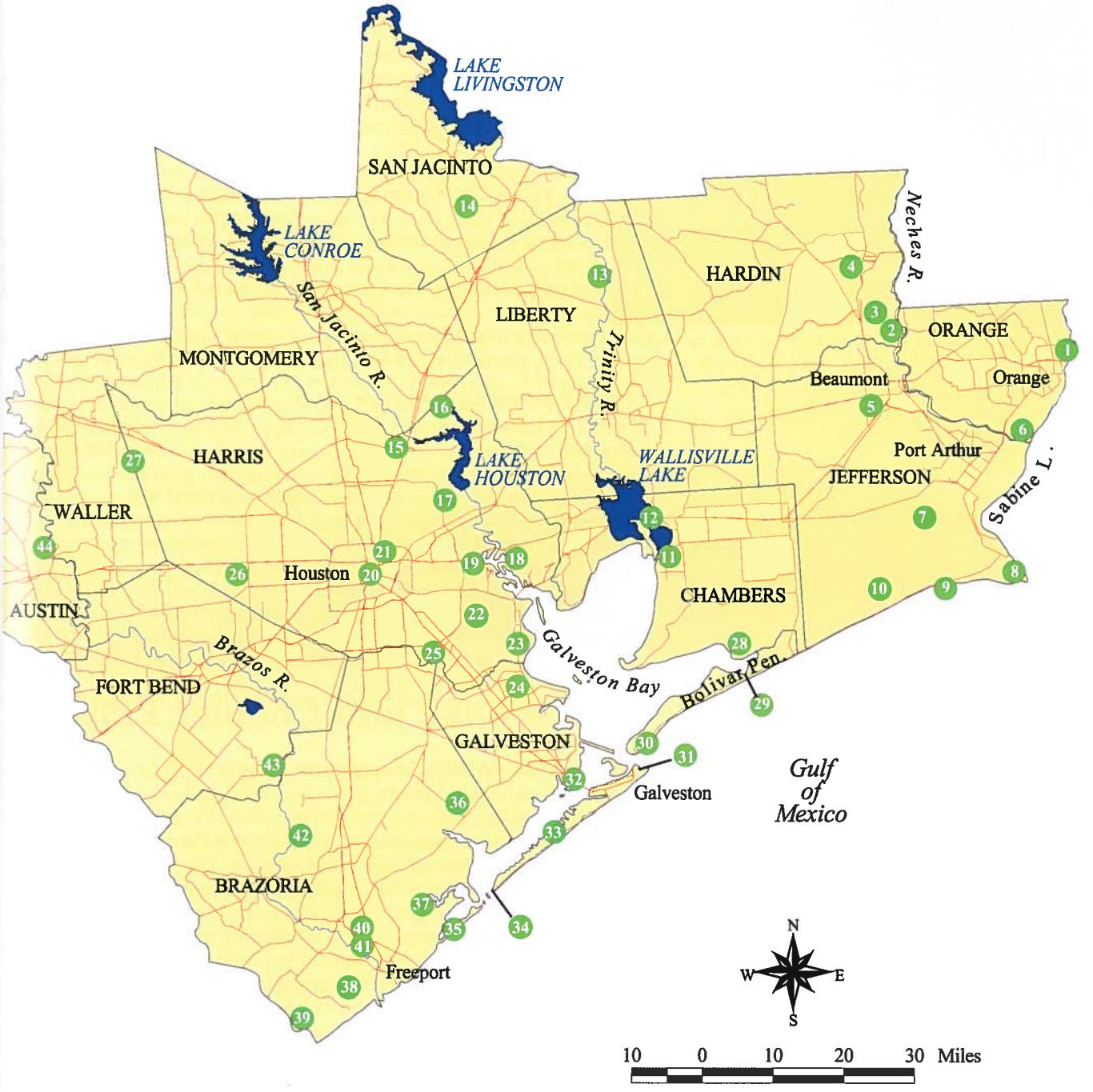
2 Big Thicket National Preserve

Owner: National Park Service 409/246-2337 (Info. Station)
Nearest Town: Beaumont **Size**: 86,000 acres
http://www.nps.gov/bith/
Wetlands: Riverine forested-swamps and bottomland hardwood
Coastal flatwoods—mixed pine-hardwood; bogs
Recreation/Education: wildlife viewing, hiking, canoeing, boating, camping, fishing, hunting, biking, horseback riding, environmental education/interpretation
Description: The preserve consists of nine separate land units and four riparian corridors, and is known for exceptional diversity of plants, animals, and habitats. The Information Station, located in the Turkey Creek Unit north of Kountze in Hardin County, is open daily except December 25. No entrance fee and all programs are free. Advance reservations are required for all environmental education programs and interpretive activities.
Directions: Information Station-From Beaumont, take US 69/287 to seven miles north of Kountze. Turn east on FM 420 for 2.9 mi. to Info. Station and Kirby Nature Trail.

3 Village Creek State Park

Owner: Texas Parks & Wildlife Dept. 409/755-7322
Nearest Town: Lumberton **Size**: 1,004 acres
http://www.tpwd.state.tx.us/park/village/village.htm
Wetlands: Riverine forested-cypress-tupelo swamp, bottomland hardwoods
Recreation: wildlife viewing, camping, hiking, fishing, swimming, canoeing
Description: The park is heavily wooded and has frontage on Village Creek. Bottomland hardwood forests dominated by water oak, willow oak, black gum, red maple, black willow, green ash, yaupon, dwarf palmetto, gallberry holly,

Upper Coast Sites



and some loblolly pine. Village Creek is a popular flat-water canoe/float stream. Wetland wildlife and waterbirds are abundant. The park is open year-round, there is an entrance fee. Call the park for details.

Directions: From Beaumont, take US 69 north. Take Mitchell Rd. exit onto Mitchell Rd. (just before US 69/96 split). Go about 0.4 mi. and turn north on FM 3513. Go about 2 mi. and turn east on Alma Dr. Cross railroad tracks (veer to left) and go 0.6 mi. to park entrance.

4 Roy E. Larsen Sandyland Sanctuary

Owner: Nature Conservancy of Texas, Inc. 409/385-0445 or 4135
Nearest Town: Silsbee **Size**: 5,593 acres
http://nature.org/wherewework/northamerica/states/texas/preserves/art6024.html
Wetlands: Riverine forested-cypress-tupelo swamp, bottomland hardwoods; Coastal flatwoods-longleaf pine savanna
Recreation/Education: wildlife viewing, hiking, nature trails, interpretive display, guided tours
Description: Another Big Thicket site with exceptional biological diversity. Bottomland hardwood forests dominated by water oak and sweet gum, with willows and river birch along the stream banks. Open to the public during daylight hours. Six miles of nature trails and an interpretive display enhance the wildlife viewing. An eight-mile canoe trail on Village Creek provides bottomland wildlife viewing. Guided tours on the nature trails are available upon request.
Directions: From Beaumont, go north on US 96 to Silsbee. Turn west for 2.5 mi. on TX 327 to entrance. Canoe trail starts where FM 418 crosses Village Creek.

5 Tyrrell Park and Cattail Marsh

Owner: City of Beaumont 409/866-0023
Nearest Town: Beaumont **Size**: 900 acres
http://www.beaumontcvb.com
Wetlands: Prairie potholes and marshes-constructed marsh
Recreation: wildlife viewing, hiking, park facilities
Description: The park is a multi-use facility. The cattail marsh is a component of the Beaumont wastewater treatment system. Water levels in the constructed wetland compartments fluctuate and attract a diverse variety of waterbirds. Visitors can walk the levees of the compartments. Day use, no fee.
Directions: From Beaumont, go west on I-10 and exit onto Walden Rd. Go south on Walden Rd., which becomes Tyrrell Park Rd., to entrance at Babe Zaharias Dr.

Sabine Lake and Chenier Plain

6 Lower Neches Wildlife Management Area

Owner: Texas Parks & Wildlife Dept. 409/736-2551
Nearest Town: Bridge City **Size**: 7,998 acres
http://www.tpwd.state.tx.us/wma/find_a_wma/list/?id=58
http://www.cityofbridgecity.org/recreation.html
Wetlands: Estuarine-tidal marshes (brackish to freshwater)
Recreation: wildlife viewing, hiking, fishing, hunting, boating
Description: Land subsidence, caused by oil and gas extraction, plus saltwater intrusion have caused much marsh to be converted to open water. Area still supports some tidal marshes. Hiking on road and levee system. Area open for day-use only, portions open year-round. No facilities or potable water. Visitors 17 years old or older must possess one of several access permits; call area for details. More marsh along road to Bailey's Fish Camp on Sabine Lake.
Directions: From Port Arthur, go north on TX 87 to Bridge City. Turn right on Lake St., go about 1.5 mi. to parking area and viewing platform on Lake St. Continue south to Bailey's Fish Camp (shell road).

7 J. D. Murphree Wildlife Management Area

Owner: Texas Parks & Wildlife Dept. 409/736-2551
Nearest Town: Port Arthur **Size**: 24,366 acres
http://www.tpwd.state.tx.us/wma/find_a_wma/list/?id=40
Wetlands: Estuarine-tidal marshes (brackish to freshwater); freshwater impoundments.

Recreation: wildlife viewing, fishing, hunting, boating, nature trail

Description: Excellent for all types of wetland wildlife. Public hunting permitted for alligator, waterfowl, gallinule, rail, and snipe. Area open for day-use only and all units except one are accessible by boat only. One unit, with a nature trail and viewing platform, is accessible on foot. No facilities or potable water. Visitors 17 years old or older must possess one of several access permits; contact area for details and open dates. Texas Marshland Tours (409/736-3023, http://www.marshland.com/marshland.html) operates commercial boat rides into the WMA.

Directions: From Port Arthur, go 3 mi. west on TX 73. From Winnie, go east 25 mi. on TX 73.

Alligator at Sea Rim State Park. (Jack Lewis, Texas Department of Transportation)

8 Texas Point National Wildlife Refuge

Owner: U.S. Fish & Wildlife Service
409/971-2909

Nearest Town: Sabine Pass
Size: 8,900 acres

http://southwest.fws.gov/refuges/texas/mcfaddin/index.html

Wetlands: Estuarine-tidal saltmarshes

Recreation: wildlife viewing, fishing/crabbing, hiking, boating, waterfowl hunting

Description: Excellent for wintering waterfowl and migrating songbirds. Lack of facilities, potable water, and interior roads combined with wet soils and biting insects requires visitors to be well prepared. Primitive trail accessible from the parking lot on TX 87 provides access to marsh and wooded cheniers. No fees and no restrictions on hours. Shallow-water boats can launch (for small fee) at private dock at Texas Bayou near east boundary. Headquarters at McFaddin NWR. TX 87 crosses tidal marshes north of Sabine Pass. The road from Sabine Pass to the Pilot Station at Texas Point crosses more tidal marshes.

Directions: From Port Arthur, take TX 87 about 15 mi. south to Sabine Pass. Go 2.4 mi. west (south) on 87 to nature trail. From Sabine Pass, go east on FM 3322, turn south on South 1st and go south to Texas Point.

9 Sea Rim State Park

Owner: Texas Parks & Wildlife Dept. 409/971-2559

Nearest Town: Sabine Pass **Size**: 4,141 acres

http://www.tpwd.state.tx.us/park/searim/searim.htm

Wetlands: Estuarine-tidal saltmarshes

Recreation/Education: wildlife viewing, beach activities, canoeing (rentals) and kayaking, camping, fishing, waterfowl hunting, nature trail, commercial airboat tours

Description: Excellent for wetland and estuarine wildlife. Marsh airboat tours (fee) by reservation only. Gambusia Nature Trail is a boardwalk in the marsh with a self-guided booklet. Visitor Center has environmental exhibits. Marshlands Unit entrance on north side of TX 87; there is a boat ramp for shallow-water craft like canoes (rented at park) and kayaks. Boardwalk in riparian woods (black willow and saltcedar) along south side of TX 87. Open year-round (entrance fee).

Directions: From Port Arthur, go south on TX 87 to Sabine Pass, then west on 87 for 10 mi. to park.

10 McFaddin National Wildlife Refuge

Owner: U.S. Fish & Wildlife Service 409/971-2909

Nearest Town: Sabine Pass **Size**: 55,000 acres

http://southwest.fws.gov/refuges/texas/mcfaddin/index.html

Wetlands: Estuarine-tidal marshes (brackish to freshwater)

Recreation: wildlife viewing, fishing/crabbing, boating, waterfowl hunting

Description: Primarily undeveloped marsh accessible only by boat. Eight miles of interior roads provide vehicle access to inland lakes and waterways. Seven launch ramps provide access for shallow-water boats. Clam Lake Rd. is open year-round during daylight hours; the rest of the road system has designated open hours. No fees. Headquarters on Clam Lake Rd.

Directions: From Sabine Pass, go west 12 mi. on TX 87 to Clam Lake Rd. TX 87 from here to High Island is closed, due to erosion, necessitating a detour onto TX 73.

Trinity River and Delta

11 Upper Texas Coast Wetland Education Center, Inc.

Owner: Chambers-Liberty Counties Navigation District 409/267-3541
Nearest Town: Anahuac
Wetlands: Estuarine-tidal saltmarshes and mudflats; open bay. Prairie pothole and marsh freshwater-marsh fringing Lake Anahuac
Recreation/Education: wildlife viewing, interpretive boat tours, nature trail
Description: Navigation District operates two 45-foot boats in the lower Trinity River Delta and the upper parts of Trinity and Galveston Bays. Boats can accommodate groups of up to 10 people. Boat tours include education and interpretation of wetlands and bay habitats. Call Navigation District for details. Lake Anahuac levee nature trail accessible on foot during daylight hours.
Directions: From I-10, take FM 563 exit and go south 7 mi. to Anahuac. Turn right on Miller Ave. and go to Anahuac Harbor. For nature trail, go west on TX 61 off FM 563 to Anahuac Pumping Station.

12 Wallisville Lake Project

Owner: Army Corps of Engineers 409/389-2285
Nearest Town: Wallisville **Size**: 20,000 acres
http://www.swg.usace.army.mil/pao/newsrel/WallisvilleBirds.pdf
Wetlands: Estuarine-tidal marshes (brackish to freshwater). Riverine forested-swamps, bottomland hardwoods. Coastal flatwoods-hardwoods.
Recreation: wildlife viewing, boating, fishing, waterfowl hunting
Description: Very diverse complex of tidally influenced estuarine and riverine wetlands. Visitor Center is located on the east levee at the lock on the Trinity River. The Trinity River Mouth Waterbird Rookery and Horseshoe Ponds trail are accessed here also. The 4-mile long west levee, accessible on foot, is reached off the west end of the Trinity River Bridge.The 80-acre Cedar Hill Park is on Lake Charlotte, on the only high ground in the area, in the middle of a cypress swamp. Contact Project office for open hours. No fees.
Directions: From Houston, go east on I-10, cross the Trinity River and exit onto frontage road (exit 806) at east end of bridge. Turn off frontage road, just before Levee Rd., onto an elevated road and go about 2 mi. to VC. Lake Charlotte is north on FM 563 off I-10 (4 mi. east of TR bridge) and west 1.3 mi. on Lake Charlotte Rd.

13 Trinity River National Wildlife Refuge

Owner: U.S. Fish & Wildlife Service 409/336-9786
Nearest Town: Cleveland **Size**: 4,547 acres
http://southwest.fws.gov/refuges/texas/trinityriver/index.html
Wetlands: Riverine forested-swamps and bottomland hardwoods. Coastal flatwoods-pine and mixed pine hardwood.
Recreation: Currently, the refuge is closed to the public. Conservation-oriented group tours can be arranged by contacting the refuge.
Description: Land acquisition is ongoing at the refuge, located 45 miles northeast of Houston on the Trinity River floodplain. Excellent habitat for waterbirds, raptors, woodpeckers, and songbirds (especially warblers, vireos, and flycatchers). Three colonial waterbird rookeries.
Directions: Contact refuge.

14 Big Creek Scenic Area

Owner: U. S. Forest Service 409/344-6205
Nearest Town: Shepherd **Size**: 1,450 acres
http://www.greatamericantrails.com/birding_trails/utc_site035.html
Wetlands: Riverine forested-bottomland hardwoods
Recreation: wildlife viewing, hiking
Description: In the Sam Houston National Forest in San Jacinto County. Miles of nature trails through extensive bottomland forests on Big Creek, a tributary of the Trinity River. A 5-mile trail connects the area with the Double Lake Recreation Area, which has a boardwalk through a marsh at the upper end of the lake. No fee.
Directions: From Houston, go north on US 59 to Cleveland. Go north 10 mi. on FM 2025, turn east on FM 2666 and go 2.5 mi. to FR 221 (gravel). Go north

0.5 mi. on FR 221 to FR 217, turn east and go 1 mi. to parking area. Double Lake entrance is 15 mi. north of Cleveland on FM 2025.

San Jacinto River

15 Jesse H. Jones Park and Nature Center

Owner: Harris County Precinct Four 281/446-8588
Nearest Town: Humble **Size**: 225 acres
http://www.homestead.com/park_volunteers/index.html
Wetlands: Riverine forested-swamp and bottomland hardwoods
Recreation/Education: wildlife viewing, hiking/biking, fishing, canoe/pontoon boat tours, interpretive displays, school outreach program
Description: The Center has a boardwalk in the forested bottomlands of Spring Creek, a tributary of the West Fork San Jacinto River. Excellent birdwatching, especially for warblers. Tuesdays, Thursdays, and Fridays are reserved for visiting school groups. Center also runs a school outreach program. Public and group canoe/pontoon boat tours offered periodically. Open year-round during daylight hours. All programs are free.
Directions: From Houston, go north about 19 mi. on US 59. Go west 1.8 mi. on FM 1960 to Kenswick Dr. Go north 1 mi. to entrance.

16 Lake Houston State Park

Owner: Texas Parks & Wildlife Dept. 281/354-6881
Nearest Town: New Caney **Size**: 4,920 acres
http://www.tpwd.state.tx.us/park/lakehous/lakehous.htm
Wetlands: Riverine forested-bottomland hardwoods; Coastal flatwoods-mixed pine-hardwood
Recreation/Education: wildlife viewing, hiking/biking, camping, nature study
Description: Miles of trails through extensive bottomland forests along Caney and Peach Creeks, and the East Fork San Jacinto River. Open year-round, every day. Day use from 8 am to 10 pm. Entrance fee; camping fees vary.
Directions: From Houston, go north on US 59 to New Caney exit and FM 1485. Go east 2 mi. to Baptist Encampment Rd.; turn south for 1.5 mi. to entrance.

17 Sheldon Lake State Park

Owner: Texas Parks & Wildlife Dept. 281/456-9350
Nearest Town: Sheldon **Size**: 2,503 acres
http://www.tpwd.state.tx.us/park/sheldon/sheldon.htm
Wetlands: Riverine forested-swamp and bottomland hardwoods. Coastal flatwoods-mixed pine-hardwood. Prairie pothole and marsh—marsh fringing reservoir.
Recreation/Education: wildlife viewing, fishing, boating, canoeing, nature study, wildscape demonstration gardens
Description: The reservoir is on Carpenter's Bayou, a tributary of Buffalo Bayou. Sheldon Lake Environmental Education Center offers fishing clinics, nature walks, and wetland studies to organized groups on a prearranged basis. Park has two boat ramps. Two miles of nature/interpretive trails with boardwalks and viewing platforms; also canoe trails. Entrance fee, contact Park for details.
Directions: From Houston, take I-10 east to Beltway 8. Go north about 8 mi. to Garrett Rd. Go east 2 mi. on Garrett Rd. to Park.

18 Baytown Nature Center and Eddie V. Gray Wetlands Education and Recreation Center

Owner: City of Baytown 281/420-7128 or 6597
Nearest Town: Baytown **Size:** 420+ acres
http://www.baytown.org/BNC/index.html
Wetlands: Estuarine-tidal saltmarsh (natural and restored). Prairie pothole and marsh—demonstration marsh.
Recreation/Education: wildlife viewing, hiking/jogging, fishing, boating, interpretive displays, wetland restoration activities
Description: Eddie V. Gray Center, on the bank of Goose Creek, has indoor classrooms, computer lab, and interpretive wetland displays, as well as indoor and outdoor fishing ponds. The Nature Center, on the San Jacinto River about 4 miles from EVG, is the outdoor classroom. The Nature Center was formerly

the Brownwood subdivision that was abandoned due to land subsidence and flooding. Wetland restoration projects at both sites. No fees. Port-A-Cans available at Nature Center.

Directions: From Houston, go east on I-10 and exit on Spur 330/Decker to Baytown. To BNC, go right (south) on Bayway Dr. 1.5 mi., turn right on Shreck to dead end. To EVG, exit Spur 330 onto service road just before TX 146 (formerly Loop 201) overpass, go to dead end, left on J. B. LeFevre to dead end, left on Market St., first building on left.

19 San Jacinto Battleground SHP

Owner: Texas Parks & Wildlife Dept. 281/479-2431
Nearest Town: La Porte **Size**: 1,121 acres
http://www.tpwd.state.tx.us/park/battlesh/battlesh.htm
Wetlands: Estuarine-tidal saltmarsh (restored)
Recreation/Education: wildlife viewing, picnicking, tours
Description: The State Historical Park's tidal marshes, which played a role in the defeat of the Mexican Army in 1836, were lost due to land subsidence. The 200-acre marsh revegetation project used dredge spoil to raise the marsh elevation so marsh vegetation could survive. The project is the largest block of tidal marsh remaining on the lower San Jacinto River. No entrance fee.
Directions: From I-610 East, take TX 225 east 11 mi. to TX 134 (Battleground Rd.), continue north about 2 mi. and turn right on Park Rd. 1836.

Greater Houston Area

20 Sam Houston Park

Owner: City of Houston 713/238-2240
Nearest Town: Houston **Size**: 19 acres
http://www.tpwd.state.tx.us/birdingtrails/upper/buffalo/text.html
Wetlands: Prairie pothole and marsh—constructed demonstration marsh (0.25 acre)
Recreation/Education: wildlife viewing, historical buildings
Description: An urban park in downtown Houston. City of Houston Parks & Recreation Dept., Enron, the Environmental Institute of Houston, and the National Fish and Wildlife Foundation have constructed a freshwater wetland and native plant gardens in the park. No fee.
Directions: Adjacent to downtown Houston across from Texaco Heritage Plaza at 1100 Bagby.

21 White Oak Bayou Park

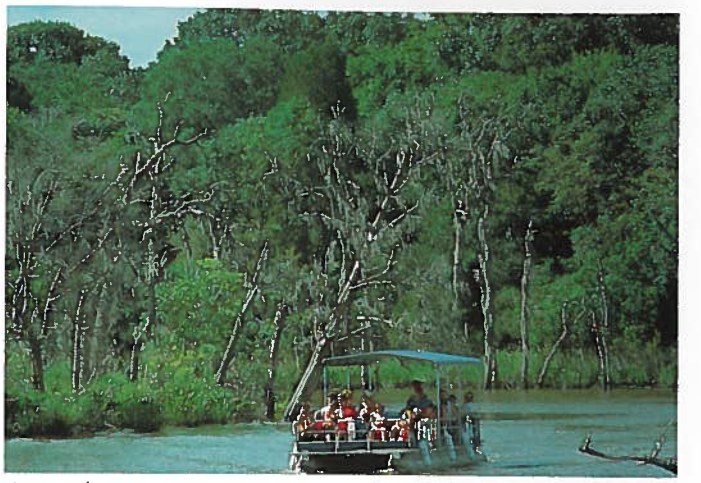
Owner: City of Houston 713/845-1000
Nearest Town: Houston
http://www.greatamericantrails.com/birding_trails/utc_site090.html
http://www.bayoupreservation.org/pages/whiteoakbayou.htm
Wetlands: Riverine forested-bottomland hardwoods and swamp
Recreation: wildlife viewing, hiking/biking
Description: Just northeast of downtown Houston. Community residents have cleaned and restored a section of swamp along White Oak Bayou. White Oak Bayou Hike and Bike (Harris County) is adjacent and has full facilities. No fee.
Directions: From Memorial Dr. in downtown Houston, exit onto Houston Ave., go north to White Oak Dr., go north on White Oak to park.

22 Pine Brook Neighborhood Park

Owner: City of Houston 713/845-1000
Nearest Town: Clear Lake **Size**: 5 acres
Wetlands: Prairie pothole and marsh—pothole on Beaumont Formation
Recreation/Education: wildlife viewing, hiking, boardwalk
Description: Site has a three-acre prairie pothole with an elevated boardwalk. The pothole is not buffered by a surrounding undeveloped landscape, so it may not survive long. No entrance fee, facilities on site.
Directions: From Houston, go south on I-45 to Clear Lake. Exit on FM 2351, go east on 2351 (Clear Lake City Blvd.) to intersection with Park Center Dr. and the park.

23 Armand Bayou Nature Center

Owner: Harris County Precinct 2 281/474-2551
Nearest Town: Pasadena **Size**: 2,500 acres
http://www.abnc.org
Wetlands: Estuarine-tidal mudflats and restored salt marshes. Coastal flatwoods-hardwoods. Prairie pothole and marsh-wet prairie.
Recreation/Education: wildlife viewing, hiking, pontoon boat rides, environmental education classes
Description: One of the last unchannelized bayous in the Houston area, the preserve protects remnant wetlands and tall grass prairie. Tidal marsh and seagrass restoration programs. Offers a variety of classes and outdoor environmental restoration programs. Offers a variety of classes and outdoor environmental education school field trips. Class and entrance fees vary. Open 9 -5 on Wed.-Sat., noon-dusk on Sun. Just west of ABNC at 7500 Bay Area Blvd. is Bay Area Park (Harris County 281/326-6539). It also has wetlands along Armand Bayou.
Directions: From Houston, go south on I-45 and exit on Bay Area Blvd. Go east 6 mi. to entrance. Bay Area Park is just west of ABNC.



Armand Bayou Nature Center. (Jack Lewis, Texas Department of Transportation)

24 Highway 96 Nature Park

Owner: City of League City 281/316-3451
Nearest Town: League City **Size**: 44 acres
Wetlands: Prairie pothole and marsh—potholes and marsh on Beaumont Formation.
Recreation/Education: wildlife viewing, hiking, interpretive trails
Description: Established as mitigation for the construction of Hwy. 96, the site is scheduled to open in spring 2001. A prairie site with natural prairie wetlands. Self-guided prairie trail and boardwalk through wetlands. Good birdwatching for grassland and wetland birds. No entrance fee. Restroom facilities available.
Directions: From Houston, go south on I-45 to League City. Take Calder Rd. exit to Hwy. 96. Go east on 96 about 5.5 mi. to park.

25 El Franco Lee County Park

Owner: Harris County Precinct One 713/485-2729
Nearest Town: Pearland **Size**: about 100 acres
http://www.co.harris.tx.us/comm_lee/parks.htm
Wetlands: Prairie pothole and marsh—marsh and shrub wetlands
Recreation: wildlife viewing, nature trail, park facilities
Description: Marsh and shrub wetlands have formed on the downthrown (low) side of a fault caused by land subsidence due to oil and gas extraction from the Clear Lake Oil Field. A nature trail skirts part of the wetlands. No fee.
Directions: From Houston, go south on I-45 to Beltway 8. Go west about 3 mi. on Beltway 8, exit onto Hall Rd. Turn left (south) on Hall Rd., go about 0.25 mi. to entrance.

26 Addicks and Barker Reservoirs

Owner: Army Corps of Engineers 281/497-0740
Nearest Town: Houston **Size**: 26,000 acres
http://www.swg.usace.army.mil/items/addicksbarker/addicks%5Fbarker.asp
Wetlands: Prairie pothole and marsh—potholes and old rice fields
Recreation: wildlife viewing, hiking
Description: Both reservoirs are for flood control and normally hold water only in the lowest areas. Local school groups have restored a small fresh marsh in the Barker floodpool. For locations and directions contact the project office. Project office is open 7:30-4:00, Mon.-Fri. Various trails cross different habitats. Areas always open; no fees.
Directions: From Houston, go west on I-10. Take TX 6 south about 1 mi. to project office at 1042 TX 6 South. Another mile south is a parking lot across from Briar Forest Rd. A gravel road (trail) goes into the floodpool and a restored wetland.

Katy Prairie

27 KPC Nelson Farm-Barn Owl Woods Preserve

Owner: Katy Prairie Conservancy 713/523-6135
Nearest Town: Katy **Size**: 1,400 acres
http://www.katyprairie.org
Wetlands: Prairie pothole and marsh—potholes (Lissie Formation), ricefields. Riparian forested-bottomland hardwood corridor
Recreation/Education: wildlife viewing, periodic guided tours
Description: Located in Harris and Waller Counties. Part of a larger system of protected prairie preserves. Tract has an assemblage of agricultural wetlands and wetlands in natural depressions, as well as a riparian hardwood corridor on Cypress Creek. An ADA-accessible viewing platform on Sharp Road overlooking a wetland enhancement project is open during daylight hours. The preserve is open to the public on a limited basis through periodically scheduled tours.
Directions: From Houston, take I-10 west to Katy. Exit onto US 90 and continue west to Ave. D. Go north about 2 mi., turn right onto Katy-Hockley Rd. Go north on Katy-Hockley 8.5 mi., then west on Sharp Rd. to preserve. Continue to Waller Co. line and viewing platform.

Galveston Bay and Barrier Islands

28 Anahuac National Wildlife Refuge

Owner: U.S. Fish & Wildlife Service 409/267-3337
Nearest Town: Anahuac **Size**: 34,000 acres
http://southwest.fws.gov/refuges/texas/anahuac.html
Wetlands: Estuarine-tidal saltmarshes. Prairie pothole and marsh—marshes, potholes, rice fields, managed impoundments
Recreation: wildlife viewing, wetlands auto tour, hiking, fishing, boating, waterfowl hunting
Description: Excellent for wintering waterfowl and migrating songbirds. Twelve miles of gravel roads offer good wildlife viewing on auto tour. Restrooms in three locations, no potable water. East Bay Bayou tract has a 1.5-mile nature trail in riparian woodlands along the bayou, and managed wet prairie at the entrance. Boating on inland waters is permitted only on the boat canal. Two boat ramps open year-round. No fees.
Directions: From I-10 at Anahuac/Hankamer exit, go south 2 mi. on TX 61 to FM 562. Go south on FM 562 for 8.3 mi. to FM 1985, then 4 mi. east to main entrance. Continue east on FM 1985 to East Bay Bayou Tract.

29 Rollover Pass and Bay

Owners: Texas General Land Office (tidal areas) and Private
Nearest Town: Gilchrist
Wetlands: Estuarine-tidal flats and saltmarshes
Recreation: wildlife viewing
Description: The channel is a man-made "fish pass" cut across Bolivar Peninsula to Rollover Bay. On the bay side of the channel an extensive tidal delta has formed. Tidal flats are fringed by saltmarsh along the bayshore. About 0.5 miles west of the Pass on TX 87, Yacht Basin Road, which goes north and ends at the Intracoastal Waterway, crosses tidal marshes.
Directions: From Galveston, take the free ferry to Port Bolivar. Go east on TX 87 about 20 mi. to the Pass.

30 Bolivar Flats Shorebird Sanctuary

Owner: Texas General Land Office
Manager: Houston Audubon Society 713/932-1639
Nearest Town: Port Bolivar **Size**: 550 acres
http://www.greatamericantrails.com/birding_trails/utc_site058.html
http://www.houstonaudubon.org/index.cfm/CFID/5456903/CFTOKEN/90254017/MenuItemID/123.htm
Wetlands: Estuarine-tidal saltmarsh and flats
Recreation: wildlife viewing, hiking, beach activities
Description: A very important site for migratory shorebirds. Also excellent for gulls,

terns, seabirds, wading birds, and sea ducks. These marine flats were created by the deposition of sediment, carried by longshore currents, behind the north jetty that protects the entrance to Galveston Bay (Bolivar Roads). No facilities, no fees.

Directions: From Galveston, take the free ferry to Port Bolivar. Take TX 87 about 3.5 mi. to Loop 108, turn right on Rettilon Rd., turn right onto beach, go about 0.75 mi. to entrance at telephone poles in sand.

31 Big Reef Nature Park

Owner: Galveston Park Board of Trustees 409/763-6564
Nearest Town: Galveston
http://www.galveston.com/islandbirding/
Wetlands: Estuarine-tidal saltmarsh and mudflats
Recreation: wildlife viewing, hiking, fishing/crabbing, beach activities
Description: The park, at the eastern tip of the island, is a tidal inlet fringed by saltmarsh and mudflats. Very accessible with parking along Boddeker Dr. A boardwalk provides access into the marsh. School groups use area as an outdoor classroom. No facilities, no fee. Apffel Park, at the end of Boddeker (a.k.a. East Beach), has facilities ($5 parking fee).
Directions: In Galveston, take Seawall Blvd. east to dead end at Boddeker. Turn right on Boddeker and go 0.25 mi. to the park.

32 John M. O'Quinn I-45 Estuarial Corridor

Owner: SCENIC GALVESTON, Inc. 409/744-7431
Nearest Town: Galveston **Size**: 900 acres
http://www.galveston.com/islandbirding/
Wetlands: Estuarine-tidal saltmarsh and mudflats
Recreation: wildlife viewing, hiking, fishing, kayaking/canoeing, educational discovery classes
Description: Along both sides of I-45, the tract extends south of Bayou Vista subdivision and TX 146 to the I-45 railroad overpass just north of the causeway to Galveston. Tract is contiguous with 2,200 acres of additional wetlands controlled by The Nature Conservancy of Texas and the Galveston Bay Foundation. Wetlands include both natural and restored saltmarsh. Tidal connection has been restored to an old dredge-spoil compartment. Facilities and picnic area at Reitan Point; adventure trail further south. No fees.
Directions: From Houston, go south on I-45. Exit onto service road south of the Bayou Vista subdivision and TX 146 to parking areas on both sides of I-45.

33 Galveston Island State Park

Owner: Texas Parks & Wildlife Dept. 409/737-1222
Nearest Town: Jamaica Beach **Size**: 2,013 acres
http://www.tpwd.state.tx.us/park/galvesto/index.htm
Wetlands: Estuarine-tidal saltmarshes and mudflats. Barrier island interior—marsh in interdunal depressions.
Recreation/Education: wildlife viewing, camping, hiking/biking, fishing, nature study, beach activities
Description: The bay side of the park has extensive tidal saltmarshes and mudflats including a restored 750-acre saltmarsh. Land subsidence and erosion had damaged this marsh. Educational tours of beach and bay ecology by appointment only. Contact park to make arrangements and for fee info. Park has an interpretive center and self-guided nature/interpretive boardwalk in the saltmarsh. Entrance fee.
Directions: From Galveston, turn right off I-45 onto 61st St., go south on 61st to Seawall Blvd., then right (west) on Seawall (FM 3005) 10 mi. to park.

34 San Luis Pass

Owners: Texas General Land Office (tidal), Galveston County
Nearest Town: Jamaica Beach
http://www.galveston.com/islandbirding/
Wetlands: Estuarine-tidal flats and saltmarsh
Recreation: wildlife viewing, fishing, beach activities
Description: Extensive tidal sand flats on the bay side of San Luis Pass, at the western tip of Galveston Island. Some tidal marsh established in areas protected from erosive wave action. Sand may be soft, so be careful when driving on the flats. No facilities or fees.

Directions: From Galveston, go west on FM 3005 to the west end of the island (about 25 mi.). Exit FM 3005 just before the toll bridge across the Pass.

35 Christmas Bay Site

Owner: Texas General Land Office 281/470-1191
Nearest Town: Freeport **Size**: 485 acres
http://www.tpwd.state.tx.us/conserve/txgems/christma/christma.htm
Wetlands: Estuarine-tidal saltmarshes and mudflats
Recreation: wildlife viewing, fishing, beach activities
Description: This undeveloped site on Follets Island northeast of Freeport has 1.5 miles of Gulf beach and 15,000 feet of frontage on Drum and Christmas Bays. Tidal saltmarshes and mudflats fringe the Bay. Christmas Bay Scenic View is 3.2 miles west of San Luis Pass. Site has no hours, no facilities, and no fees.
Directions: From Freeport, go south on TX 322 to Surfside Beach. Go east on Bluewater Highway (San Luis Pass Rd.) about 8 mi. No signs at site.

36 Amoco Wetlands Trail

Owner: Amoco
Nearest Town: Alvin
Wetlands: Prairie pothole and marsh—marsh in impoundments
Recreation: wildlife viewing, hiking
Description: Amoco has developed a trail to access wetlands in shallow impoundments. Walk the road, which passes through prairie habitat, to the observation platform. Open for day use, no fee or facilities.
Directions: From Lake Jackson, go north on FM 2004 to FM 2917. Go northwest (left) on FM 2917 about 1.1 mi. to trail. From Alvin, take FM 2403 south to FM 2917, then south 6.6 mi. on 2917 to trail.

Brazos River and Delta

Roseate spoonbills near Surfside. (Stan Williams, Texas Department of Transportation)

37 Brazoria National Wildlife Refuge

Owner: U.S. Fish & Wildlife Service 409/849-7771
Nearest Town: Clute **Size**: 43,905 acres
http://southwest.fws.gov/refuges/texas/texasmidcoast/brazoria.htm
Wetlands: Estuarine-tidal saltmarsh and mudflats. Prairie pothole and marsh—marsh in managed impoundments, potholes.
Recreation/Education: wildlife viewing, hiking, fishing, waterfowl hunting, auto tour, exhibits
Description: Auto tour has 7 miles of gravel roads and 10 interpretive stops dealing with marsh ecology. School groups can get hands-on experience during outdoor classrooms held at the refuge by teachers. Tours for organized groups can be arranged by contacting Angleton office for reservations. Public access limited in summer, contact refuge for info.
Directions: From intersection of TX 35 and FM 523 in Angleton, go 4 mi. south on FM 523 to FM 2004 intersection. Continue on 523 for 5.5 mi. to County Road 227. Turn left and go 1.7 mi. to entrance.

38 Peach Point Wildlife Management Area

Owner: Texas Parks & Wildlife Dept. 409/244-7697
Nearest Town: Jones Creek **Size**: 10,311 acres
http://www.tpwd.state.tx.us/wma/find_a_wma/list/?id=41
Wetlands: Estuarine-tidal saltmarsh. Prairie pothole and marsh—sloughs and seasonal ponds, managed impoundments.
Recreation: wildlife viewing, hunting, hiking, nature trail
Description: Excellent area for birdwatching. Nature trail is in oak motte and grassland habitats. No restrooms or potable water. Visitors 17 years old or older must possess one of several access permits (no permit required for nature trail), contact area for details.
Directions: From Freeport, go west 5 mi. on TX 36 to entrance.

39 San Bernard National Wildlife Refuge

Owner: U.S. Fish & Wildlife Service 409/964-3639
Nearest Town: Jones Creek **Size**: 28,094 acres
http://southwest.fws.gov/refuges/texas/texasmidcoast/sanbern.htm
Wetlands: Estuarine-tidal saltmarsh and mudflats. Prairie pothole and marsh—marshes, managed impoundments.
Recreation/Education: wildlife viewing, saltwater fishing/crabbing, waterfowl hunting, hiking, auto tour
Description: Designated public-use areas open daily during daylight hours. The 3-mile, self-guided auto tour and 3 hiking trails offer excellent wildlife viewing. Restrooms and brochures available at headquarters. Tours can be arranged for organized groups by contacting headquarters.
Directions: From Lake Jackson, go south on FM 2004 to intersection with TX 36. Continue south on FM 2611 for 4 mi. to FM 2918. Go south on FM 2918 1 mi. Turn right onto County Road 306 (gravel) and go 1 mi. to entrance.

40 Brazosport Nature Center and Planetarium

Owner: Center for the Arts and Sciences 409/265-3376
Nearest Town: Lake Jackson
http://www.tpwd.state.tx.us/birdingtrails/upper/brazoria/text.htm
Wetlands: Riverine forested-bottomland hardwoods
Recreation/Education: wildlife viewing, interpretive exhibits and nature trail
Description: Self-guided tour along 0.2-mile nature trail through bottomland forest on Oyster Creek, an ancient, abandoned channel of the Brazos River. Exhibits are used to present hands-on nature programs to local schools.
Directions: From Business 288 in Lake Jackson, go west on College Blvd. to Brazosport Junior College. Go in first (east) entrance, park at the Center.

41 Sea Center Texas

Owner: Texas Parks & Wildlife Dept. 409/292-0100
Nearest Town: Lake Jackson **Size**: 75 acres
http://www.tpwd.state.tx.us/news/tpwcal/s_0223.htm
Wetlands: Estuarine—constructed nontidal saltwater marsh. Prairie pothole and marsh—constructed freshwater marsh.
Recreation/Education: aquaria, interpretive displays, touch pools, videos, marine fish hatchery, interpretive marsh boardwalk
Description: Large marine fish hatchery and Visitor Center. Educational aquaria and displays on marine life and coastal habitats. Two 12-foot touch pools for hands-on learning. Adjacent to VC is a 5-acre marsh with shallow ponds, fresh and saltwater marshes, elevated 600-foot walkway and observation deck with interpretive signage and displays. Check with Center for open hours, hatchery tours by appointment only.
Directions: In Lake Jackson, exit TX 332 onto Plantation Dr. Go south on Plantation to the Center at 300 Medical Dr.

42 Brazos River County Park

Owner: Brazoria County 409/864-1541
Nearest Town: Angleton **Size**: 80 acres
http://www.tpwd.state.tx.us/birdingtrails/upper/brazoria/text.htm
http://www.greatamericantrails.com/birding_trails/utc_site116.html
Wetlands: Riverine forested-bottomland hardwoods
Recreation: wildlife viewing, hiking, picnicking
Description: County park in the Planter's Point subdivision. Boardwalk through the bottomland forest along the Brazos River. Full park facilities, no fee.
Directions: From Angleton, go west on TX 35 to TX 521. Go north on 521 about 5 mi. to County Rd. 30. Go west on CR 30 to Planter's Point, enter subdivision and follow Colony Lane to park.

43 Brazos Bend State Park

Owner: Texas Parks & Wildlife Dept. 409/553-5101
Nearest Town: Damon **Size**: 4,897 acres
http://www.tpwd.state.ts.us/park/brazos/brazos.htm
http://www.bbspvo.org
Wetlands: Riverine forested-bottomland hardwoods. Prairie pothole and marsh—marshes, managed impoundments.

Recreation/Education: wildlife viewing, camping, hiking/biking, fishing, interpretive nature trail, interpretive/educational programs

Description: About 28 miles south of Houston, area has over 3 miles of Brazos River frontage. Offers ongoing interpretive and education programs every weekend (fee). Disabled-accessible nature trail and interpretive exhibit including boardwalk and observation deck in marsh. Habitats and Niches exhibit includes "hands-on" alligator discovery area. Entrance fee, variable camping fees; contact park for details.

Directions: From Richmond, go about 20 mi. southeast on FM 762. From Houston, go south on TX 288 to Rosharon, then west on FM 1462, then north 1.4 mi. on FM 762.

44 Stephen F. Austin SHP

Owner: Texas Parks & Wildlife Dept. 409/885-3613

Nearest Town: San Felipe **Size**: 663 acres

http://www.tpwd.state.tx.us/park/sfa/sfa.htm

Wetlands: Riverine forested-bottomland hardwoods.

Recreation/Education: wildlife viewing, hiking, camping, picnicking, fishing, nature tours

Description: This State Historical Park has bottomland forests on the Brazos River in Austin County. Park has a 5-mile hiking trail and a 0.25-mile nature/interpretive trail. Nature tours given Saturday mornings upon request (no fee). Open everyday year-round; entrance fee.

Directions: From Houston, go west on I-10 to FM 1458 (just east of Sealy). Turn right (north) and go 2.1 mi. on 1458, then left on Park Rd. 38.

Mid-Coast

Coastal Prairie

1 Attwater Prairie Chicken National Wildlife Refuge

Owner: U.S. Fish & Wildlife Service 409/234-3021
Nearest Town: Eagle Lake **Size**: 8,385 acres
http://southwest.fws.gov/refuges/texas/apc.html
Wetlands: Riverine forested-bottomland hardwoods. Prairie pothole and marsh—marshes in impoundments, potholes.
Recreation/Education: wildlife viewing, picnicking, special events, auto and hiking trails
Description: Bottomland forest on San Bernard River. Wintering waterfowl use the marshes. Five auto and 2 walking trails, limited picnic facilities. Open year-round every day during daylight hours including auto tour routes and Sycamore and Pipit Trails. Headquarters open 7:30 am – 4 pm, Mon.-Fri. Remnant population of Attwater's Greater Prairie Chicken.
Directions: From Eagle Lake, go northeast 7 mi. on FM 3013 to entrance. From Sealy on I-10, go south on TX 36 to FM 3013, then west 10 mi. to entrance. Hdqrtrs. 2 mi. west of entrance.

2 D. R. Wintermann Wildlife Management Area

Owner: Texas Parks & Wildlife Dept. 409/532-2170
Nearest Town: Eagle Lake **Size**: 246 acres
http://www.tpwd.state.tx.us/wma/find_a_wma/list/?id=44
Wetlands: Prairie pothole and marsh—Lissie Formation potholes
Recreation/Education: wildlife viewing, guided tours
Description: Area has 8 natural prairie potholes, and was donated as a migratory waterfowl refuge. Access to the area is restricted and must be arranged by contacting the manager. No facilities. Contact manager about access permit requirements.
Directions: Area located off FM 102 near Bonus in Wharton County. Contact manager for details.

3 Texas R. I. C. E./Pierce Ranch

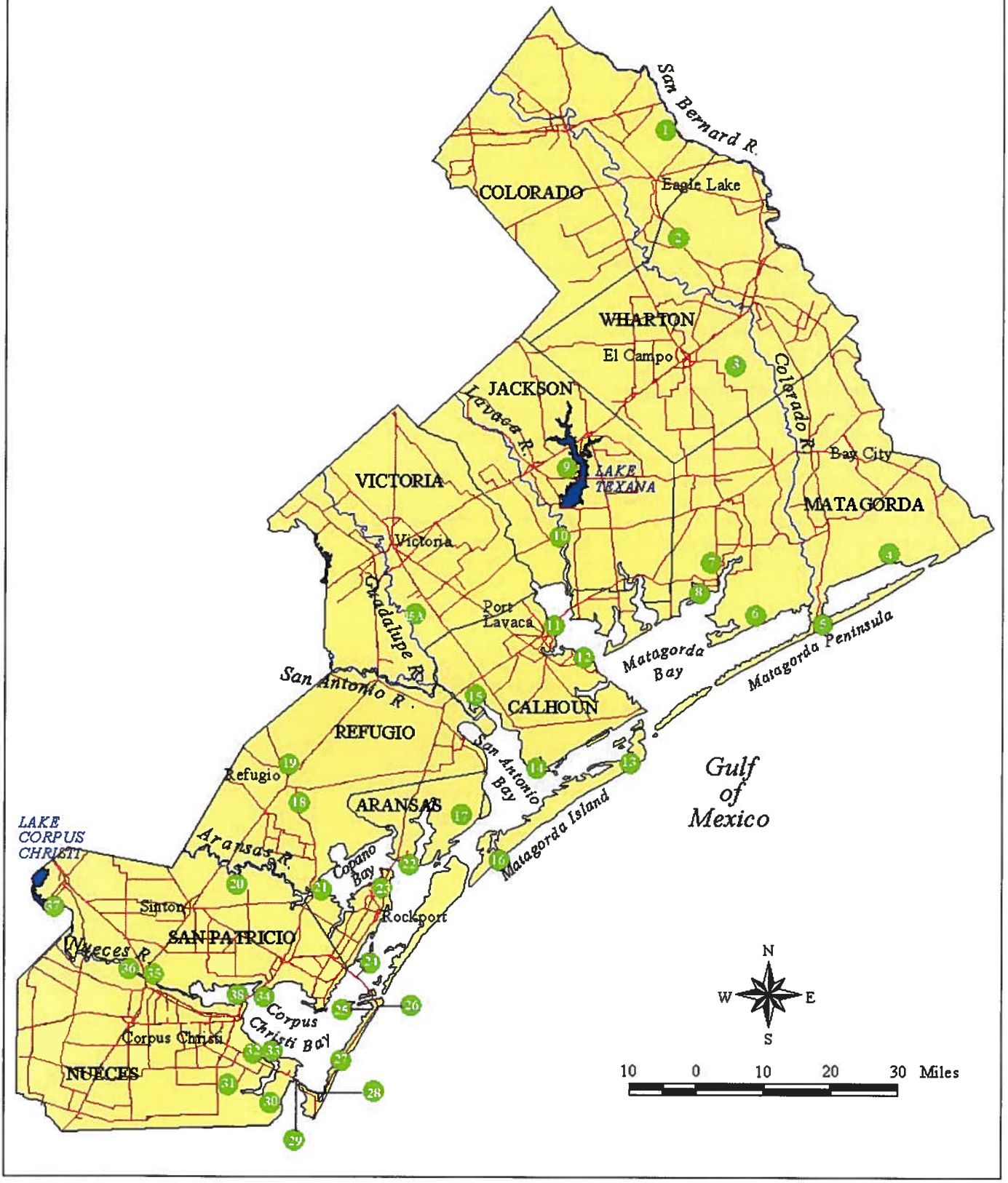
Owner: Private 409/534-0100
Nearest Town: El Campo
http://www.karankawa.com/rice.htm
Wetlands: Prairie pothole and marsh—potholes (Beaumont Formation); rice fields
Recreation: wildlife viewing
Description: The Texas Rice Industry Coalition for the Environment has created waterbird-viewing sites on the historic Pierce Ranch in Wharton County. The sites consist of viewable rice fields flooded for waterfowl habitat during the winter months. The sites are well marked, open to the public (no fee), and can be accessed from the roadside.
Directions: From Wharton, go southwest on US 59 (toward El Campo) to Pierce. Just past Pierce, exit 59 onto Pierce West Rd., go south 4 mi. to viewing sites.

Colorado River Delta/Matagorda Bay

4 Big Boggy National Wildlife Refuge

Owner: U.S. Fish & Wildlife Service 409/849-6062
Nearest Town: Wadsworth **Size**: 4,127 acres
http://www.gorp.com/gorp/resource/us_nwr/tx_big_b.htm
Wetlands: Estuarine-tidal saltmarsh and mudflats
Recreation/Education: wildlife viewing, waterfowl hunting
Description: Restricted access to the refuge. Contact refuge staff in Angleton about periodic day trips. Drive past the refuge on Chinquapin Road to Chinquapin Landing to view saltmarshes and Live Oak Bayou. No facilities at refuge.
Directions: From intersection of TX 60 and FM 521 in Wadsworth (south of Bay City on TX 60), go east 2.9 mi. on FM 521 to Chinquapin Rd. Turn

Mid-Coast Sites



right (south) and go 7 mi. on Chinquapin Rd. to refuge. Chinquapin Landing is at the end of the road.

5 Matagorda County Jetty Park

Owner: Matagorda County
Nearest Town: Matagorda
http://www.tpwd.state.tx.us/birdingtrails/central/rio/text.htm
http://www.lcra.org/commmunity/matagorda.html
Wetlands: Estuarine-tidal saltmarshes and mud flats
Recreation: wildlife viewing, fishing, beach activities
Description: The road from Matagorda follows the Colorado River to the Gulf, and the saltmarshes on East Matagorda Bay are adjacent to the road. Numerous pull-offs along the road. Excellent birdwatching area, fishing pier on the beach at the end of the road. No fee.
Directions: From Bay City, go south about 20 mi. on TX 60 to Matagorda. Turn left (south) on FM 2031 and follow the Colorado River about 6.6 mi. to Gulf.

6 Mad Island Wildlife Management Area and Clive Runnells Family Mad Island Marsh Preserve

Owners: Texas Parks & Wildlife Dept. (WMA) 361/576-0022
The Nature Conservancy of Texas (Preserve) 361/972-2559
Nearest Town: Collegeport Size: 7,281 acres (WMA); 7,048 acres
http://www.tpwd.state.tx.us/wma/find_a_wma/list/?id=39
http://www.tpwd.state.tx.us/birdingtrails/central/tres/text.htm
http://nature.org/wherewework/northamerica/states/texas/preserves/art6400.html
Wetlands: Estuarine-tidal saltmarshes and mud flats. Prairie pothole and marsh—marshes in managed impoundments, rice fields.
Recreation/Education: wildlife viewing, hunting (WMA)
Description: The Preserve runs the Mad Island Environmental Education Program to educate people about the valuable coastal environment they live in. Visitation to both areas is on an appointment only basis. No facilities or potable water on the WMA; contact area manager for details on access permits.
Directions: From Bay City, go west 12 mi. on TX 35 to FM 1095. Go south about 13 mi. on FM 1095 to Brazos Tower Rd. Turn left on Brazos Tower and go 2 mi. to Franzen Rd. Turn left on Franzen and follow signs to both areas.

7 Trull Marsh

Owner: City of Palacios 1-800-611-4567
Nearest Town: Palacios
http://www.tpwd.state.tx.us/birdingtrails/central/tres/text.htm
Wetlands: Estuarine-tidal saltmarshes and mud flats
Recreation: wildlife viewing
Description: Shallow lagoons along the road extend for two city blocks north of the intersection of Business 35/1st Street and Bayshore Drive. Trull Marsh is on the west side of the road. Saltmarsh and flats fringe the lagoons. Good birding from the observation deck on 2nd Street. No fee.
Directions: In Palacios, along west side of Business 35/1st Street north of Bayshore Dr.

8 Texas State Marine Education Center

Owner: Matagorda County Navigation District # 1 361/972-3774
Nearest Town: Palacios **Size**: 125 acres
http://portofpalacios.com/txedctr.htm
Wetlands: Estuarine-tidal saltmarsh and mud flats
Recreation/Education: wildlife viewing, hiking, marine biology classes
Description: Once part of Camp Hulen, the Matagorda County Navigation District # 1 has converted 207 acres into an educational center that specializes in marine science. The Nature Trail includes interpretive signs and an observation deck surrounded by tidal saltmarsh fringing Tres Palacios Bay. Please call the office for gate hours; check in at office. No fee.
Directions: In Palacios, from the intersection of Business 35 and Margerum Rd., go west on B-35 0.6 mi. to Camp Hulen Rd. Turn left (south) on Camp Hulen Rd., go 0.7 mi. to entrance. Nature Trails start on both sides of the pier.

Lavaca River and Bay

9 Lake Texana State Park

Owner: Texas Parks & Wildlife Dept. 361/782-5718
Nearest Town: Edna **Size**: 575 acres
http://www.tpwd.state.tx.us/park/laketexa/laketexa.htm
Wetlands: Riverine forested-bottomland hardwoods
Recreation/Education: wildlife viewing, camping, boating, canoeing, hiking, fishing, swimming, interpretive programs
Description: Full facilities. Most of the park consists of Navidad River hardwood bottomlands dominated by pecan, elms, and oaks. Nature Center and Interpretive Area for special programs; interpretive programs for groups by special arrangement. There is a 1.3-mile hiking/nature trail. Entrance and camping fees.
Directions: From Edna in Jackson County, go east 6.5 mi. on TX 111.

10 Lavaca/Navidad Estuary Overlook

Owner: Texas Dept. of Transportation 361/782-2322
Nearest Town: Lolita
Wetlands: Estuarine-tidal saltmarshes (brackish)
Recreation: wildlife viewing
Description: Site is an observation platform on FM 616 overlooking the marshes of the Lavaca/Navidad estuary. Both brackish and freshwater marshes occur here. Excellent birding. Due to road construction, this site may be unavailable until spring 2000.
Directions: From Edna, take US 59 west to FM 234, turn left (south) on 234 and go 10 mi. to Vanderbilt. Turn left (east) on FM 616 and go to pull-off at river.

11 Port Lavaca Bird Sanctuary

Owner: City of Port Lavaca 361/552-2912
Nearest Town: Port Lavaca
http://www.portlavaca.org/beach/lhbeach.html
http://www.tpwd.state.tx.us/birdingtrails/central/calhoun/text.htm
Wetlands: Estuarine-tidal saltmarsh
Recreation: wildlife viewing, camping, fishing
Description: Site is called Lighthouse Beach and Bird Sanctuary. Campground and fishing pier have fees; bird sanctuary does not. Walk out into the saltmarsh on the Formosa Wetlands Walkway to the Alcoa Birding Tower. Marshes can also be accessed on the east end (Point Comfort) of the Lavaca Bay Bridge.
Directions: From Port Lavaca, go east on TX 35 and exit to the right on TX 238 just before the Lavaca Bay Bridge. Look for the lighthouse. Cross the bridge and drive onto the old causeway for east-end wetlands.

12 Magnolia Beach

Owner: Calhoun County 1-800-556-7678
Nearest Town: Magnolia Beach 361/552-9242
http://www.tsha.utexas.edu/handbook/online/articles/view/MM/hrm5.html
http://www.tpwd.state.tx.us/birdingtrails/central/calhoun/text.htm
Wetlands: Estuarine-tidal saltmarshes and flats
Recreation: wildlife viewing, hiking, beach activities
Description: Saltmarshes and flats come right up to the road between Magnolia Beach and the LaSalle Monument, along Old Town Lake. Park in pull-offs along the road. Rice fields can be seen on the drive from Port Lavaca.
Directions: From Port Lavaca, go west on TX 35 to intersection with FM 2433. Turn left (south) and go to intersection with TX 238, turn right on 238 and go a short distance to intersection with TX 316. Go straight on 316 to FM 2760, turn left on 2760 to Magnolia Beach.

Guadalupe River/San Antonio Bay/Matagorda Island

13 Matagorda Island State Park and Wildlife Management Area

Owner: U.S. Fish & Wildlife Service
Manager: Texas Parks & Wildlife Dept. 361/983-2215

Nearest Town: Port O'Connor
Size: 43,893 acres
http://www.tpwd.state.tx.us/park/matagisl/matagisl.htm
Wetlands: Estuarine-tidal saltmarshes and flats. Barrier island interior—marshes (interdunal and on flats)
Recreation/Education: wildlife viewing, camping, hiking/biking, beach activities, fishing, nature study, passenger ferry, on-island shuttle, scheduled tours
Description: This site is a practically pristine barrier island with extensive estuarine wetlands on the bay side and inland freshwater marshes. Staff-conducted historical and natural history programs and tours are available. Contact park to arrange a group program. Group barracks can be rented on Fri. and Sat. nights. Entrance, tour, camping, and ferry fees. Contact park for ferry schedule and facilities-use details.
Directions: Headquarters in Port O'Connor at the intersection of 16th Street and the Intracoastal Waterway. Access to the island by boat only; ferry operates Thurs.-Sun.

Shuttle on Matagorda Island (Jack Lewis, Texas Department of Transportation)

14 Welder Flats Wildlife Management Area

Owner: Texas General Land Office
Manager: Texas Parks & Wildlife Dept. 409/244-7697
Nearest Town: Seadrift **Size**: 1,480 acres
http://www.tpwd.state.tx.us/wma/find_a_wma/list/?id=43
http://www.tpwd.state.tx.us/conserve/txgems/welderfl/welderfl.htm
Wetlands: Estuarine-tidal saltmarshes and flats, seagrass beds
Recreation: wildlife viewing, fishing, waterfowl hunting
Description: Site consists only of the shallow tidal waters controlled by the GLO. The upland shoreline is private property. Open year-round for day use. Endangered whooping cranes use this habitat. Contact manager for details on access permits.
Directions: Boat access only. Launch at Seadrift (public ramp at Swan Point Park) and go south on the Victoria Barge Canal to intersection with the Intracoastal Waterway.

15 Guadalupe Delta Wildlife Management Area

Owner: Texas Parks & Wildlife Dept. 361/576-0022
Nearest Town: Tivoli **Size**: 6,200 acres
http://www.tpwd.state.tx.us/wma/wmarea/guadalupe.htm
http://www.tpwd.state.tx.us/conserve/txgems/guadalup/guadalup.htm
Wetlands: Estuarine-tidal saltmarshes (brackish) and flats; managed impoundments. Riverine forested-bottomland hardwoods.
Recreation/Education: wildlife viewing, hiking/biking, fishing, hunting, auto tour, special events
Description: The Mission Lake Unit is basically freshwater marsh, and has forested riparian habitat along Goff and Hog Bayous. The Hynes Bay Unit is tidal saltmarsh and flats. Observation deck on TX 35 open year-round. No facilities or potable water on area. Visitors 17 years old or older must have one of several access permits; call for details and tour schedule.
Directions: From Port Lavaca, go west 12 mi. on TX 35. From Victoria, go 22 mi. southeast on TX 185 to TX 35. Turn right (south) on 35, go 1 mi.

15A Du Pont Victoria Plant Wetland

Owner: E.I. du Pont de Nemours and Co. 361/572-1153
Nearest Town: Bloomington **Size**: 53 acres
http://www.dupont.com/corpB420010615/environment/wetland/index.htm
Wetlands: Prairie pothole and marsh-constructed, treated-wastewater marsh
Recreation/Education: wildlife viewing; wetland and nature studies for school groups
Description: Treated wastewater from the chemical plant is polished by moving through the wetland before being returned to the Guadalupe River. The wetland features a Wetlab Education Center, observation blind, decks, walkways, boardwalk and a pier. School groups can participate in a Wetland Environmental Science Education Encounter to find, observe and identify wetland plants and animals. No fee.

Directions: From Victoria, go south on TX 185 about 5 mi. south of US 59. Turn right on Canal Rd., cross railroad tracks, turn left at stop sign onto Old Bloomington Rd. Go 0.5 mi. past the Wetland to DEAA entrance on right. Go to the Clubhouse on the right.

16 ENRON Matagorda Island Environmental Research and Education Center

Owner: U.S. Fish & Wildlife Service 361/286-3559 or 3533
Cooperator: The Nature Conservancy of Texas 361/972-2559
Nearest Town: Austwell **Size**: 56,600 acres
http://nature.org/wherewework/northamerica/states/texas/explore/index.html
http://159.189.96.215/resource/othrdata/checkbird/r2/matagora.htm
Wetlands: Estuarine-tidal saltmarshes and flats. Barrier island interior—marshes (interdunal and on flats)
Recreation/Education: wildlife viewing, ecological research and education
Description: The Center is on the southwestern end of Matagorda Island National Wildlife Refuge and State Natural Area. Site offers "hands on" environmental education for high school and college students and teacher workshops on barrier island ecology, endangered species, and wildlife biodiversity. Day and overnight programs and facilities are available. Programs (including transportation) are scheduled through the Nature Conservancy.
Directions: Contact the Nature Conservancy at the above phone #.

17 Aransas National Wildlife Refuge

Owner: U.S. Fish & Wildlife Service 361/286-3559 or 3533
Nearest Town: Austwell **Size**: 59,700 acres
http://southwest.fws.gov/refuges/texas/aransas.html
Wetlands: Estuarine-tidal saltmarshes and flats. Prairie pothole and marsh—Ingleside sand depressions.
Recreation/Education: wildlife viewing, seasonal fishing, hiking/biking, picnicking, interpretive center, auto tour, 40-foot observation tower
Description: Refuge open daily during daylight hours; Center open daily 8:30 am – 4:30 pm. Interpretive signs along the 16-mile, paved auto tour road explain wetland ecology. Several miles of walking trails. Freshwater marsh can be viewed from the Jones Lake platform. Tidal wetlands can be accessed from several locations and viewed from the tower. Contact refuge for more info. on environmental education.
Directions: From Rockport, go north about 20 mi. on TX 35. Turn right on FM 774, go about 9 mi. to FM 2040. Turn right and follow 2040 about 7 mi. to entrance.

Mission and Aransas Rivers

18 Fennessey Ranch

Owner: Private 361/529-6600
Nearest Town: Refugio **Size**: 4,000 acres
http://www.refugiocountytx.com/birding/index.htm
Wetlands: Lower coast riparian—hardwood corridor. Prairie pothole and marsh—marshes.
Recreation/Education: wildlife viewing, nature tours, hiking, hunting, fishing, boat tours
Description: Visitation must be arranged through Fennessey Ranch Nature Tours (phone number above). Ranch has 9 miles of frontage on the Mission River including riparian woodlands. Ranch has an excellent freshwater marsh. Fees for access and tours.
Directions: From Refugio, go east 2 mi. on FM 774 to intersection with FM 2678. Turn right (south) on 2678, go 4.6 mi. to ranch entrance.

19 Lion's/Shelly Park

Owner: City of Refugio 361/526-5337
Nearest Town: Refugio
http://www.refugiocountytx.com/birding/index.htm
Wetlands: Lower coast riparian—hardwood corridor
Recreation/Education: wildlife viewing, nature trails, fishing pier, park facilities

Description: This city park offers excellent birding in the forested wetlands along the Mission River. Nature trails are all about 0.6 mile long, cross over the park pond and wind through bottomlands. These riparian woodlands are islands of habitat in a sea of cropland and brush lands.
Directions: In Refugio, at the intersection of US 77 and FM 774, turn west, go 2 blocks and enter park.

20 Welder Wildlife Refuge

Owner: Rob and Bessie Welder Wildlife Foundation 361/364-2643
Nearest Town: Sinton **Size**: 7,800 acres
http://hometown.aol.com/welderwf/welderweb.html
Wetlands: Lower coast riparian—hardwood corridor. Prairie pothole and marsh—marsh fringing ponds and lakes.
Recreation/Education: wildlife viewing, guided tours
Description: The Welder Wildlife Foundation was created after the death of Robert M. Welder, who directed that the refuge be managed for the conservation of native wildlife. Aransas River riparian woodlands and other habitats support the diverse wildlife. Refuge is open for public tours every Thurs. at 3 pm (except holidays). Group tours at other times must be prearranged. No fee.
Directions: Refuge entrance is about 8 mi. north of Sinton on US 77.

Copano/Aransas/Redfish Bays

21 Egery Flats

Owner: Texas General Land Office
Nearest Town: Bayside
Wetlands: Estuarine-tidal flats and saltmarsh
Recreation: wildlife viewing
Description: On Copano Bay near the mouth of the Aransas River. Egery Road skirts extensive tidal mud flats and saltmarshes. Excellent birding. This is an undeveloped site with no facilities or fees.
Directions: From Bayside, go south on FM 136 and cross causeway. Turn left (east) after leaving causeway onto Egery Rd.

22 Goose Island State Park

Owner: Texas Parks & Wildlife Dept. 361/729-2858
Nearest Town: Rockport/Fulton **Size**: 321 acres
http://www.tpwd.state.tx.us/birdingtrails/central/aransas/text.htm
Wetlands: Estuarine-tidal saltmarsh and mud flats
Recreation/Education: wildlife viewing, camping, fishing, boating (motors allowed), picnicking, nature trail
Description: The park, on Aransas and St. Charles Bays, has "Big Tree," the State Champion coastal live oak; a boat ramp; a lighted fishing pier; and full facilities. Spring migration guided bird tours every April. There is an Adopt-A-Wetland local school project opposite the boat ramp. An observation deck was built in the saltmarsh, and the planting of saltmarsh cordgrass is planned. Open every day year-round. Entrance fee and variable camping fees.
Directions: From Rockport, go 10 mi. northeast on TX 35 to Park Rd.13, then 2 mi. east to entrance.

23 Rockport Demonstration Bird Garden and Wetlands Pond

Owner: Texas Dept. of Transportation 1-800-242-0071
Nearest Town: Rockport
http://www.tpwd.state.tx.us/birdingtrails/central/aransas/text.htm
Wetlands: Prairie pothole and marsh—Ingleside Sand, marsh in constructed pond
Recreation/Education: wildlife viewing, native plants, interpretive nature trail
Description: A Texas Department of Transportation highway rest area with a hummingbird garden and pond showing the value of native plants and wetlands in attracting birds and waterfowl. Wetland demonstration pond shows the value of wetlands as a natural resource. Boardwalk goes to a willow grove and wet slough. A 19-stop interpretive nature trail goes around wetlands pond to Fulton Beach Rd. No fee.
Directions: In Rockport, 0.9 mi. south of intersection of TX 35 and FM 3036 on east side of TX 35.

Freshwater marsh in the Aransas National Wildlife Refuge. (William A. White, The University of Texas at Austin)

24 Aransas Pass Wetlands

Owner: Texas General Land Office 1-800-633-3028
Nearest Town: Aransas Pass
http://www.tpwd.state.tx.us/birdingtrails/central/aransas/text.htm
Wetlands: Estuarine-tidal flats and saltmarshes
Recreation: wildlife viewing, hiking, fishing
Description: The Dale Miller Causeway (TX 361) between Aransas Pass and Port Aransas crosses Redfish Bay. The causeway is bordered by tidal flats, saltmarshes, and sand spits. There are many pull-offs along the road. No fee.
Directions: In Aransas Pass at the intersection of Loop 90 and TX 361, go east on 361 onto the causeway to Port Aransas.

Mustang Island

25 Port Aransas Birding Center

Owner: City of Port Aransas 361/749-4158
Nearest Town: Port Aransas
http://www.portaransas.org/Birds.asp
http://www.tpwd.state.tx.us/birdingtrails/central/mustang/text.htm
Wetlands: Barrier island interior—treated-wastewater marsh
Recreation/Education: wildlife viewing, native plant trail, guided birding tours
Description: This cattail marsh is associated with effluent from the adjacent wastewater treatment plant. There is a boardwalk and observation tower in the marsh. Weekly guided birding tours on Wed. mornings (1-800-452-0278), year-round weather permitting. "Go Native" guided wildflower walks 1st Sat., Mar.-Nov., 10 am. No fees.
Directions: From the ferry landing in Port Aransas, take Cut Off Rd. (TX 361) to the right to Ross Ave. Go right on Ross Ave. to the Center.

26 Port Aransas Wetland Park

Owner: City of Port Aransas 361/749-4158
Nearest Town: Port Aransas
http://www.cityofportaransas.org/recreationalfacilities.html
http://www.tpwd.state.tx.us/birdingtrails/central/mustang/text.htm
Wetlands: Barrier island interior—marsh
Recreation: wildlife viewing
Description: The observation platform (built by TxDOT) overlooks a freshwater basin that supports algae beds and some fringing marsh. Basin holds water periodically; very attractive to waterbirds during wet periods.
Directions: In Port Aransas, from the intersection of TX 361 and Cut Off Rd., go 0.3 mi. south on 361. Park is on right.

27 Mustang Island State Park

Owner: Texas Parks & Wildlife Dept. 361/749-5246
Nearest Town: Port Aransas **Size**: 3,954 acres
http://www.tpwd.state.tx.us/park/mustang/mustang.htm
http://www.tpwd.state.tx.us/birdingtrails/central/mustang/text.htm
Wetlands: Estuarine-tidal saltmarsh and sand flats. Barrier island interior—marsh (interdunal and on flats)
Recreation/Education: wildlife viewing, beach activities, camping, fishing, hiking/biking, picnicking, interpretive tours
Description: The park crosses the entire barrier island and includes 5 miles of Gulf beach. The Corpus Christi Bay side of the island includes tidal marshes and flats, with seagrass beds off shore. The island interior has freshwater marsh in depressions between dunes and central-island basins. Interpretive ecological tours done on request. Open every day year-round. Entrance fee; camping fees vary.
Directions: From Port Aransas, go 14 mi. south on TX 361. From Corpus Christi, take TX 358 (South Padre Island Drive) to Padre Island, cross the JFK Causeway, go 1 mi. to traffic light, turn left onto TX 361, go 5 mi. to park headquarters.

Corpus Christi Bay Area

28 Packery Channel County Park

Owner: Nueces County
Nearest Town: Corpus Christi **Size**: 45 acres
http://ccwild.cbi.tamucc.edu/viewing/PackeryChannel/index.htm
http:www.tpwd.state.tx.us/birdingtrails/central/mustang/text.htm
Wetlands: Estuarine-tidal flats and saltmarsh. Barrier island interior—interdunal marsh.
Recreation: wildlife viewing, fishing, hiking
Description: The park borders Packery Channel, which used to separate Mustang Island from Padre Island. The channel has filled with sand due to human alteration of water current patterns in Corpus Christi Bay. The edge of the channel has some saltmarsh and extensive sand flats. Small freshwater wetlands can be seen in vacant lots along the residential streets adjacent to the park. No fee.
Directions: From Corpus Christi, take TX 358 (South Padre Island Drive) to Padre Is., crossing the JFK Causeway (Park Rd. 22). Park entrance is on left about 1 mi. after leaving causeway, at the Visitor Info. Center.

29 JFK Causeway Wetlands

Owner: Texas General Land Office
Nearest Town: Corpus Christi
http://www.tpwd.state.tx.us/birdingtrails/central/corpus/text.htm
http://www.wildtexas.com/travels/tr_04.php
Wetlands: Estuarine-tidal flats, some fringing saltmarsh
Recreation: wildlife viewing, hiking, fishing
Description: The causeway has seagrass beds on both sides and seagrasses can be picked up along the shoreline. Extensive tidal sand flats but little saltmarsh vegetation. At the west end of the causeway, on the north side, is a more extensive saltmarsh. Numerous pull-offs along the causeway.
Directions: From Corpus Christi, take TX 358 (South Padre Island Dr.) toward Padre Island.

30 Redhead Pond Wildlife Management Area

Owner: Texas Parks & Wildlife Dept. 409/244-7697
Nearest Town: Corpus Christi **Size**: 37 acres
http://www.tpwd.state.tx.us/wma/find_a_wma/list/?id=42
http://www.tpwd.state.tx.us/birdingtrails/central/corpus/text.htm
Wetlands: Prairie pothole and marsh—Ingleside Sand, excavated pond
Recreation: wildlife viewing
Description: The 10-acre excavated freshwater pond has fringing marsh vegetation. Site is a very important source of freshwater for many birds, especially redhead ducks. Parking area and observation platform. Day use only, no facilities, no fee.
Directions: From South Padre Island Dr. (TX 358), just west of JFK Causeway, exit onto Waldron Rd. Turn south and return to Laguna Shores Rd. Turn right and continue south on Laguna Shores about 1.5 mi. to area.

31 Corpus Christi Botanical Gardens

Owner: Corpus Christi Botanical Society, Inc. 361/852-2100
Nearest Town: Corpus Christi **Size**: 180 acres
http://www.corpuschristi-tx-cvb.org/attractions.html
http://www.tpwd.state.tx.us/birdingtrails/central/corpus/text.htm
Wetlands: Lower coast riparian—impounded marsh
Recreation/Education: wildlife viewing, hiking, picnicking, interpretive trails and gardens, group tours, classes and events
Description: Site is on Oso Creek. It has a "Gator Lake" with marsh dominated by cattail and California bulrush. Visitor Center (no fee) and nature trails along the lake and creek. Lake can be viewed from birding tower. A wetlands education and interpretive center with boardwalks is planned. Call for prearranged group tours and class and event schedules. Fee for gardens and trails. Open 9-5 Tues.-Sun. (June-Sept. open Thurs. till 8 pm).
Directions: From South Padre Island Dr. (TX 358), take Staples St. (FM 2244) south, cross Oso Creek to entrance at 8545 S. Staples.

32 Hans A. Suter Wildlife Park

Owner: City of Corpus Christi 361/880-3460
Nearest Town: Corpus Christi **Size**: 72 acres
http://www.corpuschristi-tx-cvb.org/parks.html
http://www.tpwd.state.tx.us/birdingtrails/central/corpus/text.htm
Wetlands: Estuarine-tidal saltmarshes and flats
Recreation: wildlife viewing, hiking, picnicking
Description: Part of the Hans and Pat Suter Wildlife Refuge City Park. An 800-foot boardwalk, with viewing platform, extends into the marsh. This marsh exists because of freshwater inflow into Oso Bay from a wastewater treatment plant. Excellent birding area. No fee.
Directions: From South Padre Island Dr. (TX 358), exit onto Ennis Joslin Rd. and go north about 1.5 mi. to park at Nile Dr.

33 Texas A&M University-Corpus Christi Nature Trail

Owner: Texas A&M University-Corpus Christi 361/994-2335
Nearest Town: Corpus Christi **Size**: 240 acres
http://www.tpwd.state.tx.us/birdingtrails/central/corpus/text.htm
http://www.tamucc.edu/
Wetlands: Estuarine-tidal flats and saltmarshes
Recreation/Education: wildlife viewing, hiking/biking
Description: The nature trail follows the Ward Island shoreline on Oso Bay. Estuarine flats and marsh habitats can be closely approached. No fee for nature trail. The Partnership for Environmental and Safety Outreach (361/994-2778) is implementing the Exploring Wetlands and Waterways Youth Program. Scouting groups and students in the North Bay area will use kayaks for sea camps and exploring wetlands and waterways.
Directions: From downtown Corpus Christi, go south on Ocean Dr. to Ward Island and the campus at 6300 Ocean Dr. Take first entrance into campus. From SPID (TX 358), exit on Ennis Joslin Rd., go north to Alameda St. and veer right onto Ocean Dr.

34 Indian Point Park/Sunset Lake Hike and Bike Trail

Owner: City of Portland 361/777-3301
Nearest Town: Portland **Size**: 322 acres
http://www.portlandtx.com/about/attractions/indian.htm
http://www.tpwd.state.tx.us/birdingtrails/central/corpus.text.htm
Wetlands: Estuarine-tidal saltmarshes and flats
Recreation: wildlife viewing, fishing, hiking/biking, picnicking
Description: Indian Point Park (57 acres) has two boardwalks into tidal marshes fringing Corpus Christi Bay. There is also a fishing pier (fee). Extensive tidal flats and beach. Sunset Lake hike/bike trail has about 265 acres of wetlands, 2.1 miles hike/bike trail, 500 ft. boardwalk, 2 parking areas and nonmotorized boating. No fee for park or trail.
Directions: From Corpus Christi, go north on TX 35/US 181 and cross the Nueces Bay Causeway. At the north end of the causeway exit on Old Portland Rd. Park is on the right. Road continues north along Sunset Lake.

Nueces River and Bay

35 Nueces River Park

Owner: City of Corpus Christi 361/880-3460
Nearest Town: Corpus Christi
http://www.corpuschristi-tx-cvb.org/parks.html
http://www.tpwd.state.tx.us/birdingtrails/central/corpus/text.htm
Wetlands: Lower coast riparian—hardwood corridor
Recreation: wildlife viewing, fishing, primitive camping, boating, picnicking, Tourist Info. Center
Description: The forested bottomlands are across the river from the park and adjacent to the park boundaries. Open every day for day use (no fee). Overnight use requires camping permit available (no fee) from Tourist Center.
Directions: From Corpus Christi, go north on I-37 and take Exit 16 to park.

36 Hazel Bazemore County Park

Owner: Nueces County 361/387-4231
Nearest Town: Corpus Christi **Size**: 78 acres
http://www.corpuschristi-tx-cvb.org/parks.html
http://www.tpwd.state.tx.us/birdingtrails/central/corpus/text.htm
Wetlands: Lower coast riparian—hardwood corridor
Recreation: wildlife viewing, hiking, swimming, boating, fishing, picnicking
Description: Nueces River bottomland forest with nature trails, boat ramp, and a pond with a birding blind. Park is noted for fall migration of hawks following the river. Full facilities; open every day 7 am – 10 pm (Nov.-Jan, 7 am-7 pm); no fees.
Directions: From Corpus Christi, go north on I-37 and exit onto Up River Rd. Continue west on Up River to US 77, where Up River becomes Northwest Blvd. Continue west on Northwest 0.5 mi. to Hazel Bazemore Park Rd. and turn right into park.

37 City of Corpus Christi Wildlife Sanctuary

Owner: City of Corpus Christi 361/547-2122
Nearest Town: Mathis **Size**: 258 acres
http://www.corpuschristi-tx-cvb.org/birdinglocal.html
Wetlands: Lower coast riparian—hardwood corridor
Recreation: wildlife viewing, hiking, fishing
Description: Nature trail through elm – hackberry/sugarberry riparian corridor along the Nueces River below Wesley Seale Dam at Lake Corpus Christi. This habitat lacks the frequency of flooding, due to the dam, needed to maintain a good quality bottomland forest. Day use; no fee or facilities.
Directions: From Corpus Christi, go north on I-37 and take Exit 34 at Mathis. Go southwest on TX 359 for 5.5 mi. to Park Rd. 25. Turn right and go 0.1 mi. to first parking area; a second parking area is 0.5 mi. further down PR 25. Sanctuary is on the left.

38 Texas State Aquarium

Owner: Texas State Aquarium 361/881-1307 or 1-800-477-GULF
Nearest Town: Corpus Christi **Size**: Aquarium - 7.3 acres; Koch Tule Lake Wetland - 33 acres
http://www.texasstateaquarium.org
http://www.tpwd.state.tx.us/birdingtrails/central/corpus/text.htm
Wetlands: Prairie pothole and marsh—Koch Wetland (marsh). Estuarine—brackish marsh.
Recreation/Education: aquarium; school field trips; summer Sea Camps; teacher workshops; outreach programs; interpretive wetland exhibit and walkway
Description: The Aquarium, Koch Industries and the Adopt-a-Wetland Program formed the Wetland Educational Partnership to provide students and educators with hands-on, interactive wetland experiences. The Koch Tule Lake Wetland receives freshwater from the refinery's wastewater treatment facility. Students (grades 9-12) canoe to a tidal marsh on the Corpus Christi Ship Channel. Admission/program fees.
Directions: From downtown Corpus Christi, take US 181/TX 35 across the Harbor Bridge over the ship channel to Corpus Christi Beach. The Aquarium is at 2710 N. Shoreline Blvd., next to the USS Lexington Naval Museum.

Lower Coast

Kingsville Area

1 King Ranch

Owner: Private 361/592-8055
Nearest Town: Kingsville **Size**: 825,000 acres
http://www.king-ranch.com/kingranch/visit.htm
Wetlands: Estuarine-wind-tidal salt flats and salt marsh. Prairie pothole and marsh—potholes and marshes (Santa Gertrudis Div.). Coastal sand sheet—interdunal depressions (Norias Unit).
Recreation/Education: wildlife viewing, hunting, commercial nature tours
Description: Many freshwater wetlands associated with natural ponds, depressions, and drainages; also with stock tanks and wells. Extensive wind-tidal flats and salt marshes fringe the Laguna Madre. Various guided nature tours start at the Visitors Center. Various fees.
Directions: From Kingsville, take TX 141 about 3.5 mi. west of US 77 to VC.

Glossy ibis. (Michael Murphy, Texas Department of Transportation)

2 Santa Gertrudis Creek Bird Sanctuary

Owner: Kleberg County 361/595-8591
Nearest Town: Kingsville
http://www.kingsvilletexas.com/Birding_5.asp
Wetlands: Lower coast riparian—impounded floodplain marsh
Recreation: wildlife viewing, hiking
Description: Site includes a stretch of creek bank, a leveed pond of several acres, and a large cattail marsh. You can walk along the levee to view the marsh. No fee.
Directions: From US 77 in Kingsville, go east about 1.5 mi. on FM 1717 to the creek.

Baffin Bay

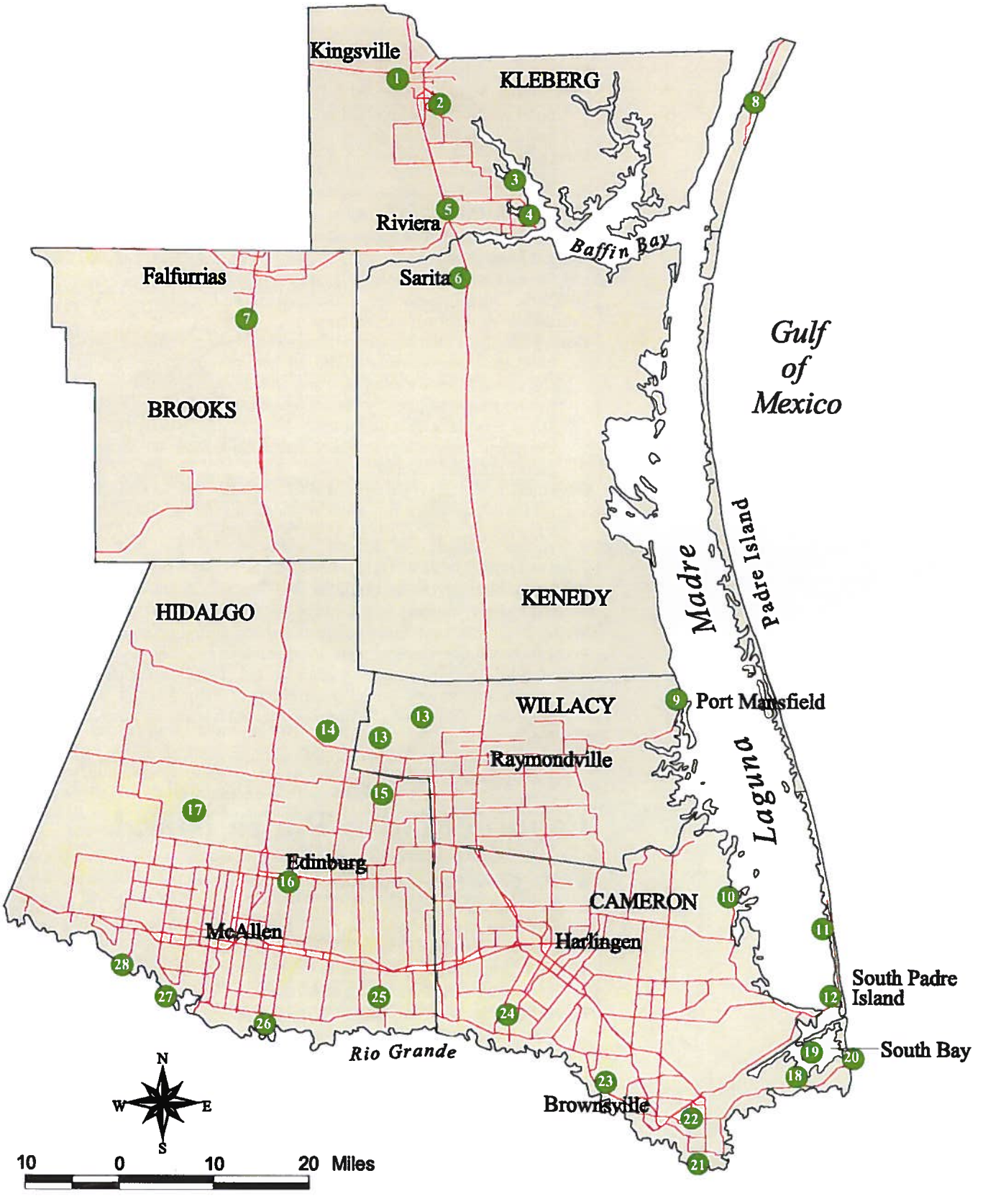
3 Drum Point

Owner: Kleberg County 361/595-8591
Nearest Town: Riviera
http://www.kingsvilletexas.com/Birding_3.asp
Wetlands: Estuarine-tidal mud flats
Recreation: wildlife viewing
Description: Drum Point is a bluff that overlooks Cayo del Grullo, a secondary bay of Baffin Bay. Extensive tidal mud flats are very attractive to shorebirds and wading birds. No fee or facilities.
Directions: From Kingsville, go about 11 mi. south on US 77 to FM 628. Go east 8.5 mi. on 628 to Loyola Beach. Turn left (north) on CR 1132 and go to bluff; continue on caliche road to shoreline and point.

4 Kaufer-Hubert Memorial County Park

Owner: Kleberg County 361/595-8591
Nearest Town: Riviera **Size**: 100 acres
http://www.kingsvilletexas.com/Birding_6.asp
Wetlands: Estuarine-tidal mud flats and salt marsh
Recreation: wildlife viewing, boating, fishing, picnicking, camping (adjacent)
Description: Just north of the main entrance, at the mouth of Vattmann Creek, are tidal mud flats and salt marshes. No fee. Seawind Campground (fee) is adjacent to the park.
Directions: From Kingsville, go 11 mi. south on US 77 to FM 628. Turn left and go about 8.5 mi. to Loyola Beach. Continue southeast on 628 to park.

Lower Coast Sites



Coastal Sand Sheet

5 Louise Trant Bird Sanctuary

Owner: Audubon Outdoor Club of Corpus Christi
Nearest Town: Riviera **Size**: 2+ acres
http://www.electrotex.com/aoc/sanctuar.htm
http://www.kingsvilletexas.com/Birding_7.asp
Wetlands: Coastal sand sheet—marsh in natural depression
Recreation: wildlife viewing
Description: A cattail marsh in a 2-acre, ephemeral pothole that is dependent upon rainfall and groundwater level. Good birding for marsh and wading birds. No facilities or fee.
Directions: On the east side of US 77, just north (0.1 mi.) of Riviera in Kleberg County.

6 Kenedy Ranch

Owner: John G. and Marie Stella Kenedy Memorial Foundation
Nearest Town: Sarita **Size**: 235,000 acres
http://www.kenedy-ranch.org
Wetlands: Coastal sand sheet—interdunal marsh. Estuarine—wind-tidal salt flats.
Recreation: educational nature tours
Description: The ranch has typical Coastal Sand Sheet freshwater wetlands in potholes and interdunal swales. The ranch borders the Laguna Madre at the Land Cut where extensive wind-tidal flats with blue-green algal mats occur. Guides that have been certified by the ranch facilitate organized tour groups. Sanborn's Travel Service of Corpus Christi (1-877-253-6339) books all group tours on the ranch. There is a marsh in Sarita on Garcia Rd.; a boardwalk, blind and picnic area are planned.
Directions: Foundation field office is at 101 E. LaParra Ave. in Sarita, Kenedy County, on US 77 about 22 mi. south of Kingsville. To see the marsh, go west on LaParra to Garcia, turn left and go 0.2 mi. Marsh is on the left.

7 Texas Department of Transportation Falfurrias Rest Area

Owner: Texas Dept. of Transportation
Nearest Town: Falfurrias
Wetlands: Coastal sand sheet—constructed demonstration marsh
Recreation: wildlife viewing, picnicking, rest area facilities
Description: The demonstration wetland is in a constructed pond that is continuously supplied with water. Wetland plants include cattail, arrowhead, and duckweed. This is not a natural wetland, but it is a good place to see dragonflies and damselflies. No fee.
Directions: From Falfurrias in Brooks County, go south about 6 mi. on US 281 to the rest area on the right.

Laguna Madre/Padre Island

8 Padre Island National Seashore

Owner: National Park Service 361/949-8068
Nearest Town: Corpus Christi **Size**: 133,000 acres
http://www.nps.gov/pais/
Wetlands: Estuarine-tidal salt marshes and flats. Barrier island interior—marshes in interdunal and central-flats depressions
Recreation/Education: wildlife viewing, beach activities, boating, camping, hiking/biking, fishing, interpretive programs/displays/trail, 4x4 driving area, hatchling sea turtle release program
Description: Longest remaining undeveloped barrier island in the world. Visitor Center has exhibits and programs. During the school year, interpretive programs are geared toward environmental education for school kids. The park is always open. VC open 9-4 in winter, extended hours in summer. Entrance fee and use fees. Marshes can be viewed along Bird Island Basin Rd., 2.6 miles north of the VC, as well as along Park Rd. 22. Estuarine marshes best viewed at Yarborough Pass (4-wheel drive required). Contact VC for hatchling sea

turtle release schedule.

Directions: From Corpus Christi, take South Padre Island Dr. (TX 358) east and cross JFK Causeway (Park Rd. 22). Continue 10 mi. south on PR 22 to entrance.

9 Port Mansfield Nature Trail

Owner: Willacy County Navigation District 956/944-2325
Nearest Town: Port Mansfield **Size**: 200 acres
http://www.tpwd.state.tx.us/birdingtrails/lower/sacah/text.htm
Wetlands: Coastal sand sheet—nontidal brackish marsh
Recreation: wildlife viewing, hiking
Description: The nature trail is 1.5 miles and crosses several habitat types including about 15 acres of ephemeral freshwater marsh supporting brackish marsh plants (due to soil salinity). No facilities, hours, or fee. Fred Stone County Park, about 1 mile away, has restrooms. On the way to Port Mansfield, TX 186 crosses the Coastal Sand Sheet and numerous potholes and swales with fresh and inland brackish marshes (all private property).
Directions: From US 77 in Raymondville, go east about 24 mi. on TX 186 to Port Mansfield. Nature trail is across from TPWD public boat ramp.

10 Laguna Atascosa National Wildlife Refuge

Owner: U.S. Fish & Wildlife Service 956/748-3607
Nearest Town: Rio Hondo **Size**: 45,187 acres
http://southwest.fws.gov/refuges/texas/laguna.html
Wetlands: Estuarine-tidal and wind-tidal mud flats; tidal salt marsh. Lower coast riparian—marsh and woods fringing ponds and resacas.
Recreation/Education: wildlife viewing, hiking/biking, auto tours, interpretive exhibits and videos, guided programs and tours
Description: The refuge impounds freshwater in ponds, resacas, and the central Laguna Atascosa ("muddy lake"). Two auto tour roads are open sunrise-sunset, daily. Six nature trails through various habitats. Visitor Center open 10-4 daily, Oct.-Apr.; 10-4, weekends in May; closed June-Sept. Schools and other groups may call to arrange programs. Entrance fee, education groups may qualify for free entry.
Directions: From Harlingen, go east 14 mi. on FM 106 past Rio Hondo. Go left at the T (Buena Vista Rd.) and go 3 mi. to VC.

11 Laguna Madre Nature Trail

Owner: City of South Padre Island 956/761-4412
Nearest Town: South Padre Island **Size**: 4 acres
http://www.tpwd.state.tx.us/birdingtrails/lower/laguna/text.htm
http://www.sopadre.com/ecotourism.asp
Wetlands: Barrier island interior—marsh (treated effluent)
Recreation/Education: wildlife viewing, hiking, interpretive trail
Description: This marsh is sustained by freshwater effluent from a wastewater treatment plant. Brackish marsh plants like southern cattail and bulrushes dominate. A 1,500-foot boardwalk, with interpretive signs, crosses the 4 acres of wetlands. This marsh is excellent for viewing rails. A tidal saltmarsh cordgrass marsh, uncommon along the Laguna Madre, is found bayward of the brackish marsh. Always open, no fee. Also, at the rear of the Convention Center is a viewing area for mud flats and low dunes.
Directions: In South Padre Island, go 4.5 mi. north of Queen Isabella Causeway on Park Rd. 100 (Padre Blvd.) to the Convention Center at 7355 Padre Blvd., on Orca Circle across from Andy Bowie County Park.

12 Queen Isabella Causeway Wetlands

Owner: Texas General Land Office
Nearest Town: South Padre Island
http://www.tpwd.state.tx.us/birdingtrails/lower/laguna/text.htm
Wetlands: Estuarine-tidal black mangrove, saltmarsh, and mudflats
Recreation: wildlife viewing, hiking
Description: At the east end of the causeway on South Padre Island, on both sides of the turnaround, are tidal mudflats fringed by black mangrove and some regionally uncommon saltmarsh cordgrass marshes. Some of the most accessible, and largest, black mangroves we know of. A boardwalk into the man-

groves, on both sides of the causeway, was built with TxDOT funds, as part of the Island Gateway Beach-To-Bay Alternative Transportation Loop.

Directions: From Port Isabel, take the Queen Isabella Causeway (Park Rd. 100) to its east end at South Padre Is.

South Texas Brush Country

13 USFWS La Sal Vieja Tracts

Owner: U.S. Fish & Wildlife Service 956/787-3079 x 100
Nearest Town: Raymondville **Size**: East Lake=1,755 acres; Teniente=5,637 acres
http://southwest.fws.gov/refuges/texas/lrgv.html
Wetlands: Lower coast potholes and marshes—inland saline flats and marsh
Recreation: wildlife viewing, hiking
Description: La Sal Vieja ("the ancient salt") consists of two large salt lakes, and many smaller potholes, on the southern edge of the Coastal Sand Sheet. The East Lake and Teniente tracts are units of the Lower Rio Grand Valley National Wildlife Refuge, as are sites 14, 17 and 18. In some areas fringing the lakes, spring flows support brackish marshes with southern cattail and bulrushes. High brackish marsh is found on the salt flats around the lakes. Open daily sunrise to sunset. Foot access only; no fee.
Directions: From Raymondville, go west 4 mi. on TX 186 to FM 1761. Go north on 1761 about 2.7 mi. to where the road turns sharply east. Continue north on the county road for 0.6 mi., then left for 0.4 mi. to the info. kiosk at the East Lake tract. To go to the Teniente tract, return to 186 and go west about 8.8 mi. (about 2.4 mi. past the junction with FM 88) to the third of three county roads that go north into the tract. Go north about 2.6 mi. to the Teniente tract info. kiosk.

14 USFWS La Sal del Rey Tract

Owner: U.S. Fish & Wildlife Service 956/787-3079 x 100
Nearest Town: Raymondville **Size**: 6,910 acres
http://southwest.fws.gov/refuges/texas/lrgv.html
Wetlands: same as La Sal Vieja
Recreation: wildlife viewing, hiking
Description: La Sal del Rey ("the King's salt"), in Hidalgo County, is another salt lake just west of La Sal Vieja, and with similar habitats including scattered potholes. Open daily sunrise to sunset. Foot access only, no fee.
Directions: From the westernmost of the three county roads into the Teniente tract, go west about 6.4 mi. on TX 186 to the info. kiosk on the right side of the road.

15 Delta Lake County Park

Owner: Delta Irrigation District
Manager: Hidalgo County Precinct One 956/262-6585
Nearest Town: Elsa **Size**: 65 acres
http://www.valleychamber.com/outdoors.html
http://www.valleychamber.com/visitor-guide/outdoors.html
Wetlands: Lower coast potholes and marshes—marsh fringing reservoir
Recreation: wildlife viewing, hiking, picnicking, park facilities
Description: Delta Lake is a 2,200-acre irrigation water reservoir. Shoreline sloughs support marshes of cattails and bulrushes. Day use only; no fee. Group camping is permitted by special arrangement.
Directions: From US 281 in Edinburg, go east about 10 mi. on TX 107 to Elsa. Go north (left) on FM 88 about 8.5 mi. to park entrance on the right. From Raymondville in Willacy County, go west about 10.5 mi. on TX 186 to FM 88. Go south (left) 4.8 mi. on 88 to park entrance on the left.

16 Edinburg Municipal Park Scenic Wetland

Owner: City of Edinburg 956/381-5631
Nearest Town: Edinburg **Size**: 40 acres
http://www.edinburg.com/attractions/attractions.html
http://www.tpwd.state.tx.us/birdingtrails/lower/santana/text.htm
Wetlands: Lower coast potholes and marshes—treatment-plant marsh
Recreation: wildlife viewing, hiking

Description: Cattail marsh is supported by effluent from a wastewater-treatment plant. One-mile nature trail has 6 marsh observation blinds. Open during daylight hours, no fee.

Directions: From the junction of TX 107 (University) and US 281 on the east side of Edinburg, go east about 1.1 mi. on 107 to Doolittle Rd. Go right (south) on Doolittle about 0.5 mi. to entrance.

17 USFWS Monte Cristo Tract

Owner: U.S. Fish & Wildlife Service 956/787-3079 x 100
Nearest Town: Edinburg **Size**: 2,701 acres
http://southwest.fws.gov/refuges/texas/lrgv.html
Wetlands: Lower coast potholes and marshes—marsh fringing potholes
Recreation: wildlife viewing, hiking

Description: This Hidalgo County tract is on the extreme southern edge of the Coastal Sand Sheet and has some potholes on it. The two potholes in the northeast corner of the tract are used as irrigation water reservoirs and support fringing wetlands. Open daily sunrise to sunset. Foot access only, no fee.

Directions: From Edinburg, take US 281 north to FM 1925. Go west on 1925 about 7.5 mi. to Wallace Rd. Go north 3.5 mi. on Wallace Rd. to info. kiosk on the left.

Rio Grande Delta

18 USFWS Boca Chica Tract

Owner: U.S. Fish & Wildlife Service 956/787-3079 x 100
Nearest Town: Brownsville **Size:** 17,255 acres
http://southwest.fws.gov/refuges/texas/lrgv.html
Wetlands: Estuarine-wind-tidal salt flats and salt marsh
Recreation: wildlife viewing, fishing, hiking

Description: Part of the Boca Chica subdelta of the Rio Grande. This largest unit of the Lower Rio Grande Valley National Wildlife Refuge is contiguous with South Bay and Boca Chica SP. Vehicles allowed on "fishing access roads" only; two roads go to Rio Grande, one to Brownsville Ship Channel. Other areas open to foot traffic only. Open every day, sunrise to sunset; no fee. Brush-covered lomas (clay dunes) can be seen from the highway on the salt flats.

Directions: From US 77/83 in Brownsville, take Boca Chica Blvd. east 1.5 mi. Boca Chica becomes TX 4; continue east for about 15 mi. to the info. kiosk near the Texas State Historical Marker.

19 South Bay Coastal Preserve

Owner: Texas General Land Office
Manager: Texas Parks & Wildlife Dept. 512/389-4639
Nearest Town: Brownsville **Size**: 3,500 acres
http://www.tpwd.state.tx.us/texaswater/txgems/southbay/south.phtml
Wetlands: Estuarine-wind-tidal salt flats with fringing black mangrove and salt marsh
Recreation: wildlife viewing, fishing, waterfowl hunting

Description: Preserve consists of the open water of the bay and intertidal flats. Black mangrove fringes the shoreline in many places and extensive seagrass beds are found in the bay waters. Boat access is off the Brownsville Ship Channel. In many areas, mats of blue-green algae cover the wind-tidal flats. The bay supports a small commercial eastern oyster fishery. Cruises of the Laguna Madre and South Bay offered by Colley's Cruises in SPI (956/943-2473, http://www.fin2feather.com).

Directions: By boat, off the Brownsville Ship Channel out of Port Isabel. From Brownsville, take TX 4 east 22.5 mi. to Boca Chica State Park, which borders the southeastern corner of the bay.

20 Boca Chica State Park

Owner: Texas Parks & Wildlife Dept. 956/585-1107
Nearest Town: Brownsville **Size**: 1,054 acres
http://www.tpwd.state.tx.us/park/boca/boca.htm
Wetlands: Estuarine-wind-tidal salt flats and black mangrove
Recreation: wildlife viewing, beach activities, fishing, primitive camping

Description: This undeveloped park borders the south shore of South Bay, which is fringed by black mangrove that dies back whenever there is a freeze. From the end of TX 4, one can drive south along the beach to the mouth of the Rio Grande or north to Brazos Santiago Pass and the Brownsville Ship Channel. No facilities or fees; always open.

Directions: From US 77/83 in Brownsville, take Boca Chica Blvd. east 1.5 mi. Boca Chica becomes TX 4; continue east for 21 mi. to the end of TX 4 and the beach.

Lower Rio Grande Valley

21 Sabal Palm Audubon Center and Sanctuary

Owner: Texas Audubon Society 956/541-8034
Nearest Town: Brownsville **Size**: 527 acres
http://www.audubon.org/local/sanctuary/sabal/
Wetlands: Lower coast riparian—woodlands fringing Rio Grande and resaca
Recreation/Education: wildlife viewing, hiking, tours, presentations and workshops, special events, interpretive displays
Description: A remnant grove of native, riparian sabal palms (Texas palmetto), once more widespread in the lower Rio Grande Valley. Three self-guided nature trails, trail guides may be purchased at the Visitors Center. VC open 9-5, Tues.-Sun., Oct.-May; June-Sept., Sat./Sun. only. Trails open year-round sunrise to sunset. Entrance fees vary.
Directions: From US 77/83 in Brownsville, at the end of the Freeway, turn left onto International Blvd. Go 0.75 mi., turn right onto Southmost Rd. (FM 1419). Go 6 mi. on 1419 and look for entrance on the right.

Las Palomas Wildlife Management Area (22-24)

Owner: Texas Parks & Wildlife Dept. 956/447-2704
http://www.tpwd.state.tx.us/wma/find_a_wma/list/?id=47
Wetlands: Lower coast riparian—woodlands fringing resacas
Recreation: wildlife viewing, hiking, hunting (except Voshell unit)

22 Voshell Unit

Owner: Texas Parks & Wildlife Department 956/447-2704
http://www.tpwd.state.tx.us/wma/find_a_wma/list/?id=47
Wetlands: Lower coast riparian—woodlands fringing resacas
Recreation/Education: wildlife viewing, hiking
Nearest Town: Brownsville **Size**: 66 acres
Description: A small tract bordered on the west and north by Resaca de la Palma. Riparian trees and brush fringe the resaca. No facilities or potable water. Contact headquarters for access info.
Directions: From US 77/83 in Brownsville, at the end of the Freeway, turn left onto International Blvd. Go 0.75 mi., turn right onto Southmost Rd. (FM 1419). Go 2.8 mi. and turn left onto FM 511. Go about 0.5 mi., area is on left after crossing Resaca de la Palma. No developed parking area.

23 Resaca de la Palma/Brasil Units

Owner: Texas Parks & Wildlife Department 956/447-2704
http://www.tpwd.state.tx.us/wma/find_a_wma/list/?id=47
Wetlands: Lower coast riparian—woodlands fringing resacas
Recreation/Education: wildlife viewing, hiking, hunting
Nearest Town: Brownsville **Size**: 1,175 acres
Description: Resaca de la Palma meanders through the units. Old Carmen Ave. crosses the resaca once just south of unit's south boundary, and twice within the units.
Directions: From US 77/83 in Brownsville, go west on TX 48 (Boca Chica) 1.3 mi. to Business 77. Continue west on US 281 (Military Highway) 4.6 mi. to Old Carmen Ave. Turn right (north) on Carmen, go 1.1 mi. to entrance.

24 Ebony Unit

Owner: Texas Parks & Wildlife Department 956/447-2704
http://www.tpwd.state.tx.us/wma/find_a_wma/list/?id=47
Wetlands: Lower coast riparian—woodlands fringing resacas

Recreation/Education: wildlife viewing, hiking, hunting
Nearest Town: Harlingen **Size**: 268 acres
Description: The unit is mostly farmland but has two interior resacas with riparian brush (such as Texas ebony) and trees. There is a parking area, information kiosk, and observation platform. Day use; contact headquarters for access info.
Directions: From US 77/83 in Harlingen, go 6.5 mi. south on FM 1479 (Rangerville Hwy.) to Jimenez Rd. (unpaved). Turn left on Jimenez, go 0.5 mi. to parking area on the right.

25 Llano Grande Lake

Owner: City of Weslaco
Nearest Town: Weslaco
http://www.tpwd.state.tx.us/birdingtraials/lower/estero/text.htm
http://www.tsha.utexas.edu/handbook/online/articles/view/LL/rolar.html
http://www.weslaco.com/
Wetlands: Lower coast riparian—woodlands fringing resaca
Recreation: wildlife viewing, fishing, hiking
Description: Llano Grande Lake is a large resaca in the Main Floodway just south of Weslaco. There are parking areas to access the resaca on both ends of the FM 1015 bridge. Good riparian woods and brush, plus the permanent water of the resaca, provide good birding. No facilities, no fee. Site will eventually have a World Birding Center interpretive center.
Directions: From US 83 just east of Weslaco, go south about 2.5 mi. on FM 1015 to the Main Floodway and Llano Grande Lake. There is a large parking area at the south end of the bridge on the left.

Great kiskadee at Santa Ana National Wildlife Refuge. (Michael Murphy, Texas Department of Transportation)

26 Santa Ana National Wildlife Refuge

Owner: U.S. Fish & Wildlife Service 956/787-3079
Nearest Town: Alamo **Size**: 2,088 acres
http://southwest.fws.gov/refuges/texas/santana.html
Wetlands: Lower coast riparian—woodlands along Rio Grande, marshes fringing lakes and resacas
Recreation/Education: wildlife viewing, hiking/biking, interpretive programs and displays, roving guides and naturalists, auto tour, interpretive tram tour
Description: On the Rio Grande in Hidalgo County. Twelve miles of trails (open sunrise to sunset) with roving naturalists during winter. Seven-mile drive open to cars. From Thanksgiving to March. there is an interpretive tram (fee) along the drive. Refuge and Visitors Center open every day except Christmas and Thanksgiving. The Friends of the Wildlife Corridor (http://www.rioweb.org/Partners/FriendsWildlifeCorridor/) operate interpretive canoe trips on the Rio Grande along the refuge.
Directions: From McAllen, go east 6 mi. on US 83 to FM 907. Turn south on 907 and go 7 mi. to US 281. Go east 0.25 mi. on 281 to entrance.

27 Anzalduas Dam and County Park

Owner: International Boundary and Water Commission
Manager: Hidalgo County Precinct 3 956/585-4509
Nearest Town: Mission **Size**: 70 acres
http://www.mcallenchamberusa.com/convention_and_visitors.htm
Wetlands: Lower coast riparian—woodlands fringing Rio Grande and resaca
Recreation: wildlife viewing, fishing, hiking, picnicking, park facilities
Description: The park is at the Anzalduas Dam on the Rio Grande. There is also a resaca. Riparian woodlands fringe the river and resaca. Day use only; no fee during the week. Entrance fee (vehicle fee) on weekends.
Directions: From Mission, go south on TX 107 (Conway) to US 83 where 107 becomes FM 1016. Go south 2.9 mi. on 1016 to FM 494. Turn right onto 494 and go 1.3 mi. to park entrance on the right.

28 Bentsen-Rio Grande Valley State Park

Owner: Texas Parks & Wildlife Dept. 956/585-1107
Nearest Town: Mission **Size**: 588 acres
http://www.tpwd.state.tx.us/park/bentsen/bentsen.htm
Wetlands: Lower coast riparian—woodlands fringing Rio Grande and resaca

Recreation/Education: wildlife viewing, camping, hiking/biking, boating, fishing, picnicking, nature study, guided tours

Description: The park is on the Rio Grande in Hidalgo County. The subtropical riparian woodlands consist of cedar elm, hackberry/sugarberry, ash, ebony, anacua, and tepequaje. Two nature trails; guided tours daily Dec.-Mar. (fee). Open every day year-round (7am-10pm). Entrance and use fees. Headquarters of the World Birding Center.

Directions: From Mission, go west 3 mi. on US Business 83 (Loop 374); then south on FM 2062 (Bentsen) for 2.6 mi. Enter on Park Rd. 43.

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APPENDIX

Scientific names of plants mentioned

Nonvascular Plants

Algae, blue-green	*Schizothrix* spp.
	Oscillatoria spp.
	Scytonema spp.

Submerged and Floating Aquatic Plants

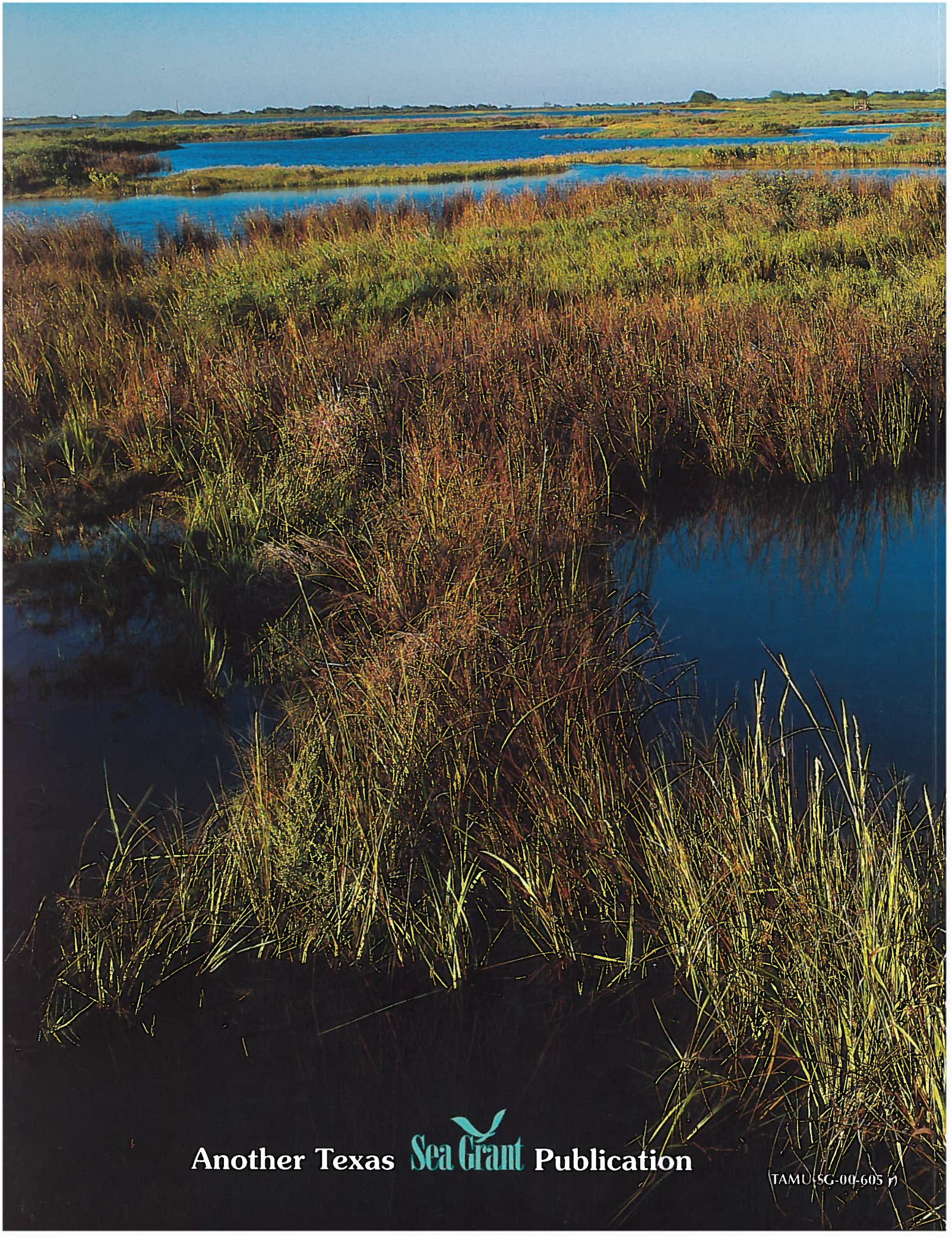
Duckweed	*Lemna* spp.
	Spirodela spp.
Pondweed	*Potamogeton* spp.
Seagrasses	
Clover grass	*Halophila engelmannii*
Manatee grass	*Cymodocea filiformis*
Shoalgrass	*Halodule wrightii*
Turtle grass	*Thalassia testudinum*
Widgeon grass	*Ruppia maritima*
Southern naiad	*Najas guadalupensis*
Water lilies	*Nymphaea* spp.

Herbaceous (Nonwoody) Plants

Arrowheads	*Saggitaria* spp.
Beakrushes	*Rhynchospora* spp.
White-topped sedge	*R. colorata*
Bluestem, bushy	*Andropogon glomeratus*
Bulrush, California	*Scirpus californicus*
———, saltmarsh	*S. maritimus*
———, three-square	*S. pungens*
Burheads	*Echinodorus* spp.
Cattail	*Typha* spp.
———, southern	*T. domingensis*
Cordgrass, Gulf	*Spartina spartinae*
———, saltmarsh	*S. alterniflora*
———, saltmeadow (marshhay)	*S. patens*
Flatsedges	*Cyperus* spp.
Frogfruit	*Phyla* spp.
Glassworts	*Salicornia* spp.
Keygrass (shoregrass)	*Monanthochloe littoralis*
Marsh fimbry	*Fimbristylis castanea*
Paspalum	*Paspalum* spp.
———, seashore	*P. vaginatum*
Pennywort, coastal plain	*Hydrocotyle bonariensis*
Reed, common	*Phragmites australis*
Rice, cultivated	*Oryza sativa*
Rush	*Juncus* spp.
———, needlegrass (black)	*J. roemerianus*
Saltgrass	*Distichlis spicata*
Seablight (seepweed)	*Suaeda* spp.
Sea-purslane	*Sesuvium portulacastrum*
Sedge	*Carex* spp.
———, Cherokee	*C. cherokeensis*
Spikerushes	*Eleocharis* spp.
Water-hyssop, coastal	*Bacopa monnieri*

Woody Shrubs and Trees

Anacua	*Ehretia anacua*
Ash, green	*Fraxinus pennsylvanica*
Baccharis (groundsel)	*Baccharis* spp.
Baldcypress	*Taxodium distichum*
Brasil	*Condalia hookeri*
Buttonbush	*Cephalanthus occidentalis*
Chinese tallow-tree	*Sapium sebiferum*
Coffee bean	*Sesbania exaltata*
Elm, American	*Ulmus americana*
——, cedar	*U. crassifolia*
Granjeno (spiny hackberry)	*Celtis pallida*
Hackberry/sugarberry	*C. laevigata*
Holly, deciduous	*Ilex decidua*
Huisache	*Acacia farnesiana*
Hickory, pecan	*Carya illinoensis*
————, water	*C. aquatica*
Locust, water	*Gleditsia aquatica*
Mangrove, black	*Avicennia germinans*
Maple, red	*Acer rubrum*
Mesquite	*Prosopis glandulosa*
Oak, cherrybark	*Quercus pagoda*
——, laurel	*Q. laurifolia*
——, live	*Q. virginiana*
——, overcup	*Q. lyrata*
——, swamp chestnut	*Q. michauxii*
——, water	*Q. nigra*
——, willow	*Q. phellos*
Palmetto, dwarf	*Sabal minor*
————, Texas	*S. mexicana*
Planertree (water elm)	*Planera aquatica*
Pine, loblolly	*Pinus taeda*
———, longleaf	*P. palustris*
———, shortleaf	*P. echinata*
———, slash	*P. elliottii*
Rattlebush	*Sesbania drummondii*
Retama	*Parkinsonia aculeata*
Saltcedar	*Tamarix* spp.
Saltwort	*Batis maritima*
Sea-oxeye	*Borrichia frutescens*
Sweetgum	*Liquidambar styraciflua*
Sycamore, American	*Platanus occidentalis*
Tepeguaje	*Leucaena pulverulenta*
Texas ebony	*Pithecellobium ebano*
Tupelo, black (black gum)	*Nyssa sylvatica*
————, water (tupelo gum)	*N. aquatica*
Wax-myrtle	*Myrica cerifera*
Willow, black	*Salix nigra*
————, sandbar	*S. exigua*
Wolfberry, Carolina	*Lycium carolinianum*
Yaupon	*Ilex vomitoria*



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